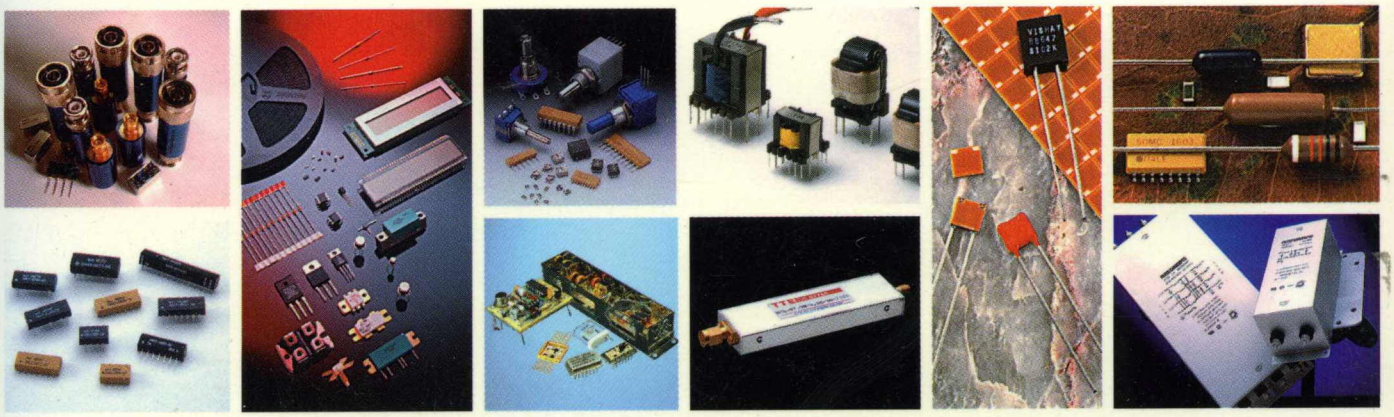
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electronic engineers master catalog

VOLUME A



electronic components

34th EDITION

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1800 Coils, Chokes, & Inductors
1850 Cores, Magnets, & Ferrites
2300 Crystals, Oscillators, Crystal & Piezoelectric Filters
2350 Delay Lines
2700 Filters, Power
2750 Filters, RF & Signal
3130 Integrated Circuits, Hybrid Circuits, & Function Modules
3450 Microwave Components, Systems, & Equipment
4700 Resistors
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volume B Electromechanical, electro-optical, and military components

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Hearst Business Communications, Inc.

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how to use eem

The 34th edition of EEM is arranged in four volumes each composed of related Product Sections. For user convenience, each volume contains its own Product Index and Directory (green pages) and its own Manufacturers and Sales Offices Directory (yellow pages). Every Product Heading and every manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other than that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and look up the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the instructions on the first page of each section. Manufacturers with catalog data pages in this edition of EEM appear in boldface type and page numbers are shown. Manufacturers appearing in lightface type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 35 Product Selection Guides included in this edition of EEM. They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

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*A Product Selection Guide precedes these Product Sections

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Hearst Business Communications, Inc.
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To find a specific manufacturer's data pages, an alphabetical index of EEM participants appears in EEM starting on page **A**•4 of Volume A and on pages **B**•4, **C**•4 and **D**•4 of the other volumes.

trademark and logofinder directories

A comprehensive Trademark Directory is included with Volume **C**. The EEM Logofinder shows the symbols and graphics used by manufacturers as identifiers on their products. Use these pages to locate manufacturers of specific trademarks and logos.

manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System is revised and updated to reflect changes in EEM itself. Each new EEM File System contains a complete Product Index. This index tells you where to file which catalog. It also contains a cross reference identifying what should be filed in each section. In order to use the EEM File System all you need is a supply of standard letter size, third-cut manila file folders. You then use the pressure sensitive labels which are supplied with the system to go into as much detail as you want or need.
Each label fits the third-cut file folder exactly. There are over 300 of these labels in each system: one for the index, one each for the EEM Product Sections, 24 for the alphabetical file of multiproduct catalogs, plus more than 200 additional labels for system expansion. The EEM File System also includes Cross Reference Cards so you can quickly and easily find multiproduct catalogs. The EEM File System is complete and can save you countless hours of time and thousands of dollars. Send your check for $25.00 to: EEM File System, 645 Stewart Ave., Garden City, NY 11530 and we'll absorb postage and handling. Send a purchase order and add $5.00 for postage and handling. NY, CA and MA residents, please add sales tax.

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Under each product heading whose Product Section appears in the volume you are using, the names of the manufacturers who supply the product are shown in alphabetical order with EEM catalogers shown first in boldface type with appropriate page numbers. Other manufacturers are shown in light face type. The symbol (§) indicates that these products are available from local distributors. The symbol (†) indicates that the product is available to MIL specifications.

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Absorbers, Microwave-3450

Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1695
§† Capcon, Inc., New York, NY 10001 212-243-6275
† Rantec Microwave & Electronics, Esco Electronics, Chatsworth, CA 91311 818-885-8223
Ray Proof, Shielding Systems Corp., Norwalk, CT 06856-5060 800-243-5704
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

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Adapters, US to European Power-2100 — ***See Vol. C***

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† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Cal-Scope, Excelitron Inc., Sunnyvale, CA 94086 ..... 408-730-4573; 1-800-828-3547
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., El Cajon, CA 92020 619-449-3644
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6656
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3795
† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-3900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 .... A•1731
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
Trontech, Inc., Eatontown, NJ 07724 908-542-1133

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Amplifiers, Klystron-3450

Aydin Corp., Horsham, PA 19044 215-657-7510
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Comtech Microwave Corp., Comtech Corp., Hauppauge, NY 11788 516-435-4646
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
† EEV Inc., Elmsford, NY 10523 914-592-6050
† ETM Electromatic Inc, Newark, CA 94560 415-797-1100
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
† LogiMetrics, Plainview, NY 11803 516-349-1700
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
Varian Associates, Electron Device Business, Palo Alto, CA 94304 ..... 415-493-4000; 800-544-4636
Varian Microwave Equip. Div., Varian Assocs., Inc., Santa Clara, CA 95054 408-496-6273

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Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400 ... D•1012
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† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1077
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1830-1831
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Amplifonix, Inc., Philadelphia, PA 19154 215-464-4000
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Aydin Corp., Horsham, PA 19044 215-657-7510
California Microwave, Sunnyvale, CA 94086 408-732-4000
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 ..... 408-730-4573; 1-800-828-3547
† Comtech Microwave Corp., Comtech Corp., Hauppauge, NY 11788 516-435-4646
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
Dowty Avionics, Arcadia, CA 91006 818-445-5955
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
† ETM Electromatic Inc, Newark, CA 94560 415-797-1100
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
HDS Inc., Reston, VA 22091 703-620-6200
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999 213-517-6000
† Keltec Florida, Inc., Microwave Pro, Ft. Walton Bch., FL 32549-2917 904-244-0043
† Litton Solid State, Litton Systems, Inc., Milpitas, CA 95035 408-433-0933
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
† LogiMetrics, Plainview, NY 11803 516-349-1700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
MACOM, Inc., Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
M/A-COM PHI, Inc., M/A COM, Inc., Torrance, CA 90501 213-320-6160
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† MDF Products Inc., Danbury, CT 06811 203-743-3579
† Microphase, Norwalk, CT 06856 203-866-8000
† Microwave Solutions, Inc., National City, CA 91950 619-474-6906
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
TRM, Inc., Manchester, NH 03103 603-627-6000
† Trontech, Inc., Eatontown, NJ 07724 908-542-1133
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
Varian Microwave Equip. Div., Varian Assocs., Inc., Santa Clara, CA 95054 408-496-6273
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analog Systems, Tucson, AZ 85731-7389 602-290-1818
§† Comlinear Corp., Fort Collins, CO 80525 303-226-0500
† M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
§† Sipex Corp., Custom Monolithic Prods. Div., Billerica, MA 01821 508-667-8700

Amplifiers, Parametric-3450

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Comtech Microwave Corp., Comtech Corp., Hauppauge, NY 11788 516-435-4646
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111

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Analyzers, Microwave-3450

† Anritsu, Oakland, NJ 07436, 201-337-1111;800-255-7234 ..... D•1218-1219
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4668
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Φ Genstar Rental Electronics, Inc, Woodland Hills, CA 91367 ..... 800-331-3440 (in CA); 800-227-8409
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
Lucas Weinschel, Gaithersburg, MD 20864-6001 301-948-3434
Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Wavetek Microwave, Inc., (Formerly Pacific Measurement, Inc.), Sunnyvale, CA 94089 408-734-5780

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Antenna Feed Systems-3450

AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
Andrew Corp., Orland Pk., IL 60462 800-255-1479
† Datron Systems, Inc., Simi Valley, CA 93065-1650 805-584-1717
† Dielectric Communications, Central Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Eastern Microwave, Burlington, MA 01803 617-273-4700
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4858 818-882-6333
† Gabriel Electronics, Scarborough, ME 04074 207-883-5161
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† MDM, Inc., Chatsworth, CA 91311 818-700-8400
† Microwave Applications Group, Santa Maria, CA 93455 805-928-5711
§ Millitect, Newark, CA 94560 415-791-5188
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† Premier Microwave, Port Chester, NY 10573 914-939-8900
§ Prodelin Corporation, Concver, NC 28613 704-464-4141
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Rantec Microwave & Electronics, Esco Electronics, Chatsworth, CA 91311 818-885-8223
ST Research Corporation, Newington, VA 22122 703-550-7000
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9800
† Tecom Industries, Inc., Chatsworth, CA 91311 818-341-4010
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
§ Ten-Tec, Inc., Sevierville, TN 37862 615-453-7172
† TIW Systems, Inc., Sunnyvale, CA 94089 408-734-3900
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831

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§ **Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891** ..... **A•2064-2065**
§ Atlas/Soundolier, Fenton, MO 63026 314-349-3110
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
§ Ciarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ..... 516-957-8700; 800-645-5516
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
§ Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181

Attenuators, Coaxial-3450

ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598, 914-962-2253 ..... **C•1155**
† **Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774** ..... **A•1747**
General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... **A•1749**
† **Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000** ..... **A•1750**
† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1753**
† **Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700** ..... **D•1077**
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
§ Coax Connection, Yorktown Hgts., NY 10598 ..... 914-962-2303;800-431-2103
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
§ Compac, Holbrook, NY 11741 516-585-3400
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§ Contact East, N. Andover, MA 01845 508-682-2000
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Electro Impulse, Neptune, NJ 07754-0278 908-776-5800
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
§† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
MarLee Switch Co., Upland, CA 91786 714-982-8988
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., El Cajon, CA 92020 619-449-3844
§† Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§ Pomona Electronics, Pomona, CA 91766 714-623-3463
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
§ Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Test Probes, Inc., San Diego, CA 92121 619-552-2090
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047 818-707-2020
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Wavetek RF Products, Inc., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Attenuators, Decade-3450

IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... **D•1258-1263**
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Contact East, N. Andover, MA 01845 508-682-2000
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
§ Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123

Attenuators, Fiber Optic-2475 — *See Vol. B*

Attenuators, Fixed-3450

† **Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774** ..... **A•1747**
† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ..... **A•1695**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1753**
† **Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700** ..... **A•1827, D•1077**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221** ..... **B•1789**
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Compac, Holbrook, NY 11741 516-585-3400
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
§† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
† GRIM Corporation, Medford, NJ 08055-0968 609-267-7950
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§† Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
† Microlab/FXR, Livingston, NJ 07039 201-992-7700

§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
§ Pomona Electronics, Pomona, CA 91766 714-623-3463
§† Probe Master, Inc., San Diego, CA 92111 ..... 619-560-9676; 800-772-1519
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
§ Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
§ Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Test Probes, Inc., San Diego, CA 92121 619-552-2090
§ Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Attenuators, IF-1900 — *See Vol. D*

Attenuators, Impedance Matching-3450

† Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... **A•1747**
Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... **A•1750**
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... **D•1077**
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... **B•1789**
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
§ Atlas/Soundolier, Fenton, MO 63026 314-349-3110
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
Compac, Holbrook, NY 11741 516-585-3400
§ Contact East, N. Andover, MA 01845 508-682-2000
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ..... 516-231-6900; 1-800-645-5104
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§ Pomona Electronics, Pomona, CA 91766 714-623-3463
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Attenuators, Logarithmic-3450

AEL Defense Corp., Lansdale, PA 19446 215-822-2929
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135

Attenuators, Microwave-3450

§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... **A•1843**
† Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... **A•1747**
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... **A•1748**
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 ..... **A•1749**
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ..... **A•1678-1679**
Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... **A•1750**
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... **A•1695**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1753**
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... **A•1827, D•1077**
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Compac, Holbrook, NY 11741 516-585-3400
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
† Eastern Microwave, Burlington, MA 01803 617-273-4700
§† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
Litton Electron Devices, San Carlos, CA 94070 415-591-8411
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§† Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Pomona Electronics, Pomona, CA 91766 714-623-3463
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Attenuators, Programmable-3450

† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 ..... **A•1749**
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... **A•1750**
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... **A•1751**
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1753**
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... **A•1827, D•1077**
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
3M Photodyne Products, Dynatel Systerms Division, Camarillo, CA 93010 ..... 805-388-8378;800-426-8688
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Wavetek RF Products, Inc., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Attenuators, Step-3450

IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258-1263
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1750
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086 ..... 408-730-4573; 1-800-828-3547
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§ Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ..... 516-957-8700; 800-645-5516
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Attenuators, Switch Operated-3450

† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1750
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Attenuators, Switchable-3450

† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1750
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
MarLee Switch Co., Upland, CA 91786 714-982-8988
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
§ Test Probes, Inc., San Diego, CA 92121 619-552-2090
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§ Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
† Wavetek RF Products, Inc., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Attenuators, Turret-3450

Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1750
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† Wavetek RF Products, Inc., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351

Attenuators, Variable-3450

Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1750
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1695
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§ Contact East, N. Andover, MA 01845 508-682-2000
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† GRIM Corporation, Medford, NJ 08055-0968 609-267-7950
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ..... 516-231-6900; 1-800-645-5104
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
3M Private Network Products, 3M, Austin, TX 78769-2963 ..... 512-984-1800; 800-745-7459
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
MicroSignals Inc., LLC., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§ Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
§ Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1843
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1750
† Amplifonix, Inc., Philadelphia, PA 19154 215-464-4000
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MACOM, Inc., Burlington, MA 01803 617-272-3000
† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... A•1156-1158

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† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Eastern Microwave, Burlington, MA 01803 617-273-4700
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
† Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2094
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1075
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
§ Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§† Semtech, Newbury Park, CA 91320 805-498-2111
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
Stetron International, Inc., Buffalo, NY 14203 716-854-3443

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§ Colimer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2094
§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ FAGOR ELECTRONICS COMPONENTS, INC., FAGOR ELECTRONICA S. COOP., Elk Grove Village, IL 60007 708-981-0161
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
Sanford-Miller Corp., Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900
§† Semtech, Newbury Park, CA 91320 805-498-2111

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ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598, 914-962-2253 ..... C•1155
§ **Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571** ..... C•1324
† **GSI Corp., Timonium, MD 21093, 410-252-1768** ..... C•1756
§† **Quality Microwave Interconnects, Inc., Wilmington, MA 01887, 508-988-9090** ..... A•1824-1826
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
Andrew Corp., Orland Pk., IL 60462 800-255-1479
† Assembly Specialists, Chelmsford, MA 01824 508-250-5900
CableStar, Incorporated, Glasgow, KY 42141 800-338-8223
† Cable Systems, Inc., Everett, MA 02149 617-389-7080
Cardinal Control Co., Kensington, CT 06037 203-828-6379
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226 602-940-0740
† Coax Connection, Yorktown Hgts., NY 10598 ..... 914-962-2303;800-431-2103
† Coaxitube Corp., Salisbury, MD 21801 301-546-3911
†# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379 508-580-0111
† CSD Industries, Inc., dba C Enterprises , San Marcos, CA 92069 ..... 619-744-8182; 800-334-3815;800-423-3345
† De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089 408-734-2020
† Electro-Support Systems, Temecula, CA 92390 714-676-2751
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 908-238-1223
W. L. Gore & Assocs., Inc., Phoenix, AZ 85044 602-438-2017
§ Johnson, E. F., Co., Minneapolis, MN 55459-0089 612-943-5500
† Kaman Instrumentation, Colo Springs, CO 80907 1-719-599-1892
Kings Electronics Co., Inc., Tuckahoe, NY 10707 914-793-5000
MACOM, Inc., Burlington, MA 01803 617-272-3000
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Pomona Electronics, Pomona, CA 91766 714-623-3463
† Precision Tube, N. Wales, PA 19454 215-699-5801
Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO 519-696-2616
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 ..... 407-848-4311;800-888-8763
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Storm Products Co., Hinsdale, IL 60521 708-323-9121
Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584 309-693-3300
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 213-316-9984
§† Western Electronic Products Co., San Clemente, CA 92672 714-492-4677
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Calibrators, Meter-2900 — *See Vol. D*

Calibrators, Oscilloscope-2900 — *See Vol. D*

Calibrators, Sound Level-2900 — *See Vol. D*

Calibrators, Sweep — See Generators, Sweep (Vol. D)

Calibrators, Synchro-2900 — *See Vol. D*

Calibrators, Time Base-2900 — *See Vol. D*

Calibrators, Transducer-2900 — *See Vol. D*

Calibrators, Voltage-2900 — *See Vol. D*

Calibrators, VSWR-2900 — *See Vol. D*

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Cameras, Data Recording-2325 — *See Vol. D*

Cameras, Digital Image Acquisition-2325 — *See Vol. D*

Cameras, Image Converter-1900 — *See Vol. D*

Cameras, Infrared-2325 — *See Vol. D*

Cameras, Machine Vision-4100 — *See Vol. D*

Cameras, Oscilloscope-2975 — *See Vol. D*

Cameras, Television-1900 — *See Vol. D*

Cameras, Television, Fiber Optic-1900 — *See Vol. D*

Capacitors, Feed-Thru-1500

§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
American Radionic Co. Inc., Palm Coast, FL 32137 904-445-6000
§† Electron Products, Irwindale, CA 91706 818-960-2299
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
S & EI Manufacturing, Northridge, CA 91324 818-349-4111
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208

Cans & Flat Packs, Integrated Circuit — See Packages, Integrated Circuit (Vol. A)

Cans, Capacitor, Relay, Semiconductor, Transformer, etc-2500 — *See Vol. C*

Capacitance Comparators — See Bridges, Capacitance (Vol. D)

Capacitor Hardware-2500 — *See Vol. C*

Capacitor Leakage Indicators — See Testers, Capacitor (Vol. D)

Capacitor Wafers-1500

† **Johanson Dielectrics, Inc., Burbank, CA 91505, 818-848-4465** ..... A•1081
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400

Capacitors, Chip (For Microcircuits)-1500

§ **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-6300; 800-999-3711** ..... A•1008-1009
§ **Armbar Industries, Inc., Old Bridge, NJ 08857, 908-679-3377** ..... A•1011
ASC, Ogallala, NE 69153, 308-284-3611 ..... A•1013,1017
§† **Electro-Films, Inc., Warwick, RI 02886, 401-738-9150** ..... A•1748,1912
§ **ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222** ..... A•1075
§ **ITW Paktron, Div. of Illinois Tool Works, Lynchburg, VA 24502, 804-239-6941** ..... A•1076-1077
† Johanson Dielectrics, Inc., Burbank, CA 91505, 818-848-4465 ..... A•1081
§† **Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621** ..... A•1082-1083
§ **KOA Speer Electronics, Bradford, PA 16701, 814-362-5536** ..... A•1085
Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1086-1088
§ **Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491** ..... A•1094,1096-1097
† **Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366** ..... A•1099-1100,1103-1106
§ **MP/Capar, Multi Products International, West Paterson, NJ 07424, 201-890-1344** ..... A•1107
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... A•1109-1110,1112
§ **NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000** .... A•1115-1119
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1124-1128
Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1140-1141
† **Tansitor Electronics, Bennington, VT 05201, 802-442-5473** ..... A•1143
§ **TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100** ..... A•1144-1147,1597
§ **United Chemi-Con Inc., Rosemont, IL 60018, 708-696-2000** ..... A•1148-1149
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300

† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
§† AVX Corporation, Myrtle Bch., SC 29577 803-448-9411
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
† Compex Corp., Medford, NJ 08055 609-596-9388
Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§† Dielectric Labs., Cazenovia, NY 13035 315-655-8710
† Dionics, Westbury, NY 11590 516-997-7474
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§# F. W. Capacitors Inc., Florence, SC 29504-0636 803-662-4728
§ GML Chip Components Limited, Hyderabad A.P., INDIA 500 044 ..... (91) 842-60106, 61593
§† Hilton Industries, Inc., Subsidiary of Core Industries, Sarasota, FL 34232 813-371-2600
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
† KD Components, Inc., Santa Ana, CA 92707 714-545-7108
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
† Loral Microwave-FSI, Semiconductor Div., Chelmsford, MA 01824 ..... 508-256-4113/8101
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§† Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
† Microcap, Inc., A MicroSemi Company, Escondido, CA 92025 619-480-1906
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
Multi Products International, West Paterson, NJ 07424 201-890-1344
§† Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips Components Discrete Products Div., A North American Philips Co., W. Palm Bch., FL 33407 407-863-1800
§ Philips Components Discrete Products Div, A North American Company, El Paso, TX 79906 915-775-4200
† Presidio Components, Inc., San Diego, CA 92121 619-578-9390
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Rogers Corp., Rogers, CT 06263 203-774-9605
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Rubycon America, Inc., Gurnee, IL 60031 708-249-3450
Samhwa U.S.A. Inc., Simi Valley, CA 93065 ..... 805-584-9494; 800-800-0069
Semtech, Newbury Park, CA 91320 805-498-2111
† SFE Technologies, San Fernando, CA 91340 818-365-9411
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
§ Thomas & Betts Corporation, Electronics Div., Greenville, SC 29616-2401 803-676-2900
Tokin America, Inc., San Jose, CA 95134 408-432-8020
Unitrode Corp., Watertown, MA 02172 617-926-0404
§ West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;215-495-5569
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Energy Storage-1500

CSI Capacitors, CSI Technologies, San Marcos, CA 92069, 619-747-4000 ..... A•1055
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1056-1057
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... D•1257
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... A•1115-1116
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1120-1122
PPD, Inc., Raleigh, NC 27613, 919-781-3955 ..... A•1130,1132-1133,1136
Aerovox Inc., North Dartmouth, MA 02747-1217 508-995-8000
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
American Radionic Co. Inc., Palm Coast, FL 32137 904-445-6000
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
Aselco, Inc., Gaithersburg, MD 20877 301-863-1937
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
§ Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
§ Chicago Condenser Corp., Chicago, IL 60622 312-227-7070
§† Component Research Co. Inc., Santa Monica, CA 90404 213-829-3615
† Condenser Products Corp., Brooksville, FL 34609 904-796-3561
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741 508-996-8561
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§† Electron Products, Irwindale, CA 91706 818-960-2299
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
§ Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Haefely Test Systems, E. Haefely & Co. LTD., Woodbridge, VA 22192 ... 703-494-1900
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
§# Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
† KD Components, Inc., Santa Ana, CA 92707 714-545-7108
§ Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
Rubycon America, Inc., Gurnee, IL 60031 708-249-3450
Samhwa U.S.A. Inc., Simi Valley, CA 93065 ..... 805-584-9494; 800-800-0069
S & E Manufacturing, Northridge, CA 91324 818-349-4111
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Wesco Electrical Co., Greenfield, MA 01301 413-774-4358

Capacitors, Fixed, AC (Incl. Motor Start)-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
§ ASC, Ogallala, NE 69153, 308-284-3611 ..... A•1012-1013,1016,1018
Condenser Products Corp., Brooksville, FL 34609, 904-796-3561 ..... A•1051
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... A•1052
CSI Capacitors, CSI Technologies, San Marcos, CA 92069, 619-747-4000 ..... A•1055
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1056
§ Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705, 714-979-4440 ..... A•1065
Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1087
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1120-1122
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1124-1128
PPD, Inc., Raleigh, NC 27613, 919-781-3955 ..... A•1130-1133,1136
Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ..... A•1150
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
American Radionic Co. Inc., Palm Coast, FL 32137 904-445-6000
Aselco, Inc., Gaithersburg, MD 20877 301-863-1937
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
Cera-Mite Corp., Grafton, WI 53024 414-377-3500
§ Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
§† Component Research Co. Inc., Santa Monica, CA 90404 213-829-3615
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ Electronic Film Capacitors, Inc., Waterbury, CT 06705 203-755-5629
§† Electron Products, Irwindale, CA 91706 818-960-2299
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Evox-Rifa Inc., Lincolnshire, IL 60069 708-948-9511
F-Dyne Elctrns., Bridgeport, CT 06605 203-367-6431
Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ Illinois Capacitor, Inc., Lincolnwood, IL 60645 708-675-1760
§ Inter-Technical Group Inc., WIMA Div., Elmsford, NY 10523 914-347-2474
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§# Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§ Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
§ Nichicon (America) Corp., Schaumburg, IL 60173 708-843-7500
Nissei Denki America, Inc., Beaverton, OR 97005 503-646-1434
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 803-772-2500
Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
Samhwa U.S.A. Inc., Simi Valley, CA 93065 ..... 805-584-9494; 800-800-0069
S & E Manufacturing, Northridge, CA 91324 818-349-4111
Seacor, Inc., Westwood, NJ 07675 201-666-5600
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
Standard Condenser Corp., Skokie, IL 60076 708-675-3133
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Teapo Electronic Corp. of America, Norcross, GA 30071 404-449-6220
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-674-7123

Capacitors, Fixed, Air-1500

† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1056
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1025
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
§ International Components Corp., Melville, NY 11747 516-293-1500
Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050

Capacitors, Fixed, Aluminum Electrolytic-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
§† Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... A•1052-1053
§ Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ..... A•1066-1068
Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•1091
§ MP/Capar, Multi Products International, West Paterson, NJ 07424, 201-890-1344 ..... A•1107
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1124-1128
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102, 508-339-8900 ..... A•1138
§ Tansitor Electronics, Bennington, VT 05201, 802-442-5473 ..... A•1143
§ United Chemi-Con Inc., Rosemont, IL 60018, 708-696-2000 ..... A•1148-1149
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
§ Alpha Dist. Corp., Richfield, OH 44286 ..... 216-659-7100; 1-800-628-0841
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
Aselco, Inc., Gaithersburg, MD 20877 301-863-1937
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† Capacitor Technology Products, Inc., Ft. Wayne, IN 46825 219-484-9054
§ Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Ei North America, New York, NY 10021 212-517-5622
§ Elna America, Inc., Cypress, CA 90630 714-761-8600
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Evox-Rifa Inc., Lincolnshire, IL 60069 708-948-9511
Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§# Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
Kemet Electronics Corporation, Greenville, SC 29606 803-963-6621
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§ Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Nichicon (America) Corp., Schaumburg, IL 60173 708-843-7500
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 803-772-2500
Plasticorp, Harbor City, CA 90710 213-539-9530
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rubycon America, Inc., Gurnee, IL 60031 708-249-3450
Samhwa U.S.A. Inc., Simi Valley, CA 93065 ..... 805-584-9494; 800-800-0069
§† Sangamo Components Division, Pickens, SC 29671 803-878-6311
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Teapo Electronic Corp. of America, Norcross, GA 30071 404-449-6220
§ West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;213-495-5569
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Fixed, Ceramic, Disc & Tubular-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
§ Armbar Industries, Inc., Old Bridge, NJ 08857, 908-679-3377 ..... A•1011
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1056
§ Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ..... A•1066,1069
Johanson Dielectrics, Inc., Burbank, CA 91505, 818-848-4465 ..... A•1081
§† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 .... A•1083
§† Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1086-1088
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... A•1098-1106
§ MP/Capar, Multi Products International, West Paterson, NJ 07424, 201-890-1344 ..... A•1107
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1109-1113
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... A•1115-1116
† Oxley Inc., Branford, CT 06405, 203-488-1033 ..... B•1025
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1124-1128
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1144-1147
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
AVX Corporation, Myrtle Bch., SC 29577 803-448-9411
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† Cera-Mite Corp., Grafton, WI 53024 414-377-3500
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
K & M Electronics, W. Springfield, MA 01089 413-781-1350
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
† KD Components, Inc., Santa Ana, CA 92707 714-545-7108
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Div, A North American Company, El Paso, TX 79906 915-775-4200
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
Raltron Electronics, Miami, FL 33172 305-593-6033
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Samhwa U.S.A. Inc., Simi Valley, CA 93065 ..... 805-584-9494; 800-800-0069
Semtech, Newbury Park, CA 91320 805-498-2111
SFE Technologies, San Fernando, CA 91340 818-365-9411
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Spectrum Control, Inc., Erie, PA 16505 814-455-0966
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Fixed, Ceramic, Monolithic-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
§ Armbar Industries, Inc., Old Bridge, NJ 08857, 908-679-3377 ..... A•1011
† Johanson Dielectrics, Inc., Burbank, CA 91505, 818-848-4465 ..... A•1081
§† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 .... A•1083
Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1086-1087
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1099-1103,1105-1106
§ MP/Capar, Multi Products International, West Paterson, NJ 07424, 201-890-1344 ..... A•1107
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1109-1113
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... A•1115-1116
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102, 508-339-8900 ..... A•1138
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1144-1147
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
§† AVX Corporation, Myrtle Bch., SC 29577 803-448-9411
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Ei North America, New York, NY 10021 212-517-5622
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
K & M Electronics, W. Springfield, MA 01089 413-781-1350
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
† KD Components, Inc., Santa Ana, CA 92707 714-545-7108
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§† Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
† Microcap, Inc., A MicroSemi Company, Escondido, CA 92025 619-480-1906
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Multi Products International, West Paterson, NJ 07424 201-890-1344

§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
§ NIC Components Corp., N. Amityville, NY 11701 ... 516-226-7500
§ Paccom, Redmond, WA 98052 ... 206-883-9200;800-426-6254
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 ... 407-881-3200
§ Philips Components Discrete Products Div, A North American Company, El Paso, TX 79906 ... 915-775-4200
† Presidio Components, Inc., San Diego, CA 92121 ... 619-578-9390
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 ... 714-263-0661
§† Rogers Corporation, Circuit Components Div., Tempe, AZ 85282 ... 602-967-0624
Samhwa U.S.A. Inc., Simi Valley, CA 93065 ... 805-584-9494; 800-800-0069
§† Semtech, Newbury Park, CA 91320 ... 805-498-2111
§† SFE Technologies, San Fernando, CA 91340 ... 818-365-9411
† Shogyo International Corp., Great Neck, NY 11021 ... 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 ... 201-321-3400
§† Spectrum Control, Inc., Erie, PA 16505 ... 814-455-0966
§ Stetco, Inc., Franklin Pk., IL 60131 ... 708-671-4208
§† Susco Elctrns., Farmingdale, NY 11735 ... 516-249-4848
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 ... 818-887-1010
Tokin America, Inc., San Jose, CA 95134 ... 408-432-8020
§ Xicon Capacitors, Arlington, TX 76003 ... 800-628-0544

Capacitors, Fixed, Feedthru-1500

§ Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ... A•1019
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ... A•1053
§ Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705, 714-979-4440 ... A•1065
Johanson Dielectrics, Inc., Burbank, CA 91505, 818-848-4465 ... A•1081
§† Maida Development Co., Hampton, VA 23663, 804-723-0785 ... A•1086
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... A•1101,1104
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1109,1698
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ... A•1120
† Oxley Inc., Branford, CT 06405, 203-488-1033 ... B•1025
† RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ... A•1633
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ... A•1144
Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ... A•1150
§† American Capacitor Corporation, Irwindale, CA 91706 ... 818-814-4444
American Radionic Co. Inc., Palm Coast, FL 32137 ... 904-445-6000
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 ... 516-547-5700
§ Armbar Industries, Inc., Old Bridge, NJ 08857 ... 908-679-3377
§† AVX Corporation, Myrtle Bch., SC 29577 ... 803-448-9411
† AVX Filters Corp., Sun Valley, CA 91352 ... 818-767-6770
§† Capcon, Inc., New York, NY 10001 ... 212-243-6275
† Ceramic Devices Inc., San Diego, CA 92111 ... 619-560-7575
§ Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 ... 708-806-6300
Compac, Holbrook, NY 11741 ... 516-585-3400
§† Component Research Co. Inc., Santa Monica, CA 90404 ... 213-829-3615
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 ... 402-371-0080
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 ... 714-540-1000
§ Electronic Resources Inc., Sunnyvale, CA 94089 ... 408-745-1420
§† Electron Products, Irwindale, CA 91706 ... 818-960-2299
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 ... 407-881-9292
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
† F-Dyne Elctrns., Bridgeport, CT 06605 ... 203-367-6431
† Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804 ... 516-752-1144
† Genisco Technology Corp., La Mirada, CA 90638 ... 714-523-7001
§ High Energy, Inductotherm Industries, Parkesburg, PA 19365 ... 215-593-2800
§ ICO-RALLY Corporation, Palo Alto, CA 94303 ... 415-856-9900
§ International Components Corp., Melville, NY 11747 ... 516-293-1500
§ ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475
Jaro Components, Inc., Boca Raton, FL 33431 ... 305-771-7000
† Jennings, San Jose, CA 95122-2696 ... 408-292-4025
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 ... 708-884-8688
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 ... 206-696-2840
Motor Capacitors, Inc., Chicago, IL 60631 ... 312-631-0713
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ... 408-730-0300;800-PENSTOCK
Presidio Components, Inc., San Diego, CA 92121 ... 619-578-9390
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 ... 714-263-0661
† Rtron Corp., Skokie, IL 60076 ... 708-679-7180
† S & El Manufacturing, Northridge, CA 91324 ... 818-349-4111
Seacor, Inc., Westwood, NJ 07675 ... 201-666-5600
† SFE Technologies, San Fernando, CA 91340 ... 818-365-9411
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
† Southern Electronics, F-Dyne, Burbank, CA 91502 ... 818-845-2458
§† Spectrum Control, Inc., Erie, PA 16505 ... 814-455-0966
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 ... 508-339-8900
§† Standard Condenser Corp., Skokie, IL 60076 ... 708-675-3133
§ Stetco, Inc., Franklin Pk., IL 60131 ... 708-671-4208
§† Tusonix, Inc., Tucson, AZ 85740-7144 ... 602-744-0400

Capacitors, Fixed, Film, Metallized & Nonmetallized-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ... A•1008-1009
§ ASC, Ogallala, NE 69153, 308-284-3611 ... A•1012-1018
§ Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ... A•1019
† Condenser Products Corp., Brooksville, FL 34609, 904-796-3561 ... A•1051
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ... A•1052
CSI Capacitors, CSI Technologies, San Marcos, CA 92069, 619-747-4000 ... A•1055
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ... A•1056-1057
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ... A•1617
§† Electronic Concepts, Inc., Eatontown, NJ 07724, 908-542-7880 .... A•1058-1063
§ Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705, 714-979-4440 ... A•1065
§ Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ... A•1068-1069
§ Inter-Technical Group Inc., WIMA Div., Elmsford, NY 10523, 914-347-2474 ... A•1071-1073
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ... A•1075
§ ITW Paktron, Div. of Illinois Tool Works, Lynchburg, VA 24502, 804-239-6941 ... A•1076-1077
§† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 .... A•1083
Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491 ... A•1097
§ MP/Capar, Multi Products International, West Paterson, NJ 07424, 201-890-1344 ... A•1107
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ... A•1120-1122
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ... A•1124-1128
PPD, Inc., Raleigh, NC 27613, 919-781-3955 ... A•1130-1136, B•1386-1387
† RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ... A•1633
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ... D•1490
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102, 508-339-8900 ... A•1138
† Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ... A•1150-1151
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ... A•1153
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ... B•1030
§ Aerovox Inc., North Dartmouth, MA 02747-1217 ... 508-995-8000
§† American Capacitor Corporation, Irwindale, CA 91706 ... 818-814-4444
American Radionic Co. Inc., Palm Coast, FL 32137 ... 904-445-6000
§ Arco Electronics, Chatsworth, CA 91311 ... 818-882-8707
Aselco, Inc., Gaithersburg, MD 20877 ... 301-863-1937
† Axel Electronics, Inc., Jamaica, NY 11418 ... 718-291-3900
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 ... 416-828-2400
§ Bishop Electronics Corp., Pico Rivera, CA 90660 ... 213-695-0446;213-692-9391
§† Capcon, Inc., New York, NY 10001 ... 212-243-6275
§ Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 ... 708-806-6300
§† Component Research Co. Inc., Santa Monica, CA 90404 ... 213-829-3615
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 ... 317-659-1874
§ Custom Electronics, Oneonta, NY 13820 ... 607-432-3880
DOW SWITCH, Wilmington, MA 01887 ... 617-935-6395
Ei North America, New York, NY 10021 ... 212-517-5622
§ Electronic Film Capacitors, Inc., Waterbury, CT 06705 ... 203-755-5629
§† Electron Products, Irwindale, CA 91706 ... 818-960-2299
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 ... 407-881-9292
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
§ Evox-Rifa Inc., Lincolnshire, IL 60069 ... 708-948-9511
† F-Dyne Elctrns., Bridgeport, CT 06605 ... 203-367-6431
† Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804 ... 516-752-1144
Globtek, Inc., N. Bergen, NJ 07047 ... 201-861-0246
§ ICO-RALLY Corporation, Palo Alto, CA 94303 ... 415-856-9900
Interelectronics Corp., Congers, NY 10920 ... 914-EL8-8000
§ International Components Corp., Melville, NY 11747 ... 516-293-1500
International Microelectronics, Arlington, TX 76003 ... 817-561-2244
§ ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475
§† ITT Components, ITT Corporation, Irvine, CA 92718 ... 714-727-3001
§# Jaro Components, Inc., Boca Raton, FL 33431 ... 305-771-7000
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 ... 708-884-8688
§ Laube Technology, Woodland Hills, CA 91367 ... 818-703-1188
§ Liberty International Corp., Torrance, CA 90501 ... 213-539-6452
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 ... 317-856-3731
§ Marcon America Corp., Vernon Hills, IL 60061 ... 312-913-9980
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 ... 216-442-2286
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 ... 619-279-5100
Motor Capacitors, Inc., Chicago, IL 60631 ... 312-631-0713
MultiComp., Inc., Beaverton, OR 97006 ... 503-626-4200
§ Multi Products International, West Paterson, NJ 07424 ... 201-890-1344
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
§ Nedco Electronics, Inc., Morton Grove, IL 60053 ... 312-967-0500
§ NIC Components Corp., N. Amityville, NY 11701 ... 516-226-7500
§ Nichicon (America) Corp., Schaumburg, IL 60173 ... 708-843-7500
Nissei Denki America, Inc., Beaverton, OR 97005 ... 503-646-1434
Noble U.S.A., Inc., Rolling Meadows, IL 60008 ... 708-364-6038
§ Peter Parts & Assocs., Webster, NY 14580 ... 716-265-2540
§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 ... 803-772-2500
§† Plastic Capacitors, Inc., Chicago, IL 60639 ... 312-489-2229
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 ... 714-263-0661
Rogers Corp., Rogers, CT 06263 ... 203-774-9605
§ Rubycon America, Inc., Gurnee, IL 60031 ... 708-249-3450
Samhwa U.S.A. Inc., Simi Valley, CA 93065 ... 805-584-9494; 800-800-0069
† S & El Manufacturing, Northridge, CA 91324 ... 818-349-4111
§ S. B. Electronics, Inc., Barre, VT 05641 ... 802-476-4146
Seacor, Inc., Westwood, NJ 07675 ... 201-666-5600

Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
† Southern Electronics, F-Dyne, Burbank, CA 91502 818-845-2458
§† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
§ Stetco, Inc., Franklin Pk, IL 60131 708-671-4208
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Teapo Electronic Corp. of America, Norcross, GA 30071 404-449-6220
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;213-495-5569
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Fixed, Glass-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... A•1079
Metuchen Capacitors, inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1104
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
AVX Corporation, Myrtle Bch., SC 29577 803-448-9411
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div, A North American Company, El Paso, TX 79906 915-775-4200
Power Electronic Components, Inc., PEC, Inc, New Albany, IN 47150 ..... 812-941-9205; 800-245-0193
Presidio Components, Inc., San Diego, CA 92121 619-578-9390

Capacitors, Fixed, Laboratory Standard-1500

§ Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ..... A•1066,1068
Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ..... A•1150
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
Aselco, Inc., Gaithersburg, MD 20877 301-863-1937
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
§† Component Research Co. Inc., Santa Monica, CA 90404 213-829-3615
† F-Dyne Elctrns., Bridgeport, CT 06605 203-367-6431
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
§ Nichicon (America) Corp., Schaumburg, IL 60173 708-843-7500
Rutherford Research, Rutherford, NJ 07070 201-933-2091
S & El Manufacturing, Northridge, CA 91324 818-349-4111
† Southern Electronics, F-Dyne, Burbank, CA 91502 818-845-2458
§† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400

Capacitors, Fixed, Mica-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
§† Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... A•1052-1053
Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1056
§† MP/Capar, Multi Products International, West Paterson, NJ 07424, 201-890-1344 ..... A•1107
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1120,1122
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
† Cera-Mite Corp., Grafton, WI 53024 414-377-3500
§† Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§† Custom Electronics, Oneonta, NY 13820 607-432-3880
Ei North America, New York, NY 10021 212-517-5622
§† Electron Products, Irwindale, CA 91706 818-960-2299
§ F. W. Capacitors Inc., Florence, SC 29504-0636 803-662-4728
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
International Microelectronics, Arlington, TX 76003 817-561-2244
Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
§† Sangamo Components Division, Pickens, SC 29671 803-878-6311
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
† Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Tobe Deutschmann Labs., Inc., Canton, MA 02021 617-828-3366
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Fixed, Mylar – See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Oil Filled-1500

§ Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ..... A•1019
† Condenser Products Corp., Brooksville, FL 34609, 904-796-3561 ..... A•1051
† CSI Capacitors, CSI Technologies, San Marcos, CA 92069, 619-747-4000 ..... A•1055
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1056
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1120-1122
† RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•1633
§ Aerovox Inc., North Dartmouth, MA 02747-1217 508-995-8000
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
§ American Radionic Co. Inc., Palm Coast, FL 32137 904-445-6000
§ ASC, Ogallala, NE 69153 308-284-3611
Aselco, Inc., Gaithersburg, MD 20877 301-863-1937
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§ Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
§† Component Research Co. Inc., Santa Monica, CA 90404 213-829-3615
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741 508-996-8561
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
§† Electron Products, Irwindale, CA 91706 818-960-2299
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
§ Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
Hipotronics Inc., Brewster, NY 10509 914-279-8091
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
§ Nichicon (America) Corp., Schaumburg, IL 60173 708-843-7500
Nissei Denki America, Inc., Beaverton, OR 97005 503-646-1434
§† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
Samhwa U.S.A. Inc., Simi Valley, CA 93065 ..... 805-584-9494; 800-800-0069
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Standard Condenser Corp., Skokie, IL 60076 708-675-3133
† Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
† Tobe Deutschmann Labs., Inc., Canton, MA 02021 617-828-3366

Capacitors, Fixed, Paper, Metallized & Nonmetallized-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
† Condenser Products Corp., Brooksville, FL 34609, 904-796-3561 ..... A•1051
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... A•1052
CSI Capacitors, CSI Technologies, San Marcos, CA 92069, 619-747-4000 ..... A•1055
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1056-1057
§ Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ..... A•1068
§ Inter-Technical Group Inc., WIMA Div., Elmsford, NY 10523, 914-347-2474 ..... A•1071-1073
ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1075
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1120-1122
† RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•1633
§ Aerovox Inc., North Dartmouth, MA 02747-1217 508-995-8000
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
§ Arco Electronics, Chatsworth, CA 91311 818-882-8707
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Bishop Electronics Corp., Pico Rivera, CA 90660 ..... 213-695-0446;213-692-9391
§† Capcon, Inc., New York, NY 10001 212-243-6275
§ Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
§ Chicago Condenser Corp., Chicago, IL 60622 312-227-7070
§† Component Research Co. Inc., Santa Monica, CA 90404 213-829-3615
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
Eichhoff Electronics, Warwick, RI 02886 ..... 401-738-1440;800-678-1040
§† Electron Products, Irwindale, CA 91706 818-960-2299
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
§ Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Evox-Rifa Inc., Lincolnshire, IL 60069 708-948-9511
† Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Components Corp., Melville, NY 11747 516-293-1500
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§# Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§ Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
Nissei Denki America, Inc., Beaverton, OR 97005 503-646-1434
§† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
§ Rubycon America, Inc., Gurnee, IL 60031 708-249-3450
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Southern Electronics, F-Dyne, Burbank, CA 91502 818-845-2458
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
† Teapo Electronic Corp. of America, Norcross, GA 30071 404-449-6220
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Fixed, Plastic – See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polycarbonate – See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polyester – See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polypropylene – See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polystyrene – See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polysulfone – See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Porcelain-1500

† Johanson Dielectrics, Inc., Burbank, CA 91505, 818-848-4465 ..... A•1081
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1109
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
§† Dielectric Labs., Cazenovia, NY 13035 315-655-8710
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
Presidio Components, Inc., San Diego, CA 92121 619-578-9390

Capacitors, Fixed, Tantalum Electrolytic-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... A•1052
§† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 .... A•1082
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1085
§ Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491 ... A•1092-1096
§ MP/Capar, Multi Products International, West Paterson, NJ 07424, 201-890-1344 ..... A•1107
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... A•1115-1119
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102, 508-339-8900 ..... A•1138
§† Tansitor Electronics, Bennington, VT 05201, 802-442-5473 ..... A•1143
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
AVX Corporation, Myrtle Bch., SC 29577 803-448-9411
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Ei North America, New York, NY 10021 212-517-5622
§ Elna America, Inc., Cypress, CA 90630 714-761-8600
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§ Hilton Industries, Inc., Subsidiary of Core Industries, Sarasota, FL 34232 813-371-2600
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§# Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§† Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§ Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§† Philips Components Discrete Products Div., A North American Philips Co., W. Palm Bch., FL 33407 407-863-1800
Raltron Electronics, Miami, FL 33172 305-593-6033
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010

Capacitors, Fixed, Vacuum-1500

† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... A•1079
ASC, Ogallala, NE 69153 308-284-3611
† EEV Inc., Elmsford, NY 10523 914-592-6050
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
Power Electronic Components, Inc., PEC, Inc, New Albany, IN 47150 ..... 812-941-9205; 800-245-0193

Capacitors, Surface Mount-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1008-1009
§ Armbar Industries, Inc., Old Bridge, NJ 08857, 908-679-3377 ..... A•1011
§† Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8561 ..... A•1052
Electronic Concepts, Inc., Eatontown, NJ 07724, 908-542-7880 ..... A•1058,1060,1063
§ Inter-Technical Group Inc., WIMA Div., Elmsford, NY 10523, 914-347-2474 ..... A•1072-1073
§ ITW Paktron, Div. of Illinois Tool Works, Lynchburg, VA 24502, 804-239-6941 ..... A•1076-1077
† Johanson Dielectrics, Inc., Burbank, CA 91505, 818-848-4465 ..... A•1081
Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 ..... A•1082-1083
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1085
Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1086
Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491 ... A•1096-1097
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1104
MP/Capar, Multi Products International, West Paterson, NJ 07424, 201-890-1344 ..... A•1107
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1109,1111
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... A•1115-1119
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1122
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1124-1128
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1140-1141
† Tansitor Electronics, Bennington, VT 05201, 802-442-5473 ..... A•1143
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1145-1146
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
ASC, Ogallala, NE 69153 308-284-3611
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Ei North America, New York, NY 10021 212-517-5622
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
§† Electron Products, Irwindale, CA 91706 818-960-2299
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Evox-Rifa Inc., Lincolnshire, IL 60069 708-948-9511
§# F. W. Capacitors Inc., Florence, SC 29504-0636 803-662-4728
§† Hilton Industries, Inc., Subsidiary of Core Industries, Sarasota, FL 34232 813-371-2600
International Microelectronics, Arlington, TX 76003 817-561-2244
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ Johnson, E. F., Co., Minneapolis, MN 55459-0089 612-943-5500
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
† KD Components, Inc., Santa Ana, CA 92707 714-545-7108
§ Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
Microcap, Inc., A MicroSemi Company, Escondido, CA 92025 619-480-1906
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Nichicon (America) Corp., Schaumburg, IL 60173 708-843-7500
Nissei Denki America, Inc., Beaverton, OR 97005 503-646-1434
Philips Components Discrete Products Div., A North American Philips Co., W. Palm Bch., FL 33407 407-863-1800
§ Philips Components Discrete Products Div, A North American Company, El Paso, TX 79906 915-775-4200
Polyflon Company, Crane Co., New Rochelle, NY 10801 914-636-7222
Rubycon America, Inc., Gurnee, IL 60031 708-249-3450
Samhwa U.S.A. Inc., Simi Valley, CA 93065 ..... 805-584-9494; 800-800-0069
§† Sangamo Components Division, Pickens, SC 29671 803-878-6311
§† SFE Technologies, San Fernando, CA 91340 818-365-9411
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Spectrum Control, Inc., Erie, PA 16505 814-455-0966
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§ Stetco, Inc., Franklin Pk, IL 60131 708-671-4208
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ Trim-Tronics, Inc., Cazenovia, NY 13035 315-655-9528
† Voltronics Corporation, E. Hanover, NJ 07936 201-887-1517
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Variable, Air-1500

§† Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1080
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1109
§† Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1140-1141
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International Microelectronics, Arlington, TX 76003 817-561-2244
Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ Johnson, E. F., Co., Minneapolis, MN 55459-0089 612-943-5500
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7831
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050
§ Trim-Tronics, Inc., Cazenovia, NY 13035 315-655-9528
† Voltronics Corporation, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, Ceramic-1500

§† **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711** ..... **A•1008-1009**
† **Jennings, San Jose, CA 95122-2696, 408-292-4025** ..... **A•1079**
§† **Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676** ..... **A•1080**
§ **Maida Development Co., Hampton, VA 23663, 804-723-0785** ..... **A•1086**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** .. **A•1109,1113**
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... **A•1115-1116**
† **Oxley Inc., Branford, CT 06405, 203-488-1033** ..... **B•1025**
§ **Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385** ..... **A•1140-1141**
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
AVX Corporation, Myrtle Bch., SC 29577 803-448-9411
† Compex Corp., Medford, NJ 08055 609-596-9388
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ Johnson, E. F., Co., Minneapolis, MN 55459-0089 612-943-5500
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div, A North American Company, El Paso, TX 79906 915-775-4200
SARONIX, Palo Alto, CA 94303 415-856-6900
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400

Capacitors, Variable, Film-1500

§† **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711** ..... **A•1008-1009**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... **A•1124-1128**
§ **Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385** ..... **A•1140-1141**
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† F-Dyne Elctrns., Bridgeport, CT 06605 203-367-6431
§ Johnson, E. F., Co., Minneapolis, MN 55459-0089 612-943-5500
Kemet Electronics Corporation, Greenville, SC 29606 803-963-6621
§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 803-772-2500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Voltronics Corporation, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, Gas Filled-1500

† **Jennings, San Jose, CA 95122-2696, 408-292-4025** ..... **A•1079**
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050

Capacitors, Variable, Glass-1500

† **Jennings, San Jose, CA 95122-2696, 408-292-4025** ..... **A•1079**
§† **Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676** ..... **A•1080**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... **A•1104**
§† **Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385** ..... **A•1140-1141**
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
Power Electronic Components, Inc., PEC, Inc, New Albany, IN 47150 ..... 812-941-9205; 800-245-0193
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
† Voltronics Corporation, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, HV (Lab Type)-Also See Decade Boxes, Capacitance-1500

Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ..... **A•1019**
Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... **A•1056**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... **D•1258-1263**
§† **Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676** ..... **A•1080**
§† **Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385** ..... **A•1140-1141**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† F-Dyne Elctrns., Bridgeport, CT 06605 203-367-6431
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Jennings, San Jose, CA 95122-2696 408-292-4025
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Southern Electronics, F-Dyne, Burbank, CA 91502 818-845-2458
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050

Capacitors, Variable, Mica-1500

§† **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711** ..... **A•1008-1009**
§ **Arco Electronics, Chatsworth, CA 91311, 818-882-8707** ..... **A•1655-1657**
§ **Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385** ..... **A•1140-1141**
Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Ei North America, New York, NY 10021 212-517-5622
§ F. W. Capacitors Inc., Florence, SC 29504-0636 803-662-4728
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

Capacitors, Variable, Padders & Trimmers-1500

§† **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711** ..... **A•1008-1009**
§ **Arco Electronics, Chatsworth, CA 91311, 818-882-8707** ..... **A•1655-1657**
§† **Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676** ..... **A•1080**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... **A•1104**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** .. **A•1109,1111**
† **Oxley Inc., Branford, CT 06405, 203-488-1033** ..... **B•1025**
§† **Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385** ..... **A•1140-1141**
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
Ei North America, New York, NY 10021 212-517-5622
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ F. W. Capacitors Inc., Florence, SC 29504-0636 803-662-4728
Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ Johnson, E. F., Co., Minneapolis, MN 55459-0089 612-943-5500
§ Maida Development Co., Hampton, VA 23663 804-723-0785
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7831
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400
† Voltronics Corporation, E. Hanover, NJ 07936 201-887-1517

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† **Jennings, San Jose, CA 95122-2696, 408-292-4025** ..... **A•1079**
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... **D•1490**
† EEV Inc., Elmsford, NY 10523 914-592-6050
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
Power Electronic Components, Inc., PEC, Inc, New Albany, IN 47150 ..... 812-941-9205; 800-245-0193

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† **Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679**
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
Zero Enclosures, Zero Corp., Burbank, CA 91503 ..... 818-846-4191;818-841-1825

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† **Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134**
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... A•1156-1158
† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159-1163**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2181
§ **Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720 ..... A•1164-1167**
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•1170
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 .. A•1172,1174-1186
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193**
§ **Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1195,1198-1199**
§ **Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... A•1204-1205**
† **Delta Products Corporation, Fremont, CA 94538, 415-770-0660 ..... A•1612**
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GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
§† **Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... A•1208**
Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525 ..... A•2235
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Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 ..... A•2241
† **Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2250**
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2254
§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ... A•1212,2279,2286**
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314, D•1915**
§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1290-1292**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236**
† **Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371**
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•1250-1252,2383
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1255-1258
§ **Schaffner EMC, Inc. Components Division, Union, NJ 07083, 908-851-0664;800-367-5566 ..... A•1634-1637**
† **Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392**
† **Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1266**
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 .... A•2422-2426
§ **Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•1269**
§† **Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2438,2440**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2450**
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Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Bicron Electronics, Canaan, CT 06018 203-824-5125
Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
§† Capcon, Inc., New York, NY 10001 212-243-6275
Component Specialties Corp., Temple City, CA 91780 213-283-0015
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Custom Coils Inc., Alcester, SD 57001 605-934-2460
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710

Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
§ Jeffers Electronics, Nogales, AZ 85621 602-281-4925
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
Sanford-Miller Corp., Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
§ Stancor, White-Rodgers, Logansport, IN 46947 219-722-2244
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Toroid Corp. of Maryland, Salisbury, MD 21801 301-860-0300
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
§ Valor Electronics, San Diego, CA 92121-2245 619-458-1471
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
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GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
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† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
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American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
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† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Component Specialties Corp., Temple City, CA 91780 213-283-0015
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
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† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electromech, Inc., Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
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Gavagan Electronics, Danbury, CT 06810 203-748-5248
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7831
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
† Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Toroid Corp. of Maryland, Salisbury, MD 21801 301-860-0300
† Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Chokes, Waveguide-3450

† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900

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† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
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† HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386, 612-443-2500 ..... A•1726
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1727
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† ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ..... D•1176
§† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 .... A•1731
† Interpoint Corporation, Redmond, WA 98073-9705, 206-882-3100 ..... A•1732-1733, D•1810,1819-1820
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•1734
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
† M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1409
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1736-1738
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1742
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986
ACC Electronics Company, Echlin Inc., Independence, KS 67301 316-331-1000
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† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Allied-Signal Aerospace Co., Bendix Communications Div., Towson, MD 21204 410-583-4000
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
Aptek Technologies, Inc., Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
Argo Transdata Corp., Clinton, CT 06413-0554 203-669-2233
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5200
§ Cermetek Microelectronics Inc., Sunnyvale, CA 94089 408-752-5000
† CTS Corporation, Elkhart, IN 46514 219-293-7511

† CTS Corporation, Microelectronics business unit, W. Lafayette, IN 47906 317-463-2565
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§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
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GC International Inc., Richardson, TX 75085-1198 214-234-3240
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO 613-724-1993
§† General Mircocircuits, Billerica, MA 01821 508-663-9101
Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
GTI/Circuits Div., Leesburg, IN 46538 219-453-3261
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† Hybrid Electronics Corp., Bedford, MA 01730 617-275-5350
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
† Hy-Tec Industries, Div. of Topo Industries, Inc., Shoreham, NY 11786 516-924-8686
Intepro Systems Inc., Billerica, MA 01821 508-663-7555
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ International Resistive Company, Boone, NC 28607 704-264-8861
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
† K & M Electronics, W. Springfield, MA 01089 413-781-1350
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Leach Corporation, Buena Pk., CA 90622-5032 714-739-0770
LTI, Inc., Carol Stream, IL 60188 708-668-8886
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§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
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§ Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
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† Q-Tech Corp., Culver City, CA 90232-3510 213-836-7900
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† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
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Semtech, Newbury Park, CA 91320 805-498-2111
SFE Technologies, San Fernando, CA 91340 818-365-9411
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
† Sipex Corp., Custom Monolithic Prods. Div., Billerica, MA 01821 508-667-8700
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
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Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† TH Electronics, Orem, UT 84058 801-226-1383
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
† Trend Circuits, Fremont, CA 94538-6148 415-651-1150
† TRW LSI Products INC., La Jolla, CA 92038 619-457-1000
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730
Vermont Semiconductor, Inc., Williston, VT 05495 802-865-3000
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402
† White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040 602-437-1520

Circuits, Hybrid, Thick Film-3130

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720-1721
† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1843
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
CAC Microcircuits Inc., Bel Fuse, Mt. Carmel, IL 62863, 618-263-4343 ..... A•1723
§ Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... A•2086-2092
DuPont Connector Systems, DuPont Elctrns., Wilmington, DE 19880-0019, 800-237-2374 ..... C•1350
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000 ..... A•1725
† HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386, 612-443-2500 ..... A•1726
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1727
† Hybridyne, Inc., Tucson, AZ 85745, 602-629-0001 ..... A•1729
† ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ..... D•1176-1177
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§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1742
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1582
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986-1988,1991
ACC Electronics Company, Echlin Inc., Independence, KS 67301 316-331-1000
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† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Allied-Signal Aerospace Co., Bendix Communications Div., Towson, MD 21204 410-583-4000
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
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California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
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Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
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Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
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Semtech, Newbury Park, CA 91320 805-498-2111
Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
Spectrum Control, Inc., Erie, PA 16505 814-455-0966
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
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§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
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† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† TH Electronics, Orem, UT 84058 801-226-1383
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§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§† TRW LSI Products INC., La Jolla, CA 92038 619-457-1000
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Circuits, Hybrid, Thick Film, Surface Mount-3130

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Circuits, Hybrid, Thin Film-3130

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Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1225
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1736-1738
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1967
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1742
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 .. A•1986,1991
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Aydin Corp., Horsham, PA 19044 215-657-7510
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5200
§ Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† CTS Corporation, Microelectronics business unit., W. Lafayette, IN 47906 317-463-2565

§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Dover Electronics Manufacturing, Binghamton, NY 13902-5212 ..... 607-772-7563; 1-800-PWB-ASSY
DOW SWITCH, Wilmington, MA 01887 617-935-6395
Dymec Inc., Winchester, MA 01890 617-729-7870
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† General Mircocircuits, Billerica, MA 01821 508-663-9101
Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hybrid Electronics Corp., Bedford, MA 01730 617-275-5350
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Resistive Company, Boone, NC 28607 704-264-8861
International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Marconi Circuit Technology Corp., Farmingdale, NY 11735 516-293-8636
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
† Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
† Micro Systems Engineering, Inc., Lake Oswego, OR 97035 503-635-4016
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
† Modular Devices, Shirley, NY 11967 516-345-3100
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
Philips Circuit Assemblies:North American Philips Corp., Slatersville, RI 02876-2078 401-762-3800
§ Raltron Electronics, Miami, FL 33172 305-593-6033
Semtech, Newbury Park, CA 91320 805-498-2111
† Sipex Corp., Custom Monolithic Prods. Div., Billerica, MA 01821 508-667-8700
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
Staffall Inc., Cranston, RI 02910 401-461-5554
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† TRW LSI Products INC., La Jolla, CA 92038 619-457-1000
Vermont Semiconductor, Inc., Williston, VT 05495 802-865-3000

Circuits, Hybrid, Thin Film, Surface Mount-3130

Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720-1721
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1727
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•1734
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 .. A•1986,1991
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Aztec Industries, Inc., Mesa, AZ 85210 ..... 602-833-3131;800-729-3132
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Dover Electronics Manufacturing, Binghamton, NY 13902-5212 ..... 607-772-7563; 1-800-PWB-ASSY
DOW SWITCH, Wilmington, MA 01887 617-935-6395
Dymec Inc., Winchester, MA 01890 617-729-7870
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Hybrid Electronics Corp., Bedford, MA 01730 617-275-5350
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Resistive Company, Boone, NC 28607 704-264-8861
† Micro Systems Engineering, Inc., Lake Oswego, OR 97035 503-635-4016
† Modular Devices, Shirley, NY 11967 516-345-3100
Philips Circuit Assemblies:North American Philips Corp., Slatersville, RI 02876-2078 401-762-3800
Semtech, Newbury Park, CA 91320 805-498-2111
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Trend Circuits, Fremont, CA 94538-6148 415-651-1150
Vermont Semiconductor, Inc., Williston, VT 05495 802-865-3000

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Circulators, Ferrite-3450

§† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1832-1833
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
Reim Communications, Inc., Indianapolis, IN 46226 317-545-4281
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

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Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§† Seaboard Electronics, New Rochelle, NY 10805 914-235-8073
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300

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Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172,1174
Custom Coils Inc., Alcester, SD 57001, 605-934-2460 ..... A•2197
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1201
§ **Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206**
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1210-1211
Magnetab, Boulder, CO 80301-4696, 303-442-6700 ..... A•1209,2253,2257
Magnos, Hudson, MA 01749, 508-562-1173 ..... D•1291
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•1250-1253,2383
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1260
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1262,1265
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1276**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1280-1283
† Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
Cortec, Inc., Huntington Bch., CA 92649 714-897-2529
Cosmo Corporation, Cleveland, OH 44109 216-861-5594
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Dynacast Inc., Yorktown Heights, NY 10598 914-962-6300
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Everett, WA 98204 206-355-1855
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
GC International Inc., Richardson, TX 75085-1198 214-234-3240
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
§† Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
§† Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
§ Katronic Elektronic Ges.m.b.H., AUSTRIA 04762-5340
§† Krystinel Corp., Paterson, NJ 07509 201-345-8900
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
Micrometals, Anaheim, CA 92807 ..... 714-630-7420;800-356-5977
Miles Platts Inc., Elk Grove Village, IL 60007 1-708-364-0363
Multi Products International, West Paterson, NJ 07424 201-890-1344
Necoa, Inc., Nittoku Engineering Group, Baltimore, MD 21237 301-574-4960
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Plastron Corp., Bensenville, IL 60106 708-595-2212
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
§† Powertron Corp., Sparta, NJ 07871 201-579-5599
Precision Paper Tube Co., Wheeling, IL 60090 708-537-4250
§† PTS Corporation, Bloomington, IN 47401 812-824-9331
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
SinoTECH, Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
Staffall Inc., Cranston, RI 02910 401-461-5554
† Stevens Products, Inc., E. Orange, NJ 07019 201-672-2140
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100
† TDS, Tang Ind., Elk Grove Village, IL 60007 ..... 1-800-323-6648;312-806-7240
† Telectro Systems Corp., Corona, NY 11368 718-651-8900
Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Trionics, Inc., St. Charles, IL 60174 312-232-9117
†# United States Electronics, Springfield, NJ 07081 201-912-0111
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300
Wontronics, Los Angeles, CA 90039 213-660-6230
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coil/Lens Aligners, Micropositioner-1800

† CELCO, Mahwah, NJ 07430 201-327-1123

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Coils, AF-1800

† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159-1161,1163
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1201
§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•1212**
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236**
† **Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371**
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2383
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1255,1259-1260
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
† **Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1266**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1276**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1280
American Magnetics, Carterville, IL 62918 618-985-4838
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9668
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† ESC Electronics Corp., Palisades Pk, NJ 07650 201-947-0400
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
Mag-Con, St. Paul, MN 55113 ..... 612 633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§ Tamura Corporation of America, Carson, CA 90746-3518 213-638-1790
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Xylog Corp., Hackensack, NJ 07601 201-489-4040
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Antenna (Incl. Loading Type)-1800

† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2383
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
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† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Broadcast-1800

Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172,1177
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1266
† Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111

Coils, Chip-1800

Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720 ..... A•1164,1166-1169
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•1171
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187-1189,1192
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1194
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... A•1202-1205
§ GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1213,1698
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1248-1249
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1255,1259-1260
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1141
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1266
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1273,1294,1597
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1274
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•1279
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
Jeffers Electronics, Nogales, AZ 85621 602-281-4925
§† Krystinel Corp., Paterson, NJ 07509 201-345-8900
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
† Stetco, Inc., Franklin Pk, IL 60131 708-671-4208
† TDS, Tang Ind., Elk Grove Village, IL 60007 ..... 1-800-323-6648;312-806-7240
† Thinco Div., Hull Corp., Hatboro, PA 19040 215-672-7800
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Degaussing-1800

§ Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•1212
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1337
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Contact East, N. Andover, MA 01845 508-682-2000
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
LDJ Incorporated, Troy, MI 48099-0219 313-528-2202
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
Mag-Con, St. Paul, MN 55113 612-633-8820
Magnetic Instrumentation, Indianapolis, IN 46226 317-545-2102
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111

Coils, Field-1800

Aibar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159-1161,1163
Magnos, Hudson, MA 01749, 508-562-1173 ..... D•1291
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1337
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
§ GC International Inc., Richardson, TX 75085-1198 214-234-3240
LDJ Incorporated, Troy, MI 48099-0219 313-528-2202
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111

Coils, Focusing-1800

Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2383
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† CELCO, Mahwah, NJ 07430 201-327-1123
Custom Coils Inc., Alcester, SD 57001 605-934-2460
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762

Coils, Foil Wound-1800

† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
Aibar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1201
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197 ..... D•1891
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1276
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
American Magnetics, Carterville, IL 62918 618-985-4838
Andover, Inc., Lafayette, IN 47904 317-447-1157
Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electromech, Inc., Kearny, NJ 07032 201-997-0950
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
† Osborne Transformer, Detroit, MI 48203 313-468-9410
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
§† Powertron Corp., Sparta, NJ 07871 201-579-5599

† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§ Tapecon, Inc., Rochester, NY 14612 716-621-8400
Texas Transformer Corp., Plano, TX 75086 214-424-1581
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
Walker Power, Inc., Warner, NH 03278 603-456-3111
§ Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232;800-962-4638
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Helmholtz-1800

§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1337

Coils, High Q, Low Frequency-1800

APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2168-2169
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159-1161,1163
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172,1174-1176,1179-1183,1185
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1198-1199
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1201
§ GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1210
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•1209,2253
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•1212
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310
Nytron Inductors, Inc., Darlington, SC 29532, 803-393-5421 ..... A•1214-1215,1220-1221,1223,1225-1233, B•1023
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... A•1705
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1248
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•1250-1253,2383
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1255-1256,1259
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1262-1266
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ..... A•2422,2424-2426
Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•1272
Torelco, Inc., Irvington, NJ 07111, 201-374-8641 ..... A•1278
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1276
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•1279
§ Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... A•2462
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1280-1282
American Magnetics, Carterville, IL 62918 618-985-4838
§† Associated Spring, Barnes Grp., Bristol, CT 06010 203-583-1331
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electromech, Inc., Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
§ Frontier Electronics, Chatsworth, CA 91311 818-709-9888
Gavagan Electronics, Danbury, CT 06810 203-748-5248
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Lenox-Fugle Electronics, S. Plainfield, NJ 07080 908-756-1164
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
§† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Hum Eliminating – See Hum Eliminators (Vol. A)

Coils, Hybrid & Repeater-1800

§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... A•1202-1205
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1201
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ... A•1212,2279,2292
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2383
American Magnetics, Carterville, IL 62918 618-985-4838
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Tamura Corporation of America, Carson, CA 90746-3518 213-638-1790
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Coils, IF-1800

APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2169
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172,1177-1183,1185-1186
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187-1190,1192
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1194
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1201
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1262,1265-1266
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1276
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1280
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
§ GC International Inc., Richardson, TX 75085-1198 214-234-3240
Hisonic, Inc., Olathe, KS 66061 913-782-0012
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
§† PTS Corporation, Bloomington, IN 47401 812-824-9331
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Tamura Corporation of America, Carson, CA 90746-3518 213-638-1790
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
§† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Metallized Ceramic-1800

Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187,1192
† Oxley Inc., Branford, CT 06405, 203-488-1033 ..... A•1705, B•1025
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1249
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
§ Stetco, Inc., Franklin Pk, IL 60131 708-671-4208

Coils, Metallized Glass-1800

§† Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1140-1141
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Thinco Div., Hull Corp., Hatboro, PA 19040 215-672-7800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762

Coils, Molded-1800

Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•1156-1158,2154-2156,2160
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159-1161,1163
§† Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720 ..... A•1164
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172,1174
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187-1189,1192
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193
CSI Capacitors, CSI Technologies, San Marcos, CA 92069, 619-747-4000 ..... A•1055
Custom Coils Inc., Alcester, SD 57001, 605-934-2460 ..... A•2197
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1194-1196
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... A•1202-1203,1205
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1201
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206
§ GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ... A•1212,2279,2286
§† Nytron Inductors, Inc., Darlington, SC 29532, 803-393-5421 ..... A•1216-1219,1222-1230,1232, B•1023
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1248
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1255-1256,1260
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1262-1266
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1273,1294
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1275-1276
§ Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... A•2459,2463
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1281-1282
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Andover, Inc., Lafayette, IN 47904 317-447-1157
† Bicron Electronics, Canaan, CT 06018 203-824-5125
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
Cosmo Corporation, Cleveland, OH 44109 216-861-5594
Coto Wabash, Kearney National Corporation, Providence, RI 02907 401-943-2686
§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
§† Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electro-Pacific, Goleta, CA 93117 805-964-0751
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† ESC Electronics Corp., Palisades Pk, NJ 07650 201-947-0400
The Five Star Co., Plantsville, CT 06479 203-628-5561
§† Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
§† Jeffers Electronics, Nogales, AZ 85621 602-281-4925
† Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
Kentron, Inc., Cedarburg, WI 53012-0142 414-377-3733
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Lenox-Fugle Electronics, S. Plainfield, NJ 07080 908-756-1164
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† MLI Industries, Inc., Apalachin, NY 13732 607-754-5800
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
† NY Glass Plastics, Calnetics Corp., Paramount, CA 90723 213-636-1035
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Stetco, Inc., Franklin Pk, IL 60131 708-671-4208
§ Tamura Corporation of America, Carson, CA 90746-3518 213-638-1790
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535
†# United States Electronics, Springfield, NJ 07081 201-912-0111
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300
Wabash Magnetics, Wabash, IN 46992 219-563-2191
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Coils, pi Winding-1800

Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172-1173
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193
Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2292
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1259-1260
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1280
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§† Associated Spring, Barnes Grp., Bristol, CT 06010 203-583-1331
† Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
EI & S, Prime Technology Inc., North Branford, CT 06471 203-481-5721
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
† Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535
†# United States Electronics, Springfield, NJ 07081 201-912-0111
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Relay-1800

APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2168
§ GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... A•1208
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1262,1266
American Magnetics, Carterville, IL 62918 618-985-4838
Andover, Inc., Lafayette, IN 47904 317-447-1157
Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
† Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
Cardinal Control Co., Kensington, CT 06037 203-828-6379
† Computer Components, Inc., Pelham, NY 10803 914-738-1611
Coto Wabash, Kearney National Corporation, Providence, RI 02907 401-943-2686
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
The Five Star Co., Plantsville, CT 06479 203-628-5561
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
§† Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
Liberty Controls, Shorewood, IL 60435 815-725-2241
Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
Relay Service Co., Chicago, IL 60651 312-252-2700
Renco Electronics, Inc., Deer Pk, NY 11729 ..... 516-586-5566;1-800-645-5828
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
TDS, Tang Ind., Elk Grove Village, IL 60007 ..... 1-800-323-6648;312-806-7240
Texas Transformer Corp., Plano, TX 75086 214-424-1581
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535
†# United States Electronics, Springfield, NJ 07081 201-912-0111
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300
Wabash Magnetics, Wabash, IN 46992 219-563-2191
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, RF-1800

APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2169
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720 ..... A•1164-1167
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•1170
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172,1174-1183,1185-1186
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187-1190,1192
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193

§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1194-1195
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... A•1202-1205
EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... B•1462-1463
Enegren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ..... A•2210
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1201
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206
§† Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... A•1208
† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2248-2249
Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•1212,2279
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310
§† Nytron Inductors, Inc., Darlington, SC 29532, 803-393-5421 ..... A•1214-1215,1217-1232, B•1023
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... A•1705
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1291-1292
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1249
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2383
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1255,1259-1260
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1140-1141
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1262,1265-1266
Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•1271-1272
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1273,1294
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1274-1276
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•1279
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1280-1281,1283
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Elite Electronic Engineering Co., Downers Grove, IL 60515 708-495-9770
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
† Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
LH. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ GC International Inc., Richardson, TX 75085-1198 214-234-3240
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
International Microelectronics, Arlington, TX 76003 817-561-2244
JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
§† Jeffers Electronics, Nogales, AZ 85621 602-281-4925
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
† Lenox-Fugle Electronics, S. Plainfield, NJ 07080 908-756-1164
† Lepel Corp., Edgewood, NY 11717 516-586-3300
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
Rutherford Research, Rutherford, NJ 07070 201-933-2091
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Stetco, Inc., Franklin Pk, IL 60131 708-671-4208
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
Texas Transformer Corp., Plano, TX 75086 214-424-1581
† Thinco Div., Hull Corp., Hatboro, PA 19040 215-672-7800
Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
§† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Saturable Reactor-1800

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-5660 ..... A•1159-1161,1163
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 .. A•1172,1177-1178
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1201
Magnetab, Boulder, CO 80301-4696, 303-442-6700 ..... A•1209,2253
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•1212
Nytron Inductors, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1023
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2383
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1266
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ..... A•2422
Torelco, Inc., Irvington, NJ 07111, 201-374-8641 ..... A•1278
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1276
† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
American Magnetics, Carterville, IL 62918 618-985-4838
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† Bicron Electronics, Canaan, CT 06018 203-824-5125
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
Cross Electronics, Warrendale, PA 15086 412-776-1591
Custom Coils Inc., Alcester, SD 57001 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
† Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electromech, Inc., Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Oram High Voltage, Dayton, TX 77535 409-258-5553
† Osborne Transformer, Detroit, MI 48203 313-468-9410
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
Rtron Corp., Skokie, IL 60076 708-679-7180
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
Walker Power, Inc., Warner, NH 03278 603-456-3111
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Coils, Shielded-1800

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
§† Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720 ..... A•1189
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 .. A•1172,1184-1186
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187,1190
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193
§† Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1195
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... A•1203-1205
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† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
§† Nytron Inductors, Inc., Darlington, SC 29532, 803-393-5421 ..... A•1214,1216-1223,1232, B•1023
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
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† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1276**
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† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
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† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
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† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Tamura Corporation of America, Carson, CA 90746-3518 213-638-1790
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
American Magnetics, Carterville, IL 62918 618-985-4838
American Magnetics, Oak Ridge, TN 37831-2509 615-482-1056
Andover, Inc., Lafayette, IN 47904 317-447-1157
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§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electromech, Inc., Kearny, NJ 07032 201-997-0950
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Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† ESC Electronics Corp., Palisades Pk, NJ 07650 201-947-0400
The Five Star Co., Plantsville, CT 06479 203-628-5561
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont, CANADA L6H 2R4 416-844-6681
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GC International Inc., Richardson, TX 75085-1198 214-234-3240
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§† Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
† Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
LDJ Incorporated, Troy, MI 48099-0219 313-528-2202
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535
†# United States Electronics, Springfield, NJ 07081 201-912-0111
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... **A•2152**
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§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... **A•2279,2286**
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† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1276**
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§† **Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535** ..... **A•2462-2463**
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Custom Coils Inc., Alcester, SD 57001 605-934-2460
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Texas Transformer Corp., Plano, TX 75086 214-424-1581
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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§ **Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790** ..... **A•1269**
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† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148

Cardinal Control Co., Kensington, CT 06037 203-828-6379
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
GC International Inc., Richardson, TX 75085-1198 214-234-3240
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
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LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
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† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
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Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
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Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535

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† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660** ..... A•1159
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2173
§† **Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720** ..... A•1164,1167
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† **Bicron Electronics, Canaan, CT 06018, 203-824-5125** ..... A•2186
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† **Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040** ..... A•2197
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§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... A•1212,2279,2292
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Cross Electronics, Warrendale, PA 15086 412-776-1591
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§ De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9668
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
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Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
§† Jovil Manufacturing Co., Inc., Danbury, CT 06810 203-792-6700
† Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
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† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4751
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
† Nesharmiry Transformer Corp., Furlong, PA 18925 215-794-7411
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
§† Powertron Corp., Sparta, NJ 07871 201-579-5599
† Precision Components, Inc., Addison, IL 60101 312-543-6400
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
Rtron Corp., Skokie, IL 60076 708-679-7180
† Schott Corp., Wayzata, MN 55391 612-475-1173
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-6900
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Standard Condenser Corp., Skokie, IL 60076 708-675-3133
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-635-6195
Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Toroid Corp. of Maryland, Salisbury, MD 21801 301-860-0300
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
Tortran Inc., Bridgeport, CT 06608 203-367-5188
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
§† Valor Electronics, San Diego, CA 92121-2245 619-458-1471
§† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Transducer-1800

† **American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100 ... B•1876**
† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ... A•1159-1161,1163**
Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ... A•1206
Magnetab, Boulder, CO 80301-4696, 303-442-6700 ... A•1209,2253,2255
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•1276**
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 ... 305-979-7920
Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
† Electronic Transformer Corp., Totowa, NJ 07511 ... 201-942-2222
Endicott Coil Co., Inc., Binghamton, NY 13905 ... 607-797-1263
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 ... 201-942-2222
General Vibrations Mfg. Co., Manchester, CT 06040 ... 203-646-0090
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 ... 416-292-4463
Mag-Con, St. Paul, MN 55113 ... 612-633-8820
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 ... 203-762-4786
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
§† Powertron Corp., Sparta, NJ 07871 ... 201-579-5599
Renco Electronics, Inc., Deer Pk., NY 11729 ... 516-586-5566;1-800-645-5828
Richard-Lee Co., Cranford, NJ 07016 ... 201-276-0710
Sensor Corp., Scottdale, PA 15683 ... 412-887-4080
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
Tokin America, Inc., San Jose, CA 95134 ... 408-432-8020
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
† Vanguard Electronics Co., Gardena, CA 90248 ... 213-323-4100
Wontronics, Los Angeles, CA 90039 ... 213-660-6230

Coils, Transformer-1800

† **Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ... A•2134**
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ... A•2152
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ... A•1158,2162
American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100 ... B•1877
APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ... A•2168-2169
† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ... A•1159**
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ... A•1170
† **Bicron Electronics, Canaan, CT 06018, 203-824-5125 ... A•2186**
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ... A•1172-1173
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ... A•1193**
† **Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040 ... A•2191-2193**
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 ... A•2194
Custom Coils Inc., Alcester, SD 57001, 605-934-2460 ... A•2197
§† **Electromech, Inc., Kearny, NJ 07032, 201-997-0950 ... A•2208-2209**
Enegren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ... A•2210
† **EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ... A•1201**
† **Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ... A•1208**
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197 ... D•1891
Magnetab, Boulder, CO 80301-4696, 303-442-6700 ... A•1209,2253-2254,2257
§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ... A•1212,2279,2286,2292**
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ... A•2310
Pilitron, Downsview, Ont., CAN M3J 2N5, 416-667-9914 ... A•2368-2369
† **Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ... A•2371**
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ... A•2383
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ... A•1254**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ... A•1255
† **Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2392**
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ... A•1262,1266-1267
§ **Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ... A•1269,1271-1272**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•1276,2451**
§ **Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ... A•2459,2462-2463**
Abacus Controls Inc., Somerville, NJ 08876 ... 908-526-6010
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 ... 213-673-3245
American Monarch, Minneapolis, MN 55421 ... 612-788-9161
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 ... 718-441-5207
Andover, Inc., Lafayette, IN 47904 ... 317-447-1157
† A.P.W. Co., Inc., Rockaway, NJ 07866 ... 201-627-0643
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 ... 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 ... 617-445-7100
† Avionic Instruments, Avenel, NJ 07001 ... 908-382-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 ... 714-447-2300
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 ... 213-515-1720
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 ... 201-694-5000
† Bourns Instruments Inc., Riverside, CA 92507 ... 714-781-5148
† Caddell Coil Corp., Middletown Springs, VT 05757 ... 802-235-2019
Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 ... 708-806-6300
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
Coil-Q Corp., Bronxville, NY 10708 ... 914-337-4775
† Component Specialties Corp., Temple City, CA 91780 ... 213-283-0015
Computer Power Inc., High Bridge, NJ 08829 ... 908-638-8000;800-526-5088
Cross Electronics, Warrendale, PA 15086 ... 412-776-1591
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 ... 614-452-6973
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
De Coursey Engineering Laboratory, Culver City, CA 90230 ... 213-EX7-9668
† Del Elctrns. Corp., Mt. Vernon, NY 10550 ... 914-699-2000
† Delta Products Corporation, Fremont, CA 94538 ... 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
§† Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 ... 312-283-4000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462/3487
Eichhoff Electronics, Warwick, RI 02886 ... 401-738-1440;800-678-1040
Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
Electrocom Industries, S. Bend, IN 46615 ... 219-232-2743
Electronetics, Inc., Everett, WA 98204 ... 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 ... 201-942-2222
Electro-Pacific, Goleta, CA 93117 ... 805-964-0751
Elma Engineering, Palo Alto, CA 94303 ... 415-494-7303
Endicott Coil Co., Inc., Binghamton, NY 13905 ... 607-797-1263
Engineering Design & Sls., Danville, VA 24541 ... 804-792-6405
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 ... 908-475-3207
The Five Star Co., Plantsville, CT 06479 ... 203-628-5561
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 ... 201-942-2222
§ Frontier Electronics, Chatsworth, CA 91311 ... 818-709-9888
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 ... 416-844-6681
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
GC International Inc., Richardson, TX 75085-1198 ... 214-234-3240
† Genisco Technology Corp., La Mirada, CA 90638 ... 714-523-7001
Gettysburg Transformer Corporation, Gettysburg, PA 17325 ... 717-334-2191
§ Hanovia, Canrad, Newark, NJ 07105 ... 201-589-4300
Hitran Corporation, Flemington, NJ 08822-9943 ... 908-782-5525
Hurricane Electronics Lab, Hurricane, UT 84737 ... 801-635-2003
Integrity Technology Corp., Santa Clara, CA 95050 ... 408-262-8640
§† JB Electronic Transformers, Chicago, IL 60647 ... 312-342-0080
§ Katronic Elektronic Ges.m.b.H., AUSTRIA ... 04762-5340
KGS Electronics, Inc., Pasadena, CA 91103 ... 818-798-0786
§† Krystinel Corp., Paterson, NJ 07509 ... 201-345-8900
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 ... 416-292-4463
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 ... 512-546-1625
Mag-Con, St. Paul, MN 55113 ... 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 ... 803-878-4700
† Magnetic Component Engineering Co., Culver City, CA 90230 ... 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 ... 516-587-0510
Mitchell Electronics Corp., Mt. Vernon, NY 10552 ... 914-699-3800
Multi Products International, West Paterson, NJ 07424 ... 201-890-1344
† Neshaminy Transformer Corp., Furlong, PA 18925 ... 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 ... 708-395-5710
† NWL Transformers, Bordentown, NJ 08505 ... 609-298-7300
Oeco Corp., Milwaukie, OR 97222 ... 503-659-7932
† Oram High Voltage, Dayton, TX 77535 ... 409-258-5553
† Osborne Transformer, Detroit, MI 48203 ... 313-468-9410
Pacific Transformer Corp., Anaheim, CA 92807 ... 1-800-325-0501
† PCA Electronics, Sepulveda, CA 91343 ... 818-892-0761
Permaluster, Inc., Burbank, CA 91504 ... 213-849-4543;213-849-6454
Phenix Technologies, Accident, MD 21520 ... 301-746-8118
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ... 914-699-5514;800-431-1064
† Piconics, Incorporated, Tyngsboro, MA 01879 ... 508-649-7501
Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
Precision Components, Inc., Addison, IL 60101 ... 312-543-6400
† PTC Transformers, Bordentown, NJ 08505 ... 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
† RDI Elctrns., Inc., New Rochelle, NY 10801 ... 914-632-7274
R.F. Electronics, Inc., Irvine, CA 92714-5517 ... 714-263-0661
Rodale Technical Sales Inc., Islip, NY 11751 ... 516-277-5454
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ... 415-471-9717;800-221-7060
† Shogyo International Corp., Great Neck, NY 11021 ... 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 ... 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
§ Sprague Fil-Mag, San Diego, CA 92111-1416 ... 619-569-6577
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 ... 618-262-5121
§ Tokin America, Inc., San Jose, CA 95134 ... 408-432-8020
Tokin Magnetics, Inc., Fremont, CA 94539 ... 415-490-7500
§ Toko America, Inc., Mt. Prospect, IL 60056 ... 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 ... 201-835-6195
Torelco, Inc., Irvington, NJ 07111 ... 201-374-8641
† Torotron Corp., Mt. Vernon, NY 10550 ... 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
†# United States Electronics, Springfield, NJ 07081 ... 201-912-0111
§† Valor Electronics, San Diego, CA 92121-2245 ... 619-458-1471

† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
Walker Power, Inc., Warner, NH 03278 603-456-3111
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 ... 607-729-6318
Wontronics, Los Angeles, CA 90039 213-660-6230
Xylog Corp., Hackensack, NJ 07601 201-489-4040
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, TV (All Types)-1800

Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159-1161,1163
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2383
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1266-1267
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
Custom Coils Inc., Alcester, SD 57001 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
§ Frontier Electronics, Chatsworth, CA 91311 818-709-9888
§ GC International Inc., Richardson, TX 75085-1198 214-234-3240
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762

Coils, Variable-1800

APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2166-2169
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•1159
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720 ..... A•1164-1167
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 .. A•1172,1185-1186
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187-1190,1192
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1193
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040 ..... A•2193
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... A•1205
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206
§† Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... A•1208
† Hisonic, Inc., Olathe, KS 66061, 913-782-9012 ..... A•2234
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1210
§† Nytron Inductors, Inc., Darlington, SC 29532, 803-393-5421 ..... A•1232-1234, B•1023
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•1250-1253,2383
§ RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254
§† Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1140-1141
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1262-1267
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•1279
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
Custom Coils Inc., Alcester, SD 57001 605-934-2460
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Elma Engineering, Palo Alto, CA 94303 415-494-7303
§ GC International Inc., Richardson, TX 75085-1198 214-234-3240
Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
North Hills Electronics, Glen Cove, NY 11542 516-671-5700
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Vidicon Alignment-1800

† CELCO, Mahwah, NJ 07430 201-327-1123
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828

Coil Sets, Magnetic Test-1800

Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... A•1208
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2307
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1337
Third Wave Instruments, Inc., Burlington, MA 01803 617-273-0779

Coils (MIL), Non-RF-2440 — *See Vol. B*

Coils (MIL), RF-2440 — *See Vol. B*

Cold-Cathode Readout Tubes — See Tubes, Readout (Vol. A)

Cold Plates — See Thermal Platforms (Vol. D)

Collection Systems (MIL)-2440 — *See Vol. B*

Collector Rings — See Slip Rings (Vol. B)

Collimators-2900 — *See Vol. D*

Combiners, Microwave — See Couplers, Microwave (Vol. A)

Communications Intelligence (Comint) Systems (MIL)-2440 — *See Vol. B*

Communications Systems, FM-1900 — *See Vol. D*

Communications Systems, Laser-1900 — *See Vol. D*

Communications Module, Power Line LANs-1900 — *See Vol. D*

Communication Systems, Megalinks-1900 — *See Vol. D*

Communication Systems, Megaplex-1900 — *See Vol. D*

Communications Systems, Microwave-3450

Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 ..... D•1067
† Micronics Technology Inc., Glen Cove, NY 11542, 516-759-5600 ..... A•1399
§ Advanced Video Products, Littleton, MA 01460 508-486-0024
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Aydin Corp., Horsham, PA 19044 215-657-7510
California Microwave, Sunnyvale, CA 94086 408-732-4000
§ Comdata Corp., Morton Grove, IL 60053 708-470-9600
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
Dowty Avionics, Arcadia, CA 91006 818-445-5955
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134 708-232-9611
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
Φ Genstar Rental Electronics, Inc., Woodland Hills, CA 91367 ..... 800-331-3440 (in CA); 800-227-8409
HDS Inc., Reston, VA 22091 703-620-6200
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92123 619-278-4100
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Modular Mining Systems, Inc., Tuscon, AZ 85706 602-746-9127
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† Schlumberger Instruments, Schlumberger Technologies, Burlington, MA 01803 617-229-4825
Varian Microwave Equip. Div., Varian Assocs., Inc., Santa Clara, CA 95054 408-496-6273
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

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† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† Quartzite Processing, Inc., Malden, MA 02148 617-322-3611

Cores, Magnetic, Ferrite, L, E, etc.-1850

Coilcraft, Cary, IL 60013, 708-639-2361 ..... **A•1191**
§ **Fair-Rite Prods., Wallkill, NY 12589, 914-895-2055** ..... **A•1284**
Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... **A•1206**
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... **A•1207**
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... **A•1211**
§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200** ..... **A•1290-1292**
§ **TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100** ..... **A•1294-1296,1299**
Ampex Corp., Redwood City, CA 94063-3199 ..... 1-800-25AMPEX
Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
§ Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
Cosmo Corporation, Cleveland, OH 44109 216-861-5594
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§† Krystinel Corp., Paterson, NJ 07509 201-345-8900
§† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100
Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020

Cores, Magnetic, Ferrite, Pot/Cup-1850

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GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... **A•1207**
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... **A•1211**
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... **A•2254-2255**
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Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1260**
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... **A•1294,1296,1299**

§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
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† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
§† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
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§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
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Cores, Magnetic, Ferrite, Slug-1850

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TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1296,1299
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§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
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Tokin America, Inc., San Jose, CA 95134 408-432-8020

Cores, Magnetic, Ferrite, Toroid-1850

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Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1211
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2254-2255
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1290-1292
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1296,1299
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
Ferronics, Fairport, NY 14450 716-388-1020
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§† Krystinel Corp., Paterson, NJ 07509 201-345-8900
§† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
Seacor, Inc., Westwood, NJ 07675 201-666-5600
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100
Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020

Cores, Magnetic, Ferrite, Yoke Section-1850

Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2255
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1296,1299
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
GC International Inc., Richardson, TX 75085-1198 214-234-3240
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100
Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
Tokin America, Inc., San Jose, CA 95134 408-432-8020

Cores, Magnetic, Metal Alloy (Other Than Silicon & Nickel-Iron)-1850

TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1299
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
GC International Inc., Richardson, TX 75085-1198 214-234-3240
† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
† Pyroferric International, Inc., Toledo, IL 62468 217-849-3300
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
Wontronics, Los Angeles, CA 90039 213-660-6230

Cores, Magnetic, Nickel-Iron, L, EE, F, & Ring Laminations-1850

TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1299
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
GC International Inc., Richardson, TX 75085-1198 214-234-3240
† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
† Products Engrg. Corp., Azusa, CA 91702 818-969-5879
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530
Wontronics, Los Angeles, CA 90039 213-660-6230

Cores, Magnetic, Nickel-Iron, Toroid-1850

TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1299
Alpha-Core Inc., Bridgeport, CT 06608 203-335-6805
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
GC International Inc., Richardson, TX 75085-1198 214-234-3240
† Infinetics Inc., Friskem Div., Wilmington, DE 19802 302-658-2471
§† Krystinel Corp., Paterson, NJ 07509 201-345-8900
† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
† Products Engrg. Corp., Azusa, CA 91702 818-969-5879
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530

Cores, Magnetic, Powdered Iron, Pot/Cup-1850

Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1211
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1260
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1299
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
Cortec, Inc., Huntington Bch., CA 92649 714-897-2529
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Micrometals, Anaheim, CA 92807 ..... 714-630-7420;800-356-5977
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Pyroferric International, Inc., Toledo, IL 62468 217-849-3300
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300

Cores, Magnetic, Powdered Iron, Slug-1850

Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1211
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1299
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
Cortec, Inc., Huntington Bch., CA 92649 714-897-2529
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Micrometals, Anaheim, CA 92807 ..... 714-630-7420;800-356-5977
† Pyroferric International, Inc., Toledo, IL 62468 217-849-3300
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828

Cores, Magnetic, Powdered Iron, Toroid-1850

TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1299
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
Cortec, Inc., Huntington Bch., CA 92649 714-897-2529
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Micrometals, Anaheim, CA 92807 ..... 714-630-7420;800-356-5977
† Pyroferric International, Inc., Toledo, IL 62468 217-849-3300
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300

Cores, Magnetic, Powdered Permalloy, Toroid-1850

TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1299
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
GC International Inc., Richardson, TX 75085-1198 214-234-3240
† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282

Cores, Magnetic, Silicon C-1850

Alpha-Core Inc., Bridgeport, CT 06608 203-335-6805
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
† Products Engrg. Corp., Azusa, CA 91702 818-969-5879
† Sko-Die, Inc., Morton Grove, IL 60053 708-965-1130

Cores, Magnetic, Silicon EI, EE, & F Laminations-1850

Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500

Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
† National Lamination Co., National Material Ltd., Des Plaines, IL 60018 ... 708-298-7676
† Products Engrg. Corp., Azusa, CA 91702 818-969-5879
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530
† Sko-Die, Inc., Morton Grove, IL 60053 708-965-1130

Cores, Magnetic, Silicon, Toroid-1850

Alpha-Core Inc., Bridgeport, CT 06608 203-335-6805
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Products Engrg. Corp., Azusa, CA 91702 818-969-5879
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530

Cores, Magnets & Ferrites-1850

Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1190-1191
Fair-Rite Prods., Wallkill, NY 12589, 914-895-2055 ..... A•1284
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1211
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294,1296-1297,1299
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Cores Unlimited, Inc., Westminster, CA 92683 ..... 714-894-3062;800-422-CORE
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Ferronics, Fairport, NY 14450 716-388-1020
GC International Inc., Richardson, TX 75085-1198 214-234-3240
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§ Magnet Sales & Mfg. Co. Inc., Culver City, CA 90230-6127 ..... 213-391-7213; 800-421-6692
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100
Tokin America, Inc., San Jose, CA 95134 408-432-8020

Corners, Waveguide — See Bends & Twists, Microwave (Vol. A)

Coulometers — See Timers, Electrolytic Cell (Vol. D)

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Counter/Timers-2900 — ***See Vol. D***

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Counters, Decade-2200 — ***See Vol. D***

Counters, Directional-2200 — ***See Vol. D***

Counters, Electromagnetic-2200 — ***See Vol. D***

Counters, Event-2200 — ***See Vol. D***

Counters, Frequency-2900 — ***See Vol. D***

Counters, Mechanical-2200 — ***See Vol. D***

Counters, Particle-2900 — ***See Vol. D***

Counters, Photoelectric-2200 — ***See Vol. D***

Counters, Predetermining — See Counters, Preset (Vol. D)

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Couplers, Acoustic-1900 — ***See Vol. D***

Couplers, Antenna-1200 — ***See Vol. D***

Couplers, Communications, Acoustic, Telephone-1900 — ***See Vol. D***

Couplers, Directional-3450

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ..... D•1003,1020-1021
Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1691-1692,1694
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 .. A•2310,2312-2313
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1077
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
BT & D Technologies, Wilmington, DE 19803 302-479-0300
C-COR Elctrns., State College, PA 16801 ..... 814-238-2461;800-233-2267
Coaxial Dynamics, Cleveland, OH 44135 ..... 1-800-COAXIAL
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Connecticut Microwave Corp., Cheshire, CT 06410 203-250-9678
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
TRM, Inc., Manchester, NH 03103 603-627-6000
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Werlatone, Inc., Brewster, NY 10509 914-279-6187
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Couplers, Microwave-3450

† Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688,1691-1692,1694
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310-2313
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1077
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4 613-226-5772
† Connecticut Microwave Corp., Cheshire, CT 06410 203-250-9678
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Eagle Wichita, Wichita, KS 67277 316-942-5100
† Eastern Microwave, Burlington, MA 01803 617-273-4700
Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
Gabriel Electronics, Scarborough, ME 04074 207-883-5161
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065 805-522-7958
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500

† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
TRM, Inc., Manchester, NH 03103 603-627-6000
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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Couplers, Optoelectronic — See Isolators, Optoelectronic (Vol. B)

Couplers, Rotary-3450

† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-5917;703-953-4751** ..... B•1218-1220,1287-1291
Mercotac Inc., Carlsbad, CA 92009, 619-431-7722 ..... B•1295
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1298, D•2243
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2312-2313
§ Acurex Corp./Autodata Div., Mountain View, CA 94039 415-567-9100
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Eastern Microwave, Burlington, MA 01803 617-273-4700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Sivers IMA AB, Culver City, CA 90230 213-306-4248
S.S White Technologies Inc., Piscataway, NJ 08854-3781 908-752-8300

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Couplings, Shaft, Rigid & Flexible-2400 — ***See Vol. C***

Covers, Protective (Incl. Dustcovers)-1400 — ***See Vol. C***

Crimping Services — See Services, Crimping (Vol. D)

Crossbars — See Scanners, Crossbar (Vol. D)

Crystal Blanks-2300

§† **Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428** ..... **A•1304**
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571** ..... **A•1308**
† **Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248** ..... **A•1322**
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825** .. **A•1379**
Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... **A•1402**
† **M-Tron Industries, Yankton, SD 57078, 605-665-9321** ..... **A•1408**
† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929** ..... **A•1448**
§† **Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121** ..... **A•1469**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1472**
§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
† Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
† K-W Manufacturing Co., Inc., Prague, OK 74864 405-567-2285
NDK America, Inc., Fremont, CA 94539 415-623-6500
§ NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
Orientation Inc., Hudson, MA 01749 508-568-0509
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
† Union Carbide Chemicals & Plastics Company Inc., Industrial Chemicals Div., Crystal, San Diego, CA 92123 619-279-4500
§† United States Crystal Corp., Fort Worth, TX 76110 817-921-3014
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
† Wall, A. T., Co., Warwick, RI 02886 401-739-0740

Crystals, Frequency Control-2300

§† **Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428** ..... **A•1304**
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571** ..... **A•1308-1309,1313-1317**
§ **Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935** ..... **A•1318-1320**
† **Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248** ..... **A•1322**
† **CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411** ..... **A•1330-1344,1346-1347**
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099** ..... **A•1364,1366**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1368**
§† **Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400** ..... **A•1372-1373**
† **Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000** ..... **A•1375**
† **McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411** ..... **A•1382-1383,1385**
† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510** ..... **A•1402-1403,1405**
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321** ..... **A•1408**
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•1412**
Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ..... **A•1427**
† **Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900** ..... **A•1444-1445**
† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929** ..... **A•1448**
§# **R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0012;800-228-8108** ..... **A•1452-1454**
§ **SARONIX, Palo Alto, CA 94303, 415-856-6900** ..... **A•1456-1457**
§ **Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770** ..... **A•1461**
§† **Statek Corp., Orange, CA 92668, 714-639-7810** ..... **A•1470-1471**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1472,1477-1479**
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
† Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Frequency Control Products, Inc., American Time Products Div., Deer Pk, NY 11729 516-243-5730
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
Hoffman, P.R., Co., Materials Proc. Carlisle, PA 17013 717-243-2011
International Crystal Mfg., Oklahoma City, OK 73126 ... 504-236-3741; 1-800-426-9825
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
† K-W Manufacturing Co., Inc., Prague, OK 74864 405-567-2285
§ Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478 216-232-8600
§ NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§† Pioneer Components, Brooklyn, NY 11234 718-444-3880
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
† Sentry Manufacturing Company, Chickasha, OK 73018 405-224-6780
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
§† United States Crystal Corp., Fort Worth, TX 76110 817-921-3014
§† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Crystals, Microprocessor-2300

Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... **A•1308**
§ **Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935** ..... **A•1318-1320**
§ **CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411** ..... **A•1331,1333,1336,1339,1341,1346-1347**
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... **A•1361,1363**
§† **Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400** ..... **A•1372-1373**
† **Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000** ..... **A•1375**
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825** .. **A•1379**
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... **A•1383**
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... **A•1395-1398**
§† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510** ... **A•1402,1405**
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321** ..... **A•1408**
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•1412**
§ **NDK America, inc., Fremont, CA 94539, 415-623-6500** ... **A•1416,1418,1421-1423**
§# **NEL Frequency Controls, Inc., Burlington, WI 53105, 414-763-3591** ..... **A•1425**
Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ..... **A•1427**
§ **Pletronics, Inc., Lynnwood, WA 98036, 206-776-1860** ..... **A•1437-1440**
† **Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900** ..... **A•1446**
§# **R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0012;800-228-8108** ..... **A•1452-1454**
§ **SARONIX, Palo Alto, CA 94303, 415-856-6900** ..... **A•1455-1458**
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... **A•1461**
§† **Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121** ..... **A•1469**

§† **Statek Corp., Orange, CA 92668, 714-639-7810** ..... **A•1470-1471**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1472,1478**
Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
International Microelectronics, Arlington, TX 76003 817-561-2244
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
† K-W Manufacturing Co., Inc., Prague, OK 74864 405-567-2285
§ Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Mouser Electronics, Mansfield, TX 76063 800-346-6873
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1133
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
§† Pioneer Components, Brooklyn, NY 11234 718-444-3880
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
† Sentry Manufacturing Company, Chickasha, OK 73018 405-224-6780
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
§† United States Crystal Corp., Fort Worth, TX 76110 817-921-3014
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
§ West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;213-495-5569

Crystals, Piezoelectric-2300

§† **Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428** ..... **A•1304**
§ **Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935** ..... **A•1318-1320**
† **Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248** ..... **A•1322**
EDO Corporation, Electro-Ceramic Division, Salt Lake City, UT 84115, 801-486-2115 ..... **A•1357**
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099** ..... **A•1364,1366**
† **Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000** ..... **A•1375**
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825** .. **A•1379**
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... **A•1395-1398**
† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510** ... **A•1402,1405**
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321** ..... **A•1408**
† **Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900** ..... **A•1444-1445**
† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929** ..... **A•1448**
§# **R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0012;800-228-8108** ..... **A•1452-1454**
§ **SARONIX, Palo Alto, CA 94303, 415-856-6900** ..... **A•1456-1457**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1478**
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Burleigh Instruments, Fishers, NY 14453 716-924-9355
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
† Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
§† CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548 815-786-8411
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
International Crystal Mfg., Oklahoma City, OK 73126 ... 504-236-3741; 1-800-426-9825
† K-W Manufacturing Co., Inc., Prague, OK 74864 405-567-2285
§ Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478 216-232-8600
§ NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1133
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§† Pioneer Components, Brooklyn, NY 11234 718-444-3880
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§† Reade Advanced Materials, Riverside, RI 02915-0039 401-433-7000
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Seacor, Inc., Westwood, NJ 07675 201-666-5600
† Sentry Manufacturing Company, Chickasha, OK 73018 405-224-6780
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854 908-572-9512
§† Statek Corp., Orange, CA 92668 714-639-7810
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§† United States Crystal Corp., Fort Worth, TX 76110 817-921-3014
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Crystals, Quartz-2300

§† **Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428** .... **A•1304-1305**
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571** ..... **A•1308,1314-1315,1317**
§ **Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935** ..... **A•1318-1320**
† **Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248** ..... **A•1322**
§† **CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411** ..... **A•1330-1333,1335-1341**
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... **A•1360-1361,1363**
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099** ..... **A•1364,1366**
§† **Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400** ..... **A•1372-1373**
† **Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000** ..... **A•1375**
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825** .. **A•1379**
† **McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411** ..... **A•1381-1383**
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... **A•1395-1398**
† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510** ..... **A•1402-1403,1405**
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321** ..... **A•1408**
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•1412**
NDK America, Inc., Fremont, CA 94539, 415-623-6500 ... **A•1416-1418,1421-1423**
§ **NEL Frequency Controls, Inc., Burlington, WI 53105, 414-763-3591** ..... **A•1425**
Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ..... **A•1426**
§ Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... A•1437-1439
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1444,1446
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1448
§# R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0012;800-228-8108 ..... A•1452-1454
§ SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1455-1457
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... A•1461
§† Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1469
§† Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1470-1471
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1472-1473,1478**
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
† Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
† Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
International Crystal Mfg., Oklahoma City, OK 73126 ... 504-236-3741; 1-800-426-9825
Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
† K-W Manufacturing Co., Inc., Prague, OK 74864 405-567-2285
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Leybold Inficon Inc., E. Syracuse, NY 13057 315-434-1100
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
† Sentry Manufacturing Company, Chickasha, OK 73018 405-224-6780
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
§† United States Crystal Corp., Fort Worth, TX 76110 817-921-3014
§† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Crystals, Quartz, for Watches-2300

Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 .... **A•1304-1305**
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... **A•1361,1363**
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099** ..... **A•1364,1366**

† Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375
§† KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825 .. A•1379
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1395-1396,1398
§ Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... A•1437-1439
§# R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0012;800-228-8108 ..... A•1452-1454
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... A•1461
§† Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1470-1471
Blackhawk Networks Corp., Janesville, WI 53545 608-752-6701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
Engineered Assemblies & Components Corp., Peterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
§ KOK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§# NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§ SARONIX, Palo Alto, CA 94303 415-856-6900
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Stetron International, Inc, Buffalo, NY 14203 716-854-3443
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Crystals, Semiconductor(Ingots & Wafers)-2300

† Aremco Products, Inc., Ossining, NY 10562 914-762-0685
§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
Dow Corning Corp., Midland, MI 48686-0994 517-496-4000
§ Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
† Saphikon, Inc., Milford, NH 03055 603-673-5631
Swiss Jewel Company, Philadelphia, PA 19106 ..... 215-925-2867;800-922-0118
§ Tennelec/Nucleus Inc., Oak Ridge, TN 37830 615-483-8405
† Union Carbide Chemicals & Plastics Company Inc., Industrial Chemicals Div., Crystal, San Diego, CA 92123 619-279-4500

Crystals, Surface Mount-2300

Anderson Electronics, Hollidayaburg, PA 16648, 814-695-4428 ..... A•1304
Bliley Electric Co., Erie, PA 16505, 814-838-3571 ..... A•1316
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1329
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1352-1353
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1359,1361-1362
§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1364,1366
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1372-1373
§† KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825 .. A•1379
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1380
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1388
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1395-1398
Monitor Products Co., inc., Oceanside, CA 92054, 619-433-4510 ... A•1402,1405
§ M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1408
NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1416,1418
§ Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... A•1437,1439
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1446
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1448
§# R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0012;800-228-8108 ..... A•1452-1454
SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1456-1457
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... A•1461
§† Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1469
§† Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1470
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1472-1473
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
§ Bakner Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Hy-Q International (USA) Inc., Erlanger, KY 41018 606-283-5000
International Microelectronics, Arlington, TX 76003 817-561-2244
§ KOK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
§ United States Crystal Corp., Fort Worth, TX 76110 817-921-3014
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Crystals, YIG-2300

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
§† Reade Advanced Materials, Riverside, RI 02915-0039 401-433-7000
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020

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Decade Boxes, Resistance-2900 — *See Vol. D*

Decade Boxes, Resistance, Programmable-2900 — *See Vol. D*

Decade Boxes, Transformer-2900 — *See Vol. D*

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Decoders, Surface Mount-3130

§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§† QUALCOMM, Inc., San Diego, CA 92121 619-587-1121

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Delay Lines, Active-2350

† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660** ..... **A•1495-1497**
§ **Bel Fuse, Jersey City, NJ 07302, 201-432-0463** ..... **A•1499**
§ **Dallas Semiconductor, Dallas, TX 75067, 214-450-0400** ..... **A•1529-1531**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ..... **A•1532,1534-1538,1542-1545**
ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861 ..... **A•1549-1557**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** .... **A•1558-1571**
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... **A•1207**
† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222** ..... **A•1572-1577**
§† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1584,1586-1588**
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... **A•1682**
§ PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... **A•1589-1593**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... **A•1595**
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102, 508-339-8900 ..... **A•1138**
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... **A•1597**
† **Technitrol, Philadelphia, PA 19134, 215-426-9105** ..... **A•1598-1603, B•1029**
§ **Valor Electronics, San Diego, CA 92121-2245, 619-458-1471** ..... **A•1606-1607**
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ CCD Imaging, Fairchild Weston Systems, Inc., Milpitas, CA 95035 408-433-2500
§ Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Frequency Devices, Inc., Haverhill, MA 01832 508-374-0761
† Hytek Microsystems, Inc., Carson City, NV 89706 702-883-0820
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Delay Lines, Cable-2350

† **Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080** ..... **A•1494**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... **A•1207**
† **Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600** ... **A•1678-1679**
Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226 602-940-0740
† Coaxitube Corp., Salisbury, MD 21801 301-546-3911
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
Fischer Connectors, Valencia, CA 91355 ..... 805-295-0600;1-800-344-0445
W.L. Gore & Assocs., Newark, DE 19714 302-738-4880
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
Micro Mode Prods., El Cajon, CA 92020 619-449-3844
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Precision Tube, N. Wales, PA 19454 215-699-5801
§† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100

Delay Lines, Digital-2350

† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660** ..... **A•1495-1498**
§ **Bel Fuse, Jersey City, NJ 07302, 201-432-0463** ..... **A•1499**
§ **Dallas Semiconductor, Dallas, TX 75067, 214-450-0400** ..... **A•1529-1531**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ..... **A•1532-1538,1540-1543,1545-1548**
† **ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861** ..... **A•1549-1557**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** .... **A•1558-1571**
† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222** ..... **A•1572-1576**
§† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1588**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1595**
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... **A•1597**
† **Technitrol, Philadelphia, PA 19134, 215-426-9105** ..... **A•1598-1603, B•1029**
§† **Valor Electronics, San Diego, CA 92121-2245, 619-458-1471** ..... **A•1606-1607**
§ AKG Acoustics, Inc., San Leandro, CA 94577 415-351-3500
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
Columbia Components, Sidney, NY 13838 607-563-3520
§ Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† Eventide, Inc., Little Ferry, NJ 07643 ..... 201-641-1200;800-446-7878
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
† Hytek Microsystems, Inc., Carson City, NV 89706 702-883-0820
§† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Delay Lines, Dispersive (Frequency Variable)-2350

Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861 ..... **A•1549-1557**
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860

Delay Lines, Distributed Constant (Fixed)-2350

† **Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080** ..... **A•1494**
† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660** ..... **A•1495-1498**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ..... **A•1540-1542,1545,1548**
† **ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861** ..... **A•1549-1557**
† **Frequency Selective Networks, Woodside, NY 11377, 718-424-7500** ..... **A•1370**
† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222** ..... **A•1572**
† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1588**
§† **PCA Electronics, Sepulveda, CA 91343, 818-892-0761** ..... **A•1589,1594**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1595**
† **Valor Electronics, San Diego, CA 92121-2245, 619-458-1471** ..... **A•1606-1607**
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7831
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100

Delay Lines, Distributed Constant (Variable)-2350

† **Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080** ..... **A•1494**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ..... **A•1546,1548**
† **ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861** ..... **A•1549-1557**
† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222** ..... **A•1572**
† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1588**
PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... **A•1589**
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100

Delay Lines, Glass & Quartz-2350

† **Microsonics, Inc., Weymouth, MA 02188, 617-337-4200** ..... **A•1401**

† Anders, Inc., Simsbury, CT 06070 203-658-7666
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211

Delay Lines, Liquid-2350

Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444

Delay Lines, Lumped Constant (Electrically Variable)-2350

† **Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080** ..... **A•1494**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ... **A•1540-1541,1546**
ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861 ..... **A•1549-1557**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1558,1560-1571**
† **Frequency Selective Networks, Woodside, NY 11377, 718-424-7500** ..... **A•1370**
† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1588**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1595**
† **Technitrol, Philadelphia, PA 19134, 215-426-9105** ..... **A•1598, B•1029**
§† **Valor Electronics, San Diego, CA 92121-2245, 619-458-1471** ..... **A•1606-1607**
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7831
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960

Delay Lines, Lumped Constant (Fixed)-2350

† **Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080** ..... **A•1494**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ..... **A•1535,1543**
† **ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861** ..... **A•1549-1557**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1558-1571**
† **Frequency Selective Networks, Woodside, NY 11377, 718-424-7500** ..... **A•1370**
† **Hitronic, Inc., Olathe, KS 66061, 913-782-4012** ..... **A•2224**
† **Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600** ... **A•1678-1679**
† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222** ..... **A•1572**
§† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1588**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... **A•1682**
§† **PCA Electronics, Sepulveda, CA 91343, 818-892-0761** ..... **A•1594**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1595**
§ **TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100** ..... **A•1597**
† **Technitrol, Philadelphia, PA 19134, 215-426-9105** ..... **A•1598, B•1029**
§† **Valor Electronics, San Diego, CA 92121-2245, 619-458-1471** ..... **A•1606-1607**
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
§ Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
James Millen Elctrns., Caywood Elec. inc., No. Andover, MA 01845 508-475-7831
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100

Delay Lines, Lumped Constant (Mechanically Variable)-2350

† **Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080** ..... **A•1494**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ..... **A•1537**
† **ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861** ..... **A•1549-1557**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1558-1571**
† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222** ..... **A•1572**
† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1588**
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
PCA Electronics, Sepulveda, CA 91343 818-892-0761
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100

Delay Lines, Magnetostrictive-2350

JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... **A•1572**
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Rhombus Industries, Huntington Bch, CA 92649-1595 714-898-0960

Delay Lines, Programmable-2350

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... **A•1494**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
§ **Dallas Semiconductor, Dallas, TX 75067, 214-450-0400** ..... **A•1529-1531**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ... **A•1532,1538,1541**
† **ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861** ..... **A•1549-1557**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1558-1568,1570-1571**
† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222** ..... **A•1573-1577**
§† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1588**
§ **PCA Electronics, Sepulveda, CA 91343, 818-892-0761** ..... **A•1589,1592**
§ **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1595**
† **Technitrol, Philadelphia, PA 19134, 215-426-9105** ... **A•1598-1599,1602, B•1029**
† **Valor Electronics, San Diego, CA 92121-2245, 619-458-1471** ..... **A•1606-1607**
† Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
§ CCD Imaging, Fairchild Weston Systems, Inc., Milpitas, CA 95035 408-433-2500
Columbia Components, Sidney, NY 13838 607-563-3520
Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
§ Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† Eventide, Inc., Little Ferry, NJ 07643 ..... 201-641-1200;800-446-7878
Frequency Devices, Inc., Haverhill, MA 01832 508-374-0761
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893

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Delay Lines, Strip-2350

Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** .... **A•1558-1571**
JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... **A•1572**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1595**
Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
PCA Electronics, Sepulveda, CA 91343 818-892-0761
§† Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404 9978 ..... 407-848-4311;800-888-8763
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893

Delay Lines, Surface Mount-2350

† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660** ..... **A•1495**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
§ **Dallas Semiconductor, Dallas, TX 75067, 214-450-0400** ..... **A•1529-1531**
Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ..... **A•1534,1545**
† **ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861** ..... **A•1549-1557**
ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 .... **A•1558-1571**
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... **A•1207**
† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222** ..... **A•1572-1577**
§† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1588**
§ **PCA Electronics, Sepulveda, CA 91343, 818-892-0761** ..... **A•1589**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1595**
† **Technitrol, Philadelphia, PA 19134, 215-426-9105** ..... **A•1598-1602,1604-1605, B•1029**
§ **Valor Electronics, San Diego, CA 92121-2245, 619-458-1471** ..... **A•1606-1607**
Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Delay Lines, Trimmer-2350

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... **A•1494**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•1499**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ..... **A•1537**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** .... **A•1558-1571**
† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1578-1588**
† Anders, Inc., Simsbury, CT 06070 203-658-7666

† Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100

Delay Lines, Ultrasonic-2350

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1494
ELMEC TECHNOLOGY OF AMERICA, INC., Monterey Park, CA 91754, 213-265-1861 ..... A•1549-1557
JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... A•1572
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1578-1588
† Anders, Inc., Simsbury, CT 06070 203-658-7666
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Columbia Components, Sidney, NY 13838 607-563-3520
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
§ Datatronics, Inc., Romoland, CA 92380 714-928-7700
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893

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Delay Lines, Waveguide-2350

Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1499
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
TRM, Inc., Manchester, NH 03103 603-627-6000
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100

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Demagnetizers-1850

§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1337
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 805-527-0900
§† Benjamin International, Inc., Plainview, NY 11803 516-753-0700
Dowty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
§ GC Thorson, Rockford, IL 61105-1209 815-968-9661
§† K & R Mfg. Co., Kearny, NJ 07032 201-991-5330
Mag Con, St. Paul, MN 55113 612-633-8820
Magnetic Instrumentation, Indianapolis, IN 46226 317-545-2102
§ Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
§ Recoton Corp., Long Island City, NY 11101 718-392-6442
† Schonstedt Instrument Co., Reston, VA 22090 703-471-1050
§† Wide Range Elctrns. Corp., Chesterfield, MISSOURI 63005 314-532-5887

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Detectors, Coaxial-2900 — *See Vol. D*

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Detectors, Crystal-2300

BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lixi, Inc., Downers Grove, IL 60515 708-620-4646
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
§ Tennelec/Nucleus Inc., Oak Ridge, TN 37830 615-483-8405
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Detectors, Fiber Optic-Also See Diodes, PIN-2475 — *See Vol. B*

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Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
Houston Atlas, a Baker Hughes Company, Houston, TX 77041 713-462-6116
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Optek Technology Inc., Carrollton, TX 75006 214-323-2200
† Ortel Corp., Alhambra, CA 91803 818-281-3636
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400

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Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... D•1251
† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1691
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Eastern Microwave, Burlington, MA 01803 617-273-4700
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Holaday Industries, Inc., Eden Prairie, MN 55344 612-934-4920
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101 617-890-4750
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
North Hills Electronics, Glen Cove, NY 11542 516-671-5700
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
Sivers IMA AB, Culver City, CA 90230 213-306-4248
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk, NY 11040 ..... 516-328-0200;328-3300

§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
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Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118
Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1582
§ Tescor Electronics, Inc., Irving, TX 75038, 214-580-1515 ..... A•2122-2125
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Raytheon/TAG Semiconductors Ltd., Burlington, MA 01803 ..... 617-272-3704 (3705)
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759

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Dials, Turns Counting-2400 — *See Vol. C*

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American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2094
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
† Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1343
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•2128-2129
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
§ Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
Koep Precision Standards, Inc., South Plainfield, NJ 07080 ..... 201-757-2220/2277
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
† Microwave Device Tech., Lawrence, MA 01843 508-688-6000
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Semtech, Newbury Park, CA 91320 805-498-2111
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Diodes, Backward-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
† Microphase, Norwalk, CT 06856 203-866-8000
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Solid State Devices, La Mirada, CA 90638 213-921-9660

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American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
† Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1342-1343
§† Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5200
§ Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
† Dionics, Westbury, NY 11590 516-997-7474
§ Electronic Devices, Inc., Yonkers, NY 10710 914-965-4400
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
General Semiconductor Ind., Inc., Square D Company, Tempe, AZ 85281 602-968-3101
† Hy-Tec Industries, Div. of Topo Industries, Inc., Shoreham, NY 11786 ... 516-924-8686
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
† Microwave Device Tech., Lawrence, MA 01843 508-688-6000
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
MSI Electronics, Inc., Woodside, NY 11377 718-672-6500
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
Shindengen America Inc., Westlake VL, CA 91361 800-634-3654
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Solid State Devices, La Mirada, CA 90638 213-921-9660
Soltec Corp., San Fernando, CA 91340-1597 ..... 818-365-0800;800-423-2344
† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Diodes, Electroluminescent (Radiating)-4800

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Leecraft Mfg., Long Island City, NY 11101 718-392-8800

Diodes, Frequency Multiplier-4800

§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microwave Device Tech., Lawrence, MA 01843 508-688-6000
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Semtech, Newbury Park, CA 91320 805-498-2111

Diodes, Germanium-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-621-1178 ..... A•2093
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187

Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
† Microphase, Norwalk, CT 06856 203-866-8000
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700

Diodes, Gunn-4800

§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
MACOM, Inc., Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
Marconi Instruments, Allendale, NJ 07401 201-934-9050
† Microwave Device Tech., Lawrence, MA 01843 508-688-6000

Diodes, High Voltage (1,000 Volts & Over)-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Calmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085, D•1659
Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2094
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206
§ Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... A•2098
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2110-2112
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1582
† Voltage Multipliers, Inc., Visalia, CA 93291, 209-651-1402 ..... A•2127
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•2128-2129
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§† K & M Electronics, W. Springfield, MA 01089 413-781-1350
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Semtech, Newbury Park, CA 91320 805-498-2111
Shindengen America Inc., Westlake Vl, CA 91361 800-634-3654
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
§† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043

Diodes, Hot Carrier-4800

§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300

Diodes, Impatt-4800

† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microwave Device Tech., Lawrence, MA 01843 508-688-6000

Diodes, Infrared-4800

§ Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... B•1092
§ Optek Technology Inc., Carrollton, TX 75006, 214-323-2200 ..... B•1333
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1340
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
I I Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196,1199
A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1866
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
BT & D Technologies, Wilmington, DE 19803 302-479-0300
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
Everlight - USA, Glendora, CA 91740 213-697-5067
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
§ Marktech International Corp., Latham, NY 12110 518-786-6591
§ Micro Lamps, Inc., Batavia, IL 60510-1420 708-879-0900
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
§ Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Ortel Corp., Alhambra, CA 91803 818-281-3636
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Detector Corp., Camarillo, CA 93012 805-484-2884
†# Spectrum Devices, Sugar Land, TX 77478-2420 713-242-6417
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Diodes, Laser-4800

Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2120-2121
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1340
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1187
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
BT & D Technologies, Wilmington, DE 19803 302-479-0300
† D. O. Industries, Rochester, NY 14623 716-359-4000
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
§ Marktech International Corp., Latham, NY 12110 518-786-6591
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Optima Precision, Inc., West Linn, OR 97068 ..... 800-544-4118;503-638-2525
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Ortel Corp., Alhambra, CA 91803 818-281-3636
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Soltec Corp., San Fernando, CA 91340-1597 ..... 818-365-0800;800-423-2344
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197

Diodes, Light Emitting (LEDs)-3700 — *See Vol. B*

Diodes, Limiting-4800

§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•2128-2129
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microphase, Norwalk, CT 06856 203-866-8000
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670

Diodes, Liquid Crystal (LCDs)-3700 — *See Vol. B*

Diodes, Matched Pairs-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... C•1584
§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
§ Teccor Electronics, Inc., Irving, TX 75038, 214-580-1515 ..... A•2122-2125
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
† Dionics, Westbury, NY 11590 516-997-7474
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880

§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§ International Diode, Harrison, NJ 07029 201-482-6518
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microphase, Norwalk, CT 06856 203-866-8000
§† Microsemi Corp., Santa Ana, CA 92704 714-979-3220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
MSI Electronics, Inc., Woodside, NY 11377 718-672-6500
§ Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Semicoa, Costa Mesa, CA 92626 714-979-1900
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
† Semtech, Newbury Park, CA 91320 805-498-2111
† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§ St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Diodes, Matched Quads-4800

ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... C•1584
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-6491
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Dionics, Westbury, NY 11590 516-997-7474
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ International Diode, Harrison, NJ 07029 201-482-6518
† Microphase, Norwalk, CT 06856 203-866-8000
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
MSI Electronics, Inc., Woodside, NY 11377 718-672-6500
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
† Semtech, Newbury Park, CA 91320 805-498-2111
† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Diodes, Microwave Detector-4800

Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
§† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
MACOM, Inc., Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microphase, Norwalk, CT 06856 203-866-8000
† Microwave Device Tech., Lawrence, MA 01843 508-688-6000
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Shindengen America Inc., Westlake Vi, CA 91361 800-634-3654

Diodes, Microwave Mixer-4800

§† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
MACOM, Inc., Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microphase, Norwalk, CT 06856 203-866-8000
† Microwave Device Tech., Lawrence, MA 01843 508-688-6000
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Shindengen America Inc., Westlake Vl, CA 91361 800-634-3654

Diodes, Noise-4800

† MDF Products Inc., Danbury, CT 06811, 203-743-3579 ..... D•1293
† Noise Com Inc., Paramus, NJ 07652, 201-261-8797 ..... A•1821, D•1304-1305
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Koep Precision Standards, Inc., South Plainfield, NJ 07080 ..... 201-757-2220/2277
§ Loral Microwave-FSI, Semiconductor Div., Chelmsford, MA 01824 ..... 508-256-4113/8101
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300

Diodes, Photoelectric-3700 — *See Vol. B*

Diodes, PIN-4800

† Centronic, Inc., The Morgan Crucible Company, Spec. Matls. & Tech Division, Newbury Park, CA 91320-1702, 805-499-5902 ..... B•1322
§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1319
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1324-1325,1328-1331
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1341
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... B•1197
† Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1342-1343
†‡ Stanley Co. INC., Stanley Electric Co. LTD., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1196,1199
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
A.C. Interface Inc., Rancho Santa Margarita, CA 92688 714-858-1566
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;in Can: 1-800-553-2448
BT & D Technologies, Wilmington, DE 19803 302-479-0300
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Loral Microwave-FSI, Semiconductor Div., Chelmsford, MA 01824 ..... 508-256-4113/8101
MACOM, Inc., Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microwave Device Tech., Lawrence, MA 01843 508-688-6000
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§ Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-0737
§ Servo Semiconductor Corp., Allendale, NJ 07401 201-825-0030
Soltec Corp., San Fernando, CA 91340-1587 ..... 818-365-0800;800-423-2344
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0965
§† Unitrode Corp., Watertown, MA 02172 617-926-0404

Diodes, Power, Surface Mount-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9538 .. A•2033
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2035
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2120-2121
† Voltage Multipliers, Inc., Visalia, CA 93291, 209-651-1402 ..... A•2127
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-4100
§ Beknor Industries Inc, Mississauga, ONT., CANADA L5L 1X9 416-828-2100
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5200
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1674
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
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Diodes, Schottky-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9538 .. A•2033
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§ Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... A•2098
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§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1319
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2094
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1075,2095
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§ Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... A•2098
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† Silicon Detector Corp., Camarillo, CA 93012, 805-484-2884 ..... B•1342-1343
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§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... A•2097
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2103-2104

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Diodes, Temperature Compensating-4800

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§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§ Bakner Industries Inc., Mississauga, ONT, CANADA L5L 1X1 416-828-2400
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5200
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Frontier Electronics, Chatsworth, CA 91311 818-709-9555
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 516-933-3333
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Philips Components Discrete Products Div., A North American Philips Co. Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Zetex, Inc., Zetex plc, Commack, NY 11725 516-543-7100

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Displays, Electroluminescent-2450 — *See Vol. B*

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Displays, Fiber Optic-2450 — *See Vol. B*

Displays, Graphic-2450 — *See Vol. B*

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Dividers, Analog-3130

Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Transmagnetics, Farmingdale, NY 11735 516-293-3100

Dividers, Frequency-3450

† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1368
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 ..... D•1761
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
† Luff Research, Floral Park, NY 11001 516-358-2880
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
† Microphase, Norwalk, CT 06856 203-866-8000
Mini-Circuits Lab., Brooklyn, NY 11235-0003 718-934-4500
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700

Dividers, Power (LF, HF, VHF, UHF)-3450

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ..... D•1020-1021
Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
† Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4 613-226-5772
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microphase, Norwalk, CT 06856 203-866-8000
MicroSignals Inc., LLC, NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§ Mirage/KLM, Morgan Hill, CA 95037 408-779-7363
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
TRM, Inc., Manchester, NH 03103 603-627-6000
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
† Werlatone, Inc., Brewster, NY 10509 914-279-6187
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Dividers, Power, Microwave-3450

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ..... D•1020-1021
Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
† Micronics Technology Inc., Glen Cove, NY 11542, 516-759-5600 ..... A•1399
§ Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1691
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310,2312
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Eastern Microwave, Burlington, MA 01803 617-273-4700
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900

† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
TRM, Inc., Manchester, NH 03103 603-627-6000
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Doublers, Voltage-Also See Rectifiers, Bridges & Assemblies-4800

§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† Mep Controls, Bordentown, NJ 08505 609-298-7300
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Semtech, Newbury Park, CA 91320 805-498-2111
§ Staco Energy Products Co., Dayton, OH 45403 513-253-1191
Teledyne Components, Mountain View, CA 94039-7267 415-968-9241

Down Converters-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
California Microwave, Sunnyvale, CA 94086 408-732-4000
† Communications Sys. Technology Inc., Hermosa Beach, CA 90254 213-374-3849
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2137
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
HDS Inc., Reston, VA 22091 703-620-6200
M/A-COM Government Products, Inc., Hunt Valley, MD 21030 301-771-0077
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
§ QUALCOMM, Inc., San Diego, CA 92121 619-587-1121
Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123

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Drafting Symbols, Dry Transfer, Pressure Sensitive, etc. (Incl. Lettering)-4200 — *See Vol. C*

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Drivers, Switch-3450

Aeroflex Laborstories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1720
CP Technology, Inc., Cupertino, CA 95014 408-996-8069
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
Plann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Marconi Circuit Technology Corp., Farmingdale, NY 11735 516-293-8636
Silicon General, Garden Grove, CA 92641 714-898-8121
Teledyne Components, Mountain View, CA 94039-7267 415-968-9241

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Drives/Subsystems, Disk, 5¼" Winchester-2000 — *See Vol. D*

Drives, Subsystems, Disk, 8" Diskette-2000 — *See Vol. D*

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Duplexers, Microwave-3450

† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1109,1820
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§† Systron-Donner Instrument Div., Concord, CA 94518 415-676-5000
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

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Electromagnets-1850

Regdon Solenoid, Inc., Westmont, IL 60559, 708-789-0600 ... B•1634-1635,1637
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1294
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1337
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Magnet Sales & Mfg. Co. Inc., Culver City, CA 90230-6127 ..... 213-391-7213; 800-421-6692
# Metrolab Instruments SA, Geneva, SWITZERLAND CH-1228 ..... (41-22)794 11 21
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
Tokin America, Inc., San Jose, CA 95134 408-432-8020

Electronic Counter Countermeasures (ECCM) Fixes (MIL)-2440 — *See Vol. B*

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Enclosures, Instrument, With Integral Connectors-1400 — *See Vol. C*

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Enclosures, Portable, Metallic & Nonmetallic-1400 — *See Vol. C*

Enclosures, Power Distribution-1400 — *See Vol. C*

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Sunrise Electronics, Inc., Glendora, CA 91740, 818-914-1926 ..... D•1329
§ BP Microsystems, Houston, TX 77043 ..... 713-461-9430;1-800-225-2102
§† BYTEK Corp., Instrument Systems Div., Boca Raton, FL 33487-1323 407-994-3520
International Instrumentation, Inc., Westlake Vlg, CA 91361 805-495-7673
§ International Microsystems, Milpitas, CA 95035 408-942-1001
Oliver Advanced Engineering, Glendale, CA 91203 818-240-0080
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Southern Computer Corp., Atlanta, GA 30342 404-252-3340
§† Spectronics Corp., Westbury, NY 11590 ..... 516-333-4840/1-800-274-8888
§ Stag Microsystems Inc., Santa Clara, CA 95054 ..... 408-988-1118;1-800-227-8836
§ UVP, Inc., San Gabriel, CA 91778 818-285-3123
§ Xeltek, Sunnyvale, CA 94086 408-745-7974

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§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200** ..... A•1286-1287,1289,1291-1292
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477, 914-246-2811 ..... A•1288
§ **TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100** ..... A•1294-1297,1299
§† Capcon, Inc., New York, NY 10001 212-243-6275
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
§ Cosmo Corporation, Cleveland, OH 44109 216-861-5594
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
§ ET&T Corporation, Costa Mesa, CA 92626 714-557-2703
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
† Ferrite International, Wadsworth, IL 60083 708-249-4900
Ferronics, Fairport, NY 14450 716-388-1020
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Hoosier Magnetics, Inc., Toledo, OH 43617 419-841-7173
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§† Krystinel Corp., Paterson, NJ 07509 201-345-8900
§† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
Magnet Sales & Mfg. Co. Inc., Culver City, CA 90230-6127 ..... 213-391-7213; 800-421-6692
Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
National Micronetics, Kingston, NY 12401 914-338-0333
NMB Technologies, Chatsworth, CA 91311 818-341-3355
§ Qualitek Electronics Corp., Mentor, OH 44060 216-951-3300
† Quartzite Processing, Inc., Malden, MA 02148 617-322-3611
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020

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§† **Datak Corp., Sparks, NV 89431, 702-359-7474** ..... C•1685
† Acheson Colloids, Div. of Acheson Industries, Inc., Port Huron, MI 48061-1747 313-984-5581
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Resistive Company, Boone, NC 28607 704-264-8861
Materials Research Corporation, Orangeburg, NY 10962 914-359-4200
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
§ Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 ..... 407-848-4311;800-888-8763

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Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1618
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† **Delta Products Corporation, Fremont, CA 94538, 415-770-0660** .... A•1612-1613
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† **Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144** ..... A•1673
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Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... C•1386
§† **JMK, Inc., Amherst, NH 03031, 603-886-4100** ..... A•1626-1627
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2212
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... A•1685-1686
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... A•1415,1697-1698
§ **Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722** ..... A•1628-1630
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229** ..... D•2224
§ **Schaffner EMC, Inc. Components Division, Union, NJ 07083, 908-851-0664;800-367-5566** ..... A•1634-1637
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311** ..... A•1638-1639
Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•1641-1643
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... A•1646-1648
Amber Inds., Inc., Dallas, TX 75379 214-490-9801
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
§ Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
MCG Elctrns., Deer Park, NY 11729 516-586-5125
§ MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
§ Qualitek Electronics Corp., Mentor, OH 44060 216-951-3300
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-0102 508-339-8900
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Superior Electric, Bristol, CT 06010 203-582-9561
§ Tycor International Inc., Calgary, Alberta, CANADA T2H 1L8 403-259-3200

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† **Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655** .... A•1631
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Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1151
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† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-3400** ..... A•1671
† **Integrated Microwave, San Diego, CA 92121-1096, 619-259-2600** ... A•1676-1678
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† **Kappa Technologies, Inc., Ramsey, NJ 07446, 908-356-4400;1-800-223-0620** ..... A•1691
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... A•1692
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... A•1706-1707
† **RFI Corporation, Bay Shore, NY 11706, 516-231-6400** ..... A•1633
† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-0224** ..... A•1708
† Alpha Components, Mechanicsburg, PA 17055 717-697-3595
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Balston, Lexington, MA 02173 617-861-7240
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Dantel, Fresno, CA 93727 209-292-1111
Data Delay Devices, Clifton, NJ 07013-1915 201-773-2299
De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9668
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
Frequency Devices, Inc., Haverhill, MA 01832 508-374-0761
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Gennum Corporation, Linear Technology Inc., Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hopkins Engrg., San Fernando, CA 91342 818-361-8691
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
§ McCurdy Radio Industries Limited, Toronto, Ont., CAN M4A 2L4 416-751-6262
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 213-462-0806
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

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Air Filtration Products, Inc., Tuscon, AZ 85705 602-624-2272
§† Aluminum Filter, Carpinteria, CA 93013 805-684-7651
Cambridge Filter Corp., Syracuse, NY 13221-4906 315-457-1000

§ Daitron, Inc., Tigard, OR 97223 503-620-2879
Micronel U.S., Vista, CA 92083 619-727-7400

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† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 .... A•1661
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1681
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
§ Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688,1690-1694
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1415
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430 914-664-2333
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... +/5576/4010-0
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

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† Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 ..... A•1659
† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 .... A•1661
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1161
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1675
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682-1683
Precision Filters, Ithaca, NY 14850, 607-277-3550 ... A•1706-1707, D•1192-1193
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708,1713, 1717
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
DSP Technology, Fremont, CA 94538-7338 415-657-7555
Encore Electronics, Inc., Saratoga Springs, NY 12866 518-584-5354
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... +/5576/4010-0
R. C. Electronics Inc., Goleta, CA 93116 805-685-7770
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-896-2255
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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† Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 .... A•1658-1660
† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1661-1663
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
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† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666,1669
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
† Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144 ..... A•1673
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1674
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
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† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
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† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682-1683
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... A•1684
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688-1690,1692-1695
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. B•1921
† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1696
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... A•1706
† RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•1633
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1481-1482
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708,1712,1716-1717
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
§ ATV Research, Inc., Dakota City, NE 68731 402-987-3771
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coilcraft, Cary, IL 60013 708-639-2361
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
CTS Corporation, Elkhart, IN 46514 219-293-7511
† CTS Corporation, Microelectronics business unit., W. Lafayette, IN 47906 317-463-2565
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
Dantel, Fresno, CA 93727 209-292-1111
§ De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9668
Dontech, Inc., Doylestown, PA 18901 215-348-5010
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
Ealing Electro-Optics, Holliston, MA 01746 ..... 508-429-8370;1-800-343-4912
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§ Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† EWC, Inc., Englishtown, NJ 07726 908-446-3110
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Marconi Instruments, Allendale, NJ 07401 201-934-9050
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Micronics Technology Inc., Glen Cove, NY 11542 516-759-5600
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100

† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6650
† Premier Microwave, Port Chester, NY 10573 914-939-6900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-896-2255
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
† Swedlow, Inc., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1600
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8693
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Western Multiplex Corp., Belmont, CA 94002 415-592-8932

Filters, Bandpass-2750

Allen Avionics, Inc., Mineola, NY 11501, 516-248-4000 ..... A•1653,1655
A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... A•1654
† Avens Corp., Brooklyn, NY 11208, 718-827-5691;800-452-1666 ..... A•1658,1659
† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9665 ..... A•1631-1633
† Communication Coil Inc., Chicago, IL 60634, 312-637-1339 ..... A•1665
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1131
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1668,1669
† Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-8400 ..... A•1671
† Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144 ..... A•1672
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1674-1675
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... A•1624-1625,1677
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2850 ... A•1678-1679
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-0400;1-800-223-0603 ..... A•1631
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825** .. A•1679
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... A•1682-1683
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... A•1684
† **Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181** ..... A•1751
† **McCoy Electronics Co., A Sub. of Colt Industries, Mt. Holly Springs, PA 17065, 717-486-3411** ..... A•1333
† **Microsonics, Inc., Weymouth, MA 02189, 617-337-4200** ..... A•1401
§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ..... A•1688-1695
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† **Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5475, 216-232-8600** .. B•1921
† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** .. A•1696,1738
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... A•1706
† **RFI Corporation, Bay Shore, NY 11706, 516-231-6400** ..... A•1633
† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-0224** ..... A•1708-1717
† Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
Aptek Technologies, Inc., Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
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† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
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† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4410
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, Cleveland, OH 44135 ..... 1-800-COAXIAL
Coilcraft, Cary, IL 60013 708-639-2361
† Coil-O Corp., Bronxville, NY 10708 914-337-4775
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3049
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Connecticut Microwave Corp., Cheshire, CT 06410 203-250-9678
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548 815-786-8411
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§ De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9662
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EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-5197 408-738-4266
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Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Assemblies & Components Corp., Totowa, NJ 07508 ..... 201-256-4477; 800-447-5639
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EWC, Inc., Englishtown, NJ 07726 908-446-3110
† Ferritec Inc., Fremont, CA 94538-7474 415-226-1216
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§ Furman Sound, Inc., Greenbrae, CA 94904 415-927-1225
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† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
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Hycomp, Inc., Marlborough, MA 01752 508-485-9340
International Crystal Mfg., Oklahoma City, OK 73126 ... 800-237-3741; 1-800-458-0625
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
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KDI/Triangle Electronics, Whippany, NJ 07981 201-887-8700
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† Lark Engineering Co, Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1288
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† Loral Microwave-Narda West, San Jose, CA 95112-4216 408-436-4400
† Loral Microwave-Wavecom, Northridge, CA 91329 818-882-3010
MACOM, Inc., Burlington, MA 01803 617-272-3000
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† Magnetico Inc., Holtsville, NY 11742 516-654-1126
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8693
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
† Metropole Products Inc., Stafford, VA 22554 703-659-2150
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micronics Technology Inc., Glen Cove, NY 11542 516-759-5500
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0097
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3K6 514-694-3666
† Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4519
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-2001
MP/Capar, Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Manufacturing Co., Ltd. Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
§ PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6650
† Premier Microwave, Port Chester, NY 10573 914-939-6900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
Reim Communications, Inc., Indianapolis, IN 46226 317-545-4281
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-896-2255
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
§† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860

§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 213-517-7770
Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
SFE Technologies, San Fernando, CA 91340 818-365-9411
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 213-462-0806
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Swedlow, Inc., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Wavetek San Diego, Inc. , Wavetek Corp., San Diego, CA 92123 619-279-2200
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Filters, Bandpass, SAW (Surface Acoustic Wave)-2750

A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... A•1654
† Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 ..... A•1658
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... A•1624-1625,1677
Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1690
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1738
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1703
Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
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§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070

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Filters, Ceramic-2750

Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
† Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. B•1921
† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1109,1696
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1699,1701-1704
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102, 508-339-8900 ..... A•1138
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1644-1645
Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§† AVX Corporation, Myrtle Bch., SC 29577 803-448-9411
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
† Ceramic Devices Inc., San Diego, CA 92111 619-560-7575
Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
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§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400

Filters, Ceramic, Surface Mount-2750

A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... A•1654
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. B•1921
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1109,1415,1696
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1699,1701,1703
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... A•1705
Avens Corp., Brooklyn, NY 11208 ..... 718-827-5991;800-452-1966
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
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† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Filters, Coaxial-2750

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688-1695
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1415,1697-1698
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
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† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
MACOM, Inc., Burlington, MA 01803 617-272-3000
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
† Reactel, Inc., Rockville, MD 20850 301-279-5535
RFI Corporation, Bay Shore, NY 11706 516-231-6400
§† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
SFE Technologies, San Fernando, CA 91340 818-365-9411
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§ Spectrum Control, Inc., Erie, PA 16505 814-455-0966
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, Color, Panel Light - Also see Lenses, Readout & Display; Lenses, Filters, Windows, Infrared-2460 – *See Vol. B*

Filters, Comb-2750

Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1674-1675
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370

Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 .. A•1677
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9668
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430 914-664-2333
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Precision Filters, Ithaca, NY 14850 607-277-3550
† Reactel, Inc., Rockville, MD 20850 301-279-5535
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

Filters, Continuously Variable-2750

A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... A•1654
† Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 ..... A•1660
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1161
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1675
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688,1694-1695
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... A•1706
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2224
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Encore Electronics, Inc., Saratoga Springs, NY 12866 518-584-5354
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... +/5576/4010-0
Pole/Zero Corporation, Cincinnati, OH 45242 513-563-1133
† Premier Microwave, Port Chester, NY 10573 914-939-8900
RFI Corporation, Bay Shore, NY 11706 516-231-6400
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-896-2255
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100

Filters, Crystal (Incl. Monolithic Devices)-2300

Delta Products Corporation, Fremont, CA 94538, 415-770-0660 ..... A•1613
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1372-1373
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1382-1383
† Microsonics, Inc., Weymouth, MA 02188, 617-337-4200 ..... A•1401
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1415
§ NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1416,1421-1423
Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... A•1631
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1472,1481-1482
† Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
Chesterfield Products, Inc., Elmwood Park, NJ 07407 201-797-9655
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548 815-786-8411
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
§† Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4510
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

Filters, Delay-2750

Arco Electronics, Chatsworth, CA 91311, 818-882-8707 ..... A•1655-1657
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1675
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1627
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682-1683
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... A•1685-1686
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1702-1703
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... A•1706-1707, D•1015
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
Rapid Systems Inc., Seattle, WA 98103 206-547-8311
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, Digital-2750

A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... A•1654
Arco Electronics, Chatsworth, CA 91311, 818-882-8707 ..... A•1655-1657
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1674-1675, D•1011
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... A•1625,1677

JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1627
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1383
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... A•1706-1707
† Valor Electronics, San Diego, CA 92121-2245, 619-458-1471 ..... A•1606-1607
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Avens Corp., Brooklyn, NY 11208 ..... 718-827-5991;800-452-1966
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
Rapid Systems Inc., Seattle, WA 98103 206-547-8311
R. C. Electronics Inc., Goleta, CA 93116 805-685-7770
RFI Corporation, Bay Shore, NY 11706 516-231-6400
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
§ Spectrum Signal Proc., Blaine, WA 98230 ... 1-800-663-8986 (US);604-438-7266 (Can.)
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Filters, Digital, High Speed FFT/FIR-2750

A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... A•1654
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
§ Interactive Circuits Systems Ltd., Gloucester,Ont., CANADA K1J 9G2 ..... 613-749-9241; 1-800-267-9794
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180

Filters, Display-2450 — *See Vol. B*

Filters, EMI/RFI-2700

§ Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1618
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2252 ..... A•1157-1158,2160
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1175
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•1170
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
§ Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... A•1610-1611, C•1330
§† Delta Products Corporation, Fremont, CA 94539, 415-770-0660 .... A•1612-1613
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1614-1617, B•1465
§† Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705, 714-979-4440 ..... A•1065,1619
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ..... A•1620-1623
† Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144 ..... A•1673
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... A•1624-1625,1677
§ Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... B•1367
† Homalite, Whitco, Inc., Wilmington, DE 19804, 302-652-3666 ..... B•1085
† Interpoint Corporation, Redmond, WA 98073-9705, 206-882-3100 ... D•1810,1815
§† JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1626-1627
Magnetab, Boulder, CO 80301-4593, 303-442-6700 ..... A•2253
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2212-2213
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3306 ..... A•1685-1687, C•1469-1471
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1415,1696-1698
† Oxley Inc., Branford, CT 06405, 203-488-1033 ..... A•1705, B•1025
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... A•1628-1631
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2224
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5328 ..... A•1255,1258,1260
† RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•1633
§ Schaffner EMC, Inc. Components Division, Union, NJ 07083, 908-851-0644;800-367-5566 ..... A•1634-1637
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... A•1638-1639
Signal Transformer Co., Inc., Inslco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102, 508-339-3900 ..... A•1138
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•1269,1271,1641-1643
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1644-1645
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... A•1646-1648, D•2110
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1280
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1153
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Ark Elctrns. Corp., Southampton, PA 18966 215-322-6510
§ Armbar Industries, Inc., Old Bridge, NJ 08857 908-679-3377
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§† Capcon, Inc., New York, NY 10001 212-243-6275
† Ceramic Devices Inc., San Diego, CA 92111 619-560-7575
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
Coilcraft, Cary, IL 60013 708-639-2361
§† Compac, Holbrook, NY 11741 516-585-3400
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741 508-996-8561
§† Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§† Current Technology, Inc., Richardson, TX 75081-4802 214-238-5300
§ Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
Elite Electronic Engineering Co., Downers Grove, IL 60515 708-495-9770
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
ESC Electronics Corp., Palisades Pk, NJ 07650 201-947-0400
§ Evaporated Coatings, Inc., Willow Grove, PA 19090 215-659-3080
§† EWC, Inc., Englishtown, NJ 07726 908-446-3110
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
† F-Dyne Elctrns., Bridgeport, CT 06605 203-367-6431
† Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
Fuses Unlimited, D.E.I., Van Nuys, CA 91406 818-786-8111
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§† Hopkins Engrg., San Fernando, CA 91342 818-361-8691
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
Intepro Systems Inc., Billerica, MA 01821 508-663-7555
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§† ITT Cannon, Santa Ana, CA 92705-5684 714-557-4700
§ Kaigio Elctrns. Co., Inc., Bethlehem, PA 18017-9359 215-837-0700
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Lambda Electronics Inc., Melville, NY 11747-3700 516-694-4200
† Lectro Magnetics, Inc., Los Angeles, CA 90016 ..... 213-870-9383;USA 800-969-9383
† Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139 708-307-7200
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCG Elctrns., Deer Park, NY 11729 516-586-5125
† Motor Technology, Inc., Dayton, OH 45429 513-294-1041
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Nissei Denki America, Inc., Beaverton, OR 97005 503-646-1434
§ North Hills Electronics Inc., Power Products Div., Glen Cove, NY 11542-3796 516-671-5700
§ Oneac Corporation, Libertyville, IL 60048 708-816-6000,800-327-8801
† Optical & Conductive Coatings, Meridian Inds., Inc., Pacheco, CA 94553 415-798-6066
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Panel Components Corp., Santa Rosa, CA 95406 707-523-0600
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
§ PolyPhaser Corporation, Minden, NV 89423-9000 ..... 702-782-2511;800-325-7170
§† Power Integrity Corp., Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
Ray Proof, Shielding Systems Corp., Norwalk, CT 06856-5060 800-243-5704
RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
† Rtron Corp., Skokie, IL 60076 708-679-7180
§ Schaffner EMC, Inc. Instr. Div., Union, NJ 07083 ..... 908-851-0644;800-367-5566
† SFE Technologies, San Fernando, CA 91340 818-365-9411
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 213-462-0806
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ..... 516-957-8700; 800-645-5516
§† Spectrum Control, Inc., Erie, PA 16505 814-455-0966
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100
Superior Electric, Bristol, CT 06010 203-582-9561
† Swedlow, Inc., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800
Switching Power Inc., Ronkonkoma, NY 11779 516-981-7231
† Tecknit (Eastern Facility), Cranford, NJ 07016 908-272-5500
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Tripp-Lite, Chicago, IL 60610-4188 312-329-1777
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200

† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Filters, Equalizer-2750

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1494
A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... A•1654
† Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 ..... A•1658
† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1661-1663
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682-1683
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1383
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
§ Cermetek Microelectronics Inc., Sunnyvale, CA 94089 408-752-5000
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Eagle Wichita, Wichita, KS 67277 316-942-5100
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
Frequency Devices, Inc., Haverhill, MA 01832 508-374-0761
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Precision Filters, Ithaca, NY 14850 607-277-3550
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, Harmonic-2750

† Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 ..... A•1658
† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1661
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144 ..... A•1673
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... A•1625,1677
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1627
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688-1690,1693-1695
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1415
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Precision Filters, Ithaca, NY 14850 607-277-3550
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, High Pass-2750

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1494,1653
A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... A•1654
† Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 ..... A•1658-1660
† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1661-1663
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1161
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1614
† Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ..... A•1621
† Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144 ..... A•1673
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1674-1675
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... A•1625,1677
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1681
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... A•1684
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688-1690,1692-1694
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1415
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... A•1706-1707
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1481
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708-1712,1716-1717
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4410
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, Cleveland, OH 44135 ..... 1-800-COAXIAL
Coilcraft, Cary, IL 60013 708-639-2361
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
Dantel, Fresno, CA 93727 209-292-1111
† Data Delay Devices, Clifton, NJ 07013-1915 201-773-2299
De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9668
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Electrocom Industries, S. Bend, IN 46615 219-232-2743

§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
§† EWC, Inc., Englishtown, NJ 07726 908-446-3110
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hopkins Engrg., San Fernando, CA 91342 818-361-8691
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† Lectro Magnetics, Inc., Los Angeles, CA 90016 ..... 213-870-9383;USA 800-969-9383
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micronics Technology Inc., Glen Cove, NY 11542 516-759-5600
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4510
MP/Capar, Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... +/5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
§ PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
† Reactel, Inc., Rockville, MD 20850 301-279-5535
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-896-2255
§† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 213-462-0606
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
† ST Microwave Corp., Sub. of Signal Technig. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Wavetek San Diego, Inc. , Wavetek Corp., San Diego, CA 92123 619-279-2200
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Filters, Hybrid-2750

† Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 .... A•1658-1659
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1161
Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1674
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
§† KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825 .. A•1379
† Modular Devices, Shirley, NY 11967, 516-345-3100 ..... D•1903
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548 815-786-8411
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
Micro Technology Inc., Menomonee Falls, WI 53051 414-783-6080
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, IF-2750

† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1661-1663
Corcom, inc., Libertyville, IL 60048, 708-680-7400 ..... A•1611
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666,1669
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1626-1627
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1383
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. B•1921
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1415,1696
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1703
RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•1633
Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708, 1712-1717
† Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
Coilcraft, Cary, IL 60013 708-639-2361
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548 815-786-8411
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
Fox Electronics, Ft. Myers, FL 33905 813-693-0099
Frequency Devices, Inc., Haverhill, MA 01832 508-374-0761
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233

† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4510
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
† Reactel, Inc., Rockville, MD 20850 301-279-5535
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100

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Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
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§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1415
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1701,1703
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
† Eagle Wichita, Wichita, KS 67277 316-942-5100
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Wavetek RF Products, Inc., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, LAN-2750

Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1681

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Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1494,1653
Arco Electronics, Chatsworth, CA 91311, 818-882-8707 ..... A•1655-1657
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•1170
† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1661-1663
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... A•1611
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666
† Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... A•1625,1677
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1681
† Microsonics, Inc., Weymouth, MA 02188, 617-337-4200 ..... A•1401
Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1690
† Oxley Inc., Branford, CT 06405, 203-488-1033 ..... A•1705, B•1025
† RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•1633
§ Schaffner EMC, Inc. Components Division, Union, NJ 07083, 908-851-0664;800-367-5566 ..... A•1634-1637
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... A•1646-1648
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
† Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
Amecon, Inc., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
Coilcraft, Cary, IL 60013 708-639-2361
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741 508-996-8561
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
Dantel, Fresno, CA 93727 209-292-1111
De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9668
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
EWC, Inc., Englishtown, NJ 07726 908-446-3110
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hopkins Engrg., San Fernando, CA 91342 818-361-8691
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
Hy-Q International (USA) Inc., Erlanger, KY 41018 606-283-5000
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., Avenel, NJ 07001 908-636-1900
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† Lectro Magnetics, Inc., Los Angeles, CA 90016 ..... 213-870-9383;USA 800-969-9383
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4510
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Performance Controls, Inc., Horsham, PA 19044 215-675-6500
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Reactel, Inc., Rockville, MD 20850 301-279-5535
Rtron Corp., Skokie, IL 60076 708-679-7180
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
† SFE Technologies, San Fernando, CA 91340 818-365-9411
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
Spectrum Control, Inc., Erie, PA 16505 814-455-0966
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Thinco Div., Hull Corp., Hatboro, PA 19040 215-672-7800
Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400
Universal Ad-Yu/D-F Inc., Milwaukee, WI 53207 414-482-4100
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1494
† Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 .... A•1658,1660
† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 .... A•1661
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1161
Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666-1667
† Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1674-1675, D•1011
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679

† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1681**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... **A•1682**
† **McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411** ..... **A•1383**
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... **A•1706-1707**
† Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
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† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Pacific Instruments Inc., Concord, CA 94520 415-827-9010
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Reactel, Inc., Rockville, MD 20850 301-279-5535
RFI Corporation, Bay Shore, NY 11706 516-231-6400
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-896-2255
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
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† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† TTE, Incorporated, W. Los Angeles, CA 90064 213-478-8224
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... **A•1494,1653**
A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... **A•1654**
† **Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966** ..... **A•1658-1660**
† **Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655** ..... **A•1661-1663**
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•1665**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... **D•1161**
† **Eagle Wichita, Wichita, KS 67277, 316-942-5100** ..... **A•1666-1668**
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... **A•1614**
† **Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333** ..... **A•1670**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1671**
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ..... **A•1621**
† **Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144** ..... **A•1673**
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... **A•1674-1675**
† **Frequency Selective Networks, Woodside, NY 11377, 718-424-7500** ..... **A•1370**
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... **A•1625,1677**
† **Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600** ..... **A•1678-1679**
† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1681**
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825** ..... **A•1379**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... **A•1682-1683**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... **A•1684**
† **Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181** ..... **A•1751**
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... **A•2253**
§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ..... **A•1688-1690,1692,1694**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1753**
§† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1415**
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... **A•1706-1707**
§ **Schaffner EMC, Inc. Components Division, Union, NJ 07083, 908-851-0664;800-367-5566** ..... **A•1634-1637**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1481**
† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224** ..... **A•1708-1717**
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
† Branmag, Inc., North Tonawanda, NY 14120 716-693-5994
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4410
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, Cleveland, OH 44135 ..... 1-800-COAXIAL
Coilcraft, Cary, IL 60013 708-639-2361
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
§ Compac, Holbrook, NY 11741 516-585-3400
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Connecticut Microwave Corp., Cheshire,, CT 06410 203-250-9678
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741 508-996-8561
CTS Corporation, Elkhart, IN 46514 219-293-7511
† CTS Corporation, Microelectronics business unit., W. Lafayette, IN 47906 317-463-2565
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
Dantel, Fresno, CA 93727 209-292-1111
† Data Delay Devices, Clifton, NJ 07013-1915 201-773-2299
De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9668
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
EWC, Inc., Englishtown, NJ 07726 908-446-3110
† Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
Filtronics, Inc., Kansas City, MO 64120 816-231-7375
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hopkins Engrg., San Fernando, CA 91342 818-361-8691
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† Lectro Magnetics, Inc., Los Angeles, CA 90016 ..... 213-870-9383;USA 800-969-9383
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Marel Instr. Co., Cape Coral, FL 33990 813-574-8788
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micronics Technology Inc., Glen Cove, NY 11542 516-759-5600

† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4510
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478 216-232-8600
MP/Capar, Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Instruments Inc., Concord, CA 94520 415-827-9010
§ PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Performance Controls, Inc., Horsham, PA 19044 215-675-6500
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Premier Microwave, Port Chester, NY 10573 914-939-8900
R. C. Electronics Inc., Goleta, CA 93116 805-685-7770
† RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
† Reactel, Inc., Rockville, MD 20850 301-279-5535
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
Relm Communications, Inc., Indianapolis, IN 46226 317-545-4281
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-896-2255
§† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
Rtron Corp., Skokie, IL 60076 708-679-7180
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
† SFE Technologies, San Fernando, CA 91340 818-365-9411
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
† Signal Processing Technologies, Colorado Springs, CO 80906 719-540-3900
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 213-462-0806
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
§† Spectrum Control, Inc., Erie, PA 16505 814-455-0966
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Wavetek San Diego, Inc. , Wavetek Corp., San Diego, CA 92123 619-279-2200
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Filters, Mechanical-2750

§ CUNO, Inc., Process Filtration Products, Meriden, CT 06450 203-237-5541
† Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
† Microphase, Norwalk, CT 06856 203-866-8000
† Penfield, Inc., Plantsville, CT 06479 203-621-9141
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070

Filters, Microwave-3450

† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666
ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688-1695
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1109,1415,1820
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... A•1705
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Capcon, Inc., New York, NY 10001 212-243-6275
† Ceramic Devices Inc., San Diego, CA 92111 619-560-7575
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
MACOM, Inc., Burlington, MA 01803 617-272-3000
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Tecknit (Eastern Facility), Cranford, NJ 07016 908-272-5500
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Filters, Notch – See Filters, Band Elimination (Vol. A)

Filters, Optical-3700 – ***See Vol. B***

Filters, Programmable – See Filters, Variable (Vol. A)

Filters, RF-2750

Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1618
Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1494,1653
A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... A•1654
† Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1661-1662
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665
§ Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... A•1610-1611, C•1330
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
† Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144 ..... A•1673
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... A•1625,1677
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1626-1627
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1681
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1382-1383
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... A•1685-1686
† Micronics Technology Inc., Glen Cove, NY 11542, 516-759-5600 ..... A•1399
Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688-1690,1692-1694
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753

Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. B•1921
§† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1415,1696,1738**
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1702-1703
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... A•1705
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... D•1015
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2224**
† **RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•1633**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1481
† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708-1711,1713-1717**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1280,1283
§ **World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1153**
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Air Maze Corp., Cleveland, OH 44146 216-292-6800
† Alpha Components, Mechanicsburg, PA 17055 717-697-2595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
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† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Ceramic Devices Inc., San Diego, CA 92111 619-560-7575
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Chomerics, inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
† CIR-Q-TEL Microwave, Inc., Beltsville, MD 20705 301-470-2900
Coilcraft, Cary, IL 60013 708-639-2361
Coil-Q Corp, Bronxville, NY 10708 914-337-4775
Compac, Holbrook, NY 11741 516-585-3400
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741 508-996-8561
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548 815-786-8411
Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
Dowty Avionics, Arcadia, CA 91006 818-445-5955
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
§ Electro-Metrics, incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
† Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430 914-664-2333
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ercona, Patchogue, NY 11772 516-758-0700
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
§† Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
§ Fox Electronics, Ft Myers, FL 33905 813-693-0099
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hopkins Engrg., San Fernando, CA 91342 818-361-8691
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† Lectro Magnetics, Inc., Los Angeles, CA 90016 ..... 213-670-9383;USA 800-969-9383
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
MACOM, Inc., Burlington, MA 01803 617-272-3000
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4510
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
Panel Components Corp., Santa Rosa, CA 95406 707-523-0600
Peca, Inc., Bensalem, PA 19020 215-245-1550
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
† Reactel, Inc., Rockville, MD 20850 301-279-5535
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-896-2255
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
§† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† Rtron Corp., Skokie, IL 60076 708-679-7180
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
† SFE Technologies, San Fernando, CA 91340 818-365-9411
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
§† Spectrum Control, Inc., Erie, PA 16505 814-455-0966
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
† Swedlow, Inc., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Φ U.S. Instrument Rentals, inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
Wide Band Engineering Co., inc., Phoenix, AZ 85036 602-254-1570

Filters, Single Sideband-2750

Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369**
† **Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370**
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375
KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
† **McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1383**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1706**
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548 815-786-8411
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hertz Filter, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4510
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, Synchronous Tracking-2750

† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1665**
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
† **Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679**
KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1682
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... A•1706-1707, D•1193

† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224** ..... **A•1708**
Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Unholtz-Dickie Corp., Wallingford, CT 06492 203-265-3929
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

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Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... **A•1670**
† **Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144** ..... **A•1673**
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. **B•1921**
† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224** ..... **A•1708**
Alpha Components, Mechanicsburg, PA 17055 717-697-8595
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
Aptek Technologies, Inc., Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
Avens Corp., Brooklyn, NY 11208 ..... 718-827-5991;800-452-1966
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Chesterfield Products, Inc., Elmwood Park, NJ 07407 201-797-9655
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Dantel, Fresno, CA 93727 209-292-1111
§ De Coursey Engineering Laboratory, Culver City, CA 90230 ..... 213-EX7-9668
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
Frequency Devices, Inc., Haverhill, MA 01832 508-374-0761
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., Avenel, NJ 07001 908-636-1900
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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Filters, Tuning Fork-2300

CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548 815-786-8411
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111

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Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... **A•1494,1653**
A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... **A•1654**
† **Chesterfield Products, Inc., Elmwood Park, NJ 07407, 201-797-9655** ..... **A•1661-1663**
† **Eagle Wichita, Wichita, KS 67277, 316-942-5100** ..... **A•1666,1669**
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... **A•1670**
Enegren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ..... **A•2210**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1671**
† **Frequency Selective Networks, Woodside, NY 11377, 718-424-7500** ..... **A•1370**
† **Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600** ... **A•1678-1679**
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... **A•1626-1627**
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... **A•1681**
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825** .. **A•1379**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... **A•1682**
† **Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181** ..... **A•1751**
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... **A•1382-1383**
§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ..... **A•1688-1695**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1753**
§† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1415,1696,1738**
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... **A•1702-1703**
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... **D•1193**
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... **A•1644-1645**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1481**
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... **A•1646-1647**
† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224** ..... **A•1708-1717**
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
§† Cambridge Filter Corp., Syracuse, NY 13221-4906 315-457-1000
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Hertz Filter, Syosset, NY 11791 516-822-4770
Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
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§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
Oxley Inc., Branford, CT 06405 203-488-1033
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Reactel, Inc., Rockville, MD 20850 301-279-5535
§† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
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† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
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§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
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† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
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§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
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§† Tusonix, Inc., Tucson, AZ 85740-7144 602-744-0400
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Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
Wavetek San Diego, Inc., Wavetek Corp., San Diego, CA 92123 619-279-2200
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Filters, Variable-2750

A. P. Circuit, Brooklyn, NY 11237, 718-456-2717 ..... **A•1654**
Arco Electronics, Chatsworth, CA 91311, 818-882-8707 ..... **A•1655-1657**
† **Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966** .... **A•1658-1659**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... **D•1161**
† **Eagle Wichita, Wichita, KS 67277, 316-942-5100** ..... **A•1666**
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ..... **A•1622-1623**
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... **A•1674-1675, D•1011**
† **Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600** ... **A•1678-1679**
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... **A•1626-1627**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... **A•1684**
† **Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181** ..... **A•1751**
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... **A•1383**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... **A•1685-1687**
§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ..... **A•1688,1690-1695**
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... **A•1701,1703**
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... **A•1706-1707**
† **TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224** ..... **A•1708-1717**
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Coaxial Dynamics, Cleveland, OH 44135 ..... 1-800-COAXIAL

Coil-Q Corp., Bronxville, NY 10708 914-337-4775
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Daden Associates, Laguna Hills, CA 92653 714-770-1522
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
Hopkins Engrg., San Fernando, CA 91342 818-361-8691
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
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NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
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Pacific Instruments Inc., Concord, CA 94520 415-827-9010
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Premier Microwave, Port Chester, NY 10573 914-939-8900
RFI Corporation, Bay Shore, NY 11706 516-231-6400
Sivers IMA AB, Culver City, CA 90230 213-306-4248
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
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† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-6007
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100

Filters, Vestigial Sideband-2750

† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
§† ATV Research, Inc., Dakota City, NE 68731 402-987-3771
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† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
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† KR Electronics, Inc., Avenel, NJ 07001 908-636-1900
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Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1494,1653
Arco Electronics, Chatsworth, CA 91311, 818-882-8707 ..... A•1655-1657
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1666
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1670
ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
† Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144 ..... A•1673
† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1626-1627
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1683
Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1692-1693
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1415,1738
† TTE, Incorporated, W. Los Angeles, CA 90064, 213-478-8224 ..... A•1708
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Anatech Electronics, Inc., Ho Ho Kus, NJ 07423 201-612-0066
Chesterfield Products, Inc., Elmwood Park, NJ 07407 201-797-9655
Coilcraft, Cary, IL 60013 708-639-2361
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Filtronics, Inc., Kansas City, MO 64120 816-231-7375
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9111
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, Waveguide-3450

† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688-1695
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Burlington, MA 01803 617-272-3000
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Reactel, Inc., Rockville, MD 20850 301-279-5535
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Tecknit (Eastern Facility), Cranford, NJ 07016 908-272-5500
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181

Filters, YIG-2750

BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
Sivers IMA AB, Culver City, CA 90230 213-306-4248
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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Flanges, Waveguide-3450

Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1688
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Gabriel Electronics, Scarborough, ME 04074 207-883-5161
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
MACOM, Inc., Burlington, MA 01803 617-272-3000
Microdry, Inc., Crestwood, KENTUCKY 40014 502-241-8933
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900

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Foil, Magnetic-1850

† Ad-Vance Magnetics, Inc., Rochester, IN 46975, 219-223-3158 ..... C•1686
† Amuneal Manufacturing Corp., Philadelphia, PA 19124, 215-535-3000 ... C•1687
† Eagle Magnetic Company, Inc., Indianapolis, IN 46224, 317-297-1030 .... C•1689
† Magnetic Shield Corporation, Perfection Mica Co., Bensenville, IL 60106, 708-766-7800 ..... C•1698-1699
Shin-Etsu Polymer America, Inc., Union City, CA 94587, 415-475-9000 .. C•1521
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Egis Corporation, Barrington Hills, IL 60010 708-639-1555
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
§† Reade Advanced Materials, Riverside, RI 02915-0039 401-433-7000
† SAS Industries Inc., Manorville, NY 11949 ..... 516-727-1441;1-800-544-5238
† Zippertubing Co., Los Angeles, CA 90061 213-321-3901

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Generators, Low Frequency-2900 – *See Vol. D*

Generators, Marker-2900 – *See Vol. D*

Generators, Microwave-3450

Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... **A•1827**

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869	201-584-1077
California Microwave, Sunnyvale, CA 94086	408-732-4000
Cober Electronics, Stamford, CT 06902	203-327-0003
Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
† Corvus Microwave Inc., Syracuse, NY 13211-2100	315-437-4400
§† EIP Microwave, Inc., Milpitas, CA 95035	408-945-1477
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Hewlett-Packard Co., Cupertino, CA 95014	800-752-0900
Lectronic Research Labs., Inc., Camden, NJ 08104	609-541-4200
Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
† Loral Microwave-Narda West, San Jose, CA 95112-4210	408-436-4400
Lucas Epsco, Inc., Hopkinton, MA 01748-2204	508-435-2400
Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
† Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
M/A-COM Government Products, Inc., Hunt Valley, MD 21030	301-771-0077
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200
§ Marconi Instruments, Allendale, NJ 07401	201-934-9050
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
Microdry, Inc., Crestwood, KENTUCKY 40014	502-241-8933
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076	708-677-4700
§ Microwave Development Laboratories, Natick, MA 01760	508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3	514-694-6666
Nemeth Engineering Associates, Inc., Crestwood, KY 40014	502-241-1502
† Racal-Dana Instrs. inc., Irvine, CA 92718	714-859-8999
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612	312-670-0150
† Republic Electronics Co., Hauppauge, NY 11788	516-273-9800
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070	717-774-2746
Tektronix, Inc., Beaverton, OR 97077	800-835-9433
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
† TRAK Microwave Corp., Tampa, FL 33634	813-884-1411
Tucker Electronics, Dallas, TX 75355-1419	214-348-6800;800-527-4642
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141
Wavetek Microwave, Inc., (Formerly Pacific Measurement, Inc.), Sunnyvale, CA 94089	408-734-5780
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000

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Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ..... **D•2206**

Integrated Technologies Solutions Inc., East Meadow, NY 11554, 516-481-0857 ..... **D•1267**

† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100**	**D•1196**
Alfa Electronics, Inc., Princeton, NJ 08543-8089	609-275-0220
Ballantine Laboratories, Noise Unlimited Inc., Cedar Knolls, NJ 07927	201-984-1900

BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Frequency Devices, Inc., Haverhill, MA 01832 508-374-0761
§ Hameg, Inc., Port Washington, NY 11050 516-883-3837
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
† Velonex, Santa Clara, CA 95050 408-727-7370
Wavetek San Diego, Inc., Wavetek Corp., San Diego, CA 92123 619-279-2200

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Generators, Square Wave – See Generators, Function (Vol. D)

Generators, Surge-2900 – *See Vol. D*

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Generators, Transient Line Voltage-2900 – *See Vol. D*

Generators, UHF/VHF-2900 – *See Vol. D*

Generators, Ultrasonic-2900 – *See Vol. D*

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Handles For Cabinets, Circuit Boards, Racks, etc.-1400 – *See Vol. C*

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Headers, Socket-2100 – *See Vol. C*

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Holders, Crystal-2300

§ Bivar, Inc., Irvine, CA 92718, 714-951-8808 ..... C•1015
Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248 ..... A•1322
† Connector Corp., Chicago, IL 60646, 312-539-3108 ..... C•1327
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1328,1332-1333,1338
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1380-1381
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1448
† Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1469
§† Atlee Inc., North Andover, MA 01845 508-681-1003
Augat Inc., Attleboro, MA 02703 617-222-2202
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Milross Controls, Inc., Southampton, PA 18966 215-355-0200
† M-Tron Industries, Yankton, SD 57078 605-665-9321
Raltron Electronics, Miami, FL 33172 305-593-6033
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
SARONIX, Palo Alto, CA 94303 415-856-6900
Schott Electronics, Seymour, CT 06483 203-881-0102
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428

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§ Bivar, Inc., Irvine, CA 92718, 714-951-8808 ..... **C•1015**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... **A•1734**
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... **A•1966**
Acme Model Engineering Co., Ridgefield, NJ 07657 201-943-7650
§ Augat Inc., Attleboro, MA 02703 617-222-2202
Burndy Corporation, An FCI Company, Norwalk, CT 06852 203-838-4444
† Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Garry Electronics an LPL Co., Langhorne, PA 19047 215-949-2300
† Gordon, L., Packaging, Baltimore, MD 21230 301-539-6537
Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
K-Two Industries, Palo Alto, CA 94306 408-720-9316
§ 3M-Electronic Products Division, Austin, TX 78769-2963 ..... 1-800-225-5373 Sls. & Prod. Info.
Milross Controls, Inc., Southampton, PA 18966 215-355-0200
§ Robinson Nugent, Inc., New Albany, IN 47150 812-948-0564
§ Wells Electronics, Inc., South Bend, IN 46613 219-287-5941

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Hum Eliminators-2700

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... **A•1494**
Delta Products Corporation, Fremont, CA 94538 415-770-0660
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700

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Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. **B•1921**
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... **A•1700**
† Valhalla Scientific, San Diego, CA 92121, 619-457-5576 ..... **D•1332-1333**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Kentron, Inc., Cedarburg, WI 53012-0142 414-377-3733

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Impedance Converters, Microwave-3450

Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123

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† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... **A•1162**
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-515-1720 ..... **A•1167-1169**
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... **A•1170-1171**
Coilcraft, Cary, IL 60013, 708-639-2361 ..... **A•1187-1188,1190,1192**
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Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... **A•1194**
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... **A•1204-1205**
EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... **B•1462-1463**
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... **A•1206**
Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... **A•1208**
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... **A•2300**
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•1213**
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... **A•1236**
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... **A•1248**
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... **A•2371**
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... **A•1140-1141**
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... **A•1262,1265-1266**

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MultiComp., Inc., Beaverton, OR 97006 503-626-4200
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§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
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§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
† Stetco, Inc., Franklin Pk, IL 60131 708-671-4208
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§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
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§† VTC, Incorporated, Control Data Corp., Bloomington, MN 55425 ..... 612-851-5200; 800-882-2667

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† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
§† AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
Avasem Corporation, San Jose, CA 95126 408-297-1201
Benchmarq Microelectronics, Inc., Carrollton, TX 75006 214-407-0011
§ Calmos Semiconductor, Inc., Kanata, Ontario, CANADA K2L 1V8 ..... 613-836-1014; 800-267-7231
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
Cirrus Logic, Inc., Fremont, CA 94538 415-623-8300

§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
EI North America, New York, NY 10021 212-517-5622
§† Exar Corp., San Jose, CA 95161-9007 408-732-7970
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
Gould Inc., Semiconductor Division, Pocatello, ID 83201 208-233-4690
§† Harris Semiconductor, Melbourne, FL 32902 305-724-7400
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
† MCE Semiconductor, Inc., West Palm Beach, FL 33407 407-845-2837
§† McGuirk Electronics Co. Inc., Middleton, MA 01949 617-933-3500
§† Micrel Semiconductor, Sunnyvale, CA 94086 408-245-2500
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
† Modular Devices, Shirley, NY 11967 516-345-3100
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† QUALCOMM, Inc., San Diego, CA 92121 619-587-1121
§† Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 213-517-7770
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Signetics Company, Sub. of North American Philips, Sunnyvale, CA 94088-3409 408-991-2000
§† Silicon General, Garden Grove, CA 92641 714-898-8121
Siltronics Ltd., Dover, MA 02030 617-329-4068
§† Standard Microsystems, Hauppauge, NY 11788 516-273-3100
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Systronix Inc., Salt Lake City, UT 84152-6398 801-487-7412
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500
† Third Domain, Inc., Tucson, AZ 85731-7568 602-290-1820
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§† TRW LSI Products INC., La Jolla, CA 92038 619-457-1000
† United Technologies Microelectronics Center, United Technologies Corp., Colorado Springs, CO 80907 ..... 719-594-8000;1-800-MIL-UTMC
Verdure Industries Inc., Omaha, NE 68124 402-691-8300
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-7673
§† VTC, Incorporated, Control Data Corp., Bloomington, MN 55425 ..... 612-851-5200; 800-882-2667
§ Western Digital Corp., Irvine, CA 92718 714-932-6000
§† Xicor, Inc., Milpitas, CA 95035 408-432-8888

Integrated Circuits, Digital, Surface Mount-3130

Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1742
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
Advanced Hardware Architectures, Inc., Moscow, ID 83843 208-883-8000
† Applied Micro Circuits Corp., San Diego, CA 92121 619-450-9333
§† AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
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Avasem Corporation, San Jose, CA 95126 408-297-1201
§ Calmos Semiconductor, Inc., Kanata, Ontario, CANADA K2L 1V8 ..... 613-836-1014; 800-267-7231
Cirrus Logic, Inc., Fremont, CA 94538 415-623-8300
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
† MCE Semiconductor, Inc., West Palm Beach, FL 33407 407-845-2837
§ Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
† Modular Devices, Shirley, NY 11967 516-345-3100
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§† QUALCOMM, Inc., San Diego, CA 92121 619-587-1121
§ Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Systronix Inc., Salt Lake City, UT 84152-6398 801-487-7412
Verdure Industries Inc., Omaha, NE 68124 402-691-8300
§† VTC, Incorporated, Control Data Corp., Bloomington, MN 55425 ..... 612-851-5200; 800-882-2667
§ Western Digital Corp., Irvine, CA 92718 714-932-6000

Integrated Circuits, Gate Array, Surface Mount-3130

§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1742
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
† Applied Micro Circuits Corp., San Diego, CA 92121 619-450-9333
† Atmel Corporation, San Jose, CA 95131 408-441-0311
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† GE Microelectronics Center, GE Aerospace, Research Triangle Park, NC 27709 919-549-3100
† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
# Indiana Microelectronics Center Corp. for Science & Technology, Fort Wayne, IN 46825 219-482-8200
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
† MCE Semiconductor, Inc., West Palm Beach, FL 33407 407-845-2837
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Optrex/Satori, Torrance, CA 90503 213-214-1791
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Silicon General, Garden Grove, CA 92641 714-898-8121
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
† United Technologies Microelectronics Center, United Technologies Corp., Colorado Springs, CO 80907 ..... 719-594-8000;1-800-MIL-UTMC
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-7673

Integrated Circuits, Interface-3130

Advanced Electronic Packaging, Huntington Beach, CA 92646, 714-969-1150 ..... A•1719
American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1158
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
§ Adaptec, Inc., Milpitas, CA 95035 408-945-8600
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
Advanced Hardware Architectures, Inc., Moscow, ID 83843 208-883-8000
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§† Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Analog Systems, Tucson, AZ 85731-7389 602-290-1818
† Applied Micro Circuits Corp., San Diego, CA 92121 619-450-9333
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Avasem Corporation, San Jose, CA 95126 408-297-1201
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Benchmarq Microelectronics, Inc., Carrollton, TX 75006 214-407-0011
† Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Cherry Semiconductor Corp, East Greenwich, RI 02818 401-885-3600
Cirrus Logic, Inc., Fremont, CA 94538 415-623-8300
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§† Elantec, Inc., Milpitas, CA 95035 ..... 408-945-1323;800-821-7429
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§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
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§ Gould Inc., Semiconductor Division, Pocatello, ID 83201 208-233-4690
§† Harris Semiconductor, Melbourne, FL 32902 305-724-7400
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† MCE Semiconductor, Inc., West Palm Beach, FL 33407 407-845-2837
§† Micrel Semiconductor, Sunnyvale, CA 94086 408-245-2500
§ Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
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§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515

§† Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Signal Processing Technologies, Colorado Springs, CO 80906 719-540-3900
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§† Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
Siltronics Ltd., Dover, MA 02030 617-329-4068
Simulex Corporation, Tustin, CA 92680 714-730-1500
† Sipex Corp., Custom Monolithic Prods. Div., Billerica, MA 01821 508-667-8700
§† Standard Microsystems, Hauppauge, NY 11788 516-273-3100
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500
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Verdure Industries Inc., Omaha, NE 68124 402-691-8300
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-7673
§† VTC, Incorporated, Control Data Corp., Bloomington, MN 55425 ..... 612-851-5200; 800-882-2667
§ Western Digital Corp., Irvine, CA 92718 714-932-6000

Integrated Circuits, Interface, Surface Mount-3130

§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
Advanced Hardware Architectures, Inc., Moscow, ID 83843 208-883-8000
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
§† Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
† Applied Micro Circuits Corp., San Diego, CA 92121 619-450-9333
Avasem Corporation, San Jose, CA 95126 408-297-1201
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Cherry Semiconductor Corp, East Greenwich, RI 02818 401-885-3600
Cirrus Logic, Inc., Fremont, CA 94538 415-623-8300
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§ Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† MCE Semiconductor, Inc., West Palm Beach, FL 33407 407-845-2837
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont, CANADA K2K 1X3 613-592-2122
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
Signal Processing Technologies, Colorado Springs, CO 80906 719-540-3900
Silicon General, Garden Grove, CA 92641 714-898-8121
Simulex Corporation, Tustin, CA 92680 714-730-1500
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Verdure Industries Inc., Omaha, NE 68124 402-691-8300
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-7673
§† VTC, Incorporated, Control Data Corp., Bloomington, MN 55425 ..... 612-851-5200; 800-882-2667

Integrated Circuits, Linear-3130

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
† Apex Microtechnology Corp., Tucson, AZ 85741, 602-742-8600 ..... D•1005
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1742
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
† Analog Systems, Tucson, AZ 85731-7389 602-290-1818
† A.S.I. Microsystems, inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
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† Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
§ Calmos Semiconductor, Inc., Kanata, Ontario, CANADA K2L 1V8 ..... 613-836-1014; 800-267-7231
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
Cherry Semiconductor Corp, East Greenwich, RI 02818 401-885-3600
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
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§† Elantec, Inc., Milpitas, CA 95035 ..... 408-945-1323;800-821-7429
Eletech Electronics, Inc., Anaheim, CA 92805 714-385-1707
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§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
Gennum Corporation, Linear Technology Inc., Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
§ Gould Inc., Semiconductor Division, Pocatello, ID 83201 208-233-4690
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† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† MCE Semiconductor, Inc., West Palm Beach, FL 33407 407-845-2837
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§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
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§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
§† Raytheon Semiconductor, Mountain View, CA 94043 415-966-7639
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
† Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
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§† Unitrode Corp., Watertown, MA 02172 617-926-0404
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§† Xicor, Inc., Milpitas, CA 95035 408-432-8888

Integrated Circuits, Linear, Surface Mount-3130

§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1742
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
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† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Cherry Semiconductor Corp, East Greenwich, RI 02818 401-885-3600
§† Comlinear Corp., Fort Collins, CO 80525 303-226-0500
Custom Linear Inc., Sunnyvale, CA 94086-3832 408-749-9933
§† Elantec, Inc., Milpitas, CA 95035 ..... 408-945-1323;800-821-7429
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Gennum Corporation, Linear Technology Inc., Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
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§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§ Linear Technology Corp., Milpitas, CA 95035 408-432-1900
† MCE Semiconductor, Inc., West Palm Beach, FL 33407 407-845-2837
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
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Silicon General, Garden Grove, CA 92641 714-898-8121
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§† VTC, Incorporated, Control Data Corp., Bloomington, MN 55425 ..... 612-851-5200; 800-882-2667

§† Xicor, Inc., Milpitas, CA 95035 408-432-8888

Integrated Circuits, Logic, Surface Mount-3130

§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
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Avasem Corporation, San Jose, CA 95126 408-297-1201
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
§ Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† VTC, Incorporated, Control Data Corp., Bloomington, MN 55425 ..... 612-851-5200; 800-882-2667

Integrated Circuits, Logic, Programmable-3130

Advanced Electronic Packaging, Huntington Beach, CA 92646, 714-969-1150 ..... A•1719
§† Actel Corporation, Sunnyvale, CA 94086 408-739-1010
Advanced Hardware Architectures, Inc., Moscow, ID 83843 208-883-8000
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
§† Atmel Corporation, San Jose, CA 95131 408-441-0311
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
# Indiana Microelectronics Center Corp. for Science & Technology, Fort Wayne, IN 46825 219-482-8200
§ Prologic Systems, Broomfield, CO 80020 303-460-0103
§† Signetics Company, Sub. of North American Philips, Sunnyvale, CA 94088-3409 408-991-2000

Integrated Circuits, Memory-3130

Advanced Electronic Packaging, Huntington Beach, CA 92646, 714-969-1150 ..... A•1719
American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1361,1363
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1742
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§† Atmel Corporation, San Jose, CA 95131 408-441-0311
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
Avasem Corporation, San Jose, CA 95126 408-297-1201
Benchmarq Microelectronics, Inc., Carrollton, TX 75006 214-407-0011
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§† Exel Microelectronics, Rohm Corporation, San Jose, CA 95131 408-432-0500
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
§† Harris Semiconductor, Melbourne, FL 32902 305-724-7400
§† Inmos Corp., Colorado Springs, CO 80935 ..... 719-630-4000 (ext 4357)
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
International Microelectronics, Arlington, TX 76003 817-561-2244
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
Memory X, Inc., San Diego, CA 92123 619-292-1151
† Micrel Semiconductor, Sunnyvale, CA 94086 408-245-2500
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§† Micron Technology, Inc., Boise, ID 83706 208-386-3900
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
† Modular Devices, Shirley, NY 11967 516-345-3100
§† Mosaic Semiconductor Inc., Implex Inc., San Diego, CA 92121 619-271-4565
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Optrex/Satori, Torrance, CA 90503 213-214-1791
§ Prologic Systems, Broomfield, CO 80020 303-460-0103
Ramtron Corp., Colo. Springs, CO 80921 ..... 719-481-7000;800-FRAM
§† Raytheon Semiconductor, Mountain View, CA 94043 415-966-7639
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† SEEQ Technology, San Jose, CA 95131 ..... 408-432-7400;1-800-333-7706
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 213-517-7770
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Signetics Company, Sub. of North American Philips, Sunnyvale, CA 94088-3409 408-991-2000
§† Simtek Corp., Colorado Springs, CO 80920 719-531-9444
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
§† Standard Microsystems, Hauppauge, NY 11788 516-273-3100
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500
† Third Domain, Inc., Tucson, AZ 85731-7568 602-290-1820
† United Technologies Microelectronics Center, United Technologies Corp., Colorado Springs, CO 80907 ..... 719-594-8000;1-800-MIL-UTMC
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-7673
§† WaferScale Integration, Inc., Fremont, CA 94538 ... 415-656-5400;800-451-5970 (USA)
§† Xicor, Inc., Milpitas, CA 95035 408-432-8888

Integrated Circuits, Microprocessor-3130

Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1721
American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1361
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1742
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Array Microsystems, Colorado Springs, CO 80906 719-540-3842
§† Calmos Semiconductor, Inc., Kanata, Ontario, CANADA K2L 1V8 ..... 613-836-1014; 800-267-7231
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
Gould Inc., Semiconductor Division, Pocatello, ID 83201 208-233-4690
§† Harris Semiconductor, Melbourne, FL 32902 305-724-7400
§† Inmos Corp., Colorado Springs, CO 80935 ..... 719-630-4000 (ext 4357)
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
Intergraph Corp., Advanced Processor Division, Palo Alto, CA 94303 415-494-8800
International Microelectronics, Arlington, TX 76003 817-561-2244
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Signetics Company, Sub. of North American Philips, Sunnyvale, CA 94088-3409 408-991-2000
§† Standard Microsystems, Hauppauge, NY 11788 516-273-3100
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500
† United Technologies Microelectronics Center, United Technologies Corp., Colorado Springs, CO 80907 ..... 719-594-8000;1-800-MIL-UTMC
§ VLSI Technology, Inc., San Jose, CA 95131 408-434-7673
§† WaferScale Integration, Inc., Fremont, CA 94538 ... 415-656-5400;800-451-5970 (USA)
§ Weitek Corp., Sunnyvale, CA 94086 408-738-8400
§ Western Digital Corp., Irvine, CA 92718 714-932-6000

Integrated Circuits, Microprocessor, Surface Mount-3130

Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1361
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
§ Calmos Semiconductor, Inc., Kanata, Ontario, CANADA K2L 1V8 ..... 613-836-1014; 800-267-7231
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
Intergraph Corp., Advanced Processor Division, Palo Alto, CA 94303 415-494-8800
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ VLSI Technology, Inc., San Jose, CA 95131 408-434-7673

§† WaferScale Integration, Inc., Fremont, CA 94538 ... 415-656-5400;800-451-5970 (USA)

Integrated Circuits, MOS, Digital-3130

Advanced Electronic Packaging, Huntington Beach, CA 92646, 714-969-1150 ..... A•1719
Advanced Hardware Architectures, Inc., Moscow, ID 83843 208-883-8000
† Applied Micro Circuits Corp., San Diego, CA 92121 619-450-9333
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
Avasem Corporation, San Jose, CA 95126 408-297-1201
Benchmarq Microelectronics, Inc., Carrollton, TX 75006 214-407-0011
Cirrus Logic, Inc., Fremont, CA 94538 415-623-8300
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† VTC, Incorporated, Control Data Corp., Bloomington, MN 55425 ..... 612-851-5200; 800-882-2667

Integrated Circuits, MOS, Linear-3130

Avasem Corporation, San Jose, CA 95126 408-297-1201
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080

Integrated Circuits, MOS, Memory-3130

Advanced Electronic Packaging, Huntington Beach, CA 92646, 714-969-1150 ..... A•1719
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
Avasem Corporation, San Jose, CA 95126 408-297-1201
Benchmarq Microelectronics, Inc., Carrollton, TX 75006 214-407-0011
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
Ei North America, New York, NY 10021 212-517-5622
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
Micro Electronic Technologies, Hopkinson, MA 01748 508-435-9057
§† Micron Technology, Inc., Boise, ID 83706 208-386-3900
Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Signetics Company, Sub. of North American Philips, Sunnyvale, CA 94088-3409 408-991-2000
§† Simtek Corp., Colorado Springs, CO 80920 719-531-9444
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
§† WaferScale Integration, Inc., Fremont, CA 94538 ... 415-656-5400;800-451-5970 (USA)

Integrated Circuits, MOS, Digital, Surface Mount-3130

§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
Advanced Hardware Architectures, Inc., Moscow, ID 83843 208-883-8000
† Applied Micro Circuits Corp., San Diego, CA 92121 619-450-9333
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
Avasem Corporation, San Jose, CA 95126 408-297-1201
Cirrus Logic, Inc., Fremont, CA 94538 415-623-8300
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
Verdure Industries Inc., Omaha, NE 68124 402-691-8300
§† VTC, Incorporated, Control Data Corp., Bloomington, MN 55425 ..... 612-851-5200; 800-882-2667

Integrated Circuits, MOS, Linear, Surface Mount-3130

§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
Applied Components, AC Interface, Rancho Santa Margarita, CA 92688 714-858-9488
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Avasem Corporation, San Jose, CA 95126 408-297-1201
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Sierra Semiconductor Corp., San Jose, CA 95132 408-263-9300
§ Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241

Integrated Circuits, MOS, Memory, Surface Mount-3130

§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Avasem Corporation, San Jose, CA 95126 408-297-1201
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† SEEQ Technology, San Jose, CA 95131 ..... 408-432-7400;1-800-333-7706
§† Simtek Corp., Colorado Springs, CO 80920 719-531-9444
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
§† WaferScale Integration, Inc., Fremont, CA 94538 ... 415-656-5400;800-451-5970 (USA)

Integrated Circuits, Silicon Monolithic, Unpackaged Chips-3130

§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
ADVANCED MICRO SYSTEMS, INC., Hudson, NH 03051-4920 603-882-1447
§† Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Avasem Corporation, San Jose, CA 95126 408-297-1201
† Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Cherry Semiconductor Corp, East Greenwich, RI 02818 401-885-3600
§† Comlinear Corp., Fort Collins, CO 80525 303-226-0500
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
§† Elantec, Inc., Milpitas, CA 95035 ..... 408-945-1323;800-821-7429
Gennum Corporation, Linear Technology Inc., Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
Gould Inc., Semiconductor Division, Pocatello, ID 83201 208-233-4690
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
† MCE Semiconductor, Inc., West Palm Beach, FL 33407 407-845-2837
§† Micrel Semiconductor, Sunnyvale, CA 94086 408-245-2500
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† SEEQ Technology, San Jose, CA 95131 ..... 408-432-7400;1-800-333-7706
† Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§† Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
Verdure Industries Inc., Omaha, NE 68124 402-691-8300

Integrated Circuits, Standard Cells-3130

Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
Avasem Corporation, San Jose, CA 95126 408-297-1201
§ Calmos Semiconductor, Inc., Kanata, Ontario, CANADA K2L 1V8 ..... 613-836-1014; 800-267-7231
† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
# Indiana Microelectronics Center Corp. for Science & Technology, Fort Wayne, IN 46825 219-482-8200
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641

Optrex/Satori, Torrance, CA 90503 213-214-1791
§ Sierra Semiconductor Corp., San Jose, CA 95132 408-263-9300
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-7673

Integrated Circuits, Telecommunications, Audio-3130

§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... A•1743-1745
Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Aptek Technologies, Inc., Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
§ Sierra Semiconductor Corp., San Jose, CA 95132 408-263-9300
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-7673

Integrated Circuits, Telecommunications, CEPT-3130

Aptek Technologies, Inc., Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
§† Gould AMI, Gould, Pocatello, ID 83201 208-233-4690

Integrated Circuits, Telecommunications, Data-3130

Advanced Hardware Architectures, Inc., Moscow, ID 83843 208-883-8000
† Applied Micro Circuits Corp., San Diego, CA 92121 619-450-9333
Aptek Technologies, Inc., Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 36 66-0
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Avasem Corporation, San Jose, CA 95126 408-297-1201
Cirrus Logic, Inc., Fremont, CA 94538 415-623-8300
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§† QUALCOMM, Inc., San Diego, CA 92121 619-587-1121
§ Sierra Semiconductor Corp., San Jose, CA 95132 408-263-9300

Integrated Circuits, Telecommunications, ISDN-3130

Aptek Technologies, Inc., Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Cirrus Logic, Inc., Fremont, CA 94538 415-623-8300
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052 408-721-2641

Integrated Circuits, Telecommunications, T-1-3130

Aptek Technologies, Inc., Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
§ Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
§ Sierra Semiconductor Corp., San Jose, CA 95132 408-263-9300

Integrators, Electronic-2325 — *See Vol. D*

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Ion, implanter, medium current-4100 — *See Vol. D*

Isolators, Antenna-1200 — *See Vol. D*

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§† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1832-1833
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
MACOM, Inc., Burlington, MA 01803 617-272-3000
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
Relm Communications, Inc., Indianapolis, IN 46226 317-545-4281
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

Isolators, High Voltage-4050 — *See Vol. D*

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Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1109,1820
§† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1832-1833
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
MACOM, Inc., Burlington, MA 01803 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

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Jack Covers-2100 — *See Vol. C*

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Joints, Rotary, Microwave-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Eastern Microwave, Burlington, MA 01803 617-273-4700
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† Graphite Metallizing Corp., Yonkers, NY 10702 914-968-8400
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715

§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900

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Joysticks, Potentiometer-2200 — *See Vol. D*

Joystick, Toggle Switch-2200 — *See Vol. D*

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Jumpers, Circuit Board-2100 — *See Vol. C*

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Junctions, Hybrid, Microwave-3450

† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
† Eastern Microwave, Burlington, MA 01803 617-273-4700
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4858 818-882-6333
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
TRM, Inc., Manchester, NH 03103 603-627-6000

Keyboard Legends and Symbols-5150 — *See Vol. B*

Keyboards, Address Encoded-5150 — *See Vol. B*

Keyboards, Capacitive-5150 — *See Vol. B*

Keyboards, Conductive Rubber-5150 — *See Vol. B*

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Keyboards, Programmable-5150 — *See Vol. B*

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Keyboards, Solid State-5150 — *See Vol. B*

Keyboards, Wireless-5150 — *See Vol. B*

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Kits, Enclosure Prototyping-1400 — *See Vol. C*

Kits, Fiber Optic-2475 — *See Vol. B*

Kits, Marking (Dial, Instrument, Equipment, etc.)-2400 — *See Vol. C*

Kits, Potentiometer, Rheostat-4750

Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•2054
Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Microelectronics, Arlington, TX 76003 817-561-2244
Mouser Electronics, Mansfield, TX 76063 800-346-6873

Kits, Printed Circuit-1700 — *See Vol. C*

Kits, Programming Board-4200 — *See Vol. C*

Kits, Shielding-4525 — *See Vol. C*

Kits, Terminal-2100 — *See Vol. C*

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Lids, Hybrid Package-3130

† **Hybridyne, Inc., Tucson, AZ 85745, 602-629-0001** ..... **A•1729**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... **A•1734**
K-Two Industries, Palo Alto, CA 94306 408-720-9316
Micro-Etch Products, Inc., Stratford, CT 06497 203-378-8610
† Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762 508-695-2000
§ Nepenthe, Inc., Palo Alto, CA 94303 415-496-6666
† Products Engrg. Corp., Azusa, CA 91702 818-969-5879

Light Choppers-3700 — *See Vol. B*

Light Pens-2000 — *See Vol. D*

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Light Sources, Stroboscopic-3700 — *See Vol. B*

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Limit Stops, Mechanical-2500 — *See Vol. C*

Limiters, Current-4300 — *See Vol. B*

Limiters, Microwave-3450

† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1753**
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microphase, Norwalk, CT 06856 203-866-8000
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Line Conditioners-4050 — *See Vol. D*

Line Controlled Switches — See Switches, Data (Vol. D)

Line Stretchers, Microwave-3450

† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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Machines, Capacitor Winding-4100 — *See Vol. D*

Machines, Cleaning & Degreasing-Also See Cleaners, Ultrasonic-4100 — *See Vol. D*

Machines, Coil Winding-4100 — *See Vol. D*

Machines, Component Handling, Feeding, Insertion & Sorting-4100 — *See Vol. D*

Machines, Drilling, Laser-4100 — *See Vol. D*

Machines, Hermetic Sealing-4100 — *See Vol. D*

Machines, Induction Heating (Electronic)-4100 — *See Vol. D*

Machines, Lead Cutting & Forming-4100 — *See Vol. D*

Machines, Magnet Wire Twisting-4100 — *See Vol. D*

Machines, Marking & Numbering-4100 — *See Vol. D*

Machines, Marking, Laser-4100 — *See Vol. D*

Machines, Mask Alignment & Exposure-4100 — *See Vol. D*

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Machines, Plating-4100 — *See Vol. D*

Machines, Printed Circuit Drilling, Etching & Punching-4100 — *See Vol. D*

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Magnetometers-2900 — *See Vol. D*

Magnetoresistors, Hall-4800

† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400

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Magnets (Lab. Type)-1850

† Jobmaster Corp., Randallstown, MD 21133-0207, 410-655-1400 ..... A•1285
Magnos, Hudson, MA 01749, 508-562-1173 ..... D•1291
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1298
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1337
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
The Electrodyne Company, Inc., Batavia, OH 45013 513-732-2822
Elma Engineering, Palo Alto, CA 94303 415-494-7303
§ General Hardware Mfg., New York, NY 10013 212-431-6100
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
LDJ Incorporated, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, Indianapolis, IN 46226 317-545-2102
† Magnet Sales & Mfg. Co. Inc., Culver City, CA 90230-6127 ..... 213-391-7213; 800-421-6692
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
RJF Interantional Corp., Fairlawn, OH 44333 216-668-7689
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990

Magnets, Permanent-1850

§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1706
§† Jobmaster Corp., Randallstown, MD 21133-0207, 410-655-1400 ..... A•1285
Shin-Etsu Polymer America, Inc., Union City, CA 94587, 415-475-9000 .. C•1521
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Bunting Magnetics Co., Newton, KS 67114 ..... 316-284-2020;800-835-2526
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
The Electrodyne Company, Inc., Batavia, OH 45013 513-732-2822
§ General Hardware Mfg., New York, NY 10013 212-431-6100
§ George Risk Industries, Inc., Kimball, NE 69145 308-235-4645
§ Go Switch, Louisville, KY 40233 502-969-2386
ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
§† Magnetic Technologies Corp., Rochester, NY 14625 716-385-9010
† Magnet Sales & Mfg. Co. Inc., Culver City, CA 90230-6127 ..... 213-391-7213; 800-421-6692
3M Electrical Specialities Division, Austin, TX 78726-9000 800-328-1368
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Multi Products International, West Paterson, NJ 07424 201-890-1344
Namiki, Precision of America, Inc., Rochelle Park, NJ 07662 201-368-0123
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
R-Columbia Prods. Co., Inc., Highland Park, IL 60035 708-432-7915
RJF Interantional Corp., Fairlawn, OH 44333 216-668-7689
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Stackpole, Magnet Div., Kane, PA 16735 814-837-0272
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020

Magnets, Superconducting-1850

Jobmaster Corp., Randallstown, MD 21133-0207, 410-655-1400 ..... A•1285
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1298
American Magnetics, Oak Ridge, TN 37831-2509 615-482-1056
Cryomagnetics, Inc., Oak Ridge, TN 37830 615-482-9551
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243

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Ball Corp., Efratom Division, Irvine, CA 92718-1605, 714-770-5000 ..... A•1307
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1155

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† Magnet Sales & Mfg. Co. Inc., Culver City, CA 90230-6127 ..... 213-391-7213; 800-421-6692
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100

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† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
Ei North America, New York, NY 10021 212-517-5622
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† Micron Technology, Inc., Boise, ID 83706 208-386-3900
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ NMB Technologies, Chatsworth, CA 91311 818-341-3355
† Ramtron Corp., Colo. Springs, CO 80921 ..... 719-481-7000;800-FRAM
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
TOYOCOM USA INC., Arlington Heights, IL 60005 ... 708-593-8780/1-800-TOYOCOM

Memories, RAM, Surface Mount-3130

† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§ Greenwich Instruments USA, Charlotte, NC 28205 704-376-1021
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§† Micron Technology, Inc., Boise, ID 83706 208-386-3900
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Optrex/Satori, Torrance, CA 90503 213-214-1791
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
§† Simtek Corp., Colorado Springs, CO 80920 719-531-9444
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
TOYOCOM USA INC., Arlington Heights, IL 60005 ... 708-593-8780/1-800-TOYOCOM
† White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040 .. 602-437-1520
§† Xicor, Inc., Milpitas, CA 95035 408-432-8888

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§ **Industrial Computer Designs, Inc., Westlake Village, CA 91361, 818-889-3179;800-423-3179** ..... **D•1179**
Wintek Corp., Lafayette, IN 47904-2993, 317-448-1903;800-742-6809 ..... **D•1122-1123**
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Alpha Omega Computer Systems, Corvallis, OR 97333 503-754-1911
Basicon, Inc., Portland, OR 97229 503-626-1012
§ Central Data Corp., Champaign, IL 61821 217-359-8010
Charles River Data Systems, Inc., Framingham, MA 01701 508-626-1000
Computer Dynamics Sales, Greer, SC 29650 803-877-8700
Cubit, Div. of Proteus Industries. Inc., Mountain View, CA 94041 415-962-8237
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
§ Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Davidge Corporation, Buellton, CA 93427 805-688-9598
§ GENROCO, Inc., Slinger, WI 53086-9407 414-644-8700
† Hancock Electronics Corp., Hingham, MA 02043 617-740-4190
Industrial Computer Source, San Diego, CA 92111 619-279-0084
Ironics Incorporated, Ithaca, NY 14850 607-277-4060
JF Microsystems, Pasco, WA 99301-9619 ..... 509-297-4294;800-532-2737
KineticSystems, Lockport, IL 60441 815-838-0005
Matrix Corp., Raleigh, NC 27610 919-231-8000
Mesa Technology Corp., Columbia, MD 21046 800-888-0567
Microbar Systems, Inc., Sunnyvale, CA 94086 408-720-9300
Micro Industries, Westerville, OH 43081 614-895-0404
Micro/sys, Glendale, CA 91201-3010 818-244-4600
Octagon Systems, Westminster, CO 80030 303-430-1500
§ Pacific Microcomputers, Signal Technology, San Diego, CA 92121 619-453-8649
Pro-Log Corp., Monterey, CA 93940 408-372-4593
QSI Corporation, Salt Lake City, UT 84115 801-466-8770
Qualogy Inc., San Jose, CA 95134 408-434-5200
Ramtron Corp., Colo. Springs, CO 80921 ..... 719-481-7000;800-FRAM
SBE, Concord, CA 94520 ..... 501-680-7722;800-347-COMM
§ Sensoray Corp., Fremont, CA 94538 415-657-7290
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk, NY 11040 ..... 516-328-0200;328-3300
Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
Truevision, Indpls., IN 46256 317-841-0332
Vector Electronic Co., Inc., Sylmar, CA 91342 ..... 818-365-9661;800-423-5659;800-426-4652
Zendex Corp., Dublin, CA 94568 415-828-3000
Ziatech, San Luis Obispo, CA 93401 805-541-0488

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† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1369**
† **Micronics Technology Inc., Glen Cove, NY 11542, 516-759-5600** ..... **A•1399**
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... **A•1699,1822**
Oxley Inc., Branford, CT 06405, 203-488-1033 ..... **A•1705**
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AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§ Compact Software, Inc., Paterson, NJ 07504 201-881-1200
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-921-2726
§ Electro Rent Corp., Van Nuys, CA 91411 818-787-2100
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
Kaman Instrumentation, Colo Springs, CO 80907 1-719-599-1892
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Litton Solid State, Litton Systems, Inc., Milpitas, CA 95035 408-433-0933
† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
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§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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ESE, El Segundo, CA 90245, 213-322-2136 ..... **D•1135**
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† Aydin Corp., Horsham, PA 19044 215-657-7510
† DEI, Escondido, CA 92029 619-743-8344
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92123 619-278-4100
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK

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† **Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774** ..... **A•1747**
† **Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181** ..... **A•1751**
† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1753**
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§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ..... 617-275-0850; 800-937-4688
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Eastern Microwave, Burlington, MA 01803 617-273-4700

† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
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† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
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† Locus, Inc., State College, PA 16804 814-466-6275
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§ Micro-Now Instr. Co., Inc., Skokie, IL 60076 708-677-4700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§† Pearl Technology, Carson City, NV 89701 702-883-1979
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
TRM, Inc., Manchester, NH 03103 603-627-6000
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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† Eicom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181 ..... A•1751
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
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§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
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† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Locus, Inc., State College, PA 16804 814-466-6275
MACOM, Inc., Burlington, MA 01803 617-272-3000
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microphase, Norwalk, CT 06856 203-866-8000
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Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
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† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
† Wenzel Associates, Inc., Austin, TX 78728 512-244-7741
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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Modulators, Microwave-3450

Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133 ..... D•2240
E.P.D./General Power Corp., Anaheim, CA 92805-8508, 714-520-0881;1-800-343-1813 ..... D•1069
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
Universal Voltronics Corp, Thermedics Inc./ThermoElctron Corp., Mt. Kisco, NY 10549, 914-241-1300 ..... D•2132-2133
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
Cober Electronics, Stamford, CT 06902 203-327-0003
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
EPD Electronics, Inc., Gardena, CA 90247 213-515-4996
† ETM Electromatic Inc, Newark, CA 94560 415-797-1100
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
HDS Inc., Reston, VA 22091 703-620-6200
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† Microphase, Norwalk, CT 06856 203-866-8000
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Rantec Microwave & Electronics, Esco Electronics, Chatsworth, CA 91311 818-885-8223
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
Sivers IMA AB, Culver City, CA 90230 213-306-4248
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Wavetek Microwave, Inc., (Formerly Pacific Measurement, Inc.), Sunnyvale, CA 94089 408-734-5780

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Modulators, Pulse-3450

† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Brandt Electronics, Inc., Mountain View, CA 94043 415-967-4944
Cober Electronics, Stamford, CT 06902 203-327-0003
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† ETM Electromatic Inc, Newark, CA 94560 415-797-1100
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Instrument Research Co., Santa Barbara, CA 93103 805-962-8336
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
Phase Control Electronics, Glendale, NY 11385 718-441-4278
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
RE Instruments Corp., Westlake, OH 44145 216-871-7617
§† Silicon General, Garden Grove, CA 92641 714-898-8121
Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
ST Research Corporation, Newington, VA 22122 703-550-7000
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Unitrode Corp., Watertown, MA 02172 617-926-0404
Universal Voltronics Corp, Thermedics Inc./ThermoElctron Corp., Mt. Kisco, NY 10549 914-241-1300
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
Verdure Industries Inc., Omaha, NE 68124 402-691-8300
Wavetek Microwave, Inc., (Formerly Pacific Measurement, Inc.), Sunnyvale, CA 94089 408-734-5780
Wavetek San Diego, Inc. , Wavetek Corp., San Diego, CA 92123 619-279-2200

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† **Analog Modules, Inc., Longwood, FL 32750, 407-339-4355** ..... **D•1004**
E.P.D./General Power Corp., Anaheim, CA 92805-8508, 714-520-0881;1-800-343-1813 ..... **D•1069**
Instruments for Industry, Inc., Ronkonkoma, NY 11779, 516-467-8400 ... **D•1012**
Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998, 213-828-7496 ..... **B•1225**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1753**
Plitron, Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... **A•2368-2369**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... **D•1375**
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
† American Microwave Technology, Inc., Brea, CA 92621 714-993-0802
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Avens Corp., Brooklyn, NY 11208 ..... 718-827-5991;800-452-1966
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† CELCO, Mahwah, NJ 07430 201-327-1123
Compact Power Company, Yorba Linda, CA 92686 714-996-5826
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
DEVAR, Inc., Bridgeport, CT 06605 203-368-6751
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† Inland Motor, Kollmorgen Corp., Sierra Vista, AZ 85635 602-459-1150
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
† Modular Devices, Shirley, NY 11967 516-345-3100
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Precision Filters, Ithaca, NY 14850 607-277-3550
§ Tennelec/Nucleus Inc., Oak Ridge, TN 37830 615-483-8405
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057

Modules, Analog Multiplier-3130

† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100** ..... **D•1196**
Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
§ DEVAR, Inc., Bridgeport, CT 06605 203-368-6751
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950

Modules, Analog-to-Digital Conversion-3130

Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880, 508-977-3000 ..... **D•1148**
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300** .... **D•1150**
† **Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000** ..... **D•1158-1160**
§ **Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000** ..... **D•1171-1173**
† **Hopper Electronics, Phoenix, AZ 85021, 602-870-3093** ..... **D•1175**
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600** ..... **D•1177**
§ **Industrial Computer Designs, Inc., Westlake Village, CA 91361, 818-889-3179;800-423-3179** ..... **D•1179**
† **International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111** .... **A•1731**
§ **Keithley MetraByte, Taunton, MA 02780, 508-880-3000** ..... **D•1184**
§† **Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998, 213-828-7496** ..... **B•1225**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... **D•1375**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100** ..... **D•1196**
Weidmuller Inc., Richmond, VA 23236, 804-794-2877 ..... **C•1579**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... **D•1395**
§ Action Instruments, San Diego, CA 92123 619-279-5726
† Addacon Greensboro, Greensboro, NC 27407 919-852-6200
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† Computer Products, Inc., Measurement & Control Div., Pompano Beach, FL 33069 305-974-5500
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
DGH Corporation, Manchester, NH 03108 603-622-0452
Digital Equip., Marlborough, MA 01752
† Dymec Inc., Winchester, MA 01890 617-729-7870
Electronic Innovations Corp., Englewood, CO 80110 303-789-0424
§ Encoder Products, Sandpoint, ID 83864 208-263-6541
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658 414-921-7100
Greenspring Computers, Inc., Menlo Park, CA 94025 415-327-1200
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
§ Interloop, San Jose, CA 95131 408-922-0520
KineticSystems, Lockport, IL 60441 815-838-0005
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
Micro Industries, Westerville, OH 43081 614-895-0404
† Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
§ National Instruments Corp., Austin, TX 78730-5039 512-794-0100
§ Opto 22, Huntington Bch., CA 92649 714-891-5861
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§† Phoenix Data, Inc., Phoenix, AZ 85017 ..... 602-278-8528;800-828-4327
Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
§ Sensoray Corp., Fremont, CA 94538 415-657-7290
Serial Lab Prods., Inc., Marlboro, MA 01752 617-481-1684
Taurus Computer Products, DY-4 Systems Inc., Nepean, Ont., CANADA K2H 9J4 613-596-9911
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§ Tennelec/Nucleus Inc., Oak Ridge, TN 37830 615-483-8405
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800
§ Veeder-Root, Simsbury, CT 06070-2003 203-651-2700
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 916-783-7878

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Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... **D•1375**

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Modules, Delay Line-2350

† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660** ..... **A•1495,1497-1498**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ... **A•1540-1541,1546**
† **Technitrol, Philadelphia, PA 19134, 215-426-9105** ..... **A•1598-1603**
§† **Valor Electronics, San Diego, CA 92121-2245, 619-458-1471** ..... **A•1606-1607**
† Anders, Inc., Simsbury, CT 06070 203-658-7666
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§ Zitel Corporation, Milpitas, CA 95035 ..... 408-946-9600;800-622-5020

Modules, Digital-to-Analog Conversion-3130

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300** ..... **D•1150-1151**
† **Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000** ..... **D•1160**
§ **Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000** ..... **D•1171-1173**
† **Hopper Electronics, Phoenix, AZ 85021, 602-870-3093** ..... **D•1175**
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600** ..... **D•1177**
§ **Industrial Computer Designs, Inc., Westlake Village, CA 91361, 818-889-3179;800-423-3179** ..... **D•1179**
† **Interface Engineering Inc., Holbrook, MA 02343, 617-986-2600** ..... **D•1182**
§ **Keithley MetraByte, Taunton, MA 02780, 508-880-3000** ..... **D•1184**
§ **National Instruments Corp., Austin, TX 78730-5039, 512-794-0100** ..... **D•1124**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... **D•1375**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100** ..... **D•1196**
Weidmuller Inc., Richmond, VA 23236, 804-794-2877 ..... **C•1579**
§ Action Instruments, San Diego, CA 92123 619-279-5726
† Addacon Greensboro, Greensboro, NC 27407 919-852-6200
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
C & C Technology Inc., West Chicago, IL 60185 708-231-0015
Compu-Mech Inc., Toledo, OH 43607 419-535-6702
† Computer Products, Inc., Measurement & Control Div., Pompano Beach, FL 33069 305-974-5500
§ Covid, Inc., Tempe, AZ 85281 602-966-2221
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Digital Equip., Marlborough, MA 01752
DSP Technology, Fremont, CA 94538-7338 415-657-7555
§ duTec, Inc., Jackson, MI 49204-0964 800-248-1632
Electronic Innovations Corp., Englewood, CO 80110 303-789-0424
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
§ International Technologies, Inc., Warwick, RI 02888 401-781-5595
KineticSystems, Lockport, IL 60441 815-838-0005
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998 213-828-7496
† Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
§ Opto 22, Huntington Bch., CA 92649 714-891-5861
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§† Phoenix Data, Inc., Phoenix, AZ 85017 ..... 602-278-8528;800-828-4327
Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
R. C. Electronics Inc., Goleta, CA 93116 805-685-7770
Serial Lab Prods., Inc., Marlboro, MA 01752 617-481-1684
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800

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† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300** ..... **D•1150-1151**
† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510** ..... **D•1152-1155, 1157**
F-P Electronics, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... **B•1075-1077**
† **Interface Engineering Inc., Holbrook, MA 02343, 617-986-2600** ..... **D•1182**
§ **Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217** ..... **B•1817**
§ **Xico, Inc., Chatsworth, CA 91311, 818-709-4403** ..... **D•1118**
Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
† Anders, Inc., Simsbury, CT 06070 203-658-7666
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658 414-921-7100
† GRIM Corporation, Medford, NJ 08055-0968 609-267-7950
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100
Vetra Systems Corp., Plainview, NY 11803 516-454-6469

Modules, Filter-3130

Avens Corp., Brooklyn, NY 11208, 718-827-5991;800-452-1966 ..... **A•1659**
§ **Corcom, Inc., Libertyville, IL 60048, 708-680-7400** ..... **C•1330**
Delta Products Corporation, Fremont, CA 94538, 415-770-0660 ..... **A•1612-1613**
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... **B•1806**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1671**
Genisco Electronics Corporation, San Diego, CA 92173, 619-661-5100 ..... **A•1624**
§ **Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246** ..... **B•1367**
† **Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600** ..... **A•1678-1679**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... **A•1684**
† **Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710, 813-347-2181** ..... **A•1751**
Merway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... **D•2212**
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... **A•1383**
§ **Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722** ..... **A•1629**
§ **Schaffner EMC, Inc. Components Division, Union, NJ 07083, 908-851-0664;800-367-5566** ..... **A•1634-1637**
† Anders, Inc., Simsbury, CT 06070 203-658-7666
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
Aptek Technologies, Inc., Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
Cambridge Filter Corp., Syracuse, NY 13221-4906 315-457-1000
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Hopkins Engrg., San Fernando, CA 91342 818-361-8691
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701 717-326-1770
† Marconi Circuit Technology Corp., Farmingdale, NY 11735 516-293-8636
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
Precision Filters, Ithaca, NY 14850 607-277-3550
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Modules, I/O Relay-3130

§ **Altech Corp., Somerville, NJ 08876, 908-707-8484** ..... **C•1166,1170**
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... **B•1422**
§ **Crydom Company, Lakewood, CA 90711-3699, 213-865-3536** ..... **A•2086-2092, B•1450-1455**
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... **D•1240**
§ **Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000** ..... **B•1488, D•1170-1173**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040** ..... **B•1490-1491**
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 ..... **B•1541**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000** ..... **B•1565**
§ **Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390** ..... **B•1582**
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... **B•1608**
§ **WECO Electrical Connectors, Inc., Moorers, NY 12958, 518-298-4810** ..... **C•1568**
§ **WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4, 514-694-9136** ..... **C•1568**
Weidmuller Inc., Richmond, VA 23236, 804-794-2877 ..... **C•1579**
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Brentek International, Inc., Hallam, PA 17406 717-755-8000
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ duTec, Inc., Jackson, MI 49204-0964 800-248-1632
EI & S, Prime Technology Inc., North Branford, CT 06471 203-481-5721
§# Encoder Products, Sandpoint, ID 83864 208-263-8541
§ Entrelec Div/GEC Alsthom International, Inc., Irving, TX 75038 214-550-9025
§ Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
§ Global Components & Controls, Eatontown, NJ 07724 201-389-1470
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
§ International Technologies, Inc., Warwick, RI 02888 401-781-5595
† Jennings, San Jose, CA 95122-2696 408-292-4025
KineticSystems, Lockport, IL 60441 815-838-0005
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
Micro Industries, Westerville, OH 43081 614-895-0404
§ National Instruments Corp., Austin, TX 78730-5039 512-794-0100
§ Opto 22, Huntington Bch., CA 92649 714-891-5861
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
§ T-Bar Data Switch Corp., Shelton, CT 06484 203-926-1801
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077

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Advanced Electronic Packaging, Huntington Beach, CA 92646, 714-969-1150 ..... **A•1719**
§† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ..... **A•1540-1541**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... **D•1159**
Elgenco, Inc., Hurricane, UT 84737, 801-635-4954 ..... **D•1244**
§ **Gordos, A Flint Industries Company, Rogers, AR 72756, 501-636-5000** ..... **D•1171,1173**
§ **Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217** ..... **B•1817**
† **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691** ..... **A•2118**
Weidmuller Inc., Richmond, VA 23236, 804-794-2877 ..... **C•1579**
† Assembly Specialists, Chelmsford, MA 01824 508-250-5900
Astrosystems, Lake Success, NY 11042 516-328-1600
Digital Equip., Marlborough, MA 01752
Dynage/Controls, Inc., Canistota, SD 57012 605-296-3487
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
† Logic Technology, Inc., Mtn. View, CA 94043 415-967-1007
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
Micro Industries, Westerville, OH 43081 614-895-0404
Micro/sys, Glendale, CA 91201-3010 818-244-4600
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
§† Superior Electric, Bristol, CT 06010 203-582-9561
Transicoil Inc., Penn Airborne Products, Southampton, PA 18966 215-355-3400
Vetra Systems Corp., Plainview, NY 11803 516-454-6469

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Advanced Electronic Packaging, Huntington Beach, CA 92646, 714-969-1150 ..... **A•1719**
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211

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Advanced Electronic Packaging, Huntington Beach, CA 92646, 714-969-1150 ..... **A•1719**
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
Micro Electronic Technologies, Hopkinoon, MA 01748 508-435-9057
Micro Industries, Westerville, OH 43081 614-895-0404
§ PTS Corporation, Bloomington, IN 47401 812-824-9331
Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960

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California Instruments Corp., San Diego, CA 92111-1216, 619-279-8620;800-356-2244 ..... **D•2181**
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300** ..... **D•1150**
Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... **A•1325-1326**
§ **Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874** ..... **A•1352-1355**
† **FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341** ..... **A•1371**
† **International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111** ..... **A•1731**
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... **A•1384**
† **TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411** ..... **A•1830**
† **Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433** ..... **A•1484-1489**
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Champion Technologies, Inc., Franklin Park, IL 60131 708-451-1000
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
† Modular Devices, Shirley, NY 11967 516-345-3100
Richard-Lee Co., Cranford, NJ 07016 201-276-0710

† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Z Communications, Inc., Ft. Lauderdale, FL 33309 305-735-1000

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Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1618
§ Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... A•1611, C•1331
§† Delta Products Corporation, Fremont, CA 94538, 415-770-0660 ..... A•1612-1613, C•1346
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1614-1615,1617
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ..... A•1620
§ Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... C•1386
§† JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1627
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2212-2213
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ..... C•1484,1486-1487
§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... A•1628-1629, C•1503
§ Schaffner EMC, Inc. Components Division, Union, NJ 07083, 908-851-0664;800-367-5566 ..... A•1634-1637
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ... A•1638-1639, C•1518-1519
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... A•1646-1647
Curtis Industries, Milwaukee, WI 53219-0910 414-649-4200
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 708-439-2800

Modules, RMS-to-DC Conversion-3130

Abbott Electronics, Los Angeles, CA 90034, 213-202-8820 ..... D•1523
Abbott Technologies, Inc. Power Supplies Division, Sun Valley, CA 91352, 818-504-0644,1-800-367-8200,818-841-3630 ..... D•1511
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Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352 ... 818-504-0644; 1-800-367-8200;818-841-3630
Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 708-439-2800

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Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1159
† Hopper Electronics, Phoenix, AZ 85021, 602-870-3093 ..... D•1175
† ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ..... D•1177
Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... D•1192
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1375
Advanced Analog, Intech, Santa Clara, CA 95050 408-988-2702
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
KineticSystems, Lockport, IL 60441 815-838-0005
R. C. Electronics Inc., Goleta, CA 93116 805-685-7770
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

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§ Bivar, Inc., Irvine, CA 92718, 714-951-8808 ..... C•1015
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1380-1381
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1473
§† Atlee Inc., North Andover, MA 01845 508-681-1003
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200

§ Methode Electronics, Inc., Interconnect Prods Div, Rolling Meadows, IL 60008 708-392-3500
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
† Milross Controls, Inc., Southampton, PA 18966 215-355-0200
Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4510
† Premier Microwave, Port Chester, NY 10573 914-939-8900
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428

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Andrew Corp., Orland Pk., IL 60462 800-255-1479
Gabriel Electronics, Scarborough, ME 04074 207-883-5161
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micro-Mounting Devices, Campbell, CA 95008 408-866-4626
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, Port Chester, NY 10573 914-939-8900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428

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† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1368
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827, D•1077
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1831
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Ajax Magnethermic Corp., Warren, OH 44482 216-372-8511
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
§ Dallas Semiconductor, Dallas, TX 75067 214-450-0400
Dowty Avionics, Arcadia, CA 91006 818-445-5955
Dowty Control Technologies, Boonton, NJ 07005-0239 201-334-3100
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micronics Technology Inc., Glen Cove, NY 11542 516-759-5600
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076 708-677-4700
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
§ Reliance Comm/Tec, Reliance Electric, Cleveland, OH 44117 800-245-4501
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
TRM, Inc., Manchester, NH 03103 603-627-6000
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
† Wenzel Associates, Inc., Austin, TX 78728 512-244-7741

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Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ..... B•1882, D•1130
Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500

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† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910
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† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986
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ACC Electronics Company, Echlin Inc., Independence, KS 67301 316-331-1000
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
† Hy-Tec Industries, Div. of Topo Industries, Inc., Shoreham, NY 11786 ... 516-924-8686
International Resistive Company, Boone, NC 28607 704-264-8861
§ Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
LTI, Inc., Carol Stream, IL 60188 708-668-8886
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Micro Technology Inc., Menomonee Falls, WI 53051 414-783-6080
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† Sipex Corp., Custom Monolithic Prods. Div., Billerica, MA 01821 508-667-8700
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730

Networks, Ladder-4700

Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1931,1933
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1696,1957
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965-1966
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 .. A•1976
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1984
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1992
† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2008
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300

† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† International Resistive Company, Boone, NC 28607 704-264-8861
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§ Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Marconi Circuit Technology Corp., Farmingdale, NY 11735 516-293-8636
Meissner Industries, Dover, NJ 07801 201-366-1700
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478 216-232-8600
§ Raltron Electronics, Miami, FL 33172 305-593-6033
Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
† Sipex Corp., Custom Monolithic Prods. Div., Billerica, MA 01821 508-667-8700
Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§ Tepro of Florida, Clearwater, FL 33575 813-796-1044
† TTE, Incorporated, W. Los Angeles, CA 90064 213-478-8224
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Networks, LC-2700

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1653
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Chesterfield Products, Inc., Elmwood Park, NJ 07407 201-797-9655
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Design Automation, Inc., Lexington, MA 02173-3992 617-862-8998
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430 914-664-2333
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
EWC, Inc., Englishtown, NJ 07726 908-446-3110
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† KR Electronics, Inc., Avenel, NJ 07001 908-636-1900
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
Philips Circuit Assemblies:A Division of North American Philips Corp., New Berlin, WI 53151 414-785-6506
† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
Rtron Corp., Skokie, IL 60076 708-679-7180
† Thinco Div., Hull Corp., Hatboro, PA 19040 215-672-7800
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† TTE, Incorporated, W. Los Angeles, CA 90064 213-478-8224
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Networks, Line Impedance Stabilization-1900 — *See Vol. D*

Networks, Matching-1900 — *See Vol. D*

Networks, Phase-2700

† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
† Frequency Selective Networks, Woodside, NY 11377, 718-424-7500 ..... A•1370
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430 914-664-2333
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
§ Tepro of Florida, Clearwater, FL 33575 813-796-1044
† TTE, Incorporated, W. Los Angeles, CA 90064 213-478-8224
† Velonex, Santa Clara, CA 95050 408-727-7370
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Networks, Pulse Forming-2700

† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1057
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1671
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... D•1257
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Artronic Instrument Co., Inc., Sidney, NY 13838 607-563-8444
† Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Electronic Precision Components Corporation, Mt. Vernon, NY 10550-4430 914-664-2333
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Phase Control Electronics, Glendale, NY 11385 718-441-4278
† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
§ Tepro of Florida, Clearwater, FL 33575 813-796-1044
† Tobe Deutschmann Labs., Inc., Canton, MA 02021 617-828-3366
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
† TTE, Incorporated, W. Los Angeles, CA 90064 213-478-8224
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Networks, Rejection — See Filters (Vol. A)

Networks, RC-2000 — *See Vol. D*

Networks, Resistance-4700

Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3714 ..... A•1847
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•1848-1849
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
§ CTS Corp., Resistor Network business unit, (Formerly CTS Corp., Berne Div.), Berne, IN 46711, 219-589-3111 ..... A•1884
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910-1911
Elliott/Jordan, A Company of Vishay, Grand Junction, CO 81502, 619-690-2401 ..... A•1914-1915
† General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1913
International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1922
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ..... A•1731
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1926
† Julie Research Labs., New York, NY 10001, 212-633-6625 .. A•1929, D•1271-1272
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1846
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1933
§ Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1947
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1696,1957
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965-1966
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1027
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 .. A•1976
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1984
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102, 508-339-8900 ..... A•1138
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1992-1993
U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... B•1871
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2006-2008
ACC Electronics Company, Echlin Inc., Independence, KS 67301 316-331-1000
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§† CTS Corporation, Elkhart, IN 46514 219-293-7511

CTS Corporation, Microelectronics business unit, W. Lafayette, IN 47906 317-463-2565
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
† Hy-Tec Industries, Div. of Topo Industries, Inc., Shoreham, NY 11786 ... 516-924-8686
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components. Inc., Boca Raton, FL 33431 305-771-7000
§ K & M Electronics, W. Springfield, MA 01089 413-781-1350
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Keystone Carbon, Thermistor Div., St. Marys, PA 15857 814-781-1591
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
LTI, Inc., Carol Stream, IL 60188 708-668-8886
† Marconi Circuit Technology Corp., Farmingdale, NY 11735 516-293-8636
Meissner Industries, Dover, NJ 07801 201-366-1700
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Micro Technology Inc., Menomonee Falls, WI 53051 414-783-6080
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
† Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
§ Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Peca, Inc., Bensalem, PA 19020 215-245-1550
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Raltron Electronics, Miami, FL 33172 305-593-6033
RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Sangamo Components Division, Pickens, SC 29671 803-878-6311
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§ Tepro of Florida, Clearwater, FL 33575 813-796-1044
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043

Networks, Resistance, Trimmer-4700

Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1841
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 .. A•1976
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Electro-Films, Inc., Warwick, RI 02886 401-738-9150
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
§ Nepenthe, Inc., Palo Alto, CA 94303 415-496-6666
Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Raltron Electronics, Miami, FL 33172 305-593-6033
§ Tepro of Florida, Clearwater, FL 33575 813-796-1044

Networks, Resistance, Voltage Divider-4700

§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
Bertan Assocs., Hicksville, NY 11801, 516-433-3110 ..... D•1631
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889, 908-534-9007 ..... D•1762-1763
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... D•1257
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258-1262
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 .. A•1986,1991
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Micro Technology Inc., Menomonee Falls, WI 53051 414-783-6080
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§ Tepro of Florida, Clearwater, FL 33575 813-796-1044
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043

Networks, Video-2700

Alpha Components, Mechanicsburg, PA 17055 717-697-8595
§ Artel Communications Corp., Hudson, MA 01749 508-562-2100

Networks, (MIL), Resistance-2440 — *See Vol. B*

Noise Sources-2900 — *See Vol. D*

Nuclear EMP (NEMP) Protectors-4300 — *See Vol. B*

Nuclear Penetrations-2900 — *See Vol. D*

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Optical Breadboards-4200 — *See Vol. C*

Optical Character Readers (OCR)-2000 — *See Vol. D*

Optical Component Mounts & Accessories-3700 — *See Vol. B*

Optical-Coupler Isolators — See Isolators, Opto (Vol. B)

Optical Design Service — See Services, Optical Design (Vol. D)

Optical Disk Drives-2000 — *See Vol. D*

Optical Radiation Measuring-2900 — *See Vol. D*

Optical Signal Sources — See Generators, Light Pulse (Vol. D)

Optical Time Domain Reflectometer (OTDR)-2900 — *See Vol. D*

Optocouplers-3700 — *See Vol. B*

Optocouplers, Surface Mount-3700 — *See Vol. B*

Oscillators, Audio (Module)-2300

† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1324-1326
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1674
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ..... D•2207
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1384
Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1403
§ Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566 ..... D•1014
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1444
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ..... 708-932-9380;800-468-6009
Φ Genstar Rental Electronics, Inc., Woodland Hills, CA 91367 ..... 800-331-3440 (in CA); 800-227-8409
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ McCurdy Radio Industries Limited, Toronto, Ont., CAN M4A 2L4 416-751-6262
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
† Modular Devices, Shirley, NY 11967 516-345-3100
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
Oscillatek, A Dover Technology Company, Olathe, KS 66062 913-829-1777
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854 908-572-9512
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Vectron Laboratories, Inc., Norwalk, CT 06850 203-853-4433

Oscillators, Audio (Test) — See Generators, Audio (Vol. D)

Oscillators, Beat Frequency (BFO)-2300

† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1368
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
† Q-Tech Corp., Culver City, CA 90232-3510 213-836-7900

Oscillators, Bias-2300

† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1325-1326
§ Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566 ..... D•1014
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

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Oscillators, Cavity-2300

§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134 708-232-9611
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
MACOM, Inc., Burlington, MA 01803 617-272-3000

† M/A COM Ltd, Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
§ Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Oscillators, Clock-2300

† **Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1305**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1499
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1312**
§ **Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935 ..... A•1318-1320**
§ **Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1321**
§ **Comclok, Inc., Anaheim, CA 92801, 714-991-1580;800-333-9825;213-836-9592(Tech. Asst.) ..... A•1323**
† **Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1325-1326**
§† **CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1334-1345,1348-1351**
§ **Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1352-1355**
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1358,1360-1361
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1365-1366**
† **FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1371**
§† **Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1372-1373**
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825 .. A•1379**
† **McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1384**
§† **MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1388-1389**
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1395-1397
§† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1402-1404,1406**
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1409**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1412,1414**
§ **NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1416-1417**
§† **NEL Frequency Controls, Inc., Burlington, WI 53105, 414-763-3591 ..... A•1425**
† **Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ..... A•1426**
§ **Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... A•1437,1440-1443**
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† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1449**
§# **R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0012;800-228-8108 ..... A•1452-1454**
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§ **Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... A•1461**
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ..... A•1462-1465,1467
§† **Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1469**
§† **Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1471**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1473-1476
† **Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1484-1485**
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Cal Crystal Lab., inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
CTS Corporation, Elkhart, IN 46514 219-293-7511
§† Data Delay Devices, Clifton, NJ 07013-1915 201-773-2299
Dymec Inc., Winchester, MA 01890 617-729-7870
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
Frequency Control Products, Inc., American Time Products Div., Deer Pk, NY 11729 516-243-5730
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
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§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
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§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
Mouser Electronics, Mansfield, TX 76063 800-346-6873
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
† TH Electronics, Orem, UT 84058 801-226-1383
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
§ West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;213-495-5569

Oscillators, Crystal Controlled (Module)-2300

§† **Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 .... A•1304-1305**
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1309,1312**
§ **Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1321**
§ **Comclok, Inc., Anaheim, CA 92801, 714-991-1580;800-333-9825;213-836-9592(Tech. Asst.) ..... A•1323**
† **Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1325-1326**
† **CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1334-1335,1338,1342-1344,1346-1348**
§ **Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1352,1354-1355**
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2192
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1359-1361
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1365-1366**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1368-1369**
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1371
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375
† **Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1376-1377**
§† **KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825 .. A•1379**
† **McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1384-1387**
§† **MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1388-1393**
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1395-1398
† **Microsonics, Inc., Weymouth, MA 02188, 617-337-4200 ..... A•1401**
† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1402-1403**
§ **M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1409**
§† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1410-1414**
NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1416-1421,1423
§ **NEL Frequency Controls, Inc., Burlington, WI 53105, 414-763-3591 ..... A•1425**
† **Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ..... A•1426-1427**
† **Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901, 804-977-8050 ..... A•1432**
§ **Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ... A•1437,1440-1441,1443**
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† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1449-1450**
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† **Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ..... A•1462-1465,1467**
§† **Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1471**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1472-1476,1479-1480
† **TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1830**
† **Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1484-1486, 1489**
† **Xsis Electronics, Inc., Shawnee, KS 66216, 913-631-0448 ..... A•1491**
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
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Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
† California Instruments Corp., San Diego, CA 92111-1216 .. 619-279-8620;800-356-2244
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
Dymec Inc., Winchester, MA 01890 617-729-7870
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
† Frequency Control Products, Inc., American Time Products Div., Deer Pk, NY 11729 516-243-5730
§† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ..... 708-932-9380;800-468-6009
§† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
§† Hi-Q Crystals, Hybrids international Ltd., Olathe, KS 66062 913-764-4544
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
International Crystal Mfg., Oklahoma City, OK 73126 ... 504-236-3741; 1-800-426-9825
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§ Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
MACOM, Inc., Burlington, MA 01803 617-272-3000
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Sensor Corp., Scottdale, PA 15683 412-887-4080
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Spectrum Control, Inc., Erie, PA 16505 814-455-0966
Standard Crystal Corporation, El Monte, CA 91731 818-443-2121
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211

† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
† Wenzel Associates, Inc., Austin, TX 78728 512-244-7741

Oscillators, Decade (Test)-2900 — *See Vol. D*

Oscillators, Digitally Compensated Crystal (DCXO)-2300

Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 .... A•1304-1305
† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1310
Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1327
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1346,1349-1351
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1386-1387
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1388-1389,1391-1393
Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ..... A•1426-1427,1430
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1472,1479
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1484
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
CTS Corporation, Elkhart, IN 46514 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
† Q-Tech Corp., Culver City, CA 90232-3510 213-836-7900
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§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
† Wenzel Associates, Inc., Austin, TX 78728 512-244-7741

Oscillators, LC-2300

Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1325-1326
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1484
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Isotemp Research, Inc., Charlottesville, VA 22903 804-295-3101
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Q-Tech Corp., Culver City, CA 90232-3510 213-836-7900
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† Wenzel Associates, Inc., Austin, TX 78728 512-244-7741

Oscillators, Low Frequency (Module)-2300

† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1312
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1325-1327
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1343,1349-1351
§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1365-1366
Frequency Devices, Inc., Haverhill, MA 01832, 508-374-0761 ..... A•1674
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1368-1369
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ..... D•2207
§† KDS America, Daishinku Corp., Overland Pk., KS 66211, 913-491-6825 .. A•1379
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1384
§† MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1388-1389
† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1404,1407
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1410-1413
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901, 804-977-8050 ..... A•1432
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1444,1447
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SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1458-1459
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ..... A•1462-1463,1465-1467
Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1469
§† Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1471
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1484
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
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§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
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CTS Corporation, Elkhart, IN 46514 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
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Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Microsonics, Inc., Weymouth, MA 02188 617-337-4200
§† M-Tron Industries, Yankton, SD 57078 605-665-9321
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† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
† Oscillatek, A Dover Technology Company, Olathe, KS 66062 913-829-1777
† Pacific Power Source Corp., Huntington Bch., CA 92649 .. 714-898-2691;800-854-2433
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§ Richard-Lee Co., Cranford, NJ 07016 201-276-0710
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Oscillators, Microwave-3450

† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
† Micronics Technology Inc., Glen Cove, NY 11542, 516-759-5600 ..... A•1399
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1109,1413,1820
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1822
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1830
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1486
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
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† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
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EVI, Inc., Columbia, MD 21046 301-290-9550
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
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† Loral Microwave-Narda West, San Jose, CA 95112-4210 408-436-4400
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† Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
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† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
§ Marconi Instruments, Allendale, NJ 07401 201-934-9050
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
MF Elctrns. Corp., New Rochelle, NY 10801 914-576-6570
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Q-Tech Corp., Culver City, CA 90232-3510 213-836-7900
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
† Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Sivers IMA AB, Culver City, CA 90230 213-306-4248
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§ Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
† Z Communications, Inc., Ft. Lauderdale, FL 33309 305-735-1000

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† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1309
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1325-1327
† CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1330,1335,1344,1346,1349-1351

FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1371
Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1376-1377
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1385,1387
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1411-1413
§ NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1416
Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ..... A•1426-1427
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1449-1450
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ..... A•1464
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1460
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1486-1489
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
CTS Corporation, Elkhart, IN 46514 219-293-7511
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
† Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Q-Tech Corp., Culver City, CA 90232-3510 213-836-7900
§ Raltron Electronics, Miami, FL 33172 305-593-6033
Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
† Wenzel Associates, Inc., Austin, TX 78722 512-244-7741

Oscillators, Power (Module)-2300

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 ..... D•2183
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... D•1152-1153
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2192
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ..... D•2207
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1273
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1392-1393
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901, 804-977-8050 ..... A•1433
† Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2221
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1444
† American Microwave Technology, Inc., Brea, CA 92621 714-993-0802
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
Energy Systems, Vancouver, WA 98682 206-896-8310
EVI, Inc., Columbia, MD 21046 301-290-9550
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Isotemp Research, Inc., Charlottesville, VA 22903 804-295-3101
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Modular Devices, Shirley, NY 11967 516-345-3100
NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
SARONIX, Palo Alto, CA 94303 415-856-6900
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† Vectron Laboratories, Inc., Norwalk, CT 06850 203-853-4433

Oscillators, Programmable-2300

§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2192
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1358,1360-1361
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... D•1279
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ... A•1388,1391-1392
Programmed Test Sources, Littleton, MA 01460, 508-486-3008 ..... D•1312
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1445
§† Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1471
Analytic Instruments Corporation, Dallas, TX 75354 214-357-3882
§ Behlman Electronics, Inc., Ventura, CA 93003 805-642-0660
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Marconi Instruments, Allendale, NJ 07401 201-934-9050
NF Electronic Instruments, Costa Mesa, CA 92626 714-557-1684
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
† Z Communications, Inc., Ft. Lauderdale, FL 33309 305-735-1000

Oscillators, Pulse (Module)-2300

§ Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1304
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1325-1326
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1343
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2192
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1358,1361
Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1365-1366
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1371
Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1376-1377
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1388,1392
Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1402,1404
Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ..... A•1428-1429
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901, 804-977-8050 ..... A•1432-1433
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1446
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1449-1450
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ..... A•1461
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ..... A•1462-1467
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1486-1488
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Berkeley Nucleonics Corp., Richmond, CA 94804 510-234-1100
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
CTS Corporation, Elkhart, IN 46514 219-293-7511
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2300
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
§ Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
§ Richard-Lee Co., Cranford, NJ 07016 201-276-0710
SARONIX, Palo Alto, CA 94303 415-856-6900
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§† Statek Corp., Orange, CA 92668 714-639-7810
§ Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

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Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... D•1279
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901, 804-977-8050 ..... A•1433
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1484
Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548 815-786-8411
Dantel, Fresno, CA 93727 209-292-1111
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Frequency Devices, Inc., Haverhill, MA 01832 508-374-0761
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Isotemp Research, Inc., Charlottesville, VA 22903 804-295-3101
† Modular Devices, Shirley, NY 11967 516-345-3100
† Q-Tech Corp., Culver City, CA 90232-3510 213-836-7900
Tektronix, Inc., Beaverton, OR 97077 800-835-9433

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† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1312
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1324-1326
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1343-1344,1347
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1352
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 213-787-6300 ..... A•1358-1359,1361
§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1365-1366
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
Hy-Q International (USA) inc., Erlanger, KY 41018, 606-283-5000 ..... A•1375

† Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1376-1377
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ... A•1384-1385
† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1403
NEL Frequency Controls, Inc., Burlington, WI 53105, 414-763-3591 ... A•1425
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901, 804-977-8050 ... A•1432-1433
Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ... A•1437,1440,1443
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ... A•1446-1447
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ... A•1449-1451
§# R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0012;800-228-8108 ... A•1452-1454
SARONIX, Palo Alto, CA 94303, 415-856-6900 ... A•1459
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ... A•1461
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ... A•1462,1464-1465
Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ... A•1469
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ... A•1475-1476,1480
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ... A•1830
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ... A•1485
Xsis Electronics, Inc., Shawnee, KS 66216, 913-631-0448 ... A•1491
AEL Defense Corp., Lansdale, PA 19446 ... 215-822-2929
† Andersen Laboratories, Bloomfield, CT 06002 ... 203-286-9090
Anderson Electronics, Hollidaysburg, PA 16648 ... 814-695-4428
§† ANZAC, M/A-COM, Burlington, MA 01803 ... 617-273-3333
§† Avantek, Inc., Milpitas, CA 95035-7492 ... 408-432-3080
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
Blackhawk Networks Corp., Janesville, WI 53545 ... 608-752-8701
§ Champion Technologies, Inc., Franklin Park, IL 60131 ... 708-451-1000
Comstron A Div. of Aeroflex, Plainview, NY 11803 ... 516-752-2351
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 ... 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 ... 913-631-6700
Engineered Components Co., San Luis Obispo, CA 93403-8121 ... 805-544-3800
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 ... 408-732-0880
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 ... 516-243-5730
† FTS/AUSTRON, Austin, TX 78761-4766 ... 512-251-2341
§† Gorman-Redlich Mfg. Co., Athens, OH 45701 ... 614-593-3150
† Greenray Inds., Inc., Mechanicsburg, PA 17055 ... 717-766-0223
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 ... 714-759-2952
International Crystal Mfg. Co., Oklahoma City, OK 73126 ... 504-236-3741; 1-800-426-9825
KDI/Triangle Electronics, Whippany, NJ 07981 ... 201-887-5700
† Loral Microwave-Narda West, San Jose, CA 95112-4210 ... 408-436-4400
† Magnum Microwave Corp., Fremont, CA 94538 ... 415-657-9898
† MCL, Inc., Bolingbrook, IL 60440-4999 ... 708-759-9500
MF Elctrns. Corp., New Rochelle, NY 10801 ... 914-576-6570
† MITEQ Inc., Hauppauge, NY 11788 ... 516-436-7400
§ M-Tron Industries, Yankton, SD 57078 ... 605-665-9321
§† Murata Erie North America, Inc., Smyrna, GA 30080 ... 404-436-1300
† Oscillatek, A Dover Technology Company, Olathe, KS 66062 ... 913-829-1777
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ... 408-730-0300;800-PENSTOCK
† Piezo Crystal Co., Carlisle, PA 17013 ... 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 ... 407-298-2000
† Racal-Dana Instrs. Inc., Irvine, CA 92718 ... 714-859-8999
† RF Monolithics, Inc., Dallas, TX 75244 ... 214-233-2903
† Servo Corporation of America, Hicksville, NY 11802-9907 ... 516-938-9700
Sokol Crystal Products, Inc., Mineral Point, WI 53565 ... 608-987-3363
† Solid State Electronics Corp., Northridge, CA 91324 ... 818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 ... 408-748-1010
§ Syntest Corp., Marlboro, MA 01752-9973 ... 508-481-7827
§† Systron-Donner Microwave Div., Sylmar, CA 91342 ... 818-362-9900
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 ... 717-774-2746
† Teledyne Microwave, Mountain View, CA 94043 ... 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 ... 406-586-0291
§ Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 ... 317-545-4196
§ Toko America, Inc., Mt. Prospect, IL 60056 ... 708-297-0070
Trilithic, Inc., Indianapolis, IN 46236 ... 800-344-2412
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 ... 508-435-6831
† Wenzel Associates, Inc., Austin, TX 78728 ... 512-244-7741
† Z Communications, Inc., Ft. Lauderdale, FL 33309 ... 305-735-1000

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† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ... A•1309-1312
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† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ... A•1324-1327
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ... D•1152-1153
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ... A•1343,1347
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ... D•2192
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ... A•1375
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ... D•2207
Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1376-1377
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ... A•1384
† Microsonics, Inc., Weymouth, MA 02188, 617-337-4200 ... A•1401
† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1402-1403
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ... A•1412
† Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ... A•1427-1429
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901, 804-977-8050 ... A•1432
† Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ... D•2221
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ... A•1444,1446-1447
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ... A•1449-1450
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ... A•1462-1464,1466-1467
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ... A•1480
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ... A•1830
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ... A•1484-1489
Xsis Electronics, Inc., Shawnee, KS 66216, 913-631-0448 ... A•1491
† Andersen Laboratories, Bloomfield, CT 06002 ... 203-286-9090
Anderson Electronics, Hollidaysburg, PA 16648 ... 814-695-4428
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
† California Instruments Corp., San Diego, CA 92111-1216 ... 619-279-8620;800-356-2244
§ Champion Technologies, Inc., Franklin Park, IL 60131 ... 708-451-1000
† Computer Conversions Corp., E. Northport, NY 11731 ... 516-261-3300
Comstron A Div. of Aeroflex, Plainview, NY 11803 ... 516-752-2351
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 ... 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 ... 913-631-6700
Energy Systems, Vancouver, WA 98682 ... 206-896-8310
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 ... 516-243-5730
Frequency Devices, Inc., Haverhill, MA 01832 ... 508-374-0761
† Frequency Electronics, Inc., Mitchel Field, NY 11553 ... 516-794-4500
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ... 708-932-9380;800-468-6009
§† Gorman-Redlich Mfg. Co., Athens, OH 45701 ... 614-593-3150
† Greenray Inds., Inc., Mechanicsburg, PA 17055 ... 717-766-0223
Hewlett-Packard Co., Cupertino, CA 95014 ... 800-752-0900
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 ... 714-759-2952
MF Elctrns. Corp., New Rochelle, NY 10801 ... 914-576-6570
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 ... 516-345-3100
† Modular Devices, Shirley, NY 11967 ... 516-345-3100
NF Electronic Instruments, Costa Mesa, CA 92626 ... 714-557-1684
† Piezo Crystal Co., Carlisle, PA 17013 ... 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 ... 407-298-2000
† RF Monolithics, Inc., Dallas, TX 75244 ... 214-233-2903
SARONIX, Palo Alto, CA 94303 ... 415-856-6900
† Solid State Electronics Corp., Northridge, CA 91324 ... 818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 ... 408-748-1010
Statek Corp., Orange, CA 92668 ... 714-639-7810
Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 ... 717-774-2746
§† Thaler Corp., Tucson, AZ 85737 ... 602-742-5572
§ Toko America, Inc., Mt. Prospect, IL 60056 ... 708-297-0070
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 ... 508-435-6831
† Wenzel Associates, Inc., Austin, TX 78728 ... 512-244-7741

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§ Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 ... A•1304
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† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ... A•1310,1312
§ Comclok, Inc., Anaheim, CA 92801, 714-991-1580;800-333-9825;213-836-9592(Tech. Asst.) ... A•1323
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ... A•1324-1327
§ CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ... A•1334-1338,1343
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FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ... A•1371
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§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ... D•2207
Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1376-1377
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ... A•1384
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§† M-Tron Industries, Yankton, SD 57078, 605-665-9321 ... A•1409
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† Oscillatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777 ... A•1427
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† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ... A•1444,1446
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ... A•1449-1451
§# R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0012;800-228-8108 ... A•1452-1454
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 213-517-7770 ... A•1461

† Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ..... A•1462-1467
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1464-1465, 1436
† Jauch Electronics, Inc., Shawnee, KS 66216, 913-631-6446 ..... A•1491
† Kuhnke Co. Ltd., A DSC Company, Miami, FL 33172 305-477-6615
§ CTS Corp., Frequency Control Products, Knights, IN 47250 812-882-2600
Kinetic Technologies Corp., Richmond, CA 94804 510-234-1100
Rockwell Avionics Corp., Janesville, WI 53545 608-752-8701
Old Crystal Lab, Inc., Annville, CA 93501 ..... 1-(800)-(661)-800-243-9825
† Saunino Instruments Corp., San Diego, CA 92111-1247 ..... (619)279-0700/800-858-2444
§ Cirkuits Technologies, Inc., Franklin Park, IL 60131 708-451-1000
Corporation A Div. of Kinetics, Pennsauken, NJ 08109 609-786-2881
§ CTI, Corporation, Bethel, NJ 43214 216-593-7511
§ ESI, Inc. a Frequency Products Inc. ESI & B Div., Cincinnati, OH 45202 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
† Engineered Components Co., San Luis Obispo, CA 93401-7411 805-544-3300
Frequency Control Products, Inc., American Time Products Div., Deer Pk, NY 11729 516-243-5730
† Hi-Q Div., Piezonics, Inc., Mineral Point, WI 53565 608-987-2261
† Hybrid Electronics, Inc., Fremont, CA 94538 415-657-9898
† Hewlett-Packard Co., Corporate, CA 95014 ..... 408-725-0700/800-538-8696
† Integrated Circuit Systems, Inc., Broadman Park, CA 94941 ..... 415-691-9640 (in CA); 800-227-8400
† Micrel Inc., Semiconductor, Cupertino, CA 95014 408-996-6000
† Monolithic Crystal, Inc., Hermosa Beach, CA 90254 213-376-8941
† Motorola Inc., Semiconductor Products Division, Phoenix, AZ 85036 602-244-6900
† Nihon Dempa Kogyo Co., Ltd., Tokyo, Japan 03-435-2111
† Oscilloquartz S.A., Neuchatel, Switzerland 038-24-02-24
† Pacific Instruments, Inc., Concord, CA 94520 415-687-6000
† Piezo Technology, Inc., Orlando, FL 32804 305-298-2000
† Pioneer Components, Brooklyn, NY 11234 718-444-3880
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
§ Spectrum Control, Inc., Erie, PA 16505 814-455-0966
§† Statek Corp., Orange, CA 92668 714-639-7810
§† Trader Corp., Tucson, AZ 85737 602-742-5572
† Triad Microwave Corp., Tampa, FL 33634 813-884-1411
§ Velpel-Fabrications Corp., Hopkinton, MA 01748 508-435-6831
† W Components Inc., Ft. Lauderdale, FL 33309 305-735-1500

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† Miller Electric Co., Erie, PA 16505, 814-833-3571 ..... A•1310-1311
§ Cirkuits Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1221
† Connor-Winfield Corp., Aurora, IL 60505-1235, 708-851-4722 ..... A•1321-1326
† CTS Corp., Frequency Control business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1330,1341-1343,1346-1348
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† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1369
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† Isotemp Research, Inc., Charlottesville, VA 22902, 804-295-3101 ..... A•1376
§† KDS America, Dalchinko Corp., Cleveland Hts., KS 66211, 913-491-6825 .. A•1379
† Motion Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1384,1387
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† Rakon Limited, Wellington, NZ 64-4, 617-567-1600 ..... A•1401
§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-630-4578 ..... A•1402-1404,1406-1407
§† Quartz Tek North America, Inc., Torrance, CA 90505, 800-423-1300 .. A•1410-1413
† NDK America, Inc., Fremont, CA 94538, 415-623-2350 ..... A•1416, 1419
† Corelation, A Division of Frequency Electronics, Clinton, KS 66023, 913-539-1777 ..... A•1426-1429
† Precision Monolithics, Inc., Santa Clara, CA 95054, 408-727-9222 ..... A•1430-1433
† Quartz Engineering, Inc., Colorado Springs, CO 80903-4110, 719-635-7589 ..... A•1434
† Electronic Industries Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1449,1451
§† P X D Inc., Bain Communications, Norfolk, NE 68701, 402-379-0612;800-228-2108 ..... A•1452-1454
Asahi Communications U.S.A., Inc., Electronic Components, Torrance, CA 90505, 213-517-7775 ..... A•1461
† Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ..... A•1462-1464,1466-1467
† Hewlett-Packard Co., Corporate Headquarters, CA 95014, 408-725-0700/800-538-8696 ..... A•1479-1480
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1436-1468
† Corelation, A Div. of Kinetics, Plainview, NY 11803 516-752-2351
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† ESI & B Frequency Products Inc, ESI & B Div., Cincinnati, OH 45202 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
† Frequency Control Products, Inc., American Time Products Div., Deer Pk, NY 11729 516-243-5730
Frequency Devices, Inc., Ravenna, MI 49451 616-853-3232
† Greenray Inc., Mechanicsburg, PA 17055 717-766-0223
† Hybrid Electronics, Inc., Fremont, CA 94538 415-657-9898
† M-Tron Industries, Inc., Yankton, SD 57078 605-665-9321
† Monolithic Crystal, Inc., Hermosa Beach, CA 90254 213-376-8941
† Motorola Inc., Semiconductor Products Division, Phoenix, AZ 85036 602-244-6900
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† Oscilloquartz S.A., Neuchatel, Switzerland 038-24-02-24
† Pacific Instruments, Inc., Concord, CA 94520 415-687-6000
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† Q-Tech Corp, Culver City, CA 90232-9510 213-836-7900

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Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1464
Berkeley Nucleonics Corp., Richmond, CA 94804 510-234-1100
† Q-Tech Corp, Culver City, CA 90232-9510 213-836-7900

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§† KDS America, Dalchinko Corp., Overland Pk., KS 66211, 913-491-6825 .. A•1379
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1435 ..... A•1385-1388
Piezonics, Inc., Lynnwood, WA 98036, 206-778-1600 ..... A•1437
† Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ..... A•1464
† Frequency Control Products, Inc, American Time Products Div., Deer Pk, NY 11729 516-243-5730

NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§ SARONIX, Palo Alto, CA 94303 415-856-6900
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
§† Statek Corp., Orange, CA 92668 714-639-7810
† Z Communications, Inc., Ft. Lauderdale, FL 33309 305-735-1000

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† **Bliley Electric Co., Erie, PA 16506, 814-838-3571** ..... **A•1312**
Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... **A•1324-1327**
CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... **A•1344**
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Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... **A•1376-1377**
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§† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1412**
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Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... **A•1437,1440,1443**
† **Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900** ..... **A•1446-1447**
† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929** ..... **A•1449-1451**
SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... **A•1459**
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Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791 ..... **A•1462-1464,1466-1467**
§† **Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121** ..... **A•1469**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1476,1480**
† **TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411** ..... **A•1830**
† **Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433** ..... **A•1484-1489**
Xels Electronics, Inc., Shawnee, KS 66216, 913-631-0448 ..... **A•1491**
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Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
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† Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
MF Elctrns. Corp., New Rochelle, NY 10801 914-576-6570
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† Servo Corporation of America, Hicksville, NY 11802-9907 516-938-9700
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
Statek Corp., Orange, CA 92668 714-639-7810
§ Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
† Wenzel Associates, Inc., Austin, TX 78728 512-244-7741
† Z Communications, Inc., Ft. Lauderdale, FL 33309 305-735-1000

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† **Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433** ..... **A•1485-1487, 1489**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Compact Power Company, Yorba Linda, CA 92686 714-996-5826
Energy Systems, Vancouver, WA 98682 206-896-8310
Matec Instruments, Inc., Hopkinton, MA 01748 508-435-9039
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Statek Corp., Orange, CA 92668 714-639-7810
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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§† **Ball Corp., Efratom Division, Irvine, CA 92718-1605, 714-770-5000** ..... **A•1307**
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571** ..... **A•1311**
§ **Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000** .... **A•1321**
† **Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722** ..... **A•1324-1327**
† **CTS Corp., Frequency Controls business unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411** ..... **A•1336-1337,1341-1343,1347**
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099** ..... **A•1365-1366**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1369**
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... **A•1375**
§ **Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700** ..... **D•2207**
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§† **MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570** ..... **A•1388-1393**
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... **A•1395-1396,1398**
† **Microsonics, Inc., Weymouth, MA 02188, 617-337-4200** ..... **A•1401**
§† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510** ... **A•1402-1403**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1109,1410-1413,1820**
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† **Oscilatek, A Dover Technology Company, Olathe, KS 66062, 913-829-1777** ..... **A•1426**
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901, 804-977-8050 ..... **A•1432**
† **Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900** ..... **A•1446**
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SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... **A•1459**
† **Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111, 805-964-7791** ..... **A•1462-1464,1466**
§ **Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121** ..... **A•1469**
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Dymec Inc., Winchester, MA 01890 617-729-7870
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
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† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
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§† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
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† Wenzel Associates, Inc., Austin, TX 78728 512-244-7741

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† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
MACOM, Inc., Burlington, MA 01803 617-272-3000
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300

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Ovens, Aging, Burn In, Life Test-2570 — *See Vol. D*

Ovens, Crystal & Components-2300

† CTS Corp., Frequency Control Business Unit, (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1306,1344,1346,1347,1371

ReCoy Electronics Co., A Sub. of Oak Industries, Rt. Dolly Sydnor, PA 17045, 717-486-3471 ..... A•1385

† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-5910 ..... A•1401

§ Nihon Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ... A•1411, 1413

† Oscilloquartz-Datum Corporation, Oak Crystal Div., Charlottesville, VA 22901, 804-977-6550 ..... A•1474-1476

Spectrum Technology, Inc., DBA/DBI, International, Santa Barbara, CA 93111, 805-964-7751 ..... A•1484

† Statek, A Unit of General Signal, San Jose, CA 95113 408-998-8400

§† Casco-Solar, Pomona, NY 10970 914-354-2500

† CTS Corporation, Elkhart, IN 46514 219-293-7511

† Frequency Electronics Inc., Mineola, NY 11501 516-794-4500

† KVG Systems, Inc., Stowe Road, NY 12401 914-688-2000

The Grieve Corporation, Round Lake, IL 60073-0500 708-546-8225

International Instrumentation, Inc., Westlake Vlg, CA 91361 805-495-7673

† Isotronic Research, Inc., Charlottesville, VA 22900 804-295-3101

† Trent, Inc., Philadelphia, PA 19127 215-482-4500

Ovens, Drying (For Electronic Instruments)-4100 — *See Vol. C*

Ovens, Electric — See Furnaces, Electric (Vol. D)

Ovens, IR, for Surface Mount Devices-4500 — *See Vol. C*

Ovens, Vacuum-4100 — *See Vol. C*

Packages, Integrated Circuit-3130

§ Silver, Inc., Irvine, CA 92715, 714-951-8006 ..... C•1918

§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-8400 ..... A•1377

Hybridyne, Inc., Tucson, AZ 85743, 602-889-4801 ..... A•1723

† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-5111 .... A•1751

ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•1754

† Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762, 508-695-2000 ..... A•1783

† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1849,1851,1946-1948

Airpax-Cambridge Division, A North American Philips Co., Cambridge, MD 21613 301-228-4600

† Deltronics Corporation, S. El Monte, CA 91733 818-579-7100

ELMA Electronic Inc., Fremont, CA 94538 415-656-3400

FDK America, Inc., Fuji Electrochemical Co., Ltd, San Jose, CA 95134 ... 408-432-8331

Gennum Corporation, Linear Technology Inc., Burlington, ON, CANADA L7R 3Y3 ..... 800-269-9353;416-632-2996

HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500

Hudson Tool & Die Co., Newark, NJ 07105 201-589-1800

International Instrumentation, Inc., Westlake Vlg, CA 91361 805-495-7673

§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000

† Isotronics, Inc., New Bedford, MA 02745 508-998-2000

K-Two Industries, Palo Alto, CA 94306 408-727-0316

Kyocera America, Inc., San Diego, CA 92123 619-576-2766

§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2040

§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000

Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203

Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208

Moldtronics, Inc., Downers Grove, IL 60515 708-968-7000

National Manufacturing Co., Inc., Chatham, NJ 07928 201-635-8846

§ Nepentho, Inc., Palo Alto, CA 94303 415-496-6660

§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1159

§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300

Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020

SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000

† Stevens Products, Inc., E. Orange, NJ 07019 201-672-2140

† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730

Vector Electronic Co., Inc., Sylmar, CA 91342 ..... 818-365-9661;800-423-5659; 800-426-4652

Packaging Materials, Antistatic-1400 — *See Vol. C*

Packaging Materials, Foam & Plastic-1400 — *See Vol. C*

Packaging Panels, Integrated Circuits — See Boards, Plug-In (Vol. C)

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Paints, Finishing-1600 — *See Vol. C*

Paints, Metallic, Conductive-1600 — *See Vol. C*

Paints, Radioactive — See Coatings, Radioactive (Vol. C)

Paints, Resistive, Also See Inks for Thick Film Microcircuits — See Vol. C

Panel Equipment — See Dials (Vol. C), Connectors (Vol. C), Jacks (Vol. C), Lights, Indicator (Vol. B), etc.

Panel Marking Kits — See Kits, Marking (Vol. D)

Panels, Rack Lighted & Relay, Lighted-3400 — *See Vol. B*

Panels, Electroluminescent-0450 — *See Vol. B*

Panels, Fuse-4300 — *See Vol. B*

Panels, I/O Packaging — See Enclosures, Plugin (Vol. C)

Panels, Jack-2100 — *See Vol. C*

Panels, Meter — See Enclosures, Circuit Board, Module, & Relay Mounting (Vol. C)

Panels, Patch — See Panels, Jack (Vol. C)

Panels, Power Strip for Rack-4200 — *See Vol. C*

Panels, Relay Rack — See Enclosures, Circuit Board, Module, & Relay Mounting (Vol. C)

Panels, Touch — See Touch Panels (Vol. D)

Paper Tape Equipment, Punch-2900 — *See Vol. D*

Paper Tape Equipment, Reader-2900 — *See Vol. D*

Paper Tape Equipment, Reader/Punch-2900 — *See Vol. D*

Paper, Graphic Recording-2900 — *See Vol. D*

Paper, Thermal-2900 — *See Vol. D*

Patch Boards — See Boards, Programming (Vol. C)

PC Instruments — See Instruments, Test & Measuring, Personal Computer (Vol. D)

Peak Sense & Hold Amplifiers — See Amplifiers, Peak Sense & Hold (Vol. D)

Peltier (Thermoelectric) Heat Pumps — See Cooling/Heating Modules, Thermoelectric (Vol. B)

Perforators, Paper Tape (Electrically Powered)-4000 — *See Vol. D*

Personal Computer Instruments — See Instruments, Test & Measuring, Personal Computer (Vol. D)

Phones — See Handsets, Headsets, Headphones, Headsets, etc. (Vol. D)

Photocells & Phototubes — See Cells, Photoconductive (Vol. B)

Photodetectors, GaAs-3700 — *See Vol. B*

Photodetectors, Silicon-3700 — *See Vol. B*

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Photographic Services — See Services, Photographic (Vol. D)

Photometers — See Meters, Light (Vol. D)

Photoresistors-3700 — *See Vol. B*

Phototransistors, Surface Mount-4800

† **Centronic, Inc., The Morgan Crucible Company, Spec. Matls. & Tech Division, Newbury Park, CA 91320-1702, 805-499-5902** ..... **B•1322**
§† **Optek Technology Inc., Carrollton, TX 75006, 214-323-2200** ..... **B•1333**
§ **Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500** ..... **B•1339-1341**
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
Everlight - USA, Glendora, CA 91740 213-697-5067
Lite-On Inc., Milpitas, CA 95035 408-946-4873
Micropac Inds., Inc., Garland, TX 75040 214-272-3571
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335

Pick and Place Equipment, Automatic-4100 — ***See Vol. D***

Pick and Place Equipment, Manual-4100 — ***See Vol. D***

Pickups, Magnetic, Proximity, Torque, Vibration, etc. — See Transducers, Specific Type (Vol. B)

Pickups, Telephone (For Recording)-1300 — ***See Vol. D***

Piezoelectric Ceramics-2300

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 ..... **D•1028-1029**
EDO Corporation, Electro-Ceramic Division, Salt Lake City, UT 84115, 801-486-2115 ..... **A•1357**
International Components Corp., Melville, NY 11747, 516-293-1500 ..... **D•1039**
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091, 708-251-3600 ..... **D•1040-1041**
† **Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600** .. **B•1921**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1414, D•1045-1047**
§ **NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133** ..... **A•1699,1702,1704**
Sonicall, Inc., Signal Hill, CA 90806, 213-490-2143 ..... **D•1061**
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512 ..... **D•1062,1064**
§ **TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100** ..... **D•1065**
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... **B•1959**
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
§† KDS America, Daishinku Corp., Overland Pk, KS 66211 913-491-6825
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§ Stetco, Inc., Franklin Pk, IL 60131 708-671-4208
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020

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Pins, Cotter, Dowel, Taper, etc.-2500 — ***See Vol. C***

Pins, Electrically Conductive-2100 — ***See Vol. C***

Pins, Mechanical-2500 — ***See Vol. C***

Plastic Raw Materials, Liquids, Pellets, Powders, Resins-1600 — ***See Vol. C***

Plastics, Custom Molding — See Services, Custom Molding, Plastic (Vol. D)

Plastics, Encapsulating — See Compounds, Encapsulating, Molding, Potting (Vol. C)

Plastics Fabrication — See Services, Plastics Fabrication (Vol. D)

Plastics, Heat Shrinkable — See Caps, Forms & Tapes, Heat Shrinkable (Vol. C), Tubing, Heat Shrinkable (Vol. C)

Plated Wire Memory Systems — See Memory Systems (Vol. D)

Plates, Instructional, Name, Silk Screen — See Nameplates (Vol. B)

Plates, Multihole-2500 — ***See Vol. C***

Platforms, Thermal — See Thermal Platforms (Vol. D)

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Plotters/Hard-Copy Devices-2000 — ***See Vol. D***

Plotters, X-Y, & Accessories-3000 — ***See Vol. D***

Plug & Jack Sets-2100 — ***See Vol. C***

Plug Adapters-2100 — ***See Vol. C***

Plug Buttons-2500 — ***See Vol. C***

Plug Caps & Shells-2100 — ***See Vol. C***

Plugboard Programming Systems — See Boards, Programming (Vol. C)

Plugs, Electrical (All Types)-2100 — ***See Vol. C***

Plugs, Fused-2100 — ***See Vol. C***

Plugs, Hole-2500 — ***See Vol. C***

Plugs, Power, International-2100 — ***See Vol. C***

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Pointers, Dial-2400 — ***See Vol. C***

Polarizers-3700 — ***See Vol. B***

Polarizers, Satellite Antennas-1200 — ***See Vol. D***

Position Control Systems, Servo — See Controls, Servo Systems (Vol. D)

Positioning Systems, Multiple Axis, Computer Guided-4100 — ***See Vol. D***

Posts, Binding-2100 — ***See Vol. C***

Posts, Harness Board-2500 — ***See Vol. C***

Potentiometer Elements-4750

Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... **A•2016**
† **Duncan Electronics, Inc., Costa Mesa, CA 92626, 714-545-8261** .... **A•2038-2039**
§ **Jan Hardware Mfg. Co., Melville, NY 11747, 718-361-0800** ..... **C•1585,1589**
† **JDK Controls, Inc., Newbury Park, CA 91320-1593, 805-499-7779** ..... **A•2043**
† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555** ..... **A•2052**
Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... **A•2062**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2069**
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... **A•2071**
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... **A•2072**
† **Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300** ..... **A•2076**
† **Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777** ..... **A•2078**
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
The J. M. Ney Company, Bloomfield, CT 06002 203-242-2281
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693

Potentiometers, Air Operated-4750

Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... **B•1766**
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733

Potentiometers, Carbon Ceramic-4750

Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... **A•2017**
§ **Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042** ..... **A•2030**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... **A•2042**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2069**
§ **Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277** ..... **A•2070**
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
CTS Corporation, Elkhart, IN 46514 219-293-7511
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
International Resistive Company, Boone, NC 28607 704-264-8861
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693

§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

Potentiometers, Carbon Film-4750

§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042 ..... A•2030
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... A•2031
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258,1261-1262
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1923
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•2042
Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... A•2049
† RDI Elctrns., Inc., New Rochelle, NY 10801, 914-632-7274 ..... A•2062
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2066
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2070
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... A•2072
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-6440
International Microelectronics, Arlington, TX 76003 817-561-2244
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911

Potentiometers, Ceramic Metal (CERMET)-4750

§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•2018-2022,2029
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042 ..... A•2030
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... A•2031
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7974 ..... A•2032-2035
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1923
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•2042
§† Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... A•2055-2057
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•2058-2060
Noble U.S.A., Inc., Rolling Meadows, IL 60008, 708-364-6038 ..... A•2061
† RDI Elctrns., Inc., New Rochelle, NY 10801, 914-632-7274 ..... A•2062
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2066
§† Spectrol Electronics Corp., Ontario, CA 91761, 714-923-3313 ..... A•2068-2069
§† Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139, 818-781-1642 ..... A•2037
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2070-2071
§† Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2073-2075
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
CTS Corporation, Microelectronics business unit, W. Lafayette, IN 47906 317-463-2565
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-6440
International Resistive Company, Boone, NC 28607 704-264-8861
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810

Potentiometers, Composition, Carbon-4750

ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•2042
Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... A•2055-2057
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•2060
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2069
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2070
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§ CTS Corp., Resistor Network business unit, (Formerly CTS Corp., Berne Div.), Berne, IN 46711 219-589-3111
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7779
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

Potentiometers, Conductive Plastic-4750

§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•2018-2017
§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•2018,2021-2022,2027-2029
§† Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042 ..... A•2030
† Duncan Electronics, Inc., Costa Mesa, CA 92626, 714-545-8261 .... A•2050-2059
§ ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... A•2041, B•1258-1259
† JDK Controls, Inc., Newbury Park, CA 91320-1583, 805-498-7779 ..... A•2043
§† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .. A•2046-2050,2052
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•2060
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2069
§† Spectrol Electronics Corp., Ontario, CA 91761, 714-923-3313 ..... A•2066-2068
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2071
§ Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2074
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2076-2078
Wilbrecht Electronics, St. Paul, MN 55107, 612-222-2701 ..... A•2077
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
Copal (USA), Inc., Torrance, CA 90501 213-618-0225
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
† Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

Potentiometers, Hot Molded-4750

Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2071
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

Potentiometers, Hybrid-4750

Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•2018,2021-2022
† Duncan Electronics, Inc., Costa Mesa, CA 92626, 714-545-8261 .... A•2050-2059
ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... A•2041
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-6440
Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Penny & Giles, Santa Monica, CA 90401 213-393-1497

Potentiometers, Lab Type-4750

§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•2018,2021-2022
Duncan Electronics, Inc., Costa Mesa, CA 92626, 714-545-8261 .... A•2050-2059
ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... A•2041
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258,1261-1262
Julie Research Labs., New York, NY 10001, 212-239-3625 ..... D•1270-1271
† Precision Control Manufacturing, Inc., Seattle, WA 98108, 206-221-8300 ..... A•2062
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2069
§† Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2075
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2078
Biddle Instruments, Blue Bell, PA 19422 215-646-9200
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Guildline Instruments, Orlando, FL 32811-7335 407-423-8215
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
§† Spectrol Electronics Corp., Ontario, CA 91761 714-923-3313
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-5050
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

Potentiometers, Linear-4750

Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•2016
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•2018,2021-2022,2027,2029
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042 ..... A•2030
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... A•2031
† Duncan Electronics, Inc., Costa Mesa, CA 92626, 714-545-8261 .... A•2038-2039
§ ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... A•2041, B•1256,1258
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258,1261-1262
Jan Hardware Mfg. Co., Melville, NY 11747, 718-361-0800 ..... C•1585,1589
† JDK Controls, Inc., Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2043
§† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .. A•2047-2048,2052
§† Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... A•2055-2057
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•2060
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1963
† Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2062
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2069
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2070-2071
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 .. A•2072, B•1031
§ Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2074
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2078
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Astrosystems, Lake Success, NY 11042 516-328-1600
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883 602-967-7874
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
International Microelectronics, Arlington, TX 76003 817-561-2244
International Resistive Company, Boone, NC 28607 704-264-8861
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
§ Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
§† Penny & Giles, Santa Monica, CA 90401 213-393-1497
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§† Spectrol Electronics Corp., Ontario, CA 91761 714-923-3313
§† Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
§ Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Potentiometers, Metal Film-4750

IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258,1261-1262
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2071
Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... A•2072
§† Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2075
§ Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2076
Caddock Electronics, Inc., Riverside, CA 92507 714-788-1700
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883 602-967-7874
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§† Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386

Potentiometers, Metal, Glazed — See Potentiometers, Ceramic Metal (Vol. A)

Potentiometers, Motorized-4750

§ ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... A•2040, B•1256-1259
† JDK Controls, Inc., Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2043
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... A•2046,2049
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2078
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
Maxmar Controls Inc., Pleasantville, NY 10570 914-747-3540
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

Potentiometers, Multiturn-4750

§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•2016-2017
§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•2018-2022,2029
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042 ..... A•2030
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•2033,2035
† Duncan Electronics, Inc., Costa Mesa, CA 92626, 714-545-8261 .... A•2038-2039
§ ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... A•2040-2041, B•1256,1258
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258,1261-1262
§ Jan Hardware Mfg. Co., Melville, NY 11747, 718-361-0800 ..... C•1585,1589
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... A•2049
Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... A•2055-2057
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•2059
Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2062
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2069
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2071
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 .. A•2072, B•1031
§† Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2073-2074
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Microelectronics, Arlington, TX 76003 817-561-2244
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
Japan Electronic Manufacturers Agency, Inc., Wilmette, IL 60091 708-251-3600
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
Mouser Electronics, Mansfield, TX 76063 800-346-6873
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
§† Penny & Giles, Santa Monica, CA 90401 213-393-1497
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§† Spectrol Electronics Corp., Ontario, CA 91761 714-923-3313
§† Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
§ West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;213-495-5569

Potentiometers, Nonlinear-4750

Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•2021-2022,2027
§† Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-872-0042 ..... A•2030
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... A•2031
† Duncan Electronics, Inc., Costa Mesa, CA 92626, 714-545-8261 .... A•2038-2039
§ Jan Hardware Mfg. Co., Melville, NY 11747, 718-361-0800 ..... C•1585,1589
† JDK Controls, Inc., Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2043
§ Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•2064-2065
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... A•2049
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2069
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 .. A•2072, B•1031
§ Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2075
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2078
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
† CTS Corporation, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883 602-967-7874
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054 619-757-7770
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
International Resistive Company, Boone, NC 28607 704-264-8861
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§† Penny & Giles, Santa Monica, CA 90401 213-393-1497
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693

Potentiometers, Trimmer-4750

§ Engineered Assemblies & Components Corp., Peterboro, NJ 07608 ..... 201-288-4477; 800-447-5639

Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-9440

International Microelectronics, Arlington, TX 76009 817-561-2244

§ Piher Potenciometros, S.A., Tres Cantos (Madrid), SPAIN 34-1-804-1100

§ Quam-Nichols Co., Chicago, IL 60639 312-631-6555

Mid-Rain Controls, Paw Paw, MI 49079 616-657-2527

Mouser Electronics, Junction, TX 76083 800-346-6873

§ Nagaoka Manufacturing Co., Ltd, Nagaoka-kyo-Shi, Kyoto, JAPAN 617 ..... 975 051-9111

† Novotechnik U.S., Inc, Marlborough, MA 01752 508-485-2244

Ohmite Manufacturing Co, Skokie, IL 60076 708-675-2600

§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-9880;800-323-6693

§ Pinh Electronic Industries, Inc., Lake Zurich, IL 60047-0578 708-438-4000

§ Precision Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 ..... A•2016

§ Precision Rio, Electronic Components Div., Riverside, CA 92507-2114; 714-684-8888;800-854-0310;800-421-7918 ..... A•2016-2027

† Rockwell Mfg. Co., Inc., Hunter Valley, PLC, Dover, NH 03820-3597 ..... A•2030

Rohm Electronics Div., Rohm Corp., Irvine, CA 92612-1699, 800-877-7676 ..... A•2032-2048

RTI Labs, Inc., Rockaway, NJ 07866, 201-586-2880 ..... D-1838, IMFI-1922

§ S&W Electronics, Inc., Fullerton, CA 92635, 714-879-0240 ..... A•2023

SC Electronic Co., Ltd., Daejeon, 82-42-673-7788, 042-67-7788 ..... A•2042

§ Seastrom Manufacturing Co., San Diego, CA 92121, 619-457-2700 ..... A•2007-2077

† Service One Parts Network, Inc., Seneca, SC 29672, 800-845-8086 ..... A•2053-2092

§ Sfernice U.S.A., Inc., Rolling Meadows, IL 60008, 708-640-1535 ..... A•2031

§ SGS Ates Componenti Elettronici S.p.A., Agrate Brianza, (MI) ITALY 39-39-603-1 ..... A•2063

Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1954

Sharon Rubber Seal, Danielson, CT 06239 ..... A•2075

§ Spectrol Electronics Corp., Ontario, CA 91761, 714-448-1400 ..... A•2066

§ Tecate Division, Dale Electronics, Inc., Van Nuys, CA 91409-7136, 818-781-1622 ..... A•2037

§ Texas Aerotron, Inc., Telex-Communications Group, Arlington Heights, IL 60005-3934, 708-934-1277 ..... A•2070-2071

† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2078

† Wilkinson Electronics, St. Paul, MN 55107, 612-221-2791 ..... A•2077

§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000

§ CTS Corporation, Elkhart, IN 46514 219-293-7511

CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-2575

§ CTS Corp, Resistor Network business unit (Formerly CTS Corp, Berne Div.), Berne, IN 46711 219-589-8111

Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506

§ Engineered Assemblies & Components Corp., Tewksbury, NJ 07606 ..... 201-288-4477; 800-447-5639

Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-9440

International Microelectronics, Arlington, TX 76009 817-561-2244

Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840

§ Mouser Instrument Corp., Chicago, IL 60630 312-631-4555

Mid-Rain Controls, Paw Paw, MI 49079 616-657-2527

Mouser Electronics, Junction, TX 76083 800-346-6873

§ Nagaoka Manufacturing Co, Ltd, Nagaoka-kyo-Shi, Kyoto, JAPAN 617 ..... 975 051-9111

† Novotechnik U.S., Inc, Marlborough, MA 01752 508-485-2244

Ohmite Manufacturing Co, Skokie, IL 60076 708-675-2600

§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-9880;800-323-6693

§ Pinh Electronic Industries, Inc., Lake Zurich, IL 60047-0578 708-438-4000

Potentiometers, Sliding-4751

Clarostat Sensors & Controls, Inc., Dover, NH 03820 603-742-3330

Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506

§ Engineered Assemblies & Components Corp., Tewksbury, NJ 07606 ..... 201-288-4477; 800-447-5639

Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-9440

International Microelectronics, Arlington, TX 76009 817-561-2244

§ Mouser Instrument Corp., Chicago, IL 60630 312-631-4555

Mid-Rain Controls, Paw Paw, MI 49079 616-657-2527

Mouser Electronics, Junction, TX 76083 800-346-6873

§ Nagaoka Manufacturing Co, Ltd, Nagaoka-kyo-Shi, Kyoto, JAPAN 617 ..... 975 051-9111

† Novotechnik U.S., Inc, Marlborough, MA 01752 508-485-2244

Ohmite Manufacturing Co, Skokie, IL 60076 708-675-2600

§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-9880;800-323-6693

§ Pinh Electronic Industries, Inc., Lake Zurich, IL 60047-0578 708-438-4000

§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;213-495-5569

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Potentiometers, Trimmer, Carbon Film — See Potentiometers, Trimmer (Vol. A)

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Potentiometers, Trimmer, Metal Film — See Potentiometers, Trimmer (Vol. A)

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§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•2018-2022
§† Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507, 603-742-1120,800-372-0042 ..... A•2030
† Duncan Electronics, Inc., Costa Mesa, CA 92626, 714-545-8261 .... A•2038-2039
§† ETI Systems, Polaris Indl. Enlpre., Oceanside, CA 92054, 619-757-7770 ..... A•2040-2041, B•1256-1258
§ Jan Hardware Mfg. Co., Melville, NY 11747, 718-361-0800 ..... C•1585,1589
§ Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•2064-2065
§† Meurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .. A•2045,2047-2049
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•2054
§ Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... A•2055-2057
Noble U.S.A., Inc., Rolling Meadows, IL 60008, 708-364-6038 ..... A•2061
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1963
† Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2062
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2069
§† Spectrol Electronics Corp., Ontario, CA 91761, 714-923-3313 ..... A•2066-2068
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904, 708-364-7277 ..... A•2070-2071
§† Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2073-2074
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
CTS Corporation, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883 602-967-7874
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
International Resistive Company, Boone, NC 28607 704-264-8861
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Mel-Rain Controls, Paw Paw, MI 49079 616-657-2527
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
† Perkin-Elmer Corp., Elctm. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
† Tech Laboratories Inc., Palisades Pk, NJ 07650 201-944-2221
§† Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100
† Vishay Resistive Systems, Malvern, PA 19355 215-644-1300
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

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Preforms, Soldering-4600 — *See Vol. C*

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Preselector-Mixers-3450

† **Microwave Filter Inc., East Syracuse, NY 13057-0488, 315-437-3953;800-448-1666** ..... A•1621-1623
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lorch Electronics:Div. of Vornitron Corp, St. Petersburg, FL 33710 813-347-5181
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† ST Microwave Corp., Sub. of Signal Technlg. Corp, Sunnyvale, CA 94086 408-736-6000
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0281

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† **Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900** ..... B•1092, D•1130,1226,1228
Magnetic Instrumentation, Indianapolis, IN 46226, 317-545-2102 ..... D•1230
Magnos, Hudson, MA 01749, 508-562-1173 ..... D•1231
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ..... D•1343
Active Control Instrumentation, Key Largo, FL 33037 305-451-1000
§ AEMC Corporation, Boston, MA 02111 ..... 617-451-0227;800-343-1391
§ C.G. Instruments Corp., Electromatic Controls Corp., Hoffman Estates, IL 60195 708-882-5757
Cryomagnetics, Inc., Oak Ridge, TN 37830 615-482-9551
Dowty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
§ John Fluke Mfg. Co., Inc., Everett, Wa 98206, WA 98203 206-347-6100
LDJ Incorporated, Troy, MI 48099-0219 313-528-2202
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
SinoTECH, Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
§ Walker Scientific, Worcester, MA 01606 ..... 508-852-3674;508-853-3232;800-962-4638

Probes, High Voltage (1,000 Volts & Over)-2900 — *See Vol. D*

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Probes, Microwave-3450

† **General Microwave Corporation, Amityville, NY 11701, 516-226-8900** ..... D•1251
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
CGB Industries, Inc., Picoprobe Division, Naples, FL 33941 813-643-4400
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Meury Microwave Corp, Cucamonga, CA 91730 714-987-4715
Probe-Rite, Inc., Santa Clara, CA 95052 408-727-0100
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§† Tektronics Corporation (Pro Instruments), Huntington, NY 11743 ..... 516-549-8411/3428
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8510

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Programmers, PROM & Logic Array-3130

§ Elan Digital Systems, Div. of Elan Digital Sys. Ltd., Milpitas, CA 95035, 800-541-ELAN;408-946-8405 ..... A•1794
Magnon Opus Custom Elect. Engrg., Iselin, NJ 08830, 908-283-4925 ... D•1121
Nohau Corporation, Campbell, CA 95008, 408-866-1820; FAX-866-4493 ..... D•1303,1302-1305
PPM, Inc., Cleveland, OH 44139, 216-349-4300 ..... D•1311
† Sunrise Electronics, Inc., Glendora, CA 91740, 818-914-1892 ..... D•1035
Windek Corp., Lafayette, IN 47904-2993, 317-463-1515;800-742-6033 ..... D•1132-1135
Advantest America, Inc., Lincolnshire, IL 60069 708-634-2552
§ Saraspine Products Ltd., North Vancouver, B.C., CANADA V7L 4L3 604-988-9865
Sardar-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-42-1
BP Microsystems, Houston, TX 77043 ..... 713-461-9430;1-800-225-2102
§† BYTEK Corp., Instrument Systems Div., Boca Raton, FL 33487-1323 407-994-3520
§ Comact East, N. Andover, MA 01845 508-682-2000
Data I/O Corp., Redmond, WA 98073-9746 206-881-6444
Digital Equip., Marlborough, MA 01752
§ Divelbiss Corp., Fredericktown, OH 43019 614-694-9015
Epson America Inc., Component Sales Dept, Torrance, CA 90503 213-787-6900
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
§† Exel Microelectronics, Rohrn Corporation, San Jose, CA 95131 408-432-0500
Φ Genstar Rental Electronics, Inc. Woodland Hills, CA 91367 ..... 800-331-3440 (in CA); 800-227-8409
§ International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
§† International Microsystems, Milpitas, CA 95035 408-942-1001
Kontron Elektronik-US Kontron Elektronik GMBH-Sub. EM, Beverly, MA 01915 508-927-6575
Maxmar Controls Inc., Pleasantville, NY 10570 914-747-3640
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Needham's Electronics, Secto, CA 95841 916-924-8037
Oliver Advanced Engineering, Glendale, CA 91203 818-240-0060
§ Omation Inc., Richardson, TX 75081 ..... 214-231-5167;800-553-9119
PEP/X,Inc., Corte Madera, CA 94925 415-927-0155
§ Prologic Systems, Broomfield, CO 80020 303-460-0102
§ Red Square Company, Fountain Valley, CA 92708 714-751-1373
§ Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
§ Southern Computer Corp., Atlanta, GA 30342 404-252-3340
§ Square D Co., Palatine, IL 60067 708-397-2600
§ Stag Microsystems Inc., Santa Clara, CA 95054 ..... 408-988-1118;1-800-227-8236
System General Corporation, Milpitas, CA 95035 408-263-6667
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
§ Xeltek, Sunnyvale, CA 94086 408-745-7974

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Quartz, Fused-2300

† Accumet Engineering, Hudson, MA 01749 508-568-8311
§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
† Quartzite Processing, Inc., Malden, MA 02148 617-322-3611
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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Radar System Components-3450

Programmed Test Sources, Littleton, MA 01460, 508-486-3008 ..... D•1312
† Servo Corporation of America, Hicksville, NY 11802-9907, 516-938-9700 ..... A•1827
† Thermacore Inc., Lancaster, PA 17601, 717-569-6551 ..... C•1666
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
Aydin Corp., Horsham, PA 19044 215-657-7510
Cober Electronics, Stamford, CT 06902 203-327-0003
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
† Corvus Microwave Inc., Syracuse, NY 13211-2100 315-437-4400
† Datron Systems, Inc., Simi Valley, CA 93065-1650 805-584-1717
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4858 818-882-6333
† Electronic Space Systems Corp., Concord, MA 01742 508-369-7200
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060 703-552-2111
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134 708-232-9611
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
† GSI Corp., Timonium, MD 21093 410-252-1768
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999 213-517-6000
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
† ITT Gilfillan, ITT Defense Inc., Van Nuys, CA 91409 818-988-2600
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Litton Solid State, Litton Systems, Inc., Milpitas, CA 95035 408-433-0933
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180
MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
§ Milliflect, Newark, CA 94560 415-791-5188
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300

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† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Electronic Space Systems Corp., Concord, MA 01742 508-369-7200
† Gabriel Electronics, Scarborough, ME 04074 207-883-5161
§ Milliflect, Newark, CA 94560 415-791-5188
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007

Reactors, Charging-5600

NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314, D•1915
Torelco, Inc., Irvington, NJ 07111, 201-374-8641 ..... A•1278
Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525 ..... A•2235
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2250
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314, D•1915
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
Torelco, Inc., Irvington, NJ 07111, 201-374-8641 ..... A•1278
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
American Magnetics, Carterville, IL 62918 618-985-4838
Andover, Inc., Lafayette, IN 47904 317-447-1157
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Genisco Electronics Corporation, San Diego, CA 92173 619-661-5100
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700

§ Magnetek Triad, Huntington, IN 46750 219-356-7100
§† Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
§ MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
† Osborne Transformer, Detroit, MI 48203 313-868-9410
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6850
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
† Schott Corp., Wayzata, MN 55391 612-475-1173
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp, Anaheim, CA 92806 714-630-9751
§† Thordarson Meissner, Components Corp. of Amer, Mt. Carmel, IL 62863 618-262-5121
Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
† Torotel Prods. Inc., Grandview, MO 64030-9199 816-761-6314
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
Wilco Corp., Indianapolis, IN 46268 317-299-9300
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Reactors, Loading-3600

† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A-2314, D-1915
§† Aydin Corporation (West), San Jose, CA 95119-1271 408-629-1100
† Del Electrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Electrocom Industries, S. Bend, IN 46615 219-232-2740
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Genisco Technology Corp., La Mirada, CA 90638 714-995-7001
Hitran Corporation, Flemington, NJ 08822-5945 908-788-5525
Meg-Con, St. Paul, MN 55113 612-633-8820
§† Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
§ MTE Corp., Menomonee Falls, WI 53051 414-253-8200
Osborne Transformer, Detroit, MI 48203 313-868-9410
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6850
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Reactors, Saturable-1600

† American Aerospace Controls, Farmingdale, NY 11735, 516-694-6700 ..... D-1577, 1877
Caddell-Burns Mfg., Mineola, NY 11501-2500, 516-746-2310 ..... A-1172
Hitran Corporation, Flemington, NJ 08822-5945, 908-782-5525 ..... A-2235
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A-2314, D-1915
Torelco, Inc., Irvington, NJ 07111, 201-374-3041 ..... A-1278
Alber, Inc., Lynnwood, WA 98036 ..... 206-771-4036;800-823-5227
American Magnetics, Cartersville, IL 62918 618-985-4838
§† Aydin Corporation (West), San Jose, CA 95119-1271 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-345-2074
† Bicron Electronics, Canaan, CT 06018 203-824-5125
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-935-6188
Cross Electronics, Warrendale, PA 15086 412-776-1591
† Del Electrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Electrocom Industries, S. Bend, IN 46615 219-232-2740
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elma Engineering, Palo Alto, CA 94303 415-494-7500
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., Brewstar, NY 10509 914-279-8091
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Meg-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
§† Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
§ MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
† Oram High Voltage, Dayton, TX 77535 409-258-5553
† Osborne Transformer, Detroit, MI 48203 313-868-9410
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6850
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
§ Schaffner EMC, Inc. Components Division, Union, NJ 07083 ..... 908-851-0664; 800-367-5566
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§ Square D Co., Palatine, IL 60067 708-397-2600
† Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
Walker Power, inc., Warner, NH 03278 603-456-3111
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Receivers, Navigation — *See Navigation, Air (Vol. D)*

Receivers, Laser-1900 — *See Vol. D*

Receivers, Loran & Omega-1900 — *See Vol. D*

Receivers, Microwave-3450

Datum Timing, Division Inc., Anaheim, CA 92807-1790, 714-920-[illegible] D-1067
† Microdyne Technology Inc., Glen Cove, NY 11542, 516-759-[illegible] D-1990
Servo Corporation of America, Hicksville, NY 11802-0[illegible] ..... [illegible]
AEL Defense Corp., Lansdale, PA 19446 ..... 215-368-[illegible]
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 ..... 516-595-[illegible]
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† A.R.F. Prods., Boulder, CO 80301 303-443-4844
Aydin Corp., Horsham, PA 19044 215-357-7510
Aydin Vector Div., Aydin Corp, Newtown, PA 18940-0328 215-968-4271
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-2248
† Condor Systems, Inc., San Jose, CA 95126 408-371-9580
† Cornus Microwave Inc., Syracuse, NY 13211-2100 315-437-6400
Dowty Avionics, Arcadia, CA 91006 818-445-5876
§ Eaton Corp., Electronic Instrument Div, Los Angeles, CA 90074 213-928-0761
Electro-Mec, Div. of C & C Jerrold, Princeton, NJ 08540 ..... 609-921-2[illegible]
§† Electro-Metrics, Incorporated, A Perrel Corp., Amsterdam, NY 12010 518-843-2600
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94089 408-734-0130
† Ferrotec Inc., Fremont, CA 94538-7474 ..... 415-[illegible]
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-939-6000
HDS Inc., Reston, VA 22091 703-620-8300
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† ISC Datacom, ISC Defense & Space, Sunnyvale, CA 94089 408-747-1000
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92128 619-673-4100
† Lucas Zeta, Inc., Lucas Aerospace, Inc., San Jose, CA 95131 ..... 408-[illegible]
MACOM, Inc., Burlington, MA 01803 617-272-3000
M/A-COM Government Products, Inc., Hunt Valley, MD 21030 301-771-5077
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)47 1200
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076 708-677-4700
† Microphase, Norwalk, CT 06856 203-866-3000
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X9 514-694-8566
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Penstock Engineering Labs, Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
ST Research Corporation, Newington, VA 22122 703-550-7000
Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2749
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8220;213-870-9631
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
§† Vega Precision Labs., Vienna, VA 22180 703-938-5300
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Receivers, Monitoring, Communications-1900 — *See Vol. D*

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Receivers, Telemetry-1900 — *See Vol. D*

Receivers, Tone-1900 — *See Vol. D*

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Receivers (MIL), ESM-2440 — *See Vol. B*

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Receivers (MIL), Radio-2440 — *See Vol. B*

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Recorders, Computer Data-2000 — *See Vol. D*

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Recorders, Event/Multievent-3000 — *See Vol. D*

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Recorders, Polar-3000 — *See Vol. D*

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Recorders, Transient-3000 — *See Vol. D*

Recorders, Vibration-3000 — *See Vol. D*

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Rectifier Assemblies-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085, D•1659
§ Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... B•1451
Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2094
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1582
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
NIEC-BASISTA, Richfield, OH 44286 216-659-9287
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443

Rectifiers, Blocks-4800

Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2094
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308

Rectifiers, Bridges & Assemblies-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
§ Crydom Company, Lakewood, CA 90711-3699, 213-865-3536 ..... B•1451
Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2094
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•2095
Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... A•2099
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2101
Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1582
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
† Basic Electronics, Inc., Stanton, CA 90680 714-530-2400
§ Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
Lark Electronics, Inc., New York, NY 10040 212-569-0430
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
† Mep Controls, Bordentown, NJ 08505 609-298-7300
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Sanford-Miller Corp., Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Semtech, Newbury Park, CA 91320 805-498-2111
Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Shindengen America Inc., Westlake Vl, CA 91361 800-634-3654
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Rectifiers, Cartridge-4800

§ Electronic Devices, Inc., Yonkers, NY 10710 914-965-4400
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499

Rectifiers, Electron Tube — See Tubes, Rectifying (Vol. A)

Rectifiers, General Purpose, Surface Mount-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2100
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
† Voltage Multipliers, Inc., Visalia, CA 93291, 209-651-1402 ..... A•2127
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700

Rectifiers, Germanium-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982

§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700

Rectifiers, Schottky, Surface Mount-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206
Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... A•2098
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2100
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§ Collmer Semiconductor, Inc., Dallas, TX 75244 ..... 800-527-0251;214-233-1589
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Shindengen America Inc., Westlake VL, CA 91361 800-634-3654

Rectifiers, Selenium-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ International Components Corp., Melville, NY 11747 516-293-1500
Lark Electronics, Inc., New York, NY 10040 212-569-0430
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Power Conversion Products, Crystal Lake, IL 60014 815-459-9100
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

Rectifiers, Silicon-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1075,2095
§ Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... A•2098
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2100
Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§† Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1582
§ Teccor Electronics, Inc., Irving, TX 75038, 214-580-1515 ..... A•2122,2125
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
§ Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ Electronic Devices, Inc., Yonkers, NY 10710 914-965-4400
§ FAGOR ELECTRONICS COMPONENTS, INC., FAGOR ELECTRONICA S. COOP., Elk Grove Village, IL 60007 708-981-0161
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
International Microelectronics, Arlington, TX 76003 817-561-2244
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
Lark Electronics, Inc., New York, NY 10040 212-569-0430
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§† Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§ PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Semtech, Newbury Park, CA 91320 805-498-2111
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
§† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Rectifiers, Silicon Controlled — See Thyristors (Vol. A)

Rectifiers, Surface Mount-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... A•2098
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
† Voltage Multipliers, Inc., Visalia, CA 93291, 209-651-1402 ..... A•2127
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Shindengen America Inc., Westlake VL, CA 91361 800-634-3654

Rectifiers, Ultrafast-4800

§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
§ Frontier Electronics, Chatsworth, CA 91311, 818-709-9888 ..... A•1206
§ Lite-On Inc., Milpitas, CA 95035, 408-946-4873 ..... A•2098
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2100-2101
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
Electronic Devices, Inc., Yonkers, NY 10710 914-965-4400
§† General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§† Semtech, Newbury Park, CA 91320 805-498-2111
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Rectifiers (MIL), Semiconductor-2440 — ***See Vol. B***

Reducers, Speed — See Gear Heads & Speed Reducers (Vol. B)

Reels, Tape — See Tape Recording Accessories (Vol. D)

Reference Books — See Technical Books (Vol. D)

References, DC Voltage-2900 — ***See Vol. D***

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Regulators, Frequency-4050 — *See Vol. D*

Regulators & References, Silicon-Also See Diodes, Zener & Stabistors-4800

Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1271
ACD-Elcor Products, Bethel, CT 06801 203-743-3510
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§† Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
§ International Diode, Harrison, NJ 07029 201-482-6518
† Keep Precision Standards, Inc., South Plainfield, NJ 07080 ..... 201-757-2220/2277
§† Linear Technology Corp., Milpitas, CA 95035 408-432-1900
§† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
Semtech, Newbury Park, CA 91320 805-498-2111
† Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§† SI-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 512-332-1435
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
† Trio Laboratories, Inc., Plainview, NY 11803 516-349-0400

Regulators & Stabilizers, Voltage-Also See Transformers, Voltage Regulating-4000 — *See Vol. D*

Regulators, Pulse-Width Modulating, Surface Mount-3130

† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221 ..... D•1599
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
§ Linear Technology Corp., Milpitas, CA 95035 408-432-1900
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241

Regulators, Voltage, Surface Mount-4800

† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221 ..... D•1599
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2441
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
† M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252 602-941-6300
† Modular Devices, Shirley, NY 11967 516-345-3100
Power Trends, Inc., Batavia, IL 60510 708-406-0900
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 213-517-7770
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123

Relays, Antenna — See Relays, RF (Incl. Antenna & Coaxial) (Vol. B)

Relays, Audio Operated — See Relays, Frequency Selective (Vol. B)

Relays, Coaxial — See Relays, RF (Vol. B)

Relays, Contact — See Relays, Power (Vol. B)

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Relays, Crystal Can, 1/2 Crystal Can-4500 — *See Vol. B*

Relays, Current Sensing-4500 — *See Vol. B*

Relays, Differential-4500 — *See Vol. B*

Relays, Frequency Selective-4500 — *See Vol. B*

Relays, General Purpose-4500 — *See Vol. B*

Relays, High Voltage (500 Volts & Over)-4500 — *See Vol. B*

Relays, Hybrid-4500 — *See Vol. B*

Relays, Impulse — See Relays, Stepping (Vol. B)

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Relays, Mercury-Wetted Contacts-4500 — *See Vol. B*

Relays, Meter-4500 — *See Vol. B*

Relays, Motor Start-4500 — *See Vol. B*

Relays, Opto-Isolated-4500 — *See Vol. B*

Relays, Phase Sensing-4500 — *See Vol. B*

Relays, Plug-in-4500 — *See Vol. B*

Relays, Power-4500 — *See Vol. B*

Relays, Printed Circuit Mounting (Incl. Transistor & DIP Case Types)-4500 — *See Vol. B*

Relays, Programmable-4500 — *See Vol. B*

Relays, RF (Incl. Antenna & Coaxial)-4500 — *See Vol. B*

Relays, Reed-4500 — *See Vol. B*

Relays, Reed, Surface Mount-4500 — *See Vol. B*

Relays, Sealed-4500 — *See Vol. B*

Relays, Solid State-4500 — *See Vol. B*

Relays, Solid State, Surface Mount-4500 — *See Vol. B*

Relays, Stepping-4500 — *See Vol. B*

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Relays, Time Delay-4500 — *See Vol. B*

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Relays, Voltage Sensitive-4500 — *See Vol. B*

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Repair Equipment, Surface Mount-4100 — *See Vol. D*

Repair Services, Surface Mount Equipment-4100 — *See Vol. D*

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Resins, Synthetic — See Plastic Raw Materials (Vol. C)

Resistance Comparators — See Bridges, Resistance (Vol. D)

Resistor Hardware-2500 — *See Vol. C*

Resistor Networks, Surface Mount-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1841-1842
§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1843
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-702-2070;201-750-7200 ..... A•1848-1849
§ CTS Corp., Resistor Network business unit, (Formerly CTS Corp., Berne Div.), Berne, IN 46711, 219-589-3111 ..... A•1884-1885
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910-1911
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1930-1931
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1957
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1966-1967
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 .. A•1976
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1984
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
CTS Corporation, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Doran Manufacturing Co., Cincinnati, OH 45225 513-681-5424
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd, Morton Grove, IL 60053 708-470-8440
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
Hy-Tec Industries, Div. of Topo Industries, Inc., Shoreham, NY 11786 ... 516-924-8686
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§ Mallory/North American Capacitor Co., Indianapolis, IN 46241 317-856-3731
§ Nepenthe, Inc., Palo Alto, CA 94303 415-496-6666
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640

§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Solitron/Microwave, Solitron Devices, Inc., Riviera Bch, FL 33404-9978 ..... 407-848-4311;800-888-8763
Sprague Electric Company, Distribution Division, Mansfield, MA 02048-9102 508-339-8900
Tepro of Florida, Clearwater, FL 33575 813-796-1044
† TH Electronics, Orem, UT 84058 801-226-1383
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810

Resistors, Adjustable-Also See Potentiometers; Rheostats-4700

Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1842
Angstrohm Precision, Inc., A Company of Vishay, Hagerstown, MD 21740, 301-739-8722 ..... A•2015
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... O•1250-1262
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1931
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
Mepcopar Company, San Diego, CA 92121, 619-453-0332 ..... A•2057
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1950-1953
Noble U.S.A., Inc., Rolling Meadows, IL 60008, 708-364-6038 ..... A•2061
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1961-1962
† Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2069
† Vernitech/Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... A•2072
§† Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2075
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Carter Manufacturing Corporation, Boston, MA 01740 508-779-5501
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC, Dover, NH 03820-1507 603-742-1120,800-872-0042
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp./Electrocomponents Purchase unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§ CTS Corp., Resistor Network business unit, (Formerly CTS Corp., Berne Div.), Berne, IN 46711 219-589-3111
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883 602-967-7874
Duncan Electronics, Inc., Costa Mesa, CA 92626 714-545-8261
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-9440
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
§ International Components Corp., Melville, NY 11747 516-293-1500
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
† Mel-Rain Controls, Paw Paw, MI 49079 616-657-2527
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§† Spectrol Electronics Corp., Ontario, CA 91761 714-923-3313
§† Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 708-364-7277
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
§† Varnistor Corp., Sevierville, TN 37862 615-453-0001
§ Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Ballast (Incl. Tube & Solid State Devices)-4700

§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1950
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EWC, Inc., Englishtown, NJ 07726 908-446-3110
L.H. Frost Limited, Oakville,Ont, CANADA L6H 2R4 416-844-6681
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
Walker Power, Inc., Warner, NH 03278 603-456-3111

Resistors, Beryllia Core — See Resistors, Integral Heat Dissipator (Vol. A)

Resistors, Bulk Ceramic-4700

† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1881
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
§ Colber Corp., Irvington, NJ 07111 201-371-9500
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KOK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8888
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
Microplex, Inc., Anaheim, CA 92806 714-634-1535
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
Stackpole Carbon Company, St. Marys, PA 15857 814-781-1234

Resistors, Carbon Film-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1842
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1850-1851
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1930,1932,1934
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1947
§ Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1960
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1985
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Component General, Inc., Odessa, FL 33556 813-376-6655
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 804-977-8050
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7371
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
† Varnistor Corp., Sevierville, TN 37862 615-453-0001

Resistors, Ceramic Core-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1839-1840
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1850-1851
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1882
CTS Corp., Resistor Network business unit, (Formerly CTS Corp., Berne Div.), Berne, IN 46711, 219-589-3111 ..... A•1885
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1199,1905
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1898-1899
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1916
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1937,1939
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
§ Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1947
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1950-1951
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1958,1961-1962
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1966
§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•1977
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ..... A•1979
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1999
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC, Dover, NH 03820-1507 603-742-1120,800-872-0042
Component General, Inc., Odessa, FL 33556 813-376-6655
Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Meissner Industries, Dover, NJ 07801 201-366-1700
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§† Nytron Inductors, Inc., Darlington, SC 29532 803-393-5421
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
Pyrohm, Inc., Farmington Hills, MI 48018 313-478-5060

§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 ..... 407-848-4311;800-888-8763
Stackpole Carbon Company, St. Marys, PA 15857 814-781-1234
† Star Porcelain, Trenton, NJ 08638 609-392-3154
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
† Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Ceramic Metal (Cermet)-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1839-1840
§ CTS Corp., Resistor Network business unit, (Formerly CTS Corp., Berne Div.), Berne, IN 46711, 219-589-3111 ..... A•1885
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1916
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1932
Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1947
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965-1967
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1027
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986-1987,1991
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1999
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
K & M Electronics, W. Springfield, MA 01089 413-781-1350
Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642

Resistors, Chip (For Microcircuits)-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1842
§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1843
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;801-750-7200 ..... A•1848-1849,2019-2020
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1905
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1891-1894
§† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1748,1910-1912
† International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1922
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ... A•1930-1931,1934
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965-1967
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1973
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1984-1985
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986-1987,1989-1991
§ Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1992
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2002,2006-2007,2009
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Component General, Inc., Odessa, FL 33556 813-376-6655
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
Hy-Tec Industries, Div. of Topo Industries, Inc., Shoreham, NY 11786 ... 516-924-8686
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§ Micro-Ohm Corp., Duarte, CA 91010 818-3575377
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Morris Enterprises, Sepulveda, CA 91343 818-894-9103
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† Sipex Corp., Custom Monolithic Prods. Div., Billerica, MA 01821 508-667-8700
Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 ..... 407-848-4311;800-888-8763
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
† United Sepertek, Inc., San Jose, CA 95131-1101 408-922-0730
§ West Electronic Sales Team, Westminster, CA 92683 .... 714-898-0120;213-495-5569
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Resistors, Composition, Carbon-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1842
§ Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1960
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-561-2244
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ KOA Speer Electronics, Bradford, PA 16701 814-362-5536
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

Resistors, Decade-4700

§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1913
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258-1262
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1925,1927
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1272
Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1947
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
† PPM, Inc., Cleveland, OH 44139, 216-349-2300 ..... D•1311
† Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2062
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Shalltronix Corp., Selma, NC 27576, 919-965-6346 ..... D•1325
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1789
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
§† Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600

† Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
§ Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Deposited Carbon-4700

§ **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711** ..... A•1842
§ **Micro-Ohm Corp., Duarte, CA 91010, 818-3575377** ..... A•1947
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... A•1982
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1996
Dale Electronics, Inc, Norfolk Div, Norfolk, NE 68701-2242 402-371-0080
Engineered Assemblies & Components Corp, Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd, Morton Grove, IL 60053 708-470-8440
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KOA Speer Electronics, Bradford, PA 16701 814-362-5536
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Vamistor Corp., Sevierville, TN 37862 615-453-0001

Resistors, Disk, Rod & Tube-4700

Cableform Inc., Troy, VA 22974, 804-589-6224 ..... A•1850-1851
† **The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521** ..... A•1881
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1908
§ **Kelema/Roden Division, Anaheim, CA 92806, 714-630-0081** ..... B•1846-1847
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
Milwaukee Reactor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1950
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... A•1982
Component General, Inc, Odessa, FL 33556 813-376-6655
§ Dale Electronics, Inc, Norfolk Div, Norfolk, NE 68701-2242 402-371-0080
Huntington Electric Inc, Huntington, IN 46750 219-356-0778
International Resistive Company, Boone, NC 28607 704-264-8861
§ K & W Electronics, W. Springfield, MA 01089 413-781-1350
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§† Solitron/Microwave, Solitron Devices, Inc., Riviera Bch, FL 33404-6978 ..... 407-848-4311;800-888-8763
Stackpole Carbon Company, St Marys, PA 15857 814-781-1234

Resistors, Film, Metallized & Nonmetallized-4700

§ **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711** ..... A•1841-1842
Angstrohm Precision, Inc., A Company of Vishay, Hagerstown, MD 21740, 301-739-8722 ..... A•1844-1845
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1901-1902,1904-1905
§† **Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080** ..... A•1891-1892,1894-1896
† Electro-Films, Inc., Warwick, RI 02886, 401-739-9150 ..... A•1748,1910,1912
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1917
§† KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ... A•1930,1932,1934
KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1933
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
§† **Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600** ..... A•1960
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1973-1974, B•1027
† **Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501** ..... A•1975
§ **Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131** ..... A•1976-1977
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986,1988-1991
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1996
§† **Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300** ..... A•2006-2009, 2076
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
§ Colber Corp., Irvington, NJ 07111 201-371-9500
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Eltec Instruments Inc., Daytona Bch, FL 32120 904-253-5328
EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7500
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
Hokuriku USA Ltd, Morton Grove, IL 60053 708-470-8440
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
§ International Components Corp, Melville, NY 11747 516-293-1500
† International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§† International Resistive Company, Boone, NC 28607 704-264-8861
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
§ Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
Raltron Electronics, Miami, FL 33172 305-593-6033
RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Tepro of Florida, Clearwater, FL 33575 813-796-1044
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567

Resistors, Flame Retardant-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1840,1842
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1882-1883
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1900,1902-1902,1905
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1895-1896
General Resistance, A True Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1913
§ **KOA Speer Electronics, Bradford, PA 16701, 814-362-5536** ..... A•1932,1934
§† **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210** ..... A•1937,1939-1940
§ **Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454** ..... A•1948
Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 .. A•1950, 1951-1952
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•1976-1977
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Resistors, Inc., Chicago, IL 60659, 708-582-7555 ..... A•1983
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Bakner Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
# Engineered Assemblies & Components Corp, Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd, Morton Grove, IL 60053 708-470-8440
Huntington Electric Inc, Huntington, IN 46750 219-356-0778
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-2900
§ International Components Corp, Melville, NY 11747 516-293-1500
§† International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Laube Technology, Woodland Hills, CA 91367 818-703-1138
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
§ Micro-Ohm Corp., Duarte, CA 91010 818-3575377
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ NTE Electronics, Inc. Bloomfield, NJ 07003 201-748-5089
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§† Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
Vamistor Corp., Sevierville, TN 37862 615-453-0001
Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Flux Sensitive-4700

§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... A•1982
§ Bachi, Inc., Itasca, IL 60143 708-773-5600
§ Colber Corp., Irvington, NJ 07111 201-371-9500

Resistors, Foil, Ultraprecision-4700

§ **Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700** ..... A•1853
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1925-1927
KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1936

§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... **A•1992**
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... **A•2001-2009, 2076**
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Hokuriku USA Ltd, Morton Grove, IL 60053 708-470-8440
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
† Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Resistors, Four Terminal-4700

§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... **A•1907-1908**
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... **A•1925-1927**
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... **A•1939**
Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... **A•1980-1981**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... **A•1982**
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... **A•1986**
§ Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... **A•1992-1993,1995**
Colber Corp., Irvington, NJ 07111 201-371-9500
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Mills Resistor Co., Los Alamitos, CA 90720 213-598-2454
Tepro of Florida, Clearwater, FL 33575 813-796-1044

Resistors, Fuse-4300 — *See Vol. B*

Resistors, Glass-4700

Angstrohm Precision, Inc., A Company of Vishay, Hagerstown, MD 21740, 301-739-8722 ..... **A•1844-1845**
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... **A•1882**
Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... **A•1975**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... **A•1982**
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... **A•1997**
Component General, Inc., Odessa, FL 33556 813-376-6655
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 ..... 407-848-4311;800-888-8763
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§† Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Heat Sink Encased — See Resistors, Integral Heat Dissipator (Vol. A)

Resistors, High Frequency-4700

Cableform Inc., Troy, VA 22974, 804-589-8224 ..... **A•1850-1851**
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... **A•1853**
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... **A•1880**
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... **A•1199**
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... **A•1897-1899**
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... **A•1949**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... **A•1982**
Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... **A•1983**
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... **A•1986**
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... **A•1998**
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... **A•2001, 2003-2004**
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
Component General, Inc., Odessa, FL 33556 813-376-6655
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Nepenthe, Inc., Palo Alto, CA 94303 415-496-6666
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810

Resistors, High Megohm (Over 22 Megohms)-4700

Cableform Inc., Troy, VA 22974, 804-589-8224 ..... **A•1850-1851**
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... **A•1853**
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... **A•1916,1918**
International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... **A•1922**
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... **A•1955**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... **A•1982**
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 .. **A•1986-1987**
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... **A•1996-1999**
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd, Morton Grove, IL 60053 708-470-8440
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ K & M Electronics, W. Springfield, MA 01089 413-781-1350
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Stackpole Carbon Company, St. Marys, PA 15857 814-781-1234
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Tepro of Florida, Clearwater, FL 33575 813-796-1044
Transicoil Inc., Penn Airborne Products, Southampton, PA 18966 215-355-3400
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, High Temperature (Over 125°C)-4700

† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... **A•1837**
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... **A•1853**
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... **A•1880**
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... **A•1902,1905-1906,1908**
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... **A•1895**
† Electro-Films, Inc., Warwick, RI 02886, 401-736-9150 ..... **A•1910**
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... **A•1916**
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... **A•1933**
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... **A•1936**
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... **A•1949**
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 .... **A•1950-1951**
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... **A•1962**
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... **A•1968-1970**
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... **A•1975**
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 .. **A•1977**
Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ..... **A•1979**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... **A•1982**
Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... **A•1983**
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 .. **A•1986-1991**
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... **A•1996,1998**
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Fenwal Electronics, Inc./APD, Milford, MA 01757 508-478-6000
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§ International Resistive Company, Boone, NC 28607 704-264-8861

§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Nytron Inductors, Inc., Darlington, SC 29532 803-393-5421
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§† Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
Stackpole Carbon Company, St. Marys, PA 15857 814-781-1234
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
§† Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, High Voltage (1,000 Volts & Over)-4700

† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1837
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1850-1851
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1880-1881
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1900-1901,1908
Elliott/Jordan, A Company of Vishay, Grand Junction, CO 81502, 619-690-2401 ..... A•1914-1915
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1916,1918
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1929, D•1270
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1961
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1968-1970
Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•1978-1980
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1996-1999
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EBG-Elektronische Bauelemente, Geselischaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Haefely Test Systems, E. Haefely & Co. LTD., Woodbridge, VA 22192 ... 703-494-1900
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ K & M Electronics, W. Springfield, MA 01089 413-781-1350
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
§ Square D Co., Palatine, IL 60067 708-397-2600
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
† Vamistor Corp., Sevierville, TN 37862 615-453-0001
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Hot Molded-4700

† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1837
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1902-1903,1906
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1891
Imperial Astronics, Northridge, CA 91324, 818-886-7672 ..... A•1919-1921
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1936,1940
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1961
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1968-1969
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1993,1995
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2005-2007
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ International Components Corp., Melville, NY 11747 516-293-1500
§† International Resistive Company, Boone, NC 28607 704-264-8861
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642

Resistors, Integral Heat Dissipator-4700

Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1837
Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1905,1907-1908
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1925,1927
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1940
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 .... A•1950-1952
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1958,1961
Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1968-1970
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2001
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
§ Mills Resistor Co., Los Alamitos, CA 90720 213-598-2454
Nytron Inductors, Inc., Darlington, SC 29532 803-393-5421
§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
§ Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810

Resistors, Low Temperature Coefficient-4700

† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1837
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1880
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1882-1883
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1900-1906
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1891,1895,1897-1898
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1913
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1917
† Imperial Astronics, Northridge, CA 91324, 818-886-7672 ..... A•1919,1921
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1925,1927
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1929, D•1270
§† KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1933
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1936,1940
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1950
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ... A•1958,1960,1962
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1966
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1968-1970
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1973-1974
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•1976-1977
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ..... A•1978,1980-1981
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
† Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1985
† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986,1988-1991
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1992-1993,1995
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1998
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2001-2004
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625

† EMCA-REMEX Products, National Starch & Chem. Co, Montgomeryville, PA 18936 215-855-1000
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Fenwal Electronics, Inc./APD, Milford, MA 01757 508-478-6000
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
§† Guildline Instruments, Orlando, FL 32811-7335 407-423-8215
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§ International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ K & M Electronics, W. Springfield, MA 01089 413-781-1350
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Nytron Inductors, Inc., Darlington, SC 29532 803-393-5421
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7671
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
Raltron Electronics, Miami, FL 33172 305-593-6033
§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§ Tepro of Florida, Clearwater, FL 33575 813-796-1044
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
Vishay Dale Electronics, St. Paul, MN 55107 612-222-2791

Resistors, Metal Film-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1841
Angstrohm Precision, Inc., A Company of Vishay, Hagerstown, MD 21740, 301-739-8722 ..... A•1844-1845
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1199
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1895-1899
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1917
§ Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1950
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1985
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Micro-Ohm Corp., Duarte, CA 91010 818-3575377
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ West Electronic Sales Team, Westminster, CA 92683 ..... 714-898-0120;213-495-5569

Resistors, Metal Glazed-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1842
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1916
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1957
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1985
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1997
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
† EMCA-REMEX Products, National Starch & Chem. Co, Montgomeryville, PA 18936 215-855-1000
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Ohmite Manufacturing Co, Skokie, IL 60076 708-675-2600
RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642

Resistors, Metal Oxide-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1842
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1900-1901
ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1923
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1932
§ KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1937,1939
§ Maida Development Co., Hampton, VA 23663, 804-723-0765 ..... A•1086,1089,1942-1944
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1985
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1996-1999
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
International Microelectronics, Arlington, TX 76003 817-561-2244
§ International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Ketema/Rodan Division, Anaheim, CA 92805 714-630-0081
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§ World Products Inc., Sonoma, CA 95476 707-996-5201

Resistors, Microwave-4700

§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1843
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1880
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1748,1910
§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•1976
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
Vamistor Corp., Sevierville, TN 37862 615-453-0001
§† Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Negative Temperature Coefficient-4700

† Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 ..... B•1834-1837
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1850-1851
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1880-1881
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1882-1883
Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1840-1841
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1893
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910
§† Fenwal Electronics, Inc./APD, Milford, MA 01757, 508-478-6000 ..... B•1845
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1929
§ Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1846-1848
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1849-1850
Millis Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949

§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•1976-1977
† Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... B•1859
† Sensor Scientific, Inc., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... B•1862-1863
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1867
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2001-2002
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
Component General, Inc., Odessa, FL 33556 813-376-6665
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Components Corp., Melville, NY 11747 516-293-1500
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
International Microelectronics, Arlington, TX 76003 817-561-2244
§† International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
§ RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§† Vernistor Corp., Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
§† Victory Engineering Corp., Springfield, NJ 07081 201-379-5900

Resistors, Noninductive-4700

† Alpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1837
Cableform Inc., Troy, VA 22974, 804-589-6224 ..... A•1850-1851
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1880-1881
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1883
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1900,1902,1906
Elliott/Jordan, A Company of Vishay, Grand Junction, CO 81502, 619-690-2401 ..... A•1914-1915
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1915,1918
† Imperial Astronics, Northridge, CA 91324, 818-886-7672 ..... A•1919,1921
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1936,1939
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9800 ..... A•1950
† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1958
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1968-1970
§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 .. A•1976
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•1978-1979
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
† Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1999
§ Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Julie Research Labs., New York, NY 10001 212-633-6625
K & M Electronics, W. Springfield, MA 01089 413-781-1350
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§† Nytron Inductors, Inc., Darlington, SC 29532 803-393-5421
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
§† Tepro of Florida, Clearwater, FL 33575 813-796-1044
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
† Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Oil Filled-4700

† Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1929, D•1270
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1936
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502 303-242-0810
§ Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Plug-in-4700

Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1936
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
§ Colber Corp., Irvington, NJ 07111 201-371-9500
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Imperial Astronics, Northridge, CA 91324 818-886-7672
International Resistive Company, Boone, NC 28607 704-264-8861
Julie Research Labs., New York, NY 10001 212-633-6625
K & M Electronics, W. Springfield, MA 01089 413-781-1350
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
§ Pomona Electronics, Pomona, CA 91766 714-623-3463
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Positive Temperature Coefficient-4700

§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1882-1883
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1900,1902-1905
§† Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1839
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1893,1895,1897
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910
§† Fenwal Electronics, Inc./APD, Milford, MA 01757, 508-478-6000 ..... B•1845
† Imperial Astronics, Northridge, CA 91324, 818-886-7672 ..... A•1919,1921
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1929
§ Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1846-1848
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1850-1851
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1934
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1936,1938
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1947
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1957
§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•1976-1977
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ..... A•1979
† Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... B•1859
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986,1988-1991
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ..... B•1867,1869
Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1992
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2001-2002
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† Cera-Mite Corp., Grafton, WI 53024 414-377-3500
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§† International Resistive Company, Boone, NC 28607 704-264-8861
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
K & M Electronics, W. Springfield, MA 01089 413-781-1350
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700

§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
Microplex, Inc., Anaheim, CA 92806 714-634-1535
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567

Resistors, Power-4700

† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1837
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1842
Angstrohm Precision, Inc., A Company of Vishay, Hagerstown, MD 21740, 301-739-8722 ..... A•2015
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1850-1851
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1880-1881
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1863
CTS Corp., Resistor Network business unit, (Formerly CTS Corp., Berne Div.), Berne, IN 46711, 219-589-3111 ..... A•1884
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1199,1900-1906
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1897-1899
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1916-1918
Imperial Astronics, Northridge, CA 91324, 818-886-7672 ..... A•1919-1921
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1929
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1932
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1937,1939-1940
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
§ Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 .... A•1950-1954
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1958-1962
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1968-1970
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•1980-1981
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
† Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986,1988-1991
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1994-1995
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1996
§ Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2001,2003,2005,2009
Allen Bradley Co, Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
Component General, Inc., Odessa, FL 33556 813-376-6655
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-6400;800-526-9067
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
International Microelectronics, Arlington, TX 76003 817-561-2244
§† International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
K & M Electronics, W. Springfield, MA 01089 413-781-1350
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Nytron Inductors, Inc., Darlington, SC 29532 803-393-5421
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 ..... 407-848-4311;800-888-8763
Stackpole Carbon Company, St. Marys, PA 15857 814-781-1234
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§† Tepro of Florida, Clearwater, FL 33575 813-796-1044
Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567

Resistors, Precision-4700

† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1837
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1842
Angstrohm Precision, Inc., A Company of Vishay, Hagerstown, MD 21740, 301-739-8722 ..... A•1844-1845,2015
§ Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1850-1851
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... A•1853
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1862
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1902
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1748,1910
Elliott/Jordan, A Company of Vishay, Grand Junction, CO 81502, 619-690-2401 ..... A•1914-1915
§ General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1913
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1916-1917
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1258-1263
† Imperial Astronics, Northridge, CA 91324, 818-886-7672 ..... A•1919-1921
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1925-1927
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1929
§† KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1930,1932
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1936-1937
§ Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1955
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1962
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965-1966
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1968-1970
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1973-1974
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1975
§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•1976-1977
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•1978-1981
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1984-1985
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986,1988-1991
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1992-1995
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•1997
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2001-2007, 2009
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Components Corp., Melville, NY 11747 516-293-1500
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§† International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
K & M Electronics, W. Springfield, MA 01089 413-781-1350
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Koep Precision Standards, Inc., South Plainfield, NJ 07080 ..... 201-757-2220/2277
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Nytron Inductors, Inc., Darlington, SC 29532 803-393-5421
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
† Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§† Tepro of Florida, Clearwater, FL 33575 813-796-1044
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567

† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Resistors, Pressure Sensitive-4700

Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Topflight, York, PA 17404 ..... 717-843-9901;800-233-9366
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Rectilinear-4700

§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
† Vernitech/Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... A•2072
§ Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2002
† Bourns Instruments Inc, Riverside, CA 92507 714-781-5148
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
Engineered Assemblies & Components Corp, Tetorboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
† Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030

Resistors, Standards — See Standards, Resistance (Vol. D)

Resistors, Strip-4700

§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Engineered Assemblies & Components Corp, Tetorboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Huntington Electric Inc, Huntington, IN 46750 219-356-0778
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
International Resistive Company, Boone, NC 28607 704-264-8861
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Topflight, York, PA 17404 ..... 717-843-9901;800-233-9366
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Suppressor-4700

† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1880-1881
Imperial Asbestos, Northridge, CA 91324, 818-886-7672 ..... A•1919-1921
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1086,1089,1942-1944
Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... B•1871
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1153
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
§† Control Concepts Corp, Liebert Corp, Binghamton, NY 13902-1380 607-724-2484
# Engineered Assemblies & Components Corp, Tetorboro, NJ 07608 ..... 201-288-4477; 800-447-5639
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
International Resistive Company, Boone, NC 28607 704-264-8861
KRL/Bantry Components, Inc., Manchester, NH 03109 603-668-3210
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Stackpole Carbon Company, St. Marys, PA 15857 814-781-1234
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Surge-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8301; 800-999-3711 ..... A•1840
§ Caddock Electronics, Inc., Riverside, CA 92507, 714-781-1760 ..... A•1853
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1880
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1906
§ Ketema/Kodan Division, Anaheim, CA 92806, 714-630-0601 ..... B•1846-1848
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1849
KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1940
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1086,1089,1942-1944
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1950
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... B•1871
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1153
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§† Control Concepts Corp., Liebert Corp, Binghamton, NY 13902-1380 607-724-2484
CTS Corp., Resistor Network business unit, (Formerly CTS Corp., Berne Div.), Berne, IN 46711 219-589-3111
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Engineered Assemblies & Components Corp, Tetorboro, NJ 07608 ..... 201-288-4477; 800-447-5639
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
Huntington Electric Inc, Huntington, IN 46750 219-356-0778
§ International Resistive Company, Boone, NC 28607 704-264-8861
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mills Resistor Co., Los Alamitos, CA 90720 213-598-2454
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Surface Mount-4700

Aalpha Precision, Pacific Resistor Co., Torzana, CA 91356, 818-345-7811 ..... A•1937
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8301; 800-999-3711 ..... A•1842
§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1843
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1847
Bourns, Inc., Electronic Components Div., Riverside, CA 92507-2114, 714-781-5500;800-782-2070;001-750-7200 ..... A•1848-1849
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1862
§ CTS Corp., Resistor Network business unit, (Formerly CTS Corp., Berne Div.), Berne, IN 46711, 219-589-3111 ..... A•1884
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1902,1905-1906
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1891-1893
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910-1911
Imperial Asbestos, Northridge, CA 91324, 818-886-7672 ..... A•1919-1921
International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1922
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1925-1927
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1930-1931,1934
§ KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1937
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1960
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965,1967
Pacific Resistor Co., Torzana, CA 91356, 818-345-7811 ..... A•1968-1969
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1972
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7591 ..... A•1975
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1984-1985
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986,1989-1990
§ Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1994
Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2002
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Clarostat Mfg. Co., Inc., Hawker Siddeley, P.L.C., Dover, NH 03820-1507 603-742-1120,800-872-0042
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2025
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
§ Engineered Assemblies & Components Corp, Tetorboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9013
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
International Microelectronics, Arlington, TX 76003 817-561-2244
§† International Resistive Company, Boone, NC 28607 704-264-8861
† International Sensor Systems, Inc., Aurora, NE 68818 308-694-3111
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§ KOA America Inc., Mitsuhishi Materials Corporation, Schaumburg, IL 60173-4516 708-864-8668
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§ Mepcopal Company, San Diego, CA 92121 619-453-0332
Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
National Electronics Corp., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
Tepro of Florida, Clearwater, FL 33575 813-796-1044
§† Vamistor Corp, Sevierville, TN 37862 615-453-0001

Resistors, Tapped-4700

† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1910
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1947
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1950-1951,1953-1954
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
† Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•1984
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
CTS Corporation, Elkhart, IN 46514 219-293-7511

CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
§ International Components Corp., Melville, NY 11747 516-293-1500
International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
K & M Electronics, W. Springfield, MA 01089 413-781-1350
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
† Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043
Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Resistors, Temperature Sensitive-5300 — *See Vol. B*

Resistors, Tin Oxide-4700

KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1939
§ Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1947
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ KOA Speer Electronics, Bradford, PA 16701 814-362-5536
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642

Resistors, Variable — See Potentiometers (Vol. A), Rheostats (Vol. A), Resistors, Adjustable (Vol. A)

Resistors, Voltage Sensitive-4700

Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1908
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1075,1923
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1086,1089,1942-1944
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1957
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1973-1974, B•1856-1857
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2001,2003,2005,2009
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
§ Colber Corp., Irvington, NJ 07111 201-371-9500
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
GTE SUPPLY, GTE SUPPLY, DFW Airport, TX 75261 800-433-4837
§ International Components Corp., Melville, NY 11747 516-293-1500
International Resistive Company, Boone, NC 28607 704-264-8861
§ Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Raltron Electronics, Miami, FL 33172 305-593-6033
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538 419-525-8450
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ Victory Engineering Corp., Springfield, NJ 07081 201-379-5900
§ World Products Inc., Sonoma, CA 95476 707-996-5201

Resistors, Wirewound-4700

† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1837
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1842
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1882-1883
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1902-1908
Elliott/Jordan, A Company of Vishay, Grand Junction, CO 81502, 619-690-2401 ..... A•1914-1915
§ General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1913
HY MEG Corp., Addison, IL 60005, 708-543-9250 ..... A•1917
† Imperial Astronics, Northridge, CA 91324, 818-886-7672 ..... A•1919-1921
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1929, D•1270
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1936-1938,1940
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1946
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1947
§ Mills Resistor Co., Los Alamitos, CA 90720, 213-598-2454 ..... A•1949
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 .... A•1950-1951
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1958-1962
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•1965
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•1968-1970
Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2062
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•1978-1981
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
† Resistors, Inc., Chicago, IL 60650, 708-652-7555 ..... A•1983
§† Ultronix, Inc., A Company of Vishay, Grand Junction, CO 81502, 303-242-0810 ..... A•1992-1995
§† Vishay Resistive Systems, Malvern, PA 19355, 215-644-1300 ..... A•2001,2006, 2009
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp.,Electrocomponents business unit (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
International Microelectronics, Arlington, TX 76003 817-561-2244
§† International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
Meissner Industries, Dover, NJ 07801 201-366-1700
† Mel-Rain Controls, Paw Paw, MI 49079 616-657-2527
§ Mepcopal Company, San Diego, CA 92121 619-453-0332
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Necca, Inc., Nittoku Engineering Group, Baltimore, MD 21237 301-574-4960
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Nytron Inductors, Inc., Darlington, SC 29532 803-393-5421
Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
Pyrohm, Inc., Farmington Hills, MI 48018 313-478-5060
§† RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† Samarius Precision Instruments, Inc., Waterbury, CT 06705 203-756-7030
Standard Condenser Corp., Skokie, IL 60076 708-675-3133
§ Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642
§† Tepro of Florida, Clearwater, FL 33575 813-796-1044
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Resistors, Zero-Ohm-4700

§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1896
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1925,1927
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1934
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1982
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•1986
§ Colber Corp., Irvington, NJ 07111 201-371-9500
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Morton Grove, IL 60053 708-470-8440
§ International Components Corp., Melville, NY 11747 516-293-1500
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
International Microelectronics, Arlington, TX 76003 817-561-2244
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33431 305-771-7000
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
§ Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mills Resistor Co., Los Alamitos, CA 90720 213-598-2454
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 708-390-6680;800-323-6693
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020

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Resolvers, Synchro-4900 — *See Vol. D*

Resonators, Ceramic-2300

† Morgan-Matroc, Vernitron Div., Bedford, OH 44146-5478, 216-232-8600 .. B•1921
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1109,1414,1957
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1702
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135 408-922-9000

Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Raltron Electronics, Miami, FL 33172 305-593-6033
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Resonators, Ceramic, Surface Mount-2700

§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1109,1414,1957
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fujitsu Component of America, Inc., Subsidiary of Fujitsu Microelectronics, Inc., San Jose, CA 95135 408-922-9000
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Z Communications, Inc., Ft. Lauderdale, FL 33309 305-735-1000

Resonators, Microwave, Dielectric-3450

Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1109
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1822
† Z Communications, Inc., Ft. Lauderdale, FL 33309 305-735-1000

Resonators, SAW-2300

NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1699
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1472,1482
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Retainers, Battery-2500 — *See Vol. C*

Retainers, Relay-4500 — *See Vol. B*

Retainers, Transistor & Diode-2500 — *See Vol. C*

Retainers, Tube-2500 — *See Vol. C*

Reticles-3700 — *See Vol. B*

Retractors & Carriers — See Cable Retractors (Vol. C)

RFI Measuring Equipment-2900 — *See Vol. D*

RFI Shielding — See Shields, RF (Vol. C)

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Rheostats-4750

Angstrohm Precision, Inc., A Company of Vishay, Hagerstown, MD 21740, 301-739-8722 ..... A•2015
§ Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•2064-2065
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•2054
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1963
† Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2062
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2069
Angstrohm Power Rheostats, A Sub. of Vishay Intertechnology, Hagerstown, MD 21740 301-739-8722
Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
CTS Corporation, Elkhart, IN 46514 219-293-7511
† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
† Mel-Rain Controls, Paw Paw, MI 49079 616-657-2527
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§† Vishay Resistive Systems, Malvern, PA 19355 215-644-1300

Rheostats, Motorized-4750

§ ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... A•2040, B•1259
† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1963
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820-1507 603-742-1120,800-872-0042

Ribbons for Printers-2000 — *See Vol. D*

Rings, Retaining-2500 — *See Vol. C*

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Rivets-2500 — *See Vol. C*

Robotic Pick & Place — See Arms & Manipulators, Robotic (Vol. D)

Robotics — See Arms & Manipulators, Robotic (Vol. D), Control Systems, Robotic (Vol. D)

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† Bacon Industries, Watertown, MA 02172-2399 617-926-2550
Ceramaseal, New Lebanon, NY 12125 518-794-7800
† Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
† Conductive System, Inc., Amsterdam, NY 12010 518-843-5740
† Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
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Parker Hannifin Corp., Seal Group, Irvine, CA 92713 714-851-3763
§† Parker Seal Group, Irvine, CALIFORNIA 92715 714-851-3763
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† SAS Industries Inc., Manorville, NY 11949 ..... 516-727-1441;1-800-544-5238
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Tecknit (Eastern Facility), Cranford, NJ 07016 908-272-5500

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Microwave Applications Group, Santa Maria, CA 93455 805-928-5711

Shifters, Phase, Microwave-3450

† **General Microwave Corporation, Amityville, NY 11701, 516-226-8900** A-1740
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
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† Daico Industries, Inc., Compton, CA 90220 213-631-1143
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microwave Applications Group, Santa Maria, CA 93455 805-928-5711
§ Microwave Development Laboratories, Natick, MA 01760 508-655-5050
§ Midwest Microwave, Saline, MI 48176-9589 313-429-4772,800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Reeve Electronics, Melissa E. Murray, Chicago, IL 60612 312-829-1600
Sivers IMA AB, Culver City, CA 90230 213-306-4349
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-6900
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TRM, Inc., Manchester, NH 03103 603-627-8000
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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† Lorch Electronics:Div. of Vermitron Corp., St. Petersburg, FL 33710, 813-347-4181 ..... A-1701
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James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7031
Ryan International Corp., Columbus, OH 43228-6207 614-866-3303
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291

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Shunts, Meter-2900 — *See Vol. D*

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† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
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Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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Soldering Equipment, Vapor Phase-4100 — *See Vol. D*

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Standards, Delay Line-2350
† Anders, Inc, Simsbury, CT 06070 203-658-7666
Anderson Laboratories, Bloomfield, CT 06002 203-242-0090

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Strip-Line Components, Microwave-3450
† Micronics Technology Inc., Glen Cove, NY 11542, 516-759-5600 ..... A•1399
† American Etching & Mfg., Pacoima, CA 91331-2796 818-896-1187
AMP, Harrisburg, PA 17105 ..... 717-564-0100;800-522-6752
§† Anaren Microwave, Inc, E. Syracuse, NY 13057 315-432-8909
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-4356 818-882-6333
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7600
# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-6600
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880

Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
International Resistive Company, Boone, NC 28607 704-264-8861
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Rogers Corp., Rogers, CT 06263 203-774-9605
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
TRM, Inc., Manchester, NH 03103 603-627-6000

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Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1618
† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 .... D•2186
Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... C•1330
GRIM Corporation, Medford, NJ 08055-0968, 609-267-7950 ..... D•1075
Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525 ..... D•2203
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1075
MCG Elctrns., Deer Park, NY 11729, 516-586-5125 ..... B•1375
3M-Electronic Products Division, Austin, TX 78769-2963, 1-800-225-5373 Sls. & Prod. Info. ..... C•1464
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1696-1697
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1286-1287,1289
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477, 914-246-2811 ..... A•1288
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1236
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2224
† RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•1633
§ Schaffner EMC, Inc. Components Division, Union, NJ 07083, 908-851-0664;800-367-5566 ..... A•1634-1637
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... A•1646-1647
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1153,2128-2129
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1030
Amber Inds., Inc., Dallas, TX 75379 214-490-9801
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§ Brooks Electronics, Philadelphia, PA 19140 215-228-4433
§† Brooks Power Systems, Bensalem, PA 19020 ..... 215-244-0264;1-800-523-1551
† Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† EFI Elctrns., Salt Lake City, UT 84119 ..... 801-977-9009;800-221-1174
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
§ E.P.D./General Power Corp., Anaheim, CA 92805-8508 ..... 714-520-0881; 1-800-343-1813
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
General Semiconductor Ind., Inc., Square D Company, Tempe, AZ 85281 602-968-3101
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Hopkins Engrg., San Fernando, CA 91342 818-361-8691
JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
§ Kaiglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359 215-837-0700
§ KCK America Inc., Mitsubishi Materials Corporation, Schaumburg, IL 60173-4516 708-884-8688
Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
§† North Hills Electronics Inc., Power Products Div., Glen Cove, NY 11542-3796 516-671-5700
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Perma Power Elctrns., Chicago, IL 60648 312-763-0763
§† Power Integrity Corp., Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
† Rtron Corp., Skokie, IL 60076 708-679-7180
Seacor, Inc., Westwood, NJ 07675 201-666-5600
Shape Electronics, Inc., Lombard, IL 60148 708-620-8394
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 708-439-2800
§† Square D Co. Power Protection Systems, San Diego, CA 92123-1165 ... 619-279-0831
§† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Superior Electric, Bristol, CT 06010 203-582-9561
§† Surgeonics Limited, Fort Edward, NY 12828 518-747-2156
Sutton Designs, Inc., Ithaca, NY 14850 800-326-8119
§ Tamura Corporation of America, Carson, CA 90746-3518 213-638-1790
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
† The Wiremold Company, W. Hartford, CT 06110 203-233-6251
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940

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Surface Acoustic Wave, Delay Line-2350

† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Shindengen America Inc., Westlake Vl., CA 91361 800-634-3654

Surface Acoustic Wave Devices-2350

NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1423
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1472,1482
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Surface Acoustic Wave, Filter-2700

TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1472,1482
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

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† Integrated Microwave, San Diego, CA 92121-1009, 619-259-2600 ... A•1678-1679
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211

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Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ... B•1673
§† Digitran Division, Xcel Corporation, Ontario, CA 91761, 714-391-4321 ... B•1680
Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1682
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1749
Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... B•1737
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500

† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Computron Display Systems, Xcel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Daico Industries, Inc., Compton, CA 90220 213-631-1143
† Eastern Microwave, Burlington, MA 01803 617-272-4700
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hyletronics:Litton Industries, Littleton, MA 01460 617-486-8911
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
MACOM, Inc., Burlington, MA 01803 617-272-3000
† M/A-COM Control Components Div., M/A-COM, Merrimack, NH 03054-4343 603-424-4111
MarLee Switch Co., Upland, CA 91786 714-982-8988
† Micronics Technology Inc., Glen Cove, NY 11542 516-759-5600
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
Peca, Inc., Bensalem, PA 19020 215-245-1550
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299** ..... A•1533
Micronics Technology Inc., Glen Cove, NY 11542, 516-759-5600 ..... A•1399
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603

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L-Com Inc., N. Andover, MA 01845, 508-682-6936 ..... **C•1424-1425**
§ Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
§ E-Z Hook, Tektest Inc., Arcadia, CA 91006 818-446-6175
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Micro Mode Prods., El Cajon, CA 92020 619-449-3844
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§ Paladin Corp., Newbury Park, CA 91320 805-499-0318
§ Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Picosecond Pulse Labs, Inc., Boulder, CO 80306 303-443-1249
§ Pomona Electronics, Pomona, CA 91766 714-623-3463
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047 818-707-2020
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Tees, Waveguide-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Eastern Microwave, Burlington, MA 01803 617-273-4700
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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† Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... **A•1747**
† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... **A•1691-1693,1695**
† Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761 ..... **C•1513**
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
§ Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808

† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Coastcom, Concord, CA 94527 510-825-7500
† Compac, Holbrook, NY 11741 516-585-3400
† Connecticut Microwave Corp., Cheshire,, CT 06410 203-250-9678
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
† Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
§ Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Eastern Microwave, Burlington, MA 01803 617-273-4700
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
International Manufacturing Services, Portsmouth, RI 02871-2416 401-683-9700
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101 617-890-4750
† Manger Electric Company, Inc., Stamford, CT 06902 203-348-7761
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., El Cajon, CA 92020 619-449-3844
† Microwave Applications Group, Santa Maria, CA 93455 805-928-5711
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
North Hills Electronics, Glen Cove, NY 11542 516-671-5700
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;600-PENSTOCK
§ Pomona Electronics, Pomona, CA 91766 714-623-3463
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Servo Corporation of America, Hicksville, NY 11802-9907 516-938-3700
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810 203-744-0096
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700

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§ Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ Crydom Company, Lakewood, CA 90711-3699 213-865-3536
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
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§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
§† International Rectifier Corp., El Segundo, CA 90245 213-772-2000
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§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
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§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Raytheon/TAG Semiconductors Ltd., Burlington, MA 01803 ..... 617-272-3704 (3705)
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
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§† Unitrode Corp., Watertown, MA 02172 617-926-0404

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† American Trans-Coil Corporation, Richmond Hill, NY 11418-1415 718-441-5207
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can: 1-800-553-2448
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
§ Atlas/Soundolier, Fenton, MO 63026 314-349-3110
§† Audiosone, Inc., Stratford, CT 06497 203-377-4475
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp, Kent, CT 06757 203-927-3541
† BG Electronics, BPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5143
§ C-MAC Micro, Santa Clara, CA 95051 800-235-2567
† Comet Coil Co., Comet Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-O Corp., Bronxville, NY 10708 914-337-4775
Custom Electron Windings, A & K Corporation, Zanesville, OH 43702-0368 614-452-6973
Daniel, Fresno, CA 93727 209-292-1111
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., Kearny, NJ 07032 201-997-0650
Electrorefus, Inc., Everett, WA 98204 206-355-1555
† Electronic Transformer Corp, Totowa, NJ 07511 201-942-2222
† Elmelin Electronics, Inc.Plant Locations: Carrollton, GA 30117 404-834-1545
Endicott Coil Co., Inc, Binghamton, NY 13905 607-797-1263
Ensign Corp, Burr Ridge, IL 60521 708-325-0643
† Fraud Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Gevegan Electronics, Danbury, CT 06810 203-748-5246
§ GC-Thorson, Rockford, IL 61105-1209 815-968-9661
Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-3091
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Integrity Technology Corp, Santa Clara, CA 95050 408-262-8640
International Microelectronics, Arlington, TX 76003 817-561-2244
§ James Electronics, Chicago, IL 60618 312-463-6600
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0766
§ Lenco Electro., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods, Brownsville, TX 78521 512-546-1625
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Hollsville, NY 11742 516-654-1166
Mouser Electronics, Mansfield, TX 76063 800-346-6873
† NTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Nesmanity Transformer Corp, Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
† Onan Power/Electronics, Minneapolis, MN 55344 612-943-4500
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-6435 ..... 805-323-7714; 800-352-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
PC Transformer Corp., West Babylon, NY 11704 516-491-3300
† Perkin-Elmer Corp. Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
Peter Parts & Assocs, Webster, NY 14580 716-265-2540
† Polyphase Instrument, Ft Washington, PA 19034 215-643-6950
† Precision Components, Inc., Addison, IL 60101 312-543-6400
§† Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
† PTC Transformers, Bordentown, NJ 08505 609-298-8200

§ Quam-Nichols Co., Chicago, IL 60637 312-488-5800
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
§ Rye Industries, Inc., Fuquay-Varina, NC 27526 919-557-0511
Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ..... 516-957-8700; 800-645-5516
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
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† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2186-2187
† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 .... D•2185
§† Electromech, Inc., Kearny, NJ 07032, 201-997-0950 ..... A•2208-2209
§ EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2222
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2227
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† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2250-2251
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
§ Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2263
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2280,2286
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† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Plitron, Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... A•2368-2369
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2385-2389
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2412-2413
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2414-2419
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... A•2421
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 .... A•2422-2423
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
§† Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2438,2441
† Toroid Corp. of Maryland, Salisbury, MD 21801, 301-860-0300 ..... A•2442
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... A•2454-2457
Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... A•2463
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
§ AC Transformer, Newark, NJ 07105 201-589-8574
† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
American Magnetics, Carterville, IL 62918 618-985-4838
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† C & C Jetronic, Inc., Princeton, NJ 08540 609-921-8540
Carson Manufacturing Co., Inc., Indianapolis, IN 46220 317-257-3191
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
Epco Products Inc., Wallkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
GAR Enterprises dba KGS Electronics, Pasadena, CA 91103 818-798-0785
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Chappaqua, NY 10514 914-238-9057
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
§ Hughey & Phillips, Inc., Simi Valley, CA 93065 805-581-5591
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
Long Island Transformer & Inductor Company, Inc., Baldwin, NY 11510 516-766-5644
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
§ Micron Industries, Hillside, IL 60162 708-547-0900
MultiComp, Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
§† North Hills Electronics Inc., Power Products Div., Glen Cove, NY 11542-3796 516-671-5700
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
Phase Control Electronics, Glendale, NY 11385 718-441-4278
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
§† Powertron Corp., Sparta, NJ 07871 201-579-5599
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Sanford-Miller Corp., Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900
Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§ Square D Co., Palatine, IL 60067 708-397-2600
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
§† Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
Walker Power, Inc., Warner, NH 03278 603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2242
Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2295
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056, 708-803-6100 ..... A•1273
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2458
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Coilcraft, Cary, IL 60013 708-639-2361
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301

Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
MicroSignals Inc., LIC, NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
† Thinco Div., Hull Corp., Hatboro, PA 19040 215-672-7800
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Transformers, Chopper-5600

† Abbott Technologies, Inc., Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2212
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2280,2295
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Torelco, Inc., Irvington, NJ 07111, 201-374-8641 ..... A•1278
Toroid Corp. of Maryland, Salisbury, MD 21801, 301-860-0300 ..... A•2442
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2458
American Magnetics, Carterville, IL 62918 618-985-4838
American Monarch, Minneapolis, MN 55421 612-788-9161
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90007 213-234-8091
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
§ James Electronics, Chicago, IL 60618 312-463-6500
Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§† Powertron Corp., Sparta, NJ 07871 201-579-5599
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

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Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
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† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... D•1652
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2188
§† Electromech, Inc., Kearny, NJ 07032, 201-997-0950 ..... A•2208-2209
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§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2412-2413
† Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622 ..... D•2108-2109
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 919-738-1121
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electronetics, Inc., Everett, WA 98204 206-355-1855
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
§ Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Epco Products Inc., Wallkill, NY 12589 914-895-2033
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§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Micron Industries, Hillside, IL 60162 708-547-0900
† MLI Industries, Inc., Apalachin, NY 13732 607-754-5800
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp, Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, Detroit, MI 48203 313-468-9410
Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
§ Perma Power Elctrns., Chicago, IL 60648 312-763-0763
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
§† Powertron Corp., Sparta, NJ 07871 201-579-5599
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
§ Shape Electronics, Inc., Lombard, IL 60148 708-620-8394
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 708-439-2800
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
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Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
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§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
§ Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2248
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
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† American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448

§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Bikor, Microsemi Corporation, Torrance, CA 90501 213-539-6320
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5086
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
Custom Coils Inc., Alcester, SD 57001 605-934-2460
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Datatronics, Inc., Romoland, CA 92380 714-928-7700
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† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4796
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
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§† Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Lenco Elctms., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
§ Love Controls Corp., Wheeling, IL 60090 708-541-3232
Mag-Con, St. Paul, MN 55113 612-633-6820
† Magnetic Circuit Elements, Salinas, CA 93906 408-757-8752
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
Multi Products International, West Paterson, NJ 07424 201-890-1344
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-5950
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§† Powertron Corp., Sparta, NJ 07871 201-579-5599
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† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
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Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
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† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torwico Elctms. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transformer Technologies, Inc., Mt. Vernon, NY 10550 914-668-1600
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
Xylog Corp., Hackensack, NJ 07601 201-489-4040
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462/3487 ..... A•2202
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2294-2295
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Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2458
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577

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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
American Magnetics, Carterville, IL 62918 618-985-4838
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† C & C Jetronic, Inc., Princeton, NJ 08540 609-921-8540
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Electromech, Inc., Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Perkin-Elmer Corp., Elctm. Prods. Dept, Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Torwico Elctms. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762

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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
American Magnetics, Carterville, IL 62918 618-985-4838
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† C & C Jetronic, Inc., Princeton, NJ 08540 609-921-8540
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Del Elctms. Corp., Mt. Vernon, NY 10550 914-699-2000
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4796
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342 818-362-7151
Electromech, Inc., Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
Mag-Con, St. Paul, MN 55113 612-633-6820
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3630
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torwico Elctms. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
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† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
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† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... D•1652
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† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§ Beil Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Datatronics, Inc., Romoland, CA 92380 714-928-7700
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† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
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† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
Genisco Technology Corp., La Mirada, CA 90638 714-523-7001

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§† Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
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† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100

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† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
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† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2265
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2276
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Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•1253
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Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
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† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
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† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Valor Electronics, San Diego, CA 92121-2245 619-458-1471
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Transformers, Ferroresonant-5600

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.: 1-800-553-2448 ..... A•2171-2173
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423, 716-538-4421 ..... A•2189
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2187
§† Electromech, Inc., Kearny, NJ 07032, 201-997-0950 ..... A•2208-2209
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2191
Enegren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ..... A•2210
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2227
Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525 ..... A•2235
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 ..... A•2241
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2306
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11596, 516-239-5777 ..... A•2392
† ACD-Elcor Products, Bethel, CT 06801 203-743-3510
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
§ C-COR Elctrns., State College, PA 16801 ..... 814-238-2461;800-233-2267
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Epco Products Inc., WAllkill, NY 12589 914-895-2033
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., Brewster, NY 10509 914-279-8091
ISOREG Corp., Littleton, MA 01460 508-486-9483
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Micron Industries, Hillside, IL 60162 708-547-0900
† MLI Industries, Inc., Apalachin, NY 13732 607-754-5800
§† MTE Corp., Menomonee Falls, WI 53051 414-253-8000
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ S & H Inds., Hatfield, PA 19440 215-822-7211
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
§ Shape Electronics, Inc., Lombard, IL 60148 708-620-8394
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 708-439-2800
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 213-316-9984
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Filament-5600

† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2200
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Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... A•2233
Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525 ..... A•2235
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2242
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2280,2287
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
† Oram High Voltage, Dayton, TX 77535, 409-258-5553 ..... D•1917
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 .... A•2317
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2324-2326,2328-2329
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2414-2419
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
† Transformer Technologies, Inc., Mt. Vernon, NY 10550, 914-668-1600 ... A•2453
† Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622 ..... D•2108-2109
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
Custom Coils Inc., Alcester, SD 57001 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Epco Products Inc., Wallkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Chappaqua, NY 10514 914-238-9057
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Precision Components, Inc., Addison, IL 60101 312-543-6400
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§ Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Flyback-5600

† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040 ..... A•2191
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462/3487 ..... A•2202
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2227
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
Magnetab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2264-2265
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Codi Semiconductor, Kenilworth, NJ 07033 201-298-0400
Custom Coils Inc., Alcester, SD 57001 605-934-2460
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electronetics, Inc., Everett, WA 98204 206-355-1855
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
GC International Inc., Richardson, TX 75085-1198 214-234-3240
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Nedap N.V., Groenlo, HOLLAND 7140 AA ..... +31-5440-71111
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Texas Transformer Corp., Plano, TX 75086 214-424-1581
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
Video Display Corp., Tucker, GA 30084 404-938-2080,800241-5005
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
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Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... A•2158,2161
Avel-Lindberg Inc., New Milford, CT 06776, 203-355-4711 ..... A•2176-2177
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ..... A•2182
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423, 716-538-4421 ..... A•2189
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2200
§† Electromech, Inc., Kearny, NJ 07032, 201-997-0950 ..... A•2208-2209
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 .. A•2212-2213,2222,2224-2225
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2227
† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2242
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2250
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
Magnetab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2259,2263
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2264
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2276

§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... **A•2287-2288**
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... **A•2306**
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300** ..... **A•2314-2315**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ..... **B•1938**
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 .... **A•2317**
† **PCA Electronics, Sepulveda, CA 91343, 818-892-0761** ..... **A•2320**
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... **A•2330**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2333**
Piltron, Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... **A•2368-2369**
† **Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700** ..... **A•2371**
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... **A•2375-2377**
† **Signal Transformer Co., Inc., Inwood, NY 11696, 516-239-5777** ..... **A•2392**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244** ..... **A•2414-2419**
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Torelco, Inc., Irvington, NJ 07111, 201-374-8641 ..... **A•1278**
† **Toroid Corp. of Maryland, Salisbury, MD 21801, 301-860-0300** ..... **A•2442**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•2448-2449,2451**
Tortran Inc., Bridgeport, CT 06608, 203-367-5188 ..... **A•2447**
† **Transformer Technologies, Inc., Mt. Vernon, NY 10550, 914-668-1600** ... **A•2453**
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... **A•2454-2457**
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... **A•2458**
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
† American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
Astrosystems, Lake Success, NY 11042 516-328-1600
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Bicron Electronics, Canaan, CT 06018 203-824-5125
Custom Coils Inc., Alcester, SD 57001 605-934-2460
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Elnetic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
Epco Products Inc., WAlkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
GAR Enterprises dba KGS Electronics, Pasadena, CA 91103 818-798-0785
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† MLI Industries, Inc., Apalachin, NY 13732 607-754-5800
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
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† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oram High Voltage, Dayton, TX 77535 409-258-5553
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Performance Controls, Inc., Horsham, PA 19044 215-675-6500
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§† Staco Energy Products Co., Dayton, OH 45403 513-253-1191
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
§† Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, High Voltage (1,000 Volts & Over)-5600

Aibar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... **A•2152**
APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... **A•2168**
Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... **B•1883**
† **C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540** ..... **A•2188**
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423, 716-538-4421 ..... **A•2189**
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•2190**
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 .... **D•2185**
† **Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040** ..... **A•2192-2193**
§ **CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518** ..... **A•2194**
Custom Coils Inc., Alcester, SD 57001, 605-934-2460 ..... **A•2197**
† **Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000** ..... **A•2200**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462/3487 ..... **A•2203**
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... **A•2219**
† **Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207** ..... **A•2227**
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... **A•2231-2233**
§ **Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525** ..... **A•2235**
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ... **A•2242,2244**
† **Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900** ..... **A•2250**
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... **A•2253**
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... **A•2259**
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... **A•2272**
§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... **A•2289**
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... **A•2307**
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300** ..... **A•2314-2315**
† **Oram High Voltage, Dayton, TX 77535, 409-258-5553** ..... **D•1917**
† **Pearson Electronics, Inc., Palo Alto, CA 94303, 415-494-6444** ..... **A•2332**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2333**
† **Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686** ..... **D•2049**
Torelco, Inc., Irvington, NJ 07111, 201-374-8641 ..... **A•1278**
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300
American Magnetics, Carterville, IL 62918 618-985-4838
American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† Aydin Corp., Horsham, PA 19044 215-657-7510
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Chappaqua, NY 10514 914-238-9057
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
ISOREG Corp., Littleton, MA 01460 508-486-9483
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
§ Micron Industries, Hillside, IL 60162 708-547-0900
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
Nedap N.V., Groenlo, HOLLAND 7140 AA ..... +31-5440-71111
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710

Osco Corp., Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, Detroit, MI 48203 313-468-9410
† Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
Phenix Technologies, Accident, MD 21520 301-746-8118
† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
§† Powertron Corp., Sparta, NJ 07871 201-579-5599
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44117 800-245-4501
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Rutherford Research, Rutherford, NJ 07070 201-933-2091
§ S & H Inds., Hatfield, PA 19440 215-822-7211
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
Simco Co., Hatfield, PA 19440 215-822-2171
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§ Square D Co., Palatine, IL 60067 708-397-2600
Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0614
† Technitrol, Philadelphia, PA 19134 215-426-9105
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Universal Voltronics Corp, Thermedics Inc./ThermoElctron Corp., Mt. Kisco, NY 10549 914-241-1300
Valor Electronics, San Diego, CA 92121-2245 619-458-1471
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Horizontal Sweep-5600

GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2266,2272,2276
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2383
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521

Transformers, Hybrid-5600

APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2168-2169
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178,2180
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•2198
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462/3487 ..... A•2201-2202,2204
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2288,2292
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... A•2300
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2307
† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 ..... A•2317
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2376
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Custom Coils Inc., Alcester, SD 57001 605-934-2460
Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
§ James Electronics, Chicago, IL 60618 312-463-6500
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
PC Transformer Corp., West Babylon, NY 11704 516-491-3300
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Texas Transformer Corp., Plano, TX 75086 214-424-1581
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
† Werlatone, Inc., Brewster, NY 10509 914-279-6187
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Transformers, IF-5600

† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 ..... A•2195
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... A•2391
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
APX-Arstan Products, Hicksville, NY 11801 516-433-1313
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
† C & C Jetronic, Inc., Princeton, NJ 08540 609-921-8540
Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coilcraft, Cary, IL 60013 708-639-2361
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
GC International Inc., Richardson, TX 75085-1198 214-234-3240
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
International Microelectronics, Arlington, TX 76003 817-561-2244
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
MicroSignals Inc., LIC, NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
† Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Multi Products International, West Paterson, NJ 07424 201-890-1344
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
PC Transformer Corp., West Babylon, NY 11704 516-491-3300
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Transformers, Input-5600

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2186
† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2212
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2242
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2297
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... A•2300
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 ..... A•2317
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2328,2331
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2450-2451
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Custom Coils Inc., Alcester, SD 57001 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681

Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp, Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Precision Power Systems, Longmont, CO 80501 303-443-6250
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Schott Corp., Wayzata, MN 55391 612-475-1173
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535

Transformers, Instrument-5600

† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-341-3630 ..... A•2134
Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501, 213-328-0060;310-328-0060 ..... A•2150-2151
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2159,2162-2165
§† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2186
Calex Mfg. Co., Inc., Pleasant Hill, CA 94523, 510-932-3911 ..... D•1646
† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
§ CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 ..... A•2194
§† Electromech, Inc., Kearny, NJ 07032, 201-997-0950 ..... A•2208-2209
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2212
Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235, 614-889-6152 ..... A•2228
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711 ..... D•1289
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
Magnetab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253,2257
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2271,2276
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2281-2284,2288-2289,2293
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... A•2300
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2306
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ..... B•1938
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 .... A•2317
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2324,2328-2329
† Pearson Electronics, Inc., Palo Alto, CA 94303, 415-494-6444 ..... A•2332
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Plitron, Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... A•2368-2369
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1254
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 .... A•2422-2423
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
† Toroid Corp. of Maryland, Salisbury, MD 21801, 301-860-0300 ..... A•2442,2444-2445
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
Tortran Inc., Bridgeport, CT 06608, 203-367-5188 ..... A•2447
† Transformer Technologies, Inc., Mt. Vernon, NY 10550, 914-668-1600 ... A•2453
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... A•2454-2457
§ Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... A•2459-2460,2463
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
Andover, Inc., Lafayette, IN 47904 317-447-1157
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-284-9425;414-377-7040
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Custom Coils Inc., Alcester, SD 57001 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
Electronetics, Inc., Everett, WA 98204 206-355-1855
Electronic Coil Corp., Bloomfield, CT 06002 203-243-5233
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
Esterline Angus Instrument Corp., Indianapolis, IN 46224 317-244-7611
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont, CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109 ... 815-397-7070
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
Ion Physics Co., Atkinson, NH 03811 603-893-6687
§ James Electronics, Chicago, IL 60618 312-463-6500
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-796-0786
§ Larson Instrument, Orangeburg, NY 10962 914-359-3800
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Perkin-Elmer Corp., Elctrn. Prods. Dept, Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
§ Square D Co., Palatine, IL 60067 708-397-2600
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Vemitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
§ Western Electro-Mechanical Co., Inc., Oakland, CA 94607 415-452-1936
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Transformers, Interface & Coupling-5600

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... A•2238
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2269

Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... **A•2300**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•2451**
Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... **A•2462**
Custom Coils Inc., Alcester, SD 57001 605-934-2460
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
§ Schaffner EMC, Inc. Components Division, Union, NJ 07083 ..... 908-851-0664; 800-367-5566
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Valor Electronics, San Diego, CA 92121-2245 619-458-1471
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181

Transformers, Interstage-5600

§ **AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;in Can.: 1-800-553-2448** ..... **A•2172**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•2178**
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1172**
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•2190**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•2211**
† **EWC, Inc., Englishtown, NJ 07726, 908-446-3110** ..... **A•2212**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... **A•2237**
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... **A•2253**
§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... **A•2297**
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... **A•2331**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2333**
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2414-2419
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... **A•2427**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•2448,2450-2451**
American Magnetics, Canterville, IL 62918 618-985-4838
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6186
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
International Microelectronics, Arlington, TX 76003 817-561-2244
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
Mouser Electronics, Mansfield, TX 76063 800-346-6873
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Renco Electronics, Inc., Deer Pk, NY 11729 ..... 516-586-5566;1-800-645-5828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762

Transformers, Inverter-5600

Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010 ..... **D•2149**
Alber, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... **A•2152**
† **Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660** ..... **A•2174**
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•2178**
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... **A•2184-2185**
† **Bicron Electronics, Canaan, CT 06018, 203-824-5125** ..... **A•2186**
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1172**
† **C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540** ..... **A•2188**
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•2190**
† **Endicott Research Group, Endicott, NY 13760, 607-754-9187** ..... **B•1066-1067, 1151**
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... **A•2242**
† **Magnecomp, Inc., Pickens, SC 29671, 803-878-4700** ..... **A•2252**
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... **A•2253**
§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... **A•2280**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2333**
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... **A•2371**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•2385-2389**
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ..... **A•2422**
§ **Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790** ..... **A•2427**
Torelco, Inc., Irvington, NJ 07111, 201-374-3641 ..... **A•1276**
† **Toroid Corp. of Maryland, Salisbury, MD 21801, 301-860-0300** ..... **A•2442**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•2448,2451**
† **Transformer Technologies, Inc., Mt. Vernon, NY 10550, 914-668-1600** ..... **A•2453**
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
Amecon, Inc., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292
† American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Axel Electronics, Inc., Jamaica, NY 11413 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5086
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 ..... 414-284-9425;414-377-7040
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Datatronics, Inc., Romoland, CA 92380 714-928-7700
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Energy, Ltd., Bladensburg, MD 20710 301-699-1144
Epco Products Inc., Wallkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
† JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp, Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Schott Corp., Wayzata, MN 55391 612-475-1173
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814

Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
Valor Electronics, San Diego, CA 92121-2245 619-458-1471
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Isolation-5600

Abacus Controls Inc., Somerville, NJ 08876, 908-526-6010 ..... D•2149
† Abbott Technologies, Inc. Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501, 213-328-0060;310-328-0060 ..... A•2150
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1653
APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2168
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;in Can.: 1-800-553-2448 ..... A•2171
§ Avel-Lindberg Inc., New Milford, CT 06776, 203-355-4711 ..... A•2176-2177
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178,2180
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•2184-2185
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2186-2187, B•1883
† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2186,2188
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040 ..... A•2192
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0160, 605-665-9301 ..... A•2198
† Dei Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2200
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•2206-2207
§† Electromech, Inc., Kearny, NJ 07032, 201-997-0950 ..... A•2208-2209
Enegren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ..... A•2210
§† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 .. A•2212,2217-2218,2222,2224
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§ Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525 ..... A•2235
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•2237
† JBM Electronics, Inc., Bedford, NH 03110-6602, 603-623-0222 ..... A•2239
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† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2248-2249
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2250
Magnetab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253
§ Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2263
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2265
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§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2282,2286-2290,2292,2297
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... A•2300
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
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† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310-2312
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
§ Opamp Labs, Inc., Los Angeles, CA 90038, 213-934-3566 ..... D•1014
† Oram High Voltage, Dayton, TX 77535, 409-258-5553 ..... D•1917
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ..... A•2316
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PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•2319
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Pilkor, Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... A•2368-2369
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2385-2389
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2412-2413
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2414-2419
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ..... A•2422
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-636-1790 ..... A•2427
† Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2438,2440
† Toroid Corp. of Maryland, Salisbury, MD 21801, 301-860-0300 ..... A•2442-2446
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2450-2451
† Transformer Technologies, Inc., Mt. Vernon, NY 10550, 914-668-1600 ... A•2453
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... A•2454-2457
§† Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... A•2460-2461,2463
† Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083, 619-727-0940 ..... D•2232-2233
† ACD-Elcor Products, Bethel, CT 06801 203-743-3510
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
Astrosystems, Lake Success, NY 11042 516-328-1600
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Caristrap International, Inc., Chomedey, Lavac, QUEBEC, CANADA H7SIN8 514-667-4700
Carson Manufacturing Co., Inc., Indianapolis, IN 46220 317-257-3191
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Dantel, Fresno, CA 93727 209-292-1111
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dymec Inc., Winchester, MA 01890 617-729-7870
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electro-Mech Co., Colorado Springs, CO 80915 719-597-1620
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
§ Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
Epco Products Inc., Wallkill, NY 12589 914-895-2033
EPE Technologies, Inc., Subsidiary of Merlin Gerin, Costa Mesa, CA 92626 714-557-1636
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6661
GAR Enterprises dba KGS Electronics, Pasadena, CA 91103 818-798-0785
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Chappaqua, NY 10514 914-238-9057
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
ISOREG Corp., Littleton, MA 01460 508-486-9483
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
§ Katronic Elektronic Ges.m.b.H., AUSTRIA 04762-5340
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
Long Island Transformer & Inductor Company, Inc., Baldwin, NY 11510 516-766-5644
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
§ Micron Industries, Hillside, IL 60162 708-547-0900
§ MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
Phenix Technologies, Accident, MD 21520 301-746-8118
† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
Power Conversion Products, Crystal Lake, IL 60014 815-459-9100
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Precision Components, Inc., Addison, IL 60101 312-543-6400
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Rutherford Research, Rutherford, NJ 07070 201-933-2091
Sanford-Miller Corp., Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900
Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
Schott Corp., Wayzata, MN 55391 612-475-1173

Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
Sencore, Sioux Falls, SD 57107 ..... 1-800-736-2673; 605-339-0100
§ Shape Electronics, Inc., Lombard, IL 60148 708-620-8394
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 708-439-2800
§ Square D Co., Palatine, IL 60067 708-397-2600
§† Square D Co. Power Protection Systems, San Diego, CA 92123-1165 ... 619-279-0831
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
† Stangenss Industries, Inc., Palo Alto, CA 94303 415-493-0814
Sutton Designs, Inc., Ithaca, NY 14850 800-326-8119
† Technitrol, Philadelphia, PA 19134 215-426-9105
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., Plano, TX 75086 214-424-1581
† Thinco Div., Hull Corp., Hatboro, PA 19040 215-672-7800
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
† TTE, Incorporated, W. Los Angeles, CA 90064 213-478-8224
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Universal Voltronics Corp, Thermedics inc./ThermoElctron Corp., Mt. Kisco, NY 10549 914-241-1300
Valor Electronics, San Diego, CA 92121-2245 619-458-1471
Vector-VIZ Instrument Div. of The Vector Grp., Inc., Newburgh, NY 12550 800-627-0943
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
Vynckier, Inc., Hawthorne, NY 10532 714-896-0772
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.: 1-800-553-2448 ..... A•2171
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BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•2184-2185
† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
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§† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2248-2249
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† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2311
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§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
§† Valor Electronics, San Diego, CA 92121-2245, 619-458-1471 ..... A•1606
§† Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... A•2461
American Monarch, Minneapolis, MN 55421 612-788-9161
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Epco Products Inc., Wallkill, NY 12589 914-895-2033
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
§ Nano Pulse Industries, Brea, CA 92670 714-529-2600
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
§ Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Sutton Designs, Inc., Ithaca, NY 14850 800-326-8119
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
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APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2168-2169
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.: 1-800-553-2448 ..... A•2173
§ Avel-Lindberg Inc., New Milford, CT 06776, 203-355-4711 ..... A•2175-2177
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† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2186, B•1663
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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 .... D•2185
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Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2248
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2250-2251
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253,2256-2257
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2264
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2270-2271,2276
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ... A•2280,2288,2290
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 .... A•2317
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2324-2325,2327-2330
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... A•2391
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2412-2413
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2414-2419
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ..... A•2422
§ Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2438,2440
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Valor Electronics, San Diego, CA 92121-2245, 619-458-1471 ..... A•1606
Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... A•2459-2460
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
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† American Monarch, Minneapolis, MN 55421 612-788-9161
† Avionic Instruments, Avenel, NJ 07001 908-382-7100
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Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
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Dantel, Fresno, CA 93727 209-292-1111
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
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† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
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L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
§ Micron Industries, Hillside, IL 60162 708-547-0900
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
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MultiComp., Inc., Beaverton, OR 97006 503-626-4200
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† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Precision Components, Inc., Addison, IL 60101 312-543-6400
† Precision Power Systems, Longmont, CO 80501 303-443-6250
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Quam-Nichols Co., Chicago, IL 60637 312-488-5800
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Relay Specialties, Oakland, NJ 07436 201-337-1000
Shape Electronics, Inc., Lombard, IL 60148 708-620-8394

Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ..... 516-957-8700; 800-645-5516
§ Square D Co., Palatine, IL 60067 708-397-2600
§† Square D Co. Power Protection Systems, San Diego, CA 92123-1165 ... 619-279-0831
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

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† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2186
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† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2450-2451
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† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
Amecon, Inc., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292
† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
† Aydin Corp., Horsham, PA 19044 215-657-7510
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† C & C Jetronic, Inc., Princeton, NJ 08540 609-921-8540
Coilcraft, Cary, IL 60013 708-639-2361
Cross Electronics, Warrendale, PA 15086 412-776-1591
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
Tokin America, Inc., San Jose, CA 95134 408-432-8020
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040 ..... A•2191
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† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310-2311
§ Panduit Corp., Tinley Park, IL 60477-0981, 800-777-3300 ..... C•1802
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† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
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Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
Amplifier Research, Souderton, PA 18964-9990 215-723-8181
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6186
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
Computer System Products, Minneapolis, MN 55447 ..... 612-476-6866;800-422-2537
Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 708-455-8830
§ Cooper Industries/Belden Div., Richmond, IN 47375 .... 317-983-5200;800-BELDEN-1
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Dantel, Fresno, CA 93727 209-292-1111
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc:Plant Locations, Gardena, CA 90247 213-515-1546
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
LH. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
† JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
§ Leviton Telcom, Leviton Manufacturing, Bothell, WA 98021-4416 ..... 206-485-4288; 206-486-2222
Long Island Transformer & Inductor Company, Inc., Baldwin, NY 11510 516-766-5644
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
Mag-Con, St. Paul, MN 55113 612-633-8820

† Magnecomp, Inc., Pickens, SC 29671 ... 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 ... 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 ... 408-757-8752
† Magnetic Component Engineering Co., Culver City, CA 90230 ... 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
§ MG Electronics, Hauppauge, NY 11788 ... 516-582-3400
MicroSignals Inc., LI.C., NY 11101 ... 718-937-7955;718-937-0391;800-648-2252
Mitchell Electronics Corp., Mt. Vernon, NY 10552 ... 914-699-3800
† MTE Corp., Menomonee Falls, WI 53051 ... 414-253-8200
§ Multi Products International, West Paterson, NJ 07424 ... 201-890-1344
† Northlake Engineering, Inc., Antioch, IL 60002 ... 708-395-5710
Oeco Corp., Milwaukie, OR 97222 ... 503-659-7932
Olektron Corp., Signal Technology Corp., Webster, MA 01570 ... 508-943-7440
† Onan Power/Electronics, Minneapolis, MN 55344 ... 612-943-4600
† Osborne Transformer, Detroit, MI 48203 ... 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 ... 1-800-325-0501
§ Palomar Engineers, Escondido, CA 92033 ... 619-747-3343
PC Transformer Corp., West Babylon, NY 11704 ... 516-491-3300
Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 ... 203-762-4756
§ Philmore Manufacturing, Rockford, IL 61125-1386 ... 815-229-7773
† Piconics, Incorporated, Tyngsboro, MA 01879 ... 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
† Precision Components, Inc., Addison, IL 60101 ... 312-543-6400
† PTC Transformers, Bordentown, NJ 08505 ... 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
Rhombus Industries, Huntington Bch., CA 92649-1595 ... 714-898-0960
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 ... 215-489-3700
† Sabre Communications Corp., Sioux City, IA 51102 ... 712-258-6690
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
Servo Corporation of America, Hicksville, NY 11802-9907 ... 516-938-9700
§ Sescom, Inc., Henderson, NV 89015-4249 ... 702-565-3400
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
§ Shure Brothers Inc., Evanston, IL 60202-3696 ... 708-866-2200
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
§ Sitco Antennas Div.of Simplicity Tool Corp., Portland, OR 97220 ... 503-253-2000
§† Skyway Magnetics, Warner Springs, CA 92086 ... 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ... 516-957-8700; 800-645-5516
§ Sprague Fil-Mag, San Diego, CA 92111-1416 ... 619-569-6577
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 ... 618-262-5555
§ Terminal Data Corp., Rockville, MD 20855 ... 301-921-8282
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 ... 618-262-5121
Tokin Magnetics, Inc., Fremont, CA 94539 ... 415-490-7500
§ Toko America, Inc., Mt. Prospect, IL 60056 ... 708-297-0070
† Torema U.S.A., Inc., Houston, TX 77042 ... 713-977-2500
† Torotron Corp., Mt. Vernon, NY 10550 ... 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
† TTE, Incorporated, W. Los Angeles, CA 90064 ... 213-478-8224
Unadilla Antenna Mfg. Co., Andover, MA 01810 ... 508-475-7831
United Technologies Control Systems, Logansport, IN 47401 ... 219-747-6142
† Vanguard Electronics Co., Gardena, CA 90248 ... 213-323-4100
§ Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
Western Multiplex Corp., Belmont, CA 94002 ... 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 ... 602-254-1570
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 ... 607-729-6318
Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 ... 415-968-9176

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† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ... A•2174
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† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ... A•2248
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§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ... A•2282,2287,2289,2292-2298
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† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ... A•1753
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† B. G. Laboratories, Inc., Binghamton, NY 13904 ... 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 ... 714-781-5148
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
Electromech, Inc., Kearny, NJ 07032 ... 201-997-0950
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† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 ... 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 ... 201-942-2222
§† Gowanda Electronics Corp., Gowanda, NY 14070 ... 716-532-2234
Grand Transformers, Inc., Grand Haven, MI 49417 ... 616-842-5430
† ILC Data Device Corp., Bohemia, NY 11716-2482 ... 516-567-5600
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† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
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† Bourns Instruments Inc., Riverside, CA 92507 ... 714-781-5148
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
§ Direct Sound Corporation, New York, NY 10011 ... 212-691-9050
Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
Electronetics, Inc., Everett, WA 98204 ... 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 ... 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 ... 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 ... 201-942-2222
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
§ James Electronics, Chicago, IL 60618 ... 312-463-6500
Lenco Elctrns., Inc., McHenry, IL 60050 ... 815-344-2900
§ Magnetek Triad, Huntington, IN 46750 ... 219-356-7100
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
Multi Products International, West Paterson, NJ 07424 ... 201-890-1344

§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
§ Paso Sound Products, Pelham, NY 10803 914-738-4800
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§ Sascom, Inc., Henderson, NV 89015-4249 702-565-3400
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535

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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
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§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2280
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† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
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North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2311
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
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American Magnetics, Carterville, IL 62918 618-985-4838
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
GC International Inc., Richardson, TX 75085-1198 214-234-3240
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
§ James Electronics, Chicago, IL 60618 312-463-6500
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† TTE, Incorporated, W. Los Angeles, CA 90064 213-478-8224
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535

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Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
LH. Frost Limited, Oakville,Ont, CANADA L6H 2R4 416-844-6681
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
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§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
LH. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ James Electronics, Chicago, IL 60618 312-463-6500
† Lence Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
§† Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Schott Corp., Wayzata, MN 55391 612-475-1173
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178
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† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... A•2391
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† Toroid Corp. of Maryland, Salisbury, MD 21801, 301-860-0300 ..... A•2442
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Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
LH. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248

GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Precision Components, Inc., Addison, IL 60101 312-543-6400
† Precision Power Systems, Longmont, CO 80501 303-443-6250
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
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Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Epco Products Inc., WAllkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
LH. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Chappaqua, NY 10514 914-238-9057
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
§† Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Universal Voltronics Corp, Thermedics Inc./ThermoElctron Corp., Mt. Kisco, NY 10549 914-241-1300
Walker Power, Inc., Warner, NH 03278 603-456-3111
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
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§ Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900 ..... D•1618-1619
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2185,2187
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† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2250-2251
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197 ..... D•1891
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253-2257
§ Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2261-2263
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2264-2265
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2266,2268-2270,2274-2276
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2278,2280-2285,2287-2288,2290,2296,2298
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2306
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2307
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310-2311
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315, D•1915
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ..... A•2316
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 .... A•2317
PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•2321-2322
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 .... A•2324-2330
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Plitron, Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... A•2368-2369
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714, 714-975-1222 ..... D•1975
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2372-2374,2383

Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•2385-2389**
† **Shogyo International Corp., Great Neck, NY 11021, 516-466-0911** ..... **A•2391**
† **Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777** ..... **A•2392**
§† **Staco Energy Products Co., Dayton, OH 45403, 513-253-1191** ..... **A•2412-2413**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244** ..... **A•2414-2419**
§ **Superior Electric, Bristol, CT 06010, 203-582-9561** ..... **A•2421**
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ..... **A•2422-2423**
§ **Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790** ..... **A•2427**
§† **Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400** ..... **A•2438-2440**
Toreico, Inc., Irvington, NJ 07111, 201-374-8641 ..... **A•1278**
† **Toroid Corp. of Maryland, Salisbury, MD 21801, 301-860-0300** ..... **A•2442-2446**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•2448-2449,2451**
Tortran Inc., Bridgeport, CT 06608, 203-367-5188 ..... **A•2447**
† **Transformer Technologies, Inc., Mt. Vernon, NY 10550, 914-668-1600** ..... **A•2453**
† **Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622** ..... **D•2108-2109**
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... **A•2454-2457**
Valor Electronics, San Diego, CA 92121-2245, 619-458-1471 ..... **A•1606**
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... **A•2458**
§† **Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535** ..... **A•2463**
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Avionic Instruments, Avenel, NJ 07001 908-382-7100
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Carson Manufacturing Co., Inc., Indianapolis, IN 46220 317-257-3191
§ C-COR Elctrns., State College, PA 16801 ..... 814-238-2461;800-233-2267
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coilcraft, Cary, IL 60013 708-639-2361
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
§ CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026 314-343-8518
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
† Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electro-Mech Co., Colorado Springs, CO 80915 719-597-1620
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
§ Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., Danville, VA 24541 804-792-6405
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
Epco Products Inc., Wallkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Golden Pacific Electronics, Inc, Placentia, CA 92670 714-993-6970
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Chappaqua, NY 10514 914-238-9057
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
International Microelectronics, Arlington, TX 76003 817-561-2244
ISOREG Corp., Littleton, MA 01460 508-486-9483
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
Long Island Transformer & Inductor Company, Inc., Baldwin, NY 11510 516-766-5644
MACROAMP Inc., Ukiah, CA 95482 707-462-2222
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
§ Micron Industries, Hillside, IL 60162 708-547-0900
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 ..... 503 659 7932
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
Oram High Voltage, Dayton, TX 77535 409-258-5553
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
§† Powertron Corp., Sparta, NJ 07871 201-579-5599
† Precision Components, Inc., Addison, IL 60101 312-543-6400
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Sanford-Miller Corp., Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900
Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
† Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
§ Shape Electronics, Inc., Lombard, IL 60148 708-620-8394
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
SinoTECH, Technology Communications Group, Inc., West Linn, OR 97068 503-636-1000
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Square D Co., Palatine, IL 60067 708-397-2600
§† Square D Co. Power Protection Systems, San Diego, CA 92123-1165 619-279-0831
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
Sutton Designs, Inc., Ithaca, NY 14850 800-326-8119
† Technitrol, Philadelphia, PA 19134 215-426-9105
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Universal Voltronics Corp, Thermedics Inc./ThermoElctron Corp., Mt. Kisco, NY 10549 914-241-1300
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
Walker Power, Inc., Warner, NH 03278 603-456-3111
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501, 213-328-0060;310-328-0060 ..... **A•2150-2151**
American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... **A•2167**
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ..... **A•2192**
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423, 716-538-4421 ..... **A•2189**
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... **D•2185**
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... **A•2206-2207**
Electromech, Inc., Kearny, NJ 07032, 201-997-0950 ..... **A•2208-2209**
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... **A•2229**
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... **A•2232**
§ **Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525** ..... **A•2235**
Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... **A•2252**
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... **A•2261-2263**
Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... **A•2265**
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... **A•2269,2274,2276**
Oram High Voltage, Dayton, TX 77535, 409-258-5553 ..... **D•1917**
PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... **A•2321**
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... **A•2372,2374**
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... **A•2392**
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... **A•2438-2439**
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 919-738-1121
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100

Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
EWC, Inc., Englishtown, NJ 07726 908-446-3110
GC International Inc., Richardson, TX 75085-1198 214-234-3240
§ Golden Pacific Electronics, Inc, Placentia, CA 92670 714-993-6970
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
ISOREG Corp., Littleton, MA 01460 508-486-9483
Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Precision Power Systems, Longmont, CO 80501 303-443-6250
§ Square D Co., Palatine, IL 60067 708-397-2600
§† Square D Co. Power Protection Systems, San Diego, CA 92123-1165 ... 619-279-0831
§† Staco Energy Products Co., Dayton, OH 45403 513-253-1191
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Texas Transformer Corp., Plano, TX 75086 214-424-1581
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
Walker Power, Inc., Warner, NH 03278 603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940

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† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501, 213-328-0060;310-328-0060 ..... A•2150-2151
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2159,2161-2165
American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... A•2167
APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2169
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.: 1-800-553-2448 ..... A•2171-2173
Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900 ..... D•1619
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
§ Avel-Lindberg Inc., New Milford, CT 06776, 203-355-4711 ..... A•2175-2177
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178-2179
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•2184-2185
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2186-2187
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172
§ C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
 # CCP/Technical Devices, Dayton, OH 45414, 513-890-7881 ..... D•1649
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040 ..... A•2191-2193
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 ..... A•2194
Custom Coils Inc., Alcester, SD 57001, 605-934-2460 ..... A•2197
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•2198
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462/3487 ..... A•2201-2202,2204
§† Electromech, Inc., Kearny, NJ 07032, 201-997-0950 ..... A•2208-2209
§† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2212-2217,2224
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2227
§ Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... A•2229
† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 ..... A•2241
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2242,2246-2247
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2250
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2253,2256
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2264-2265
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2266-2268,2271-2273,2276
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2281-2289,2292-2298
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... A•2300
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2307
† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2311
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 .... A•2317
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2324,2326-2328,2331
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2373,2375-2383
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2385-2389
§ Schaffner EMC, Inc. Components Division, Union, NJ 07083, 908-851-0664;800-367-5566 ..... A•1634-1637
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... A•2391
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2414-2419
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1266
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2439
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448-2451
Tortran Inc., Bridgeport, CT 06608, 203-367-5188 ..... A•2447
Transformer Technologies, Inc., Mt. Vernon, NY 10550, 914-668-1600 ... A•2453
† Transistor Devices, Inc., Randolph, NJ 07869, 201-361-6622 ..... D•2108-2109
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... A•2454-2457
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2458
§† Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... A•2459
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
Computer Components, Inc., Pelham, NY 10803 914-738-1611
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Dantel, Fresno, CA 93727 209-292-1111
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Eichhoff Electronics, Warwick, RI 02886 ..... 401-738-1440;800-678-1040
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Everett, WA 98204 206-355-1855
Electronic Coil Corp., Bloomfield, CT 06002 203-243-5233
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., Danville, VA 24541 804-792-6405
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
§ Golden Pacific Electronics, Inc, Placentia, CA 92670 714-993-6970
§† Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
International Microelectronics, Arlington, TX 76003 817-561-2244
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
Long Island Transformer & Inductor Company, Inc., Baldwin, NY 11510 516-766-5644
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
† MLI Industries, Inc., Apalachin, NY 13732 607-754-5800
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Onan Power/Electronics, Minneapolis, MN 55344 612-943-4600
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Precision Components, Inc., Addison, IL 60101 312-543-6400
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577

Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051. ... 414-253-8200
† TTE, incorporated, W. Los Angeles, CA 90064 213-478-8224
§† Valor Electronics, San Diego, CA 92121-2245 619-458-1471
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
Xylog Corp., Hackensack, NJ 07601 201-489-4040
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Transformers, Programmable Ratio-5600

MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... **A•2307**
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... **A•2333**
Astrosystems, Lake Success, NY 11042 516-328-1600
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
Ryan International Corp., Columbus, OH 43229-6207 614-885-3303
Staco Energy Products Co., Dayton, OH 45403 513-253-1191

Transformers, Pulse-5600

Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501, 213-328-0060;310-328-0060 ..... **A•2150-2151**
APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... **A•2168-2169, D•1597**
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.: 1-800-553-2448 ..... **A•2173**
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... **A•2174**
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772 ..... **D•1222**
§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... **A•2178-2180**
† BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... **A•2184-2185**
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... **A•2186, B•1883**
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1172**
§ C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... **A•2188**
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423, 716-538-4421 ..... **A•2189**
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... **A•2190**
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040 ..... **A•2191**
† Dei Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000 ..... **A•2200**
Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... **A•1205**
Engren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ..... **A•2210**
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... **A•2211**
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... **A•2212**
† Fernwood Transformer Co., Translator Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... **A•2227**
† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... **A•2234**
† JBM Electronics, Inc., Sedford, NH 03110-6802, 603-623-0222 ..... **A•2238-2239**
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... **A•2248**
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... **A•2252**
Magnetek, Boulder, CO 80301-4696, 303-442-5700 ..... **A•2253,2256**
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... **A•2264-2265**
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... **A•2266,2270,2276**
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... **A•2280**
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... **A•2300**
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3600 ..... **A•2306**
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... **A•2307**
§† PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... **A•2320**
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... **A•2331**
† Pearson Electronics, Inc., Palo Alto, CA 94303, 415-494-6444 ..... **A•2332**
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... **A•2333**
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... **A•2371**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•2385-2389**
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... **A•2392**
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... **A•2427**
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... **A•2458**
§† Vitec Electronics Corp., Visalia, CA 93291, 209-651-1535 ..... **A•2459-2460,2463**
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
Amplifier Research, Souderton, PA 18964-9990 215-723-8181
Andover, Inc., Lafayette, IN 47904 317-447-1157
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0160 605-665-9301
Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
† Elnetic Electronics, Inc.:Plant Locations,'Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† I.C Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† Ion Physics Co., Atkinson, NH 03811 603-893-6687
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
MicroSignals Inc., LIC, NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Nano Pulse Industries, Brea, CA 92670 714-529-2600
Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Oaco Corp., Milwaukie, OR 97222 503-659-7932
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Picosecond Pulse Labs, Inc., Boulder, CO 80306 303-443-1249
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Precision Components, Inc., Addison, IL 60101 312-543-6400
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-7274
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
§ Schaffner EMC, Inc. Components Division, Union, NJ 07083 ..... 908-851-0664; 800-367-5566
† Schott Corp., Wayzata, MN 55391 612-475-1173
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Simmonds Precision Engine Systems, BF Goodrich Aerospace, Norwich, NY 13815 607-335-5000
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
† Technitrol, Philadelphia, PA 19134 215-426-9105
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Transformer Technologies, Inc., Mt. Vernon, NY 10550 914-668-1600
§† Valor Electronics, San Diego, CA 92121-2245 619-458-1471
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Ratio-5600

† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2270,2276
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2280
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2385-2389
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
† JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Ryan International Corp., Columbus, OH 43229-6207 614-885-3303
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743 813-347-2181

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APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2169
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178-2179
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1187
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449, 716-652-3600 ..... A•1205
Elcom Systems, Inc., Boca Raton, FL 33487, 407-994-1774 ..... A•1747
Enegren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ..... A•2210
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2212
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2227
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2248-2249
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2275
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2385-2386,2388-2389
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... A•2391
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Amplifier Research, Souderton, PA 18964-9990 215-723-8181
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4 613-226-5772
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Datatronics, Inc., Romoland, CA 92380 714-928-7700
Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electro Impulse, Neptune, NJ 07754-0278 908-776-5800
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
Multi Products International, West Paterson, NJ 07424 201-890-1344
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., Plano, TX 75086 214-424-1581
† Thinco Div., Hull Corp., Hatboro, PA 19040 215-672-7800
Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† TTE, Incorporated, W. Los Angeles, CA 90064 213-478-8224
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
§† Valor Electronics, San Diego, CA 92121-2245 619-458-1471
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
† Werlatone, Inc., Brewster, NY 10509 914-279-6187
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
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† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
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§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
† Toroid Corp. of Maryland, Salisbury, MD 21801, 301-860-0300 ..... A•2442,2445-2446
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
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Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
ACD-Elcor Products, Bethel, CT 06801 203-743-3510
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
§† Bendix Electric Power Division, Allied Signal Aerospace, Eatontown, NJ 07724 201-542-2000
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
Controlled Power Co., Troy, MI 48083 ..... 313-528-3700;1-800-521-4792
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Epco Products Inc., WAllkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222

L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
§ Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Chappaqua, NY 10514 914-238-9057
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
§ Liberty International Corp., Torrance, CA 90501 213-539-6452
Long Island Transformer & Inductor Company, Inc., Baldwin, NY 11510 516-766-5644
MACROAMP Inc., Ukiah, CA 95482 707-462-2222
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† MagneTek Defense Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Pacific Scientific, Electro Kinetics Division, Santa Barbara, CA 93101 805-963-2055
† Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Precision Components, Inc., Addison, IL 60101 312-543-6400
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
§ S & H Inds., Hatfield, PA 19440 215-822-7211
Sanford-Miller Corp., Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900
Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
Schott Corp., Wayzata, MN 55391 612-475-1173
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
Staco Energy Products Co., Dayton, OH 45403 513-253-1191
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
Walker Power, Inc., Warner, NH 03278 603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940
Xylog Corp., Hackensack, NJ 07601 201-489-4040
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2252
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2280
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
American Magnetics, Carterville, IL 62918 618-985-4838
Astrosystems, Lake Success, NY 11042 516-328-1600
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
† Schott Corp., Wayzata, MN 55391 612-475-1173
Staco Energy Products Co., Dayton, OH 45403 513-253-1191
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Transmagnetics, Farmingdale, NY 11735 516-293-3100
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2270
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1947
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762

Transformers, Scott T-5600

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... D•1152,1155
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† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2264
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† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
American Magnetics, Carterville, IL 62918 618-985-4838
Astrosystems, Lake Success, NY 11042 516-328-1600
Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341;[1] 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Dynapower Corporation, Farmington Hills, MI 48333 313-553-4300
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Hitran Corporation, Flemington, NJ 08822-9943 908-782-5525
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, Detroit, MI 48203 313-468-9410
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† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
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† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 414-253-8200
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
Walker Power, Inc., Warner, NH 03278 603-456-3111
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2280,2295
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Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Valor Electronics, San Diego, CA 92121-2245 619-458-1471
Xylog Corp., Hackensack, NJ 07601 201-489-4040
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Advanced Components Inds., Inc., Spitznagel GmbH, Torrance, CA 90501, 213-328-0060;310-328-0060 ..... **A•2150-2151**
Alber, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... **A•2152**
American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... **A•2167**
APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... **A•2168**
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... **A•2174**
§ Avel-Lindberg Inc., New Milford, CT 06776, 203-355-4711 ..... **A•2175**
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... **A•2184-2185**
§ C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... **A•2188**
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... **A•2190**
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040 ..... **A•2192-2193**
Custom Coils Inc., Alcester, SD 57001, 605-934-2460 ..... **A•2197**
§ EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... **A•2212-2213,2217-2218,2221-2223**
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... **A•2227**
Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235, 614-889-6152 ..... **A•2228**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... **A•2237**
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... **A•2242,2244-2247**
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MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... **A•2269,2271-2275**
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PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... **A•2324-2326,2328**
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... **A•2333**
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714, 714-975-1222 ..... **D•1975**
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... **A•2371**
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Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•2385-2389**
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... **A•2392**
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... **A•2414-2419**
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... **A•2427**
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... **A•2443,2451**
Transformer Technologies, Inc., Mt. Vernon, NY 10550, 914-668-1600 ... **A•2453**
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... **A•2458**
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
§ CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026 314-343-8518
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
§ Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
Electro-Mech Co., Colorado Springs, CO 80915 719-597-1620
Electronetics, Inc., Everett, WA 98204 206-355-1855
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., Danville, VA 24541 804-792-6405
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
§ Golden Pacific Electronics, Inc, Placentia, CA 92670 714-993-6970
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
§ James Electronics, Chicago, IL 60618 312-463-6500
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
Long Island Transformer & Inductor Company, Inc., Baldwin, NY 11510 516-766-5644
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
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§ Multi Products International, West Paterson, NJ 07424 201-890-1344
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
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† Precision Power Systems, Longmont, CO 80501 303-443-6250
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
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Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-9200;818-841-3630 ..... **A•2134**
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;in Can.: 1-800-553-2448 ..... **A•2172-2173**
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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... **A•2190**
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§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Coilcraft, Cary, IL 60013 708-639-2361
Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
Custom Coils Inc., Alcester, SD 57001 605-934-2460
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
EWC, Inc., Englishtown, NJ 07726 908-446-3110
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
MicroSignals Inc., LI.C, NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
§ PCA Electronics, Sepulveda, CA 91343 818-892-0761
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† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
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† Thinco Div., Hull Corp., Hatboro, PA 19040 215-672-7800
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§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† Valor Electronics, San Diego, CA 92121-2245 619-458-1471
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
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† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
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Ensign Corp., Burr Ridge, IL 60521 708-325-9343
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Gavagan Electronics, Danbury, CT 06810 203-748-5248
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† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Integrity Technology Corp., Santa Clara, CA 95050 408-262-8640
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Oram High Voltage, Dayton, TX 77535 409-258-5553
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696 516-239-5777
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510** ..... **D•1152-1153, 1155**
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† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600** ..... **D•1176**
† **Magnetico Inc., Holtsville, NY 11742, 516-654-1166** ..... **A•2264**
§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... **A•2280**
† **Natel Engineering Co., Inc., Simi Valley, CA 93063-3449, 805-581-3950** .. **D•1187**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2333**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100** ..... **D•1196**
American Magnetics, Carterville, IL 62918 618-985-4838
Astrosystems, Lake Success, NY 11042 516-328-1600
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magtech Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transicoil, Inc., Eagle-Picher, Valley Forge, PA 19485 215-539-4400
Valor Electronics, San Diego, CA 92121-2245 619-458-1471
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

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† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•2190**
† **Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-284-9425;414-377-7040** ..... **A•2193**
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§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
Ensign Corp., Burr Ridge, IL 60521 708-325-9343
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
Nedap N.V., Groenlo, HOLLAND 7140 AA ..... +31-5440-71111
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Onan Power/Electronics, Minneapolis, MN 55344 612-943-4600
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Precision Components, Inc., Addison, IL 60101 312-543-6400
† Schott Corp., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
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Vynckier, Inc., Hawthorne, NY 10532 714-896-0772
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† **Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630** ..... **A•2134**

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§† PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•2321-2322
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
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† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Andover, Inc., Lafayette, IN 47904 317-447-1157
§† ANZAC, M/A-COM, Burlington, MA 01803 617-273-3333
Astrosystems, Lake Success, NY 11042 516-328-1600
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coilcraft, Cary, IL 60013 708-639-2361
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
Crompton Modutec, Manchester, NH 03103 ..... 603-669-5121;800-METERS-1
Cross Electronics, Warrendale, PA 15086 412-776-1591
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 714-987-3570
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Delta Products Corporation, Fremont, CA 94538 415-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
† Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electrocom Industries, S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro-Pacific, Goleta, CA 93117 805-964-0751
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
L.H. Frost Limited, Oakville,Ont., CANADA L6H 2R4 416-844-6681
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Richardson, TX 75085-1198 214-234-3240
Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§† Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
† Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 512-546-1625
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering Co., Culver City, CA 90230 213-398-4761
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Osborne Transformer, Detroit, MI 48203 313-468-9410
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Pacific Transformer Corp., Anaheim, CA 92807 1-800-325-0501
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Precision Components, Inc., Addison, IL 60101 312-543-6400
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
† Schott Corp., Wayzata, MN 55391 612-475-1173
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 415-471-9717;800-221-7060
§ Shape Electronics, Inc., Lombard, IL 60148 708-620-8394
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Sprague Fil-Mag, San Diego, CA 92111-1416 619-569-6577
§ Square D Co., Palatine, IL 60067 708-397-2600
§† Staco Energy Products Co., Dayton, OH 45403 513-253-1191
Standard Magnetic Corp., Anaheim, CA 92806 714-630-9751
Teco Corp., Winnisquam, NH 03289 603-524-1998
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., Plano, TX 75086 214-424-1581
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
§† Valor Electronics, San Diego, CA 92121-2245 619-458-1471
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
† Voltampere Corp., Lynbrook, NY 11563 516-887-9443
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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APX-Arstan Products, Hicksville, NY 11801, 516-433-1313 ..... A•2169
† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
Avel-Lindberg Inc., New Milford, CT 06776, 203-355-4711 ..... A•2175
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•2184-2185
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2212
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2264
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2286,2297
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 .... A•2317
† PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•2320
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2381
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2414-2419
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 213-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148

† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Custom Coils Inc., Alcester, SD 57001 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Datatronics, Inc., Romoland, CA 92380 714-928-7700
Delta Products Corporation, Fremont, CA 94538 415-770-0660
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
GC International Inc., Richardson, TX 75085-1198 214-234-3240
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Schott Corp., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172
† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... A•2229
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... A•2230-2232
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1210-1211
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2262
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2270,2273,2275-2276
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2307
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2330-2331
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 908-826-4700 ..... A•2371
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2412-2413
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... A•2421
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Astrosystems, Lake Success, NY 11042 516-328-1600
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
§ Contact East, N. Andover, MA 01845 508-682-2000
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Grand Transformers, Inc., Grand Haven, MI 49417 616-842-5430
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Precision Power Systems, Longmont, CO 80501 303-443-6250
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
§† Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100

Transformers, Variable, Motorized-5600

ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... A•2040, B•1259-1260
GC International Inc., Richardson, TX 75085-1198, 214-234-3240 ..... A•1207
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... A•2421

Transformers, Voltage Dividing-5600

† Abbott Technologies, Inc, Transformer Division, Sun Valley, CA 91352, 818-504-0644;1-800-367-8200;818-841-3630 ..... A•2134
† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... A•2230-2231, D•2200
† Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... D•1274
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2242
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2251
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2273
§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2280
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
† Oram High Voltage, Dayton, TX 77535, 409-258-5553 ..... D•1917
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2412-2413
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2448,2451
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
American Magnetics, Carterville, IL 62918 618-985-4838
Astrosystems, Lake Success, NY 11042 516-328-1600
Automatic Coil Corp., A DSG Company, Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Custom Coils Inc., Alcester, SD 57001 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 213-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Hisonic, Inc., Olathe, KS 66061 913-782-0012
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
North Hills Electronics, Glen Cove, NY 11542 516-671-5700
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Para-Line Transformer Co., Inc., Alhambra, CA 91803 818-281-0222
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Precision Power Systems, Longmont, CO 80501 303-443-6250
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Schott Corp., Wayzata, MN 55391 612-475-1173
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
Teco Corp., Winnisquam, NH 03289 603-524-1998
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2152
† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188, D•1652
† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2185,2188
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2191
Enegren Electronics, Inc., Olathe, KS 66062, 913-782-4720 ..... A•2210
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... A•2230, D•2200-2201
§ Hitran Corporation, Flemington, NJ 08822-9943, 908-782-5525 .. A•2235, D•2203
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2262-2263
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2267,2269
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2314-2315
Power-One, Inc., Camarillo, CA 93012, 805-987-8741 ..... D•1988

Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2224
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2392
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2412-2413
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... A•2421
§ Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2441
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... A•2454-2457
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Adtech Power Inc., Anaheim, CA 92806 714-634-9211
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
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Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Charles Inds. Ltd., Charles Center, Rolling Meadows, IL 60008 708-806-6300
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ..... 605-296-3462/3487
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§ HDR Power Systems, Inc., Hilliard, OH 43026 614-771-5500
§ ISOREG Corp., Littleton, MA 01460 508-486-9483
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
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Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
§ Micron Industries, Hillside, IL 60162 708-547-0900
§† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
§† North Hills Electronics Inc., Power Products Div., Glen Cove, NY 11542-3796 516-671-5700
† Northlake Engineering, Inc., Antioch, IL 60002 708-395-5710
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Osborne Transformer, Detroit, MI 48203 313-468-9410
Parker McCrory Mfg. Co., Kansas City, MO 64108 816-221-2000
§ Perma Power Elctrns., Chicago, IL 60648 312-763-0763
Phenix Technologies, Accident, MD 21520 301-746-8118
Power Conversion Products, Crystal Lake, IL 60014 815-459-9100
† Precision Power Systems, Longmont, CO 80501 303-443-6250
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§ S & H Inds., Hatfield, PA 19440 215-822-7211
Schott Corp., Wayzata, MN 55391 612-475-1173
§ Shape Electronics, Inc., Lombard, IL 60148 708-620-8394
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 708-439-2800
§ Square D Co., Palatine, IL 60067 708-397-2600
§† Square D Co. Power Protection Systems, San Diego, CA 92123-1165 ... 619-279-0831
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
§ Sunshine Instruments, Philadelphia, PA 19115 ..... 215-673-5600;800-343-1199
§† Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Universal Voltronics Corp, Thermedics Inc./ThermoElctron Corp., Mt. Kisco, NY 10549 914-241-1300
Xentek, Inc., Taiyo Yuden USA, Inc., Vista, CA 92083 619-727-0940
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Transformers, Wideband-5600

† Automatic Coil Corp., A DSG Company, Miami, FL 33147, 305-696-6660 ..... A•2174
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•2178
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1172
† C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2190
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•2211
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2212
† Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2234
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... A•2300
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1753
† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2310-2312
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2333
§ Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•2427
Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2458
American Magnetics, Carterville, IL 62918 618-985-4838
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
† Axel Electronics, Inc., Jamaica, NY 11418 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
§ C-COR Elctrns., State College, PA 16801 ..... 814-238-2461;800-233-2267
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coilcraft, Cary, IL 60013 708-639-2361
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Dantel, Fresno, CA 93727 209-292-1111
Datatronics, Inc., Romoland, CA 92380 714-928-7700
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
§† JB Electronic Transformers, Chicago, IL 60647 312-342-0080
† Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
§ Katronic Elektronic Ges.m.b.H., AUSTRIA 04762-5340
KGS Electronics, Inc., Pasadena, CA 91103 818-798-0786
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§† Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Oeco Corp., Milwaukie, OR 97222 503-659-7932
Onan Power/Electronics, Minneapolis, MN 55344 612-943-4600
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
Picosecond Pulse Labs, Inc., Boulder, CO 80306 303-443-1249
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Tokin Magnetics, Inc., Fremont, CA 94539 415-490-7500
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
TRM, Inc., Manchester, NH 03103 603-627-6000
† TTE, Incorporated, W. Los Angeles, CA 90064 213-478-8224
§† Valor Electronics, San Diego, CA 92121-2245 619-458-1471
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Transformers (MIL), Audio, Power, RF-2440 — *See Vol. B*

Transformers (MIL), Data Bus Coupling-2440 — *See Vol. B*

Transformers (MIL), Interface & Coupling-2440 — *See Vol. B*

Transformers (MIL), Pulse & Variable-2440 — *See Vol. B*

Transistor Arrays-4800

International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 .... A•1731
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§† Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
† Dionics, Westbury, NY 11590 516-997-7474
§† Exar Corp., San Jose, CA 95161-9007 408-732-7970
§ General Transistor Corp., GTC, Inglewood, CA 90301 213-673-8422
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semicoa, Costa Mesa, CA 92626 714-979-1900
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§† Siliconix, Inc., Santa Clara, CA 95054 408-988-8000

§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§ Zetex, Inc., Zetex plc, Commack, NY 11725 516-543-7100

Transistor Arrays, Surface Mount-4800

Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2103-2104,2107
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Siliconix, Inc., Santa Clara, CA 95054 408-988-8000

Transistor, Diode, Thyristor Heat Dissipators — See Heat Sinks, Transistor (Vol. C)

Transistors, Bipolar-Also See Transistors, Silicon-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
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§† Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
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Shindengen America Inc., Westlake Vl, CA 91361 800-634-3654
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Transistors, Bipolar, Surface Mount-4800

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Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
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Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
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Transistors, Chip, Unpackaged-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1319
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
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Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
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Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Hy-Tec Industries, Div. of Topo Industries, Inc., Shoreham, NY 11786 ... 516-924-8686
International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
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† Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
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† Solid State Devices, La Mirada, CA 90638 213-921-9660
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Unitrode Corp., Watertown, MA 02172 617-926-0404
§ Zetex, Inc., Zetex plc, Commack, NY 11725 516-543-7100

Transistors, Darlington-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1319
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2102,2104-2106,2108-2109
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
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§ Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
International Microelectronics, Arlington, TX 76003 817-561-2244
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Mouser Electronics, Mansfield, TX 76063 800-346-6873
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
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§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
† Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
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† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
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§ Zetex, Inc., Zetex plc, Commack, NY 11725 516-543-7100

Transistors, Darlington, Surface Mount-4800

Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2103-2104
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Powertech, Inc., Fairlawn, NJ 07410 201-791-5050
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Transistors, Dual-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
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Transistors, Field Effect-4800

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Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2113-2116
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
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§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
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§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
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Transistors, Field Effect, Surface Mount-4800

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QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Shindengen America Inc., Westlake Vl., CA 91361 800-634-3654
§† Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Transistors, Germanium-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ General Transistor Corp., GTC, Inglewood, CA 90301 213-673-8422
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, La Mirada, CA 90638 213-921-9660

Transistors, Insulated Gate Bipolar (IGBT)-4800

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
§† International Rectifier Corp., El Segundo, CA 90245 213-772-2000

Transistors, Low Noise, GaAs, FETs - Also See Transistors, Microwave-4800

§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
MACOM, Inc., Burlington, MA 01803 617-272-3000
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080

Transistors, Microwave-4800

Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2113-2116
Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
MACOM, Inc., Burlington, MA 01803 617-272-3000
M/A-COM PHI, Inc., M/A COM, Inc., Torrance, CA 90501 213-320-6160
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Texas Instrs., Information Technlg. Grp., Dallas, TX 75380-9063 1-800-527-3500

Transistors, NPN, Surface Mount-4800

Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Transistors, Photo (Incl. Arrays)-3700 — *See Vol. B*

Transistors, PNP, Surface Mount-4800

Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2102,2105-2106,2108-2109
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300

Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§† Precision Monolithics Inc. Subsidiary of Bourns Inc., Santa Clara, CA 95052-8020 ..... 408-727-1500;800-843-1515
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§ Zetex, Inc., Zetex plc, Commack, NY 11725 516-543-7100

Transistors, Power-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ..... D•2207
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2101-2102,2105,2108,2110-2112
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§† Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
† Dionics, Westbury, NY 11590 516-997-7474
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
§† General Semiconductor Ind., Inc., Square D Company, Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., GTC, Inglewood, CA 90301 213-673-8422
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
§ International Diode, Harrison, NJ 07029 201-482-6518
International Microelectronics, Arlington, TX 76003 817-561-2244
§† International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Mouser Electronics, Mansfield, TX 76063 800-346-6873
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
NIEC-BASISTA, Richfield, OH 44286 216-659-9287
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† Powertech, Inc., Fairlawn, NJ 07410 201-791-5050
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§† PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semicoa, Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706 206-834-2500
§ Shindengen America Inc., Westlake Vl., CA 91361 800-634-3654
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
§† Unitrode Corp., Watertown, MA 02172 617-926-0404

Transistors, Power, Bipolar-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2101-2102,2105,2108,2110-2112
Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§† Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
† Dionics, Westbury, NY 11590 516-997-7474
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
† Powertech, Inc., Fairlawn, NJ 07410 201-791-5050
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§† PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shindengen America Inc., Westlake Vl., CA 91361 800-634-3654
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Unitrode Corp., Watertown, MA 02172 617-926-0404

Transistors, Power, Bipolar, Surface Mount-4800

§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763

Transistors, Power, FET-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2102,2105,2108,2110-2112
§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ Fujitsu Microelectronics Inc., Integrated Circuits Division, San Jose, CA 95134 408-922-9000
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† International Rectifier Corp., El Segundo, CA 90245 213-772-2000
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
MACOM, Inc., Burlington, MA 01803 617-272-3000
M/A-COM PHI, Inc., M/A COM, Inc., Torrance, CA 90501 213-320-6160
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Polyfet RF Devices, Newbury Park, CA 91320 805-498-4552
R.F. Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shindengen America Inc., Westlake Vl, CA 91361 800-634-3654
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
Tokin America, Inc., San Jose, CA 95134 408-432-8020

Transistors, Power, Field Effect, Surface Mount-4800

QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2126
§ International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
† M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
Shindengen America Inc., Westlake Vl, CA 91361 800-634-3654
§ Siliconix, Inc., Santa Clara, CA 95054 408-988-8000

Transistors, Pressure Sensitive-4800

Omega Engineering, Stamford, CT 06907 800-826-6342

Transistors, RF-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2105-2106,2108,2113-2116
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2119
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
§ Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)

§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ General Transistor Corp., GTC, Inglewood, CA 90301 213-673-8422
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ International Components Corp., Melville, NY 11747 516-293-1500
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Polyfet RF Devices, Newbury Park, CA 91320 805-498-4552
§ Semicoa, Costa Mesa, CA 92626 714-979-1900
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Transistors, RF, Surface Mount-4800

Philips Components Discrete Products Division, A North American Philips Com., any, Riviera Beach, FL 33404, 407-881-3200 ..... A•2113-2116
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
§ Katronic Elektronic Ges.m.b.H., AUSTRIA 04762-5340
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Transistors, Silicon-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118-2119
§† Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§† Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
† Dionics, Westbury, NY 11590 516-997-7474
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§† General Semiconductor Ind., Inc., Square D Company, Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., GTC, Inglewood, CA 90301 213-673-8422
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† Powertech, Inc., Fairlawn, NJ 07410 201-791-5050
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§† PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, La Mirada, CA 90638 213-921-9660
§ Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Transistors, Switching-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2085
Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2105-2106,2108,2113-2116
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118-2119
§† Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Continential Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
Delta Products Corporation, Fremont, CA 94538 415-770-0660
† Dionics, Westbury, NY 11590 516-997-7474
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§† General Semiconductor Ind., Inc., Square D Company, Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., GTC, Inglewood, CA 90301 213-673-8422
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ International Diode, Harrison, NJ 07029 201-482-6518
International Microelectronics, Arlington, TX 76003 817-561-2244
§† International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
Mouser Electronics, Mansfield, TX 76063 800-346-6873
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† Powertech, Inc., Fairlawn, NJ 07410 201-791-5050
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§ PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§† Raytheon Semiconductor, Mountain View, CA 94043 415-966-7639
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semicoa, Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shindengen America Inc., Westlake Vl, CA 91361 800-634-3654
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Transistors, Switching, Surface Mount-4800

Diodes Inc., Chatsworth, CA 91311, 818-882-4920;800-821-1178 ..... A•2093
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2113-2116
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013, 615-641-2020 ..... A•2121
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§† International Rectifier Corp., El Segundo, CA 90245 213-772-2000
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., A North American Philips Co, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† Power Technology Components, A Div. of Microsemi Corp., Torrance, CA 90501 213-534-3737
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 ..... 407-848-4311;800-888-8763
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Transistors, Unijunction-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2083
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2118
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§ General Transistor Corp., GTC, Inglewood, CA 90301 213-673-8422
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
§ Unitrode Corp., Watertown, MA 02172 617-926-0404

Transistors, Unijunction, Surface Mount-4800

NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2315
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900

Transistors (MIL)-2440 — *See Vol. B*

Translators, Data-2325 — *See Vol. D*

Translators, Frequency Band-2750

Precision Filters, Ithaca, NY 14850, 607-277-3550 ..... D•1192-1193
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1831
§ Beckman Industrial Corp., An Affiliate of Emerson Elec. Co., San Diego, CA 92123-1898 619-495-3200

§ C-COR Elctrns, State College, PA 16801 ..... 814-238-2461;800-233-2267
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
ISC Datacom, ISC Defense & Space, Sunnyvale, CA 94089 408-747-0300
Western Multiplex Corp, Belmont, CA 94002 415-592-8832

Translators, Time Code-2000 — *See Vol. D*

Transmission Line, Data — See Cable, Data Transmission (Vol. C)

Transmission Line, Wire & Cable — See Cable, Transmission Line (Vol. C)

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Transmitters, Fiber Optic-2475 — *See Vol. B*

Transmitters, Fixed Frequency-1900 — *See Vol. D*

Transmitters, Infrared remote control transmitters for satellite T.V. receivers-1900 — *See Vol. D*

Transmitters, Laser-3700 — *See Vol. D*

Transmitters, Position-1000 — *See Vol. D*

Transmitters, Process Control (Temperature, Pressure, Flow, etc.)-5500 — *See Vol. B*

Transmitters, Radar — See Radar System Components (Vol. A)

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Transmitters, Tone-1900 — *See Vol. D*

Transmitters (MIL)-2440 — *See Vol. B*

Transmitters (MIL), Fiber Optic-2440 — *See Vol. B*

Transponders-1900 — *See Vol. D*

Transports, Tape (all kinds)-2000 — *See Vol. D*

TRIACs-4800

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-4668 .. A•2082
§ Crydom Company, Lakewood, CA 90714-9669, 213-865-3536 ..... B•1451
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2101
§ Philips SCG, North American Philips Co., Williamsport, PA 17701, 717-323-4091 ..... A•2119
§ Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272 ..... A•2117
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98706, 206-834-2500 ..... B•1340
§ Silicon Power Subs Corp., Long Beach, CA 90805, 213-634-8830 ..... B•1332
§ Teccor Electronics, Inc., Irving, TX 75039, 214-580-1515 ..... A•2122-2125
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
§ IXYS Corp, San Jose, CA 95131-1109 408-435-1900
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Phase Control Electronics, Glendale, NY 11385 718-441-4278
§ Philips Components Discrete Products Div., A North American Philips Co. Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Raytheon/TAG Semiconductors Ltd, Burlington, MA 01803 ..... 617-272-9704 (3705)
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759

Triggers, SCR — See Controls, SCR (Vol. D)

Trimmers, Capacitor — See Capacitors, Variable, Padders & Trimmers (Vol. A)

Trimmers, Potentiometer — See Potentiometers, Trimmer (Vol. A)

Trimmers, Surface Mount, Capacitor-1900

§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1140-1141
# Engineered Assemblies & Components Corp, Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 803-772-2500
§ Trim-Tronics, Inc., Cazenovia, NY 13035 315-655-9528

Trimmers, Surface Mount, Potentiometer-4750

§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•2016
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501, 515-573-1300 ..... A•2031
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•2032-2033
§ Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... A•2055-2057
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1111
Noble U.S.A., Inc., Rolling Meadows, IL 60008, 708-364-6030 ..... A•2061
§ Vernitron Corp., Passive Comps. Group, St. Petersburg, FL 33743, 813-347-2181 ..... A•2075
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 714-781-5500; 800-732-2070;801-750-7200
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC, Dover, NH 03820-1507 603-742-1120,800-872-0042
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Engineered Assemblies & Components Corp, Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§† Techno Division, Dale Electronics, Inc., Van Nuys, CA 91405-1139 818-781-1642

Tube Heat Dissipators-2000 — *See Vol. C*

Tubes, Ballast — See Resistors, Ballast (Vol. A)

Tubes, Cathode Ray, General Purpose-2450 — *See Vol. B*

Tubes, Cathode Ray, Special Purpose-2450 — *See Vol. B*

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Tubes, Ignitron-2200 — *See Vol. D*

Tubes, Image Converter-2450 — *See Vol. B*

Tubes, Indicator — See Tubes, Readout (Vol. B)

Tubes, Magnetron — See Tubes, Microwave (Vol. A)

Tubes, Microwave-3450

§ A E G Corporation, Somerville, NJ 08876-1269 908-231-8491
† EEV Inc., Elmsford, NY 10523 914-592-6050
† Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999 213-517-6000
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
MACOM, Inc., Burlington, MA 01803 617-272-3000
Microdry, Inc., Crestwood, KENTUCKY 40014 502-241-8933
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3505 203-753-5840
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02254 617-899-8400
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Thomson Electron Tubes & Devices Corp, Thomson CSF, Totowa, NJ 07511 201-812-9000
Varian Associates, Electron Device Business, Palo Alto, CA 94304 ..... 415-493-4000; 800-544-4636
Varian Microwave Equip. Div., Varian Assocs., Inc., Santa Clara, CA 95054 408-496-6273
† Well, A. T., Co., Warwick, RI 02886 401-739-0740
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Tubes, Photomultiplier-3700 — *See Vol. B*

Tubes, Readout (CRT, Cold-Cathode, Vacuum Fluorescent, Incandescent, etc.)-2450 — *See Vol. B*

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Tubes, X-ray-2200 — *See Vol. D*

Tubes (MIL), Indicator & Pickup-2440 — *See Vol. B*

Tubes (MIL), Microwave-2440 — *See Vol. B*

Tubes (MIL), Power & Gas, Planar-2440 — *See Vol. B*

Tubes (MIL), Receiving, & Tube Shields-2440 — *See Vol. B*

Tubing, Ceramic-2500 — *See Vol. C*

Tubing, Expandable-6000 — *See Vol. C*

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Tubing, Glass-2500 — *See Vol. C*

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Tubing, Paper-2500 — *See Vol. C*

Tubing, Plastic-Also See Tubing, Spaghetti-2500 — *See Vol. C*

Tubing, Spaghetti-2500 — *See Vol. C*

Tubing, Spiral Wrap-2500 — *See Vol. C*

Tubing, Waveguide-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§ Applied Plastics Technology, Bristol, RI 02809 401-253-0200
† Gabriel Electronics, Scarborough, ME 04074 207-883-5161
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700

§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Wall, A. T., Co., Warwick, RI 02886 401-739-0740

Tubing, Zipper-2500 — *See Vol. C*

Tuners, AM/FM-1300 — *See Vol. D*

Tuners, Microwave-3450

E.P.D./General Power Corp., Anaheim, CA 92805-8508, 714-520-0881;1-800-343-1813 ..... D•1069
§† Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1080
† Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•2064-2065
† Micronics Technology Inc., Glen Cove, NY 11542, 516-759-5600 ..... A•1399
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
† Eastern Microwave, Burlington, MA 01803 617-273-4700
EPD Electronics, Inc., Gardena, CA 90247 213-515-4996
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† Ferretec Inc., Fremont, CA 94539-7474 415-226-1216
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
† Voltronics Corporation, E. Hanover, NJ 07936 201-887-1517
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Tuning Forks-2300

SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1455
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400

Tweezers, Manual & Vacuum-5400 — *See Vol. C*

Ultrasonic Transceivers, High Resolution, Narrow Beam-5500 — *See Vol. B*

Ultraviolet Inspection Lighting-Also See Microscopes, Ultraviolet-4100 — *See Vol. D*

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Valve Position Indicators/Transmitters-5500 — *See Vol. B*

Valve Positioners & Actuators-4750

ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... B•1260
Infranor, Naugatuck, CT 06770 ..... 203-729-8258;800-BE-SERVO
ITT Conoflow, ITT Fluid Technology Corp., St. George, SC 29477 803-563-9281
Moore Products Co., Spring House, PA 19477 215-646-7400
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
Parker Hannifin Corp., Filter Division, Metamora, OH 43540 419-644-4311
Parker Hannifin Corp., Fluidpower Pump Division, Ostego, MI 49078-1495 616-694-9411
Parker Hannifin Corp., Hydraulic Valve Division, Elyria, OH 44035 216-366-5100
Parker Hannifin Corp., Rotary Actuator Division, Wadsworth, OH 44281-0450 216-336-3511
Parker Hannifin Corp., Schrader Bellows Division, Akron, OH 44309-0631 216-375-5202
Rotork Controls, Inc., Rochester, NY 14624 716-328-1550
Schenck Pegasus Corp., Troy, MI 48083 313-689-9000
Transmagnetics, Farmingdale, NY 11735 516-293-3100

Valves, Solenoid-4550 — *See Vol. B*

Valves, Vacuum-4100 — *See Vol. D*

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Video Components & Equipment — See Specific Component: Amplifiers (Vol. D), Cameras (Vol. D), Networks (Vol. D), etc.

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Voice Recognition Equipment — See Recognition Equipment, Speech (Vol. D)

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Warning Systems (MIL)-2440 — *See Vol. B*

Washers, Lock-2500 — *See Vol. C*

Washers, Plain-2500 — *See Vol. C*

Washers, Shoulder-2500 — *See Vol. C*

Waveguide-Coax Adapters-3450

§† Adams-Russell, Inc., Div. of M/A COM, INC., Amesbury, MA 01913 508-388-5210
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Andrew Corp., Orland Pk., IL 60462 800-255-1479
† Applied Plastics Technology, Bristol, RI 02809 401-253-0200
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Eastern Microwave, Burlington, MA 01803 617-273-4700
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., El Cajon, CA 92020 619-449-3844
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
Φ U.S. Instrument Rentals, Inc., AT&T Capital Corp., D/FW Airport, TX 75261 800-874-7123
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

Waveguides-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Andrew Corp., Orland Pk., IL 60462 800-255-1479
† Ark Elctrns. Corp., Southampton, PA 18966 215-322-6510
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Eastern Microwave, Burlington, MA 01803 617-273-4700
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Gabriel Electronics, Scarborough, ME 04074 207-883-5161
† Gamma-f Corp., Electromagnetic Sciences, Inc., Torrance, CA 90505 213-539-6704
† W.L. Gore & Assocs., Newark, DE 19714 302-738-4880
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† Lectro Magnetics, Inc., Los Angeles, CA 90016 ..... 213-870-9383;USA 800-969-9383
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139 708-307-7200
Litton Electron Devices, San Carlos, CA 94070 415-591-8411
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715

§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Pro Com Technology Inc., Farmingdale, NY 11735 ..... 516-293-4443;800-762-3785
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
† Rosenberger-Micro Coax, (Formerly Micro-Coax Components, Inc.), Collegeville, PA 19426 215-489-3700
† Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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Wave Traps — See Filters, Antenna (Vol. A), Filters, Microwave (Vol. A), etc.

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White Printers-4200 — *See Vol. C*

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Wire, Bare, Nickel-6000 — *See Vol. C*

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Wire, Fiberglass Insulated — See Wire, Glass Insulated (Vol. C)

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Wire, Flat Strip-6000 — *See Vol. C*

Wire, Glass Insulated-6000 — *See Vol. C*

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Wire, Guy-6000 — *See Vol. C*

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Wire, High Voltage (1000 Volts & Over)-6000 — *See Vol. C*

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Wire, Lead-in & Ground-6000 — *See Vol. C*

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Wire, Magnet-6000 — *See Vol. C*

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Wire, Resistance-6000 — *See Vol. C*

Wire, Semiconductor Lead-6000 — *See Vol. C*

Wire, Shielded-6000 — *See Vol. C*

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Wire, Thermocouple-6000 — *See Vol. C*

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C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
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Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
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Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
SinoTECH, Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000

Yokes, Deflection, Oscilloscope-1800

C & C Jetronic, Inc., Princeton, NJ 08540, 609-921-8540 ..... A•2188
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† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

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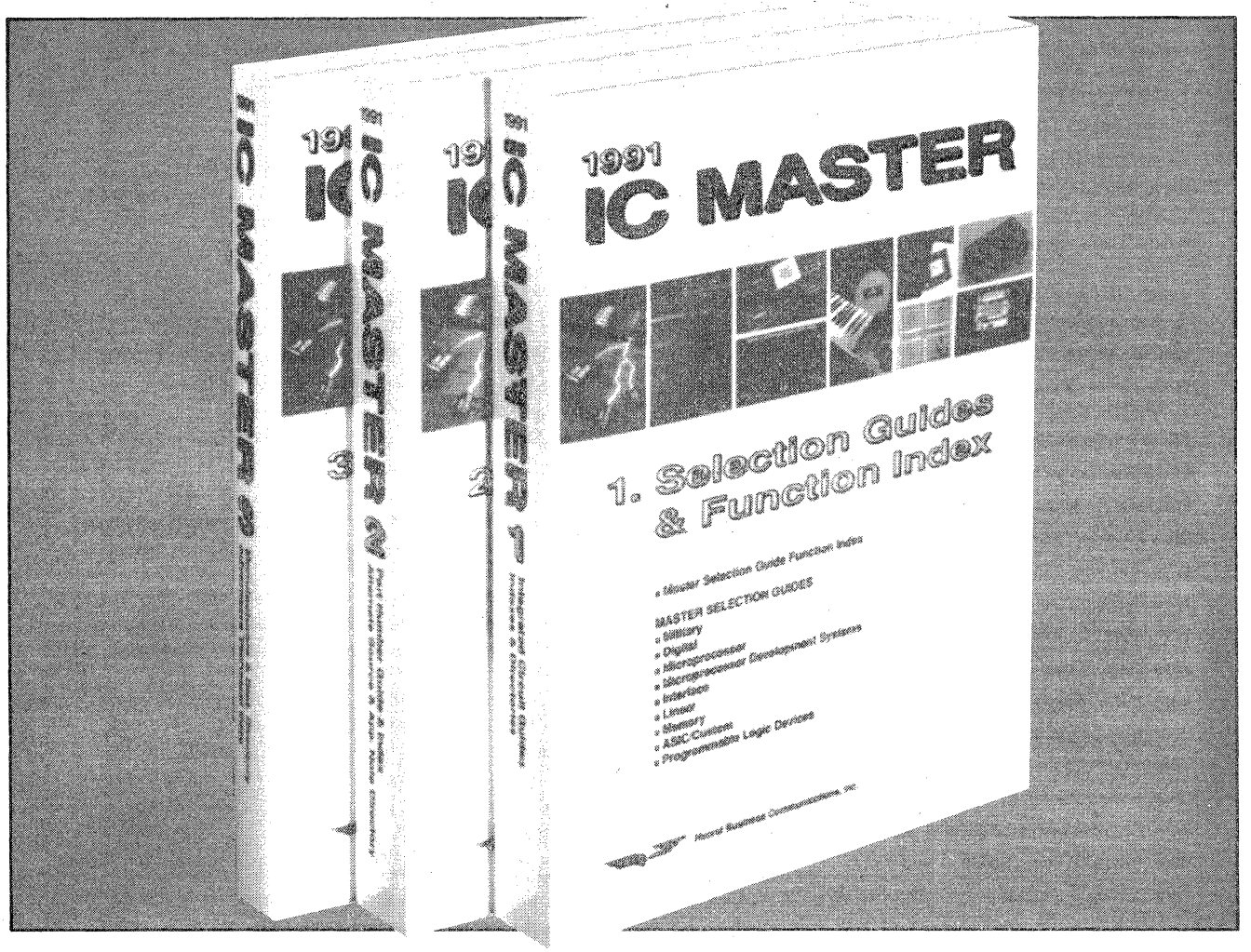
Yokes, Deflection, TV Camera-1800

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Zone Boxes, Thermocouple — See Thermocouples, Elements & Accessories (Vol. B)

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MINIGLOSSARY
POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

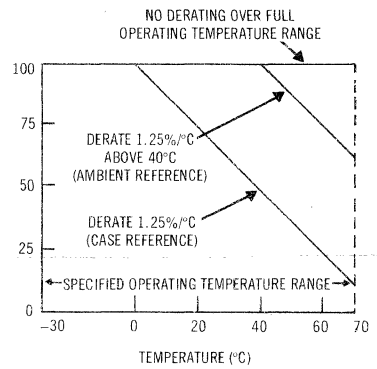


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

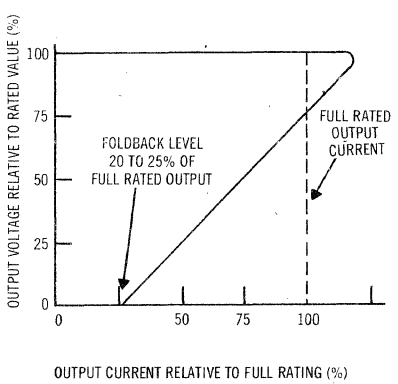


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

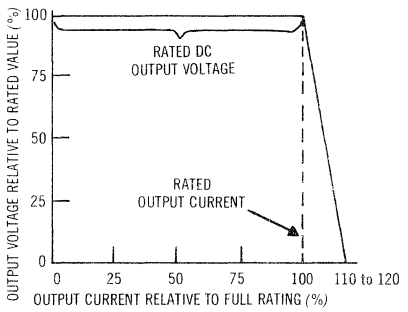


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

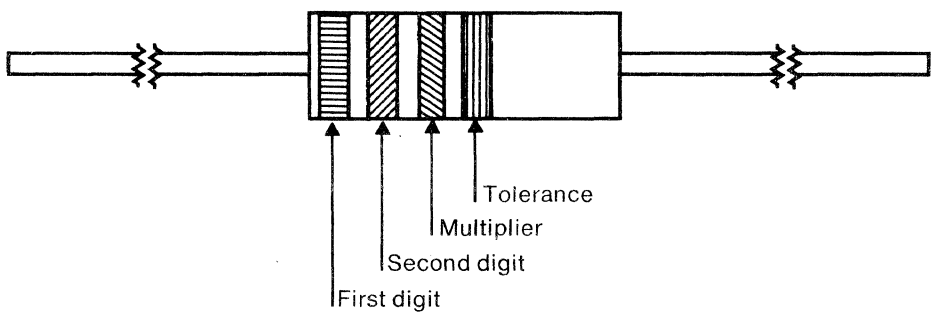
Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

MAXIMUM CURRENT CAPACITY—CONDUCTORS

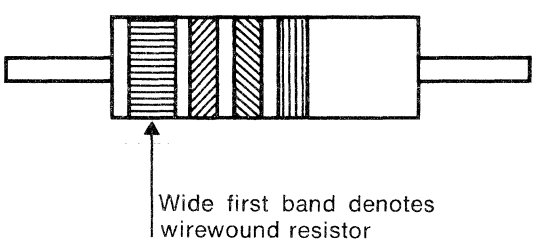
Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single-wire	Wire-bundled	Single-wire	Wire-bundled					
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

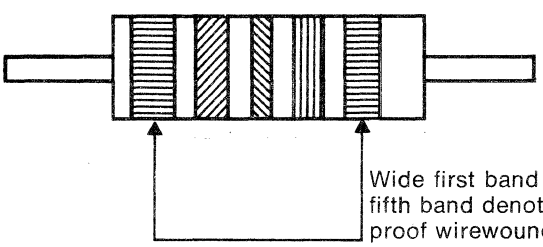
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

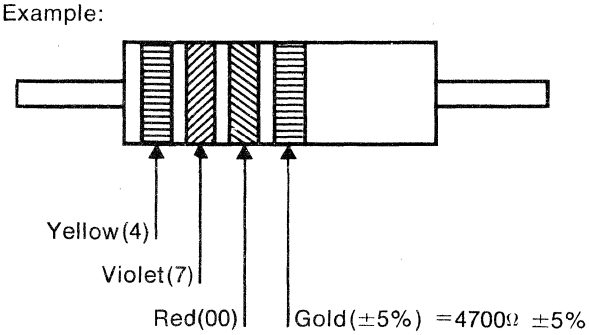




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

91
92 Manufacturers and Sales Offices Directory

Each manufacturer is listed alphabetically with complete address and telephone number of main offices. The names of those with data pages in this edition of EEM are shown in **boldface**

Many manufacturers also show FAX, TWX and Telex numbers, FSC (Federal Supply Code), other pertinent company data, their sales and/or local distributor offices and phones. The page numbers of their data pages in this edition are shown in all volumes.

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FAX: 508-373-8881

AAK CORP, 747 River St, Haverhill, MA 01832, Tel: 508-373-3769, 800-886-2225, TELEX: 04 26 3109-1; FSC No.: 04 26 3109-1; Empl.: 20; *Sls. Mgr.:* Marie Credit ..... **D•1507-1510**

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IN Indianapolis, Loren Green Assocs. 317-293-9827
MN Minneapolis, Hei-Lite Sls. 612-861-6051
OH Cleveland, Tiby Co. 216-371-5335
PA Cheltenham, Stein Instr. Corp. 215-379-1990

AALPHA PRECISION, Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, FAX: 818-345-1507; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt ..... **A•1837**

Local Sales Offices & Reps

CA San Jose, Comtech Mktg. 408-294-5448

Local Distributors

CA San Jose, Comtech Mktg. 408-294-5448

A & D ELEC. INSTRS., 73-07 88th St, Glendale, NY 11385, Tel: 718-275-6516, FAX: 718-275-6516; FSC No.: 01914; Empl.: 7

A & J MANUFACTURING CO., 14131 Franklin Ave., Tustin, CA 92680, Tel: 714-544-9570, FAX: 714-544-4215; FSC No.: 08060; Empl.: 70; *Sls. Mgr.:* Wayne L. Seeley

AAVID ENGINEERING, INC., One Kool Path, P.O. Box 400, Laconia, NH 03247-0400, Tel: 603-528-3400, TWX: 510-298-1127, FAX: 603-528-1478; FSC No.: 30161; Empl.: 450; *Sls. Mgr.:* Charles Nelson; *Dist. Mgr.:* David Mendel ..... **C•1604**

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FL Deerfield Bch., Cartwright & Bean, Inc. 305-429-3400
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NJ Berkeley Hgts., Cambridge-Allen & Assocs. 908-464-0203
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NM Albuquerque, Ron-Tek, Inc. 505-299-4124
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NY Fairport, Reagan/Compar Corp. 716-271-2230
NY New Hartford, Reagan/Compar Syracuse/Utica 315-732-3775,315-735-9831
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NC Raleigh, Cartwright & Bean, Inc. 919-876-4130
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OH Columbus, Kahsar Sls. Inc. 614-252-4009
OH Mentor, Kahsar Sls. Inc. 216-946-7659
OR Portland, S P S Elctrns. 503-297-6919
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CT Wallingford, Cronin Elctrns., Inc. 800-982-4449
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MO St. Louis, Ric-Tronics 314-576-9816
NH Salem, Cronin Elctrns., Inc. 603-898-4440
NJ Mt. Laurel, Future Elctrns. Inc. 609-778-7600
NJ Springfield, Route Elctrns. 201-379-7710
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Distrs. inc. 716-887-2800
NY Elmhurst, Century Fasteners Corp. 718-446-5000
NY Holtsville, Tower Fasteners 516-289-8800
NY Liverpool, Future Elctrns. Inc. 315-451-2371
NY Mineola, Allied Elctrns. 516-248-2360
NY Mt. Vernon, Q A R Indl. Elec. 914-699-2224
NY Rochester, Masline Elctrns. Inc. 716-546-5373
NY Rochester, Summit Elctrns. Inc. 716-334-8110
NC Charlotte, Century Fasteners Corp. 704-554-0444
NC Greensboro, Golden Elctrns. 919-294-4653
NC Greensboro, Hammond Elctrns. Inc. 919-275-6391
NC Raleigh, Century Elctrn. Comps. 919-782-2116
NC Raleigh, Century Fasteners Corp. 919-787-1800
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Twinsburg, Schuster Elctrns. 216-425-8134
OH Warren, REM Elctrns. 216-373-1300
OK Tulsa, Carlton-Bates Co. Inc. 918-250-1626
OR Beaverton, Acacia/Deanco 503-646-3377
OR Beaverton, Comp. Resources 503-641-8488
OR Beaverton, Future Elctrns. Inc. 503-626-2977
OR Beaverton, Murphy Elctrns. 503-642-2001
OR Portland, Dunn Elctrns. 503-285-0214
PA Carisle, Cumberland Elctrns. 717-243-8006
PA Erie, REM Elctrns. 814-453-5626
PA Harrisburg, Cumberland Elctrns. 717-232-5999
PA Lancaster, Cumberland Elctrns. 717-393-8304
PA Lewistown, Cumberland Elctrns. 717-249-9631
PA Norristown, Century Elctrn. Comp. 215-631-5400
PA Philadelphia, P E I-Genesis 800-523-0727
PA Philadelphia, Shap Elctrns. 215-969-3300
PA York, Cumberland Elctrns. 717-845-8791
SC Greenville, Hammond Elctrns. Inc. 803-233-4121
SC W. Columbia, Century Fasteners Corp. 803-791-1800
TN Memphis, Carlton-Bates Co. Inc. 901-365-3539
TN Nashville, Carlton-Bates Co. Inc. 615-244-3562
TX Austin, Wofford Elctrns., Inc. 512-339-1131
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Wofford Elctrns., Inc. 713-847-3583
TX Texarkana, Carlton-Bates Co. Inc. 214-792-6923
UT Salt Lake City, Future Elctrns. Inc. 801-972-8489
VA Richmond, Century Fasteners Corp. 804-262-8671
WA Bellevue, Future Elctrns. Inc. 206-881-8199
WA Kent, Pyramid Elctrns. 206-872-5800
WA Redmond, Comp. Resources 800-547-6523
WA Redmond, Energy Sls. Inc. 206-883-2342
WA Redmond, Murphy Elctrns. 206-881-1234
WA Seattle, Allied Elctrns. 206-547-2827
WI New Berlin, N E P Elctrns. Inc. 414-785-9100
Can Calgary, Alberta, Future Elctrns. Inc. 403-259-6408
Can Downview, Ont., Future Elctrns. Inc. 416-638-4771
Can Edmonton, Alberta, Future Elctrns. Inc. 403-438-2858
Can Mississauga, Ont., Rush Elctrns. 416-677-7280
Can Nepean, Ont., Carsten Elctrns. Ltd. 613-726-9250
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. Inc. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can St. Laurent, Que., Carsten Elctrns. 514-334-8321
Can Vancouver, BC, Future Elctrns. Inc. 604-294-1166
Can Victoria, BC, Queale Elctrns. Ltd. 604-388-6111
Can Winnipeg, Manitoba, Future Elctrns. Inc. 204-339-0554



FAX: 908-526-6866

ABACUS CONTROLS INC., 89 Readington Rd, Somerville, NJ 08876, Tel: 908-526-6010; FSC No.: 54241; Empl.: 45; *Sls. Mgr.:* P. Milone ..... **D•2149-2151**

Local Sales Offices & Reps

AL Gurly, Saber Assocs. 800-327-0853
CA Los Angeles, Power Partners 800-468-5400
CA San Diego, Power Partners 800-468-5400
CA Sunnyvale, N-S Westronics 408-745-1102
CT New London, Elctrn. Sls. of New England 203-443-2646
FL Apopka, Saber Assocs. 800-432-6288
FL Melbourne, Saber Assocs. 800-432-6288
FL Plantation, Saber Assocs. 800-432-6288
FL Tampa, Saber Assocs. 800-432-6288
GA Dacula, Saber Assocs. 800-327-0853
MD Landover, Sel-Tronics 301-341-2700
MA Wareham, Elctrn. Sls. of New England 508-295-7634
NC Clayton, Saber Assocs. 800-327-0853
TX Dallas, True Technlg. 214-691-7870
VA Hampton, Sel-Tronics 301-341-2700
VA Herdon, Sel-Tronics 301-341-2700
WA Bellevue, Al Smith Co. 206-746-6770
WA Vancouver, Al Smith Co. 206-892-9912

ABALON PRECISION MFG., 1040 Home Street, Bronx, NY 10459, Tel: 212-589-5682, 1-800-888-ABALON, FAX: 212-589-0300; Empl.: 25; *Sls. Mgr.:* Harold Miller

ABB KENT-TAYLOR INC., ASea Brown Boveri, P.O. Box 110, 95 Ames St., Rochester, NY 14692, Tel: 716-235-5000, TELEX: 978412, FAX: 716-235-7131; Empl.: 600; *Dist. Mgr.:* Michael Spoonhower

ABB METRAWATT, 2150 W. 6th Ave. Unit J, Broomfield, CO 80020, Tel: 303-469-5231, 800-821-6327, TELEX: 4970869, FAX: 303-469-4256; Empl.: 20; *Sls. Mgr.:* Erik Pfanku

ABB SEMICONDUCTOR, See IXYS Corporation

abbott

FAX: 213-836-1027

ABBOTT ELECTRONICS, 2727 S. La Cienega Blvd., Los Angeles, CA 90034, Tel: 213-202-8820, TELEX: 69-1398; FSC No.: 6130, 5999, 15755; Empl.: 200; *Sls. Mgr.:* Brooke Hartman ..... **D•1523-1543**

Local Sales Offices & Reps

NJ Ft. Lee, Abbott Elctrns. 201-461-4411
TX Richardson, Abbott Elctrns. 214-437-0697
UT Bountiful, Anderson & Assocs. 801-292-8991
AZ Scottsdale, Aztech-CPS Assocs. 602-991-6300
Can Ottawa, Subtec Ltd. 613-738-1470

ABBOTT TECHNOLOGIES, INC, Transformer Division, 8203 Vineland Ave, Sun Valley, CA 91352, Tel: 818-504-0644, 1-800-367-8200, 818-841-3630, TELEX: 75-2972, FAX: 818-768-0395,69-6282; FSC No.: 58910; Empl.: 62; *Sls. Mgr.:* Suresh Soni ..... **A•2134-2149; D•2152-2153**

Local Sales Offices & Reps

CA Mission Viejo, Abbott Technlgs., Inc. .. 714-454-1361
CA Sun Valley, Abbott Technlgs., Inc. 818-504-0644
NJ Palisades Pk., Abbott Technlgs., Inc. .. 201-461-4005

ABBOTT TECHNOLOGIES, INC. POWER SUPPLIES DIVISION, 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644,1-800-367-8200,818-841-3630, TELEX: 75-2972, FAX: 818-768-0395; Empl.: 62; *Sls. Mgr.:* Suresh Soni ..... **D•1511-1521, 2152-2153**

Local Sales Offices & Reps

CA Mission Viejo, Abbott Technlgs., Inc. .. 714-454-1361
CA Sun Valley, Abbott Technlgs; Inc. 818-504-0644
NJ Palisades Pk., Abbott Technlgs., Inc. .. 201-461-4005

ABBOTT TRANSISTOR LABS, Power Supplies, See Abbott Electronics, Power Supplies

ABL ELECTRONICS SUPPLY, INC., 1736 Front St, Yorktown Hgts, NY 10598, Tel: 914-962-2253, FAX: 914-962-2296; Empl.: 18; *Sls. Mgr.:* George Wiesel ..... **C•1155, 1710-1713**

ABLESTIK LABORATORIES, 20021 Susana Rd, Rancho Dominguez, CA 90221, Tel: 213-764-4600, FAX: 213-764-2545; FSC No.: 21109; Empl.: 150; *Sls. Mgr.:* J. Gausepohl

ABORN ELECTRONICS INC., 2108 D Bering Dr., San Jose, CA 95131, Tel: 408-436-5444, FAX: 408-436-0969; FSC No.: 8Z441; Empl.: K. Bomin; *Sls. Mgr.:* V. Lumba

ABRAMS INSTRUMENT CORP., 2859 W. Jolly Rd., Okemos, MI 48864, Tel: 517-332-6405, FAX: 517-332-8270; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

ACC ELECTRONICS COMPANY, Echlin Inc., 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, FAX: 316-331-1422; Empl.: 1000; *Sls. Mgr.:* Leon Allen

ACCEL INDUSTRIAL HEAT SINK CORP., 3709 Medford St, Los Angeles, CA 90063, Tel: 213-261-5156, FAX: 213-261-5159; FSC No.: 26701; *Sls. Mgr.:* Ron Ruby

ACCEL TECHNOLOGIES, INC., 6825 Flanders Dr., San Diego, CA 92121, Tel: 619-554-1000, TELEX: 201-582 ATI UR, FAX: 619-554-1019; Empl.: 26; *Sls. Mgr.:* Ray Schnorr

ACCESSORIES FOR ELECTRONICS, INC., 800 Merrick Rd., Baldwin, NY 11510-3593, Tel: 516-546-1751, FAX: 516-867-1922; FSC No.: 54355; Empl.: 27; *Sls. Mgr.:* Bill Harris

ACCU DATA, INC., 1220 Spring Creek Place, Springville, UT 84663-0963, Tel: 801-377-9156, FAX: 801-377-9158; Empl.: 10; *Sls. Mgr.:* Ralph D. Bradley; *Dist. Mgr.:* Ralph D. Bradley

ACCUDYNE CORP., P.O. Box 1429, Janesville, WI 53547, Tel: 608-752-4053, FAX: 608-752-9706; FSC No.: 18356; Empl.: 540; *Sls. Mgr.:* R. E. Mowris; *Dist. Mgr.:* R. E. Mowris

ACCULEX CORPORATION, 440 Myles Standish Blvd, Taunton, MA 02780, Tel: 508-880-3660, TELEX: 503989, FAX: 508-880-0179; *Sls. Mgr.:* Richard A. Mullen

ACCULIN, INC., 214 N. Main St., Suite 204, Natick, MA 01760, Tel: 508-650-1012, FAX: 508-650-1457; Empl.: 3; *Sls. Mgr.:* Barry Hilton

ACCUMET ENGINEERING, 518 Main St, Hudson, MA 01749, Tel: 508-568-8311, FAX: 508-562-4384; *Sls. Mgr.:* C. T. Haering

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 508-745-7878, FAX: 508-745-7922; Empl.: 22; *Sls. Mgr.:* Thomas H. Murphy; *Dist. Mgr.:* T. H. Murphy

ACCURATE ELECTRONICS CORP., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-366-6330, 1-800-325-8979, FAX: 216-366-0522; FSC No.: 11375; Empl.: 35; *Sls. Mgr.:* J. F. Seybold

Local Sales Offices & Reps

FL Niceville, Adams Sls. Co. 904-897-4958
OH Worthington, Padgett Sls. Co. 614-885-5908

ACCURIDE, 12311 Shoemaker, Santa Fe Springs, CA 90670, Tel: 213-903-0373, TWX: 910-586-1632, FAX: 213-903-0208; *Sls. Mgr.:* Jackie Pinto

ACCUSONIC DIVISION, Ferranti O.R.E. Inc., Box 709, Falmouth, MA 02541, Tel: 508-548-5800, TELEX: 6817399 OREFAL UW, FAX: 508-540-3835; Empl.: 125; *Sls. Mgr.:* Robert Beede

ACCUSONIC SYSTEMS CORP., A DSG Company, 2101 Jericho Turnpike, New Hyde Park, NY 11040, Tel: 516-328-3300, FAX: 516-326-8827; Empl.: 116; *Sls. Mgr.:* Michael D'Agostino

ACCUTECH, Adaptive Instrs. Corp., 15 Bunazzoli Ave., Riverside Indl. Park, Hudson, MA 01749, Tel: 508-568-0500, FAX: 508-568-9085; *Sls. Mgr.:* Cliff Lewis

ACCUTECH BENCHMARK SERVICES, P.O. Box 252, Brick, NJ 08723, Tel: 1-908-206-0026, FAX: 908-206-0280 ..... **D•1024-1026**

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

acdc electronics
A DIVISION OF ASTEC AMERICA, INC.

ACDC ELECTRONICS, DIV. OF ASTEC AMERICA, See Astec America

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, Div. of Acheson Industries, Inc., P.O. Box 611747, Port Huron, MI 48061-1747, Tel: 313-984-5581, FAX: 313-984-1446; Empl.: 200

A.C. INTERFACE INC., 22391 Gilberto, Rancho Santa Margarita, CA 92688, Tel: 714-858-1866, FAX: 714-858-1073; FSC No.: OAP 78; Empl.: 23; *Sls. Mgr.:* Bill Roth; *Dist. Mgr.:* Al Kile

ACL INC., 1960 E. Devon Ave., Elk Grove, IL 60007, Tel: 708-981-9212, 1-800-782-8420, FAX: 708-981-9212; Empl.: 12; *Sls. Mgr.:* Ralph D. Considine; *Dist. Mgr.:* Tony Banks



FAX: 716-968-3948

ACME ELECTRIC CORPORATION, 20 Water Street, Cuba, NY 14727, Tel: 716-968-2400; *Sls. Mgr.:* Dale Guilford; *Dist. Mgr.:* Bill Bengle ..... **D•1544-1547, 2154-2155**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean 205-830-1540
AZ Phoenix, O'Donnell Assocs. S.W. 602-944-9542
CA San Jose, O'Donnell Assocs., North ... 408-432-1940
CO Littleton, Harthun Assocs. 303-795-5545
FL Apopka, Cartwright & Bean 407-422-4531
FL Deerfield Bch., Cartwright & Bean 305-429-3400
GA Norcross, Cartwright & Bean 404-368-0160
ID Boise, Jas. J. Backer Co. 208-343-9831
IL Des Plaines, Electron Mktg. 312-298-2330
IN Ft. Wayne, Needler Sls. Co., Inc. 219-447-2123
IN Indianapolis, Luebbe Sls. 317-845-7389
IN Indianapolis, Needler Sls. Co., Inc. 317-255-8056
KS Shawnee Mission, Lowell Kangas & Assocs. 913-631-3515
LA Covington, Cartwright & Bean 504-892-1780
MD Gaithersburg, Naudain Assocs. 301-258-5040
MA Framingham, Marathon Sls. 508-875-3566
MI Farmington Hills, Luebbe Sls. 313-489-8828
MS Jackson, Cartwright & Bean 601-981-1170
MN Minneapolis, Boerger & Assocs. 612-560-3435
MO St. Louis, Lowell Kangas & Assocs. ... 314-821-4050
NM Albuquerque, O'Donnell Assocs. S.W. 505-889-4522
NY Clark Mills, KLM Garner 315-853-6126
CA Torrance, O'Donnell Assocs. S. W. 213-539-9664
NC Charlotte, Cartwright & Bean 704-536-0303
NC Lumberton, Acme Elec. Corp. 919-738-9202
NC Raleigh, Cartwright & Bean 919-876-4130
OH Cincinnati, Luebbe Sls. 513-530-0600
OH Cleveland, Luebbe Sls. 216-333-0425
OH Cleveland, Marlow Assocs. 216-831-8232
OH Columbus, Luebbe Sls. 614-431-0474
OH Dayton, Luebbe Sls. 513-294-0426
OH Dayton, Marlow Assocs. 513-274-9666
OR Beaverton, Jas. J. Backer Co. 503-627-0775
PA Pittsburgh, Luebbe Sls. 412-364-0490
PA Pittsburgh, Marlow Assocs. 412-343-5050
TN Knoxville, Cartwright & Bean 615-693-4750
TN Memphis, Cartwright & Bean 901-362-8345
UT Salt Lake City, Acme Elec. Corp. 801-539-0227
WA Seattle, Jas. J. Backer Co. 206-285-1300
WI Sullivan, Electron Mktg. 414-593-2981

Local Distributors

AL Birmingham, American Elctrns. Supp. 205-942-4656
AL Birmingham, Forbes Distrbg. 205-251-3941
AL Decatur, Forbes Distbg. 205-353-4762
AL Huntsville, Allied Elctrns. 205-721-3500
AL Huntsville, Forbes Distbg. 205-837-1579
AL Huntsville, Future Elctrns. 205-882-3190
AL Mobile, Allied Elctrns. 205-476-1875
AL Mobile, Forbes Distbg. 205-479-4535
AL Mobile, Spectronics 205-344-0450
AL Montgomery, Forbes Distrbg. 205-263-2083
AZ Phoenix, Allied Elctrns. 602-437-9080
AZ Phoenix, Future 602-968-7140
AZ Tempe, L Comp 602-730-1633
AZ Tempe, P&A Entprs. 602-894-1519
AR Little Rock, Carlton Bates 501-562-9100
AR N. Little Rock, Allied Elctrns. 501-376-0233
CA Chatsworth, Allied Elctrns. 818-882-6981
CA Chatsworth, Future Elctrns. 818-722-6240
CA Fremont, Allied Elctrns. 415-770-0590
CA Irvine, Allied Elctrns. 714-727-3010
CA Irvine, Future Elctrns. 714-250-4141
CA Irvine, ITT Multicomp. 714-727-3001
CA Los Angeles, Bell Inds. 213-826-6778
CA Rockland, Allied Elctrns. 916-632-3014
CA S. San Francisco, Allied Elctrns. 415-952-9599
CA San Diego, Allied Elctrns. 619-279-2550
CA San Diego, Future Elctrns. 619-278-5020
CA San Jose, Capstone 408-453-9804
CA San Jose, Future Elctrns. 408-434-1122
CA San Jose, ITT Multicomp. 408-453-1404
CA San Jose, Rose Elctrns. 408-943-0255
CA Sunnyvale, Target Elctrns. 408-733-0384
CA Torrance, Allied Elctrns. 213-373-8828
CA Tustin, Capstone 714-730-0349
CA Yorba Linda, Target Elctrns. 714-692-1630
CO Denver, Consolidated Parts 303-623-5313
CO Englewood, Allied Elctrns. 303-790-1664
CO Englewood, NEP Elctrns. 303-799-9898
CO Westminster, ITT Multicomps. 303-451-8740
CT Bethel, Future Elctrns. 203-743-9594
CT Cheshire, Allied Elctrns. 203-272-7730
CT Wallingford, Sager 203-265-7741
FL Altamonte Springs, Future Elctrns. 407-767-8414
FL Casselberry, Allied Elctrns. 407-831-3331
FL Clearwater, Future Elctrns. 813-578-2770
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Jacksonville, Allied Elctrns. 904-346-0741
FL Jacksonville, Hammond/EMSCO 904-356-4851
FL Largo, Allied Elctrns. 813-541-4660
FL Orlando, EMSCO 407-849-6362
FL Orlando, Hammond Elctrns. 407-849-6060
FL Pompano Bch., Allied Elctrns. 305-978-3008
FL Riviera Bch., K & M Elctrl. 407-842-4911
GA Doraville, Voltex Batteries 404-448-6021
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Future Elctrns. 404-441-7676
GA Norcross, Hammond Elctrns. 404-449-1996
IL Addison, LComp Elctrns. 312-628-1400
IL Itasca, Capstone 708-250-3000
IL Libertyville, Allied Elctrns. 708-918-0250
IL Oak Forest, Allied Elctrns. 708-535-0038
IL Wood Dale, Allied Elctrns. 708-860-0007
IN Carmel, Altex Elctrns. 317-848-1323
IN Ft. Wayne, Bell Inds. 219-742-4346
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Allied Elctrns. 317-875-0448
IN Indianapolis, Bell Inds. 317-634-8202
IN Indianapolis, Meunier Elctrns. 317-635-3511
IN Indianapolis, R S Elctrns. 513-793-2450
ID Boise, Radar Elec. 208-336-2227
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IA W. Des Moines, Allied Elctrns. 515-223-6488
KS Lenexa, Allied Elctrns. 913-599-6227
KS Overland Park, Olive Elctrns. 312-297-6200
IL Schaumberg, Future Elctrns. 312-882-1255
KY Florence, URI Elctrns. 606-371-4423
KY Lexington, Radio Elctrn. 606-255-6661
KY Louisville, Allied Elctrns. 502-452-2293
KY Louisville, Peerless Elctrns. 502-637-7674
LA Baton Rouge, Menard Elctrns. 504-355-0323
LA Metairie, Allied Elctrns. 504-885-1195
LA New Orleans, Menard Elctrns. 504-734-8445
LA New Orleans, Radio Parts 504-581-5959
MD Baltimore, Resco/Baltimore 301-931-8200
MA Billerica, Allied Elctrns. 508-667-7921
MD Columbia, Allied Elctrns. 301-381-1560
MD Columbia, Future Elctrns. 301-290-0600
MD Columbia, Sager 301-995-6580
MD Jessup, Treeko Elctrns. 301-470-3300
MD W. Friendship, Cerberus Sys. 301-489-7198
MA Hingham, Sager Elctrl. 617-749-6700
MA Norwood, Allied Elctrns. 617-255-0361
MA Wilmington, Capstone 508-657-5874
MA Wilmington, North Star Elctrns. 508-657-5155
MI Battle Creek, Gt. Lakes Elctrns. 616-963-6282
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Grand Haven, Fitzpatrick Elec. 616-846-5591
MI Grand Rapids, Allied Elctrns. 616-949-8200
MI Grand Rapids, Fitzpatrick Elec. 800-968-9880
MI Grand Rapids, R S Elctrns. 616-241-3483
MI Holland, Fitzpatrick Elec. 800-968-4625
MI Lansing, Battery Exchange(Dynalite) .. 517-694-0411
MI Livonia, Allied Elctrns. 313-462-0190
MI Livonia, Future Elctrns. 313-261-5270
MI Livonia, R S Elctrns. 313-525-1155
MI Muskegon, Fitzpatrick Elec. 800-968-6621
MI Traverse City, Fitzpatrick Elec. 800-968-7262
MN Eden Prairie, Allied Elctrns. 612-829-7554
MN Eden Prairie, Future Elctrns. 612-944-2200
MN Minneapolis, Bergquist Co. 612-835-2322
MN Minneapolis, ISI-Instrmn. Svc. 612-544-8916
MS Jackson, Ellington Elec. 601-355-0561
MO Earth City, Allied Elctrns. 314-291-7031
MO Kansas City, LComp Elctrns. 816-221-2400
MO Maryland Hgts., LComp Elctrns. 314-291-6200
MO Maryland Hgts., Olive Elctrns. 314-997-7709
MO St Louis, ISL Corp. 314-535-5760
MO St. Louis, Future Elctrns. 314-469-6805
MO St. Louis, Vansickle Elctrns. 314-621-5000
NE Omaha, Allied Elctrns. 402-697-0038
NH Nashua, Allied Elctrns. 603-883-3008
NJ Edison, Allied Elctrns. 908-572-9600
NJ Fairfield, Future Elctrns. 201-227-4346
NJ Green Brook, Apparatus Elec. 201-752-8400
NJ Lodi, TRC 201-779-8282
NJ Mt. Laurel, Capstone 609-727-7800
NJ Oakland, Relay Specialties 201-337-1000
NJ Parsippany, Allied Elctrns. 201-428-3350
NM Albuquerque, International Elctrns. 505-291-9951
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NY Buffalo, Summit Inds. 716-887-2800
NY Cen. Islip, Circuit Sls. 516-348-7670
NY E. Rochester, Rome Elctrns. 716-248-0160
NY Fairport, Allied Elctrns. 716-425-3850
NY Hauppauge, Future Elctrns. 516-234-4000
NY Hauppauge, Sager Elctrl. 516-348-1300
NY Lagrangeville, Allied Elctrns. 914-452-1470
NY Liverpool, Future Elctrns. 315-451-2371
NY Melville, Capstone 516-391-1300
NY Mineola, Allied Elctrns. 516-248-2360
NY Mt. Vernon, OAR Elctrns. 914-699-2224
NY Mt. Vernon, QAR Elctrns. 914-699-2224
NY Rochester, CAM/RPC Elctrns. 716-427-9999
NY Rochester, Future Elctrns. 716-272-1120
NY Rochester, Simcona 716-328-3230
NY Rochester, Summit Inds. 716-334-8110
NY Rockville Centre, Group 516 Inc. 516-678-7360
NY Rome, Rome Elctrns. 315-337-5400
NC Asheville, Southeastern Elctrns. 704-253-1446
NC Charlotte, Future Elctrns. 704-529-5500
NC Charlotte, Southeastern Elctrns. 704-523-1122
NC Fayetteville, Southeastern Elctrns. 919-483-0371
NC Greensboro, Hammond/EMSCO 919-275-6391
NC Greensboro, Southeastern Elctrns. 919-273-8675
NC Hickory, Southeastern Elctrns. 704-322-9493
NC Jacksonville, Southeastern Elctrns. ... 919-353-4171
NC Kingston, Southeastern Elctrns. 919-523-5113
NC Lumberton, The Computer Store 919-738-3755
NC Raleigh, Allied Elctrns. 919-876-5845
NC Raleigh, Capstone 919-954-0600
NC Raleigh, Sager Elctrns. 919-850-9550
NC Raleigh, Southeastern Elctrns. 919-828-2311
NC Wilmington, Southeastern Elctrns. 919-791-7365
OH Cincinnati, Allied Elctrns. 513-771-6990
OH Cincinnati, Hughes-Peters, Inc. 513-351-2000
OH Cincinnati, URI Elctrns. 513-761-4030
OH Cleveland, Acorn Inds. 216-289-2531
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Columbus, Foster Battery (Dynalite) .. 614-351-1500
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Duellman Elec. 513-461-8000
OH Maumee, R S Elctrns. 419-893-0721
OH Millbury, Dynalite Battery 419-837-6837
OH Solon, Allied Elctrns. 216-248-4200
OH Warren, REM Elctrns. 216-373-1300
OH Worthington, Allied Elctrns. 614-785-1270
OK Oklahoma City, Radio, Inc. 405-789-0741
OK Tulsa, Allied Elctrns. 918-664-0844
OK Tulsa, Altair Co. 918-252-9123
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Future Elctrns. 503-645-9454
OR Beaverton, Rose Elctrns. 503-629-9288
OR Portland, Radar Elec. 503-232-3404
PA Allentown, Yates Battery 215-437-6700
PA Bristol, Aim Elctrns. 215-785-3500
PA Camp Hill, Allied Elctrns 717-975-3570
PA Drexel Hill, Kass Elctrns. 215-449-2300
PA Erie, REM Elctrns. 814-453-5626
PA Essington, Tri-Com 215-521-3080
PA Mars, Sager Elctrns. 412-772-2233
PA N. Huntingdon, REM Elctrns. 412-864-7423
PA Pittsburgh, Allied Elctrns. 412-367-4124
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Reading, Yates Battery 215-670-2515
SC Charleston, Cameron & Barkley 803-554-9550
SC Florence, Cameron & Barkley 803-664-0600
SC Greenville, Allied Elctrns. 803-288-8835
TN Clarksville, Randolph, Hale & Matthews 615-647-2325
TN Columbia, Randolph & Williams 615-388-7566
TN Memphis, Allied Elctrns. 901-367-2895
TN Nashville, Randolph & Rice 615-255-5601
TN Tullahoma, Randolph & Vandergaff ... 615-455-4531
TX Austin, Allied Elctrns. 512-389-3771
TX Austin, Altair Co. 512-837-4970
TX Carrollton, Capstone 214-380-9049
TX Corpus Christi, Douglas Elctrns. 512-883-5103
TX Dallas, Allied Elctrns. 214-553-4370
TX El Paso, Allied Elctrns. 915-779-6294
TX Ft. Worth, Allied Elctrns. Exp. 817-595-3500
TX Houston, Altair Co. 713-462-3029
TX Houston, Future Elctrns. 713-556-8696
TX Humble, Allied Elctrns. 713-446-8005
TX Irving, Allied Elctrns. 214-570-5196
TX Richardson, Altair Co. 214-231-5166
TX Richardson, Bell Inds. 214-744-2510
TX Richardson, Future Elctrns. 214-437-2437
UT Salt Lake City, Allied Elctrns. 801-261-5244
UT Salt Lake City, Future Elctrns. 801-972-8489
VA Alexanderia, Allied elctrns. 703-750-0206
VA Roanoke, Southeastern Elctrns. 703-344-6611
VA Virginia Bch., Allied Elctrns. 804-363-8662
WA Bellevue, Syntek 206-488-0394
WA Redmond, Future Elctrns. 206-881-8199
WA Richland, Radar Elec. 509-943-8336
WA Seattle, Allied Elctrns. 206-547-2827
WA Seattle, Radar Elec. 206-282-2511
WA Spokane, Radar Elec. 509-747-3053
WI Mequon, Taylor Elctrns. 414-241-4321
WI New Berlin, Allied Elctrns. 414-796-1280
WI Sullivan, The Bergquist Co. 414-593-2020
WI Waukesha, Future Elctrns. 414-786-1884
WI Everett, Pringle Elctrns. 206-258-6161
PR San Juan, Clary Corp.of P.R. 809-760-5845
Can Calagary, Future Elctrns. 403-250-5550
Can Downsview, Future Elctrns. 416-638-4771
Can Edmonton, Future Elctrns. 403-438-2858
Can Ottawa, Future Elctrns. 613-820-8313
Can Ottawa, Ont., Wackid Radio 613-728-1821
Can Pt. Claire, Que., Future Elctrns. 514-694-7710
Can St. Foy, Future Elctrns. 418-682-8092
Can Van Couver, Future Elctrns. 604-294-1166
Can Winnipeg, Future Elctrns. 204-786-7711

Can Winnipeg, Westrock Battery 204-786-6034
Can Yellowknife, Yukon, Northern Comm .. 403-873-3953

ACME MODEL ENGINEERING CO., 654 Bergen Blvd., Ridgefield, NJ 07657, Tel: 201-943-7650; Empl.: 29

ACME TRANSFORMER, Acme Electric Corporation, 4815 West 5th St., Lumberton, NC 28358, Tel: 919-738-1121, FAX: 919-739-0024; *Sls. Mgr.:* Don Chesner

ACME-URDC, INC., 7915 South 1530 West, Box 10, West Jordan, UT 84084, Tel: 801-561-9385, FAX: 801-562-9004; *Sls. Mgr.:* Leland Coleman

ACON, INC., 15c Plymouth Dr., South Easton, MA 02375, Tel: 508-230-8022, FAX: 508-230-2371; Empl.: 10

ACOPIAN TECHNICAL COMPANY, Box 638, Easton, PA 18044, Tel: 215-258-5441, FAX: 215-258-2842; FSC No.: 14749; *Sls. Mgr.:* T. Skopal ..... **D•1549-1578**

Local Sales Offices & Reps
FL Melbourne, Acopian 407-727-1172
MD Jessup, Doss Elctrns. 301-880-3262

ACRODYNE CONTROLS, See Accudyne Corp.

ACROMAG INC., 30765 Wixom Rd., P.O. Box 437, Wixom, MI 48393-7037, Tel: 313-624-1541, FAX: 313-624-9234; Empl.: 100; *Sls. Mgr.:* C. Mitchell

ACROSYSTEMS CORP., 66 Cherry Hill Dr., Beverly, MA 01915, Tel: 508-927-8880; Empl.: 30; *Sls. Mgr.:* Herbert Tobey

ACR SYSTEMS INC., 8561-132nd St., Surrey,B.C., Canada V3W 4N8, Tel: 604-591-1128, FAX: 604-591-2252; Empl.: 5; *Sls. Mgr.:* Rick Schellenberg; *Dist. Mgr.:* Rick Schellenberg

ACTEL CORPORATION, 955 E. Arques Ave., Sunnyvale, CA 94086, Tel: 408-739-1010, FAX: 408-739-1540; Empl.: 86; *Sls. Mgr.:* Bob Duyn

ACTION INSTRUMENTS, 8601 Aero Dr., San Diego, CA 92123, Tel: 619-279-5726, FAX: 619-279-6290; Empl.: 230; *Sls. Mgr.:* Frank Williams, Sls. VP

ACTIVE CONTROL INSTRUMENTATION, P.O. Box 243-Wildwood Circle, Key Largo, FL 33037, Tel: 305-451-1000, FAX: 305-451-3232; FSC No.: 55116; Empl.: 6 ..... **D•1126**

ACTOWN-ELECTROCOIL, INC., 2414 Highview, Spring Grove, IL 60081, Tel: 815-675-6641, FAX: 815-675-2050; Empl.: 200; *Sls. Mgr.:* Les Friedman

AC TRANSFORMER, 89 Madison St., Newark, NJ 07105, Tel: 201-589-8574, FAX: 201-589-3155; FSC No.: 3677; Empl.: 13; *Sls. Mgr.:* George Giangrande, Sls. Consit.

ACUREX CORP./AUTODATA DIV., 555 Clyde Ave., P.O. Box 7042, Mountain View, CA 94039, Tel: 415-967-9100, TELEX: 34-6391, TWX: 910-379-6593, FAX: 415-967-7727; Empl.: 40; *Sls. Mgr.:* David Swartz; *Dist. Mgr.:* David Swartz

ADALET-PLM/DIV. OF SCOTT & FETZER CO., 4801 W. 150th St., Cleveland, OH 44135, Tel: 216-267-9000, TELEX: 98-5349, FAX: 216-267-1681; FSC No.: 73389; Empl.: 177

ADAMS-MAXWELL DIVISION, Coast Magnetics, 1207 North La Brea Ave., Inglewood, CA 90302-1284, Tel: 213-673-3245, TELEX: 686103AMISPACEASA, FAX: 213-673-8828; FSC No.: 22558; Empl.: 60; *Sls. Mgr.:* Allen Adams

ADAMS RITE PRODUCTS, INC., 540 W. Chevy Chase Dr., Glendale, CA 91204, Tel: 818-241-5121, TWX: 910-497-2276, FAX: 818-500-7239; Empl.: 150; *Sls. Mgr.:* Jonas Williams

ADAMS-RUSSELL, INC., DIV. OF M/A COM, INC., 110 Haverhill Rd., Amesbury, MA 01913, Tel: 508-388-5210, TWX: 710-347-6360, FAX: 508-388-9758; FSC No.: 11556; Empl.: 400; *Sls. Mgr.:* H. Adjemian

ADAPTEC, INC., 691 South Milpitas Blvd., Milpitas, CA 95035, Tel: 408-945-8600, TELEX: 910-338-0060, FAX: 408-262-2533; Empl.: 6000; *Sls. Mgr.:* Wayne Gartin; *Dist. Mgr.:* Roy Safire

ADAPTIVE NETWORKS, P.O. Box 1020 Kendall Sq., Cambridge, MA 02142, Tel: 617-497-5150; Empl.: 20; *Sls. Mgr.:* Sumin Tchen

ADATEK, INC., 700 Airport Way, Sandpoint, ID 83864, Tel: 208-263-1471, 800-323-3343, TELEX: 62903932, FAX: 208-263-6596; Empl.: 18; *Sls. Mgr.:* Jeff Siebert; *Dist. Mgr.:* Suzy Hook

ADCOUR, INC., 18 Billings St., PO Box 277, Sharon, MA 02067, Tel: 617-784-8123, FAX: 617-784-5563; Empl.: 29; *Sls. Mgr.:* William O'Connell; *Dist. Mgr.:* William O'Connell

ADC TELECOMMUNICATIONS, INC., 4900 W. 78th St., Minneapolis, MN 55435, Tel: 612-835-6800, TELEX: 290321, FAX: 612-893-3292; Empl.: 2200; *Sls. Mgr.:* Mark Lonergan, VP. Sls. ..... **C•1157-1159**

ADDACON GREENSBORO, 3702-C Alliance Dr., Greensboro, NC 27407, Tel: 919-852-6200, FAX: 919-852-6256; *Sls. Mgr.:* Lynn Cummings

A.D. DATA SYSTEMS CORP., Photographic Sciences Corp., 770 Basket Rd., Webster, NY 14580-0748, Tel: 716-265-1600, FAX: 716-265-1689; FSC No.: 23389; Empl.: 12; *Sls. Mgr.:* J. Cessna, J. Butters

Local Sales Offices & Reps
CA Torrance, AMASCO-South 213-781-9494
FL Melbourne, Saber Assocs. 800-327-0853
KS Lenexa, Midtec Assocs. 913-541-0505
MD Landover, Sel-Tronics 301-341-2700
MA Westford, ICS Assocs. 508-692-3545
NM Albuquerque, Trembly Assocs. 505-266-8616
OH Westlake, TMS, Inc. 216-327-3527
PA N. Wales, Scientific Devs. 215-699-7707
TX Richardson, Scientific Devs. (SW) 214-231-8106
WA Seattle, Datacom Assocs. 206-285-2525
EXP Leport Marly, France, Euromeasure, SA ... 395-84863
EXP Warwickshire, England, Measurement LTD 926-35411
Can Scarborough, Ont., Multitest Elctrns. ... 416-609-8396

ADDITIVE CIRCUITS, AMP-AKZO Corp., P.O. Box 700, West La., Aquebogue, NY 11931, Tel: 516-722-4100, FAX: 516-722-4154; Empl.: 500; *Sls. Mgr.:* Lenny Smookler, Nat. Sls. Mgr.

ADE, INC., 1430 E. 130th St., Chicago, IL 60633, Tel: 312-646-3400, FAX: 312-646-3919; FSC No.: 62049; *Sls. Mgr.:* Fred Tenzer

ADIRONDACK WIRE & CABLE, ACS Industries Inc., 160 Hamlet Ave., Woonsocket, RI 02895, Tel: 1-401-769-1600, FAX: 1-401-769-1607; Empl.: 650; *Sls. Mgr.:* Julian Caduto

ADTECH POWER

FAX: 714-634-0802

ADTECH POWER INC., 1620 S. Sunkist St., Anaheim, CA 92806, Tel: 714-634-9211; FSC No.: 56410; Empl.: 55; *Sls. Mgr.:* Royston A. Allman; *Dist. Mgr.:* Royston A. Allman ..... **D•1580-1583**

Local Sales Offices & Reps
CA Campbell, Sedillo Co. 408-374-5220
FL Deerfield Beach, Jack Krutek & Assoc. 305-427-4202
IL Elk Grove Vl, Carlson Elect. Sls. 312-956-8240
MA Natick, Wayland Eng. Sls. 508-655-6080
MI Troy, C.B. Jensen & Assoc. 313-643-0506
NY New York, Morgan Elctrn. Sls. 516-549-5180
OR Beaverton, Quest Mktg. 503-641-7377
TX Dallas, Spectra Sls. Corp. 214-234-3600
WA Bellevue, Quest Mktg. 206-747-9424

Local Distributors
AL Birmingham, Industrial Elec. Supp. 205-956-8504
CA Palo Alto, Zack Elctrns. 415-326-5432
CA San Francisco, Zack Elctrns. 415-626-1444
IL Chicago, Newark Elctrns. 1-312-784-5100
LA Lafayette, Ralph's of Lafayette 318-233-0105
MD Gaithersburg, M S Elctrns. 301-921-0200
MA Woburn, Mac Bearing 617-933-2110
PA Philadelphia, Philadelphia Elctrns. 215-673-0400
TX Ft. Worth, Allied Elctrns. 1-800-433-5700

ADTRON CORPORATION, 128 W. Boxelder Ste. 102, Chandler, AZ 85224, Tel: 602-926-9324, FAX: 602-926-9359; Empl.: 4; *Sls. Mgr.:* Shiela Fitzgerald

ADVACOM, INC., 5620 West Rd., McKean, PA 16426, Tel: 1-800-458-0512, 814-476-7774

ADVANCE, A Unit of Zero Corporation, 6900 Beck Avenue, N. Hollywood, CA 91605, Tel: 818-983-0333; *Sls. Mgr.:* Kevin Quinn

ADVANCE CONVERSION DEVICES CO.UNIT OF TRANSITOR DVCS., INC., 85 Horsehill Rd., Cedar Knolls, NJ 07927, Tel: 201-267-1900, FAX: 201-267-2047; FSC No.: 52298; Empl.: 24; *Sls. Mgr.:* Ron Zeman ..... **D•2156-2159**

Local Sales Offices & Reps
AL Huntsville, Reynolds & Assocs., Inc. ... 205-539-1485
AZ Scottsdale, Dave Menegay & Assocs. 602-994-9519
AR El Dorado, Kemp Instrs. Co., Inc. 501-862-5869
CA Bakersfield, FLW, Inc. 805-398-0720
CA Campbell, SMA 408-370-6900
CA Canoga Park, FLW, Inc. 818-719-0037
CA Carlsbad, FLW, Inc. 619-434-5251
CA Costa Mesa, FLW Inc. 714-751-7513
CA Costa Mesa, FLW, Inc. 714-751-7512
CO Denver, Elcom, Inc. 303-337-2300
CT Watertown, May Technlg. 203-274-3777
FL Ft. Lauderdale, Reynolds & Assocs., Inc. 305-344-4536
FL Melbourne, Reynolds & Assocs., Inc. .. 407-259-7000
FL Tampa, Reynolds & Assocs., Inc. 818-372-8369
GA Duluth, Reynolds & Assocs. 404-476-4992
IL Wheeling, Ed Joyner & Co. 708-520-1200
KS Overland Pk, WEB Assocs., Inc. 913-381-7986
MD Hunt Valley, Elctrn. Resources, Inc. ... 301-584-8157
MA Lexington, E.F. Delfino,Inc. 617-862-1118
MI Ann Arbor, Ashby Assocs., Inc. 313-995-4082
MN St. Louis Pk., Elctrn. Innovation, Inc. ... 612-922-2945
MO Florissant, WEB Assocs./Elctrns. Inc. 314-921-5720
NY Endicott, Advanced Comp. Corp. 607-785-3191
NY Kingston, Advanced Comp. Corp. 914-339-1730
NY N. Syracuse, Advance Comps. 315-699-2671
NY Rochester, Advanced Comps. Corp. 716-544-7017
NY Scottsville, Advanced Comps. Corp. 716-889-1429
NC Raleigh, Reynolds & Assocs., Inc. 919-876-0282
OH Arcanum, Ashby Assocs., Inc. 513-692-8713
OH Cleveland, Ashby Assocs., Inc. 216-461-0826
OK Tulsa, Kemp Instrs.,Inc. 918-663-4501
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Pittsburgh, Ashby Assocs., Inc. 412-343-5105
PA Southampton, Campbell Assocs. 215-322-6630
PA West Chester, Elctrn. Resources, Inc. 215-431-0198
SC Greenville, Reynolds & Assocs., Inc. .. 803-288-8701
TX Lewisville, J. Hughes Co. 214–221-1536, 214-221-1538
UT Murray, Elcom 801-262-2400,801-262-2472
VA Alexandria, Dyna-Rep Co. 703-354-1222
VA Harrisburg, Elctrn. Resources, Inc. 703-289-5571
VA Norfolk, Elctrn. Resources, Inc. 804-583-4859
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
EXP NY/New York, Robum Agencies, Inc. 914-968-1016
Can Weston, Ont., Duncan Instrs., Canada Ltd. 416-742-4448

ADVANCED ANALOG, Intech, 2270 Martin Ave., Santa Clara, CA 95050, Tel: 408-988-2702, FAX: 408-988-2702; FSC No.: 52467; Empl.: 200; *Sls. Mgr.:* Michael Sullivan ..... **D•1548**

Local Sales Offices & Reps
AL Huntsville, Sides Assoc. 205-859-9395
AZ Tempe, Thor Engrg. 602-438-8494
CA La Jolla, Thorson 619-292-8525
CA Newport Bch., Leading Concept 714-851-0654
CA Sunnyvale, Pass Assoc. 408-735-9040
CT North Haven, Kitchen & Kutchin 203-239-0212
IL Berkeley, ESA Tech. Mktg. 708-544-0120
IN Indianapolis, CC Electro Sls. 317-921-5000
IA Cedar Rapids, Delltron 319-393-0075
KS Wichita, Miller Aerospace 316-689-8292
MD Randallstown, Beacon North 703-478-2480
MA Burlington, Kitchen & Kutchin 617-229-2660
MI Madison Hgts., Pine Sls. 313-589-0350
MN Eden Prairie, Electro Mark 612-944-5850
MO Hazelwood, Acorn 314-731-2002
MO St. Louis, Acorn 314-421-1751
NY Huntington, Compar 516-423-5660
NY Rochester, Foster & Wager 716-385-7744
OH Cincinnati, Makin 513-871-2424
OH Dayton, Del Steffen 513-293-3145
OR Beaverton, Micro Sls. 503-645-2841
PA Collegeville, HB Sys. 215-489-3256
TX Dallas, MGR 214-238-5246
UT Ogden, Taylor Mktg. 801-546-9570
VA Sterling, Beacon North 703-478-2480
WA Bellevue, Micro Sls. 206-451-0568
Can Quebec, Kaytronics 514-745-5000

ADVANCED CIRCUIT TECHNOLOGY, 118 Northeastern Blvd., Nashua, NH 03062, Tel: 603-880-6000, 800-234-FLEX, TWX: 710-228-8961, FAX: 603-880-1785; FSC No.: 57034; Empl.: 185; *Sls. Mgr.:* David Bouley, Dir. of Sls.

ADVANCED COMPONENTS INDUSTRIES, INC.

FAX: 310-328-0062

ADVANCED COMPONENTS INDS., INC., Spitznagel GmbH, 1308 Sartori Ave., No. 105, Torrance, CA 90501, Tel: 213-328-0060, 310-328-0060; *Sls. Mgr.:* Irma Spreitzer ..... **A•2150-2151; B•1492**

Local Sales Offices & Reps

CT	Hopkinton, Berkshire Elctrns.	508-435-9356
IL	Schaumburg, Terry McNulty & Assocs.	708-894-2529
MA	Hopkinton, Berkshire Elctrns.	508-435-9356

ADVANCED CONNECTOR TECHNOLOGY, 326 Oakwood St., Ventura, CA 93001, Tel: 805-653-5753, FAX: 805-653-0940; Empl.: 5; *Sls. Mgr.:* Karin Kalli

ADVANCED CONTROL SYS., 10 Old Mine Rock Way, Hingham, MA 02043, Tel: 617-740-0223, FAX: 617-740-4227; Empl.: 13; *Sls. Mgr.:* Leopold Bric ..... **D•1127**

ADVANCED CONVERSION TECH., 2001 Fulling Mill Rd. P.O.B. 70, Middletown, PA 17057, Tel: 717-939-2300, FAX: 717-939-7170; FSC No.: 60642; Empl.: 100; *Sls. Mgr.:* LM. Reis

ADVANCED ELECTRONIC PACKAGING, 21562 Surveyor Circle, Huntington Beach, CA 92646, Tel: 714-969-1150, FAX: 714-536-0936; Empl.: 12; *Sls. Mgr.:* Douglas A. Hill ..... **A•1719**

Local Sales Offices & Reps

Can	Mississauga, Ont., Vitel Elctrns.	416-676-9720

ADVANCED FILTER DEVICES, INC., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009, Tel: 619-438-2074, FAX: 619-438-5937; FSC No.: 56620; Empl.: 45; *Sls. Mgr.:* Herbert Johnson

ADVANCED HARDWARE ARCHITECTURES, INC., P. O. Box 9669, Moscow, ID 83843, Tel: 208-883-8000, FAX: 208-883-8001; Empl.: 50; *Sls. Mgr.:* Jack Maynard

ADVANCED HARDWARE MANUFACTURING, INC., 925 Horan Drive, Fenton, MO 63026, Tel: 314-343-3850, FAX: 314-343-3937; Empl.: 11

ADVANCED HIGH VOLTAGE CO. INC., P.O. Box 32408, Tucson, AZ 85751, Tel: 818-997-7222, 602-721-2424; *Sls. Mgr.:* John Richardson ..... **D•1579**

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, TWX: 510-776-0584; FSC No.: 95666; Empl.: 300; *Sls. Mgr.:* Jim Bennett ..... **B•1795**

Local Sales Offices & Reps

CO	Aurora, Electrodyne	303-695-8903
CT	Wallingford, Apex Assocs.	203-269-8401
FL	Casselbury, Southern Elctrn. Sls.	407-332-4718
ID	Coeur'd Alene, Advanced Input Dvcs.	208-765-8000
IL	N. Arlington Hgts., Coombs Assocs. Inc.	312-439-9810
MD	Gaithersburg, Carwither Assocs. Inc.	301-912-9545
MA	Westwood, Apex Assocs.	617-326-5042
MN	Minneapolis, Debeck-Hays	612-835-3610
NJ	Matawan, Shepard & Assocs.	201-566-0095
NJ	Matawau, Shepard	201-566-0095
NY	Victor, Net Sls.	716-924-1844
PA	Prospect Park, Elf Sls.	215-534-3340
PA	Warrendale, Baehr-Greenleaf & Assocs.	412-934-3088
FL	Casselberry, S.E.M.I.	305-962-2255
OH	Westlake, Baehr-Greenleaf	216-892-1770
UT	Salt Lake City, Electrodyne	801-264-8050
WI	Milwaukee, Coombs Assocs. Inc.	414-351-6123
Can	Hamilton, Ont., Cartwright Southall Assoc., Inc.	416-528-0294

ADVANCED INTERCONNECTIONS CORP., P.O. Box 1019, West Warwick, RI 02893, Tel: 401-823-5200, TWX: 910-240-3454, FAX: 401 823-8723; FSC No.: 05-0394638; *Sls. Mgr.:* Max E. Rice

ADVANCED LINEAR DEVICES, INC., 1180F Miraloma Way, Sunnyvale, CA 94086-4606, Tel: 408-720-8737, FAX: 408-720-8297; Empl.: 10; *Sls. Mgr.:* G. M. O'Neal; *Dist. Mgr.:* G. M. O'Neal

ADVANCED MATERIALS SYSTEMS, See Handy & Harman Electronic Materials Corp.

ADVANCED MICRO SYSTEMS, INC., 31 Flagstone Drive, Hudson, NH 03051-4920, Tel: 603-882-1447, FAX: 603-881-7600; Empl.: 50

ADVANCED POWER PRODUCTS, 1510 Garden St. Ste. 17, Santa Barbara, CA 93101, Tel: 805-965-0042, FAX: 805-684-4400

ADVANCED SYSTEMS CONCEPTS, INC., 2333 N. Lake Ave., Altadena, CA 91001, Tel: 818-791-0983, TELEX: 701 215 ASCI, FAX: 818-791-8347; FSC No.: 6U785; Empl.: 15; *Sls. Mgr.:* Maria Reddix; *Dist. Mgr.:* B. Lee ..... **D•1144**

Local Sales Offices & Reps

IA	Des Moines, Beams Co.	515-255-1148
MN	Edina, Integrated Peripheral Sys.	612-831-0349
OH	Dayton, Ashby Assocs.	513-252-5627
VA	Vienna, Advanced Technlg. Assocs.	703-556-0500

FAX: 619-727-4436

ADVANCED TECHNOLOGY COMPANY, 2142 F Industrial Ct., Vista, CA 92083, Tel: 619-727-7430; Empl.: 10; *Sls. Mgr.:* Bill Linko ... **B•1235-1237; C•1605-1608**

ADVANCED THERMAL PRODUCTS, INC., P.O. Box 249, St. Marys, PA 15857, Tel: 814-834-1541, FAX: 814-834-1556; Empl.: 15; *Sls. Mgr.:* John M. Sidoni

Local Sales Offices & Reps

GA	Atlanta, DHR Mktg.	404-564-0529
MA	Andover, Crawford & Assoc.	508-470-2122
NY	Syracuse, John R. Costello	315-472-0322
NC	Raleigh, DHR Mktg.	919-829-1970
TX	Dallas, Eatman Engineering	214-771-1903
WI	New Berlin, Thomas Labant	414-425-7157

ADVANCED VIDEO PRODUCTS, P.O. 1450/543 Great Rd., Littleton, MA 01460, Tel: 508-486-0024, FAX: 508-486-8488; Empl.: 65; *Sls. Mgr.:* Christopher Mohen

AD-VANCE MAGNETICS, INC., 625 Monroe St., Rochester, IN 46975, Tel: 219-223-3158, TWX: 810-290-0294, FAX: 219-223-2524; FSC No.: 50788; Empl.: 31; *Sls. Mgr.:* Kay Nixon ..... **C•1686**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp	205-539-8476
CA	El Cajon, ATronix Technlg.	619-444-1501
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Solvang, ATronix Technlg.	805-686-4366
CO	Arvada, Arrowhead	303-423-5556
CA	Mission Viejo, ATronix Technlg., Inc.	714-858-9009
CT	Branford, Abbott-Allison	203-481-0405
FL	Miramar, DAN-Tech Sls., Inc.	305-963-6142
IL	Wheaton, EMTronics, Inc.	708-665-6222
NJ	Flanders, K & R Engrg. Sls. Corp.	201-584-5235, 800-631-9362
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	W. Conshohocken, Eastern Comps.	215-825-8610
MD	Baltimore, Eastern Comps. Sls. Corp.	301-788-7050
TX	Dallas, J.M. Spell Co. Inc.	214-620-0040
UT	Midvale, Arrowhead	801-561-5688
Can	Nepean, Ont., Subtec Ltd.	613-723-7720
WA	Bellevue, Caruso & Assocs.	206-455-8811

ADVANCE POWER SUPPLIES, INC., See Farnell Advance Power, Inc.

ADVANCE WIRE & CABLE, The Advance Group, 1661 Industrial Way, Belmont, CA 94002, Tel: 415-592-4550, TELEX: 334475, FAX: 415-593-8859; FSC No.: 57775; Empl.: 158; *Sls. Mgr.:* Ed Mittelbusher; *Dist. Mgr.:* Ed Mittelbusher

Local Sales Offices & Reps

AZ	Phoenix, The Advance Grp.	602-437-1334
CA	Anaheim, The Advance Grp.	714-870-0300
CA	Belmont, The Advance Grp.	415-592-4550
CT	Torrington, Phoenix Sls.	203-496-7709
CO	Lakewood, CDT	303-989-6563
MI	Livonia, JFCO Inc.	513-421-7590
FL	Orlando, Gillum Sls.	305-857-2110
FL	Tampa, Gillum Sls.	813-531-2248
GA	Duluth, DTM Inc.	404-381-5592
IL	Deerfield, Flaherty-Haines, Inc.	312-948-7800
MD	Ellicott City, Tech. Sls. Inc.	301-461-2400
MN	Minneapolis, TecTeam Sls. Inc.	612-854-6616
NY	Glen Cove, Dynorep	516-676-1598
OH	Cleveland, JFCO Inc.	216-398-6300
OH	Vandalia, JFCO Inc.	513-890-8322
SC	Greer, Advance Wire & Cable	803-877-9600
TX	Richardson, Promark	214-644-0467
WA	Redmond, The Advance Grp.	206-867-0416

ADVANTEST®
Advantest America, Inc.

FAX: 708-634-2610

ADVANTEST AMERICA, INC., 300 Knightsbridge Parkway, Lincolnshire, IL 60069, Tel: 708-634-2552, FAX: 708-634-2610; Empl.: 233; *Sls. Mgr.:* John Heitman ..... **D•1214-1215**

Instruments

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs.	205-534-6020
AZ	Phoenix, Advantest America, Inc.	602-840-9470
AZ	Phoenix, Tech. Mktg. Svc.	602-678-4940
CA	Cypress, Ward Davis	213-402-2458
CA	Redondo Bch., Ward Davis	213-643-6977
CA	Santa Clara, Advantest America, Inc.	408-970-9922
CA	Santa Clara, Ward Davis	408-245-3700
CA	Santa Monica, Advantest America, Inc.	213-392-0088
CA	Westlake Village, Advantest America,Inc.	805-496-2523
CO	Englewood, Tech. Mktg. Svc.	303-781-8819
CT	Wallingford, Pat Jenks Assocs.	203-265-9939
FL	Longwood, Southern Mktg. Assocs.	407-682-7317
FL	Orlando, Advantest America, Inc.	407-859-0722
GA	Marietta, Southern Mktg. Assocs.	404-565-0603
IL	Arlington, Dytec/Midwest	708-255-3200
IL	Lincolnshire, Advantest America, Inc.	708-634-2552
IL	Park Ridge, Aegis	708-823-1587
IN	Indianapolis, Dytec/Midwest	317-849-9898
KS	Lenexa, Dytec/Midwest	913-888-0215
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MD	Rockville, Creative Mktg. Assocs.	301-880-4161
MA	Beverly, Pat Jenks Assocs.	508-921-4600
MA	Marlboro, Advantest America, Inc.	508-481-1141
MA	Reading, Aegis	617-944-0974
MN	Edina, Dytec Instrs.	612-831-7169
MO	Maryland Hgts., Dytec/South	314-739-0665
NJ	Fort Lee, Advantest America, Inc.	201-886-0300
NJ	Teaneck, Scientific Dvcs.	201-837-1004
NM	Albuquerque, Tech. Mktg. Svc.	505-884-3444
NC	Greensboro, Southern Mktg. Assocs., Inc.	919-479-6034
OH	Dayton, WKM Associates, Inc.	513-434-7500
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
OR	Portland, Advantest America, Inc.	503-255-8985
OR	Wilsonville, SYNTEK	503-682-2750
PA	Allentown, Advantest America, Inc.	215-264-7680
PA	Coopersburg, Aegis	215-965-6840
PA	Northampton, AEGIS	215-837-8400
PA	Southampton, Eastern Instrmn. of PA	215-355-7700
PA	Stroudsburg, AEGIS	717-421-8660
TX	Austin, Advantest America, Inc.	512-451-3936
TX	Austin, Aegis	512-451-6188
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Farmers Branch, Advantest America, Inc.	214-239-7834
UT	Salt Lake City, Tech. Mktg. Svc.	801-596-8803
VT	Williston, Advantest America, Inc.	802-879-8974
WA	Bellevue, SYNTEK	206-462-7700
Can	Mississauga, Ont., Allan Crawford Assocs., Ltd.	416-890-2010
Can	N. Vancouver, B.C., Allan Crawford Assocs., Ltd.	604-988-2195
Can	Ottawa, Ont., Allan Crawford Assocs., Ltd.	613-596-9300
AL	Huntsville, Southern Mktg. Assoc.	205-534-6020
CA	Camarillo, Advantest America, Inc.	808-987-6415
CT	Wallingford, Pat Jenks	203-265-9939
FL	Longwood, Southern Mktg.Assoc.	407-682-7317
GA	Marietta, Southern Mktg. Assoc.	404-565-0603
MD	Frederick, Advantest America, Inc.	301-662-1696
MA	Beverly, Pat Jenks Assocs.	508-921-4600
MI	Madison Heights, WKM Assocs.	313-588-2300
NM	Albuquerque, Barnhill Assocs.	505-299-7658

NY Canastota, New York Hytek Assocs. .. 315-697-8415
NC Greensboro, Southern Mktg. Assoc. ... 919-854-5588
OH Dayton, WKM Assocs. ... 513-434-7500
OH Independence, WKM Assocs. ... 216-524-5930
OR Wilsonville, Syntek ... 503-682-2750
PA Pittsburgh, WKM Assocs. ... 412-892-2953
PA Southampton, Eastern Instrs. of PA ... 215-355-7700
TX Dallas, Data Mktg. Assocs. ... 214-661-0300
TX Houston, Data Mktg. Assocs. ... 713-954-5023
TX San Antonio, Data Mktg. Assocs. ... 512-342-3031
VA Sterling, Advantest America, Inc. ... 703-444-3372
WA Bellevue, Syntek ... 206-462-7700
WI Hartland, Dytec/Midwest ... 414-367-4550
Can Calgary,AL, Allan Crawford Assocs. ... 403-295-0822
Can Mississauga, Ont., Allan Crawford Assocs. ... 416-890-2010
Can N. Vancouver, B.C., Allan Crawford Assocs. ... 604-988-2195
Can Ottawa, Ont., Allan Crawford Assocs. ... 613-596-9300
Can St. Laurent, QE, Allan Crawford Assocs. ... 514-747-7878

ADVANTEST CORPORATION, NS Bldg. 2-4-1, Nishi-Shinjuku, Tokyo 163, Japan, Tel: 03-3342-7500, TELEX: 232-4914 ADVAN; Empl.: 1444; *Sls. Mgr.:* Shinpei Takeshita

ADVANZ TECHNOLOGIES, INC., 455 Industrial Drive, Warwick, RI 02887, Tel: 800-669-9987/401-737-1050, FAX: 401-732-0240; Empl.: 80; *Sls. Mgr.:* Richard J. DeGiacomo, Jr.; *Dist. Mgr.:* Richard J. DeGiacomo, Jr.

ADVOTECH, INC., 670 Mercer Rd., Butler, PA 16001, Tel: 412-283-4497, FAX: 412-283-4713

A E G CORPORATION, 3140 Rte. 22, P.O. Box 3800, Somerville, NJ 08876-1269, Tel: 908-231-8491, FAX: 908-231-8353; Empl.: 200; *Dist. Mgr.:* Graham Wells

A E G CORPORATION, Telefunken Semiconductors Div., 3140 Route 22, Somerville, NJ 08876-1269, Tel: 201-231-8300, FAX: 201-231-8353; *Sls. Mgr.:* John Szafranski

AEG TELEFUNKEN, SEMICONDUCTOR GRP., See AEG Corp.

AEL DEFENSE CORP., 305 Richardson Rd., Lansdale, PA 19446, Tel: 215-822-2929; FSC No.: 93346; Empl.: 1,600; *Sls. Mgr.:* Denis Ritchie

AEMC CORPORATION, 99 Chauncy Street, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, TELEX: 95-1073, FAX: 617-423-2952; *Sls. Mgr.:* George Wood

AEROCOM, 3090 S.W. 37th Ave., Miami, FL 33133, Tel: 305-448-6503, TELEX: 6812020, FAX: 305-448-6916; FSC No.: 81535; Empl.: 55; *Sls. Mgr.:* Thomas A. Coleman

AERODYNE CONTROLS CORPORATION, 30 Haynes Court, Ronkonkoma, NY 11779, Tel: 516-737-1900, FAX: 516-737-1912; FSC No.: 14923; Empl.: 80; *Sls. Mgr.:* Anthony R. Pipitone

AEROFLEX

FAX: 516-694-6771

AEROFLEX LABORATORIES INC., ARX, Inc., 35 South Service Road, Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417; FSC No.: 88379; Empl.: 490 ... **A•1720-1721**

Local Sales Offices & Reps

AL Huntsville, EMA ... 205-830-4030
AL Huntsville, South Design and Mktg. ... 205-880-3623
AZ Phoenix, JBS Assocs. ... 602-893-2382
CA Camarillo, RD & D Sls. Engrg. ... 805-388-8220
CA Long Beach, RD & D Sls. Engrg. ... 213-988-1116
CA Los Altos Hills, HB Mktg. ... 415-941-4080
CA Mt. View, Bay Area Sls. ... 415-969-7959
CA Woodland Hills, Peterson Engrg. Co. .. 818-346-1201
CO Englewood, Deltron Co. ... 303-741-2122
CO Lakewood, Tech. Mktg. ... 303-989-3611
CT Southbury, Dynamic Technlgs. ... 203-262-6220
CT Thomaston, Tygren Co. ... 203-283-8722
FL Altamonte Sp., EMA ... 407-339-2604
FL Pinellas Park, P & M Tech Sls. ... 813-546-4175
FL Tampa, APM Assocs. ... 813-886-2457
FL Winterpark, Max Tech ... 407-679-1220
GA Roswell, EMA ... 404-992-7240
IL Northfield, Feller Assocs., Inc. ... 312-446-8065
IL West Dundee, American Specialties Prods. ... 708-428-2100
IA Cedar Rapids, Richardson Assocs. Grp. ... 319-364-2003
MD Columbia, Autek Assocs. ... 301-740-5100
MA N. Andover, Russett Assoc. ... 508-794-4995
MA Needham Hghts., Kanan Assoc. ... 617-449-7400
MN Minneapolis, International Elctrns., Inc. ... 612-571-0000
MO St. Louis, Rush & West Assoc., Inc. ... 314-965-3322
NJ Ft. Lee, Nexus Technlg. Sls., Inc. ... 201-947-0151
NY Buffalo, Vibratech, Inc. ... 716-895-8000
NY East Syracuse, Fountain, Young & Co. ... 315-437-7733
NY Great Neck, F & F Metro, Inc. ... 516-482-4080
NY Oswego, Fountain, Young & Co., Inc. ... 607-687-3373,FAX:607-687-7511
NC Burlington, EMA ... 919-227-1832
NC Charlotte, EMA ... 704-365-0547
NC Raleigh, EMA ... 919-846-6888
AZ Phoenix, Hartland Sls. Inc. ... 602-492-0012
PA Horsham, Nexus Technlg. Sls., Inc. ... 215-675-9600
PA Nottingham, Excel Tech ... 717-529-6059
TX Austin, Tesco Inc. ... 512-834-8374
TX Dallas, Tesco Inc. ... 214-553-1200
TX Houston, Tesco, Inc. ... 713-370-8117
VA Alexandria, Dyna Rep. ... 703-354-1222
NY Mendon, Tech Mark ... 716-624-3840
WA Mercer Island, Eagle Entprs., Inc. ... 206-232-7401
MA N. Andover, Russet Assoc. ... 508-794-4995
Can Dorval, PQ., Korfund Sampson, Ltd. ... 514-631-3565
Can Laval, Que., Elcom GMB Inc. ... 514-668-3361
Can St. Eustache, Que., Elcom GMB Inc. ... 514-623-4766

AEROSPACE OPTICS, INC., 3201 Sandy La., Fort Worth, TX 76112, Tel: 817-451-1141, FAX: 817-654-3405; Empl.: 60; *Sls. Mgr.:* Ben L. Fryrear

AEROSPACE WIRE & CABLE INC., 129-09 18 Ave., College Point, NY 11356, Tel: 718-358-2345, FAX: 718-358-2522; Empl.: 15

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238, Tel: 412-963-7470, TWX: 710-795-3125, FAX: 412-963-7459; Empl.: 156; *Sls. Mgr.:* K. Wyman; *Dist. Mgr.:* K. Ross

AEROVOX INC., 370 Faunce Corner Rd., North Dartmouth, MA 02747-1217, Tel: 508-995-8000; FSC No.: 4K459; Empl.: 700; *Sls. Mgr.:* Jack Chmura .... **A•1618**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg. ... 205-772-9999
AZ Scottsdale, Interstate Mktg. ... 602-244-9050
CA Los Gatos, Luscombe Engrg. Co. ... 408-370-2020
CA Woodland Hills, Interstate Mktg. ... 818-883-7606
CO Franktown, M.R.C. ... 303-660-8750
CT North Haven, J.E. Boeing Co. ... 203-265-7378
DE Greenville, H. Anderson ... 302-655-2917
FL Orlando, E.P.M. Corp. ... 407-425-6149
GA Norcross, 20th Century Mktg. ... 404-446-1999
IL Elk Grove Village, Carlson Elctrn. Sls. ... 708-956-8240
IN Ft. Wayne, F.J. Campisano Co. ... 219-486-6443
IN Indianapolis, F.J. Campisano Co. ... 317-577-0319
IA Cedar Rapids, Carlson Elctrn. Sls. ... 319-379-1450
MD Baltimore, Burgin-Kreh Assoc., Inc. ... 301-265-8500
MA Chelmsford, J.E. Boeing Co. ... 508-256-5800
MA Marion, Raymond F. Swoish Co. ... 508-748-2536
MI Farmington Hills, Carrier & Gable ... 313-477-8700
MN Minneapolis, Comstrand ... 612-788-9234
KS Overland Park, Beneke & McCaul ... 816-765-2998
NJ Moorestown, TAI Corp. ... 609-778-5353
NM Albuquerque, Hewitt & Assocs. ... 505-299-7746
NY Ithaca, B. Dean ... 607-257-1111
NY Melville, Comtronic Assocs. ... 516-249-0505
NY Wappingers Falls, Bob Dean ... 914-297-6406
NC Raleigh, 20th Century Marketing ... 919-790-9389
OH Cincinnati, F.J. Campisano Co. ... 513-574-7111
OH Dayton, Schmidt & Assocs. ... 513-293-6652
OH Mentor, F.J. Campisano Co. ... 216-975-9300
OK Tulsa, Ammom & Rizos Co. ... 918-749-6116
PA Coraopolis, F.J. Campisano Co. ... 412-264-5151
TN Knoxville, 20th Century Mktg., Inc. ... 615-966-2099
TX Austin, Ammon & Rizos ... 512-454-5131
TX Houston, Ammon & Rizos Co. ... 713-781-6240
TX Richardson, Ammon & Rizos ... 214-644-5591
WI Milwaukee, Carlson Elctrn. Sls. ... 414-476-2790
EXP Santurce, PR, J.E. Boeing Co. ... 809-753-9805
CA San Diego, Bestronics, Inc. ... 619-693-1111

AERTECH INDS., See TRW Microwave

AES CORP., 285 Newbury St., Peabody, MA 01960, Tel: 508-535-7310, TELEX: 387852 AES CORP INTL, FAX: 508-535-7313; Empl.: 25; *Sls. Mgr.:* Brian Rockett

AETNA ENGINEERING, P.O. Box 7749, Van Nuys, CA 91409-7749, Tel: 818-341-9409, FAX: 818-882-5131; Empl.: 6; *Sls. Mgr.:* T. W. Collins

AFE DISPLAYS INC., 3046A Berkmar Dr., Charlottesville, VA 22901, Tel: 804-974-7801, FAX: 804-974-7803; Empl.: 3(USA) 75(UK); *Sls. Mgr.:* Mike Humpherson; *Dist. Mgr.:* Mike Humpherson

AFI/DATATROL, See Datatrol, Div. of Data Card Corp.

AHAMTOR INC., 999 Inc., 27901 Front St., Temecula, CA 92390, Tel: 714-676-4151, FAX: 714-676-3031; *Sls. Mgr.:* John Markley

AIL, DIV. CUTLER-HAMMER, See Eaton Corp. AIL Div.

AIL SYSTEMS, INC., Eaton Corp., Commack Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 2400; *Sls. Mgr.:* J.B. Migliaccio

AILTEC DIV. CUTLER-HAMMER, See Eaton Corp., Elctrn. Instrmn. Div.

AIMSCO INC., Cheler Corp., 5707 Airport Way So., Seattle, WA 98108, Tel: 206-762-8014, 800-426-0244, TWX: 910-444-1333, FAX: 206-762-8394; FSC No.: 3D536; Empl.: 30; *Sls. Mgr.:* C. Ernst; *Dist. Mgr.:* Carl Teichman

AIPHONE, 1700 130th Ave. NE, Bellevue, WA 98005, Tel: 206-455-0510, FAX: 206-455-0071; Empl.: 44; *Sls. Mgr.:* John Mosebar

AirBorn

FAX: 214-931-9305

AIRBORN, INC., 4321 AirBorn Dr., Addison, TX 75001-0519, Tel: 214-931-3200; FSC No.: 10400;Multiple; Empl.: 412; *Sls. Mgr.:* W.A. Clark, Sls. Mgr.; *Dist. Mgr.:* Jerry Jameson ... **C•1160**

Local Sales Offices & Reps

AL Huntsville, South Design & Mktg. ... 205-880-3623
AZ Tempe, Piper Sls. Co. ... 602-949-0048
CA Downey, Buffa Co., Inc. ... 213-923-4618
CA Sunnyvale, Advanced Tech. Sls. ... 408-746-0800
CT Torrington, Phoenix Sls. Co. ... 203-496-7709
FL Ft. Lauderdale, Southland Comps. ... 305-491-6110
IL Des Plaines, ESCO Assoc. ... 708-298-5310
IA Cedar Rapids, Dytronix ... 319-377-8275
KS Wichita, Dytronix ... 316-838-0884
MD Hunt Valley, Eagle Sls. Corp. ... 301-666-3930
MO Bridgeton, Dytronix ... 314-291-4777
KS Leawood, Dytronix ... 913-339-6333
NH Nashua, Solla - Tronics ... 603-882-7146
NY Glen Cove, Dynorep ... 516-676-1598
NM Albuquerque, Piper Sls. Co. ... 505-883-9090
NY Penfield, Upstate Comps. ... 716-381-6070
NC Raleigh, GWC ... 919-790-7879
OH Kettering, Electro-Com ... 513-299-0864
WA Bellevue, Eltech Inc. ... 206-643-4330
Can Mississauga, Ont., Source Elctrns. Ltd. ... 416-676-0830
Can Ottawa, Ont., Source Elctrns. Ltd. ... 613-737-7580

Local Distributors

NY Elmsford, Gemini Elect ... 914-592-5252
TX Dallas, Hall Mark Elctrns. ... 214-343-5000
CA Monrovia, Erik-A-Elect ... 818-574-1020
AZ Scottsdale, Spirit Elctrns. ... 602-998-1533

Distributor

FAX: 818-988-4746

AIR ELECTRO INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, TELEX: 66-2459, TWX: 910-495-1794 ... **C•1280**

AIR FILTRATION PRODUCTS, INC., 707 No. Main Ave., Tuscon, AZ 85705, Tel: 602-624-2272, FAX: 602-624-2279; Empl.: 10; *Sls. Mgr.:* Ike Campos

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060, FAX: 1-818-579-7063; FSC No.: 22782; *Sls. Mgr.:* Brett Hoffman

Airflyte ELECTRONICS CO.

FAX: 201-436-6024

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, Tel: 201-436-2230; Empl.: 85; *Sls. Mgr.:* John Piret ..... **B•1238-1243**

Local Sales Offices & Reps

CA	Los Altos, Poltronics	415-941-3020
CA	Signal Hill, Thorson Co.	213-595-0361
CT	No. Haven, Kitchen & Kutchin	203-239-0212
FL	Naples, Techtron Sls. Corp.	813-566-3800
IL	Park Ridge, Probe Elctrns.	312-698-2044
MA	Lexington, Kitchen & Kutchin	617-862-8230
NJ	Kinnelon, Avionics Equip.	201-838-8105
NY	Rochester, Milton C. Matthews Co.	716-271-1910
PA	Downingtown, Budd Elctrns. Corp.	215-458-8258
TX	Austin, Electra Reps., Inc.	512-339-1163
TX	Dallas, Electra Reps., Inc.	214-248-3852

AIR MAZE CORP., 25000 Miles Rd., Cleveland, OH 44146, Tel: 216-292-6800, TELEX: 98-5413, FAX: 216-292-6812; Empl.: 300; *Sls. Mgr.:* J.B. Emster

AIR-O-TRONICS, Trush, Inc., 2747 Rt 20 E., P.O. Box 326, Cazenovia, NY 13035, Tel: 315-655-2387, TWX: 710-541-1530, FAX: 315-655-3862; FSC No.: 16663; Empl.: 15

AIRPAX-CAMBRIDGE DIVISION, A North American Philips Co., Woods Rd., Cambridge, MD 21613, Tel: 301-228-4600, TELEX: 6849138, TWX: 710-865-9655, FAX: 301-228-8910; FSC No.: 81541; Empl.: 1100; *Sls. Mgr.:* Sandy Monaghan ..... **B•1348**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
FL	Pompano Bch., Airpax	305-978-9019
GA	Chamblee, BCI	404-455-0405
ID	Boise, Lange Sls., Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton, Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Marion, Rep Assocs.	319-373-0152
MD	Frederick, Airpax	301-243-3133
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
OH	Dayton, Baehr, Greenleaf	513-439-0724
OH	Westlake, Baehr, Greenleaf	216-892-1770
OH	Worthington, Baehr, Greenleaf	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Pittsburgh, Russell F. Clark	412-242-9500
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX-CHESHIRE DIVISION, A North American Philips Co., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-271-6000, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 800; *Sls. Mgr.:* Jerry Gabbard ..... **B•1875; D•1128**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
FL	Pompano Bch., Airpax Co.	305-978-9019
GA	Chamblee, B.C.I.	404-455-0405
ID	Boise, Lang Sls., Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton, Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Marion, Rep Assocs.	319-373-0152
MD	Frederick, Airpax	301-243-3133
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX-FREDERICK DIVISION, A North American Philips Co., Husky Park P.O. Box 500, Frederick, MD 21701, Tel: 301-663-5141, FAX: 301-698-0624; Empl.: 600; *Sls. Mgr.:* Dennis Karr, Prod. Mgr.; *Dist. Mgr.:* Mike Zusi, Mktg. Mgr. ..... **B•1832**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
FL	Pompano Bch., Airpax	305-978-9019
GA	Chamblee, B.C.I.	404-455-0405
ID	Boise, Lange Sls., Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Marion, Rep Assocs., Inc.	319-373-0152
MD	Frederick, Airpax	301-243-3133
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX-INTERNATIONAL DIVISION, A North American Philips Co., West Johnson Ave., Cheshire, CT 06410, Tel: 203-271-6000, FAX: 203-271-6400; Empl.: 350; *Sls. Mgr.:* Art Catano ..... **B•1875; D•1128**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westerep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
FL	Pompano Bch., Airpax	305-978-9019
GA	Chamblee, B.C.I.	404-455-0405
ID	Boise, Lang Sls., Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton, Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Marion, Rep Assocs.	319-373-0152
MD	Frederick, Airpax	301-243-3133
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
OH	Dayton, Behr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Behr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Behr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX SENSOR DIV., A North American Philips Co., Cheshire Industrial Park, Cheshire, CT 06410, Tel: 203-271-6000, TELEX: 962421, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 200; *Sls. Mgr.:* Jim Rochford ..... **B•1875; D•1128**

Local Sales Offices & Reps

AL	Birmingham, Dwight W. Prouty Co., Inc.	205-988-8110
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax	408-980-0410
CO	Littleton, Lange Sls., Inc.	303-795-3600
FL	Pompano Bch., Airpax	305-978-9019
GA	Marietta, Control Equip. Co.	404-427-8776
ID	Boise, Lange Sls, Inc.	208-345-8207
IL	Lake Zurich, Somers-Stanton Inc.	708-438-2999
IN	Indianapolis, Airpax	317-573-9911
IA	Cedar Rapids, Rep Assocs.	319-373-0152
LA	Kenner, D & W System Sls.	504-466-1692
MA	Northboro, Airpax	508-393-1919
MI	Farmington Hills, Airpax	313-553-6030
MN	Eagan, Airpax	612-683-9007
MS	Jackson, D & W Sys. Sls.	601-956-9292
NY	Rochester, Airpax	716-654-7470
NY	Syosset, Airpax	516-364-1217
NC	Charlotte, MacGuire & Crawford Inc.	704-366-3454
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf, & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax	503-641-6130
PA	Warrendale, Baehr, Greenleaf & Assocs.	412-934-3088
TX	Dallas, Airpax	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
VA	Salem, Process Specialities	703-562-0707
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

AL	Birmingham, Dwight D. Prouty	205-988-8110
AL	Mobile, Dwight D. Prouty	205-476-5056
AZ	Mesa, FLW, Inc.	602-641-9157
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Santa Clara, MANCO	408-496-6611
CT	Milford, Motors & Drivers Inc.	203-877-6509
FL	Ft. Lauderdale, Indl. Instrs.	305-971-0209
FL	Tampa, Wacco Inc.	813-621-6441
GA	Marietta, Control Equip. Co.	404-427-8776
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Countryside, Chicago Chain & Transmission	708-482-9000
IN	Mishawaka, Power Comps. of Midwest	219-256-6630
IA	Des Moines, Kim Controls	515-274-9194
KY	Louisville, Automatic Controls	502-426-4666
LA	Baton Rouge, D & W Sys. Sls.	504-753-0992
LA	Kenner, D & W. Sys. Sls.	504-466-1692
MA	Hingham, Hingham Bay Corp.	617-740-1900
MI	Detroit, Automatic Controls	315-533-8890
MN	Minneapolis, Kim Controls	612-780-2991
MO	Fenton, Hi-Tech Elec.	314-343-6060
NY	Johnson City, Help Elctrns.	607-729-3528
NY	N. Tonawanda, N.E. Controls of Buffalo	716-691-0081
NY	New Hyde Park, 1/0 Corp.	516-355-0130
NY	Thompson Ridge, Vespo Mktg.	914-361-2800
NC	Charlotte, McGuire & Crawford	704-366-3454
OH	Brunswick, Automatic Controls	216-273-1117
OH	Cleves, ATR Distrs.	513-353-1800
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
PA	Conshohocken, I/O Corp.	215-825-4610
PA	Pittsburgh, Friday Engrg.	412-341-1444
TX	Dallas, Automatic Sys.	214-688-1810
TX	Houston, The Haltom Co.	713-782-5625
VA	Salem, Process Specialties	703-563-0707
WA	Richland, Radar Elec, Co., Inc.	509-943-6790
WA	Seattle, Radar Elec, Co., Inc.	206-282-2511
WA	Spokane, Radar Elec, Co., Inc.	509-747-3053
WI	New Berlin, Electric Sales & Engrg.	414-782-2400

AIRTRON, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473, FAX: 201-539-0357; FSC No.: 80006; Empl.: 500; *Sls. Mgr.:* M. R. Grosso, Natl. Sls. Mgr.

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541, FAX: 203-783-1383; Empl.: 40

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44482, Tel: 216-372-8511, TELEX: 098-2482, FAX: 216-372-8644; Empl.: 500

A.J.'S POWER SOURCE, 214A Cox Drive, Land-O-Lakes, FL 34639, Tel: 800-933-7725, FAX: 813-996-5037; Empl.: 10; *Sls. Mgr.:* Allen L. Johnson Jr. ..... **D•1584**

Local Sales Offices & Reps

FL	Land-O-Lakes, AJ's Power Source	813-996-2583
GA	Duluth, AJ's Power Source	404-441-7927
NC	Raleigh, Overton Assocs.	919-781-7004
SC	Walhalla, Overton Assocs.	803-638-7101
TN	New Tazewell, Overton Assocs.	615-626-6009

AKG ACOUSTICS, INC., 1525 Aluardo St., San Leandro, CA 94577, Tel: 415-351-3500, FAX: 415-351-0500; Empl.: 100; *Sls. Mgr.:* David Angress

AKRO-MILS, Myers Industries, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, TELEX: 98-6321, FAX: 216-253-9801; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN INDUSTRIES INC., P.O. Box 1203, Columbus, IN 47202, Tel: 812-372-8869, FAX: 812-372-5909; FSC No.: 52750; Empl.: 36; *Sls. Mgr.:* Blayde A. Kennedy

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Calabasas, Parncor, Inc.	818-348-8701
CA	Palo Alto, RF Assocs.	415-494-3331
FL	Apopka, Saber Assocs.	800-432-6288
FL	Melbourne, Saber Assoc.	800-432-6288
FL	Tampa, Saber Assocs.	800-432-6288
GA	Lawrenceville, Saber Assocs.	800-327-0853
IN	Fort Wayne, TX Sls.	219-489-4447
KS	Roeland Park, Abrams & Assocs.	913-432-2303
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Topsfield, Liberty Electro Mktg.	508-887-6655
MO	St. Louis, Abrams & Assocs.	314-569-0447
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NY	Syracuse, T-Squared Elctrns.	315-463-8592
NC	Clayton, Saber Assocs.	800-327-0853
OH	Dayton, Frederic L. Ohmer	513-434-1454
OR	Portland, Caruso & Assocs.	503-246-5439
PA	Glenside, Koebert Assocs.	215-887-2310
TX	Addison, Robert R. Thomas Co.	214-233-8235
WA	Bellevue, Caruso & Assocs.	206-455-8811
WV	Inwood, Koebert Assocs.	304-229-8401
EXP	CT, Stamford, Dage Corp.	203-324-3123
Can	Ottawa, Ont., Giga-Tron	613-225-4090,

ALARM CONTROLS CORPORATION, P.O. Box 280, Deer Park, NY 11729, Tel: 516-586-4220, FAX: 516-586-6500; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* John Benedetto

ALASCO RUBBER & PLASTICS CORP., 617 Mountain View Ave.67, Belmont, CA 94002, Tel: 415-595-4100, FAX: 415-595-0298; FSC No.: 13862; Empl.: 25

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006, 800-822-5227, FAX: 206-771-2163; Empl.: 50; *Sls. Mgr.:* David C. Stiffler ..... **A•2152**

Local Sales Offices & Reps

CA	Granada Hills, Crown Elctrns.	818-368-7475
GA	Marietta, B-C Elctrns. Sls.	404-565-2088
PA	Newtown, Indl. Sls. Assocs.	215-860-2076

ALBEROX CORPORATION, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 508-995-1725, FAX: 508-995-6954; Empl.: 180

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ALBION INDUSTRIES, 800 N. Clark St., Albion, MI 49224, Tel: 517-629-9441

ALDEC, INC., 3525 Old Conejo Rd., , Newbury Park, CA 91320, Tel: 805-499-6867, TELEX: 239-447, FAX: 805-498-7945; Empl.: 57; *Sls. Mgr.:* Harry Tosado

ALDEN COMPUTER SYSTEMS, One Salem Green, Ste. 420, Salem, MA 01970, Tel: 508-744-1314; *Sls. Mgr.:* Donald O'Brien

ALDEN ELECTRONICS, INC., 40 Washington Street, Westboro, MA 01581, Tel: 508-366-8851, TELEX: 94-8404, FAX: 508-898-2427; Empl.: 125; *Sls. Mgr.:* L. A. Farrington

ALDEN PRODUCTS CO., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, Tel: 508-583-0160, FAX: 508-583-0164; FSC No.: 01009; Empl.: 150; *Sls. Mgr.:* Donald J. Paul ..... **C•1161-1163**

ALDEN SYSTEMS, Alden Products Co., 262 N. Main St., P.O. Box 860, Brockton, MA 02403-0860, Tel: 508-583-0160, TELEX: 287 793 ALDN UR, FAX: 508-583-0164; Empl.: 150; *Sls. Mgr.:* D. Paul

A. L. DESIGN, INC., 1411 Military Rd., Buffalo, NY 14217, Tel: 716-875-6240, FAX: 716-875-2404; Empl.: 25

ALEPH INTERNATIONAL CORP., Nippon Aleph Corp., 1026 Griswold, San Fernando, CA 91340, Tel: 818-365-9856, 800-423-5622, FAX: 818-365-7274; Empl.: 17; *Sls. Mgr.:* Frank Mastrolonardo

A.L.E. SYS., INC., 150 Homer Ave., Ashland, MA 01721, Tel: 508-881-5252, FAX: 617-235-6588; Empl.: 70; *Sls. Mgr.:* John Boyd/Ken Duval; *Dist. Mgr.:* John Boyd/Ken Duval ..... **D•1604**

ALEXANDER BATTERIES, New Product/OEM Divison, P.O. Box 28880, San Diego, CA 92198, Tel: 619-480-4445, TELEX: 371-9855, FAX: 619-480-1351; Empl.: 390; *Sls. Mgr.:* Dave Zeman ..... **D•1430**

Local Sales Offices & Reps

CA	San Diego, Alexander Batteries;New Prod./OEM Div.	619-480-4445-619-480-1351

ALEXANDER MANUFACTURING COMPANY, P.O. Box 1508, Mason City, IA 50401, Tel: 800-247-1821, 515-423-8955, TELEX: 3719855, FAX: 515-423-1644; Empl.: 270; *Sls. Mgr.:* Bill Sapp ..... **D•1430**

ALEXANDRIA EXTRUSION CO., P.O. Box 847 Cty. Rd. 22 North, Alexandria, MN 56308, Tel: 612-763-6537, FAX: 612-763-6530; Empl.: 140; *Sls. Mgr.:* Brian L. Bloedorn

ALFA ELECTRONICS, INC., P. O. Box 8089, Princeton, NJ 08543-8089, Tel: 609-275-0220, FAX: 609-275-9536; Empl.: 9; *Sls. Mgr.:* Jeff Kao

ALGO, INC., 1237 Queen Anne Avenue, ODENTON, MD 21113, Tel: 301-672-1544, TELEX: FAX: (301) 672-1456; Empl.: 12; *Sls. Mgr.:* G. J. O'Mara

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, TWX: 710-462-1178, FAX: 203-877-3241 (ext. 360); Empl.: 255

ALLEGRO MICROSYSTEMS, INC., formerly Sprague Semiconductor Grp., 363 Plantation St., Worcester, MA 01605, Tel: 508-795-1300, FAX: 508-792-9024; FSC No.: 31019,0CVK3,2D532; Empl.: 2000; *Sls. Mgr.:* D. Ax; *Dist. Mgr.:* J. Nardone

ALLEN AVIONICS, INC., 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080, FAX: 516-747-6724; Empl.: 300; *Sls. Mgr.:* Jeffrey Buchman ..... **A•1494, 1653**

Local Sales Offices & Reps

AZ	Phoenix, J. F. Hurlbut Co.	602-952-2079
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Palo Alto, Adtek Assocs.	415-323-5414
CA	San Diego, Van Gott & Assocs.	619-308-0667
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MA	Scituate, D&M Tech. Sls.	617-545-9369
MO	St. Louis, The Beams Co.	314-434-8448
NY	Plainview, Eastern Metro Assocs.	516-931-1414
NC	Raleigh, Reynolds Assocs.	407-259-7000
PA	W. Conshohocken, Eastern Comp. Sls. Inc.	215-825-8610
TX	Dallas, Bradenco Corp.	214-352-3554
VA	Alexandria, Vanguard Engrg. Sls.	703-768-1660
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160

ALLEN BRADLEY CO., ELECTRONIC COMPONENTS DIV., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, Tel: 915-592-4888, 800-592-4888, TELEX: 749-400, FAX: 915-594-8922; Empl.: 6500; *Sls. Mgr.:* George Hackstadt; *Dist. Mgr.:* George Hackstadt

ALLEN- BRADLEY CO., Div. of Industrial Control Grp., 1201 S. Second St., Milwaukee, WI 53201, Tel: 414-382-2000, TELEX: 26699, TWX: 4311016, FAX: 414-382-4444; Empl.: 1600; *Dist. Mgr.:* Dick Zajork

RGA

FAX: 818-765-2387

ALLEN CO., INC., ROBERT G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300, 800-999-3711; Empl.: 35; *Sls. Mgr.:* Bob Keltz ..... **A•1008-1009, 1839-1842**

Local Sales Offices & Reps

CA	Sunnyvale, Robert G. Allen Co., Inc.	408-243-7007
CT	Windsor, Janeco	203-688-4513
IL	Chicago, Rendell Sls.	312-967-1513
NJ	Palisades Park, Janco Technlg. Inc.	201-941-4008
NM	Albuquerque, Nelco Elctrns.	503-293-1399
NC	Kernsville, Wallace Elctrns.	919-996-2742
MN	Oakdale, Complete Sls.	612-731-2923
TX	Irving, Kite Elctrns.	214-986-0321
WA	Redmond, Interstate Elctrns.	206-885-5257
EXP	Dublin, Ireland, Standard Comps. Ltd.	375-25025

Local Distributors

CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Oakland, Brill Elctrns.	405-834-5888
CA	Redwood City, H D B	415-368-1388
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Diego, Mock III	619-560-0515
CA	San Leandro, Gateway Elctrns.	415-632-4500
CT	Greenwich, Wise Comps.	203-531-4880
CT	Stratford, C-Tronics, Inc.	800-243-9967
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Itasca, Voyager Elctrns. Corp.	312-773-4900
MA	Wilmington, Heiland Elctrns., Inc.	617-657-4870
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
NJ	Garfield, B & R Elctrns.	201-470-0700
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
UT	Provo, Central Utah Elctrn. Supp.	801-373-7522
WA	Richland, Radar Elec. Co., Inc.	509-943-8336
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053

ALLEN DATAGRAPH, INC., 2 Industrial Way, Salem, NH 03079, Tel: 603-893-1983, FAX: 603-893-9042; *Sls. Mgr.:* Tom Allen

ALLEN SYSTEMS, 2346 Brandon Rd., Columbus, OH 43221, Tel: 614-488-7122; Empl.: 10

ALLEN TECHNOLOGY, PO Box 575, Sutton, NE 68979, Tel: 402-773-5285

ALLIED CONTROLS INCORPORATED, 562 Captain Neville Dr., Waterbury, CT 06705-3827, Tel: 203-757-4200, FAX: 203-757-4204; FSC No.: 5945; *Sls. Mgr.:* John T. Kryjak, VP Sls. & Mktg. ..... **B•1400-1403**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs. Inc.	205-533-9108
CA	Irvine, Component Mktg. Assocs., Inc.	714-727-0688
CA	Tarzana, Component Mktg. Assocs., Inc.	818-708-8058
CT	Clinton, Selmark Assocs., Inc.	203-573-9088
FL	Orlando, Trimark Assocs., Inc.	407-859-5504
GA	Norcross, Hughes Assocs. Inc.	404-662-1587
IL	Skokie, Industrial Reps., Inc.	708-967-8430
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
MD	Burtonsville, Chesapeake Technlg. Inc.	301-236-0530
MA	Millis, Selmark Assocs., Inc.	508-376-2914
MN	Bloomington, Indl. Reps., Inc.	612-854-8027
MS	Corinth, Hughes Assocs. Inc.	601-287-2915
NH	Hopkinton, Selmark Assocs., Inc.	603-746-3299
NJ	Englewood, Gray Assocs., Inc.	201-894-0894
NJ	Kenvil, Gray Assocs. Inc.	201-927-6662
NC	Cary, Hughes Assocs. Inc.	919-467-7029
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
AZ	Phoenix, BLS Comms.	602-841-6613
PA	Pittsburgh, Process Engrg. Co.	412-561-5050
TN	Knoxville, Hughes Assocs. Inc.	615-558-0283

TX	Austin, Comp. Technlg.	512-250-2450
TX	Dallas, Comp. Technlg.	214-783-8831
TX	El Paso, Alexander Entprs.	915-591-3142
TX	Houston, Component Technlg.	713-961-1262
WI	Brookfield, Industrial Reps., Inc.	414-789-9393
	Local Distributors	
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Santa Ana, El-Com, Inc.	714-432-6633
CA	Santa Ana, Norstan Elctrns. Inc.	213-924-7651
FL	Ft. Lauderdale, Peerless Radio	305-973-4141
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Newton, Greene-Shaw	617-969-8900
MN	Minneapolis, Control Design	612-721-1628
NJ	Oakland, Relay Specialties	201-337-1000
NY	Buffalo, Summit Distrbg.	716-887-2800
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Plainview, ACI	516-293-6630
NY	Rome, Rome Elctrns.	315-337-5400
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Oklahoma City, Electro Entprs.	405-427-6591
PA	Philadelphia, P. E. I. Genesis	215-673-0400
PA	Philadelphia, Shap Elctrns.	215-969-3300
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710

ALLIED ELCTRNS., SUBSIDIARY OF HALL-MARK, 7410 Pebble, Fort Worth, TX 76118, Tel: 800-433-5700, FAX: 817-595-6470; Empl.: 250; *Sls. Mgr.:* Ed Bridges

ALLIED-SIGNAL AEROSPACE CO., Bendix Communications Div., 1300 E. Joppa Rd., Towson, MD 21204, Tel: 410-583-4000, TWX: 710-232-1823, FAX: 410-337-7485; FSC No.: 06845; Empl.: 1500; *Sls. Mgr.:* Jack L. Shagena

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ALL-STATES, INC., 1801 W. Foster Ave., Chicago, IL 60640, Tel: 312-728-0525, TELEX: 317027, FAX: 312-728-6410; FSC No.: 26863

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ALPHA COMPONENTS, 1106 E. Simpson Rd., Mechanicsburg, PA 17055, Tel: 717-697-8595, FAX: 717-697-8608; FSC No.: 52748; *Sls. Mgr.:* Jerry Buckwalter

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FAX: 818-701-5508

ALTAIR EXCHANGE CORPORATION, 19201 Parthenia St. No.E, Northridge, CA 91324, Tel: 818-701-6977, 800-824-5620 ..... **B•1034-1036**

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ALTRON, INC., 6700 Industry Ave., N.W., Anoka, MN 55303, Tel: 612-427-7735, FAX: 612-427-3980; Empl.: 185; *Sls. Mgr.:* Waldo W. Hasse

ALUMINUM FILTER, 1000 Cindy Lane, Carpinteria, CA 93013, Tel: 805-684-7651, TELEX: 6713624, FAX: 805-684-3654; FSC No.: 17504; Empl.: 120; *Sls. Mgr.:* B. L. Baker

ALUSETT U.S.A., INC., 3 Cecilia Lane, Pleasantville, NY 10570, Tel: 914-737-0120, FAX: 914-737-8697; Empl.: 35

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CO	Highland Ranch, Valcomp	303-791-0330
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KS	Roeland Pk., M.S.B. Assocs.	913-432-2131
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MA	Wellesley, Reps. Corp.	617-237-6476
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GA	Atlanta, PAR Assocs.	404-391-9117
IL	Park Ridge, G. McL. Cole Co.	312-692-0665
IN	Jasper, E & K Elec., Inc.	812-482-3161
KS	Lenexa, Dytec/South (west)	913-888-0215
KS	Wichita, Dytec/South	316-263-7090
MD	Westminster, Chesapeake Technlgs.	301-875-0004
MA	Reading, May Technlg.	617-942-7135
MI	Southfield, Comtel Instruments	313-358-2505
MN	Crystal, Abtech	612-537-3384
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NJ	Medford, McCoy Grp.	609-953-0770
NM	Albuquerque, ESCO Elctrns.	505-243-3470
NC	Charlotte, PAR Assocs.	704-535-9858
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instruments	513-426-5310
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NC	Charlotte, PAR Assocs.	704-366-6516

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AMBI-TECH INDS., 319 Knickerbocker Ave., Hillsdale, NJ 07642, Tel: 201-666-0504, FAX: 201-666-0597; Empl.: 20; *Sls. Mgr.:* Al Nagler; *Dist. Mgr.:* Al Nagler

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AL	Huntsville, Kemp Instrs.	205-837-4304
AZ	Phoenix, C. T. Carlberg	602-468-0750
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CA	Rancho, The Knight Co.	619-452-7196
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FL	Tampa, Temco Sls. Inc.	813-855-7566, 800-282-6815
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IL	Bensenville, R. L. Lang & Assocs.	708-766-3667
IN	Ft. Wayne, Walter W. Bieberich	219-432-2537
IN	New Albany, Walter W. Biebrich, Inc.	812-945-3187
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OH Chesterland, Electro Sls. Assocs. 216-729-0190
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AMECON, INC., 1900 S. Chris La., Anaheim, CA 92805, Tel: 714-634-2220, 800-392-2292, TWX: 510-1000-364; *Sls. Mgr.:* Frank Carleone ..... **A•1154, 1156-1158, 2154-2165**

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AMERICAN ALUMINUM, 230 Sheffield St., Dept. EEM, Mountainside, NJ 07092, Tel: 908-233-3500, FAX: 908-233-3241; Empl.: 125; *Sls. Mgr.:* Ronald R. King

AMERICAN ASSEMBLY INC., P.O. Box 515, 7 Industrial Dr., Florida, NY 10921, Tel: 914-651-3433, FAX: 914-651-2055; FSC No.: 74795; Empl.: 5

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AMERICAN ARIUM, Formerly American Automation & Arium, 14281 Chambers Rd., Tustin, CA 92680-7207, Tel: 714-731-1661; Empl.: 39; *Sls. Mgr.:* Suzanne Apitz ..... **D•1217**

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CA	Newbury Park, Interconn	805-499-4024
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CA	San Jose, Arnold Tech. Sls., Inc.	408-954-0400
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FL	Odessa, Synergistic Technlgs., Inc.	813-920-5814
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IL	Arlington Hgts., KMA Sls. Co.	708-398-5300
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MO	St. Charles, AME Sls.	314-928-2599
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
NJ	Rahway, R. E. Breuer Co., Inc.	201-388-5045
NM	Albuquerque, Thorson Desert States, Inc.	505-293-8555
NY	Rochester, Union Mktg. Grp.	716-546-7820
NY	Wantagh, R. E. Breuer Co. Inc.	516-783-7307
NC	Raleigh, Benchmark Tech. Sls. Inc.	919-850-0633
OH	Cincinnati, Makin & Assocs.	513-871-2424
OH	Dublin, Makin & Assocs.	614-793-9545
OH	Solon, Makin & Assocs.	216-248-7370
OR	Beaverton, Thorson Co. N.W.	503-644-5900
TX	Irving, AID Elctrns.	214-790-4761
UT	Midvale, Luscombe Engrg. Co.	801-565-9885
WA	Bellevue, Thorson Co. N.W.	206-455-9180
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Burlington, Ont., Alternate Source Comps. Ltd.	416-335-6385

Local Distributors

AL	Huntsville, Electro-Wise	205-721-0773
AZ	Tempe, Acacia Elctrns.	602-894-2874
CA	Buena Pk., Cypress Elctrns.	714-521-5230
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Monica, Master Distrs.	213-452-1229
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Lakewood, Acacia Elctrns.	303-232-2882
CT	E. Haven, J V Elctrns.	203-469-2321
CT	Wallingford, The Greene-Shaw Co.	203-265-3333
FL	Orlando, Time Elctrns.	407-841-6565
IL	Lisle, Comps., Inc.	708-852-7707
IN	Carmel, Altex Elctrns.	317-848-1323
MD	Jessup, Treeko Sls., Inc.	301-470-3300
MD	Savage, Pyttronic Inds.	301-953-9650
MA	Peabody, Time Elctrns./New Eng.	508-532-6200
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	New Brighton, Chris Elctrns. Distrs.	612-631-2647
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Oakland, Relay Spec.	201-337-1000
NJ	W. Berlin, General Comps., Inc.	609-768-6767
NY	Buffalo, Genesee Indl. Elctrns.	716-873-9661
NY	Farmingdale, Pride Elctrns.	516-293-4020
NC	Raleigh, Resco/Raleigh	919-781-5700
OH	Columbus, Time Elctrns.	614-761-1138
OR	Beaverton, Acacia Sls.	503-646-3377
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
TX	Irving, Cypress Elctrns.	214-255-0065
TX	Richardson, RSC Elctrns.	214-644-3444
WA	Redmond, Time Elctrns.	206-882-1600
WI	Milwaukee, Progressive Image	414-321-4722

AMETEK CONTROLS DIV., Ametek Fiber Optic Products, 820 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-355-6900, TELEX: 29-1769, FAX: 215-355-2937; Empl.: 100; *Sls. Mgr.:* Jon Koval, Bus. Unit Mgr.

AMETEK, INC., Mansfield & Green Div., 8600 Sunset Dr., Largo, FL 34643, Tel: 813-536-7831, FAX: 813-539-6882; Empl.: 120; *Sls. Mgr.:* Gary Queensberry

LAMB ELECTRIC DIVISION, Ametek, Inc., 627 Lake Street, Kent, OH 44240, Tel: 216-673-3451, TELEX: 4332140, FAX: 216-673-8994; Empl.: 1,000; *Sls. Mgr.:* Roger Smith

PROCESS & ANALYTICAL INSTRUMENTS DIV., Ametek, Inc., 150 Freeport Road, Pittsburgh, PA 15238, Tel: 412-828-9040, TELEX: 6714789, FAX: 412-826-0399; Empl.: 110; *Sls. Mgr.:* Jerry Barth

AMF POTTER & BRUMFIELD, See Potter & Brumfield

AMHERST INTERNATIONAL CORP., 540 Commercial St., Manchester, NH 03101, Tel: 603-644-3555, 1-800-547-5600, FAX: 603-644-3550; *Sls. Mgr.:* Brock Putney; *Dist. Mgr.:* Brock Putney

AMILON CORP., 49-12 30th Ave., Woodside, NY 11377, Tel: 718-274-1794, FAX: 718-278-5621; Empl.: 50; *Sls. Mgr.:* L. Rosenblatt

AMITRON
American Micro-Tronix Inc.

FAX: 508-686-0622

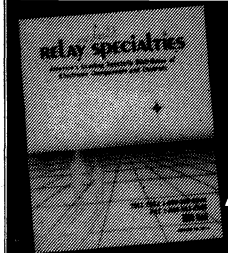
AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, Tel: 508-686-1882; *Sls. Mgr.:* Raymond Simione ..... **A•1843**

Local Sales Offices & Reps

AZ	Tempe, Cain Technlg.	602-966-4322
CA	Del Mar, K L Mktg.	619-755-0669
CA	Orange, Cain Technlg.	714-997-7311
CA	San Jose, Precision Svcs.	408-996-2808
CA	Van Nuys, Cain Technlg.	818-904-9392
CO	Englewood, Cain Technlg.	303-220-8118
CT	Litch Field, Intrade, Inc.	203-567-5901
CT	Wethersfield, Compak, Inc.	203-563-4784
FL	Melbourne Bch., Millett Assocs.	305-725-5055
MD	Columbia, PSA	215-245-0513
MA	Hudson, Compak, Inc.	617-568-0331
PA	Trevose, PSA	609-234-0661
NY	Great Neck, F&F Metro, Inc	516-482-4080
TX	Plano, BK Assocs.	214-437-4153
VA	Lynchburg, PSA	215-245-0513
VA	Oakton, PSA	215-245-0513

Local Distributors

CA	Los Alamitos, Semi- Dice, Inc.	213-594-4631
CA	Santa Clara, Semi-Dice, North	408-980-9777
MA	S. Easton, Semi Dice, Inc.	508-238-8344
MA	Stoneham, East Coast Microwave	617-279-0900
NY	Central Islip, Semi Dice Long Island	516-234-7676

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AMKEY, 1 Aegean Drive, Methuen, MA 01844, Tel: 508-975-5445, FAX: 508-975-0357; Empl.: 35; *Sls. Mgr.:* Philip P. Bodoni; *Dist. Mgr.:* Philip P. Bodoni ..... **B•1796-1797**

AMOCO OIL CO., Lubricants Business Unit, 2021 Spring Rd., Ste. 500, Oak Brook, IL 60521-1857, Tel: 800-876-3221, FAX: 708-571-7174

AMP

FAX: 717-986-7575

AMP, Box 3608, Mail Stop 21026, Harrisburg, PA 17105, Tel: 717-564-0100, 800-522-6752, TWX: 510-657-4110; Empl.: 24,000; *Dist. Mgr.:* Neal Spatz ..... **B•1646-1647; C•1173-1273**

Local Sales Offices & Reps

CA	Diamond Bar, AMP	714-594-8388
IL	Schaumburg, AMP	708-351-5020
PA	Harrisburg, AMP	800-522-6752

Local Distributors

MA	Andover, Bell Inds.	603-882-1133
TX	Austin, Hamilton/Avnet Elctrns.	512-837-8911
AZ	Chandler, Hamilton/Avnet Elctrns.	602-961-1211
MD	Columbia, Hamilton/Avnet Elctrns.	301-995-3516
NC	Greenboro, Hammond Elctrns.	919-275-6391
PA	Horsham, Schweber Elctrns.	215-441-0600
NJ	Mt. Laurel, Lex Elctrns.	609-273-7900
CA	Sacramento, Hamilton/Avnet Elctrns.	916-925-2216
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sunnyvale, Hamilton/Avnet Elctrns.	408-743-3300
CT	Wallingford, Marshall Inds.	203-265-3822
AL	Huntsville, Hamilton/Avnet	205-837-7210
AL	Huntsville, Lex Elctrns.	205-895-0480
AL	Huntsville, Marshall	205-881-9235
AL	Huntsville, Powell Elctrns.	205-837-5300
CA	Woodland Hills, Hamilton/Avnet	818-594-0404
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2885

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AZ	Phoenix, Sterling Elctrns. Corp.	602-437-5565
AZ	Tempe, Time Elctrns.	602-967-2000
AR	Little Rock, Carlton-Bates Co.	501-562-9100
AR	Little Rock, Electro Entprs.	501-562-6936
CA	Buena Pk., Cypress	714-521-5230
CA	Calabasas, Schweber Elctrns.	818-880-9686
CA	Chatsworth, Marshall Inds.	818-407-4100
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Costa Mesa, Hamilton/Avnet	714-754-6029
CA	El Monte, Marshall Inds.	818-459-5500
CA	Fountain Valley, Comps. Ctr, Inc.	714-979-0437
CA	Gardena, CA Switch & Signal	213-770-2330
CA	Gardena, Hamilton/Avnet	213-217-6888
CA	Irvine, Marshall Inds.	714-458-5301
CA	Irvine, Schweber Elctrns.	714-863-0200
CA	Manhattan Bch., Prime Electro Prods. Co.	213-379-3642
CA	Milpitas, Marshall Inds.	408-942-4600
CA	Milpitas, Zack Elctrns., Inc.	408-942-5432
CA	Monrovia, Erik-A-Elctrns.	818-574-1020
CA	North Hollywood, Alatec Prods.	213-875-1790
CT	Oxford, Lex Elctrns.	203-264-4700
CA	Placentia, Telesis Elctrns., Inc.	714-579-7555
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Sacramento, Zack Elctrns., Inc.	916-369-1786
CA	San Diego, Cypress	619-535-0011
CA	San Diego, Hamilton Avnet Elctrns.	619-571-7540
CA	San Diego, Marshall Elctrns. Grp.	619-578-9600
CA	San Diego, Schweber Elctrns.	619-495-0015
CA	San Diego, Time Elctrns.	619-586-1331
CA	San Diego, Western Micro Technlg., Inc.	619-453-8430
CA	San Francisco, Zack Elctrns., Inc.	415-626-1444
CA	San Jose, Powell Elctrns.	408-943-9020
CA	San Jose, Schweber Elctrns.	408-432-7171
CA	Santa Clara, Comps. Ctr, Inc.	405-988-3751
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
FL	St. Petersburg, Marshall Inds.	813-573-1399
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Kent Elctrns.	213-320-2700
CA	Torrance, Time Elctrns.	213-320-0800
CA	Tustin, Time Elctrns.	714-937-0911
CA	Woodland Hills, Hamilton/Avnet	818-594-0404
CO	Colorado Springs, Hamilton/Avnet Elctrns.	303-637-0055
CO	Denver, CSID, Inc.	303-292-9594
CO	Englewood, Hamilton Avnet Elctrns.	303-799-0663
CO	Englewood, Time Elctrns.	303-799-8851
CO	Thornton, Marshall Inds.	303-451-8383
CT	Danbury, Hamilton/Avnet	203-743-6077
FL	Pompano Bch., Schweber Elctrns.	305-977-7511
CT	Southbury, Time Elctrns.	203-271-3200
CT	Wallingford, ALMO Elctrns., Inc.	203-269-6801
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Altamonte Springs, Marshall Inds.	305-767-8585
FL	Altamonte Springs, Schweber Elctrns.	305-331-7555
FL	Ft. Lauderdale, Hamilton/Avnet	305-979-2802
FL	Ft. Lauderdale, Hammond Elctrns., Inc.	305-973-7103
FL	Ft. Lauderdale, Marshall	305-977-4880
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Orlando, Hammond Elctrns.	305-849-6362
FL	Orlando, Time Elctrns.	407-841-6565
FL	St. Petersburg, Hamilton/Avnet	813-572-4346
FL	Winter Pk., Hamilton/Avnet	305-628-3888
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Norcross, Hamilton/Avnet	404-447-7500
GA	Norcross, Hammond	404-449-1996
GA	Norcross, Marshall	404-923-5750
GA	Norcross, Schweber Elctrns. Corp.	404-446-5842
GA	Norcross, Time Elctrns.	404-448-4448
GA	Norcross, TTI, Inc.	404-662-0911
ID	Boise, Kimball Elctrns.	208-342-3559
IL	Bensenville, Hamilton Avnet Elctrns.	708-860-7780
IL	Elmhurst, Semiconductor Spec.	312-279-1000
FL	Orlando, TTI, Inc.	407-859-1000
IL	Palatine, OHM Elctrns., Inc.	312-359-5500
IL	Schaumberg, Lex Elctrns. Corp.	708-330-2888
IL	Schaumberg, Marshall	312-490-0755
IL	Schaumberg, Time Elctrns.	708-303-3000
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Carmel, Hamilton/Avnet	317-844-9533
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds. Inc.	317-875-8200
IN	Indianapolis, Marshall	317-297-0483
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
IA	Cedar Rapids, Hamilton/Avnet	319-362-4757
KS	Edwardsville, Schweber Elctrns.	913-441-1801
KS	Lenexa, Hamilton Avnet Elctrns.	913-888-1055
KS	Lenexa, Marshall	913-492-3121
KY	Lexington, Hamilton/Avnet Elctrns.-IBM	606-259-1475
KY	Louisville, Peerless Elctrns.	502-637-7674
MD	Annapolis Jct., Powell	301-880-3255
MD	Columbia, Hamilton/Avnet	301-995-3559
MD	Columbia, Lex Elctrns.	301-596-7800
MD	Columbia, Time Elctrns.	301-964-3090
MD	Columbia, TTI, Inc.	301-995-1331
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Silver Springs, Marshall Inds.	301-622-1118
MA	Andover, Aved Elctrns.	508-688-3800
MA	Bedford, Lex Elctrns.	617-275-5100
MA	Burlington, QPL Elctrns.	617-229-2424
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Peabody, Hamilton/Avnet Elctrns.	508-532-3701
MA	Peabody, Time Elctrns.	508-532-6200
MA	Westborough, In Stock Prods.	508-870-5750
MA	Wilmington, Heiland Elctrns.	508-657-4870
MA	Wilmington, Marshall Inds.	617-658-0810
MA	Winchester, Webb Distbn.	617-729-5800
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Grandville, Hamilton/Avnet	616-531-0345
MI	Livonia, Chelsea Inds.	313-525-1155
MI	Livonia, Marshall	313-525-5850
MI	Novi, Hamilton Avnet Elctrns.	313-522-4270
MI	Troy, Northern Wire/Cable	313-589-0510
MN	Edina, Lex Elctrns.	612-941-5280
MN	Edina, Time Elctrns.	612-835-1250
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minnetonka, Hamilton/Avnet	612-932-0608
MN	Minnetonka, TTI, Inc.	612-933-8555
MN	Plymouth, Marshall	612-559-2211
MN	St. Paul, Gopher Elctrns. Co., Inc.	612-483-3322
MO	Bridgetown, Marshall Inds.	314-291-4650
MO	Chesterfield, Hamilton Avnet Elctrns.	314-537-4265
MO	Maryland Hgts., Chelsea Inds.	314-997-7709
MO	St. Charles, Lectronix	314-946-6424
MO	St. Louis, Franklin Elctrns.	314-993-5333
MO	St. Louis, Time Elctrns.	314-391-6444
NH	Manchester, Cronin Elctrns.	603-624-0105
NY	Buffalo, Summit Distrs.	716-887-2800
NJ	Camden, G.R.S. Elctrns., Inc.	609-964-8560
NJ	Cherry Hill, Hamilton/Avnet	609-424-0100
NJ	Fairfield, Hamilton Avnet Elctrns.	201-575-3490
NJ	Fairfield, Marshall Elctrns.	201-882-0320
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Moorestown, Marlac Elctrns.	609-234-4200
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Old Bridge, BTC, Inc.	201-679-9300
NJ	Pinebrook, Lex Elctrns.	201-227-7880
NJ	Pinebrook, Time Elctrns.	201-882-4611
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Hamilton Avnet Elctrns.	505-345-0633
NY	Bohemia, March Elctrns., Inc.	516-563-6000
NY	East Syracuse, Time Elctrns.	315-432-0355
NY	Elmsford, Ancar Elctrns. Supp., Inc.	914-592-7100
NY	Farmingdale, Pride Elctrns., Inc.	516-293-4020
NY	Hauppage, Marshall Inds.	516-273-2424
NY	Hauppauge, Hamilton/Avnet	516-434-7420
NY	Hauppauge, Lex Elctrns.	516-231-2500
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Hempstead, Davis Elctrns. Corp.	516-483-9200
NY	Holbrook, Delmar Elctrns.	516-472-2400
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Johnson City, Marshall	607-798-1611
NY	Lynbrook, Peerless Elctrns.	516-593-2121
NY	Rochester, Hamilton/Avnet	716-475-9130
NY	Rochester, Marshall Inds.	301-235-7620
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
NY	Rome, Rome Elctrns., Inc.	315-337-5400
NY	Syracuse, Hamilton Avnet Elctrns.	315-434-2438
NC	Cary, Powell Elctrns.	919-467-1212
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Greensboro, Hammond Elctrns., Inc.	919-275-6391
NC	Raleigh, Hamilton Avnet Elctrns.	919-878-0819
NC	Raleigh, Marshall	919-878-9882
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Beechwood, Lex Elctrns.	216-464-2970
OH	Cincinnati, Schuster Elctrns., Inc.	513-489-1400
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Columbus, Hughes-Peters	614-294-5351
OH	Columbus, Thompson Elctrns.	614-228-6191
OH	Dayton, Bell Inds.	513-434-8231
OH	Dayton, Bell Inds.	513-435-8660
OH	Dayton, Hamilton/Avnet	513-439-8700
OH	Dayton, Lex Elctrns.	513-439-1800
OH	Dayton, Marshall	513-898-4480
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Dublin, Time Elctrns.	614-761-1100
OH	Solon, Hamilton/Avnet	216-349-4910
OH	Solon, Marshall Inds.	216-248-1788
OH	Solon, Repco Elctrns.	216-248-8900
OH	Twinsburg, Schuster Elctrns., Inc.	216-425-8134
OH	Westerville, Hamilton/Avnet	614-882-7389
OH	Worthington, TTI, Inc.	614-848-5770
OK	Oklahoma City, Electro Ent.	405-427-6591
OK	Tulsa, Carlton-Bates	918-250-1626
OK	Tulsa, Hamilton/Avnet	918-252-7297
OK	Tulsa, Marshall Inds.	918-622-7151
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OR Portland, Radar Elec. Co., Inc. 503-232-3404
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PA Braddock, Leff Elctrns. 412-351-5000
PA Essington, Tri-Com, Inc. 215-521-3080
PA Horsham, Lex Elctrns. Corp. 215-441-0600
PA Mars, ALMO Elctrns., Inc. 412-776-9090
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, Hamilton/Avnet 412-281-4150
PA Pittsburgh, Marshall Inds. 412-788-0441
PA Wayne, Peak Elctrns., Corp. 215-293-9000
SC Greenville, Hammond Elctrns., Inc. 803-233-4121
TN Nashville, Carlton-Bates 615-244-3562
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Kent Elctrns. Corp. 512-834-1900
TX Austin, Marshall 512-837-1991
TX Austin, Time Elctrns. 512-339-3051
TX Carrollton, Connec/Tek, Inc. 214-245-1266
TX Carrollton, Marshall Inds. 214-233-5200
TX Carrollton, Time Elctrns. 214-241-7441
TX Carrolton, Sterling Elctrns. 713-243-1600
TX Dallas, Hamilton/Avnet 214-404-9906
TX Dallas, Lex Elctrns. 214-247-6300
TX Dallas, Wallace Elctrns., Inc. 214-340-0400
TX El Paso, Ideal Inds. Elctrn. Supp. 915-779-6647
TX El Paso, Marshall Inds. 915-593-0706
TX Ft. Worth, Carlton-Bates 817-831-0395
TX Ft. Worth, TTI Inc. 817-831-8300
TX Harlington, Marshall Inds. 512-542-4589
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Marshall 713-895-9200
TX Richardson, Kent Elctrns. Corp. 214-669-2600
TX Stafford, Hamilton-Avnet Elctrns. 713-240-7733
UT Salt Lake City, Hamilton Avnet Elctrns. 801-972-4300
UT Salt Lake City, Kimball Elctrns. 801-328-2075
UT Salt Lake City, Marshall 801-485-1551
UT West Valley City, Time Elctrns. 801-973-8181
VA Richmond, Sterling Elctrns. Corp. 804-226-2190
VA Roanoke, Mexitronics 703-342-4444
WA Bothel, Cypress Elctrns. 206-483-1144
WA Bothell, Marshall Inds. 206-486-5747
WA Redmond, Hamilton Avnet Elctrns. 206-881-6697
WA Redmond, Pyramid Elctrns. Supp., Inc. 206-883-7200
WA Redmond, Time Elctrns. 206-882-1600
WA Seattle, Radar Elec. Co., Inc. 206-282-2511
WA Spokane, Radar Elec. Co., Inc. 509-747-3053
WI Milwaukee, Electronic Expeditors 414-228-8100
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
WI Oshkosh, Electronic Inds. 414-235-8930
WI Waukesha, Hamilton/Avnet Elctrns. 414-784-4511
WI Waukesha, Marshall Inds. 414-797-8400
PR Rio Piedras, Hamilton/Avnet 809-731-1110

AMP-AKZO CORPORATION, 322 South Service Rd., Melville, NY 11747, Tel: 516-454-4400, TELEX: 6852163, FAX: 516-454-0317; Empl.: 600

AMPERITE

FAX: 201-864-3955

AMPERITE CO., INC., 600 Palisade Ave., Union City, NJ 07087, Tel: 201-864-9503; FSC No.: 70563; Empl.: 76 ..... **B•1414**

Local Sales Offices & Reps
NJ Fairfield, Brunetta Mktg. Svcs. 201-227-2522

AMPEX CORP., 401 Broadway, Redwood City, CA 94063-3199, Tel: 1-800-25AMPEX, TELEX: 348464, FAX: 415-367-2769; Empl.: 6000; *Sls. Mgr.:* Rollin Stanford; *Dist. Mgr.:* John Hennessey

AMPHENOL CORPORATION, Corporate Headquarters, 358 Hall Ave., Wallingford, CT 06492, Tel: 203-265-8910, FAX: 203-265-8793; Empl.: 3200(USA)

AMPHENOL, Bendix Connector Operations, 40-60 Delaware St., Sidney, NY 13838, Tel: 607-563-5011, TELEX: 932456, FAX: 607-563-5157; FSC No.: 77820; Empl.: 2500; *Sls. Mgr.:* Chas. Morse; *Dist. Mgr.:* Lew Lafornara

AMPHENOL CANADA CORPORATION, An LPL Company, 20 Melford Dr., Scarborough, Ontario, Canada M1B 2X6, Tel: 416-291-4401, TELEX: 065-25210, FAX: 416-292-0647; Empl.: 197

AMPHENOL INTERCONNECT PRODUCTS, 20 Valley St., Endicott, NY 13760, Tel: 607-754-4444, FAX: 607-754-4444; FSC No.: 13509; *Sls. Mgr.:* Robert Anderson; *Dist. Mgr.:* Robert Anderson

AMPHENOL RF OPERATIONS, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810, Tel: 203-743-9272, FAX: 203-796-2032; FSC No.: 74868; Empl.: 600; *Sls. Mgr.:* J. D. Norwood; *Dist. Mgr.:* H. Blumenschein

AMPHENOL SPECTRA-STRIP/ITD, 720 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-3200, FAX: 203-281-5872; Empl.: 119

AMPLIFIER RESEARCH

FAX: 215-723-5688

AMPLIFIER RESEARCH, 160 School House Rd., Souderton, PA 18964-9990, Tel: 215-723-8181, TWX: 510-661-6094; FSC No.: 30639; Empl.: 75; *Sls. Mgr.:* L. Pokorny ..... **D•1002-1003, 1020-1021**

Local Sales Offices & Reps
AL Huntsville, W. A. Brown Instrs. 205-830-9224
AZ Tempe, Mar Tech Assocs. 602-535-4961
CA N. Hollywood, O'Halloran Assoc. 213-877-0173
CA San Jose, O'Halloran Assoc. 408-243-1600
CO Boulder, H. Bass. Assoc. 303-530-7509
CT Yalesville, Larry Plante 203-269-3360
FL Davie, W. A. Brown Instrs., Inc. 305-581-6444
FL Melbourne, W.A. Brown Instrs., Inc. 407-723-0766
FL Orlando, W.A. Brown Instrs., Inc. 407-648-9660
GA Atlanta, W. A. Brown Instrs., Inc. 404-449-7160
IL Park Ridge, Elctrn. Instr. Assocs. 708-298-2290
IN Indianapolis, Elctrn. Instr. Assocs. 317-257-7231
KS Lenexa, Midtec Assocs., Inc. 913-541-0505
LA Lockport, Airep Elctrns. 504-693-3666
MD Severna Park, Round Bay Eng. 301-647-8388
MA Lexington, R. J. Sickles Assoc. 617-862-5100
MN Minnetonka, Elctrn. Instr. Assocs. 612-933-7793
MO St. Louis, Midtec Assocs., Inc. 314-275-8666
NJ Ridgefield Pk., Scientific Dvcs. 201-837-1004
NM Albuquerque, Hewitt & Assocs. 505-299-7746
NY Rochester, Eastern Sys. of NY 716-292-1460
NC Cary, W. A. Brown Instrs., Inc. 919-460-1120
OH Dublin, Micro Sls. 614-792-9117
OK Tulsa, The Hugh J. Daly Co. 918-494-7711
PA Philadelphia, R. Meyers Assoc. 215-224-1663
TX Austin, Airep Elctrns. 512-328-0778
TX Dallas, Airep Elctrns. 214-349-4360
TX Houston, Airep Elctrns. 713-343-9611
UT Bountiful, Herb Bass Assoc. 801-295-7100
WA Seattle, J. J. Assocs., Inc. 206-246-6619
Can Quebec, Tekron Communications 514-335-0152

AMPLIFONIX, INC., 2707 Black Lake Place, Philadelphia, PA 19154, Tel: 215-464-4000, FAX: 215-464-4001; FSC No.: 60979; Empl.: 75; *Sls. Mgr.:* Richard P. Dubois; *Dist. Mgr.:* Richard P. Dubois

AMPROBE INSTRUMENT, Core Industries, Inc, 630 Merrick Rd., Lynbrook, NY 11563, Tel: 516-593-5600, FAX: 516-593-5682; Empl.: 200; *Sls. Mgr.:* Duncan Ladd, VP Sls.; *Dist. Mgr.:* W. Eagle

AMPRO COMPUTERS,INC., 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-522-2100, FAX: 408-720-1305; Empl.: 51; *Sls. Mgr.:* Victor Maccharoli/Tim Lavelle/Phyllis Proscia, Sls. Admin.; *Dist. Mgr.:* Paul Getty, VP Sls.

AMPTEK, INC., 6 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-2242, FAX: 617-275-3470; Empl.: 17

AMPTRONIX, INC., P.O. Box 8146, Rowland Heights, CA 91748, Tel: 213-666-1564; *Sls. Mgr.:* Lou Lim; *Dist. Mgr.:* Ching Lim

AMRAD & TRANSCON MFG. CO., Div. of D.J. Assocs., Inc., 8411 South Zero St, Fort Smith, AR 72903-7045, Tel: 501-452-3987, FAX: 501-452-7752; FSC No.: 55943; Empl.: 5; *Sls. Mgr.:* M. P. Beck; *Dist. Mgr.:* M. P. Beck

A M SENSORS, INC., 26 Keewaydin Dr., Unit B, Salem, NH 03079, Tel: 603-898-1543, FAX: 603-898-1638; Empl.: 10; *Sls. Mgr.:* Marc R. Saucier

AMTEK DIGITAL SYSTEMS, INC., See Actek, Inc.

AMUNEAL MANUFACTURING CORP., 4737 Darrah St., Philadelphia, PA 19124, Tel: 215-535-3000, FAX: 215-743-1715; FSC No.: 23740; Empl.: 55; *Sls. Mgr.:* Larry Maltin ..... **C•1687**

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CA La Canada, C.E.M., Inc. 818-790-8358
CA San Diego, C.E.M., Inc. 619-268-8911
CA San Diego, C.E.M., Inc. 619-692-3551
CA Santa Ana, C.E.M., Inc. 714-835-2702
CO Wheatridge, Waugaman Assocs., Inc. 303-423-1020
CT Meriden, MPS Elctrns. 203-235-1414
FL Melbourne, Reynolds & Assocs., Inc. 800-255-1965,407-259-7000
MD Baltimore, Muncy Sls. 301-484-6376
MA Norwood, MPS Elctrns. 617-769-8700
NJ Pennsauken, J.A. Maguire & Co. Inc. 609-665-5136
NM Albuquerque, Shefler Kahn Co. 505-296-0749
NY Yonkers, Sonkin Assocs. 914-968-8282
OH Kettering, F.L.Ohmer & Assoc. 513-434-1454
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UT Salt Lake City, Waugaman Assocs. Utah, Inc. 801-261-0802
WA Seattle, Rep-West 206-283-8351

ANACOM, 1335 S. Claudina St., Anaheim, CA 92805-6235, Tel: 714-774-8080, FAX: 714-774-7388; Empl.: 65

ANADEX INC., 1080 Avenida Acaso, Camarillo, CA 93012, Tel: 805-987-9660, TWX: 910-494-2761, FAX: 805-388-0133; Empl.: 15; *Sls. Mgr.:* Ken Mathews

ANADYNE POWER SUPPLY DIVISION, 14005 Stage Road, Santa Fe Springs, CA 90670-5216, Tel: 213-921-9364, FAX: 213-921-8163; Empl.: 100

ANAHEIM AUTOMATION, 910 E. Orangefair La., Anaheim, CA 92801, Tel: 714-992-6990, TELEX: 2978217 MCI, FAX: 714-992-0471; Empl.: 35

ANALOG & DIGITAL PERIPHERALS, INC.(ADPI), P.O. Box 499, Troy, OH 45373, Tel: 513-339-2241, FAX: 513-339-0070; FSC No.: 31-0949-745; Empl.: 28; *Sls. Mgr.:* Jerry Davis; *Dist. Mgr.:* Lyle Ellicott

ANALOG DEVICES, INC., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, Tel: 617-329-4700, TWX: 710-394-6577, ESYLNK: 62896514, FAX: 617-326-8703; FSC No.: 24355; Empl.: 5200; *Sls. Mgr.:* Joe Reichbach; *Dist. Mgr.:* Ed Renola

ANALOG EQUIPMENT CORPORATION, 5606 PGA Blvd., Palm Bch. Gardens, FL 33418, Tel: 407-622-3715; FSC No.: 67584; *Sls. Mgr.:* V. Ratner

ANALOGIC CORP., 8 Centennial Dr., Peabody, MA 01960, Tel: 508-977-3000, FAX: 508-531-1266; Empl.: 1200; *Sls. Mgr.:* Martyn Culverhouse; *Dist. Mgr.:* Bob Shipione

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AZ Scottsdale, Arcom Sls., Inc. 602-947-5745
CA Huntington Bch., Mil-Com Sls. 714-840-2424
NY Manhassett, Win-Cor Elctrns. 516-627-9474
OK Tulsa, Norcom, Inc. 918-832-7747
TX Austin, Norcom, Inc. 512-451-2757
TX Dallas, Norcom 214-386-4888
TX Houston, Norcom, Inc. 713-778-0392
TX San Antonio, Norcom, Inc. 512-680-4513

ANALOG MODULES INC.

FAX: 407-834-3806

ANALOG MODULES, INC., 126 Baywood Avenue, Longwood, FL 32750, Tel: 407-339-4355; FSC No.: 61651; Empl.: 48; *Sls. Mgr.:* W.C. Hudson, Exec. VP; *Dist. Mgr.:* Mark Roberts ..... **D•1004**

ANALOG SYSTEMS, P.O. Box 17389, Tucson, AZ 85731-7389, Tel: 602-290-1818, FAX: 602-885-1189; Empl.: 9; *Sls. Mgr.:* Sharon Raban; *Dist. Mgr.:* Sharon Raban

ANALYTIC INSTRUMENTS CORPORATION, P.O. Box 542845, Dallas, TX 75354, Tel: 214-357-3882; Empl.: 15; *Sls. Mgr.:* Carl Dreher

ANALYTIC TECHNOLOGY CORP., 15233 N.E. 90th, Redmond, WA 98052, Tel: 206-883-2445, 800-428-2808, FAX: 206-882-2138; Empl.: 10; *Sls. Mgr.:* C. Johan Masreliez

ANAREN MICROWAVE, INC., P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057, Tel: 315-432-8930, FAX: 315-432-9121; FSC No.: 31597; Empl.: 424

ANATECH ELECTRONICS, INC., 213 First St., Ho Ho Kus, NJ 07423, Tel: 201-612-0066, FAX: 201-612-0404; Empl.: 10

ANCO ELECTRONICS, INC., 9477 Archibald Avenue, Rancho Cucamonga, CA 91730, Tel: 1-800-545-ANCO, FAX: 714-989-9935 ..... **D•1080**

ANCOT, 115 Constitution Drive, Menlo Park, CA 94025, Tel: 415-322-5322, FAX: 415-322-0455; Empl.: 7; *Sls. Mgr.:* Tom Lau

AND, William J. Purdy Co., 770 Airport Blvd, Burlingame, CA 94010, Tel: 415-347-9916, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (PURDY UW); Empl.: 32; *Sls. Mgr.:* Clarence Bruce ..... **B•1038-1039, 1137-1139**

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AL Huntsville, Currie, Peak, Frazier 205-536-1506
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CA Burlingame, William J. Purdy 415-347-7701
CO Englewood, William J. Purdy Assoc. ... 303-790-2211
FL Orlando, Currie, Peak, Frazier 407-855-0843
IL Addison, Hedge Assocs., Inc. 708-543-0888
IN Indianapolis, John Sukup, Inc. 317-253-5501
MA Framingham, Gallagher Assocs., Inc. .. 508-626-2346
MI E. Detroit, Jack M. Thorpe Co. 313-779-6363
MN Minneapolis, Hei-Lite Sls. 612-550-0506
MO Grandview, Harris-Hanson 816-763-6200
NJ Leonia, Peter E. Schmitt Co., Inc. 201-944-2806
NY Victor, Net Sls., Inc. 716-924-1844
NC Greensboro, Currie, Peak & Frazier, Inc. 919-373-0380
OH Cleveland, Marlow Assocs. 216-831-8232
OR Beaverton, Pacific Mktg. Specialists ... 503-641-9373
TN Smyrna, Currie, Peak & Frazier 615-459-0743
TX Dallas, Elcom Mktg. 214-241-2166
WA Redmond, Pacific Mktg. Specialists ... 206-882-3144

Local Distributors

AL Huntsville, Newark Elctrns. 205-837-9091
AZ Tempe, Newark Elctrns. 602-968-7441
CA Anaheim, A to Z Elctrns. 714-632-1620
CA Fremont, Allied Elctrns. 415-770-0590
CA Los Angeles, Newark Elctrns. 213-664-5252
CA Los Angeles, Trebor Elctrns. 213-641-8304
CA Milpitas, Sierra West Elctrns. 408-945-1050
CA Sacramento, Integrated Elctrns. 916-363-6030
CA San Jose, Rose Elctrn. 408-943-0200
CA Sunnyvale, Penstock 408-730-0300
CA Torrance, Kent Elctrns. 213-320-2700
CO Arvada, Denver Beta Wintronics 303-431-7161
CO Denver, Integrated Elctrns. 303-292-6121
CO Denver, Newark Elctrns. 303-757-3351
CT Stratford, Coghlin, Inc. 203-265-2724
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FL Melbourne, Rome Elctrns. South 407-242-8151
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IL Elgin, Allied Elctrns. 312-697-8200
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IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Newark Elctrns. 317-872-7070
IA Cedar Rapids, Advent Elctrns. 800-332-8407
KS Overland Park, Newark Elctrns. 913-677-0727
MA Lynn, Land Elctrn. Supp. 617-592-2220
MA Wilmington, Allied Elctrns. 617-942-0150
MI Farmington Hills, Advent Elect. 313-447-1650
MI Grand Rapids, Newark Elctrns. 616-455-9190
MI Livonia, Shand Elctrns. 313-422-7000
MN Minneapolis, Newark Elctrns. 612-331-6350
NE Omaha, Newark Elctrns. 402-592-2423
NH Nashua, Newark Elctrns. 603-883-9110
NJ Cranford, Garden State Elect. 201-272-6400
NM Albuquerque, Newark Elctrns. 505-883-6181
NY Fairport, Allied Elctrns. 716-425-3850
NY Rome, Rome Elctrns. 315-337-5400
NY Syracuse, Newark Elctrns. 315-437-6611
NC Greensboro, Newark Elctrns. 919-292-7240
NC Raleigh, Allied Elctrns. 919-876-5845
OH Cleveland, Newark Elctrns. 216-391-9330
OH Dayton, Stotts-Friedman 513-298-5555
OH Warren, REM Elect. 216-373-1300
OR Beaverton, Almac Elctrns. Grp. 503-629-8090
OR Portland, Radar Elec. Co., Inc. 503-232-3404
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PA Pittsburgh, Newark Elctrns. 412-367-2790
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Irving, Newark Elctrns. 214-258-1355
UT Salt Lake City, Standard Supp. Co. 801-486-3371
UT West Valley City, Salt Lake Beta Wintronic 801-483-1882
VA Richmond, Newark Elctrns. 804-282-5671
WA Bellevue, Almac Elctrns. Corp. 206-643-9992
WA Richland, Radar Elec. 509-943-8336
WA Seattle, Allied Elctrns. 206-547-2827
WI Grafton, Lakeview Elctrns. Corp. 414-377-8250
Can Rexdale, Ont., Newark Elctrns. 416-675-1130

ANDEEN-HAGERLING, INC., 31899 Miles Road, Chagrin Falls, OH 44022, Tel: 216-349-0370, TELEX: 4931432, FAX: 216-349-0359; Empl.: 14; *Sls. Mgr.:* Eric Whitman

ANDERS, INC., 77 Wolcott Rd., Simsbury, CT 06070, Tel: 203-658-7666, FAX: 203-651-5597; FSC No.: 52045; Empl.: 18; *Sls. Mgr.:* Donald W. Miner

ANDERSEN LABORATORIES, 45 Old Iron Ore Rd., Bloomfield, CT 06002, Tel: 203-286-9090, FAX: 203-242-4472; FSC No.: 03947; Empl.: 130; *Sls. Mgr.:* Richard Johnson

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FAX: 814-696-0403

ANDERSON ELECTRONICS, P. O. Box 89, Hollidaysburg, PA 16648, Tel: 814-695-4428; Empl.: 60; *Sls. Mgr.:* Mike Martin ..... **A•1304-1305**

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GA Lawrenceville, B. T. Funderburk, Inc. .. 404-963-9495
IL South Elgin, R.K. Elctrn. 708-695-8552
KS Roeland Park, Abrams & Assocs. 913-432-2303
MA Woburn, Microwave Comp. Mktg., Inc. 617-273-3106
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
MO St. Louis, Abrams & Assocs. 314-569-0447
NC Raleigh, B. T. Funderburk, Inc. 919-846-2373
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PA Souderton, Intek, Inc. 215-723-0433
TX Plano, GW Prods. 214-422-1746
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Can Hamilton, Ont., Cartwright South All Assocs. 416-528-0294

ANDERSON POWER PRODUCTS, Div. of High Voltage Engineering, 145 Newton St., Boston, MA 02135, Tel: 617-787-5880, TELEX: 940453, FAX: 617-254-9217

AEC

FAX: 401-333-0287

ANDON ELCTRNS. CORP., 4 Court Dr., Lincoln, RI 02865, Tel: 401-333-0388; FSC No.: OEBT2; Empl.: 55; *Sls. Mgr.:* Irene Small; *Dist. Mgr.:* Irene Small ..... **C•1274-1279**

Local Sales Offices & Reps

AZ Tempe, Elctrn. Dvc. & Sls., Inc. 602-438-1547
CA Milpitas, Inter-Tech Mktg. 408-263-7635
GA Norcross, ELCOM 404-447-8200
IL Rolling Meadows, Eagle Tech. Sls. 708-991-0700
KS Stanley, R. C. Napper & Assoc. 913-897-3719
MN Minneapolis, Electro Serv Co. 612-338-3475
NY Huntington, Applied Tech. Mktg. 516-271-0200
OH Akron, Augnat Assocs. 216-273-1211
OH Dayton, Dirckson & Assoc. Inc. 513-294-3657
PA Montgomeryville, Quick Response 215-362-9225
TX Dallas, SW Mktg. Assoc. 214-341-8631
WA Lynnwood, Blair Hirsh Co. 206-774-8151

Local Distributors

CA Milpitas, J-DOIT 408-956-1301
CA San Jose, Spectra Elctrns. 408-452-1590
CA Santa Clara, Trinity Elctrns. 408-980-9011
TX Houston, Wofford Elctrns. 713-847-3583

ANDOVER, INC., 310 North Earl Avenue, Lafayette, IN 47904, Tel: 317-447-1157, FAX: 317-447-1150; Empl.: 120; *Sls. Mgr.:* Harry O. Minns

ANDREW CORP., 10500 W. 153rd St., Orland Pk., IL 60462, Tel: 800-255-1479, TELEX: 25-3897, FAX: 708-349-5943; *Sls. Mgr.:* Carl Van Hecke

ANDREW/KMW SYSTEMS, 6034 West Courtyard Dr., Austin, TX 78730, Tel: 800-531-5167, 512-338-3082, TELEX: 28-338-3199, FAX: 512-338-3199; Empl.: 135; *Sls. Mgr.:* John McLellan, Dir. of Sls.

ANGO ELECTRONICS CORP., 16 North Third St, Harrison, NJ 07029, Tel: 201-484-1115, FAX: 201-484-0530; *Sls. Mgr.:* Brian K. Yuen ..... **C•1012**

ANGSTROHM POWER RHEOSTATS, A Sub. of Vishay Intertechnology, P.O. Box 1827, Hagerstown, MD 21740, Tel: 301-739-8722, FAX: 301-797-6852; Empl.: 500

ANGSTROHM PRECISION, INC., A Company of Vishay, One Precision Plz. P.O. Box 1827, Hagerstown, MD 21740, Tel: 301-739-8722, FAX: 301-797-6852; Empl.: 500 ..... **A•1844-1845, 2015**

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FL	Clearwater, VEC	813-461-4675
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Can	Concord, Ont., Kaytronics, Inc.	416-669-2262
Can	Kanata, Ont., Kaytronics, Inc.	613-564-0080
Can	St. Laurent, Que., Kaytronics, Inc.	514-745-5800

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CA	Chatsworth, Shelley-Ragon, Inc.	818-998-3333
CA	Laguna Hills, Jaco Elctrns.	714-837-8966
CA	Milipitas, TTI, Inc.	408-946-5577
CA	Mission Hill, TTI, Inc.	818-891-8885
CA	San Diego, Shelley-Ragon, Inc.	619-453-7133
CA	San Diego, TTI, Inc.	619-748-2025
CA	San Diego, Zeus Comps.	619-277-9681
CA	San Jose, Jaco Elctrns.	408-432-9290
CA	San Jose, Passive Compnts.	408-441-1441
CA	San Jose, Shelley-Ragon, Inc.	408-432-0600
CA	San Jose, Zeus Comps.	408-629-4789
CA	Santa Ana, TT I, Inc.	714-641-9393
CA	Westlake Village, Jaco Elctrns.	805-495-9998
CA	Yorba Linda, Zeus Comps.	714-921-9000
CO	Denver, TTI, Inc.	303-429-6806
CT	Meriden, Jaco Elctrns.	203-235-1422
CT	Wallingford, TT I, Inc.	203-284-7474
FL	Boca Raton, Jaco Elctrns.	800-776-5226
FL	Orlando, TT I, Inc.	407-859-1000
FL	Oviedo, Zeus Comps.	407-365-3000
FL	Pinellas Park, MMG Elec./L & S	813-545-1700
FL	Tampa, C & D Elctrns.	813-839-5486
FL	Tampa, Shelley-Ragon, Inc.	813-623-6560
GA	Norcross, Jaco Elctrns.	404-449-9508
GA	Norcross, TTI, Inc.	404-662-0911
MA	Chelmsford, Shelley-Ragon, Inc.	508-250-9666
IL	Glendale Heights, Shelley-Ragon, Inc.	708-529-9977
IA	Cedar Rapids, Shelley-Ragon, Inc.	319-373-0525
MD	Baltimore, RESCO/Baltimore	301-931-8200
MD	Beltsville, RESCO/Washington	301-937-9100
MD	Columbia, Jaco Elctrns.	301-995-6620
MD	Columbia, TTI, Inc.	301-995-1331
MD	Columbia, Zeus Comps.	401-997-1118
MA	Springfield, C & D Elrtns.	413-781-1776
MA	Tewksbury, Jaco Elctrns.	508-640-0010
MA	Wakefield, Zeus Comps.	617-246-8200
MA	Wilmington, TT I, Inc.	508-658-4700
MN	Minnetonka, TTI, Inc.	612-933-8555
MN	St. Paul, Shelley-Ragon, Inc.	612-642-2828
MO	Hazlewood, Shelley-Ragon, Inc.	314-895-1515
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NJ	Mt. Laurel, TTI Inc.	609-234-6400
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Medford, Shelley-Ragon, Inc.	516-447-2000
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Ronkonkoma, Mast Distrs., Inc.	516-471-4422
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NY	Ronkonkoma, Zeus Comps.	516-737-4500
NY	Valley Stream, L & S Elctrns.	516-561-2474
NC	Raleigh, Jaco Elctrns.	919-876-7767
OH	Cincinnati, G & A Sls.	513-385-1105
OH	Dayton, Micro Mil Div.	513-434-8231
OH	Dayton, Zeus Comps.	513-293-6162
OH	Worthington, TTI, Inc.	614-848-5770
TX	Addison, Jaco Elctrns.	214-733-4300
SC	Charleston, L&S	803-720-4242
TX	Ft. Worth, TT I, Inc.	817-831-8300
TX	Ft. Worth, TTI, Inc.	817-595-3100
TX	Houston, Texas Comps.	713-468-3882
TX	Richardson, Zeus Comps.	214-783-7010
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, TTI, Inc.	206-882-0291
Can	Burnaby, B.C., Kaytronics, Inc.	604-294-2000
Can	Concord, Ont., Kaytronics	416-669-2262
Can	Kanata, Ont., Kaytronics, Inc.	613-564-0080
Can	Quebec, Kaytronics, Inc.	514-745-5800

ANNULUS TECHNICAL INDUSTRIES, INC., P.O. Box 7407, 1296 Osprey Dr., Ancaster, Ontario, CAN L9G 4G4, Tel: 416-648-8100, FAX: 416-648-8102; Empl.: 21; *Sls. Mgr.:* Don MacAdam

ANORAD CORP., 110 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1995, TWX: 510-227-9894, FAX: 516-435-1612; Empl.: 280; *Sls. Mgr.:* Richard Scherer,VP Sls.

Anritsu

FAX: 201-337-1033

ANRITSU, 15 Thornton Rd., Oakland, NJ 07436, Tel: 201-337-1111, 800-255-7234, TELEX: 64-2141 ANRITSUOKLD; Empl.: 75; *Sls. Mgr.:* Chuck Smith ..... **D•1218-1219**

Local Sales Offices & Reps

CA	San Jose, Anritsu	408-434-6666
FL	Melbourne, Anritsu	305-951-7302
GA	Norcross, Anritsu	404-662-1541
IN	Columbus, Anritsu	812-372-0516
KS	Overland Park, Anritsu	913-451-4438
MD	Gaithersburg, Anritsu	301-590-0300
MA	Nashua, Anritsu	603-888-0230
TX	Dallas, Anritsu	214-991-8864

ANSLEY ELECTRONICS, DIVISION OF THOMAS & BETTS, See T & B/Ansley Corp.

ANSONICS, INC., P.O. Box 910, Halfway, OR 97834, Tel: 503-742-7475, FAX: 503-742-2991; Empl.: 6

ANTEL OPTRONICS INC., 3325B Mainway, Burlington, Ontario, Canada L7M 1A6, Tel: 416-335-5507, TELEX: 061-8514, FAX: 416-335-5141; Empl.: 25; *Sls. Mgr.:* J. D. Brown

ANTENNA RESEARCH ASSOCIATES, 11317 Frederick Ave., Beltsville, MD 20705, Tel: 301-937-8888, TELEX: 374-6620, FAX: 301-937-2796; FSC No.: 23360; Empl.: 30; *Sls. Mgr.:* H.W. Rapalus

ANTENNA SPECIALISTS, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139, Tel: 216-349-8400, TELEX: 4332133 (AS INTL CLV), FAX: 216-349-8407; Empl.: 1000; *Dist. Mgr.:* Bob Levy, VP Sls.

ANTEX DIVISION, 24 Tioga Way, P.O.Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel

ANTEX ELECTRONICS CORP., 16100 S. Figueroa St, Gardena, CA 90248, Tel: 213-532-3092, FAX: 213-532-8509; Empl.: 53; *Sls. Mgr.:* Richard Gross; *Dist. Mgr.:* Richard Gross

ANTONA CORP., 1643 1/2 Westwood Blvd., Los Angeles, CA 90024-5603, Tel: 213-473-8995, FAX: 213-473-7112; *Sls. Mgr.:* Katherine Capanna

ANZAC, M/A-COM, 80 Cambridge St., Burlington, MA 01803, Tel: 617-273-3333, TELEX: 200155, TWX: 710-332-0258; FSC No.: 21912; Empl.: 300; *Sls. Mgr.:* Lee Cooper; *Dist. Mgr.:* Lisa Owens

AOFR, INC., 800 E. Campbell, Suite 108, Richardson, TX 75081, Tel: 214-644-1394, FAX: 214-480-9278; Empl.: 50; *Sls. Mgr.:* Dwain Lawhon

A. P. CIRCUIT, 397 Linden St., Brooklyn, NY 11237, Tel: 718-456-2717, TELEX: 428759, FAX: 718-456-2717 ..... **A•1654**

Local Sales Offices & Reps

MI	Southfield, Comtel Instrs.	313-358-2505
NJ	Matawan, Reps Five	201-495-2315
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-298-7573

A.P.C.S. AMERICA, 3286 Kentland Ct. SE, Grand Rapids, MI 49548, Tel: 616-247-1453; Empl.: 13; *Sls. Mgr.:* Julie A. Corby

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FAX: 602-888-3329

APEX MICROTECHNOLOGY CORP., 5980 N. Shannon Rd., Tucson, AZ 85741, Tel: 602-742-8600, TELEX: 170631; FSC No.: 60024; Empl.: 100; *Sls. Mgr.:* Richard Spielman; *Dist. Mgr.:* Bridget Riceci-Byrne, Intl. Sls. Mgr. ..... **D•1005-1007, 1598**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier, Inc.	205-536-1506
AZ	Tucson, Apex Microtechnology	602-742-8600
CA	Laguna Hills, Conprod	714-361-0765
CA	Los Altos, Kolm Mktg.	415-948-2635
CA	Los Altos, KOLM Mktg.	415-948-2635
CT	Guilford, Data Mark Inc.	203-453-0575
MD	Elicott City, Nelson Elctrns.	301-747-7887
GA	Duluth, Currie, Peak & Frazier, Inc.	404-497-9404
IL	Buffalo, Torkelson Assocs.	312-520-0710
IN	Indianapolis, Torkelson Assocs.	317-244-7867
IA	Cedar Rapids, Torkelson Assocs.	319-373-0200
MD	Ellicot City, Nelson Elctrns.	301-747-7887
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	Woburn, Signal Sls. Engrg.	617-938-7872
MN	Minneapolis, Torkelson Assocs.	612-835-2414
NJ	Flanders, K & R Engrg. Sls.	201-584-5235
NC	Greensboro, Currie, Peak & Frazier Inc.	919-373-0380
IN	Fort Wayne, TX Sales	219-489-4447
TX	Dallas, Repmasters	214-247-6236
TX	Sherman, Repmaster	214-247-6236
WI	Waukesha, Torkelson Assocs.	414-784-7736

Local Distributors

AZ	Tuscon, Apex	602-742-8600
FL	Tampa, Currie, Peak & Frazier	813-963-1076
KS	Olathe, Tech Sls. Assoc.	913-829-2800
NY	Southern, K & R Engrg. Sls.	800-631-9362
NY	St. Louis, Tech Sls. Assocs.	314-521-2044
Can	Mississauga, Ont., bbd Elctrns.	416-821-7800

APOLLO DISPLAY TECHNOLOGIES, INC., 182-2 Morris Ave., Holtsville, NY 11742, Tel: 516-654-1143, FAX: 516-654-1496; *Sls. Mgr.:* Richard Eicher ..... **B•1040**

APOLLO MAGNETICS CORP., 2720 W. Beverly Blvd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348, FAX: 213-384-4067; Empl.: 420; *Sls. Mgr.:* Charles Williams

APPLIED COMPONENTS, AC Interface, 22391 Gilberto, Rancho Santa Margarita, CA 92688, Tel: 714-858-9488, FAX: 714-589-7267; FSC No.: 5930; Empl.: 5; *Sls. Mgr.:* Curtis Armijo

APPLIED CONTROLS CO., INC., 1275 Bloomfield Ave., Fairfield, NJ 07004, Tel: 201-227-5454, FAX: 201-882-1422; FSC No.: 4A725; Empl.: 20; *Sls. Mgr.:* W. Merel

APPLIED DATA COMMUNICATIONS, 14272 Chambers Rd., Tustin, CA 92680, Tel: 714-731-9000, TELEX: 183823 ADC, FAX: 714-838-7172; Empl.: 50; *Sls. Mgr.:* David M. Besse

APPLIED DATA SYSTEMS, 409A East Preston St, Baltimore, MD 21202, Tel: 800-541-2003, 410-576-0335, FAX: 410-576-0338; Empl.: 6; *Sls. Mgr.:* Edward Shea; *Dist. Mgr.:* Edward Shea

APPLIED ELECTRO TECHNLG., INTL., See STI-Control Components Div.

APPLIED INFORMATION SYSTEMS, INC., 500 Eastowne Dr., Suite 207, Chapel Hill, NC 27514, Tel: 919-942-7801, 800-334-5510, TELEX: 701365, FAX: 919-493-7563; *Sls. Mgr.:* John Wyatt

APPLIED MAGNETICS, 75 Robin Hill Rd., Goleta, CA 93117, Tel: 805-683-5353, FAX: 805-967-8227; FSC No.: 11935; Empl.: 12,000; *Sls. Mgr.:* O. M. Fundingsland

APPLIED MICRO CIRCUITS CORP., 6195 Lusk Blvd., San Diego, CA 92121, Tel: 619-450-9333, TWX: 910-337-1136,, FAX: 619-450-9885-FAX; FSC No.: 367 4112; Empl.: 235; *Sls. Mgr.:* Greg Barnhart

APPLIED MICROSYSTEMS CORP., 5020 148th Ave NE, Redmond, WA 98052, Tel: 206-882-2000, TELEX: 185196, FAX: 206-883-3049; Empl.: 200; *Sls. Mgr.:* Joe Gomula

APPLIED MICROWAVE DIV. EPSCO, See Epsco Microwave

APPLIED PLASTICS TECHNOLOGY, 45 Broadcommon Rd., Bristol, RI 02809, Tel: 401-253-0200; FSC No.: 9330; Empl.: 30; *Sls. Mgr.:* John A. MacIntyre Jr.

APPLIED POWER CONVERSION

FAX: 201-385-0702

APPLIED POWER CONVERSION, Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70 ..... **D•1588-1593**

Local Sales Offices & Reps

CA	Escondido, Larry Ford	619-743-1557
CO	Boulder, AS Rep Co.	303-442-8018
CT	Cheshire, Scientific Comps.	203-272-2963
FL	Land O'Lakes, A J Power Source	813-996-2583
MO	St. Louis, Abrams & Assocs.	314-569-0447
NH	Salem, Integrated Technlg.	603-898-6333
NM	Albuquerque, IMEC	505-275-0936
NY	Rochester, A.J. Electro Mktg.	716-426-3598
PA	West Chester, TCA Inc.	215-692-6853
TX	Garland, Carey McMahill	214-681-1414
WA	Edmonds, Power Sources	206-743-6641
Can	Rexdale, Ont., QPL Elctrns.	416-674-8858

APPLIED REASONING CORP., 86A Sherman St., Cambridge, MA 02140, Tel: 617-492-0700, TELEX: 6714194, FAX: 617-492-7908; *Sls. Mgr.:* Paul Blumeufeld

APPLIED SOFTWARE TECH., INC., 1908 Cliff Valley Way, N.E., Atlanta, GA 30329, Tel: 404-663-8660; Empl.: 29; *Sls. Mgr.:* Jim A. Moss

APPLIED STATISTICS INC., 3080 Centerville Rd., St. Paul, MN 55117, Tel: 612-481-0202, FAX: 612-481-0410; Empl.: 25

APPROVED PURIFICATION CORP., 1088 R Hope St., Stamford, CT 06907, Tel: 203-357-0141, FAX: 203-356-1697 ..... **B•1878**

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APSCO, INC., 5976 Heisley Road, Mentor, OH 44060, Tel: 216-352-8961, TELEX: 284580, FAX: 216-354-7306; Empl.: 200; *Sls. Mgr.:* Ian Davey-Turner

APS DYNAMICS, INC., 5731 Palmer Way, Ste. A, Carlsbad, CA 92008, Tel: 619-438-4848, TELEX: 4995113 (SHAKE), FAX: 619-438-8845; Empl.: 5

APTEK TECHNOLOGIES, INC., Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442, Tel: 305-421-8450, TELEX: 441020, FAX: 305-421-8044; FSC No.: 36741; Empl.: 150; *Sls. Mgr.:* Jerry D. Moore, Dir. Mktg./Sls.; *Dist. Mgr.:* D.L. Gilley, Sr.

A.P.W. CO., INC., 72 W. Main, Rockaway, NJ 07866, Tel: 201-627-0643, FAX: 201-627-6396; Empl.: 14

apx

FAX: 516-433-1457

APX-ARSTAN PRODUCTS, 264 Duffy Ave., Hicksville, NY 11801, Tel: 516-433-1313; Empl.: 300; *Sls. Mgr.:* David Baum ..... **A•2168-2169; D•1594-1597**

Local Sales Offices & Reps

CA	Santa Clara, Source Tronics	408-988-8801
FL	Dunedin, John White Assoc.	813-733-5319
MA	Framingham, Bob Mirabella	617-877-0884
MA	Wellesley, Brownstone Assoc.	508-877-0884
MN	Golden Valley, Highland	612-546-2123
NM	Albuquerque, Syntech	505-266-7951
NY	Hauppauge, Sticom Sls.	516-366-4221
MO	Independence, Hitec Central	816-796-6684
NC	Raleigh, C-Tech	919-782-8100
TX	Richardson, John Duncan Assoc.	214-437-3967
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WA	Vancouver, Elctrn. Mktg. Grp.	503-684-5935

Local Distributors

NC	Raleigh, Century Elctrns.	919-872-2203
PA	Norristown, Century Elctrns.	215-631-5400

AQUALARM, Marine Safety Systems, Inc., 1151 D. Bay Blvd., Chula Vista, CA 91911, Tel: 619-575-4011, FAX: 619-575-4012; FSC No.: 2V373; Empl.: 8; *Sls. Mgr.:* John L. Hooper

ARCO ELECTRONICS, 9822 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8707, FAX: 818-882-6513; FSC No.: 84171; Empl.: 10; *Sls. Mgr.:* Randy Ryan ..... **A•1655-1657**

Local Sales Offices & Reps

CA	Chatsworth, Arco	818-882-8707
IN	Granger, Gregory Sls.	219-272-9629
MA	Taunton, Focus Elctrn. Sls.	617-824-3840
MN	St. Paul, Northport Eng.	612-457-8000
NY	Syracuse, PyTronics	315-454-9346
CA	Chatsworth, Arco Elctrns.	818-882-8707

ARCOLECTRIC CORP., 9001 Canoga Ave., Canoga Park, CA 91304, Tel: 818-700-1933, FAX: 818-700-9541; *Sls. Mgr.:* Carrie Donze; *Dist. Mgr.:* Carrie Donze ..... **B•1141, 1648**

Local Distributors

CA	Haywood, Electro Comps.	415-783-5800
FL	Lakeland, Wesgarde	813-644-7564
CA	Los Angeles, Electric Switches	800-252-4640, 800-421-8855
CA	Tustin, Western Switches	213-627-6126
CA	Van Nuys, Wesgarde Comp.	818-786-3724
CT	Hartford, Wesgarde Comp.	203-527-7705
IL	Carol Stream, Wesgarde Comp.	708-653-1460
KS	Overland Park, Wesgarde Comp.	913-262-2718
MD	W. Springfield, T. F. Cushing	413-788-7341
MI	Madison Hts., Galco Ind.	313-542-9090
MN	Minneapolis, Scorpio	612-473-8656
MO	St. Louis, Wesgarde Comp.	314-567-7776
NH	Nashua, Wesgarde Comp.	603-880-1971
NJ	Denville, Lashen Elctrns.	201-627-3783,
NJ	Mt. Laurel, Wesgarde Comp.	609-778-8190
OH	Westerville, Wesgarde Comp.	614-885-0319
OR	Eugene, Larsco	503-484-7491
TX	Dallas, Wesgarde Comp.	214-357-1768
TX	Garland, Barcon	214-414-1863

ARC SYSTEMS, INC., 2090 Joshuas Path, Hauppauge, NY 11788, Tel: 516-582-8020, FAX: 516-582-8038; FSC No.: 67245; *Sls. Mgr.:* Robert Miller

AREMCO PRODUCTS, INC., Box 429, Ossining, NY 10562, Tel: 914-762-0685, FAX: 914-762-1663; Empl.: 30; *Sls. Mgr.:* Brian Miles

A.R.F. PRODS., 2559 75th St., Boulder, CO 80301, Tel: 303-443-4844, FAX: 303-443-4846; FSC No.: 4G971; Empl.: 10

ARGA CONTROLS, 35 E. Glenarm St., Pasadena, CA 91105, Tel: 213-682-3314, FAX: 818-799-9407; FSC No.: 50290; Empl.: 25; *Sls. Mgr.:* Linda Galman

ARGO ELECTRONICS, INC., 5054 Bleecker St., Baldwin Park, CA 91706, Tel: 818-962-8422, FAX: 818-960-7312; Empl.: 12

ARGOS PRODS., 600 S. Sycamore St., Genoa, IL 60135, Tel: 815-784-5118; Empl.: 35; *Sls. Mgr.:* Ron Evers

Local Sales Offices & Reps

CA	Burlingame, Meyer, Ross & Fleming	415-348-6800
FL	Ocala, Bencsik Assoc.	904-732-9775
GA	Atlanta, Murphy & Cota	404-875-2525
IL	Arlington Hgts., Arch Hoyne	708-398-1681
IN	Mulberry, Maish Sls.	317-296-2322
MA	North Scituate, W.A. Hendrickson	617-545-0652
MN	Edina, Foster Tech. Sls.	612-941-9800
MO	Kansas City, Nevco	816-421-1751
NJ	Fort Lee, TMC Sls.	201-944-5665
NY	Syracuse, Lewis & Dunnigan	315-446-5522
OH	Dayton, Shamrock Elctrn	513-258-1227
PA	Wynnewood, Stinson Assocs.	215-896-7378
WA	Lynnwood, Pacnor Mktg.	206-284-8020
EXP	N.Y., New York, Roburn Agencies	212-989-5939

ARGO TRANSDATA CORP., 1 Heritage Pk., Clinton, CT 06413-0554, Tel: 203-669-2233, FAX: 203-669-4316; Empl.: 20

ARIEL CORPORATION, 433 River Rd., Highland Pk., NJ 08904, Tel: 908-249-2900, FAX: 908-249-2123; *Sls. Mgr.:* Irene Getvay

ARIES ELECTRONICS, INC.

FAX: 908-996-3891

ARIES ELECTRONICS, Box 130, Frenchtown, NJ 08825, Tel: 908-996-6841; FSC No.: 51167; Empl.: 160; *Sls. Mgr.:* Frank Folmsbee ..... **A•1722; B•1649; C•1281-1288**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Fountain Hills, Contact Aries Elctrns.	908-996-6841
CA	San Mateo, Larsen Assoc.	415-358-9559
CA	Westlake Vlg., Elkins & Assoc.	818-597-1075
CO	Denver, West Inc.	303-477-8180
FL	Melbourne, The R-Rep Co.	407-242-9800
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Bloomingdale, Orion Mktg.	708-893-2111
WI	Hartland, Selective Sls.	414-367-1133
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
MD	Glen Burnie, Macrotech Assoc. Ltd.	301-766-1111
MA	Harvard, Enterprise Tech.	508-772-6003
MI	Novi, I.E. Hampton & Assoc.	313-344-8860
MI	St.Joseph, I.E. Hampton & Assoc.	616-938-0862
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co.	816-436-6445
NJ	Ho-Ho-Kus, DJ Fisher Co.	201-652-0080
NY	Fairport, TAC Sls., Inc.	716-377-2250
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Willoughby Hills, Versatron	216-944-0082
OR	Hillsboro, Doran Sls. Assocs.	503-640-4500
PA	Harrisburg, All-Tech Mktg.	717-540-1204
PA	West Chester, All-Tech Mktg.	215-344-0134
TX	Dallas, REM Comps.	214-234-1069
TX	Houston, REM Comps.	713-589-9721
WA	Redmond, Doran Sls. Assocs.	206-885-1885

Local Distributors

AL	Huntsville, Comp. Dist.	205-883-7501
AL	Huntsville, Gateway Megatech	205-830-5955
AL	Huntsville, Gateway MegaTech.	205-830-5955
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Dalis	602-275-2626
CA	Canoga Park, Timco Comps.	818-992-5040
CA	Compton, Harper SID	213-979-5090
CA	Fremont, Frys Elctrns.	415-770-3743
CA	Gardena, Cal, Switch & Signal	213-770-2330
CA	Irvine, IEC	714-837-9960
CA	Sacramento, IEC	916-363-6030
CA	San Diego, Harper SID	619-578-2500
CA	San Francisco, Peters De Laet	415-873-9595
CA	San Jose, Harper SID	408-943-9490
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Sunnyvale, Fry's Elect.	408-733-1770
CA	Sunnyvale, Frys Elctrns.	408-733-1770

CA	Torrance, Pyramid/Kent	714-773-0781
CO	Denver, I.E.C.	303-292-6121
CO	Englewood, Component Dist.	303-799-4915
CO	Englewood, Indelco	303-694-9444
CT	Danbury, Pilgrim	203-792-7274
CT	Wallingford, Cronin	203-265-3134
FL	Ft. Lauderdale, KSM	305-971-5900
FL	Melbourne, CDI	407-724-9910
FL	Pompano Bch., Peerless Radio	305-973-4141
GA	Atlanta, Gateway Megatech	404-497-0799
GA	Atlanta, KSM	800-554-9227
ID	Boise, Kimball	208-342-3559
IL	Hoffamn Estates, IEC	708-843-2040
IL	Northbrook, Classic	312-272-9650
CT	Norwalk, Cobra Comps.	203-847-6442
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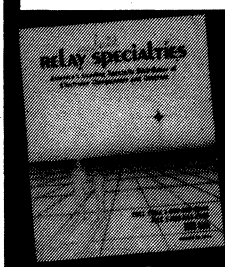
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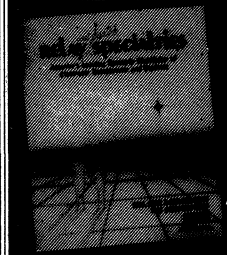
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CO	Wheatridge, Waugaman Assocs.	303-423-1020
GA	Norcross, R. O. Whitesell & Assocs.	404-449-9190
IL	Itasca, Circuit Sls., Inc.	312-773-0200
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KY	Pewee Valley, R. O. Whitesell & Assocs.	502-241-1441
LA	Hammond, Design Mktg. & Assocs.	504-542-1115
LA	Hammond, Design Mktg. Of LA, Inc.	504-542-1115
MD	Annapolis, EES, Inc.	301-269-4234
MI	Grand Blanc, R. O. Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MO	St. Louis, John G. Macke Co.	314-432-2830
NH	Salem, Sls. Engrg. Co.	603-893-5521
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-888-0800
NY	Buffalo, Quality Comps.	716-837-5430
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NY	Manlius, Quality Comps.	315-682-8885
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OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
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TX	Houston, Design Mktg. & Assocs.	713-550-3318
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
VA	Midlothian, EES, Inc.	804-794-8939
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FAX: 619-439-4243

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CA Milpitas, Emerging Technlgs. 408-263-9366, FAX:408-263-9566
CA San Diego, SC Cubed 619-458-5808, FAX:619-458-5823
CA Thousand Oaks, SC Cubed 805-496-7307, FAX:805-495-3601
CA Tustin, SC Cubed 714-731-9206, FAX:714-731-7801
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MO Blue Springs, Palatine Engrg. 816-229-4007, FAX:816-229-4471
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NC Davidson, R.W. Mitscher Co., Inc. 704-896-7434, FAX:704-896-7842
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OH Richfield, Lyons Corp. 216-659-9224, FAX:216-659-9227
OH Westerville, Lyons Corp. 614-895-1447
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WI Brookfield, Tri-Star Grp., Inc. 414-782-2670, FAX:414-782-2187
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ATKINS TECHNICAL INC., 3401 S.W. 40th Blvd., Gainesville, FL 32608, Tel: 904-378-5555, FAX: 904-335-6736; Empl.: 45; *Sls. Mgr.:* Robert M. Atkins; *Dist. Mgr.:* Liddon Dell

ATLANTA SIGNAL PROCESSORS, INC., 770 Spring Street N.W., Atlanta, GA 30308, Tel: 404-892-7265, FAX: 404-892-2512; Empl.: 20; *Sls. Mgr.:* William E. Jouris

ATLANTIC MAGNETICS, INC., 1441 S.W. 30th Ave., Pompano Beach, FL 33069, Tel: 305-979-7920, FAX: 305-977-5128; Empl.: 37; *Sls. Mgr.:* Edward Cammarata; *Dist. Mgr.:* Scott Thompson

ATLANTIC OPTICAL MOULDING, Ellis St., P.O. Box 309, Webster, MA 01570, Tel: 508-943-1746; Empl.: 6

ATLANTIC SCIENTIFIC CORPORATION, 2711 S. Harbor City Blvd., Melbourne, FL 32901, Tel: 1-800-544-4737, FAX: 407-727-0736; Empl.: 50; *Sls. Mgr.:* George Mayle; *Dist. Mgr.:* William Purcell, Mktg. Mgr.

ATLAS ENERGY SYSTEMS, INC., 16872 Milliken Avenue, Irvine, CA 92713, Tel: 714-863-0900, FAX: 714-553-8191; Empl.: 30; *Sls. Mgr.:* Steven Laffond; *Dist. Mgr.:* Gene Weaver

ATLAS ENGINEERING CORP., 10 Cheney St., Dorchester, MA 02121, Tel: 617-445-7100, FAX: 617-445-4942; FSC No.: 07001; Empl.: 75; *Sls. Mgr.:* Norman Scotch

ATLAS/SOUNDOLIER, 1859 Intertech Dr., Fenton, MO 63026, Tel: 314-349-3110, TWX: 910-760-1650, FAX: 314-349-1251; Empl.: 700; *Sls. Mgr.:* Gary Shamel ..... **C•1013**

Local Sales Offices & Reps
AL Huntsville, Saber Assocs., Inc. 800-327-0853
AZ Tempe, Hanna-Hill, Inc. 602-431-1771
CA Laguna Niguel, Aktron Sls. 714-496-5057
CA Sunnyvale, Logan Sls. 408-732-6020
CO Denver, Hanna-Hill, Inc. 303-252-1154
FL Melbourne, Saber Assocs., Inc. 407-724-0920
GA Lawrenceville, Saber Assocs., Inc. 800-327-0853
IL Buffalo Grove, Torkelson Assocs., Inc. 708-520-0710
KY Springfield, O'Daniel & Co. 606-336-9479
MD Ellicott City, Technology Sls., Inc. 301-461-7802
MI Madison Hgts., WKM Assocs., Inc. 313-588-2300
MN Minneapolis, Torkelson Assocs., Inc. .. 612-835-2414
MO Maryland Hgts., Dytec/South, Inc. 314-739-0665
NJ Sparta, Latronics Assocs., Inc. 201-729-5303
NM Albuquerque, Hanna-Hill, Inc. 505-268-0950
NC Clayton, Saber 800-327-0853
OH Dayton, WKM Assocs., Inc. 513-434-7500
OK Stillwater, Acudata Inc. 405-743-1886
OR Beaverton, Northwest Test & Meas. Inc. 503-645-9000
PA Pittsburgh, WKM Assocs., Inc. 412-892-2953
TX Plano, Acudata Inc. 214-424-3567
UT Lake City, Hanna-Hill, Inc. 801-364-0606
WI Waukesha, Torkelson Assocs., Inc. 414-784-7736

Local Distributors
WA Redmond, Northwest Test & Meas. Inc. 206-881-8857

ATLEE

FAX: 508-686-2934

ATLEE INC., 10 Bayfield Dr., North Andover, MA 01845, Tel: 508-681-1003, TELEX: 928252; FSC No.: 99378; Empl.: 40; *Sls. Mgr.:* Tom Fiocco; *Dist. Mgr.:* Tom Fiocco ..... **C•1014, 1679**

Local Sales Offices & Reps
CA Irvine, The Hapco Grp. 714-474-8474
FL Casselberry, T-Squared Mktg. 407-699-9992
MA Sharon, Cummings Assocs. 617-784-5600
PA Paoli, Stitzer Assocs. 215-644-5500
TX Arlington, Rem-Air Corp. 214-234-1069

Local Distributors
CA Anaheim, Bisco Inds. 714-635-0380
CA San Jose, Bisco Inds. 408-946-8980
IL Franklin Pk., Bisco Inds. 312-451-1230
MA Marlboro, Hardware Specialties 617-481-8622
MA N. Andover, Atlee, Direct 508-681-1003
MA Winchester, Rush Inds. 617-729-5800
MA Woburn, Bisco Inds. 617-938-8590
MN Minneapolis, Aerospace Computer 612-884-4725
NJ Paramus, N.Y. Fastener 201-265-8770
NY Bayshore, Merrit Fastener 516-242-1800
NY Long Island City, Hardware Specialty 212-361-9393
NY Plainview, Elctrn. Precepts 516-293-7441
NY Plainview, G & B Fasteners 516-694-0990
NY Rochester, Summitt Elec. 716-334-8110
TX Richardson, Altair Co. 214-231-5166

ATMEL CORPORATION, 2125 O'Nel Drive, San Jose, CA 95131, Tel: 408-441-0311, FAX: 408-436-4200; Empl.: 1026

ATOCHEM NORTH AMERICA, Three Pkwy., Philadelphia, PA 19102, Tel: 215-587-7520, TELEX: 84-5234, FAX: 215-587-7497

ATOMERGIC CHEMETALS CORP., 222 Sherwood Ave., Farmingdale, NY 11735-1718, Tel: 516-694-9000, TELEX: 144612, TWX: 6852289, FAX: 516-694-9177; Empl.: 40; *Sls. Mgr.:* M. Hollander

ATV RESEARCH, INC., 1301 Broadway, Dakota City, NE 68731, Tel: 402-987-3771; *Sls. Mgr.:* Mel Shadbolt

THE AUBURN MANUFACTURING COMPANY, 29 Stack Street/P.O. Box 251, Middletown, CT 06457, Tel: 203-346-6677, FAX: 203-346-1334; Empl.: 45; *Sls. Mgr.:* Gary L. Mittelman, VP

AUDIO PRECISION, INC., PO Box 2209, Beaverton, OR 97075, Tel: 503-627-0832, TELEX: 283957 AUDIO UR, FAX: 503-641-8906; Empl.: 25; *Sls. Mgr.:* Thomas Mintner

AUDIOSEARS, South St., Stamford, NY 12167, Tel: 607-652-7305, 800-533-7863, FAX: 607-652-3653; FSC No.: 97101; Empl.: 120; *Sls. Mgr.:* Fred Rosscoe

AUDIOSONE, INC., 335 Benton St., Stratford, CT 06497, Tel: 203-377-4475, FAX: 203-377-3374; *Sls. Mgr.:* Rudolph Duris

AUDIOTRONICS CORP., 7428 Bellaire Ave., N. Hollywood, CA 91605, Tel: 818-765-2645, TELEX: 69-1241; Empl.: 15; *Sls. Mgr.:* Gordon Anderson

AUDRE, INC., 10915 Technology Place, San Diego, CA 92127, Tel: 619-451-2260, FAX: 619-451-0267; Empl.: 25

AUGAT INC., 33 Perry Ave., Box 779, Attleboro, MA 02703, Tel: 617-222-2202, TWX: 710-391-0644, FAX: 617-226-5257; FSC No.: 91506; Empl.: 2500; *Sls. Mgr.:* Jim Fuchs/Jeff Mahall; *Dist. Mgr.:* William Hall

AUGAT ALCOSWITCH, Augat Inc., 1551 Osgood St., N. Andover, MA 01845, Tel: 508-685-4371, TELEX: 275423, FAX: 508-686-9545; FSC No.: 95146; Empl.: 150; *Sls. Mgr.:* Robyn Goodwin; *Dist. Mgr.:* Jon Siccoe

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Local Sales Offices & Reps

AL	Huntsville, Interep Assoc.	205-881-1096
AL	Daphne, Interep Assoc.	205-621-1036
AL	Huntsville, Alpha Mktg.	205-533-0766
AZ	Phoenix, Augat Sls.	602-224-6104
AZ	Scottsdale, Spectrum Mktg.	602-890-9000
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Montrose, Signal Entprs.	818-957-0640
CA	San Diego, Wiley Co.	619-453-9018
CA	San Jose, Augat Sls.	408-249-8801
CA	SAnta Clara, Interconnect Sls. Grp.	408-980-1166
CO	Denver, Spectrum Mktg.	303-480-9991
CT	Noack, Augat Sls.	203-572-7503
FL	Lantana, Augat Sls.	407-967-6150
FL	Orlando, Augat Sls.	407-352-2020
GA	Norcross, Interep	404-449-8680
HI	Honolulu, Hawaii Elctrns.	808-845-8207
ID	Boise, J.J. Backer Co.	308-378-4680
IL	Downers Grove, Rockford Controls	312-960-2046
IN	Indianapolis, Luebbe Sls.	317-845-7389
IN	Indianapolis, Luebbe Sls. Co.	317-845-7387
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Leawood, Dy-Tronix	913-339-6333
KS	Wichita, Dy-Tronix	316-838-0884
MA	Sharon, Augat Sls.	617-784-7766
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Minneapolis, H.M.R.	612-888-2122
MN	St. Paul, Count/Man Assoc.	612-645-9151
MO	Bridgeton, Dy-Tronix	314-291-4777
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NY	Yonkers, Sonkin Assoc.	914-968-8282
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Charlotte, Quantum Mktg.	704-523-8828
NC	Kernersville, Wallace Elect. Sls.	919-996-2742
NC	Raleigh, Quantum Mktg.	919-846-5728
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Dayton, Luebbe Sls.	513-294-0426
NH	Manchester, Augat Sls.	603-647-7276
OH	Westlake, Luebbe Sls.	216-899-0070
OR	Beaverton, J.J. Backer Co.	503-627-0775
PA	Pittsburgh, Luebbe Sls.	412-364-0490
TN	Greenville, Interep Assoc.	615-639-3491
TN	Murfeesboro, Alpha Mktg.	615-896-6102
TN	Oakridge, Alpha Mktg.	615-482-4681
TX	Austin, Augut Sls.	512-272-9060
TX	Dallas, Augat Sls.	214-788-4211
TX	Houston, Augat Sls.	713-781-9343
UT	Salt Lake City, Butterworth Mktg.	801-972-5566
VA	Charlottesville, Trinkle Sls. Inc.	609-795-4200
WA	Seattle, J.J. Backer Co.	206-285-1300
WI	Madison, Rockford Controls	608-223-8750
PR	Rio Piedras, DK Mktg.	809-765-5380
Can	Mississauga, Ont., Augat Elctrns. Inc.	416-677-1500

Local Distributors

CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Gardenia, Calswitch	213-770-2330
CA	San Jose, Capstone	408-453-9804
CA	Sunnyvale, Abacus	408-732-2000
CA	Sunnyvale, Time Elctrns.	408-734-9888
CT	Wallingford, Sager Elec.	203-265-4600
FL	Orlando, Sager Elec.	407-240-3114
FL	Orlando, Time Elctrns.	407-841-6565
IL	Addison, Pioneer	312-495-9680
IL	Bensenville, Hamilton/Avnet Elctrns.	312-860-7700
IL	Itasca, Capstone	708-250-0200
IL	Shaumburg, Time Elctrns.	708-303-3900
MD	Columbia, Sager Elec. Supp.	301-995-6580
MA	Hingham, Sager Elec.	617-749-6700
MA	Lexington, Pioneer	617-861-9200
MA	Peabody, Hamilton/Avnet Elctrns.	508-531-7430
MA	Wilmington, Capstone	508-657-5874
MA	Woburn, Sterling Elctrns.	617-938-6200
NH	Salem, Sager Elec.	603-898-1348
NJ	Cherry Hill, Hamilton/Avnet Elctrns.	609-424-0100
NY	E. Syracuse, Time Elctrns.	315-432-0555
NY	Hauppauge, Sager Elec.	516-348-1300
NY	Hauppauge, Time Elctrns.	516-273-0100
NC	Raleigh, Sager Elec. Supp.	919-850-9550
PA	Mars, Sager Elec. Supp.	412-772-2233
PA	Philadelphia, Sager Elec. Supp.	215-464-4336
TX	Austin, Hamilton/Avnet Elctrns.	512-837-8911
TX	Austin, Time Elctrns.	512-339-3054
TX	Carrollton, Capstone	214-347-4301

Components

MA	Norwood, Gerber Elect.	617-769-6000
MA	Peabody, Time Elect.	508-532-6200
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Milgray Elect.	516-420-9800
NY	Melville, Capstone Elec.	516-391-1300
OH	Cleveland, Pioneer Technlgs.	216-587-3600
TX	Houston, Sterling Elect.	713-623-6600

Systems

CA	Monrovia, Erik-A Elect	213-574-1020
IN	Indianapolis, Bell Inds./Graham Div.	317-634-8202
IA	Cedar Rapids, Deeco Inc.	319-365-7551
NY	Bohemia, Car-Lac Elect	516-567-4200
TX	El Paso, Ideal Elect	915-779-6647

Test Probes and Fixtures

AZ	Tempe, D.C. Elect Supp.	602-438-1234
CA	Costa Mesa, Hamilton Electro Sls.	714-641-1850
CA	Santa Clara, D.C. Elect. Supp.	408-980-1199
CA	Tustin, DC Elect Supp.	714-259-9066
IL	Addison, Pioneer	312-495-9680
IL	Chicago, Newark Elect	312-784-5100
MA	Waltham, Vector Sls.	617-893-7780
NJ	Union, Meridian Supp. Co.	800-648-8378, 201-687-6220
OR	Beaverton, Comp. Resources	503-641-8488
TX	El Paso, REM Elect. Supp.	915-778-7333
TX	Houston, Arrow Elctrns.	713-530-4700
WA	Redmond, Comp. Resources	206-454-8666

Test Probes and Fixtures

CT	Wallingford, Arrow Elctrns.	203-265-7741
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Altamonte Springs, Pioneer/Technlgs.	305-834-9090
FL	Winter Pk, Hamilton/Avnet Elctrns.	305-628-3888
FL	Winter Pk, Milgray/Florida	305-647-5747

AUGAT/PYLON CO., INC., P.O. Box 2510, Attleboro Falls, MA 02763, Tel: 508-699-9800, TELEX: 948095; Empl.: 400; *Sls. Mgr.:* Gillis Mellon

AUGAT/RDI, 525 Randy Rd., Carol Stream, IL 60188, Tel: 708-682-4100, FAX: 708-682-4562; FSC No.: 53337; Empl.: 85; *Sls. Mgr.:* Jim Steranko, Mktg. Mgr.; *Dist. Mgr.:* Jim Steranko, Mktg. Mgr.

FAX: 612-493-1911

AULT, INCORPORATED, 7300 Boone Ave. N, Minneapolis, MN 55428, Tel: 612-493-1900; Empl.: 300; *Sls. Mgr.:* Greg Harris ..... **D•1618-1619**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	Santa Clara, Magna Sls.	408-727-8753
CT	Wallingford, Marathon Sls., LTD	203-663-2734
FL	Deerfield Bch., Sls. Engrg. Concepts Inc.	305-426-4601
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Itasca, MSI	708-285-1000
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MA	Framingham, Marathon Sls., LTD	508-875-3566
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Minneapolis, Cahill, Schmitz & Cahill	612-646-7217
MO	St. Louis, Beams Co.	314-434-8448
NJ	Fairfield, T.A.M.	201-575-4130
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Jas. J. Backer Co.	503-627-0775
PA	Philadelphia, All-Tech Mktg.	717-540-1204
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Seattle, Jas. J. Backer Co.	206-285-1300
Can	Toronto, Deskin Sls.	416-475-1412

Local Distributors

Can	Markham, Deskin Sls.	416-475-1412
CA	Van Nuys, Natl. Electro Sls. Corp.	800-423-2664
CO	Littleton, Lange Sls.	303-795-3600
MA	Sharon, Adcour	617-784-8123
MO	St. Charles, Finnigan Elctrns.	314-946-6201
OH	Cincinnati, Hughes Peters	513-351-2000
TX	Fort Worth, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Std. Supp. Co.	801-453-3371
WA	Seattle, Radar Elec.	206-282-2511
Can	St. Laurent, Que., Tech-Rep Elctrns., Ltd.	514-331-2860

AURIC CORP., 470 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4100, FAX: 201-242-5796; Empl.: 60; *Sls. Mgr.:* Michael Aleksinas

AUSTRIA MIKRO SYSTEME INTERNATIONAL, Schloss Premstaetten, Unterpremstaetten, Austria A-8141, Tel: (03136) 36 66-0, TELEX: 312547 AMS A, FAX: (03136) 2501, 3650; Empl.: 550; *Sls. Mgr.:* Mr. Wilfried Beie

AUSTRON, INC., See FTS Austron

AUTEC POWER SYSTEMS, 9301-101 Jordan Ave., Chatsworth, CA 91311, Tel: 818-341-6123, FAX: 818-341-5726; Empl.: 100; *Sls. Mgr.:* Jeanne Hirsch ..... **D•1620-1624**

Local Sales Offices & Reps

CA	Los Alamitos, Power Specialists, Inc.	213-594-9418
Can	Etobicoke, Ont., Canadian Mktg. Technlg.	416-740-4005
Can	Pointe Claire, Que., Canadian Mktg. Technlg.	514-694-6088

AUTOMATED PRODUCTION CONCEPTS, 63 Hillside Terrace, Wayne, NJ 07470, Tel: 201-831-8300, FAX: 201-633-7755; Empl.: 4

AUTOMATED PROD. EQUIP. CORP., 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1197, TWX: 510-228-2120, FAX: 516-289-4735; FSC No.: 57216; *Sls. Mgr.:* Arthur Ayala

AUTOMATIC COIL CORP., A DSG Company, 3545 N.W. 71st Street, Miami, FL 33147, Tel: 305-696-6660, FAX: 305-696-0626; FSC No.: 03765; Empl.: 245; *Sls. Mgr.:* Roger Millheim .. **A•1159-1163, 1495-1498, 2174**

Local Sales Offices & Reps

AL	Huntsville, Mountain Electro Mktg.	205-881-3937
CA	San Clemente, Com-Star	714-498-8722
CT	Glastonbury, Liberty Electro.	203-657-8023
FL	Spring Hill, Mountain Electro Mktg.	813-996-7653
GA	Norcross, Mountain Electro Mktg.	404-448-5594
IN	Indianapolis, Joe Keith	317-856-3619
KS	Kansas City, Hitec Central	816-796-6684
MA	Topsfield, Liberty Electro.	508-887-6655
MO	Bridgeton, Hitec Central	314-291-5920
MO	Bridgeton, HiTec Central	314-291-5920
NJ	Cherry Hill, Vantage Sls. Co.	609-424-6777
NJ	S.Orange, Kahgan Brody Assoc.	201-763-6038
NY	Hempstead, Kahgan Brody Assoc.	516-538-2300
TX	Plano, Corwin Assoc. Inc.	214-424-8333
NC	Raleigh, Mountain Electro Mktg.	919-878-8606
OK	Brethany, Design Mktg.	405-789-5911
PA	Pittsburgh, Catalyst Sls., Inc.	412-826-3434

AUTOMATIC SWITCH CO., 50-60 Hanover Road, Florham Park, NJ 07932, Tel: 1-201-966-2000, TELEX: 136422, FAX: 1-201-966-2628; Empl.: 1,200; *Sls. Mgr.:* Wayne Bouchard

AUTOMATIC SYSTEMS DEVELOPERS, P.O. Box 3210, Industry St., Poughkeepsie, NY 12603, Tel: 914-473-5530, FAX: 914-454-2538; Empl.: 650; *Sls. Mgr.:* Stanley Bachman

AUTOMATIC TIMING & CONTROLS CO., 201 So. Gulph Rd., King of Prussia, PA 19406, Tel: 215-337-5500, 800-441-8245, TELEX: 84-6437; Empl.: 300; *Sls. Mgr.:* R. L. Swanson ..... **D•1129**

Local Sales Offices & Reps

AZ	Chandler, Automation West	602-940-0884
CA	Gardena, Instrument Lab.	213-327-3282
CA	San Francisco, Instr. Lab	408-434-0160
CO	Englewood, E & M Sls.	303-761-6202
FL	Lakeland, A.A. Elec. Div.	813-665-6941
GA	Norcross, A.A.Electric Div. of AEC	404-449-8670
IL	Downers Grove, Rockford Controls	708-960-2046
KY	Louisville, Air-Hydro Power	502-451-1000
LA	New Orleans, Mid South Sls.	504-641-7480
MD	Baltimore, Jobe & Co.	301-288-0560
MA	Hingham, Hingham Bay Corp.	617-740-1900
MI	Brighton, H. H. Barnum Co.	313-229-2961
MN	Minneapolis, Daniel J. Minor Co.	612-885-0622
MO	Salina, Kriz Davis Co.	913-827-4497
MO	St. Louis, E. Mooney Co.	314-878-9910
NE	Omaha, Lakeland Engrg. Equipt.	402-734-2600
NJ	Newark, ATC	201-278-1121
NM	Albuquerque, E & M Sls.	505-883-8955
NY	Buffalo, Niagara Electric Sls.	716-825-3100
NY	Rochester, Niagara Electric Sls.	716-272-9150
NY	Syracuse, Niagara Elec. Sls.	315-437-1656
NC	Charlotte, Brown & Morrison	704-554-8570
OH	Cincinnati, Anderson-Bolds	513-528-5680
OH	Cleveland, Anderson-Bolds	216-360-9800
OK	Tulsa, Driscoll Auto. Control	918-663-6625
OR	Portland, Coons Western	503-295-0411
PA	King of Prussia, Applied Controls	215-265-3832
PA	Pittsburgh, Gilson Engrg. Sls.	412-369-0100
TX	Houston, GEA of Texas	713-781-3005
UT	Salt Lake City, Control Equip.	801-487-7741
VA	Richmond, Jobe & Co.	804-672-6508
WA	Everett, T&T Instr. Co.	206-742-9833
WI	Cedarburg, Automation Engrg.	414-377-7500

AUTOMATION DISPLAYS INC., 3533 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-9595, FAX: 715-834-9596; Empl.: 21

AUTOMATION ELCTRNS., R.J.A. Inds., Inc., 9640 Topanga Cyn Pl. Bldg. J, Chatsworth, CA 91311, Tel: 818-998-5124, FAX: 818-998-6654; Empl.: 25; *Sls. Mgr.:* Robert J. Aiani

AUTOMATION PRODS., INC., 3030 Max Roy, Houston, TX 77008, Tel: 713-869-0361, TELEX: 775-959, FAX: 713-869-7332

AUTOMATIX INC., 755 Middlesex Turnpike, Billerica, MA 01821, Tel: 506-667-7900, FAX: 508-663-5482; Empl.: 92; *Sls. Mgr.:* Peter Mayek, Dir. of Sls.

AUTOMOTION, INC., 683 Airport Blvd., Ann Arbor, MI 48108, Tel: 313-662-7771, FAX: 313-662-3707; Empl.: 25; *Sls. Mgr.:* David E. Drenning ..... **B•1245**

Local Sales Offices & Reps

CA	Laguna Hills, South Rep	714-951-1084
CT	Seymour, Sturdy Corp.	203-888-1480
FL	Ft. Lauderdale, Motion Controls, Inc.	305-434-5682
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
MN	Little Canada, Assured Sls.	612-482-1309
NH	Derry, Sturdy Corp.	603-434-8440
KS	Shawnee Mission, J.F. Gleeson & Assoc.	913-362-4422
NY	Sidney, Charles Co.	607-563-8064
MO	Florissant, J.F. Gleeson & Assoc.	314-921-8446
OR	Portland, Controltek, Inc.	503-641-0876
PA	Wexford, Intek Sys.	412-935-0440
TX	Richardson, Control Dynamics	214-644-6945
WA	Spokane, Controltek, Inc.	509-922-2971

AUTOROLL MACHINE CORPORATION, 11 River St., Middleton, MA 01949, Tel: 508-777-2160, TELEX: 940250, FAX: 508-777-9453; Empl.: 120

AUTOSPLICE, INC., 10121 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-535-0077, FAX: 619-535-0130; Empl.: 197; *Sls. Mgr.:* Ken Krone

AUTOSWAGE PRODUCTS, 726 River Rd., Shelton, CT 06484, Tel: 203-929-1401, FAX: 203-929-6187; Empl.: 170; *Sls. Mgr.:* R. D'Autrechy

Local Sales Offices & Reps

AZ	Phoenix, McKee & Assoc., Inc., I.	602-494-1020
CA	Glendale, Haldeman & Frazier	818-957-4554
CO	Arvada, Darrell Higgins & Assoc.	303-421-8601
IN	Greensburg, Comp. Resources	812-663-5608
MD	Upperco, Berwanger & Co.	301-374-5354
MI	Harper Woods, Wm. S. Turner & Co.	313-881-8585
MN	Minnetonka, Crum Co., Inc.	612-938-2573
MO	Maryland Heights, Meiners Sls.	314-739-1114
NY	Pittsford, Production Mktg. Grp.	716-248-5835
PA	Mechanicsburg, Par Assocs., Inc.	717-761-1797
SC	Fort Mills, Eagle Sales, Inc.	803-548-2222
TX	Arlington, Paine & Murray, Inc.	817-461-6331
WA	Bellevue, H.J. Sls. Co.	206-453-1957
Can	Candiac, Que., W. H. Elctrns. Registered	514-632-3685

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AUTRONICS CORP., 314 E. Live Oak, Ste. A, Arcadia, CA 91006, Tel: 818-445-5470, TWX: 910-582-3216, FAX: 818-446-0014; FSC No.: 03972; Empl.: 100; *Sls. Mgr.:* Annabelle Cloud, Contracts Mgr.; *Dist. Mgr.:* Gary Noyes

AVA ELECTRONICS CORPORATION, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026, Tel: 215-284-2500, TELEX: 3711411, FAX: 215-259-8379; Empl.: 100; *Dist. Mgr.:* Martin Bisk

AVA INSTRUMENTATION, INC., 8010 Highway 9, Ben Lomond, CA 95005, Tel: 408-336-2281, FAX: 408-336-5049; FSC No.: 61933; Empl.: 7; *Sls. Mgr.:* Allan Hughes

AVANTEK, INC., 481 Cottonwood Dr., Milpitas, CA 95035-7492, Tel: 408-432-3080, TWX: 310-371-8717, FAX: 408-954-0633; Empl.: 2300; *Dist. Mgr.:* John Locke

Local Sales Offices & Reps

CA	Westlake Vl, Avantek, Inc.	805-373-3870
IL	Palatine, Avantek, Inc.	708-358-8963
MD	Columbia, Avantek, Inc.	301-381-2600

Local Distributors

AZ	Tempe, Sertek, Inc.	800-334-7127
CA	San Diego, Insight Elctrns.	800-677-7716
CA	Sunnyvale, Penstock, Inc.	408-730-0300
CA	Westlake Vl, Sertek, Inc.	800-334-7127
FL	Ft. Lauderdale, Nu Horizons	305-735-2555
FL	Melbourne, Comp. Dists. Inc.	800-558-2351
IL	Palatine, Penstock Midwest	708-934-3700
MD	Beltsville, Applied Specialists, Inc.	301-595-5395
MD	Columbia, Nu Horizons	301-995-6330
MA	Wakefield, Nu Horizons	617-246-4442
NJ	Fairfield, Penstock-East	201-808-1414
NJ	Marlton, Nu Horizons	215-557-6540
NJ	Pinebrook, Nu Horizons	201-882-8300
NY	Amityville, Nu Horizons	516-226-6000
NY	Rochester, Nu Horizons	716-248-5980
NC	Raleigh, Comp. Dists. Inc.	919-859-3391
PA	Ardmore, Penstock East	201-808-1414
TX	Dallas, Insight Elctrns.	800-677-7716
TX	Dallas, Thorson Distbg. Co.	214-233-5744
WA	Bellevue, Penstock, Inc.	206-454-2371
Can	Sertek, Inc.	800-548-0409

AVANTI CIRCUITS, INC., 17650 N. 25th Ave., Phoenix, AZ 85023, Tel: 1-800-234-1556, FAX: 1-602-375-1909; Empl.: 65; *Sls. Mgr.:* Steve Tappan

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AVELEM, La Billardiere, Gargilesse, France 36190, Tel: 33-54478672, FAX: 33-54477799; Empl.: 20

AVEL-LINDBERG INC., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776, Tel: 203-355-4711, FAX: 203-354-8597; Empl.: 225; *Sls. Mgr.:* Melanie B. Roman ..... **A•2175-2177; D•1625**

Local Distributors

CT	Wallingford, Sager Elctrl. Supp. Co.	203-265-4600
MA	Hingham, Sager Elctrl. Supp. Co.	617-749-6700
MA	Hingham, Sager Electrical Supp. Co.	617-749-6700

AVENS CORP., 256 Lincoln Ave., Brooklyn, NY 11208, Tel: 718-827-5991, 800-452-1966, FAX: 718-235-9805; Empl.: 15; *Sls. Mgr.:* Peter Eng ..... **A•1658-1660**

AVEX ELECTRONICS, 1683 Winchester Rd., P.O. Box 1026, Bensalem, PA 19020, Tel: 215-638-1515, 800-345-1295, FAX: 215-638-9108; FSC No.: 58414; *Sls. Mgr.:* Dona Logan; *Dist. Mgr.:* Michael S. Batley VP/GM ..... **D•1431-1433**

Local Sales Offices & Reps

CO	Denver, Tessco	303-778-1119
IL	Cary, Bob Burns Assoc.	708-516-3322
IN	Carmel, New Era	317-844-4530
NM	Albuquerque, Genl. Mktg.	505-892-3426
PA	Philadelphia, Allpower Tech.	215-289-6025
TX	Rowlett, Campion Sls.	800-877-7623

AVIBANK MANUFACTURING, INC., 210 S. Victory Blvd, P.O. Box 391, Burbank, CA 91503-0391, Tel: 818-843-4330, TWX: 910-498-2215; FSC No.: 84256; Empl.: 485; *Sls. Mgr.:* D. Ladin



FAX: 908-382-4996

AVIONIC INSTRUMENTS, 1414 Randolph Ave., Avenel, NJ 07001, Tel: 201-388-3500, 908-388-3500, TELEX: 844413; Empl.: 160; *Sls. Mgr.:* Bryce Wiedeman; *Dist. Mgr.:* Mike Barnaba ..... **D•2160-2166**

Local Distributors

NJ	Avenel, REA Intl. Ltd.	201-382-7100

AVTECH

FAX: 613-226-2802

AVTECH ELECTROSYSTEMS LTD., P.O. Box 5120, Stn. F, Ottawa, Ontario, Canada K2C 3H4, Tel: 613-226-5772; Empl.: 8 ..... **D•1222**

Local Sales Offices & Reps

MA	Westford, ICS Assocs, Inc.	508-692-3545
NM	Albuquerque, Tech. Mktg. Specialists	505-884-3444
NY	Ogdensburg, Avtech Electrosystems Ltd.	315-472-5270
Can	Ottawa, Ont., Avtech Electrosystems Ltd.	613-226-5772

AVTEL DIV., UNITRON INC., 10925 Miller Rd., Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511, FAX: 214-341-2099; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* Fred Cullum

AVX CORPORATION, Box 867, Myrtle Bch., SC 29577, Tel: 803-448-9411, TWX: 810-661-2252, FAX: 803-626-2442; FSC No.: 9K916; *Sls. Mgr.:* Allan Cole; *Dist. Mgr.:* Robert Burns

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NORMAN N. AXELROD ASSOCS.: ELECTRO-OPTICAL, LASER, & MACHINE VISION DIV., 445 East 86th Street, New York, NY 10028, Tel: 212-228-0900

AXIAL MAGNETICS, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, Tel: 805-527-0900, FAX: 805-527-4968; *Sls. Mgr.:* K. G. Kroll

AXIS CORPORATION, 4715 Viewridge Ave.,Ste. 110, San Diego, CA 92123, Tel: 619-560-7737, FAX: 619-560-8260; FSC No.: 9S849; Empl.: 21; *Sls. Mgr.:* Mark J. Prager; *Dist. Mgr.:* Jack Robinson

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AYDIN VECTOR DIV., Aydin Corp., Box 328, Newtown, PA 18940-0328, Tel: 215-968-4271, TWX: 510-667-2320, FAX: 215-968-3214; FSC No.: 13923; Empl.: 400

AZCO CORP., 385 Falmouth Ave., Elmwood Park, NJ 07407, Tel: 201-791-1428, FAX: 201-791-8420; Empl.: 11

AZIMUTH ELECTRONICS, INC., 2605 So. El Camino Real, San Clemente, CA 92672, Tel: 714-492-6481, FAX: 714-492-0744; *Sls. Mgr.:* Kenneth C. Johnsen

A/Z-TECH, INC. R&D LAB, Indiana Institute of Technlg., 1600 East Washington Blvd., Fort Wayne, IN 46803, Tel: 219-422-5561, FAX: 219-422-7696; Empl.: 25

aztec INDUSTRIES

FAX: 602-844-9625

AZTEC INDUSTRIES, INC., 333 S. Nina Drive, Mesa, AZ 85210, Tel: 602-833-3131, 800-729-3132; Empl.: 40; *Sls. Mgr.:* Anthony G. Shumway ..... **B•1799**

Local Sales Offices & Reps

CA	San Jose, Landia Sls. Grp.	408-453-5695, FAX:408-453-5699
IL	Glendale Heights, Synergistic Sls., Inc.	708-858-8686
KS	Shawnee Mission, Marc E. Nelson Assoc.	913-268-9099
NE	Omaha, Label Concepts	402-496-3997, FAX:402-496-3855
TX	Dallas, Kay Todd Assocs.	214-458-8833, FAX:214-458-8837
WI	Mukwanago, Synergistic Sls., Inc.	414-363-2020

BABCOCK, INC., 1717 West Collins Ave., Orange, CA 92667, Tel: 714-633-3700, TWX: 910-595-1517, FAX: 714-538-9740; FSC No.: 56623; Empl.: 270; *Sls. Mgr.:* Bosie White; *Dist. Mgr.:* Bosie White ..... **B•1041**

Local Distributors

CA	Santa Ana, Norstan Elctrns.	714-667-7826

BABCOCK DISPLAY PRODUCTS, INC., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, Tel: 714-491-5100, TELEX: 249646, FAX: 714-490-1368; Empl.: 150; *Sls. Mgr.:* Brian Lundstram ..... **B•1041**

BACON INDUSTRIES, 192 Pleasant St, Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518, FAX: 617-926-2022; FSC No.: 99098; Empl.: 25; *Sls. Mgr.:* R. S. Cass

BAILEY CONTROLS CO., 29801 Euclid Ave., Wickliffe, OH 44092, Tel: 216-585-8500, TELEX: 980621, FAX: 216-944-4160; Empl.: 2300

BAKER CO., INC., Drawer E - Sanford Airport, Sanford, ME 04073, Tel: 1-800-992-2537; Empl.: 150

BAKNOR INDUSTRIES INC., 2209 Dunwin Drive, Mississauga, Ont., Canada L5L 1X1, Tel: 416-828-2400, FAX: 416-828-5500; Empl.: 25; *Sls. Mgr.:* M. E. Sawicki

BALDOR ELECTRIC COMPANY, P.O. Box 2400, Fort Smith, AR 72902, Tel: 501-646-4711, TELEX: 53-7425, FAX: 501-648-5792; Empl.: 2000; *Sls. Mgr.:* Harold Kosten V.P., Sls.

BALLANTINE LABORATORIES, Noise Unlimited Inc., 9 Saddle Rd., Cedar Knolls, NJ 07927, Tel: 201-984-1900, FAX: 201-984-1479; FSC No.: 50423; Empl.: 30; *Sls. Mgr.:* Joe Deery; *Dist. Mgr.:* Joe Deery

BALLARD TECHNOLOGY, 1216 NW 75th Street, Seattle, WA 98117, Tel: 206-782-8704, FAX: 206-782-8174; Empl.: 7; *Sls. Mgr.:* Kevin S. Christian

BALLCO INC., P.O. Box 1078, Snellville, GA 30278-1078, Tel: 404-979-5900, FAX: 404-979-3785; Empl.: 49; *Sls. Mgr.:* W. Kann

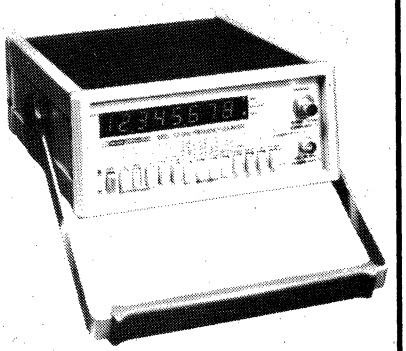
BALL CORP., EFRATOM DIVISION, 3 Parker, Irvine, CA 92718-1605, Tel: 714-770-5000, TELEX: 68-5635, FAX: 714-770-2463; Empl.: 225 ..... **A•1307**

Local Sales Offices & Reps

CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CO	Parker, Howard Assoc.	303-841-5755
FL	Sarasota, Bass Assocs.	813-922-9538
GA	Atlanta, Beacon Microwave	404-256-9640
IN	Fort Wayne, TX Sls. Indiana	219-489-4447
MA	Natick, Wayland Engrg. Sls.	617-655-6080
NM	Albuquerque, Mayco, Inc.	505-299-4002
NY	Huntington, CDB Entprs.	516-692-5200
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BALL CORPORATION, Industrial Systems Division, 3400 Gilchrist Rd., Mogadore, OH 44260, Tel: 216-784-4456, TELEX: 98-6327-PVI-AKR, FAX: 216-784-9854; Empl.: 130; *Sls. Mgr.:* Sandra R. Donaldson

BALL SCREWS & ACTUATORS CO., 3616 Snell Ave., San Jose, CA 95136-1305, Tel: 408-629-1132, FAX: 408-629-2620; Empl.: 50; *Sls. Mgr.:* Steve Trumbauer

BALSTON, 703 Massachusetts Ave., Lexington, MA 02173, Tel: 617-861-7240, TELEX: 92-3481, FAX: 617-862-4810; Empl.: 200; *Sls. Mgr.:* Scott Feenan

BAMBECK SYSTEMS INC., 1921 E. Carnegie Ave., Santa Ana, CA 92705, Tel: 714-250-3100, 800 334-3101, FAX: 714-757-1610; Empl.: 25; *Sls. Mgr.:* Robert Bambeck

B & B MOTOR & CONTROL CORP., B & B Long Island City, 1967 State Hwy 27 Ste. 32, Edison, NJ 08817, Tel: 908-819-7070, 908-572-0500, FAX: 908-819-7010; Empl.: 90; *Sls. Mgr.:* Thomas Miceli

BAND-IT - IDEX, INC., 4799 Dahlia Street, Denver, CO 80216, Tel: 303-320-4555, TELEX: 45-0009, FAX: 303-333-6549; *Sls. Mgr.:* Terry L. Joles; *Dist. Mgr.:* Enrique J. Martinez

B & K PRECISION, Maxtec International Corp, 6470 W. Cortland, Chicago, IL 60635, Tel: 312-889-1448, FAX: 312-794-9740; FSC No.: 08098, 18110, 48560, 30678; Empl.: 200; *Sls. Mgr.:* Richard Polak ..... **D•1223-1225, 1407, 1626**

Local Sales Offices & Reps

AR	Mabelville, Erickson Sls., Inc.	501-455-0618
CA	Santa Ana, Mike Roth Sls.	714-647-0606
CO	Denver, The Lindberg Co.	303-758-9033
FL	Altamonte Springs, Dynamic Mktg.	407-788-1878
GA	Tucker, Maitland K. Smith	404-939-3322
IL	Arlington Hgts., Brainard-Nielsen Mktg.	312-437-2700
IN	Huntington, Elctrn. Reps. Inc.	219-356-3513
IN	Indianapolis, Elctrn. Reps. Inc.	317-894-1414
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MD	Edgewood, Electra-Tech	301-676-2254
MA	Woburn, W & D Mktg.	617-935-5610
MI	Farmington Hills, Rathsburg Assoc.	313-489-1500
NJ	Medford, Champion Elctrn. Sls. Co.	609-983-0807
NY	Bellmore, Selectra Sls.	516-221-7865
NY	Fairport, Senn Tec Sls. Corp.	716-425-3954
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Dayton, Marlow Assocs.	513-274-9666
PA	Pittsburgh, Marlow Assocs.	412-343-5050
TX	Dallas, Erickson Sls.	214-739-5833
TX	Houston, Erickson Sls., Inc.	713-266-1604
TX	Round Rock, Erickson Sls, Inc.	512-244-3068
VA	Dumfries, Electra-Tech	703-670-6962
WA	Olympia, M V P Mktg.	206-357-4172
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BANNER ENGINEERING CORP., 9714 - 10th Ave. N., Minneapolis, MN 55441, Tel: 612-544-3164, FAX: 612-544-3573; *Sls. Mgr.:* Floyd Schneider

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BARBER COLMAN CO. (A SIEBE CO.), Motor Division, P.O. Box 7040, Rockford, IL 61125-7040, Tel: 815-397-7400, TELEX: 4330183, FAX: 815-398-3885; Empl.: 300; *Sls. Mgr.:* Manny Amato

BARKSDALE CONTROLS DIV., Imo Industries Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058, Tel: 213-589-6181; Empl.: 234; *Sls. Mgr.:* J. Douglas Holland

BARNES ENGINEERING, 1645 So. Claudina Way, Anaheim, CA 92805, Tel: 714-533-7530; FSC No.: 53823, SIC 3400; Empl.: 47; *Sls. Mgr.:* Gordon Mackenzie

BARNES ENGINEERING DIV., EDO Corporation, 88 Long Hill Cross Rds., Shelton, CT 06484, Tel: 203-926-1777, TELEX: 6819115, FAX: 203-926-9285; Empl.: 250; *Sls. Mgr.:* M. L. Marusic ..... **A•1357**

BARR ASSOCIATES, INC., 2 Lyberty Way, Westford, MA 01886, Tel: 508-692-7513, TELEX: 710-347-0657, FAX: 508-692-7443; FSC No.: 65808; Empl.: 81; *Sls. Mgr.:* Jack Bosch; *Dist. Mgr.:* Jack Bosch

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BARSOM INC., See IR Scientific

BARTLETT INSTRUMENT CO., 14th & Ave. 'M', P.O. Box 445, Ft. Madison, IA 52627, Tel: 319-372-8366; Empl.: 10; *Sls. Mgr.:* David P. Bartlett

BAS BLEU INDL. CO., LTD., Rm. 815, No.110, Han-Kow ST., Sec.1, Taipei, Taiwan 10008, Tel: (02)331-6519, TELEX: 23015 HJIC, FAX: 886-2-381-6812; Empl.: 20; *Sls. Mgr.:* Athena W.R. Lo, VP

BASCOM-TURNER INSTRUMENTS, 111 Downey St., Norwood, MA 02062, Tel: 617-769-9660, TELEX: 92-2413, FAX: 617-551-0283; Empl.: 35; *Sls. Mgr.:* D. Weise

BASIC ELECTRONICS, INC., 11762 Western Ave. "Q", Stanton, CA 90680, Tel: 714-530-2400; Empl.: 50; *Sls. Mgr.:* Tom Jones; *Dist. Mgr.:* Tom Jones

BASIC MEASURING INSTRUMENTS, 335 Lakeside Dr., Foster City, CA 94404, Tel: 415-570-5355, TWX: 910-374-3059, FAX: 415-574-2176; Empl.: 90; *Sls. Mgr.:* John DiGiralimo

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CA	Santa Clara, Sourcetronics, Inc.	408-988-8801
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CT	Woodbury, Power Factor & Assocs.	203-264-9812
FL	Ft. Lauderdale, Sunland Assoc.	305-561-1303
FL	Largo, Sunland Assoc.	813-536-2955
FL	Winter Springs, Sunland Assocs.	407-365-9533
GA	Norcross, Electro Mech Sls. Engrg. Co.	404-447-6478
IL	Chicago, G. Mcl. Cole Co.	708-692-6040
IA	Cedar Rapids, Thomas L. Dowell & Assoc., Inc.	319-364-3880
KS	Overland, Thomas L. Dowell & Assocs., Inc.	913-599-1100
MD	Glen Burnie, Faion Lott Co.	301-744-4611
MA	Braintree, R. F. Duffy Assocs.	617-848-3550
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OH Maineville, J. P. Woods & Assocs. 513-677-8352
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UT N. Salt Lake City, Trembly Assocs. 801-295-4703
VA Ashland, Glasscock & Assoc. 804-798-2125
WA Chattaroy, Elctrn. Mktg. Grp. 509-238-6307
WA Redmond, Elctrn. Mktg. Grp. 206-882-0962
WA Vancouver, Elctrn. Mktg. Grp. 206-254-4572
PR Rio Piedras, Klamco Elctrns. 809-752-6225

+ PRIMACELL –
High Energy Lithium Battery

FAX: 617-361-1835

BATTERY ENGINEERING, INC., 1636 Hyde Park Ave., Hyde Park, MA 02136, Tel: 617-361-7555; FSC No.: 60289; Empl.: 50; *Sls. Mgr.:* R. Yetman .... **D•1435**

Distributor

BATTERY SPECIALTIES
3530 Cadillac Avenue
Costa Mesa, CA 92626

FAX: 714-755-0889

BATTERY SPECIALITIES, 3530 Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-755-0888, 1-800-352-3706 (Toll free in CA); Empl.: 30; *Sls. Mgr.:* Michael Meurer; *Dist. Mgr.:* Michael Meurer .... **D•1438**
.....662, 668, 685, 766, 777, 794

BAXTER-INDUSTRIAL DIVISION, 27200 N. Tourney Rd., Valencia, CA 91355, Tel: 805-253-7466, FAX: 805-253-7466; Empl.: 50; *Sls. Mgr.:* Dick Brown

BAYLEY INSTRUMENT COMPANY, Box 357, Kenwood, CA 95452, Tel: 707-833-6014

BAYSTAT, Bay Packaging & Converting Co., Inc., 3575 Haven Ave., Menlo Park, CA 94025, Tel: 415-364-3205, FAX: 415-363-8079; Empl.: 100; *Sls. Mgr.:* James V. Travis

BAYTRON, See M/A-Com Millimeter Products Inc.

B C SYSTEMS, INC., 200 Terminal Road, Setauket, NY 11790, Tel: 516-751-9370, FAX: 516-751-9378; Empl.: 50; *Sls. Mgr.:* G. Blazek

BEAD ELECTRONICS, Div. Bead Industries, Inc., 110 Mountain Grove St., P.O. Box K, Dept. 100, Bridgeport, CT 06605-0571, Tel: 203-334-4124, FAX: 203-367-9957; Empl.: 175; *Sls. Mgr.:* Keith Lebo

BEA ELECTRO-OPTICS, INC., 640 Pearson, Ste. 200, Des Plaines, IL 60016, Tel: 708-298-1420, FAX: 708-298-1423; *Sls. Mgr.:* George E. Magerl; *Dist. Mgr.:* Vic Halkyn

BEARING INSPECTION, 10041 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 213-944-6251, FAX: 213-946-9670; Empl.: 31

BEAU PRODUCTS DIV., Vernitron Corp., Box 10, Laconia, NH 03247, Tel: 603-524-5101, FAX: 603-524-1627; FSC No.: 13150; Empl.: 165; *Sls. Mgr.:* Wayne Eshelman; *Dist. Mgr.:* Larry Murphy .... **C•1292-1294**

Local Sales Offices & Reps
AL Huntsville, Electro-Mech Sls. Engrg. 205-880-0592
AZ Phoenix, Shelfer-Kahn 602-257-9015
CA Anaheim, Westrep 714-527-2822
CA Santa-Clara, Westrep 408-988-8833
CO Englewood, Delitron 303-741-2122
GA Norcross, Electro-Mech Sls. Engrg. 404-447-6478
IL Lisle, W-G Controls 312-963-5954
MD Sykesville, DVS Co. 301-781-4080
MN Minneapolis, PSI 612-944-8545
MO St. Louis, KKB & Co. 314-647-2400
NH Amherst, D.A.Crowley & Assoc. 603-673-7050
OK Tulsa, Comptech Sls. Inc. 918-622-7744
NJ Lawrenceville, DVS Co. 609-896-1112
NJ W. Caldwell, Grimm Siegel & Assoc. .. 201-575-9300
NY Syracuse, Pi'tronics, Inc. 315-455-7346
NC Raleigh, Electro-Mech Sls. Engrg. 919-790-9300
OH Beechwood, Electronic Salesmasters Inc. 216-831-9555
OR Beaverton, Pacific Mktg. Specialist, ... 503-641-9373
TX Irving, Comtech Sls. Inc. 214-751-1181
WA Redmond, Pacific Mktg. Specialists, ... 206-882-3144

BEAU TECH, 98 Elm Street, Portland, ME 04101, Tel: 207-775-6139, TELEX: 950-027 Attn Beau, FAX: 207-775-7710; Empl.: 6; *Sls. Mgr.:* Jean M. Wong, Credit Mgr.; *Dist. Mgr.:* Barbara Pike

BEAVER LABS, P. O. Box 202, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

BEC INC./CERTIFIED CALIBRATION LABS, 945 Horsham Rd., Horsham, PA 19044, Tel: 800-523-3808, FAX: 215-675-0966,800-523-3808; Empl.: 13; *Sls. Mgr.:* Herb Miller

Beckman Industrial
Affiliate of Emerson Electric Co

FAX: 714-447-2400

BECKMAN INDUSTRIAL CORP., Affiliate of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635, Tel: 714-447-2300, TELEX: 7607569; Empl.: 1900; *Sls. Mgr.:* Ron Sullivan, Sls. & Mktg. V.P. .... **A•1847, 2016-2017**

Local Sales Offices & Reps
AL Huntsville, Elctrn. Sls., Inc. 205-533-1735
AZ Scottsdale, Thom Luke Sls. 602-941-1901
CA Escondido, Clint Bradley Sls. 619-743-0138
CA Santa Ana, Jones & McGeoy Sls. 714-547-6466
CA Santa Clara, Criterion Sls. 408-988-6300
CO Littleton, Simpson Assocs. 303-794-8381
CT Cheshire, Datatrack Engrg., Inc. 203-271-1311
FL Ft. Lauderdale, QXI, Inc. 305-978-0120
FL St. Petersburgh, QXI, Inc. 813-894-4556
GA Norcross, Elctrn. Sls., Inc. 404-448-6554
IL Elk Grove Village, Carlson Elctrn. Sls. Co. 708-956-8240
IN Indianapolis, Precision Elec. Comp. ... 317-842-3740
IA Cedar Rapids, Carlson Elctrns. 319-378-1450
KS Overland Park, Electri-Rep, Inc. 913-649-2168
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MA Farmingham, Gallagher Assoc. 508-626-2346
MI Brighton, A.P. Assoc. 313-229-6550
MN Minneapolis, Cornstrand, Inc. 612-788-9234
MO St. Louis, Electri-Rep 314-993-4421
NJ Fairfield, Tech. Applications & Mktg., Inc. 201-575-4130
NM Albuquerque, Reptronix, Ltd. 505-292-1718
NY Fairport, LamTec Sls. Corp. 716-377-1210
NY Manlius, LamTec Sls. Corp. 315-682-4780
NC Cary, Electronic Sls., Inc. 919-467-8486
NC Charlotte, Electronic Sls. Inc. 704-543-8705
OH Centerville, Omega Sls., Inc. 513-434-5507
OH Cleveland, Omega Sls., Inc. 216-751-9600
OR Portland, Venture Elctrns., Inc. 503-624-0617
PA Trevose, Omega Sls. 215-947-4135
TX Austin, Norcom, Inc. 512-451-2757
TX Dallas, Norcom, Inc. 214-386-4888
TX Houston, Norcom, Inc. 713-778-0392
UT Midvale, Simpson Assoc. 801-566-3691
WA Bellevue, Venture Elctrns., Inc. 206-454-4594
WI Milwaukee, Carlson Elctrn. Sls. Co. 414-476-2790
Can Bramptom, Ont., Designtronics 416-793-5155
Can Pointe Claire, Que., Designtronics 514-695-3124
Can Richmond, B.C., Blakewood Elctrn. Sys., Inc. 604-273-9910

BECKMAN INDUSTRIAL CORP., An Affiliate of Emerson Elec. Co., 3883 Ruffin Road, San Diego, CA 92123-1898, Tel: 619-495-3200, TELEX: 249031, FAX: 619-268-0172

BECKMAN INSTRS., HELIPOT DIV., See Beckman Instrs., Electro-Prods. Grp.

BEEDE ELECTRICAL INSTRUMENT CO., INC., S. Main St., Penacook, NH 03303, Tel: 603-753-6362, FAX: 603-753-6201; FSC No.: 06555; Empl.: 620; *Sls. Mgr.:* Dan Russell; *Dist. Mgr.:* Brenda Beaudet

BEHLMAN

FAX: 805-642-0790

BEHLMAN ELECTRONICS, INC., 2021 Sperry Ave.,No. 18, Ventura, CA 93003, Tel: 805-642-0660; FSC No.: 53636; *Sls. Mgr.:* Jerry Zechmeister .... **D•2168-2175**

Local Sales Offices & Reps
CA Carson, Tritek Solutions, Inc. 213-515-1590, FAX:213-515-7007
CA San Carlos, WDI ... 415-591-6535,FAX:415-591-9180
FL Melbourne, Reynolds & Assocs. 407-259-7000, FAX:407-242-8031
IL Wheeling, Ed Joyner & Co. 312-520-1200, FAX:312-520-7927
IN Fishers, R & D 317-849-2026
KS Lenexa, Midtec Assocs. 913-541-0505, FAX:913-541-1729
MN Eden Prairie, Professional Mktg. Svcs. Inc. 612-934-5939,FAX:612-934-9433
NH Nashua, Intersell ... 603-880-6500,FAX:603-595-0050
NY Fayettsville, Martin P. Andrews 315-637-5291, FAX:315-637-9734
NY Great Neck, Industron Assocs. 516-487-2620, FAX:516-482-6698
OH Cleveland, Technical Sls. Assocs. 216-461-0826, FAX:216-461-5811
PA Doylestown, Tech. Instr. Sls. 215-345-4110, FAX:215-345-4138
TX Dallas, The Thorsen Co. S.W. 214-233-5744, FAX:214-702-0993
WA Seattle, Datacom Assocs. 206-285-2525, FAX:206-285-0772

BEI

FAX: 619-931-1212

BEI MOTION SYSTEMS COMPANY, Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009, Tel: 619-931-1500, TWX: 910-380-5402; Empl.: 20 .... **B•1879-1881**

Local Sales Offices & Reps
CA Garden Grove, BEI Motion Sys. Co. ... 714-534-5830
CA San Rafael, BEI Motion Sys. Co. 415-492-2840
CO Westminster, BEI Motion Sys. Co. 303-426-1566
FL Clearwater, BEI Motion Sys. Co. 813-791-6043
IL Rockford, BEI Motion Sys. Co. 815-968-9528
MA Needham Hgts., BEI Motion Sys. Co. .. 617-455-1414
MA Norwell, BEI Motion Sys. Co. 617-878-9820
MI Plymouth, BEI Motion Sys. Co. 313-451-0359
NJ Parsippany, BEI Motion Sys. Co. 201-984-5600
OH Cincinnati, BEI Motion Sys. Co. 513-232-4545
OR Beaverton, Thorson Co. NW 503-644-5900
PA Lancaster, BEI Motion Sys. Co. 717-299-6243
TX Cleburne, BEI Motion Sys. Co. 817-556-2211
WA Bellevue, Thorson Co. Northwest 206-455-9180
Can Willowdale, Willer Engrg., Ltd. 416-499-4421

BEI MOTION SYSTEMS COMPANY, Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600, TWX: 910-333-4534, FAX: 619-471-2675; *Sls. Mgr.:* Hank Robinson .... **B•1879**

Refer to BEI Motion Sys. Co., Corporate Off. Carlsbad, CA for sales off. info.

BEI MOTION SYSTEMS COMPANY, Digital Products Div., P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, TWX: 910-722-7384, FAX: 501-851-5476; *Sls. Mgr.:* Mike Jumper .... **B•1879**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782, TELEX: 888069, FAX: 805-968-3154; *Sls. Mgr.:* Glenn Avolio .... **B•1879**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Itek Encoder Div., 178 A Street, Needham Hgts., MA 02194, Tel: 617-455-1414, FAX: 617-455-6514; *Sls. Mgr.:* Marvin Kansky .... **B•1879-1881**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Kimco Magnetics Div., 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, TWX: 910-322-1168, FAX: 619-744-8815; *Sls. Mgr.:* Mike Lopez ..... **B•1879**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Chatsworth Encoder Div., 9223 Deering Avenue, Chatsworth, CA 91311, Tel: 818-341-6161, FAX: 818-882-4553; *Sls. Mgr.:* Ken Rendler ..... **B•1879**

Refer to BEI Motion Sys. Co., Corporate Off.,Carlsbad, CA for sales office information.

BELDEN WIRE AND CABLE COOPER INDS., See Cooper Industries/Belden

bel BEL FUSE INC.

FAX: 201-432-9542

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463; Empl.: 225; *Sls. Mgr.:* A. Sutta; *Dist. Mgr.:* Dennis Ackerman ..... **A•1492, 1499-1528, 2178-2181; B•1346, 1352-1355; D•1629-1630**

Local Sales Offices & Reps

CA	Irvine, Groh Assoc.	714-837-9871
FL	Maitland, D.J. Ellis & Assoc.,Inc.	407-645-1101

Fuses

AL	Huntsville, Beacon Elect.	205-881-5031
CA	Irvine, Groh Assocs.	714-837-9871
CA	Redwood City, James S. Heaton Co.	415-367-9000
FL	Maitland, Beacon Elect.	305-647-3498
FL	Boca Raton, Beacon Elec.	305-997-5740
IL	Chicago, LTD	708-773-2900
FL	Clearwater, Beacon Elect.	813-769-2378
FL	Melbourne, Beacon Elect.	305-724-8010
GA	Atlanta, Beacon Elect.	404-256-9640
ID	Boise, N.R. Schultz Co.	208-377-8686
MN	St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994
KS	Leawood, Dy-Tronix	913-339-6333
MD	Randallstown, Beacon North, Inc.	703-478-2480
NH	Amherst, David A. Cowley Assoc.	603-673-7050
NY	Rochester, Tri-Tech Elec.	716-385-6500
NJ	New Brunswick, Winch Sls. Assocs.	201-613-1515
NC	Raleigh, Beacon Elect.	919-787-0330
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Beaverton, N.R. Schultz Co.	503-643-1644
PA	Hatboro, AQS	215-674-3562
TN	Knoxville, Insul-Reps., Inc.	615-691-7586
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Bellevue, N.R. Schultz Co.	206-454-0300
PR	Hato Rey, Max Anderson Co., Inc.	809-751-2026
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Delay Lines

AL	Hunstville, Beacon Elect.	205-881-5031
AZ	Scottsdale, SMS & Assoc.	602-998-0831
CA	Irvine, Groh Assoc.	714-837-9871
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Longwood, D-Assocs., Inc.	407-830-8976
CA	Redwood City, James S. Heaton Co.	415-367-9000
ID	Boise, N.R. Schultz Co.	208-377-8686
IL	Chicago, LTD	708-773-2900
GA	Atlanta, Beacon Elect.	404-256-9640
KS	Leawood, Dy-Tronix	913-339-6333
MD	Randallstown, Beacon North, Inc.	703-478-2480
MN	S. St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994
NH	Amherst, David A. Cowley Assocs.	603-673-7050
NJ	E. Brunswick, Winch Sls. Assoc.	201-613-1515
MO	St. Louis, Dy-Tronix	314-291-4777
OH	Cleveland, Arthur Baier Co.	216-461-6161
NY	E. Rochester, Tri-Tech Elec.	716-385-6500
OR	Beaverton, N.R. Schultz	503-643-1644
PA	Hatsboro, AQS	215-674-3562
NC	Raleigh, Beacon Elect.	919-787-0330
TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
UT	Midvale, Front Range Mktg.	801-566-2500
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Bellevue, N.R. Schultz Co.	206-454-0300
TN	Knoxville, Insul. Reps.	615-691-7586
PR	Hato Rey, M. Anderson Co., Inc.	809-751-2020
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Local Distributors

FL	Boca Raton, D & R	407-977-8751
PA	Bristol, Aim Elctrns.	215-785-3500
Can	Scarborough, Ont., Carsten Elctrns.	416-495-7705
AL	Huntsville, CDI	205-883-7501
CA	Anaheim, Deco	714-630-8252
CA	City of Industry, Ital Elctrns.	818-968-8515
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Hayward, Kea Elctrns.	415-887-2900
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Force Elctrns.	408-943-1324
CA	Santa Clara, Pyramid	408-727-9810
FL	Ft. Lauderdale, CDI	305-971-4950
GA	Norcrosss, CDI	404-441-3320
MD	Columbia, DK Elctrns.	301-995-1950
MO	St. Charles, Finnigan Elctrns.	314-946-6201
MA	Marlboro, Hardware Specialty	617-481-8622
MN	New Brighton, Chris Elctrns.	612-631-2647
NH	Hudson, Bell Inds.	603-882-1133
NY	Bohemia, Key Comps.	516-567-7500
NC	Raleigh, CDI	919-787-7311
OR	Beaverton, Comp. Resources	503-641-8488
PA	Cornwall Hgts., Reliance Merchandising	215-638-8200
PA	Harrisburg, Cumberland Elctrns.	717-232-9715
TX	Dallas, Fuses Inc.	214-341-6407
VA	Falls Church, CDI	703-241-8227
WA	Kent, Pyramid	206-872-5800

BELL, FLOYD, INC., 897 Higgs Ave., Columbus, OH 43212, Tel: 614-294-4000, FAX: 614-291-0823; FSC No.: 56493; *Sls. Mgr.:* Tom Shain ..... **D•1028-1029**

Local Sales Offices & Reps

IL	Mt. Prospect, Robert Adams Sls. Co.	312-297-8733
MD	Columbia, Tyler Griffin Co.	301-995-1215
PA	Paoli, Tyler Griffin Co.	215-647-1550

BELL, F. W., INC., 6120 Hanging Moss Rd., Orlando, FL 32807, Tel: 407-678-6900, TWX: 810-853-3115, FAX: 407-677-5765; FSC No.: 18479; *Sls. Mgr.:* Stephen L. Dakel; *Dist. Mgr.:* Stephen L. Dakel ..... **B•1882; D•1130, 1226-1228**

Local Sales Offices & Reps

AL	Adamsville, Southrep	205-674-3056
AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Arcadia, Jim Robins Assocs.	818-574-0049
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CO	Wheat Ridge, Trembly Assoc.	303-421-8900
FL	Winter Springs, Lighthouse Mktg.	407-366-0073
IL	Palatine, Golbeck Milota Assoc.	708-705-0602
KS	Lenexa, Dytec/South, Inc.	913-888-0215
KS	Wichita, Dytec/South, Inc.	316-263-7090
ME	Bethel, Shain Assoc.	207-836-3200
MD	Hampstead, Technical Instr. Sls.	301-239-4452
MA	Bellmont, Shain Assocs.	617-489-3598
MA	Hingham, Shain Assoc.	617-740-2334
MO	Maryland Hgts., Dytec/South Inc.	314-739-0665
NE	Omaha, Dytec/South, Inc.	402-334-1222
NV	Las Vegas, Trembly Assoc.	702-739-9770
NH	Nashua, Shain Assoc.	603-881-4881
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NM	Albuquerque, Trembly Assoc.	505-266-8616
NC	Raleigh, Eastern Elctrns.	919-876-7591
PA	Lansdale, Technical Instr. Sls.	215-361-7850
PA	Pittsburgh, Technical Instr. Sls.	412-767-5110
TX	Carrollton, Seaton Corp.	214-980-9860
UT	Salt Lake City, Trembly Assoc.	801-295-4703
WA	Bellevue, Scientific Dvcs.-NW	206-747-5169
WI	Madison, Golbeck Milota Assoc.	608-222-7037

Local Distributors

AZ	Phoenix, Jensen Tools & Alloys	602-968-6241
AL	Birmingham, Argo & Co.	205-787-1100
ID	Boise, Radar Elec. Co. Inc.	208-336-2227
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
MA	N. Andover, Contact East	508-682-2000
CA	Pomona, Inspection Technlgs.	714-626-2600
CA	San Marcos, Mitchell Instrs.	619-744-2690
OR	Portland, Radar Elec. Co.	503-232-3404
GA	Atlanta, P & R Instrs.	404-391-9117
IN	Muncie, Wesco	317-284-6335
IL	Mattoon, Electronic Lab & Sls.	217-235-0546
IL	Palatine, Golbeck Milota Assocs.	708-705-0602
MD	Baltimore, Davis Instrmn.	301-358-3900
MA	Hingham, Shain Assocs.	617-740-2334
MI	Livonia, Electro Sls. Assoc.	313-421-7500
NY	Rochester, Transcat	800-828-1470
NY	Whitehouse, Power Electro Supply	718-767-1447
OH	Chesterland, Electro Sls. Assoc.	216-729-0190
OH	Dayton, Electro Sls. Assoc.	513-426-5551
TX	Dallas, Seaton Elctrns.	214-980-9860
PA	Reading, Barbey Elctrns.	215-376-7451
SC	Charleston, Cameron Barkley Co.	803-745-2837
TN	Chattanooga, Edwin Bohr Elctrns.	615-877-8207
PA	Pittsburgh, Electro Sls. Assoc.	412-322-9000
WA	Seattle, Radar Elec. Co.	206-282-2511

BELL INDS., J. W. Miller Div., 306 E. Alondra Blvd. P.O. Box 2859, Gardena, CA 90247-1059, Tel: 213-515-1720, FAX: 213-515-1962; FSC No.: 76493; Empl.: 30 ..... **A•1164-1169**

Local Sales Offices & Reps

AZ	Mesa, Fetty/Schoenduve, Inc.	602-844-8289
CA	Campbell, Shur Sls.	408-374-5577
NC	Raleigh, C-Tech Sls. Co.	919-782-8100
CO	Denver, West, Inc.	303-477-8180
FL	Clearwater, HHP Assocs., Inc.	813-797-4447
FL	Pompano Bch., HHP Assocs., Inc.	305-971-5750
FL	Winter Park, HHP Assocs., Inc.	407-740-0320
IL	Elk Grove Vl, Levy, Grams & Lassers	708-272-8500
IN	Carmel, Current Elctrn. Mktg., Inc.	317-844-1770
MD	Sykesville, DJC Elctrn. Sls., Inc.	301-795-7020
MA	Burlington, Conti-Younger Assocs., Inc.	617-273-1582
MD	Woodbine, DJC Elctrn. Sls.	301-795-7020
MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
MS	Hattiesburg, Mfgs. Sls. & Mktg. Svcs.	601-264-4755
NJ	Englewood, Epstein & Siebel Assoc.	201-569-7600
NY	Marcellus, J.G. Welch Sales	315-673-1009
NY	Rochester, J.G. Welch Sales	716-244-1100
OH	St. Mary's, Thomas Shelby & Co., Inc.	419-394-3377
OR	Portland, Caruso Assoc. Inc.	503-246-5439
TX	Ft. Worth, Chet Wells & Co.	817-284-0261
WA	Bellevue, Caruso Assoc. Inc.	206-455-8811
EXP	N.Y., Yonkers, Roburn Agencies, Inc.	914-968-1016
Can	Calgary, Alberta, Cana Rep Group	403-243-5148
Can	Montreal, Que., Cana-Rep. Grp., Inc.	514-276-4477
Can	Surrey, B.C., Cana Rep Group	604-589-8593
Can	Willowdale, Cana Rep Group	416-250-6683

BELLOFRAM CORPORATION, State Route 2, Box 305, Newell, WV 26050, Tel: 304-387-1200, 800-727-5646, FAX: 304-387-1212; Empl.: 300; *Sls. Mgr.:* David Lewis; *Dist. Mgr.:* David Lewis

BELTING INDUSTRIES CO., INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 201-272-8591, TELEX: 229854, FAX: 201-272-3825; Empl.: 125; *Sls. Mgr.:* Gene Hobson

BELMONT INSTRUMENT CORP., Pinehurst Pk., 8 Cook St., Billerica, MA 01821, Tel: 508-663-0212, FAX: 508-663-0214 ..... **D•2176**

BEMCO, 2255 Union Place, Simi Valley, CA 93065, Tel: 805-583-4970, FAX: 805-583-5033; Empl.: 43; *Sls. Mgr.:* Glenn Elliott

BENCHMARQ MICROELECTRONICS, INC., 2611 Westgrove 101, Carrollton, TX 75006, Tel: 214-407-0011, FAX: 214-407-9845; Empl.: 35; *Sls. Mgr.:* John Landau

BENDIX CONNECTOR OPERATIONS, See Amphenol, Bendix Connector Ops.

BENDIX CORP., MOTOR COMPS. DIV., See Facet Entprs.

BENDIX ELECTRIC POWER DIVISION, Allied Signal Aerospace, 118 Hwy. 35, Eatontown, NJ 07724, Tel: 201-542-2000, TELEX: 132-444, FAX: 201-389-7758; FSC No.: 83298;Multiple; Empl.: 1,000; *Sls. Mgr.:* R. Freeman

BENJAMIN INTERNATIONAL, INC., 16 Newtown Plaza, Plainview, NY 11803, Tel: 516-753-0700, FAX: 516-753-0839

BENTLY NEVADA CORP., P.O. Box 157, Minden, NV 89423, Tel: 800-227-5514, 702-782-3611, TELEX: 354437, FAX: 702-782-9253; FSC No.: 1561105

BERG, W. M., INC., 499 Ocean Ave., East Rockaway, NY 11518, Tel: 516-599-5010, TELEX: 9103506176, FAX: 516-599-3274; Empl.: 150; *Sls. Mgr.:* Marie Raitz

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NY Lynbrook, P. Saftler Assocs. 516-593-7880
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OH Cleveland, Staff Co. 216-331-5100
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
TX Lewisville, Bergquist 214-317-1502
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

Local Distributors

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CA Hawthorne, Electrosonic 213-970-0997
CA Mtn. View, Energy Sls. 415-969-0800
CA San Diego, Southland Fasteners 619-578-6630
CO Aurora, JET Elctrns. 303-364-1000
FL Ft. Lauderdale, Components Dist. Inc. 305-973-6915
GA Norcross, Components Dist. Inc. 404-441-3320
IL Chicago, NEP Elctrns. 312-625-8400
MA Brookline, Harman Sls. 617-232-6687
NC Raleigh, Components Dist. Inc. 919-834-9465
TX Dallas, Components Dist. Inc. 214-694-0373
WA Redwood, Murphy Elctrns. 206-881-1234

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BERTAN ASSOCS., 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110, TWX: 510-221-2144; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Jim Donley ... **D•1631-1636**

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CT Farmington, Ray Perron & Co., Inc. 203-673-4825
GA Norcross, Currie, Peak, Frazier 404-449-7662
IL Arlington Hgts., Coombs Assocs. 312-439-9810
KS Lenexa, Midtec Assoc. 913-541-0505
MD Randallstown, Beacon North 703-591-1300
MA Needham, Ray Perron & Co., Inc. 617-449-6162
MI Detroit, Geotronix, Inc. 313-559-2440
MN Minneapolis, Electronic Instrs. 612-374-5628
MO St. Louis, Midtec Assoc. 314-275-8666
NM Albuquerque, Thorson/Desert States Co. 505-293-8555
NY Elmont, Crane & Egert Corp. 516-872-0800
NY Hicksville, Bertan Assocs., Inc. 516-433-3110
NY Liverpool, Northern Tech. Sls. Co. 315-451-1091
OH Cleveland, Geotronix 216-659-6100
PA Audubon, Holmes Assocs. 215-666-0636
TX Dallas, Automated Motion Control 214-340-4192
UT Bountiful, H. Bass Assoc. 801-295-7100
VA Fairfax, Beacon North 703-591-1300
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WI Milwaukee, Coombs Assocs. 414-351-6123
Can Downsview, Ont., Rayonics Sci., Inc. 416-736-1600

BERTSCH U.S.

FAX: 619-727-4436

BERTSCH U.S., 2142F Industrial Ct., Vista, CA 92083, Tel: 619-727-7420; FSC No.: 619-727-4436; Empl.: 25; *Sls. Mgr.:* B. Linko ..... **B•1246-1247**

BEST POWER TECHNOLOGY, INC., P.O. Box 280, Necedah, WI 54646, Tel: 608-565-7200, 800-356-5794, TELEX: 701934, FAX: 608-565-2221; Empl.: 600; *Sls. Mgr.:* Donald Soe ..... **D•2177**

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CO Westminster, Straube Assocs. 303-426-0890

BESWICK:COOPER U.K. LTD., Alert Works, Frome, United Kingdom BA11 1PP, Tel: (0373) 64311, TELEX: 449196 G, FAX: (0373) 73175

BETA AUTOMATION, INC., 3541 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-5785, FAX: 805-499-9071; Empl.: 8; *Sls. Mgr.:* James Valentino

BETA REVIEW, INC., PO Box 38, Millwood, VA 22646, Tel: 703-837-1436, FAX: 703-837-3063; Empl.: 2; *Sls. Mgr.:* Norman M. Fine

BT

FAX: 508-842-0748

BETATHERM CORP., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545, Tel: 508-842-0516; Empl.: 80 ..... **B•1834-1837**

BEY ELECTRIC, INC., 362 Main St., Box 548, Lincoln Park, NJ 07035, Tel: 201-694-5000, FAX: 201-694-7975; *Sls. Mgr.:* Fred DeMauro, Gen. Mgr. ..... **A•2182**

BG ELECTRONICS, EPC Corp., 519 South 5th Avenue, Mt. Vernon, NY 10550-4430, Tel: 914-664-5591, FAX: 914-664-4729; FSC No.: 33791; Empl.: 6; *Sls. Mgr.:* Don Edwards ..... **D•1081**

B-G INSTRUMENTS, INC., P.O. Box 1867, Vashon, WA 98070, Tel: 206-567-5000, FAX: 206-567-5010; *Sls. Mgr.:* John Baum ..... **D•1081**

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WA Spokane, B-G Instrs., Inc. 509-238-4757

B. G. LABORATORIES, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-722-2376, FAX: 607-722-4204; FSC No.: 26522; Empl.: 150

BH Electronics

FAX: 612-894-9380

BH ELECTRONICS, INC., 12219 Wood Lk. Dr., Burnsville, MN 55337, Tel: 612-894-9590; FSC No.: 08450; Empl.: 300; *Sls. Mgr.:* Fred LaMarche ..... **A•1170-1171, 2184-2185**

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AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA San Mateo, Halbar North, Inc. 415-349-4700
CA Van Nuys, Halbar Assocs. 818-906-3941
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NJ Montville, PAF Assocs. 201-335-0680
MA Norwood, Tom Maguire Assocs. 617-551-0500
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MI St. Joseph, I. E. Hampton & Assocs. ... 616-983-0862
MN Osseo, Gaffney Sls. Co. 612-425-5484
NC Raleigh, Tingen Tech. Sls. 919-870-6670
OH Worthington, R J Mktg. 614-888-7638
NY Smithtown, PAF Assocs. 516-360-0940
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TX Dallas, Precision Sls. 214-701-9031
WA Redmond, Halbar PNW, Inc. 206-882-0990
WI Theinsville, TFL Assoc. 414-242-6800
Can Toronto, Strategic Elctrns. 416-602-0855

BIBCO, INC., 258 Territorial, Benton Harbor, MI 49022, Tel: 616-925-8445, 800-851-5701, FAX: 616-925-3081; Empl.: 150; *Sls. Mgr.:* Carol McMellen

BICC-VERO ELECTRONICS, INC., 1000 Sherman Ave, Hamden, CT 06514, Tel: 203-288-8001, TWX: 510-227-8890, FAX: 203-287-0062; Empl.: 50; *Sls. Mgr.:* John Bruno

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CO Littleton, Simpson Assocs. 303-794-8381
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GA Duluth, A C M, Inc. 404-447-5499
IL Hoffman Estates, Panatek Tech. Sls. .. 708-519-0867
IN Indianapolis, Mohrfield Mktg. 317-546-6969
KS Overland Park, Markline Technologies 913-681-8880
MD Lutherville, J. A. Dougherty Sls. 301-321-7890
MA Plainville, Entprs. Tech. 617-695-4700
MI Brighton, Elctrn. Sources, Inc. 313-227-3598
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NY Centerport, Big Apple Reps. 516-261-3012
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OH Columbus, KT/Depco 614-262-9159
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PA Pittsburgh, KT/Depco 412-367-1011
TX Houston, Microlog 713-956-0837
TX Richardson, Microlog 214-644-2945
WI Madison, Panatek Tech. Sls. 608-831-3103

BICRON ELECTRONICS, 50 Barlow Street, Canaan, CT 06018, Tel: 203-824-5125, FAX: 203-824-1137; FSC No.: 10617; Empl.: 120; *Sls. Mgr.:* Frank Pierzga ..... **A•2186-2187; B•1615, 1883**

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CO Denver, Omega, Ltd. 303-762-1921
MN Minneapolis, PSI 612-944-8545
NY Pittsford, W.A. Franklin Sls. 716-248-8251
NC Jamestown, Homersmith, Inc. 919-883-3999
PA Media, Homersmith Co. 215-543-2434
PA Pittsburgh, S.K.A. Co. 203-582-5897
UT Salt Lake City, Omega, Ltd. 303-762-1921
VA Arlington, Homersmith 215-543-2434
VA Salem, Homersmith, Inc. 703-387-1600
WI Milwaukee, KMA Sls. Co. 414-259-1771

BIDDLE INSTRUMENTS, 510 Township Line Rd., Blue Bell, PA 19422, Tel: 215-646-9200, TELEX: 685 1045 JGBCO, FAX: 215-643-2670; Empl.: 285

BIKOR, Microsemi Corporation, 1504 W. 228th St., Torrance, CA 90501, Tel: 213-539-6320, FAX: 213-539-0296; FSC No.: 58996; Empl.: 70; *Sls. Mgr.:* James Rorke

BINDICATOR, P.O. Box 61009, 1915 Dove St., Port Huron, MI 48061-0009, Tel: 313-987-2700, TWX: 810-231-5261 BINDICATOR P THY, FAX: 313-987-4476; Empl.: 60; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Secord

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BIOMATION, 19050 Pruneridge Ave., Cupertino, CA 95014-0718, Tel: 408-988-6800, FAX: 408-988-1647; *Sls. Mgr.:* Mark Zamoyski

BIOSOFT, P.O. Box 10938, Ferguson, MO 63135, Tel: 314-524-8029, FAX: 314-525-8129

BIRD ELECTRONIC CORP., 30303 Aurora Rd., Cleveland, OH 44139-2794, Tel: 216-248-1200, TELEX: 706898 Bird Elec. UD, FAX: 216-248-5426; FSC No.: 70998; Empl.: 267; *Sls. Mgr.:* W. F. Kail; *Dist. Mgr.:* Greg Johns

BIRTCHER CORP., See EG & G Birtcher

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BISHOP GRAPHICS, INC., 5210 Lewis Rd., Agoura, CA 91304, Tel: 818-991-2600, TELEX: 66-2400 BISHOP WKVG, FAX: 818-889-3744; Empl.: 140; *Sls. Mgr.:* Robert Reiss

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Bivar

FAX: 714-951-3974

BIVAR, INC., 4 Thomas, Irvine, CA 92718, Tel: 714-951-8808, TELEX: 852348; FSC No.: 32559; Empl.: 20; *Sls. Mgr.:* Thomas Silber; *Dist. Mgr.:* Thomas Silber ..... **C•1015**

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CA	Solana Beach, Cook Entprs.	619-753-7272
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FL	Indian Harbour Bch., Post Mktg.	407-777-0994
FL	Indian Harbour Beach, Symco, Inc.	407-777-0994
GA	Norcross, Twentieth Century Mktg.	404-446-1999
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IN	Indianapolis, Richmar Elec. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
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MA	Norwood, The MacInnis Co.	617-762-8090
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Can	Markham, Ont., Avotronics, LTD.	416-475-2024
NY	Victor, Net Sls.	716-924-1844

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AZ	Phoenix, EKO Sales	602-437-4646
AZ	Tucson, PSN Distbn., Inc.	602-623-9800
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Chatsworth, Jacon Fasteners	818-700-2901
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Fremont, Alatec	415-657-7701
CA	Fremont, Vic/Tal Sls.	415-651-6420
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CA	Milpitas, MS Inserts	408-946-6565
CA	Mission Hills, Coast Air Inc.	818-898-2288
CA	Mission Viejo, Opto Plus, Inc.	714-380-8654
CA	Monrovia, Erik-A-Elctrn. Distb.	818-574-1020
CA	North Hollywood, Elctrn. Hardware Ltd.	818-982-6100
CA	Oxnard, R. C. Dudek	805-988-4882
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Diego, Western Fasteners	619-292-5115
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Santa Fe Springs, F T R Fasteners	714-957-0202, 213-946-6464
CA	Sunnyvale, R. C. Dudek	408-734-3830
CA	Torrance, MS Inserts	213-539-1530
CO	Littleton, Indelco	303-795-3431
CO	Wheatridge, Colorado Elctrn. Hdwr.	303-431-4334
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CT	Wallingford, Midstate Elctrns.	203-265-9900
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FL	Largo, Elctrn. Precepts of FL	813-544-3636
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GA	Peachtree City, Engineered Comps.	404-487-7600
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IL	Lisle, Comps. Inc.	312-852-7707
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, MAR Elctrns.	317-633-6699
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MD	Gaithersburg, Capital Fasteners	301-948-9310
MA	Ashland, Quality Comps.	508-881-6504
MA	Billerica, MS Inserts	508-670-5600
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MA	Waltham, Electronic Fasteners	617-890-7780
MA	Winchester, Webb Distbn.	617-729-5800
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MN	Hibbing, Minn-Tech Elctrns.	218-267-5228
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NH	Amherst, Main Source Elctrns.	603-883-6996
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NY	Elmhurst, Century Fasteners	718-446-5000
NY	Holtsville, Tower Fastener Co.	516-289-8800
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NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Century Elctrn. Comps.	919-782-2116
NC	Raleigh, Century Fasteners	919-787-1800
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OH	Columbus, Hughes-Peters	614-294-5351
OH	Englewood, ADS	513-836-8636
OH	Solon, Repco	216-248-8900
OR	Beaverton, Component Resources	503-641-8488
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Huntingdon Valley, Plastic & Metal Prods.	215-322-2000
PA	Norristown, Century Elctrns.	215-631-5400
SC	West Columbia, Century Fasteners	803-791-1800
TN	Nashville, Tebco Prods.	615-255-1234
TX	Dallas, Global Fasteners	214-340-6068
TX	Houston, Rainbow Fasteners Co.	713-957-0500
TX	Richardson, RSC Elctrns.	214-644-3444
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Seattle, Component Resources	206-454-8666
WA	Seattle, Radar Elec. Co. Inc.	206-282-2511
EXP	CA/Bakersfield, Gray-Weatherhead Equip.	805-397-4281
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Can	Richmond Hill, Ont., Irwin Indl.	416-889-9100
Can	Scarborough, Ont., Carsten Elctrns.	416-495-9999
Can	St. Laurent, Quebec, Carsten Elctrns.	514-334-8321
Can	Surry, British Columbia, Memco	604-590-1553

BIW CABLE SYSTEMS, INC., 22 Joseph E. Warner Blvd., N. Dighton, MA 02764, Tel: 508-822-6600, TELEX: 94-0604, FAX: 508-822-1944; Empl.: 230; *Sls. Mgr.:* S. Adams

BKL, 421 Feheley Dr., King of Prussia, PA 19406, Tel: 215-277-2910, FAX: 215-277-2956; Empl.: 34

BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545, Tel: 608-752-8701, FAX: 608-752-8701; FSC No.: 12724; Empl.: 10; *Sls. Mgr.:* D. Adee

BLACKHOLE TECHNOLOGY, 225 East St., Winchester, MA 01890, Tel: 617-721-7690, FAX: 617-721-7260; Empl.: 5; *Sls. Mgr.:* John W. McDonough, Jr.

BLATEK, INC.

FAX: 814-231-2087

BLATEK, INC., 2820 E. College Ave., Ste. F, State College, PA 16801, Tel: 814-231-2085, 814-231-2086; Empl.: 20 ..... **B•1885**

BLH ELECTRONICS, INC., 75 Shawmut Road, Canton, MA 02021-9111, Tel: 617-821-2000, TELEX: 172116, FAX: 617-828-1451; FSC No.: 03089; Empl.: 170; *Sls. Mgr.:* Kristin Scharf

BLILEY ELECTRIC CO., 2545 W. Grandview Blvd, Erie, PA 16506, Tel: 814-838-3571, FAX: 814-833-2712; FSC No.: 71034;3098; Empl.: 135 ..... **A•1308-1317**

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FL	Tequesta, R.W. Mitscher Co., Inc.	407-575-4485
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NJ	Collingswood, R. W. Mitscher Co., Inc.	609-858-6440
NM	Albuquerque, C. T. Carlberg & Assocs., Inc.	505-899-2155
NY	Binghamton, R. W. Mitscher Co., Inc.	607-724-6561
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	Hauppauge, Aurora-Schmitt Assocs.	516-434-1313
NY	Pittsford, R. W. Mitscher Co., Inc.	716-586-4012
NY	Rochester, R. W. Mitscher Co., Inc.	716-227-0839
NC	Davidson, R.W. Mitscher Co., Inc.	704-896-7434
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Alpha, Poliquin & Co., Inc.	513-426-8055
OR	Portland, Temper Tech. Mktg.	503-292-8201
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Dallas, Electra Reps, Inc.	214-248-3852
VA	Richmond, R. W. Mitscher Co., Inc.	804-320-7350
EXP	CT, Stamford, Dage Corp.	203-324-3123

BLUE M, A UNIT OF GENERAL SIGNAL, 2218 W. 138th St., Blue Island, IL 60406, Tel: 708-385-9000, FAX: 708-331-2515; Empl.: 300; *Sls. Mgr.:* Gary Carlin

BMW, INC./ATLAS TACK CORP., 17 Willow St., Lynn, MA 01903, Tel: 617-593-0200, FAX: 617-592-0964; Empl.: 25; *Sls. Mgr.:* William J. Valles; *Dist. Mgr.:* Richard Pelletier

BODINE® ELECTRIC COMPANY

FAX: 312-478-3232

BODINE ELECTRIC COMPANY, 2500 W. Bradley Pl., Chicago, IL 60618, Tel: 312-478-3515, TELEX: 25-3646; Empl.: 800; *Sls. Mgr.:* R. J. Stuchly; *Dist. Mgr.:* R. J. Stuchly ..... **B•1248**

Local Sales Offices & Reps

CA Saratoga, E. W. Duemmlein 408-253-1201
CA Yorba Linda, Bodine Elec. Co. 714-974-8650
KS Shawnee Mission, J. F. Gleeson & Assocs. 913-362-4422
MD Denton, Motion Specialists South, Inc. 301-479-1164,65
MA Woburn, J. A. Cascino 617-938-1446,
MI Southfield, Bodine Elec. Co. 313-350-3610
MN Mound, John F. Rynkar 612-472-4252
NY Commack, Motion Specialists North, Inc. 516-366-0383
NY E. Syracuse, Application Specialists, Inc. 315-437-2814
NY Rochester, Application Specialists, Inc. 716-586-6226
OH Hudson, J. A. Basten 216-656-4226
TX Richardson, Control Dynamics 214-644-6945
VA McLean, J. S. Hsia 703-734-1739
EXP IL, Chicago, Export Dept., Bodine Elec. 312-478-3515
Can Vancouver, BC, Madison Indl. Equip. Ltd. 604-872-8155

Local Distributors

AZ Phoenix, Motion Solutions, Inc. 602-437-5255
CA San Diego, Sloan Elec. Co. 619-239-5174
CA Benicia, Republic Supp. Co. of CA 707-746-6960
CA Fremont, Elec. Motor Svc. 415-651-2706
CA Fullerton, South Coast Controls 714-525-0471
CA Santa Fe Springs, Power Transmission Specs. 213-907-7650
CO Denver, Wazee Elec. Co. 303-623-8658
CO Englewood, Motion Solutions, Inc. 303-792-5518
CT Berlin, B & B Motor & Control 203-828-8550
CT Hartford, Machine Drives & Controls .. 203-728-0403
CT Norwalk, Machine Drives & Controls .. 203-846-2007
FL Hialeah, Condo Elec. & Ind. Supp., Inc. 305-691-5400
FL Orlando, Brownell Electro, Inc. 407-843-6770
FL Tampa, Electrical-Mech. Dr., Inc. 813-621-8675
GA Forest Park, Brownell Electro, Inc. 404-362-9009
GA Tucker, Research Designs, Inc. 404-491-0745
IL Chicago, Excel Elec. Svc. Co. 312-421-7220
IL Franklin Pk., Flolo Corp. 708-595-1010
IL Loves Park, Tek-Matic, Inc. 815-282-1775
IN Indianapolis, B & B Motor & Control ... 317-248-0396
KS Kansas City, Kornfeld Thorp Elec. 913-321-7070
PA Bridgeport, Advent Electric Inc. 215-277-6610
MA Medford, Empire Elctrl. Co. 617-395-5000
MA Somerville, Electro Sls. Co., Inc. 617-666-0500
MI Detroit, Howard Elec. Co. 313-923-0430
MI Grand Rapids, MacKay Ind. Sls. 616-241-1671
MI Southfield, Reserve Motion Control Sys. 313-557-0800
MN Minneapolis, Boustead Elec. & Mfg. ... 612-544-9131
MO St. Louis, State Elec. Co. 314-569-2140
MO St. Louis, Zeller Elec., Inc. 314-638-9641
NE Omaha, Precision Bearing Co. 402-593-7050
NH Manchester, Empire Elctrl. Co. 603-627-6630
NJ Cherry Hill, Jos. T. Fewkes & Co. 609-424-3932
NJ Edison, B & B Motor & Control 201-819-7070
NY Long Island City, B & B Motor & Control 718-784-1313
NY Rochester, B & B Motor & Control 716-424-7040
NY Syracuse, K. J. Elec. Corp. 315-454-5535
NY Victor, Vordex, Inc. 716-924-4360
NC Charlotte, Brownell Electro, Inc. 704-597-1270
NC Charlotte, Piedmont Motor &Control Ltd. 704-523-7121,
OH Dayton, Thal Mor Assoc., Inc. 513-298-9939
OH Middleburg Hgts., Reserve Motion Control Sys. 216-826-0290
OK Oklahoma City, Evans Elec. Mtr. Ctrs., Inc. 405-631-1344
OK Tulsa, Southwest Drives, Inc. 918-665-1455
OR Portland, North Coast Elec. 503-281-8888
PA Altoona, Miller Elec. Svc. & Supp. 814-942-9943
PA Pittsburgh, Braunlich-Roessle 412-471-6995
SC Taylors, B & B Motor & Control 803-268-5702
TN Cookeville, Cookeville Elec. Motor, Inc. 615-526-5461
TN Memphis, Brownell Electro, Inc. 901-795-8487
TX Dallas, Motion Ind. 214-351-2211
TX Dallas, Purvis Bearing Svc. 214-358-5588
TX Houston, B & B Motor & Control 713-444-9260
TX Houston, Research Des., Inc. 713-995-8591
VA Richmond, Ind. Supp. Corp. 804-355-8041
WA Redmond, Cascade Controls Corp. ... 206-881-8843
WA Seattle, Indl. Elec. Mtr. & Mach., Inc. ... 206-329-3900
WI Milwaukee, Trester Svc. Elec. 414-264-8170
WI New Berlin, Elec. Sls. & Engrg. 414-782-2400
Can Don-Mills, R.G. Shelley LTD. 416-447-6471
Can Edmonton, Alberta, Soper's Supp. Ltd. 403-423-4066
Can Scarborough, Ont., Toronto Elec. Co. .. 416-755-7716
Can St. Laurent, Seltron, Inc. 514-341-3685
Can Vancouver, B.C., Armature Elec. 604-879-6141

BOGEN COMMUNICATIONS, INC. MPD PRODS., See Memory Protection Devices, Inc.

BOGEN COMMUNICATIONS, INC., Sound Prods., 50 Spring St, P.O. Box 575, Ramsey, NJ 07446, Tel: 201-934-8500, FAX: 201-934-9832; *Sls. Mgr.:* David A. Chambers; *Dist. Mgr.:* Christopher Wildfoerster

BOKER'S, INC., 3104 Snelling Ave., Minneapolis, MN 55406-1937, Tel: 612-729-9365, FAX: 612-729-8910; FSC No.: 85446; Empl.: 110; *Sls. Mgr.:* Andy Tscholl

BOMAR CRYSTAL COMPANY, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 908-356-7787, 800-526-3935, FAX: 1-908-356-7362; Empl.: 40; *Sls. Mgr.:* Beth Shapiro, OEM Sls. Mgr. ..... **A•1318-1320**

Local Distributors

TX Ft. Worth, Allied Elctrns. 1-800-433-5700

BOMCO, See MuShield Co.

BOMEM INC., 450 Ave. St-Jean Baptiste, Quebec, Canada G2E-5S5, Tel: 418-877-2944, 1-800-888-FTIR, TELEX: 051-31543, FAX: 418-877-2834; Empl.: 120; *Sls. Mgr.:* Henry Buijs

BONAR-KARD-O-LITE, See BKL (formerly Bonar-Kard-O-Lite)

BOONTON ELECTRONICS CORP., 791 Route 10, Randolph, NJ 07869, Tel: 201-584-1077, TWX: 710-986-8215 BOONTRONICS, FAX: 201-584-3037; FSC No.: 04901; Empl.: 180; *Sls. Mgr.:* R. Morrell

BOPLA ENCLOSURES, 7330 Executive Way, Frederick, MD 21701, Tel: 301-696-9300, FAX: 301-696-9494; FSC No.: 4Y520; Empl.: 35 ..... **C•1016**

Local Sales Offices & Reps

CA Irvine, Comp. Mktg. Assocs. 714-951-5950
FL Tampa, FL Comp. Sls. 813-960-7044
IL Chicago, Paddock Mktg./Sls. 312-452-7852
MA Needham, T.E.S.C.O. 617-444-7925
PA Lancaster, Indl. Comps. Inc. 215-889-0650
WA Federal Way, K. R. Jensen Sls. 206-874-2772

Local Distributors

OR Portland, Radar Elctrns. 503-232-3404
PA Harrisburg, Cumberland Elctrns. 717-232-5999
PA Lancaster, Peak Elctrns. 215-293-9000
WA Seattle, Radar Elec. 206-282-2511

BORG-WARNER THERMOELECTRICS, BORG-WARNER CORP., See TECA, ThermoElectric Cooling America Corp.

BOSCH

FAX: 708-865-5203

BOSCH, ROBERT, CORP., 2800 S. 25th Ave., Broadview, IL 60153, Tel: 708-865-5200; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson ..... **B•1429**

Local Sales Offices & Reps

AL Huntsville, Hughes Assocs. 205-533-9108
CA Los Gatos, Luscombe Engrg. 408-370-2020
CA Montrose, Luscombe Engrg. 818-249-9000
CO Longmont, Piper Sls. 303-443-5337
IL Woodridge, Trend-Tronics, Inc. 708-972-1166
MA Burlington, Conti-Younger Assocs. 617-273-1582
MN Minneapolis, H.M.R., Inc. 612-888-2122
MO St. Louis, Rush & West Assocs. 314-965-3322
OH Richfield, Geotronix Inc. 216-659-6100
PA Norristown, Brandon Assocs. 215-278-0500
TX The Colony, Juliana Co. 214-625-1075
WA Mercer Island, Electronic Comp. Sls. .. 206-232-9301

Local Distributors

AL Huntsville, World Distrs. 205-539-0441
CA Carson, Accele Elctrns. 213-637-3533
CA Cerritos, David Levy Co. 800-421-3536
CA N. Hollywood, Mobile Sound 213-668-1699
CA Santa Monica, Distr. Specialities 213-452-3445
FL Naranja, L.E.S. Distrs. 305-248-6701
GA Norcross, Whitehead Elctrn. 404-923-6667
IL Lemont, Trend-Tronics, Inc. 708-972-1166
IL N. Chicago, Sound Quest/Delta 708-473-1200
MA Burlington, Conti-Younger Assoc. 617-273-1582
MI Livonia, Delta Supp. Co. 313-525-5858
MN Minneapolis, Control Design Supp. 612-721-1628
MO St. Louis, Wes Garde Comp. 314-567-7776
NY Elmsford, Kin-Tronics, Inc. 914-968-7736
PA Norristown, Brandon Assocs. 215-278-0500
TX The Colony, The Juliana Co. 214-625-1075

BOSCHERT, INC., Computer Products/Boschert, 3797 Spinnaker Ct., Fremont, CA 94538, Tel: 415-657-6700, FAX: 415-683-6400

Refer to Computer Products, Inc., Fremont, CA, for sales offices, Reps. and Distributors.

BOSCHERT, INC., See Computer Products, Inc.

BOURNS®

FAX: 714-781-5273

BOURNS, INC., Electronic Components Sls., 1200 Columbia Ave., Riverside, CA 92507-2114, Tel: 714-781-5500, 800-782-2070, 801-750-7200; Empl.: 5000; *Sls. Mgr.:* Dennis Lause; *Dist. Mgr.:* Patricia Moorman ..... **A•1848-1849, 2012, 2018-2029**

Local Sales Offices & Reps

AL Huntsville, CSR Elctrns. 205-533-2444
AZ Scottsdale, Summit Sls. 602-998-4850
CA Agoura, QuadRep. Southern 818-597-0222
CA Auburn, QuadRep Inc. 916-269-2701
CA Irvine, QuadRep. Southern 714-727-4222
CA San Diego, QuadRep. Southern 619-560-8330
CA San Jose, QuadRep, Inc. 408-432-3300
CO Parker, Parker Webster 303-841-4888
CT Wallingford, John E. Boeing Co., Inc. .. 203-265-1318
FL Casselberry, Dyne-A-Mark 407-831-2822
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
GA Atlanta, CSR Elctrns. 404-396-3720
ID Meridian, Intermountain Technlg. 208-888-6071
IL Elk Grove Village, Oasis Sls. Corp. 708-640-1850
IN Carmel, Technlg. Mktg. Corp. 317-844-8462
IN Ft. Wayne, Technlg. Mktg. Corp. 219-432-5553
IN Kokomo, Technlg. Mktg. Corp. 317-459-5152
IA Cedar Rapids, REP Assocs. Corp. 319-373-0152
KY Louisville, Technlg. Mktg. Corp. 502-893-1377
MD Baltimore, Micro-Comp. 301-644-5700
MA Chelmsford, John E. Boeing Co. 508-256-5800
MI Farmington Hills, Rathburg Assocs. ... 313-489-1500
MN Edina, Mel Foster 612-941-9790
MO Bridgeton, Centech 314-291-4230
MO Raytown, Centech 816-358-8100
NH Hooksett, John E. Boeing Co., Inc. 508-256-5800
NJ Moorestown, Thomas Assocs. 609-778-7828
NM Albuquerque, Summit Sls. 505-345-5003
NY Hicksville, J-Square Mktg. 516-935-3200
NY Ithaca, Bob Dean 607-257-1111
NY Wappingers Falls, Bob Dean, Inc. 914-297-6406
NC Charlotte, CSR Elctrns. 704-847-7878
NC Raleigh, CSR Elctrns. 919-878-9200
OH Centerville, Bear Mktg., Inc. 513-436-2061
OH Richfield, Bear Mktg. 216-659-3131
OK Tulsa, Ammon & Rizos 918-749-6116
OR Beaverton, J. J. Backer 503-627-0775
TN Knoxville, CSR Elctrns. 615-689-7911
PA Allison Park, Bear Mktg., Inc. 216-659-3131
TX Austin, Ammon & Rizos 512-454-5131
TX Houston, Ammon & Rizos 713-781-6240
TX Richardson, Ammon & Rizos 214-644-5591
UT Murray, Parker Webster 801-266-9939
WA Seattle, J. J. Backer 206-285-1300
WI Brookfield, Oasis Sls. Corp. 414-782-6660
Can Burnaby, B.C., Davetek Mktg. Inc. 604-430-3680
Can Dorval, Quebec, John G. Weiss Co. ... 514-685-6644

Local Distributors

AL Huntsville, Allied Elctrns. 205-721-3500
AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AL Huntsville, Hamilton/Avnet Elctrns. ... 205-837-7210
AL Huntsville, Hammond Elctrns. 205-830-4764
AL Huntsville, Marshall Ind. 205-881-9235
AZ Chandler, Hamilton/Avnet 602-961-6400
AZ Phoenix, Allied Elctrns. 602-437-9080
AZ Phoenix, Hall-Mark Elctrns. 602-437-1200
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Scottsdale, Spirit Elctrn. 602-998-1533
AZ Tempe, Bell Inds. 602-966-7800
AZ Tempe, TTI, Inc. 602-431-1191
CA Irvine, Hall-Mark Elctrns. 714-727-6000
CA Los Angeles, Bell Inds. 213-826-6778
CA Agoura Hills, Bell Inds. 818-706-2608
CA Anaheim, Compumech 714-826-0866
CA Calabasas, Schweber Elctrns. 818-880-9686
CA Chatsworth, Allied Electronics 818-882-6981
CA Chatsworth, Hall-Mark Elctrns. 818-773-4500
CA Chatsworth, Marshall Ind. 818-407-4100

CA Compton, Harper S.I.D. 213-979-5090
CA Costa Mesa, Hamilton/Avnet Elctrns. 714-641-4100
CA Culver City, Hamilton/Avnet 213-558-2071
CA Cypress, Bell Inds. 714-895-7801
CA Del Mar, Compumech 619-792-7800
CA Elmonte, Marshall Ind. 818-307-6186
CA Elmonte, Marshall Industries 818-350-3341
CA Elmonte, Marshall Industries 818-307-6000
CA Fremont, Allied Elctrns. 415-770-0590
CA Gardena, Hamilton/Avnet 213-217-6700
CA Irvine, Allied Elctrns. 714-727-3010
CA Irvine, Hall-Mark Electrns. 714-727-6000
CA Irvine, Marshall Ind. 714-458-5301
CA Milpitas, Compumech 408-945-9100
CA Milpitas, Marshall Ind. 408-942-4600
CA Milpitas, TTI, Inc. 408-946-5577
CA Mission Hills, TTI, Inc. 818-891-8885
CA Oakland, Brill Elctrns. 415-834-5888
CA Rancho Cordova, Marshall Ind. 916-635-9700
CA Riverside, Elctrn. Supp. Corp. 714-683-7300
CA Rocklin, Allied Electrns. 916-632-3104
CA Rocklin, Bell Inds. 916-652-0414
CA Rocklin, Hall-Mark Elctrns. 916-624-9781
CA Sacramento, Hamilton/Avnet 916-925-2216
CA San Diego, Allied Elctrns. 619-279-2550
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Elctrn. Supp. 619-693-8222
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Diego, Hamilton/Avnet 619-571-7500
CA San Diego, Harper S.I.D. 619-578-2500
CA San Diego, Marshall Ind. 619-578-9600
CA San Diego, TTI, Inc. 619-748-2025
CA San Jose, Electronic Supply 408-297-3726
CA San Jose, Hall-Mark Elctrns. 408-432-4000
CA San Jose, Harper S.I.D. 408-943-9490
CA Santa Ana, Teknopak 714-558-8840
CA Santa Ana, TTI, Inc. 714-641-9393
CA Santa Fe Springs, Bell/JIT Inds. 213-921-3611
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvale, Hamilton/Avnet 408-743-3355
CA Torrance, Allied Elctrns. 213-373-8828
CO Denver, Newark Elctrns. 303-757-3351
CO Denver, TTI, Inc. 303-429-6806
CO Englewood, Allied Elctrns. 303-790-1664
CO Englewood, Hall-Mark Elctrns. 303-790-1662
CO Englewood, Hamilton/Avnet 303-799-7800
CO Thornton, Marshall Ind. 303-451-8383
CO Wheat Ridge, Bell Inds. 303-424-1985
CT Cheshire, Allied Elctrns. 203-272-7730
CT Cheshire, Hall-Mark Elctrns. 203-271-2844
CT Danbury, Hamilton/Avnet 203-797-2800
CT Norwalk, Pioneer Std. 203-853-1515
CT Wallingford, Marshall Ind. 203-265-3822
CT Wallingford, Midan Elctrns. 203-265-2077
CT Wallingford, TTI, Inc. 203-284-7474
FL Altamonte Springs, Marshall Ind. 407-767-8585
FL Casselberry, Allied Elctrns. 407-831-3331
FL Casselberry, Hall-Mark Elctrns. 407-830-5855
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Ft. Lauderdale, Marshall Ind. 305-977-4880
FL Largo, Allied Elctrns. 813-541-4660
FL Largo, Hall-Mark Elctrns. 813-541-7440
FL Melbourne, Rome Elctrns. 407-242-8151
FL Orlando, Hammond Elctrns. 407-849-6060
FL Orlando, TTI, Inc. 407-859-1000
FL Pompano Beach, Allied Elctrns. 305-978-3008
FL Pompano Beach, Hall-Mark Elctrns. 305-971-9280
FL St. Petersburg, Hamilton/Avnet 813-573-3930
FL St. Petersburg, Marshall Ind. 813-573-1399
FL Winter Park, Hamilton/Avnet 407-628-3888
GA Norcross, Marshall Ind. 404-923-5750

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610 E. 10th St., Oakland, CA 94606
COOPER INDUSTRIES BELDEN
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

GA Norcross, Allied Elctrns. 404-446-8595
GA Norcross, Allied Electrns. 404-446-8595
GA Norcross, Bell Elctrns. 404-662-0923
GA Norcross, Hall-Mark Elctrns. 404-447-8000
GA Norcross, Hamilton/Avnet 404-447-7507
GA Norcross, Hammond Elctrns. 404-449-1996
GA Norcross, TTI, Inc. 404-662-0911
IL Addison, Pioneer Std. 312-495-9680
IL Bensenville, Hamilton/Avnet 312-860-7700
IL Chicago, Newark Elctrns. 312-784-5100
IL Des Plaines, Allied Elctrns. 312-803-1040
IL Elk Grove Village, Bell Inds. 312-640-1910
IL Palatine, Ohm Elctrns. 312-359-5500
IL Schaumburg, Marsh Electrns. 312-240-9290
IL Schaumburg, Marshall Ind. 708-490-0155
IL Wood Dale, Allied Electrns. 312-860-0007
IL Wood Dale, Hall-Mark Elctrns. 312-860-3880
IN Carmel, Hamilton/Avnet 317-844-9333
IN Fort Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Allied Elctrns. 317-875-0448
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Bell Inds./JIT Div. 317-299-5487
IN Indianapolis, Hall-Mark Elctrns. 317-872-8875
IN Indianapolis, Pioneer Std. Elctrns. 317-573-0880
IN Indianapolis, RS Elctrns. 317-253-9065
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
KS Lenexa, Allied Elctrns. 913-599-6227
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Lenexa, Hamilton/Avnet Elctrns. 913-888-1055
KS Lenexa, Marshall Ind. 913-492-3121
KS Overland, Chelsea Edg 913-362-1923
KY Louisville, Allied Elctrns. 502-452-2293
MD Baltimore, Radio Elec. Svc. Co. 301-931-8200
MD Beltsville, Radio Elec. Svc. Co. 301-937-9100
MD Columbia, Allied Elctrns. 301-381-1560
MD Columbia, G.R.S. Elctrns. 301-995-6744
MD Columbia, Hall-Mark Elctrns. 301-998-9800
MD Columbia, Hamilton/Avnet 301-995-3500
MD Columbia, TTI, Inc. 301-995-1331
MD Silver Springs, Marshall Ind. 301-622-1118
MA Andover, Bell Inds. 508-474-8880
MA Billerica, Allied Elctrns. 508-667-7921
MA Billerica, Hall-Mark Elctrns. 617-667-0902
MA Lexington, Pioneer Std. 617-861-9200
MA Norwood, Gerber Elctrns. 617-769-6000
MA Peabody, Hamilton/Avnet 508-531-7430
MA Wilmington, Marshall Ind. 508-658-0810
MA Wilmington, TTI, Inc. 508-658-4700
MI Ann Arbor, Bell Inds. 313-971-9093
MI Flint, RS Elctrns. 313-742-5000
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Grand Rapids, Pioneer STD 616-989-1800
MI Grand Rapids, RS Elctrns. 616-241-3483
MI Livonia, Allied Elctrns. 313-462-0190
MI Livonia, Hall-Mark Elctrns. 313-462-1205
MI Livonia, Marshall Ind. 313-525-5850
MI Livonia, Pioneer Std. Elctrns. 313-525-1800
MI Livonia, RS Elctrns. 313-525-1155
MI Novi, Hamilton 313-347-4270
MN Eden Prairie, Allied Elctrns. 612-829-7554
MN Eden Prairie, Hall-Mark Elctrns. 612-941-2600
MN Eden Prairie, Pioneer Std. Elctrns. 612-944-3355
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minnetonka, Hamilton/Avnet 612-932-0600
MN Minnetonka, TTI, Inc. 612-933-8555
MN Plymouth, Masshall Inds. 612-559-2211
MN Thief River Falls, Digikey 218-681-6674, 800-344-4539
MO Bridgeton, Marshall Ind. 314-291-4650
MO Chesterfield, Hamilton/Avnet 314-537-1600
MO Earth City, Hall-Mark Elctrns. 314-291-5350
MO Maryland Hgts., Chelsea Inds. 314-997-7709
MO St. Louis, Pioneer Standard 314-432-4350
NH Manchester, Hamilton/Avnet 603-624-9400
NH Nashua, Allied Elctrns. 603-883-3006
NJ Camden, GRS Elctrns. 609-964-8560
NJ Cherry Hill, Hamilton/Avnet 609-424-0100, 800-257-8110
NJ Fairfield, Hamilton/Avnet 201-575-3390
NJ Fairfield, Marshall Ind. 201-882-0320
NJ Fairfield, Pioneer Std. 201-575-3510
NJ Moorestown, Hall-Mark Elctrns. 609-235-1900
NJ Mt. Laurel, Allied Elctrns. 609-234-7769
NJ Mt. Laurel, Marshall Ind. 609-234-9100
NJ Mt. Laurel, TTI, Inc. 609-234-6400
NJ Parsippany, Allied Elctrns. 201-428-3350
NJ Parsippany, Hallmark Elctrns. 201-515-5000
NJ Teterboro, EAC 201-288-4477
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Hamilton/Avnet Elctrns. 505-345-0633
NY Rome, Rome Elctrns. 315-337-5400
NY Binghamton, Pioneer Std. 607-722-9300
NY Buffalo, Summit Distrs. 716-887-2800
NY E. Rochester, Rome Elctrns. 716-248-0160
NY Fairport, Allied Elctrns. 716-425-3850
NY Fairport, Hall-Mark Elctrns. 716-425-3300
NY Fairport, Pioneer Standard 716-381-7070

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CO Littleton, Harthun Assoc. 303-795-5545
CO Louisville, MJM Mktg.Inc. 303-666-9177
FL Ft. Lauderdale, Synergistic Technlgs. 305-791-8255
FL Melbourne, Synergistic Technlgs. 407-242-9661
FL Odessa, Synergistic Technlgs. 813-920-5814
FL Orlando, Motion Prods. Inc. 407-381-8480
FL Palm Harbor, Synergistic Technlgs. 813-785-7238
FL Pompano,Bch., Motion Prods. Inc. 305-783-9003
GA Atlanta, Murphy and Cota 404-875-2525
IL Des Plaines, Lincoln Hodges Inc. 708-297-3810
IL Schaumburg, Tech-Tron Sls., Inc. 708-843-7530
IN Indianapolis, Wilson Tech. Sls. 317-872-2513
KS Overland Pk., Singer Indl. Sls. 913-897-2008
KS Overland Pk., Singer Indl. Sls. 913-381-3684
KS Shawnee Mission, Mertens Co. 913-432-9323
MD Glenarm, Hodgins Assocs. 301-592-7047
MA Braintree, R.F. Duffy Assocs. 617-848-3550
MA Monson, R.F. Duffy Assoc. Inc. 413-267-9884
MI Grand Haven, Hiltronics 616-847-1010
MI Royal Oak, Elctrl. Sys. Co. 313-542-1747
MI Royal Oak, Hilltronics 313-435-0920
MI Warren, AEC/APG 313-751-4646
MN St. Paul, Kencotronics 612-645-7717
MN St. Paul, Vikeland Sls. Inc. 612-645-4647
MO St. Louis, Mertens Co. 314-993-6600
NH Manchester, Peak Sls. 603-485-7325
NH Sandown, Peak Sls. 603-887-2404
NJ Palisades Park, A. P. Technical Sls. 201-461-8875
NJ Sussex, Carbone Assocs. 201-875-1882
NY Rochester, Application Specialists 716-586-6226
NC Burlington, Murphy & Cota 919-584-6450
OH Cincinnati, Anderson-Bolds, Inc. 513-528-5680
OH Cleveland, Anderson-Bolds, Inc. 216-360-9800
OH Worthington, Anderson-Bolds Inc. 614-885-3933
OR Hillsboro, Doran Sls. Assocs. 503-640-4500
PA Philadelphia, Kenneth B. Erdman, Co. 215-233-0172
PA Wayne, Hodgins Assocs. 215-688-9056
TX Denton, Motion Reps Inc. 817-382-4159
WA Redmond, Doran Sls. Assocs. 206-885-1885
WI Janesville, Antek Mktg. Corp. 608-754-4214
Can Scarborough, Ont., Burgess Switch Co. 416-299-0852

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AL Muscle Shoals, Jones Elctrns., Inc. 205-383-1241
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CA Fresno, Control Elec. 209-268-4411
CA Long Beach, Elctrl. Power & Controls 213-498-6699
CA Redwood City, HdB Elec. 415-368-1388
FL Boca Raton, Zelcon Inc. 407-451-1600
FL Miami, B & R Elctrns. Supp. Inc. 305-255-4510
FL W. Palm Bch., Atlantic Elec. Inc. 407-686-8553
IL Chicago, Leeds Electro Comp. 312-625-3800
IL Harvey, George Elctrns. 708-331-1983
MA Fall River, Broadway Elec. Sls. 508-673-3339
MA Holyoke, Falcetti & Clark Elec. 413-532-9402
MA Medford, Empire Elec. 617-395-5000
NJ Rockaway, NASCO 201-625-7777
MI Grand Rapids, S & F Elctrns. Supp. 616-459-0216
MI St. Clair Shores, Spemco 313-771-2700
MN Minneapolis, Elctrn. Center Inc. 612-378-2442
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NH Manchester, Cohen Machinery Co. Inc. 603-624-4324
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NJ South Hackensack, NASSOR 201-641-3737
NY Bronx, Equiptex Ind. Prod. 212-324-1190
NY Roosevelt, Automated Equip. Co. 516-538-7417

NY Woodside, Switches Unlimited 718-478-5000
NC Durham, Triangle Elec. Motor 919-596-1333
NC Gastonia, JMT Elctrns. & Control 704-867-4401
OH Cincinnati, Richards Elec. Supp. 513-242-8800
PA Bristol, Aim Elctrns. 215-785-3500
PA Harrisburg, Cumberland Elctrns. 717-232-5999
PA Lansdale, County Elec. 215-368-1960
RI Providence, J & H Elec. Co., Inc. 401-421-7840
SC Greenville, Sawyer Elctrns. Corp. 803-235-0438
TX San Antonio, Sherman Elec. Supp. Inc. 512-224-1004
VA Charlottsville, Virginia Elect. Comp. ... 804-296-4184
WI Milwaukee, Midwestern Elec. Co. 414-463-1500
WI Racine, Badger Elect. Parts 414-637-1256

BURLEIGH INSTRUMENTS, Burleigh Pk., Fishers, NY 14453, Tel: 716-924-9355, TELEX: 978379, FAX: 716-924-9072; Empl.: 65; *Sls. Mgr.:* Timothy Van Slambrouck; *Dist. Mgr.:* Timothy Van Slambrouck

BURLING INSTRUMENTS, INC., P.O. Box 298, Chatham, NJ 07928-0298, Tel: 201-635-9481, FAX: 201-635-9530; Empl.: 23; *Sls. Mgr.:* Roger Nation

BURNDY CORPORATION, An FCI Company, Richards Ave., Norwalk, CT 06852, Tel: 203-838-4444, FAX: 203-852-6228/6227; Empl.: 3500; *Sls. Mgr.:* Frank Zanattaro

BURR-BROWN CORP., P.O. Box 11400, Tucson, AZ 85734, Tel: 602-746-1111, TELEX: 66-6491, TWX: 910-1111, FAX: 609-741-3895; Empl.: 1500; *Sls. Mgr.:* M. Dickey/B. McGrath/J. Stoupa ..... **D•1637-1639**

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AL Huntsville, Rep Inc. 205-881-9270
CA Los Angeles, Burr-Brown Corp. 818-991-8544, 805-496-7581
CA San Jose, Burr-Brown Corp. 408-559-8600
CA Santa Ana, Burr-Brown Corp. 714-835-0712
CO Denver, Burr-Brown Corp. 303-452-3545
GA Atlanta, Rep Inc. 404-938-4358
IL Arlington Hgts., Burr-Brown Corp. 708-437-2877
IA Cedar Rapids, Rep Assoc. Corp. 319-373-0152
KS Kansas City, BC Elctrn Sls., Inc. 913-342-1211
MD Hunt Valley, Marktron Inc. 301-628-1111
MD Rockville, Marktron Inc. 301-251-8990
MA N. Billerica, Burr-Brown Corp. 508-670-9800
MI Farmington, Burr-Brown Corp. 313-474-6533
MN Bloomington, Electronic Sls. Agency .. 612-884-8291
MO Bridgeton, BC Elctrn Sls., Inc. 314-739-6683
NM Albuquerque, Morrison & Fern, Inc. ... 505-271-8433
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NY Rochester, Advanced Comp. Corp. 716-544-7017
NY Scottsville, Advanced Comps. Corp. ... 716-889-1429
NY Syracuse, Advanced Comps. Corp. 315-699-2671
NY Syracuse, Expert Inds. 315-455-2469
NY Yonkers, Burr-Brown Corp. 914-964-5252
NC Winston-Salem, Murcota Corp. 919-722-9445
OH Aurora, Meta Tech. Sls. Inc. 216-562-8772
OH Cincinnati, Burr-Brown Corp. 513-891-4711
OH Cleveland, K-T/Depco Mktg. 216-442-6200
PA Pittsburgh, K-T/Depco Mktg. 412-367-1011
PA Spring House, QED Elctrns. 215-643-9200
TN Jefferson City, Rep Inc. 615-475-4105
TX Dallas, Burr-Brown Corp. 214-783-4555
TX Houston, Acudata Inc. 713-580-2451
TX Houston, Burr-Brown Corp. 713-988-6546
TX Plano, Acudata Inc. 214-424-3567
UT Salt Lake City, Aspen Sls., Inc. 801-467-2401
WA Kent, Burr-Brown Corp. 206-859-9220

BURR-BROWN/INTELLIGENT INSTRUMENTATION, See Intelligent Instrumentation/Burr-Brown

BURTON ELECTRICAL ENGINEERING, Wyle Laboratories, 111 Maryland Street, El Segundo, CA 90245, Tel: 213-322-0615, TELEX: 858485, TWX: 910-348-6699, FAX: 213-322-4520; FSC No.: 81861; Empl.: 55; *Sls. Mgr.:* Bill Owen

BUSSCO INC., 119 Standard St., El Segundo, CA 90245, Tel: 213-322-6580, TWX: 910-348-6295, FAX: 213-322-8130; FSC No.: 29593; Empl.: 55

BUSSMANN:COOPER INDUSTRIES, P.O. Box 14460, St. Louis, MO 63178, Tel: 314-394-2877, TELEX: 44 841; FSC No.: ;Multiple; Empl.: 3000; *Sls. Mgr.:* John Monter; *Dist. Mgr.:* John Monter

BYTE CRAFT LIMITED, 421 King St. N., Waterloo, Ont., CAN N2J 4E4, Tel: 519-888-6911, FAX: 519-746-6751; Empl.: 5; *Sls. Mgr.:* Judi Banks

BYTEK CORP., Instrument Systems Div., 543 NW 77th St., Boca Raton, FL 33487-1323, Tel: 407-994-3520, TELEX: 4998369 BYTEK, FAX: 407-994-3615; Empl.: 45; *Sls. Mgr.:* Madeline Selwitz

BYTEX CORP., 120 Turnpike Rd., Southborough, MA 01772, Tel: 508-480-0840, TELEX: 951151; Empl.: 250; *Sls. Mgr.:* Stephen Giambra, VP, Sls.

CABLEFORM INC., Zion Cross Roads, Troy, VA 22974, Tel: 804-589-8224, TELEX: 822434, FAX: 804-589-3803; *Sls. Mgr.:* Richard L. Shannon ... **A•1850-1851; D•1640**

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EXP Troy, VA, Cableform, Inc. 804-589-8224

CABLESCAN, INC., Subsidiary of Eubanks Engrg. Co., 145 E. Emerson Ave., Orange, CA 92665, Tel: 714-998-1961, TELEX: 291693, FAX: 714-921-2493; *Sls. Mgr.:* Richard Heintz

CABLESTAR, INCORPORATED, 310 S. Franklin St., Glasgow, KY 42141, Tel: 800-338-8223, FAX: 502-651-2973; Empl.: 25; *Sls. Mgr.:* Larry Hollon

CABLE SYSTEMS, INC., 210 Broadway, Everett, MA 02149, Tel: 617-389-7080, FAX: 617-389-4758; FSC No.: 33426; Empl.: 70; *Sls. Mgr.:* James R. Collmer

CABLETEST

FAX: 416-475-2609

CABLETEST INTERNATIONAL INC., 951 Denison St. E., Unit 21, Markham, Ont., Canada L3 3W9, Tel: 416-475-2607; Empl.: 50 ..... **D•1230-1233**

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NJ Toms River, Heyco Stamped Prods. .. 908-280-1800

CABLETEST PRODUCTS CO., P.O. Box 494, Malden, MA 02148, Tel: 617-665-2932; Empl.: 28; *Sls. Mgr.:* H. E. Holley; *Dist. Mgr.:* H. E. Holley

CABLETRON SYSTEMS, INC., 35 Industrial Way, Rochester, NH 03867, Tel: 603-332-9400, FAX: 603-332-4616; Empl.: 1500; *Sls. Mgr.:* Jack Branowski

CABLE USA, INC., 2584 So. Horseshoe Dr., Naples, FL 33942-3560, Tel: 813-643-6400, FAX: 813-643-4230; FSC No.: 67050; Empl.: 55; *Sls. Mgr.:* Joe Giordano

CABLEX, INC., 96 Inverness Dr. E., Ste. J, Englewood, CO 80112, Tel: 303-792-5760, FAX: 303-792-3006; Empl.: 50; *Sls. Mgr.:* Ken Harms; *Dist. Mgr.:* Reed C. Mulder

CABOT BERYLCO, DIV. OF CABOT CORP., See NGK Berylco, Div. of NGK Metals Corp.

CABTRON SYSTEMS INC.

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CABTRON SYSTEMS, INC., 200 N. Anets Dr., Northbrook, IL 60062, Tel: 708-498-6090; Empl.: 45; *Sls. Mgr.:* Mike Gober ..... **C•1018**

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CA Orange, XBX Sls., Inc. 714-998-8200
CA San Diego, XBX Sls., Inc. 619-586-1577
CO Englewood, Sierra Tech. Grp. 303-790-1700
CT Watertown, May Tech 203-274-3777
FL Orlando, D.A.I. 407-299-7754
GA Lilburn, Phillip Matthews Corp. 404-381-1662
IN Indianapolis, Liberty Sls. 317-888-8396
KS Wichita, Buckman & Assocs. 316-267-2052
MD Silver Spring, Ansell Engrg. 301-949-1655
MA Reading, May Tech. 617-942-7135
MI Livonia, Lowell-Wendt 313-464-2722
MN St. Paul, Countryman Assocs. 612-645-9151
MO St. Charles, Buckman & Assocs. 314-947-4727
NJ Kenvil, Components for Elctrns. 201-927-6662
NM Organ, Sierra Tech. Grp. 505-382-5542
NC Kings, Phillip Matthews Corp. 919-983-9790,
OH Dayton, Geotronix 513-854-5939
OH Richfield, Geotronix 216-659-6100
OR Portland, McLaren, Inc. 503-297-2248
PA Allison Pk, Geotronix 412-487-1770
PA Blue Bell, Comp. for Elctrns. 215-825-3939
TX Dallas, Dunbar Assocs. 214-239-7151
UT Holladay, Sierra Tech. Grp. 801-272-3733
WA Kirkland, McLaren 206-827-9400

CAC MICROCIRCUITS INC., Bel Fuse, 2 Southgate Dr., Mt. Carmel, IL 62863, Tel: 618-263-4343, FAX: 618-263-4295; Empl.: 148; *Sls. Mgr.:* Warren Mitch ..... **A•1723**

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AZ Scottsdale, Arcom Sls. 602-947-5745
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CA Valencia, C & N and Assoc. 805-254-5844
CO Boulder, Front Range Mktg. 303-443-4780
FL Longwood, D-Assocs. 407-830-8976
GA Norcross, Interep 404-449-8680
IL Itasca, LTD Technlgs. 708-773-2900
IN Indianapolis, Insul-Reps, Inc. 317-251-1994
IA Cedar Rapids, Dy-Tronix 319-377-8275
KS Wichita, Dy-Tronix Inc. 316-838-0884
MN S. St. Paul, Northport Engrg. 612-457-8000
MO Raytown, Dy-Tronix 913-229-6333
MO St. Louis, Dy-Tronix 314-291-4777
NH Amherst, D. A. Crowley & Assocs., Inc. 603-673-7050
NJ Ft. Lee, Neptune 201-461-2789
NY Plainview, Neptune 516-349-1600
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Cleveland, Arthur H. Baier, Inc. 216-461-6161
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TN Knoxville, Insul-Reps 615-691-7586
TX Austin, Oeler & Menelaides, Inc. 512-453-0275
UT Salt Lake City, Front Range Mktg. 801-566-2500
VA Charlottesville, DVS 804-973-0303
WA Bellevue, N.R. Schultz Co. 206-746-1890
WI Milwaukee, LTD Technlgs. 414-774-1000

CADDELL-BURNS MFG., 258 E. 2nd St., Mineola, NY 11501-3508, Tel: 516-746-2310, FAX: 516-742-2416; Empl.: 30 ..... **A•1172-1186**

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WA Bellevue, Elctrn. Sources 206-451-3500

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CAD ENGRG. & ASSEMBLY INC., 8663 Tyler Blvd., Mentor, OH 44060, Tel: 216-255-7744, FAX: 216-255-5900; Empl.: 28

CADILLAC PLASTIC & CHEM. CO. DIV. OF M.A. HANNA, 143 Indusco Ct., Troy, MI 48083, Tel: 313-583-1200, TWX: 810-232-1886, FAX: 313-583-4715; Empl.: 1000

CAD UTILITY CO., 21115 Devonshire St., Ste.318, Chatsworth, CA 91311, Tel: 805-527-8630, FAX: 805-526-5093; Empl.: 6; *Sls. Mgr.:* Stan Chambers

CAIG LABS., 1175-0 Industrial Ave., Escondido, CA 92029-1431, Tel: 619-743-7143, FAX: 619-743-2460; Empl.: 15; *Sls. Mgr.:* Laurie Skultety; *Dist. Mgr.:* Laurie Skultety

CALABRO INDS., INC., See UNITRACK Div., Calabro Inds., Inc.

CAL-AV, INC., 515B Westchester Drive, Campbell, CA 95008, Tel: 408-371-0666, FAX: 408-371-0672; Empl.: 8

CALAY SYSTEMS, INC., 16842 Von Karman Ave., No. 100, Irvine, CA 92714, Tel: 714-863-1700, TELEX: 6711321, FAX: 714-863-0310; Empl.: 70

CAL CRYSTAL LAB., INC., 1142 N. Gilbert, Anaheim, CA 92801, Tel: 714-991-1580, 800-333-9825, FAX: 714-491-9825; Empl.: 30; *Sls. Mgr.:* Audrey Gevers

CALEX MFG. CO., INC., 3355 Vincent Rd., Pleasant Hill, CA 94523, Tel: 510-932-3911, TELEX: 269888, FAX: 510-932-6017; FSC No.: 29988; Empl.: 75; *Sls. Mgr.:* Steve Mathias ..... **D•1008, 1641-1648**

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CA Mtn. View, Saber Entprs., Inc. 415-968-0427
CA San Diego, Saber Entprs., Inc. 619-271-1523
CO Parker, Davis Assocs. 303-841-8648
CT Tolland, R.G. Assocs. 203-875-4201
GA Marietta, Testech Entprs., Inc. 404-971-2298
IL Carpentersville, Precision Meas. Prods. Inc. 708-426-4446
MA Hanover, R.G. Assocs. 617-293-5233
MA Lowell, R.G. Assocs. 508-458-9802
NJ Cherry Hill, Analectro Tech. Rep., Inc. 609-795-6676
NC Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-854-5939
OR Portland, Topp Engrg. 503-244-7265
PA Allison Pk., Geotronix 412-487-1770
MI Sterling Hgts., Geotronix 313-254-0520
TX Houston, Chauvin Engrg. Co. 713-668-4770
TX Richardson, Chauvin Engrg. Co. 214-220-1234
VA Burke, Analectro Tech. Rep., Inc. 703-922-4317
WA Bellevue, Topp Engrg. Sls. Co. 206-747-5400
WA Greenacres, Topp Engrg. Sls. 509-928-4177

Local Distributors

OH Richfield, Alpha Distr. 216-659-7100

CALIBRON INSTRUMENTS, Burton-Rogers Co., 220 Grove St., Waltham, MA 02154, Tel: 617-894-6440, FAX: 617-893-8393; Empl.: 14; *Dist. Mgr.:* W. Burton

CALIFORNIA AUTOMATION INC., 11815 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-452-1341

CALIFORNIA AVIONICS LABS., See Cal-Av, Inc.

CALIFORNIA DC, 2150 Anchor Ct., Newbury Park, CA 91320, Tel: 805-499-3621, FAX: 805-498-8381; Empl.: 100; *Sls. Mgr.:* C. Paton; *Dist. Mgr.:* C. Paton

CALIFORNIA EASTERN LABS. INC., 4590 Patrick Henry Dr., Santa Clara, CA 95056-0964, Tel: 408-988-3500, TELEX: 346393, TWX: 171197; Empl.: 118

California INSTRUMENTS

FAX: 619-279-8139

CALIFORNIA INSTRUMENTS CORP., 5125 Convoy St., Ste. 201, San Diego, CA 92111-1216, Tel: 619-279-8620, 800-356-2244, TELEX: 695047 CALICO SDG; FSC No.: 16067; Empl.: 70; *Sls. Mgr.:* D.R. Chilcoat, G.R. Holland ..... **D•2179-2181**

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AL Huntsville, Sci. Dvcs.-SE 205-536-1969
AZ Tempe, Sci. Dvcs.-West 602-730-9774
CA Huntington Beach, Sci. Dvcs. West 714-840-3501
CA San Jose, Scientific Dvcs. 408-554-0455
CO Broomfield, Sci. Dvcs.-West 303-469-5145
CT Mt. Carmel, Sci. Dvcs.-NE 203-248-9361
FL Orlando, Scientific Dvcs.-SE 407-841-8180
IL Arlington Hts., Berndt Assoc. 708-632-0900
IN Carmel, Berndt Assoc. 317-844-0114
KS Overland Park, Ramsey Assocs. 913-541-1007
LA Metairie, Data Mktg. Assocs. 504-833-3655
MD Hunt Valley, Electronic Resources, Inc. 301-584-7547
MA Waltham, Sci. Dvcs.-NE 617-890-5816
MN Minneapolis, Berndt Assoc. 612-546-2021
MO St. Louis, Ramsey Assocs. 314-532-9386
NJ Ridgefield Park, Sci. Dvcs. East, Inc. 201-440-3430
NM Albuquerque, Sci. Dvcs.-West 505-883-3668
NY Rochester, TAE-Rep, Inc. 716-586-8710
NY Whitney Pt, TAE-Rep, Inc. 607-692-3705
NC Raleigh, Sci. Dvcs.-SE 919-859-0868
OH Cincinnati, Dietrich & Assoc. 513-984-8924
OH Independence, Dietrich & Assoc. 216-642-7965
OK Tulsa, Data Mktg. Assocs. 918-494-2711
OR Beaverton, Northwest T&M 503-645-9000
PA Horsham, Sci. Dvcs. East 215-956-0700
PA Pittsburgh, Dietrich & Assoc. 412-892-2992
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TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-579-2995
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WI Milwaukee, Berndt Assocs. 414-545-8400
Can Markham, Ont., Multitest Elctrns. 416-470-2929
Can N. Vancouver, B.C., Jerome & Francis Co., Ltd. 604-986-1286

CALIFORNIA MICRO DEVICES, INC., 215 Topaz Street, Milpitas, CA 95035, Tel: 408-263-3214, FAX: 408-263-7846; FSC No.: 56427; Empl.: 70; *Sls. Mgr.:* Stephen R. Pass

CALIFORNIA MICROWAVE, 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-732-4000, TELEX: 35 2016, TWX: 910-339-9231, FAX: 408-732-4244; Empl.: 1020

CALMARK CORPORATION

FAX: 818-287-7350

CALMARK CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-0451; FSC No.: 52094; Empl.: 90; *Sls. Mgr.:* Peter Jeanseau; *Dist. Mgr.:* Peter Jeanseau ..... **C•1019**

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CA Oceanside, Noo Rep. Tech. Sls. 619-941-0558
CA San Gabriel, Calmark Corp. 818-287-0451
CA Santa Clara, Calmark Corp. 408-988-1260
FL Winter Springs, Sunland Assocs. 407-365-9533
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IA Cedar Rapids, Stan Clothier Co. 319-393-1576
KS Olathe, Stan Clothier Co. 913-829-0013
MD Cockeysville, Dalbrook Corp. 301-666-2212
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MN St. Paul, Innovate Sls. 612-225-9772
MO St. Charles, Stan Clothier Co. 314-928-8078
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NY E. Syracuse, Fountain, Young & Co. 315-437-7733
NY Plainview, Neptune Elect. 516-349-1600
NC Matthews, Arthur, Harris & Assocs. 704-845-1085
OH Miamisburg, Electronics Comps., Inc. 513-866-3340
OH Rocky River, Electronic Comps., Inc. 216-331-5330
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TX Richardson, Zonk Assocs. 214-238-7651
TX Stafford, Zonk & Assocs. 713-561-7777
WA Snohomish, Unicomp, Inc. 206-568-0511
EXP Ireland/Cappoquin, Calmark Ireland, Ltd. 353-58-54205
EXP San Gabriel, CA, Calmark Corp. 818-287-0451
PR Santruce, SISCO 809-726-3137
Can Islington, Ont., Pipe-Thompson Ltd. 416-236-2355

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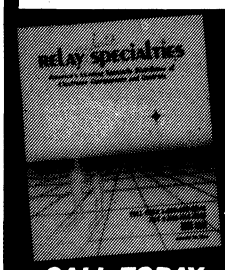
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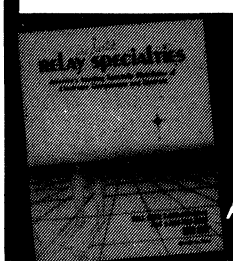
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CARTER MOTOR, 400 Stagecoach Trail, Warren, IL 61087-0647, Tel: 815-745-2100, FAX: 815-745-2135; *Sls. Mgr.:* John W. Smith III

CASEMAKER, Stebco Industries, Inc., 1020 West 40th Street, Chicago, IL 60609, Tel: 312-254-1221, TWX: 910-221-2470, FAX: 312-254-4030; FSC No.: 36-2405334; Empl.: 25

CASSO-SOLAR, P.O. Box 163, U.S. Route 202, Pomona, NY 10970, Tel: 914-354-2500, TELEX: 475-4099, FAX: 914-362-1856; Empl.: 50; *Sls. Mgr.:* T. Corl

CASTALL INC., Weymouth Ind. Pk., E. Weymouth, MA 02189, Tel: 617-337-6075, FAX: 617-337-2820; FSC No.: 04-2459700; Empl.: 32; *Sls. Mgr.:* Charles Howland; *Dist. Mgr.:* Joseph Mc Donough

CATALYST RESEARCH, Mine Safety Appliances Co., Inc., 3706 Crondall La., Owings Mills, MD 21117, Tel: 301-356-2400, TELEX: 87768, FAX: 301-581-0346; FSC No.: 00681; Empl.: 275; *Sls. Mgr.:* Mark Dilliplaine; *Dist. Mgr.:* Edward S. Hatch, Jr.

CATAMOUNT MANUFACTURING, 158 Governor Dr., P.O. Box 720, Orange, MA 01364, Tel: 1-800-222-5969, FAX: 508-544-8351; FSC No.: 65664; Empl.: 120; *Sls. Mgr.:* Henry Schweitzer; *Dist. Mgr.:* Henry Schweitzer

CATEL TELECOMMUNICATIONS, 4050 Technology Pl., Fremont, CA 94537, Tel: 415-659-8988, FAX: 415-651-8437; Empl.: 150; *Sls. Mgr.:* James F. Caldwell

CATON

FAX: 617-585-2973

CATON CONNECTOR CORP., Jones River Indl. Pk., 20 Wapping Rd., Kingston, MA 02364, Tel: 617-585-4315; FSC No.: 52196; Empl.: 28; *Sls. Mgr.:* D. Galambos ..... **C•1311-1315**

Local Sales Offices & Reps
CA Fairfield, Baribeault Assocs. 707-428-6095
CA LaHabra, Cygnus Sls. Engrg. 213-691-2993
GA Atlanta, Electro Tech. Prods. 404-262-1522
MA Tewksbury, Sequal Assocs. 617-851-4010
NM Albuquerque, Westfahl & Assocs. 505-881-0995
NY Plainview, Neptune Elctrns. 516-349-1600
OH Cincinnati, Delta Sales 513-271-5444

CITIZEN

FAX: 213-828-0846

CBM AMERICA CORP., 2020 Santa Monica Blvd. Ste. 410, Santa Monica, CA 90404, Tel: 213-828-8245, TELEX: 182508; Empl.: 20; *Dist. Mgr.:* Robin Pierce ..... **D•1082-1083**

Local Distributors
CA Los Angeles, MFI 213-826-8133
NY Hewlett, Metropolitan Sls. 516-599-7900
TX Dallas, R Squared Elctrns. 214-406-1117
Can Concord, CBC 416-660-1616
Can Toronto, TLS 416-479-1911
Can Toronto, Ont., TLS 416-479-1911

CCD IMAGING, Fairchild Weston Systems, Inc., 1801 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2500; *Sls. Mgr.:* Jim Johnson

C-COR ELCTRNS., 60 Decibel Rd., State College, PA 16801, Tel: 814-238-2461, 800-233-2267, FAX: 814-238-4065; FSC No.: 12775; Empl.: 530; *Sls. Mgr.:* J. Hastings

CCP/TECHNICAL DEVICES, 8529 North Dixie Dr., Dayton, OH 45414, Tel: 513-890-7881, FAX: 513-890-5136; Empl.: 12 ..... **D•1649**

Local Sales Offices & Reps
AL Huntsville, BCI, Inc. 205-539-4411
GA Chamblee, BCI, Inc. 404-455-0405
IL Darien, Rah Assocs. 708-963-5401
MN Plymouth, C & L Elctrns. 612-557-9944
NH Hampton, Primary Source 603-926-8044
NC Raleigh, Spears & Assocs. 919-790-7606
OH Dayton, Tech. Dvcs. 513-890-6811

CDRL DATA, INC., 21642 North 9th Ave., Suite 103, Phoenix, AZ 85027-2823, Tel: 602-582-8844, FAX: 602-582-2199; FSC No.: 56060; Empl.: 25; *Sls. Mgr.:* Roy T. Alberti

CDS - COLORADO DATA SYS., 3301 W. Hampden, Unit C, Englewood, CO 80110, Tel: 303-762-1640, 800-CDS-ATE1, TWX: 910-933-0193, FAX: 303-781-0253; Empl.: 80; *Sls. Mgr.:* Bob Frodge

CEC, 330 W. Taft Ave., Orange, CA 92665, Tel: 714-637-2970, FAX: 714-637-8654; Empl.: 58

CEAG

FAX: 516-582-4922

CEC ELECTRONICS CORP., 1324 Motor Pkwy., Hauppauge, NY 11788, Tel: 516-582-4422; FSC No.: 57973; Empl.: 200; *Sls. Mgr.:* John Carroll ..... **D•1650-1651**

Local Sales Offices & Reps
MD Ellicott City, MD, Tytronics Tech. 301-465-5944
TX Richardson, TX, Jim Gray & Assocs. .. 214-699-9976
VA Fairfax, VA, Tytronics Tech. 703-323-9640
VA Reston,VA, Tytronics Tech. 703-620-4600

CEC INSTRUMENTS, Imo Industries Inc., 955 Overland Ct., San Dimas, CA 91773, Tel: 714-394-4410, TELEX: 200445 RCA; Empl.: 200; *Sls. Mgr.:* Jim Eakins

CELADON CORPORATION, 400 Fifth Ave., Waltham, MA 02154, Tel: 617-290-5775, FAX: 617-890-1340; *Sls. Mgr.:* Ms. Corinne Schneider

CELCO, 70 Constantine Dr., Mahwah, NJ 07430, Tel: 201-327-1123, TWX: 710-988-1018; FSC No.: 05954; Empl.: 25; *Sls. Mgr.:* Art Weirgen, Engrg. Sls. Mgr.

CELESCO TRANSDUCER PRODS., INC., 7800 Deering Ave., Canoga Pk., CA 91304-5005, Tel: 818-884-6860, TELEX: 499-8137; *Sls. Mgr.:* Richard Proud

CELESTION INDUSTRIES, INC., 89 Doug Brown Way, Holliston, MA 01746, Tel: 508-429-6706, TELEX: 948417, FAX: 508-429-2426; *Sls. Mgr.:* Brian Coviello; *Dist. Mgr.:* Steve Chandler

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FAX: 215-363-8719

CELL-CON, INC., 305 Commerce Dr., Exton, PA 19341, Tel: 215-363-8552; Empl.: 14; *Sls. Mgr.:* Gene Kiley Jr. ..... **D•1436**

Local Sales Offices & Reps
CT Essex, Winslow Elec. Co. 203-767-8229
TX Dallas, REM Comps. 214-234-1069

Local Distributors
PA Bensalem, Scott's Emergency Lighting 215-639-1777

CENTECH CORPORATION, 200 W. 88th St., Minneapolis, MN 55420, Tel: 612-881-8245, TWX: 431-0015-L8M, FAX: 612-881-4137

CENTENT CO., 3879 S. Main St., Santa Ana, CA 92707, Tel: 714-979-6491; Empl.: 14; *Sls. Mgr.:* A. Freimanis

CENTRALAB, See Mepco/Centralab

CENTRAL DATA CORP., 1602 Newton Dr., Champaign, IL 61821, Tel: 217-359-8010, FAX: 217-359-6904; Empl.: 60; *Sls. Mgr.:* Avon Morgan; *Dist. Mgr.:* Avon Morgan

CENTRAL SEMICONDUCTOR CORP., 145 Adams Ave., Hauppauge, NY 11788, Tel: 516-435-1110, FAX: 516-435-1824; Empl.: 50

CENTRONIC, INC., THE MORGAN CRUCIBLE COMPANY, SPEC. MATLS. & TECH DIVISION, 1829 B DeHavilland Dr., Dept. E, Newbury Park, CA 91320-1702, Tel: 805-499-5902, FAX: 805-499-7770; FSC No.: 63334; Empl.: 23; *Sls. Mgr.:* George Pankau; *Dist. Mgr.:* Yuval Tamari ..... **B•1322**

Local Sales Offices & Reps
CA Newbury Pk., Centronic, Inc., E-O Comps. Div. 805-499-5902

CENTURION INTERNATIONAL, INC., 3425 N. 44 St., Lincoln, NE 68504, Tel: 402-467-4491, FAX: 402-467-4528; Empl.: 160; *Sls. Mgr.:* Steven C. Bowles; *Dist. Mgr.:* Bob Bonebright

C.E. PRECISION ASSEMBLIES, INC., 101 S. McKemy Ave., Chandler, AZ 85226, Tel: 602-940-0740, FAX: 602-961-4754; FSC No.: 67810; Empl.: 24; *Sls. Mgr.:* Henry Richards

CERAMASEAL, Box 260, New Lebanon, NY 12125, Tel: 518-794-7800, TELEX: 14-5442, FAX: 518-794-8080; FSC No.: 07601; Empl.: 85; *Sls. Mgr.:* Gene D. Sawin

CERAMAWIRE, Box 1084, Cranford, NJ 07016, Tel: 908-276-1170; Empl.: 4; *Sls. Mgr.:* Edward Hamilton

CERAMIC DEVICES INC., 8145 Ronson Rd., San Diego, CA 92111, Tel: 619-560-7575, FAX: 619-560-4906; FSC No.: 66230; Empl.: 40; *Sls. Mgr.:* Linda Parrish

CERAMIC MAGNETICS, INC., 16 Law Dr., Fairfield, NJ 07004, Tel: 201-227-4222, FAX: 201-227-6735; Empl.: 90

CERA-MITE CORP., 1327 Sixth Ave., Grafton, WI 53024, Tel: 414-377-3500, FAX: 414-377-7309; Empl.: 215; *Sls. Mgr.:* Claude Marquardt

CERCAST GROUP HOWMET CORPORATION, 3905 Industrial Blvd., Montreal-North, Que H1H 2Z2, Tel: 514-322-2371, FAX: 514-322-1340; Empl.: 1100; *Sls. Mgr.:* Dieter Rupp

CERMETEK MICROELECTRONICS INC., 1308 Borregas Ave., Sunnyvale, CA 94089, Tel: 408-752-5000, FAX: 408-752-5004; Empl.: 50; *Sls. Mgr.:* Thomas Newton

C.G. INSTRUMENTS CORP., Electromatic Controls Corp., 2495 Pembroke Ave., Hoffman Estates, IL 60195, Tel: 708-882-5757, FAX: 708-882-7234; Empl.: 27; *Sls. Mgr.:* Mike Meurer; *Dist. Mgr.:* Mike Meurer

CGRS MICROTECH, P.O. Box 102L, Langhorne, PA 19047, Tel: 215-757-0284; Empl.: 5; *Sls. Mgr.:* J. Swope; *Dist. Mgr.:* J. Swope

CHACE PRECISION METALS, INC., 1704 Barnes St., Reidsville, NC 27320, Tel: 919-342-2381, FAX: 919-342-4012; Empl.: 190; *Sls. Mgr.:* Pat J. Urban

CHA INDUSTRIES, 4201 Business Center Dr., Fremont, CA 94538, Tel: 415-683-8554, TELEX: 334426, FAX: 415-683-3848; *Sls. Mgr.:* Jack Patten

CHALCO ENGRG. CORP., Chalco Industries, Inc., 15126 S. Broadway, Gardena, CA 90248-1898, Tel: 213-321-0121, 213-323-5525, FAX: 213-323-0405; Empl.: 95; *Sls. Mgr.:* Steven Kierman, Dir. Sls.

Champion Technologies, Inc.

FAX: 708-451-7585

CHAMPION TECHNOLOGIES, INC., 2553 N. Edgington, Franklin Park, IL 60131, Tel: 708-451-1000; Empl.: 175; *Sls. Mgr.:* Greg Dec ..... **A•1321**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	Irvine, Prism Assocs.	714-252-1208
CA	San Diego, Spinnaker Sls.	619-451-8595
FL	Longwood, Delmac Sls.	407-831-0040
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Itasca, Micro Sls.	708-285-1000
IN	Indianapolis, Schank Elctrn. Mktg.	317-842-6204
AZ	Phoenix, Integrated Sys. & Dvc. Sls.	602-971-8250
MD	Columbia, Third Wave Solutions	301-290-5990
MA	Natick, Wayland Engrg. Sls.	508-655-6080
MI	Farmington Hills, Schank Elctrn. Mktg.	313-626-2551
MN	Minneapolis, Horizon	612-884-6515
CO	Littleton, Contec Mktg., Inc.	303-973-8490
NY	E. Rochester, W. Kreger Assocs.	716-381-4430
NY	Great Neck, Trionic Assoc.	516-466-2300
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Solon, J.R. Thornberry Co.	216-248-4995
TX	Austin, Electra Reps.	512-339-1163
TX	Dallas, Electra Reps.	214-248-3852
Can	Brampton, Ont., Cantec Reps. Inc.	416-791-5922
WA	Redmond, Electronic Mktg. Grp.	206-882-0962
WI	Brookfield, Micro Sls.	414-786-1403
IL	Franklin Pk., Champion Technlgs.	708-451-1000

Local Distributors

CA	San Jose, Passive Technlgs.	408-435-5566
IL	Palatine, OHM Elctrns.	708-359-5500
NY	Bayshore, Brookdale Elctrns.	516-242-8033

CHAMPLAIN CABLE CORP., Huber & Suhner(USA)Corp., 12 Hercules Dr., Colchester, VT 05446, Tel: 802-655-2121, FAX: 802-655-2025; FSC No.: 05973; Empl.: 300o; *Sls. Mgr.:* M.Brennan; *Dist. Mgr.:* J. Brooks

CHANDLER PRODUCTS, 1491 Chardon Rd., Cleveland, OH 44117, Tel: 216-481-4400; *Sls. Mgr.:* Nick Andos

CHANNEL INDUSTRIES, 839 Ward Dr., Santa Barbara, CA 93111, Tel: 805-967-0171, TELEX: 658416, FAX: 805-683-3420; Empl.: 75

CHAPMAN CORP., P.O. Box 10700, 125 Presumpscot St., Portland, ME 04104, Tel: 207-773-4726, TELEX: 493 1536 CHAP UI, FAX: 207-775-7369; Empl.: 42; *Sls. Mgr.:* John Goodwin; *Dist. Mgr.:* Peter DeFilipp

CHARLES INDS. LTD., Charles Center, 5600 Apollo Drive, Rolling Meadows, IL 60008, Tel: 708-806-6300, TWX: 910-687-3375, FAX: 708-806-6231; Empl.: 100; *Sls. Mgr.:* Laurie Goro

CHARLES RIVER DATA SYSTEMS, INC., 983 Concord St., Framingham, MA 01701, Tel: 508-626-1000, TELEX: 681-7373, FAX: 508-626-1046; Empl.: 170; *Sls. Mgr.:* David Greer; *Dist. Mgr.:* David Greer

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CHATSWORTH DATA CORPORATION, 20710 Lassen St., Chatsworth, CA 91311, Tel: 818-341-9200; Empl.: 95; *Sls. Mgr.:* Hank Boehm ..... **D•1234**

CHAUVIN ARNOUX, Chauvin Arnoux-France, 15 Faraday Dr., Dover, NH 03820, Tel: 603-749-6434, FAX: 603-742-2346

CHEMICAL ABSTRACTS SERVICE, American Chemical Society, 2540 Olentangy River Road, Columbus, OH 43202-1505, Tel: 614-447-3600, FAX: 614-447-3709; *Sls. Mgr.:* Tom Gornick

CHEMREX INC., ResTech Prods. Div., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, FAX: 303-289-5283; *Sls. Mgr.:* Michael P. Manegold

CHEMTRONICS INC., 681 Old Willets Path, Hauppauge, NY 11788, Tel: 516-582-3322, 800-645-5244, TELEX: 968567, FAX: 516-582-3046; FSC No.: 21267; Empl.: 112; *Sls. Mgr.:* Louis Friedman; *Dist. Mgr.:* Scott Friedman

CHENANGO INDUSTRIES, INC., 200 Stage Road, Vestal, NY 13850, Tel: 607-748-1572, TWX: 510-252-0899, FAX: 717-879-4220; *Sls. Mgr.:* Rick Hammond

CHEROKEE INTERNATIONAL, INC., Core Industries, 2841 Dow Avenue, Tustin, CA 92680-7211, Tel: 714-544-6665, TWX: 510-101-0493, FAX: 714-838-4742; Empl.: 350; *Sls. Mgr.:* Dennis Pouliot ..... **D•1653-1657**

Local Sales Offices & Reps

CA	Santa Clara, Cindel, Inc.	408-988-8331
FL	Del Ray Beach, Phelps Assoc.	407-276-7591
GA	Atlanta, Naylor Assoc.	404-373-5036
AZ	Phoenix, Chaparral Elctrns.	602-996-5909
IL	Downers Grove, Richmar Elctrns.	708-968-0118
IL	Prairie Vl, Crosslink Elctrns.	913-649-7100
IN	Indianapolis, Richmar Elctrns. Corp.	317-846-6383
KS	Prairie Village, Crosslink Elctrns.	913-649-7100
MN	Minneapolis, Robt. W. Marshall Co., Inc.	612-929-0457
NH	Amherst, Bennetron	603-880-7008
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Wappinger Falls, Bob Dean, Inc.	914-297-6406
NC	Resch. Triangle Pk., Naylor Assocs., Inc.	919-544-6630
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix, Inc.	216-659-6100
OR	Beaverton, Elctrns. N.W.	503-629-9241
PA	Allison Pk., Geotronix, Inc.	412-487-1770
TX	Dallas, Richmar Elctrns.	214-424-8388
VA	Charlottesville, DVS Co.	804-973-0303
WA	Redmond, Elctrns. N.W.	206-557-0851
Can	Downsview, Ont., Elbit Elctrns.	416-633-5050

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FAX: 708-360-3566

CHERRY ELECTRICAL PRODUCTS, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, Tel: 708-662-9200; Empl.: 1,000; *Dist. Mgr.:* George Di Martino ..... **B•1044-1045, 1661-1665, 1802**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs. S.W.	602-944-9542
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs. N., Inc.	408-432-1940
CA	Torrance, O'Donnell Assocs., Inc.	213-539-9664
CO	Denver, Spectrum Mktg. Assocs., Inc.	303-480-9991
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Orlando, Cahill Assocs.	407-282-5117
FL	Palm City, Cahill Assocs.	407-288-3113
IL	Waukegan, Cherry Elctrl. Prods.	708-662-9200
IN	Ft. Wayne, Menze Sls., Inc.	219-747-5616
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, Cherry Elctrl. Prods., Automotive	313-477-4477
MI	Grand Rapids, Miltimore Sls., Inc.	616-942-9731
MI	Novi, Miltimore Sls., Inc.	313-349-0260
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	W. Caldwell, Grimm, Siegel Assocs., Inc.	201-575-9300
NM	Albuquerque, O'Donnell Assocs., S.W.	505-889-4522
NY	Pittsford, Elcom Sls., Inc.	716-385-1400
NY	Skaneateles, Elcom Sls., Inc.	315-685-8967
NC	Raleigh, CSR Elctrns., Inc.	919-878-9200
OK	Tulsa, Comptech Sls., Inc.	918-622-7744
OR	Beaverton, Westmark Elctrns., Inc.	503-641-8780
TN	Knoxville, CSR Elctrns.	615-689-7911
TX	Austin, Comptech Sls., Inc.	512-343-0300
TX	Houston, Comptech Sls., Inc.	713-492-0005
TX	Irving, Comptech Sls., Inc.	214-751-1181
UT	Ogden, Spectrum Mktg. Assocs., Inc.	801-972-8552
VA	Fairfax, Colrud Corp.	703-904-0240
WA	Bellevue, Westmark Elctrns., Inc.	206-454-1944
Can	Coquitlam, B.C., r.n. Longman Sls., Inc.	604-931-4744
Can	Kirkland, Que., r.n. Longman Sls., Inc.	514-694-3911
Can	Mississauga, Ont., r.n. Longman Sls., Inc.	416-670-8100
Can	Ottawa, Ont., r.n. Longman Sls., Inc.	613-564-0100

Local Distributors

AL	Birmingham, Ack Radio Supp. Co.	205-322-0588
AL	Huntsville, Powell Elctrns.	205-837-5300
CA	Inglewood, Newark Elctrns.	213-671-7377
CA	San Jose, Powell Elctrns.	408-943-9020
AZ	Tempe, L Comp, Inc.	602-730-1633
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Compton, Harper S.I.D.	213-979-5090
CO	Denver, Newark Elctrns.	303-757-8531
CA	Gardena, Cal Switch	213-770-2330
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Oakland, Brill Elctrns.	415-834-5888
CA	Sacramento, Integrated Elec.	916-363-6030
CA	San Diego, Harper S.I.D.	619-578-2500
CA	San Jose, Harper S.I.D.	408-943-9490
CA	Sunnyvale, Target Elctrns.	408-733-0384
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Sager Elctrns.	203-265-4600
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Denver, Integrated Elec.	303-292-6121
CT	Wallingford, G.R.S. Midan Elec., Inc.	203-265-2077
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Atlanta, Ack Radio Supp. Co.	404-351-6340
IL	Champaign, Klaus Radio, Inc.	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Ft. Wayne, Bell Inds.	219-423-3422
IL	Palatine, OHM Elctrns., Inc.	708-359-5500
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, Bell Inds./Graham	317-875-8200
IN	Indianapolis, PEI Genesis Elec.	317-879-0700
IN	South Bend, PEI Genesis Elect.	219-287-2911
IA	Cedar Rapids, Advent Elec., Inc.	319-363-0221
GA	Norcross, Reptron Elctrns.	404-446-1300
MD	Annapolis Jct., Powell Elctrns.	301-953-3435
MD	Savage, Pyttronic Inds., Inc.	301-792-0780
MA	Needham, Cronin Elctrns., Inc.	617-449-5000
MA	Newton, Greene-Shaw Co.	617-969-8900
MI	Livonia, Reptron Elect., Inc.	313-525-2700
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minneapolis, Sterling Elctrns.	612-831-2666
MO	Kansas City, L Comp, Inc.	816-241-0111
MO	Maryland Hgts., L Comp, Inc.	314-291-6200
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Oakland, Relay Specs.	201-337-1000
NJ	Teterboro, E.A.C. Elec., Inc.	201-288-4477
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Dists.	716-887-2800
MD	Columbia, Sager Elctrns.	301-995-6580
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Rochester, Summit Dists.	716-334-8110
NC	Cary, Powell Elctrns.	919-467-1212
NC	Raleigh, Sager Elctrns.	919-850-9550
NC	Winston-Salem, Kirkman Elect.	919-722-9131
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Dayton, Bell Inds.	513-435-8660
OH	Valley View, Newark Elctrns.	216-447-8860
OH	Warren, REM Elctrns. Supp. Co.	216-373-1300
OH	Worthington, Reptron Elctrns.	614-436-6675
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Integrated Elec.	503-641-1690
OR	Portland, Radar Elec.	503-232-3404

OR Portland, Tek-Elec. 503-246-5451
PA Erie, REM Elctrns. Supp. Co. 814-453-5626
PA Montgomeryville, Pyttronics Inds., Inc. 215-643-2850
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Philadelphia, PEI Genesis Elect. 800-523-0727, 800-222-1772
PA Philadelphia, Sager Elctrns. 215-464-4336
TX Garland, Newark Elctrns. 214-487-8144
MA Hingham, Sager Elctrns. 617-749-6700
TX Houston, Newark Elctrns. 713-270-4800
TX Irving, Harper S.I.D. 214-621-0500
TX Irving, Powell Elctrns. 214-550-0547
MI Oak Park, Newark Elctrns. 313-967-0600
TX Stafford, Southwest Elec., Inc. 713-240-4000
UT N. Salt Lake City, Integrated Elctrns. .. 801-298-1869
UT Salt Lake City, Stand. Supp. Co. 801-486-3371
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Integrated Elctrns., Inc. 206-455-2727
WA Seattle, Radar Elctrns. 206-282-2511
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
WI Waukesha, Hawk Elctrns. 414-547-4457
Can Burnaby, B.C., ITT/Rae Ind. Elect. 604-291-8866
Can Calgary,Alberta, ITT/Rae Ind. Elect. ... 403-273-2780
Can Concord, Ont., ITT/RAE Ind. Elect. 416-736-1144
Can London, Ont., C. M. Peterson Co., Ltd. 519-434-3204
Can Mississauga, Ont., Newark Elctrns. 416-670-7799

CHERRY SEMICONDUCTOR CORP, 2000 S. County Trail, East Greenwich, RI 02818, Tel: 401-885-3600, TELEX: WUI 6817157; FSC No.: WUI 6817157;;;401-885-5786; Empl.: 365

CHESSELL CORP., 1 Pheasant Run, Newtown, PA 18940, Tel: 215-968-0660, FAX: 215-968-0662; Empl.: 82; *Sls. Mgr.:* Richard Veit; *Dist. Mgr.:* R. Veit

CHESTER CABLE CORP., Sub. Alcatel NA Cable Sys. Inc., 15 Oakland Ave., Chester, NY 10918, Tel: 914-469-2141, TWX: 510-249-4813, FAX: 914-469-9935

CHESTERFIELD PRODUCTS, INC., 37 Midland Ave., Elmwood Park, NJ 07407, Tel: 201-797-9655, FAX: 201-797-9504; Empl.: 35; *Sls. Mgr.:* Bob Fiordalisi ..... **A•1661-1663**

Local Sales Offices & Reps
NM Phoenix, CPS Assocs., Inc. 602-246-1097
CA Carlsbad, MTM Intl., Inc. 619-729-6338
IL Chicago, Tech. Sls. 312-237-7210
MD Baltimore, Advanced Tech. Sls. 301-323-3140
MA Framingham, Bengal Assocs. 617-877-2639
MA Randolph, Bengal Assocs. 617-961-4120
NY Syracuse, Rep Tech, Inc. 315-437-2845
TX Richardson, Carl Tinch Sls. Co. 214-231-1322

CHICAGO BLOWER CORP., 1675 Glen Ellyn Rd., Glendale Heights, IL 60139, Tel: 708-858-2600, ESYLNK: 62912209, FAX: 708-858-7172; Empl.: 250; *Sls. Mgr.:* R.W. Wessel

CHICAGO CONDENSER CORP., 2900 West Chicago Ave., Chicago, IL 60622, Tel: 312-227-7070, FAX: 312-227-6646; FSC No.: 5910; *Sls. Mgr.:* Joan Looi ..... **A•1019**

CHICAGO LASER SYSTEMS, INC., 4034 N. Nashville Ave., Chicago, IL 60634, Tel: 312-282-2710, TELEX: 6711269 LASER UW, FAX: 312-282-8455; *Sls. Mgr.:* Bernard Alpiner, V.P.

CHICAGO LOCK CO., 4311 W. Belmont Ave., Chicago, IL 60641, Tel: 312-282-7177, TELEX: ITT 4994023, FAX: 312-282-8199; Empl.: 375; *Sls. Mgr.:* Dale N. Padjen

CHIU TECHNICAL CORP., 252 Indian Head Rd., Kings Park, NY 11754, Tel: 516-544-0606, FAX: 516-544-0809; FSC No.: 38-32, 38-41; Empl.: 25; *Sls. Mgr.:* Frank A. Denny, V.P. Mktg.



FAX: 716-538-6345

CHLORIDE ELECTRO NETWORKS, Chloride Power Electronics, Inc., 1 Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, TWX: 510-254-0422; Empl.: 350; *Sls. Mgr.:* Gary Balfour ..... **A•2189; D•1658, 2182**

Local Sales Offices & Reps
CA Mission Veijo, Jim Anl 714-454-8997
FL Lakeland, Robert Coughlin 813-667-1663
MD Laurel, R.W. Mitscher Co. 301-498-6090
NH Nashua, Bell Ctrls. 603-882-6984
NY Liverpool, Thomas Ealy 315-652-3149

CHLORIDE EL PASO, Chloride Power Elctrns., 10931 Pellicano Drive, El Paso, TX 79935, Tel: 915-592-9985, FAX: 915-595-1664; FSC No.: 08715; Empl.: 1000; *Sls. Mgr.:* Robin Lee

CHOMERICS, INC.:W.R. GRACE & CO., 77 Dragon Ct, Woburn, MA 01888, Tel: 617-935-4850, TWX: 710-393-0173; Empl.: 650; *Sls. Mgr.:* Louis M. Yantosca; *Dist. Mgr.:* Gary L. Wood ..... **C•1674**

Local Sales Offices & Reps
AZ Mesa, Chomerics 602-964-0771
CA Carson, Chomerics 213-518-6921
CO Boulder, Front Range Mktg. 303-443-4780
CT Trumbull, Chomerics 203-452-0253
FL Longwood, Chomerics 407-876-5800
GA Kennesaw, Chomerics 404-928-4243
IL Chicago, Chomerics 708-458-0649
MD Elliott City, Tech. Sls. 301-461-2400
MA Woburn, Chomerics 617-935-4850
MN Eagan, Chomerics 612-681-1615
NH Hudson, Chomerics 603-880-4807
NY Bohemia, Chomerics 516-567-6186
NC Greensboro, Chomerics 919-674-3144
OH Beavercreek, Chomerics 513-427-0002
TX Dallas, Chomerics 214-960-7236
WA Seattle, Chomerics 206-624-3763

Local Distributors
AZ Tucson, Cupps Indl. Supp. 602-294-1922
CA Santa Clara, K.R. Anderson, Co. 408-727-2959
CO Denver, R.S.I. 303-373-1812
CT Bloomfield, E.I.S. 203-243-9440
FL Orlando, E.I.S. 407-855-7100
GA Atlanta, United Seal & Rubber 404-454-9912
IL Hillside, E.I.S. 708-547-5400
MD Baltimore, Sosco Corp. 301-574-7555
MA N. Andover, Mktg. East 508-689-9565
MI Mt. Clemens, E.I.S. 313-791-8510
MN Mounds View, Indl. Gasket 612-785-2266
MO Kansas City, E.I.S. 816-471-5966
NJ Branchburg, Robert McKeown 201-218-9000
NY Lancaster, Sealing Dvcs. 714-684-7600
OH Chargin Falls, Electrolock 216-543-6626
OR Portland, E.I.S. 503-227-3601
PA Essington, Tri-Com, Inc. 215-521-3080
SC Greenville, Electrolock 803-297-9830
TN Memphis, E.I.S. 901-947-4176
TX Dallas, Oriental Gasket 214-956-9100
UT Salt Lake City, E.I.S. 801-483-1226
VA Bluefield, E.I.S. 703-322-5424
WA Tukwilla, E.I.S. 206-241-1010
WI Mequon, Fabrico 414-241-5300
Can Markham, Ont., Matrix Technlg. 416-477-4442

CHR, Furon, 407 East St, P.O. Box 1911, New Haven, CT 06509, Tel: 203-777-3631, TWX: 710-465-0264; Empl.: 116; *Sls. Mgr.:* Joseph T. Ballentine; *Dist. Mgr.:* Joseph T. Ballentine

CHRISTIANA INDUSTRIES CORP., 6500 North Clark, Chicago, IL 60626, Tel: 312-465-6330, FAX: 312-465-6271; Empl.: 250; *Sls. Mgr.:* Mitchell Waters; *Dist. Mgr.:* Mitchell Waters

CHRISTIE ELECTRIC CORP., 18120 S. Broadway, Gardena, CA 90248, Tel: 213-715-1402, TWX: 910-349-6260, FAX: 213-618-8368; FSC No.: 02294; Empl.: 90; *Sls. Mgr.:* Scott Marvel

CHROMALOX INSTRS. & CONTROLS, 1382 Heil-Quaker Blvd., La Vergne, TN 37086-3536, Tel: 615-793-3900, TELEX: 55-5129, FAX: 615-793-3563; Empl.: 110; *Sls. Mgr.:* Mary Hausman ..... **D•1131**

CHROMATICS, 2558 Mountain Ind. Blvd, Tucker, GA 30084, Tel: 404-493-7000, FAX: 404-493-1314; FSC No.: FSCM 59992

CHRONO-LOG CORP., 2 W. Park Rd., Havertown, PA 19083, Tel: 215-853-1130, FAX: 215-853-3972; Empl.: 20; *Sls. Mgr.:* Kathy Jacobs ..... **D•1084**

Local Sales Offices & Reps
AL Huntsville, Dynamic Measurements ... 205-535-6663
Can Scarborough, Canadian Applied Technlg. 416-431-0004

CHURCHILL CORP., 344 Franklin St, Box G, Melrose, MA 02176, Tel: 617-665-4700, FAX: 617-662-5291; FSC No.: 94867; Empl.: 30; *Sls. Mgr.:* W. Schermerhorn

CIC COMPONENTS INDS. CO., LTD., 4FL No. 5 Lane 130, Min-Chung Rd., Hsin Tien City, Taiwan R.O.C., Tel: 886-2-9174302, TELEX: 35261 MEISCO, FAX: 886-2-9124480; Empl.: 30; *Sls. Mgr.:* James Huang

CICOIL CORP., 24960 Ave. Tibbitts, Valencia, CA 91355-3428, Tel: 805-295-1295, FAX: 805-295-0813; Empl.: 75; *Sls. Mgr.:* James Alderson

CIDTEC (CID TECHNOLOGIES INC.), 101 Commerce Blvd., Liverpool, NY 13088, Tel: 315-451-9410, FAX: 315-451-9421

CIMCO WIRE & CABLE, INC., See Specialty Cable Corp.

CINCH CONNECTOR DIVISION, Labinal Components & Systems Inc., 1501 Morse Ave., Elk Grove Village, IL 60007, Tel: 312-981-6000, TWX: 910-222-1796; *Sls. Mgr.:* James L. Hartranft Jr.; *Dist. Mgr.:* Scott Campbell

CINCH CYLINDRICAL DIVISION, Labinal Comps. & Systems, Inc., 8821 Science Center Dr., Minneapolis, MN 55428, Tel: 612-537-1010, FAX: 612-537-9614; *Sls. Mgr.:* Jim Simmons; *Dist. Mgr.:* Scott Campbell

CINCINNATI ELECTROSYSTEMS, 420 Wards Corner Rd., Loveland, OH 45140, Tel: 513-831-6800, TELEX: 312328, FAX: 513-831-4866; Empl.: 110; *Sls. Mgr.:* Brian Doherty

CINCINNATI SUB-ZERO PRODS., 12011 Mosteller Rd., Cincinnati, OH 45241, Tel: 513-772-8810, TELEX: 214390 SUBZERO CIN, FAX: 513-772-9119; Empl.: 117; *Sls. Mgr.:* Harold Zeilman

CIPHER DATA PRODUCTS, INC., an Archive Co., 10101 Old Grove Rd., San Diego, CA 92131, Tel: 619-578-9100, FAX: 619-693-4435; Empl.: 1500; *Sls. Mgr.:* Wes Bankston, VP Sls.

CIPRICO INC., 2955 Xenium Lane, Plymouth, MN 55441, Tel: 612-559-2034, FAX: 612-559-8799; Empl.: 79; *Sls. Mgr.:* Bill Rost

CIRCOM INC., 505 W. Main St., Bensenville, IL 60106, Tel: 708-595-4460, FAX: 708-595-4615; Empl.: 38; *Sls. Mgr.:* R. Alan Rosenberg

CA CIRCUIT ASSEMBLY CORP.

FAX: 714-855-4298

CIRCUIT ASSEMBLY CORP., 18 Thomas St., Irvine, CA 92718-2703, Tel: 714-855-7887, TELEX: 183109UD; FSC No.: 52072; Empl.: 275; *Sls. Mgr.:* Robert R. Brinckman; *Dist. Mgr.:* Robert R. Brinckman ..... **C•1316-1322**

Local Sales Offices & Reps
AL Huntsville, L & D, Inc. 205-837-1469
AZ Scottsdale, BSE, Inc. 602-483-0373
CA San Diego, Varigon-San Diego, Inc. ... 619-576-0100
CA Santa Clara, Westrep 408-988-8833
CO Englewood, Delltron Co. 303-741-2122
FL Clearwater, Tech-Rep Assoc., Inc. 813-572-9900
FL Ft. Lauderdale, Tech-Rep Assoc., Inc. 305-791-2708
FL Merritt Island, Tech-Rep Assoc., Inc. .. 407-453-3313
FL Winter Sprgs., Tech-Rep Assoc., Inc. .. 407-699-4010
GA Atlanta, L & D, Inc. 404-395-7079

BRILL ELECTRONICS
(415) 834-5888
610 E 10th St Oakland, CA 94606
CHERRY
(213) 452-8002
1220 Olympic Bl Santa Monica, CA 90404

IL Itasca, LTD Technlgs., Inc. 708-773-2900
IL Roscoe, LTD Technlgs., Inc. 815-389-4316
IN Carmel, Frank E. Kahsar Sls. 317-844-9353
MD Rising Sun, LHR Elctrns., Inc. 301-658-4058
MA Randolph, The TMR Grp. 617-961-4486
MI Grand Haven, Frank E. Kahsar Sls. 616-846-7590
MI Warren, Frank E. Kahsar Sls. 313-795-3530
MN Osseo, Gaffney Sls., Inc. 612-425-5484
MO Grandview, Harris Hanson Co. 816-763-6200
MO St. Louis, Harris Hanson Co. 314-432-3611
NJ Berkeley Hgts., Cambridge Allen & Assoc. 201-464-0203
NJ Moorestown, LHR Elctrns., Inc. 609-778-1019
NM Albuquerque, SynTech 505-266-7951
NY Forest Hills, Cambridge Allen & Assoc. 718-592-6361
NY Rochester, Apex Assocs., Inc. 716-272-7040
NC Raleigh, L & D, Inc. 919-876-5301
NC Wilmington, L & D, Inc. 919-256-8110
OH Cincinnati, Frank E. Kahsar Sls. 513-922-3133
OH Columbus, Frank E. Kahsar Sls. 614-252-4009
OH Mentor, Frank E. Kahsar Sls. 216-257-1166
OR Portland, General Elctrns. 503-297-8500
PA Sewickley, Frank E. Kahsar Sls. 412-741-4155
PA Wexford, Frank E. Kahsar Sls. 412-935-8561
TN Bristol, L & D, Inc. 615-878-2266
TX Houston, Procomp Sls. Co. 713-681-1591
TX Hurst, Procomp Sls. Co. 817-589-0336
TX Richardson, Procomp Sls. Co. 214-669-1500
UT American Fork, Delltron Co. 801-263-9413
VA Midlothian, LHR Elctrns., Inc. 804-794-6013
VA Richmond, L & D, Inc. 804-257-7717
WA Redmond, General Elctrns. 206-867-0969
WI Milwaukee, LTD Technlgs., Inc. 414-774-1000

Local Distributors

AL Birmingham, Newark Elctrns. 205-942-4044
AL Huntsville, Comp. Resources 205-837-1469
AL Huntsville, Component Distrs. 205-851-7800
AL Huntsville, Newark Elctrns. 205-837-9091
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Arizona Comps. 602-269-5655
AZ Phoenix, Newark Elctrns. 602-244-0133
AZ Phoenix, Tri Tek 602-371-0860
AZ Tempe, Circuit Specialists 602-966-0764
AZ Tucson, Newark Elctrns. 602-628-7891
AR Little Rock, Newark Elctrns. 501-225-8130
CA Chatsworth, Passive Comps. 818-341-1745
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Foster City, Newark Elctrns. 415-572-8300
CA Irvine, Mann Southwest 714-380-4170
CA Los Angeles, All American 213-320-0240
CA Orange, Newark Elctrns. 714-634-8224
CA San Diego, Southland Comps. Inc. 619-673-3800
CA San Jose, All American 408-943-1200
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Ana, B D S Elctrns. 714-662-1050
CA Santa Clara, Trinity Elctrns. 408-980-9011
CA Santee, Mouser Elctrns. 619-449-2222
CO Colorado Springs, Newark Elctrns. 719-576-2644
CO Denver, C.S.I.D. 303-292-9594
CO Denver, Comp. Distributors 303-770-6214
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Indelco 303-694-9444
CO Englewood, Nep Elctrns. 303-799-9898
CT Bloomfield, Newark Elctrns. 203-243-3985
CT Bridgeport, Park Distrs. 203-366-7200
CT East Hartford, Newark Elctrns. 203-289-1416
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Clearwater, Component Distrs. 813-796-0466
FL Deerfield Beach, Vantage Comps. 305-429-1001
FL Ft. Lauderdale, All American 305-572-7999
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
FL Jacksonville, Newark Elctrns. 904-399-5041
FL Longwood, Intertec 407-834-7777
FL Maitland, Electronic Equip. 407-539-0888
FL Melbourne, Component Distrs. 407-724-9910
FL Miami, All American 305-621-8282
FL Miami, Electronic Equip. 305-526-6000
FL Plantation, Newark Elctrns. 305-587-2372
FL Pompano Bch., Electronic Equip. 305-960-1200
FL Tampa, Electronic Equip. 813-988-0810
FL West Palm Beach, Atlantic Electronics 407-686-8553
GA Atlanta, Newark Elctrns. 404-951-2363
GA Norcross, Component Distrs. 404-441-3320
GA Norcross, Newark Elctrns. 404-448-1300
HI Aiea, Newark Elctrns. 808-487-8951
ID Boise, Newark Elctrns. 208-342-4311
IL Addison, Belford Elctrns. 708-691-1000
IL Bensenville, Goold Elctrns. 708-860-7171
IL Champaign, Klaus Radio 217-356-1986
IL Elk Grove, Bell Inds. 708-640-1910
IL La Salle, Klaus Radio 815-223-7400
IL Peoria, Klaus Radio 309-691-4840
IL Quincy, Klaus Radio 217-223-7560
IL Schaumberg, Q P S Elctrns. 708-884-6620
IL Schaumburg, Newark Elctrns. 312-843-0700
IL Springfield, Newark Elctrns. 217-787-9972
IL Wood Dale, Nep Elctrns. 708-595-8500
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Mar Elctrns. 317-633-6699
IN Indianapolis, Newark Elctrns. 317-872-7070
IN Merrillville, Newark Elctrns. 312-768-5059
IA Cedar Rapids, Newark Elctrns. 319-393-3800
IA Des Moines, Newark Elctrns. 515-278-0670
IA Eldridge, Klaus Radio 319-285-8484
IA Marion, Brenneman & Assoc. 319-377-6394
KS Overland Pk., Newark Elctrns. 913-677-0727
KS Wichita, Newark Elctrns. 316-267-8755
KY Lexington, Newark Elctrns. 606-255-4161
LA Metairie, Newark Elctrns. 504-838-9771
MD Annapolis, Powell Elctrns. 301-953-3435
MD Beltsville, Newark Elctrns. 301-206-3300
MD Columbia, Vantage Comps., Inc. 301-720-5100
MD Gaithersburg, Axis Elctrns., Inc. 301-840-9640
MD Hanover, Newark Elctrns. 301-796-9092
MD Rockville, All American 301-251-1205
MA Boston, All American 617-846-2300
MA Holliston, Goold Elctrns. 508-429-8154
MA Milford, Car Lac Indl. 508-478-7797
MA Norwood, Gerber Elctrns. 617-329-2400
MA W. Springfield, Newark Elctrns. 413-785-5851
MA Westboro, In Stock Prods. 508-870-5750
MA Westborough, Powell Elctrns. 508-366-6100
MA Woburn, Newark Elctrns. 617-932-9040
MI Ann Arbor, Wedemeyer Elctrn. Supp. Co. 313-665-8611
MI Grand Rapids, Newark Elctrns. 616-455-9190
MI Mt. Clemens, Spec Connector Corp. 313-465-3232
MI Oak Park, Newark Elctrns. 313-967-0600
MN Burnsville, Cassidy Elctrns. 612-895-9026
MN Crystal, Newark Elctrns. 612-535-4280
MN Minneapolis, All American 612-944-2151
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Vadnais Hts., N A A Connectron 612-481-0022
MO Blue Springs, Newark Elctrns. 816-228-3170
MO St. Louis, Beckwith Elctrns. 314-343-6463
MO St. Louis, Newark Elctrns. 314-298-2505
MT Helena, Newark Elctrns. 406-443-6192
NE Omaha, Newark Elctrns. 402-392-1221
NV Las Vegas, Newark Elctrns. 702-796-5090
NV Reno, Newark Elctrns. 702-322-6090
NH Goffstown, Key Comps. 603-626-1717
NH Manchester, Yankee Elctrns. 603-625-9746
NH Nashua, Newark Elctrns. 603-888-5790
NJ Bellmawr, Mid-Atlantic 609-931-5303
NJ Clifton, Vantage Comps. 201-777-4100
NJ E. Hanover, State Elctrns. 201-887-2550
NJ Englewood, Powell Elctrns. 201-894-0800
NJ Pennsauken, Newark Elctrns. 609-663-9490
NJ Rahway, R.S.R. Elctrns., Inc. 201-381-8777
NJ Randolph, Mouser Elctrns. 201-328-3322
NJ Union, Newark Elctrns. 908-851-2290
NM Albuquerque, Bestech 505-298-0034
NM Albuquerque, Betatron 505-821-1122
NM Albuquerque, Connecting Comps. 505-345-8921
NM Albuquerque, Newark Elctrns. 505-883-6181
NY Bohemia, Car Lac Indl. 516-567-4200
NY Bohemia, Key Comps. 516-567-7500
NY Cheektowaga, Newark Elctrns. 716-862-9700
NY Comack, Car Lac Indl. 516-493-0556
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Long Island, All American 516-981-3935
NY Mt. Vernon, All American/QAR 914-699-2224
NY Redcreek, Advacom 315-754-8796
NY Smithtown, Vantage Comps. 516-543-2000
NY Syracuse, Newark Elctrns. 315-437-6611
NY Valley Stream, Newark Elctrns. 516-561-8400
NC Cary, Powell Elctrns. 919-467-1212
NC Greensboro, Newark Elctrns. 919-292-7240
NC Raleigh, Component Distrs. 919-859-3391
NC Raleigh, Newark Elctrns. 919-781-7677
OH Bedford, Advacom 216-439-0321
OH Cincinnati, Newark Elctrns. 513-771-9700
OH Cleveland, Car Lac Indl. 216-881-0050
OH Columbus, Wedemeyer Elctrns. 614-436-9600
OH Warrensville Hgts., Newark Elctrns. 216-587-1700
OK Oklahoma City, Newark Elctrns. 405-495-5000
OK Tulsa, Newark Elctrns. 918-832-7004
OR Eugene, Newark Elctrns. 503-484-2158
OR Portland, Newark Elctrns. 503-257-0741
PA Cornwall Hgts., Newark Elctrns. 215-245-7300
PA Export, Advacom 412-733-5910
PA Levittown, G.W. Elctrns. 215-547-7422
PA McKean, Advacom 814-476-7774
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, Newark Elctrns. 412-788-4790
SC Greenville, Newark Elctrns. 803-288-9610
SC N. Charleston, Newark Elctrns. 803-764-3091
TN Brentwood, Newark Elctrns. 615-371-1341
TN Memphis, Newark Elctrns. 901-365-8060
TX Allen, Prime Distrs. 214-231-0170
TX Austin, Carlton Bates 512-458-1175
TX Dallas, All American 214-231-5300
TX Dallas, Component Distrs. 214-644-0373
TX Dallas, Off The Shelf 214-247-0052
TX Ft. Worth, Carlton Bates 817-831-0395
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elctrns. 713-270-4800
TX Irving, Powell Elctrns. 214-550-0547
TX Mansfield, Mouser Elctrns. 817-483-0165
TX Richardson, Off The Shelf 214-238-0808
UT Provo, Omega Elctrns. 801-375-4664
UT Salt Lake City, Newark Elctrns. 801-484-8611
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VT Burlington, Newark Elctrns. 802-860-1856
VA Arlington, Newark Elctrns. 703-522-7552
VA Richmond, Newark Elctrns. 804-282-5671
WA Bellevue, Newark Elctrns. 206-641-9800
WA Spokane, Newark Elctrns. 509-327-1935
WV Dunbar, Newark Elctrns. 304-768-6872
WI Green Bay, Newark Elctrns. 414-494-1660
WI New Berlin, Nep Elctrns. 414-785-9100
WI Wauwatosa, Newark Elctrns. 414-453-9100
Can Dartmouth, NS, Arcom Elctrns. 902-464-1600
Can Laval, PQ, Newark Elctrns. 514-681-6476
Can London, Ont., Newark Elctrns. 519-685-4280
Can Mississauga, Ont., Newark Elctrns. 416-673-5449
Can Nepean, Ont., Carsten Elctrns. 613-725-9250
Can New Westminster, BC, Newark Elctrns. 604-520-5721
Can Scarborough, Ont., Carsten Elctrns. 416-495-7705
Can St. Laurent, PQ, Carsten Elctrns. 514-334-8321
Can St. Laurent, PQ, Newark Elctrns. 514-738-4488

CIRCUITECH, INC., Division of Heyco, Inc., 542 Industrial Way West, Eatontown, NJ 07724, Tel: 201-542-6550, FAX: 201-542-1612; Empl.: 80; *Sls. Mgr.:* Ron Calvo

CIRCUIT IMAGES, INC., 1600 NW 167th Pl, Ste. 345, Beaverton, OR 97006, Tel: 503-629-2133, FAX: 503-645-9857; Empl.: 5; *Sls. Mgr.:* Tom Stevenson

CIRCUIT SPECIALISTS, INC., 738 S. Perry Lane, Tempe, AZ 85281, Tel: 602-966-0764, FAX: 602-967-2539

CIR-Q-TEL MICROWAVE, INC., 6600 Virginia Manor Rd., Beltsville, MD 20705, Tel: 301-470-2900, FAX: 301-776-3882; FSC No.: 21377; Empl.: 17; *Sls. Mgr.:* Henry D. Nibbe

CIRRIS SYSTEMS CORP.

FAX: 801-973-4609

CIRRIS SYSTEMS CORP., 1991 Parkway, Salt Lake City, UT 84119, Tel: 801-973-4600, 800-441-9910, TELEX: 446786; Empl.: 30; *Sls. Mgr.:* Brent Stringham ..... **D•1235**

CIRRUS LOGIC, INC., 3100 West Warren Ave., Fremont, CA 94538, Tel: 415-623-8300, TELEX: 171918, FAX: 415-226-2180; Empl.: 420; *Sls. Mgr.:* William Caparelli; *Dist. Mgr.:* Frank Reynolds

CITIZEN BUSINESS MACHINES, See CBM America Corporation

CP Clare CORPORATION

FAX: 312-262-7819

C.P. CLARE CORP., 3101 W. Pratt Blvd., Chicago, IL 60645, Tel: 312-262-7700, TELEX: 210075; Empl.: 2400; *Sls. Mgr.:* Thomas Cunneen; *Dist. Mgr.:* William Sowa ..... **B•1396, 1430-1431**

Local Sales Offices & Reps

AL Decatur, El Tech Inc. 205-353-7899
AL Huntsville, El Tech Inc. 205-464-0599
AZ Scottsdale, Summit Sls. 602-998-4850
CA El Toro, C.P. Clare Corp. 714-586-0650
CA Los Angeles, Landa & Assocs. 213-879-0770
CA San Diego, Gary Chilcote Assocs. 619-728-7678
CA San Jose, Ruppert Sls. & Engrg. 408-998-8717
CA Santa Ana, Landa & Assocs. 714-543-7805
CO Broomfield, Western Region Mktg. 303-428-8088
CT Stamford, Fran Bigoa 203-322-0240
FL Altamonte Springs, Sls. Engrg. Concepts 407-682-4800
FL Deerfield Beach, Sls. Engrg. Concepts 305-426-4601

GA Lilburn, El Tech Inc. 404-564-1236
IL Itasca, Beta Tech Sls., Inc. 708-250-9586
IN Indianapolis, Schank Elctrn. Mktg. 317-842-6204
IA Cedar Rapids, Delltron Co. Inc. 319-393-0075
KY Fort Wright, El Tech Inc. 606-331-3495
MD Baltimore, Advanced Tech Sle Inc. 301-323-3140
MA Tewksbury, Procomp Assoc. 508-858-0100
MI Farmington Hills, Schank Elctrn. Mktg. 313-626-2551
MN Eden Prairie, High Technlg. Sls. Assocs. 612-944-7274
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Kansas City, Delltron Co., Inc. 816-436-6445
NJ Fort Lee, Nexus Technlg. Sls. 201-947-0151
NM Albuquerque, Summit Sls. 505-345-5003
NY Hicksville, C.P. Clare Corp. 516-933-3645
NY Rochester, Electra Sls. Corp. 716-427-7860
NY Syracuse, Electra Sls. Corp. 315-463-1248
NC Raleigh, Zucker Assocs. 919-782-8433
OH Cleveland, Baehr, Greenleaf & Assoc. 216-892-1770
OH Dayton, Baehr-Greenleaf & Assocs. ... 513-439-0724
OH Worthington, Baehr-Greenleaf & Assocs. 614-847-0220
OR Portland, Westmark Elctrns. Inc. 503-641-8780
PA Erdenheim, Omni Sls. 215-233-4600
PA Warrendale, Baehr-Greenleaf & Assocs. 412-934-3088
TX Austin, Norcom Inc. 512-451-2757
TX Dallas, Norcom Inc. 214-386-4888
TX Houston, Norcon Inc. 713-778-0392
UT Salt Lake City, Western Region Mktg. 801-268-9768
WI Milwaukee, Beta Tech Sls., Inc. 414-543-6609
WA Bellevue, Westmark Elctrns. Inc. 206-454-1944
Can Dorval, Que., John G. Weiss Co. Ltd. .. 514-685-6644
Can Mississauga, Ont., John G. Weiss Co. Ltd. 416-673-0011

CLARCOR TUBULAR PRODUCTS, Clarcor, Box 7007, Rockford, IL 61125, Tel: 815-962-8867, FAX: 815-962-0417; Empl.: 2000; *Sls. Mgr.:* Douglas W. Franklin

CLARKE-HESS COMMUNICATIONS RESEARCH CORP., 220 West 19th St, New York, NY 10011, Tel: 212-255-2940, TELEX: 238667-RAPID NYK, FAX: 212-691-8158; FSC No.: 34423; Empl.: 14 ..... **D•1236-1237**

Local Sales Offices & Reps

CT Manchester, ICS Assocs. 203-649-3765
IL Chicago, Pat Lind Elctrns. 312-726-3513
IN Indianapolis, Pat Lind Elctrns. 317-632-7444
MA Westford, ICS Assocs. 617-692-3545
MN Circle Pines, Pat Lind Elctrns. 612-786-5770
OR Wilsonville, Syntek 503-682-2750
WI Milwaukee, Pat Lind Elctrns. 414-224-0146

HAWKER SIDDELEY CLAROSTAT

FAX: 603-742-0481

CLAROSTAT MFG. CO., INC., Hawker Siddeley, PLC., 1 Washington St, Dover, NH 03820-1507, Tel: 603-742-1120,800-872-0042, TELEX: MCI 6713344; FSC No.: 12697; Empl.: 900; *Sls. Mgr.:* Al Tapscott; *Dist. Mgr.:* Al Tapscott ..... **A•2030; B•1888**

Local Sales Offices & Reps

AL Huntsville, El Com 205-830-4001
AZ Phoenix, More Sls. 602-788-9181
AR Little Rock, J. Y. Schoonmaker 501-375-2168
CA Irvine, Gravley & Assocs. 714-852-9994
CO Englewood, Purdy Co. Assocs. 303-790-2230
CT Meriden, Delta Conn Corp. 203-238-1240
FL Coral Springs, HHP Assocs., Inc. 305-753-8389
FL Palm Bay, H H P Assocs. 407-951-9236
FL Tarpon Springs, H H P Assocs., Inc. ... 813-937-6099
FL Winter Park, HHP Assocs., Inc. 407-740-0320
GA Atlanta, ELCOM 404-594-1392
IL Rolling Meadows, Sumer, Inc. 708-991-8500
IN Fort Wayne, Needler Sls. 219-447-2123
IN Indianapolis, Needler Sls. 317-255-8056
MI Farmington Hills, W.R. Hummon & Assocs., Inc. 313-474-0661
MN St. Paul, Cahill, Schmitz & Cahill, Inc. 612-646-7217
MO St. Louis, K K B & Co. 314-647-2400
NH Home Off., Clarostat 603-742-1120, 1-800-872-0042
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NY Manhasset, Win-Cor Elctr. Sls. 516-627-9474
NY Syracuse, L. D. Allen 315-437-8387
NC Raleigh, C-Tech Sls., Inc. 919-782-8100
OH Dayton, K.W. Elctrn. Sls. 513-890-2150
OH Shaker Hgts., K.W. Elctrn. Sls. 216-491-9177
NM Albuquerque, More Sls., Inc. 505-255-6265
OR Beaverton, Electronic Sources, Inc. ... 503-627-0838
PA Pittsburgh, K.W. Elctrn. Sls. 412-366-9396
TX Dallas, J. Y. Schoonmaker 214-349-1650
WA Bellevue, Elctrn. Sources, Inc. 206-451-3500
WI Brookfield, Sumer 414-784-6641

CLARY CORP., Precision Instrs. Div., 320 W. Clary Ave., San Gabriel, CA 91776, Tel: 818-287-6111, FAX: 818-286-7216; Empl.: 1000; *Sls. Mgr.:* Stewart Nowak; *Dist. Mgr.:* Chris Dean

CLAUSS CUTLERY CO., Alco Industries, 223 N. Prospect St., Fremont, OH 43420, Tel: 419-332-7344, 800-225-2877, FAX: 419-332-8077; Empl.: 90; *Sls. Mgr.:* Thomas D. Reinert; *Dist. Mgr.:* Thomas D. Reinert

CLEAN ROOM PRODS., 1800 Ocean Ave., Ronkonkoma, NY 11779-6528, Tel: 516-588-7000, TELEX: 645151; Empl.: 110; *Sls. Mgr.:* Robert S. Kearton

CLEARPOINT RESEARCH CORP., 35 Parkwood Drive, Hopkinton, MA 01748, Tel: 508-435-2000, FAX: 508-435-7504; Empl.: 300; *Sls. Mgr.:* Dennis Kirshy

CLEVELAND CRYSTALS, Box 17157, Euclid, OH 44117, Tel: 216-486-6100, TWX: 810-421-8031, FAX: 216-486-6103; FSC No.: 8K400; Empl.: 46; *Sls. Mgr.:* P. D. Marlowe

CLIFFORD OF VERMONT, INC., Route 107, P.O. Box 51, Bethel, VT 05032, Tel: 802-234-9921, 800-451-4381, FAX: 802-234-5006; Empl.: 47; *Sls. Mgr.:* John F. Baxter

CLIFTON PRECISION, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, Tel: 215-622-1000, TWX: 510-669-9782, FAX: 215-623-6344; FSC No.: 86197; Empl.: 1000; *Sls. Mgr.:* C.Scalies ..... **B•1251**

Local Sales Offices & Reps

AL Huntsville, L&D, Inc. 205-837-1469
AZ Phoenix, Clifton Precision 602-242-0911
CA Cupertino, Clifton Precision 408-996-7507
CA Ontario, Clifton Precision 714-983-9374
CA San Clemente, Clifton Precision 714-492-6904
CO Denver, Motion Technlg. 303-757-3003
FL Sorrento, Boetto Corp. 904-735-0077
KS Lenexa, Midtec Assoc., Inc. 913-541-0505
MA W. Newton, Larcom Inc. 617-244-2053
MI Grand Rapids, Midwest Meridian 616-698-7391
MN Eden Prairie, PWC, Inc. 612-934-1409
MO St. Louis, Midtec Assoc. Inc. 314-275-8666
NM Albuquerque, S. W. Sls., Inc. 505-899-9005
OH Lakewood, Midwest Meridian 216-228-8636
PA Clifton Heights, Eastern Sls. 215-622-1000
TX Garland, Cary, McMahill & Assocs. 214-681-1414

CLIMATRONICS, 140 Wilbur Pl., Bohemia, NY 11716, Tel: 516-567-7300, TELEX: 5101007669, FAX: 516-567-7585; Empl.: 46; *Sls. Mgr.:* David Gilmore

CLIPLITE, See Visual Communications

CLOVER ELCTRNS., INC., 136 Hillwood Circle PO Box 972, Newnan, GA 30264, Tel: 404-251-5323, FAX: 404-251-7542; Empl.: 75; *Sls. Mgr.:* Patricia A. Walker

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FAX: 201-471-2811

CML MACARR, A Marine Electric Systems Co., 50 Carol St., P.O. Box 1135, Clifton, NJ 07014-1135, Tel: 201-471-6800; FSC No.: 00062; Empl.: 100; *Sls. Mgr.:* Gary Mandell ..... **D•1009**

Local Sales Offices & Reps

WI Prembine, The Winn Agy. 715-324-6129
MI Detroit, Bill Teplitz Associates 216-439-3265
OH Cincinatti, Teplitz Assocs. 513-481-1648
OH Cleveland, Teplitz Assocs. 216-439-3265
Can Montreal, Metrone 514-483-2323,

CMV SOFTWARE SPECIALISTS INC., 5009 W. 12th St, Sioux Falls, SD 57106, Tel: 605-338-6645

COAST BOOK DISTRIBUTORS, PO Box 18418, Anaheim, CA 92817, Tel: 714-281-0805, FAX: 714-281-0806; Empl.: 2

COAST COIL CO., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016, Tel: 213-936-6188, TELEX: 686103 AMI SPACE ASA; FSC No.: 05254; Empl.: 50

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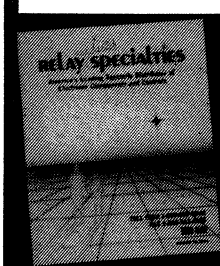
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COASTCOM, P.O. Box 27068, Concord, CA 94527, Tel: 510-825-7500, TWX: 910-481-5781; FSC No.: 415 682-2015; Empl.: 100; *Sls. Mgr.:* John Ehrig

COAX CONNECTION, 1736 Front St., Yorktown Hgts., NY 10598, Tel: 914-962-2303, 800-431-2103, FAX: 914-962-2296; FSC No.: 13-3289669 ..... **C•1155**

COAXIAL DYNAMICS, 15210 Industrial Parkway, Cleveland, OH 44135, Tel: 1-800-COAXIAL, FAX: 216-267-3142; Empl.: 36; *Sls. Mgr.:* R. J. Scott; *Dist. Mgr.:* J. R. Ittel

COAXITUBE CORP., 245 Naylor Mill Rd., Salisbury, MD 21801, Tel: 301-546-3911, FAX: 301-546-3911; FSC No.: OBV02; Empl.: 13

COBER ELECTRONICS, 102 Hamilton Ave., Stamford, CT 06902, Tel: 203-327-0003, TWX: 710-474-3371, FAX: 203-359-6319; FSC No.: 28909; Empl.: 40; *Sls. Mgr.:* Art Fairman

CODAR TECHNOLOGY, INC., 2405 Trade Centre Ave., Longmont, CO 80503, Tel: 303-776-0472, TELEX: 4947090 Codar, FAX: 303-776-1806; Empl.: 125; *Sls. Mgr.:* L.Brose

CODENOLL TECHNOLOGY CORP., 1086 N. Bwy., Yonkers, NY 10701, Tel: 914-965-6300, TELEX: 646159, FAX: 914-965-9811; Empl.: 90; *Sls. Mgr.:* Paul A. O'Brien; *Dist. Mgr.:* Paul A. O'Brien

CODI SEMICONDUCTOR, 144 Market Street, Kenilworth, NJ 07033, Tel: 201-298-0400, FAX: 201-298-0477; Empl.: 49; *Sls. Mgr.:* James R. Beamish

CODY ELECTRONICS, INC., 2284-C Ringwood Ave., San Jose, CA 95131, Tel: 408-432-7570, FAX: 408-432-1891; Empl.: 30; *Sls. Mgr.:* Patrick Sargent

COGEBI, INC., 14 Farady Dr., Dover, NH 03820, Tel: 603-749-6896, FAX: 603-749-6958; Empl.: 20; *Sls. Mgr.:* M. Chaisson

COGENT SOFTWARE, 1030 Pine St., Menlo Park, CA 94025-3405, Tel: 415-324-4360; *Sls. Mgr.:* Jerry M. Seitzman; *Dist. Mgr.:* Leo D. Eskin

COGNEX CORP., 15 Crawford St., Needham, MA 02194, Tel: 617-449-6030, TELEX: 948022, FAX: 617-449-4013; Empl.: 111; *Sls. Mgr.:* Kris Nelson

COGNITRONICS, 25 Crescent St., Stamford, CT 06906, Tel: 203-327-5307, FAX: 203-327-2002; Empl.: 140; *Sls. Mgr.:* Vincent Harrison

COHERENT COMMUNICATIONS SYS. CORP., 60 Commerce Dr., Hauppauge, NY 11788, Tel: 516-231-1550, TELEX: WUI 96-1439, FAX: 516-231-0018; Empl.: 150; *Sls. Mgr.:* William Hendrix

COHERENT GENERAL, INC., Picker Rd., Sturbridge, MA 01566, Tel: 508-347-2681, TELEX: 95-1806, FAX: 508-347-5134; Empl.: 200; *Sls. Mgr.:* William H. Shiner

COHERENT, INC., P.O. Box 10042, Palo Alto, CA 94303, Tel: 415-493-2111, TELEX: 34-8304, FAX: 415-858-7631; Empl.: 1640; *Sls. Mgr.:* Paul Crosby

COHU, INC., Elctrns. Div., 5755 Kearny Villa Rd., San Diego, CA 92123, Tel: 619-277-6700, TELEX: 910-335-1244, FAX: 619-277-0221; FSC No.: 05157; Empl.: 165; *Sls. Mgr.:* Jeff Tyler

COILCRAFT, 1102 Silver Lake Rd., Cary, IL 60013, Tel: 708-639-2361, TELEX: 216378, FAX: 708-639-1469; Empl.: 1200; *Sls. Mgr.:* Larry Thompson ..... **A•1187-1192**

Local Sales Offices & Reps

CA	Rancho Santa Margarita, Stewart Mktg.	714-589-2687
CA	San Jose, Westron	408-997-7332
KS	Olathe, Advanced Tech. Sls.	913-782-8702
MD	Silver Spring, Mid Atlantic Sls. Co.	301-593-7749
MA	Braintree, Coilcraft	617-848-9194
MI	Clark Lake, Dick Trull	517-529-9285
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NY	Rochester, Micro-Tech Mktg.	716-328-1420
NC	Matthews, Coilcraft	704-846-5422
TX	Richardson, Coilcraft	214-437-5597
WA	Kirkland, DMI, Inc.	206-823-4798
Can	Oakville, Ont., Haltronics	800-387-7955

COIL-Q CORP., 340 Bronxville Rd., Bronxville, NY 10708, Tel: 914-337-4775, FAX: 914-779-7109; FSC No.: 55940; Empl.: 12

COIL WINDING EQUIPMENT CO., R.R. Plaza, P.O. Box 660, Oyster Bay, NY 11771, Tel: 516-922-5660, TELEX: 14-3128, FAX: 516-922-5029; Empl.: 25; *Sls. Mgr.:* Joseph Pizzonia

the Colber Corporation

FAX: 201-371-0318

COLBER CORP., 26E Buffington St., Irvington, NJ 07111, Tel: 201-371-9500, TWX: 710-995-4416; Empl.: 50; *Sls. Mgr.:* Roberta Bryner ..... **A•1882-1883**

COLE-FLEX CORPORATION, 91 Cabot Street, West Babylon, NY 11704, Tel: 516-249-6150, TELEX: 358084, FAX: 516-249-6186; FSC No.: 56352; Empl.: 25; *Sls. Mgr.:* Western:Mr. Mike Steffen Midwestern:Joseph Emma

COLE HERSEE CO., 20 Old Colony Ave., Boston, MA 02127-2467, Tel: 617-268-2100, TELEX: 94-0901, FAX: 617-268-9490; *Sls. Mgr.:* E. Carl Price; *Dist. Mgr.:* John R. West

COLE INSTRUMENT CORP

FAX: 714-241-9061

COLE INSTRUMENT CORP., 2650 S. Croddy Way, Santa Ana, CA 92704, Tel: 714-556-3100; FSC No.: 31946; Empl.: 60; *Sls. Mgr.:* P. Hanson; *Dist. Mgr.:* B. Hendricks ..... **B•1660**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445,
AZ	Scottsdale, Advent Comps.	602-481-0044
CA	Los Angeles, Wiley Co.	213-666-1611
FL	Deerfield Bch., Brandel-Stephens	305-427-5441,
FL	Orlando, Brandel-Stephens	407-425-3202
CO	Denver, Advent Comps. Corp.	303-455-1985
IL	Elk Grove, Oasis Sls. Co.	708-640-1850
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792,
MD	Gaithersburg, Carwithen Assocs.	301-921-9545,
MA	Norwood, Tom Maguire & Assocs.	617-551-0500,
CT	Avon, Tom Maguire & Assocs.	203-673-0601
MN	Bloomington, Oasis Sls. Co.	612-941-1917
MO	St. Louis, Harris & Hanson	314-432-3611
NH	Windham, Tom Maguire & Assocs.	603-437-1245
NY	Hauppauge, Aurora Schmitt	516-343-1313
GA	Norcross, Brandel Stephens Co.	404-662-8330
NC	Greensboro, Brandel-Stephens	919-274-6952,
PA	West Chester, TCA	215-692-6853,
TX	Dallas, Control Components Inc.	214-458-8877
WA	Bellevue, Flightlines Intl.	206-454-2026
WI	Brookfield, Oasis Sls. Co.	414-782-6660
EXP	Rishon LeZion, Israel, Elimec Electromechanical Ltd.	972-3 965-1422
Can	Rexdale, Ont., Myelco, Inc.	416-674-1636

COLE-PARMER INSTRUMENT COMPANY, 7425 North Oak Park Avenue, Chicago, IL 60648, Tel: 708/647-7600, TELEX: 28-9405, FAX: 708-647-9660

COLLINS COMMERCIAL AVIONICS, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498, Tel: 319-395-1000, TELEX: 464-421, TWX: 910-525-1321; Empl.: 6,600; *Sls. Mgr.:* S.M. Murchison

Collmer Semiconductor, Inc.

FAX: 214-233-0481

COLLMER SEMICONDUCTOR, INC., 14368 Proton Rd., Dallas, TX 75244, Tel: 800-527-0251, 214-233-1589; Empl.: 85; *Sls. Mgr.:* Gene Uecker ... **A•2085; D•1659**

Local Sales Offices & Reps

CA	Mission Viejo, Collmer Semiconductor Inc.	714-582-2188
CA	Playa Del Rey, Corcoran Assocs.	213-823-4589
TX	Dallas, Collmer Semiconductor Inc.	800-527-0251
GA	Alpharetta, Tec Rep Svcs. Inc.	404-664-0869
AZ	Scottsdale, Bill Earl Assoc. Inc.	602-994-3813
CO	Parker, TMA Colorado	305-841-3435
CA	San Jose, Comtech Mktg.	408-249-3330
MN	Minneapolis, Loren Green Assocs.	612-571-6666
MA	Burlington, Collmer Semiconductor	617-229-5822
IN	Frankfort, C-S Elctrn. Sls., Inc.	317-659-1874
NY	Franklin Square, Cooper Simon & Co., Inc.	516-489-0404
NY	Clark Mills, KLM Garner	315-853-6126
NY	Pittsford, KLM Garner	716-381-8350
NC	Cary, Tec Rep Svcs., Inc.	919-467-6444
NC	Charlotte, Tec Rep Svcs. Inc.	704-342-3900
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
PA	Hatboro, AQS Electro	215-674-4421
TN	Brentwood, Tec Rep Svcs. Inc.	615-832-0449
Can	Mississauga, Ont., Source Elctrns. Ltd.	416-676-0830
WI	Waukesha, Collmer Semiconductor, Inc.	414-547-0185
UT	Murray, TMA Colorado	801-483-1009
WA	Redmond, Elctrn. Engrg. Sls.	206-883-3374

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AL	Mobile, Allied Elctrns.	205-476-1875
AZ	Phoenix, Allied Elctrns.	602-437-9080
AZ	Phoenix, Betaron Elctrns.	602-277-0133
AZ	Tucson, Allied Elctrns.	602-797-8260
AR	N. Little Rock, Allied Elctrns.	501-376-0233
CA	Camarillo, Milgray/Los Angeles	805-484-4055
CA	Chatsworth, Allied Elctrns.	818-882-6981
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Irvine, Allied Elctrns.	714-727-3010
CA	Rocklin, Allied Elctrns.	916-632-3104
CA	S. San Francisco, Allied Elctrns.	415-952-9599
CA	San Diego, Allied Elctrns.	619-279-2550
CA	Torrance, Allied Elctrns.	213-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CO	Englewood, Nep Elctrns.	303-799-9898
CO	Littleton, Indelco	303-795-3431
CT	Cheshire, Allied Elctrns.	203-272-7730
CT	Milford, Milgray/Connecticut	203-878-5538
FL	Casselberry, Allied Elctrns.	407-831-3331
FL	Jacksonville, Allied Elctrns.	904-346-0761
FL	Largo, Allied Elctrns.	813-541-4660
FL	Pompano Bch., Allied Elctrns.	305-978-3008
FL	Winter Park, Milgray/Florida	407-647-5747
GA	Duluth, Allied Elctrns.	404-497-9544
GA	Norcross, Allied Elctrns.	404-446-8595
GA	Norcross, Milgray/Atlanta	404-446-9777
IL	Arlington Hgts., Milgray/Chicago	312-253-1212
IL	Des Plaines, Allied Elctrns.	312-803-1040
IL	New Lenox, Allied Elctrns.	815-485-1511
IL	Schaumberg, Marsh Elctrns.	708-240-9290
IL	Wood Dale, Allied Elctrns.	312-860-0007
IL	Wood Dale, Nep Elctrns.	312-595-8500
IN	Indianapolis, Allied Elctrns.	317-876-0448
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
IA	W. Des Moines, Allied Elctrns.	515-223-6488
KS	Lenexa, Allied Elctrns.	913-599-6227
KS	Overland Pk., Milgray/Kansas City	913-236-8800
KY	Louisville, Allied Elctrns.	502-452-2293
LA	Metairie, Allied Elctrns.	504-885-1195
MD	Columbia, Allied Elctrns.	301-381-1560
MD	Columbia, Milgray/Washington	301-621-8169
MA	Billerica, Allied Elctrns.	508-667-7921
MA	Norwood, Allied Elctrns.	617-255-0361
MA	Wilmington, Milgray/New England	508-657-5900
MI	Grand Rapids, Allied Elctrns.	616-949-8200
MI	Livonia, Allied Elctrns.	313-462-0190
MN	Eden Prairie, Allied Elctrns.	612-829-7554
MN	Minneapolis, AEI Elctrns.	612-338-4754
MN	Minneapolis, Marsh Elctrns.	612-831-4840
MO	Earth City, Allied Elctrns.	314-291-7031
NE	Omaha, Allied Elctrns.	402-696-0038
NH	Nashua, Allied Elctrns.	603-883-3006
NJ	Edison, Allied Elctrns.	908-572-9600
NJ	Fairfield, Allied Elctrns.	201-227-8776
NJ	Marlton, Milgray/Delaware Valley	609-983-5010
NJ	Mtn. Laurel, Allied Elctrns.	609-234-7769
NJ	Parsippany, Allied Elctrns.	201-428-3350
NJ	Parsippany, Milgray/New Jersey	201-335-1766
NM	Albuquerque, Betatron Elctrns.	505-821-1122
NY	Fairport, Allied Elctrns.	716-425-3850
NY	Farmingdale, Milgray/New York	516-391-3000
NY	La Grangeville, Allied Elctrns.	914-452-1470
NY	Mineola, Allied Elctrns.	516-248-2360
NY	Pittsford, Milgray/Upstate NY	716-381-9700
NC	Raleigh, Allied Elctrns.	919-876-5845
NC	Raleigh, Milgray/Raleigh	919-790-8094
OH	Cincinnati, Allied Elctrns.	513-771-6990
OH	Cleveland, Milgray/Cleveland	216-447-1520
OH	Solon, Allied Elctrns.	216-248-4200
OH	Worthington, Allied Elctrns.	614-785-1270
OK	Tulsa, Allied Elctrns.	918-664-0844
OR	Portland, Allied Elctrns.	503-245-4225
PA	Camp Hill, Allied Elctrns.	717-975-3570

PA Pittsburgh, Allied Elctrns. 412-367-4124
SC Greenville, Allied Elctrns. 803-288-8835
TN Knoxville, Industrial Elctrns. 615-573-7135
TN Memphis, Allied Elctrns. 901-367-2895
TX Austin, Allied Elctrns. 512-389-3771
TX Dallas, Allied Elctrns. 214-553-4370
TX Dallas, Milgray/Dallas 214-248-1603
TX El Paso, Allied Elctrns. 915-779-6294
TX Ft. Worth, Allied Elctrns. 817-595-3500
TX Humble, Allied Elctrns. 713-446-8005
TX Irving, Allied Elctrns. 214-570-5196
TX Stafford, Milgray/Houston 713-240-5360
UT Salt Lake City, Allied Elctrns. 801-272-4999
UT Salt Lake City, Milgray/Utah 801-272-4999
VA Alexandria, Allied Elctrns. 703-750-8206
VA Virginia Bch., Allied Elctrns. 804-363-8662
WA Seattle, Allied Elctrns. 206-547-2827
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Allied Elctrns. 414-796-1280
WI New Berlin, Nep Elctrns. 414-785-9100
Can Pointclaire, Que., Milgray/Montreal 514-426-5900
Can Willowdale, Ont., Milgray/Toronto 416-756-4481



FAX: 303-667-3500

COLORADO CRYSTAL CORP., 2303 W. 8th St, Loveland, CO 80537, Tel: 303-667-9248; FSC No.: 33096; Empl.: 75; *Sls. Mgr.:* David Lind ..... **A•1322**

Local Sales Offices & Reps

CA Calabasas, Shel Schreiber Assocs. ... 818-703-8083
CA Los Altos, Kolm Mktg. Assoc. 415-948-2635
IL Northfield, Feller Assocs. Inc. 800-776-7369
IA Cedar Rapids, Barnes Wes Tech Assoc. 319-393-9790
KS Overland Park, Barnes Midwest Sls. .. 913-469-9688
MD Kensington, Koebert Assocs. Inc. 301-493-8924
MA Randolph, Bengal 617-961-4120
OR Beaverton, L. D. Elctrns. 503-649-6177
PA Glenside, Koebert Assocs. Inc. 215-887-2310
TX Austin, Oeler & Menelaides 512-453-0275
TX Dallas, Oeler & Menelaides 214-361-8876
TX Houston, Oeler & Menelaides 713-682-7001
WA Snohomish, L.D. Elctrns. 206-568-0511
WV Inwood, Koebert Assocs. Inc. 304-229-8401

COLORADO DATA SYSTEMS, INC., 3301 W. Hampden Ave., Unit C, Englewood, CO 80110, Tel: 303-762-1640, 800-TEK-4VXI, TWX: 910-933-0193, FAX: 303-781-0253; Empl.: 80; *Sls. Mgr.:* Robert L. Frodge

COLORADO VIDEO, INC., Box 928, Boulder, CO 80306, Tel: 303-530-9580, FAX: 303-530-9569; Empl.: 21; *Sls. Mgr.:* Kirk Fowler

COLORGRAPHIC COMMUNICATIONS CORP., 30341 New Peachtree Rd./P.O. Box 30366, Atlanta, GA 30366, Tel: 404-455-3921, FAX: 404-458-0616; Empl.: 50; *Sls. Mgr.:* Elyse Mintz

COLT ELECTRONICS CO., INC., 15301 West 109th St, Lenexa, KS 66219, Tel: 913-888-1673, FAX: 913-888-3666; *Sls. Mgr.:* Michael S. Lynn

COLT TECHNOLOGY CORP., 15301 West 109th St, Lenexa, KS 66219, Tel: 913-888-1673, FAX: 913-888-3666; Empl.: 95; *Sls. Mgr.:* Jeffrey S. Lynn

COLUMBIA CHASE CORP., HUMISEAL DIV., See HumiSeal Div.

COLUMBIA COMPONENTS, 9 Division St, Sidney, NY 13838, Tel: 607-563-3520; FSC No.: 59178; Empl.: 12; *Sls. Mgr.:* Helen Montren

COLUMBIA ELCTRN. CABLES DIV., See Carol Cable Co., Inc., Columbia Elctrn. Cables Div.

COLUMBIA RESCH. LABS., Macdade Blvd. & Bullens La, Woodlyn, PA 19094, Tel: 215-872-3900, TWX: 510-669-3625, FAX: 215-872-3882; FSC No.: 07571; Empl.: 95; *Sls. Mgr.:* Robert R. Reymos

COLUMBUS INSTRUMENTS, 950 N. Hague Ave., Columbus, OH 43204, Tel: 614-488-6176, TELEX: 246514; *Sls. Mgr.:* Jan Czekajewski

COMAIR ROTRON, A KLI Company, 12 North Street, Saugerties, NY 12477, Tel: 914-246-3615, TELEX: 551496, TWX: 510-247-1941, FAX: 914-246-1176; FSC No.: 5Y921; Empl.: 800; *Dist. Mgr.:* Ralph R. Stevens

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Phoenix, Westrep 602-820-9932
CA Anaheim, Westrep 714-527-2822
CA San Diego, Hadden Assocs. 619-565-9444
CA Santa Clara, Westrep 408-988-8833
CO Littleton, Lange Sls., Inc. 303-795-3600
FL Altamonte Springs, Semtronics 407-831-8233
FL Clearwater, Semtronics 813-461-4675
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL (Northern), Sumer, Inc. 708-991-8500
IN Ft. Wayne, Frank J. Campisano Co. ... 219-486-6443
IN Indianapolis, Frank J. Compisano Co. 317-253-7651
IA Cedar Rapids, S & O Sls. 319-363-8878
MA Chelmsford, J.E. Boeing Co. 508-256-5800
MI Farmington Hills, Rathsburg Assocs., Inc. 313-489-1500
MN Mendota Hgts., G-II Sls., Inc. 612-454-3086
MO Bridgetown, Cen Tech, Inc. 314-291-4230
MO Raytown, Cen Tech, Inc. 816-358-8100
NJ Saugerties, Comair Rotron 201-227-7383
NY Saugerties, Comair Rotron, Inc. 914-246-3615
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Cincinnati, Frank J. Campisano Co. ... 513-574-7111
OH Cleveland, Components, Inc. 216-243-9200
OK Tulsa, Ammon & Rizos Co. 918-749-6116
PA Broomall, L. D. Lowery, Inc. 215-356-5300
TX Austin, Ammon & Rizos Co. 512-454-5131
TX Houston, Ammon & Rizos Co. 713-781-6240
TX Richardson, Ammon & Rizos Co. 214-644-5591
UT Salt Lake City, Lange Sls., Inc. 801-487-0843
WA Seattle, Jas. J. Backer Co. 206-285-1300
WI Brookfield, Sumer, Inc. 414-784-6641
PR Hato Rey, Semtronics 809-766-0700
Can Hamilton, Ont., Cartwright/Southall Assocs., Inc. 416-528-0294
Can Montreal, PQ, McIntyre Agencies Ltd. 514-731-9617
Can Vancouver, Arwin Tech. Sls. 604-980-4557

Local Distributors

CA Garden Grove, Richey/Impact Elctrns. 714-895-0060
CO Aurora, Capstone Elctrns 303-375-1300
IL Chicago, Newark Elctrns. 312-784-5100
MI Livonia, Chelsea/Rs Elctrns 313-525-1155
MN Minneapolis, Sterling Elctrns. 612-831-2666
NM Thief River Falls, Digi-Key Corp. 218-681-6674
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Westbury, Schweber Elctrns. 516-334-7474
TX Dallas, Hall-Mark Elctrns. 214-343-5000
TX Ft. Worth, Allied Elctrns. 817-595-3500
WA Bellevue, Almac Elctrns. Corp. 206-643-9992
WA Seattle, Radar Elec. 206-282-2511
Can Don Mills, Ont., Saynor Varah, Inc. 416-445-0723
Can Scarborough, Ont., Carsten Elctrns. ... 416-495-7705
Can Willowdale, Ont., Electrosonic 416-494-1666

COMARK CORP., 93 West Street, Medfield, MA 02052, Tel: 508-359-8161, FAX: 508-359-2267; Empl.: 35

COMATEL USA, INC., 22 Eagle Rd., Commerce Pk, Danbury, CT 06810, Tel: 203-797-9445, TELEX: 643-011, FAX: 203-790-9298; Empl.: 10; *Sls. Mgr.:* Tim Papp

COMCAB, 8255 Black Run Rd., Nashport, OH 43830, Tel: 614-828-2468, FAX: 614-828-2796; Empl.: 40; *Sls. Mgr.:* Cheryl Mumma; *Dist. Mgr.:* Cheryl Mumma

COMCLOK, INC., 1142 N. Gilbert St, Anaheim, CA 92801, Tel: 714-991-1580, 800-333-9825, 213-836-9592(Tech. Asst.), FAX: 714-491-9825; Empl.: 30; *Sls. Mgr.:* Herb Plumhoff ..... **A•1323**

Local Sales Offices & Reps

CA Arcadia, HMC 818-447-0958
CA San Jose, Blue Elctrns. Sls. 408-248-4399
CO Denver, Electrophase 303-296-0443
TX Rockwall, Eatman Mfg. Rep. 214-771-1903

Local Distributors

CA Fountain Valley, Ecliptek 714-963-4009
CA Stanton, Inductive Comps. 714-828-3420
CA Sunnyvale, Target Elctrns. 408-734-5611

COMDATA CORP., 7900 N. Nagle Ave., Morton Grove, IL 60053, Tel: 708-470-9600

COMLINEAR CORP., 4800 Wheaton Drive, Fort Collins, CO 80525, Tel: 303-226-0500; FSC No.: 62839; Empl.: 160; *Sls. Mgr.:* John Perzow; *Dist. Mgr.:* Bill Henderson

COMM CON CONNECTORS INC., 4111 Ocean View Blvd., Montrose, CA 91020, Tel: 818-957-2018, FAX: 818-957-4851; Empl.: 13; *Sls. Mgr.:* Robert Farnum; *Dist. Mgr.:* James Orr ..... **C•1323**

Local Sales Offices & Reps

AL Huntsville, Effective Mktg. Force 205-233-2947
AZ Tempe, Elctrn. Tech. Sls. 602-921-7122
CA Montrose, Signal Entprs. 818-957-0640
CA Napa, Stewart/Fullerton Assoc. 707-258-1160
CT New Fairfield, Sales Engrg. 203-746-6905
GA Atlanta, Effective Mktg. Force 404-948-6023
IL Wheaton, CS Tech. Sls. 708-653-8126
NH Salem, Sales Engrg. 603-893-5521
NC Raleigh, Effective Mktg. Force 919-867-6221
OR Portland, Caruso & Assoc. 503-246-5439
PA Souderton, Intek Inc. 215-723-0433
TX Plano, Connector Specialists Inc. 214-517-1207
Can Markham, Matrix Technlg. Ltd. 416-477-4442

Local Distributors

AZ Phoenix, Be-Switched 602-275-4805
CA Fremont, KEA Elctrns. 415-651-2691
CA Gardena, Cal Switch 213-538-9830
CA Riverside, Elctrn Supp. 714-781-0453
CA Sunnyvale, PSC Elctrns. 408-737-1333
CT Danbury, Heilind Elctrns 203-797-8600
GA Norcross, Century Elctrns. 404-449-3424
IL Chicago, Leeds Electro Comps. 312-625-3800
MA Wilmington, Heilind Elctrns. 508-657-4870
MN Plymouth, Leeds Electro Comps. 612-557-1277
NC Raleigh, Century Elctrns. 919-782-2116
OK Tusla, Radio Inc. 918-587-9123
PA Norristown, Century Elctrns. 215-631-5400
TX Richardson, Duke Elctrns 214-680-3853
WA Vancouver, Interconnect Sls. 206-256-4085
WI Milwaukee, Progressive Image 414-321-4722

COMM/SCOPE, INC., Network Cable Div., P.O. Box 879, Claremont, NC 28610, Tel: 704-324-2200, 800-982-1708, TELEX: 802-166, FAX: 704-459-5099; *Sls. Mgr.:* Nita Hunsucker



FAX: 312-637-8564

COMMUNICATION COIL INC., 2839 N. Narragansett Ave., Chicago, IL 60634, Tel: 312-637-1333; FSC No.: 81815; Empl.: 75; *Sls. Mgr.:* E. Goldman ..... **A•1193, 1665, 2190**

Local Sales Offices & Reps

AZ Chandler, Lindberg & Co. 602-786-9115
CO Denver, Lindberg & Co. 303-758-9033
GA Maitland, E.I.R. Inc. 407-660-9600
IL Chicago, CCI 312-637-1333
MA Brookline, TPG Inc. 617-731-0858
NM Albuquerque, Lindberg & Co. 505-881-1006
OH Beavercreek, Electro-Com 513-427-2696
UT Salt Lake City, Lindberg & Co. 801-277-2643

COMMUNICATION DEVICES, INC., 1-130 McLevin Ave., Scarborough, Ont., CAN M1B3R6, Tel: 416-292-4463, TELEX: 065-25428, FAX: 416-292-4295; Empl.: 70

COMMUNICATIONS INSTRUMENTS, INC., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, Tel: 704-628-1711, TELEX: 577436, FAX: 704-628-1439; FSC No.: 58614; Empl.: 260; *Sls. Mgr.:* R. McClinton ..... **B•1432-1438**

Local Sales Offices & Reps

AL Huntsville, Dean Assocs. 205-534-2255
AZ Phoenix, CPS Assocs. 602-246-1097
CA Santa Clara, Ross Mktg. 408-988-8111
CO Denver, Con-Tek Mktg. 303-973-8490
CT Torrington, Phoenix Sls. 203-496-7709
FL Oviedo, Conley & Assocs. 305-365-3283
GA Atlanta, Dean Assocs. 205-534-2255
IL Arlington Hts., MB Sls. 312-392-9499
IN Kokomo, Schillinger Assocs. 317-455-2708
IA Cedar Rapids, C. H. Horn & Assocs. .. 319-393-8703
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MA Needham, Component Technlg., Inc. .. 617-449-8490
MI Grosse Pointe Park, Greiner Assocs., Inc. 313-499-0188
MN North Mankato, El Sls. 507-345-5786
NY Babylon, ASTROREP 516-422-2500
NY Syracuse, M. M. Hare Co. 315-457-6859
NC Raleigh, Godwin Assocs. 919-878-8000
OH Vandalia, Stegman Blaine 513-890-7975
PA Philadelphia, Tech. Sls. Assoc. 215-784-0170
WA Seattle, Eclipse Mktg. 206-885-6991
Can Montreal, Que., Empro Sls. Co. 514-341-6420
Can Richmond Hill, Ont., Renmark Elctrns., Ltd. (Off. No. 1) 416-881-8844

Local Distributors

AZ Tempe, Time Elctrns. 602-967-2000
CA Anaheim, Time Elctrns. 714-937-0911

CA Chatsworth, Time Elctrns. 818-998-7200
CA San Diego, Time Elctrns. 619-586-1331
CA Santa Ana, Norstan Elctrns. 714-540-4165
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Englewood, Time Elctrns. 303-799-8851
FL Orlando, T & T Prods., Inc. 305-857-2282
FL Orlando, Time Elctrns. 305-841-6565
GA Norcross, Time Elctrns. 404-448-4448
IL Wood Dale, Time Elctrns. 312-350-0610
MD Columbia, Time Elctrns. 301-964-3090
MA Peabody, Time Elctrns. 617-532-6200
NJ Pine Brook, Time Elctrns. 201-582-4611
NY Hauppauge, Time Elctrns. 516-273-0100
NY Lynbrook, Peerless Radio 516-593-2121
NY Centereach, Gemcap Comps. 516-736-0069
OH Dublin, Time Elctrns. 614-761-1100
OR Portland, Time Elctrns. 503-684-3780
PA King of Prussia, Time Elctrns. 215-337-0900
TX Carrolton, Time Elctrns. 214-241-7441
TX Houston, Time Elctrns. 713-530-0800
UT Salt Lake City, Time Elctrns. 801-973-8181
WA Redmond, Time Elctrns. 206-882-1600

COMMUNICATIONS SYS. TECHNOLOGY, INC., 2018 Rhodes Street, Hermosa Beach, CA 90254, Tel: 213-374-3849; Empl.: 4; *Sls. Mgr.:* A.L. Perry

COMPAC™

FAX: 516-585-3534

COMPAC, 1320-13 Lincoln Ave., Holbrook, NY 11741, Tel: 516-585-3400; FSC No.: 62099; Empl.: 35; *Sls. Mgr.:* Peter C. Rao ..... **C•1021-1025**

Local Sales Offices & Reps

GA Atlanta, EMA Inc. 404-448-1215
TX Dallas, Talo Products 214-644-6010
SC Greenville, EMA Inc. 803-233-4637
CA Westlake Village, CAL-Rep. 818-991-1940
AL Huntsville, EMA Inc. 205-837-7363
CA Campbell, Senah 408-374-1031
MA Haverill, L-K Assoc. 617-373-1313
MO St. Louis, Abrams & Assocs. 314-569-0447
NC Raliegh, EMA Inc. 919-847-8800
OR Portland, Temper Tech Mktg. 503-292-8201
VA Fairfax, Schibley Assocs. 703-591-3008

Local Distributors

CA Cupertino, DC Elctrns. 408-996-8858

COMPACT POWER COMPANY, 17282 Orange Drive, Yorba Linda, CA 92686, Tel: 714-996-5826; *Sls. Mgr.:* Charles Lindberg ..... **D•2183**

COMPACT SOFTWARE, INC., 483 McLean Boulevard, Paterson, NJ 07504, Tel: 201-881-1200, TELEX: 130073, FAX: 201-881-8361; FSC No.: 43304; Empl.: 60; *Sls. Mgr.:* Ray Pengelly; *Dist. Mgr.:* Scott Wheelis

COMPAR, D.G.W. Electronics Corporation, 85 Spy Ct., Markham, Ontario, Canada L3R 4Z4, Tel: 416-475-8500, FAX: 416-475-4158; Empl.: 36; *Sls. Mgr.:* Rick Lewis

COMPAS, 100 Chimney Point Dr., Ogdensburg, NY 13669, Tel: 315-393-3573, FAX: 315-393-7638; Empl.: 350; *Sls. Mgr.:* James L. Clare

COMPEX CORP., Taunton Professional Park, 238 Taunton Blvd., Medford, NJ 08055, Tel: 609-596-9388, FAX: 609-596-3482; Empl.: 24

COMPIX, INC., 16195 SW 72nd St., Tigard, OR 97224, Tel: 503-639-8496; Empl.: 14; *Sls. Mgr.:* James G. Walcutt-VP Sls. Mktg.

COMPLIANCE DESIGN INC., 593 Massachusetts Ave., Boxboro, MA 01719, Tel: 508-264-4668, TWX: 317-632-DASH; *Sls. Mgr.:* Chip Digirolamo

COMPONENT GENERAL, INC., 2445 Success Dr., Odessa, FL 33556, Tel: 813-376-6655, FAX: 813-372-9096; Empl.: 30; *Sls. Mgr.:* Thomas Floridio

Local Sales Offices & Reps

CA Santa Ana, Landa & Assocs., Inc. 714-543-7805
CA Los Angeles, Landa & Assocs., Inc. ... 213-879-0770
CA Mountain View, Bridge Mktg. 415-965-8045
DC Washington, M. Lader Co. 1-800-442-3177
GA Lawrenceville, M. Lader Co. 404-264-8111
MA N. Andover, Bee Assoc. 508-475-2124
MN Minneapolis, Comstrand 612-788-9234
MO Grandview, R. R. Burton 816-763-5385
NY Buffalo, Upstate Engrg. Sls. 716-632-0011
NY Rochester, Upstate Engrg. Sls. 716-225-2383
PA Conshohocken, M. Lader Co. 215-825-3177, 1-800-442-3177
PA Murrysville, Pittsburgh Sls. Assoc. 412-327-3268
TX Austin, Allied Comps., Inc. 512-331-4494
TX Dallas, Allied Comps., Inc. 214-238-0408
TX Ft. Worth, Allied Comps., Inc. 817-589-0456
EXP Odessa, FL, Comp. Gen. Inc. 813-376-6655

COMPONENT MFG. SVC., INC., 1 Component Park, W. Bridgewater, MA 02379, Tel: 508-580-0111, FAX: 508-559-9893; Empl.: 600; *Sls. Mgr.:* Scott Allen; *Dist. Mgr.:* Wayne Douglas

COMPONENT RESEARCH CO. INC., 1655-26 St., Santa Monica, CA 90404, Tel: 213-829-3615, FAX: 213-829-9584; FSC No.: 12517;Multiple; Empl.: 230; *Sls. Mgr.:* Sylvia Kellerman ..... **A•1022-1050**

Local Sales Offices & Peps

SC Greenville, Walter Lamphier 803-232-4687

COMPONENTS CORP., 6 Kinsey Pl., Denville, NJ 07834, Tel: 201-627-0290, FAX: 201-361-5801; FSC No.: 26364; Empl.: 20; *Sls. Mgr.:* Fred Bielenberg

COMPONENTS ELECTRONICS CORP., 629A Lowther Rd., Lewisberry, PA 17339, Tel: 717-938-4151, FAX: 717-938-5910; Empl.: 45; *Sls. Mgr.:* J.Galli; *Dist. Mgr.:* J.Galli

COMPONENT SPECIALTIES CORP., 9143 E. La Rosa Dr., Temple City, CA 91780, Tel: 213-283-0015, FAX: 818-287-7189; FSC No.: 28984; Empl.: 45; *Sls. Mgr.:* D.R. Heins

COMPUCART, Versa Tec, P.O. Box 2095, Tampa, FL 33601-2095, Tel: 800-237-9024, 813-251-2431; Empl.: 25

COMPU-CRAFT FABRICATORS INC., 669 Mary St., Warminster, PA 18974, Tel: 215-443-7107, FAX: 215-443-7195; FSC No.: 76977; Empl.: 18; *Sls. Mgr.:* Stephen Dalton

COMPU-MECH INC., 2375 Dorr St., Toledo, OH 43607, Tel: 419-535-6702, TWX: 510-601-7362, FAX: 419-535-0805; *Sls. Mgr.:* John Stanley III

COMPUMOTOR DIVISION, Parker Hannifin Corp., 5500 Business Park Dr., Rohnert Park, CA 94928, Tel: 707-584-7558, FAX: 707-584-8015; Empl.: 150; *Sls. Mgr.:* K. McNicholas; *Dist. Mgr.:* A. Wales

COMPUTER AVIONICS, See CAC Microcircuits, Inc.

COMPUTER CABLE & PRODS., INC., Vertex Computer Cable & Products

COMPUTER COMPONENTS INC.

FAX: 914-738-6706

COMPUTER COMPONENTS, INC., 629 Fifth Ave., Pelham, NY 10803, Tel: 914-738-1611; FSC No.: 12965; Empl.: 25; *Sls. Mgr.:* John Hunsicker; *Dist. Mgr.:* John Hunsicker ..... **B•1399**

COMPUTER CONVERSIONS CORP., 6 Dunton Ct., E. Northport, NY 11731, Tel: 516-261-3300, FAX: 516-261-3308; FSC No.: 51086; Empl.: 100; *Sls. Mgr.:* S. J. Renard ..... **D•1150-1151**

Local Sales Offices & Reps

IN Mishawaka, Engrd. Sls. 219-255-5111
WI Delavan, Clawson Controls 414-728-8325
MA Brookline, Technology Prod. Grp. 617-731-0858
MI Newport, Industrial Sensors, Inc. 313-289-3374
NY Moravia, Electrotech Sys. 315-497-1598
OH Cincinnati, Rilco 513-271-0630
PA Ingoma, Greye Glass 412-366-6664
TX Lewisville, Automated Dynamics 214-221-0052

COMPUTER DEVICES, 34 Linnell Cir., Nutting Lake, MA 01865, Tel: 508-663-4980, TELEX: 949398; Empl.: 30; *Sls. Mgr.:* Sandra R. Clark

COMPUTER DOCTORS, 9204-B Baltimore Blvd., College Park, MD 20740, Tel: 1-800-RAM-STAR, 301-474-3095, FAX: 301-474-0805

COMPUTER DYNAMICS SALES, 107 S. Main St., Greer, SC 29650, Tel: 803-877-8700, FAX: 803-879-2030; *Sls. Mgr.:* Barry Steele

COMPUTER INSTRUMENTS CORP., 1000 Shames Drive, Westbury, NY 11590, Tel: 516-476-8400, FAX: 516-876-9153

COMPUTER INSTRUMENTS DIV., 100 Madison Ave., Hempstead, NY 11550, Tel: 516-483-8200, TWX: 510-222-4189, FAX: 516-483-8327; Empl.: 65; *Sls. Mgr.:* Cary Ratner

COMPUTERIZED COIL WINDERS, INC., 5 W. Kenosia Ave., Danbury, CT 06810, Tel: 203-744-6715, FAX: 203-798-7563; Empl.: 6

COMPUTER MAINTENANCE CORP., 405 Murray Hill Pkwy, East Rutherford, NJ 07073, Tel: 201-896-0707, FAX: 201-896-8503; Empl.: 105; *Sls. Mgr.:* Arthur Young

COMPUTER OPTICAL PRODUCTS, INC., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, Tel: 818-882-0424, TELEX: 18-33-73-UD, FAX: 818-882-0492; Empl.: 50; *Sls. Mgr.:* David Richards

COMPUTER PERIPHERALS INC., 667 Rancho Congo Blvd., Newbury Pk., CA 91320, Tel: 805-499-5751, 800-854-7600, TELEX: 759299CPI, FAX: 805-498-8848; Empl.: 100; *Sls. Mgr.:* Davius Antia; *Dist. Mgr.:* Mike Krunic

COMPUTER POWER INC., 124 W. Main St., High Bridge, NJ 08829, Tel: 908-638-8000, 800-526-5088, TELEX: 847481, FAX: 908-638-4931; FSC No.: 3643; Empl.: 170; *Sls. Mgr.:* John Deliman; *Dist. Mgr.:* Angela Anderson

COMPUTER PRODUCTS, INC., Measurement & Control Div., 2900 Gateway Dr., Pompano Beach, FL 33069, Tel: 305-974-5500, FAX: 305-979-7371; Empl.: 150; *Sls. Mgr.:* Gene Ackerman

COMPUTER PRODUCTS™ POWER CONVERSION

FAX: 510-683-6400

COMPUTER PRODUCTS INC., Power Conversion America, 3797 Spinnaker Ct. (P.O. Box 5102), Fremont, CA 94537-5102, Tel: 510-657-6700; FSC No.: 62125; Empl.: 1,200; *Sls. Mgr.:* Ken Clouther, VP, Sls.; *Dist. Mgr.:* Emilie Creager, Distbn. Mgr. ..... **D•1500, 1661-1679**

Local Sales Offices & Reps

AZ Phoenix, C.T. Carlberg 602-488-0750
CA Encinitas, Jones & McGeoy Sls. 619-753-6784
CA San Diego, Jones & McGeoy Sls. 714-756-6269
CA Santa Ana, Jones & McGeoy Sls. 714-547-6466
CA Santa Clara, Criterion Sls. 408-988-6300
CO Aurora, Electrodyne 303-695-8903
CT New Milford, Alpha-Omega Sls. 203-354-2923
FL Oviedo, Conley & Assocs. 407-365-3283
GA Norcross, Mountain Electro Mktg. 404-448-5594
IL Itasca, Janus, Inc. 708-250-9650
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
IA Cedar Rapids, Dy-Tronix, Inc. 319-377-8275
KS Leawood, Dy-tronix, Inc. 913-339-6333
KS Wichita, Dy-tronix, Inc. 316-838-0884
MD Columbia, Third Wave Solutions, Inc. 301-290-5990
MA North Reading, Alpha Omega Sls. 508-664-1118
MN Minneapolis, Stan Clothier Co. 612-944-3456
MO Bridgeton, Dy-tronix, Inc. 314-291-4777
NJ Mt. Laurel, Paragon Sls. & Mktg. 609-778-1190
NM Albuquerque, C.T. Carlberg 505-899-2155
NY Binghamton, Empire Tech. Assocs. ... 607-772-0651
NY Rochester, Empire Tech 719-381-8500
NY Rockville Centre, S-J Assocs. 516-536-4242
NY Skaneateles, Empire Tech 315-685-5703
NC Raleigh, Zucker Assocs., Inc. 919-782-8433
OH Cleveland, Elctrn. Salesmasters 216-831-9555
OK Tulsa, Ammon & Rizos 918-749-6116
OR Beaverton, Micro Sls., Inc. 503-645-2841
TX Austin, Ammon & Rizos 512-454-5131
TX Houston, Ammon & Rizos 713-781-6240
TX Richardson, Ammon & Rizos 214-644-5591
UT Salt Lake City, Electrodyne, Inc. 801-264-8050
WA Bellevue, Micro Sls., Inc. 206-451-0568
WI Waukesha, Janus, Inc. 414-542-7575
Can Montreal, Electro Source 514-630-7486
Can Ottawa, Ont., Electro Source 613-592-3214
Can Toronto, Electro Source 416-675-4490
Can W. Vancouver,B.C., Blakewood Elctrns. Sys., Inc. 604-273-9910

Local Distributors

AL Huntsville, Bell Inds. 205-837-1074
AL Huntsville, Lex Elctrns. 205-895-0480
AL Huntsville, Marshall Inds. 205-881-9235
AZ Phoenix, Lex Elctrns. 602-431-0030
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Tempe, Bell Inds. 602-966-7800
CA Canoga Park, Lex Elctrns. 818-999-4702
CA Chatsworth, Marshall Inds. 818-407-4100, 818-880-9680
CA El Monte, Marshall Inds. 818-307-6000
CA Fountain Valley, Bell Micro Products .. 714-963-0667
CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Lex Elctrns. 714-587-0404,213-537-4321
CA Irvine, Marshall Inds. 714-458-5380
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, Bell Micro Products 408-434-1150
CA Milpitas, Marshall Inds. 408-943-4600
CA N. Hollywood, B. J. Wolfe Entprs. 213-877-5518
CA Sacramento, Lex Elctrns. 916-929-9732
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Lex Elctrns. 619-495-0015
CA San Diego, Marshall Inds. 619-578-9600
CA San Jose, B.J. Wolfe Entprs. 408-371-3443
CA San Jose, Lex Elctrns. 408-432-7171
CA Sunnyvale, Bell Inds. 408-745-0400,408-773-1100
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Englewood, Lex Elctrns. 303-799-0258
CO Thornton, Marshall Inds. 303-451-8383
CO Wheat Ridge, Bell Inds. 303-424-1985
CT Oxford, Lex Elctrns. 203-264-4700
CT Wallingford, Marshall Inds. 203-265-3822
FL Altamonte Springs, Lex Elctrns. 407-331-7555
FL Altamonte Springs, Marshall Inds. 407-767-8585
FL Deerfield Bch., Bell Inds. 305-421-1997
FL Deerfield Bch., Lex Elctrns. 305-977-7511
FL Ft. Lauderdale, Marshall Inds. 305-977-4880
FL Largo, Bell Inds. 813-541-4434
FL St. Petersburg, Marshall Inds. 813-576-1399
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Lex Elctrns. 404-449-9170
GA Norcross, Marshall Inds. 404-923-5750
IL Elk Grove, Bell Inds. 312-640-1910
IL Schaumburg, Lex Elctrns. 708-330-2888
IL Schaumburg, Marshall Inds. 312-490-0155
IL Urbana, Bell Inds. 217-328-1077
IN Ft. Wayne, Bell Inds. 219-424-3422
IN Indianapolis, Bell Inds. .. 317-875-8200,317-299-5487
IN Indianapolis, Lex Elctrns. 317-843-1050
IN Indianapolis, Marshall Inds. 317-297-0483
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Lex Elctrns. 319-373-1417
KS Lexena, Marshall Inds. 913-492-3121
KS Overland Park, Lex Elctrns. 913-492-2922
MD Columbia, Lex Elctrns. 301-596-7800
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Andover, Bell Inds. 508-474-8880
MA Teaksbury, Jaco Elctrns. 508-640-0010
MA Wilmington, Bell Micro Products 508-658-0222
MA Wilmington, Jaco Elctrns. 617-273-1860
MA Wilmington, Lex Elctrns. 508-694-9100
MA Wilmington, Marshall Inds. 617-658-0810
MI Ann Arbor, Bell Inds. 313-971-9093
MI Livonia, Lex Elctrns. 313-525-8100
MI Livonia, LWC Distrs. 313-464-7700
MI Livonia, Marshall Inds. 313-525-5850
MN Eden Prairie, Lex Elctrns. 612-941-5280
MN Plymouth, Marshall Inds. 612-559-2211
MO Bridgeton, Marshall Inds. 314-291-4650
NH Hudson, Bell Inds. 603-882-1133
NH Manchester, Lex Elctrns. 603-625-2250
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Mt. Laurel, Lex Elctrns. 609-274-7900
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NJ Pine Brook, Lex Elctrns. 201-227-7880
NM Albuquerque, Bell Inds. 505-292-2700
NY Farmingdale, Bell Inds. 516-752-9303
NY Hauppauge, Lex Elctrns. 516-231-2500
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 607-798-1611
NY Pittsford, Lex Elctrns. 716-383-8020
NY Rochester, Marshall Inds. 716-235-7620
NC Raleigh, Century Elctrns. 919-782-2116
NC Raleigh, Lex Elctrns. 919-876-0000
NC Raleigh, Marshall Inds. 919-878-9882
OH Beachwood, Lex Elctrns. 216-464-2970
OH Dayton, Bell Inds. 513-434-8231,513-435-8660
OH Dayton, Lex Elctrns. 513-439-1800
OH Dayton, Marshall Inds. 513-898-4480
OH Solon, Marshall Inds. 216-248-1788
OH Westerville, Marshall Inds. 614-891-7581
OK Tulsa, Lex Elctrns. 918-665-0277
OK Tulsa, Norvell Elctrns. 918-254-8606
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Marshall Inds. 503-644-5050
OR Lake Oswego, Bell Inds. 503-635-6500
PA Horsham, Lex Elctrns. 215-441-0600
PA Norristown, Century Elctrn. Comps. ... 215-631-5400
PA Pittsburg, Lex Elctrns. 412-963-6807
PA Pittsburgh, Marshall Inds. 412-963-0441
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Norvell Elctrns. 512-837-5555
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Lex Elctrns. 214-247-6300
TX Dallas, Norvell Elctrns. 214-233-0020
TX Houston, Lex Elctrns. 713-977-5383
TX Houston, Marshall Inds. 713-895-9200
TX Houston, Norvell Elctrns. 713-777-1666
TX Richardson, Bell Inds. 214-690-0466
UT Salt Lake City, Bell Inds. 801-255-2477
UT Salt Lake City, Marshall Inds. 801-485-1551
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bothell, Marshall Inds. 206-747-9100
WA Redmond, Bell Inds. 206-867-5410
WA Spokane, Almac Elctrns. 509-924-9500
WI New Berlin, Lex Elctrns. 414-784-9451
WI Waukesha, Bell Inds. 414-547-8879
WI Waukesha, Marshall Inds. 414-797-8400
Can Brampton, Ont., Zentronics 416-451-9600
Can Montreal, Que., Zentronics 514-737-9700
Can Richmond, B.C., Zentronics 604-273-5575
Can Saskatoon, Saskatchewan, Zentronics 306-955-2202
Can Winnipeg, Mani., Zentronics 204-694-1957

COMPUTER SYSTEM ASSOCS., 7564 Trade St., San Diego, CA 92121, Tel: 619-566-3911, TELEX: 333693, FAX: 619-566-0581; Empl.: 15; *Sls. Mgr.:* Bill Reed; *Dist. Mgr.:* Bill Reed

COMPUTER SYSTEM PRODUCTS, 14305 21st Ave. N., Minneapolis, MN 55447, Tel: 612-476-6866, 800-422-2537, FAX: 612-476-6966; Empl.: 50; *Sls. Mgr.:* Mick Maher; *Dist. Mgr.:* Tom Quanbeck

COMPUTER SYSTEMS TECHNICAL SUPPORT, 4015 E. Leaverton Ct., Anaheim, CA 92807, Tel: 714-632-1300, FAX: 714-632-1937; FSC No.: 9J740; Empl.: 13; *Sls. Mgr.:* Reuven Arad

COMPUTERWARE, INC., 8480-I Tyco Rd., Vienna, VA 22182-2266, Tel: 703-821-8200, FAX: 703-821-1746; Empl.: 18; *Sls. Mgr.:* John Dargo

COMPUTERWISE, 302 N. Winchester, Olathe, KS 66062, Tel: 913-829-0600, FAX: 913-829-0810; Empl.: 27; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTROL:AN AEG CO., 239 Ethan Allen Hwy., Ridgefield, CT 06877, Tel: 203-431-2000, TELEX: 643358, FAX: 203-431-2090; Empl.: 45; *Sls. Mgr.:* C. R. Wolfe

COMPUTRON DISPLAY SYSTEMS, Xcel Corporation, 845 Bonnie Lane, Elk Grove Village, IL 60007, Tel: 708-952-8800, FAX: 708-952-0832; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* R. Van Horn; *Dist. Mgr.:* Kathy Privett ..... **B•1057**

COMSPEC DIGITAL PRODUCTS INC., 2313 W. Sam Houston Pkwy. N.S. 145, Houston, TX 77043, Tel: 713-461-4487, FAX: 713-461-8846; Empl.: 15; *Sls. Mgr.:* T. A. Paine; *Dist. Mgr.:* T. A. Paine

COMSTRON A DIV. OF AEROFLEX, 35 S. Service Road, Plainview, NY 11803, Tel: 516-752-2351, TWX: 310-497-3525, FAX: 516-694-6771; Empl.: 120; *Sls. Mgr.:* William J. Meditz

COMTECH MICROWAVE CORP., Comtech Corp., 63 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-4646, TELEX: 221-234 CMTCH; FSC No.: 31196; *Sls. Mgr.:* J. Tardi

COM-2, INC., 1556 Woodland Dr., Saline, MI 48176, Tel: 313-429-9027, FAX: 313-429-1902; Empl.: 70; *Sls. Mgr.:* Robert Green

COMUS INTERNATIONAL, 263 Hillside Ave., Nutley, NJ 07110, Tel: 201-667-6200, FAX: 201-667-6837; *Sls. Mgr.:* Gene Moran ..... **B•1668**

Local Sales Offices & Reps

CA Milpitas, Maxim Elect. Sls. Co. 408-946-6001
CA Newport Beach, Forbes-Pacific 714-722-6174
IL Mundelein, Dynamic Elctrns. Co. 708-566-8350
MA Andover, Grassi Assocs. 508-475-3418
MN Savage, Comps. & Controls 612-890-3002
NJ Westfield, John Abruzzo 201-233-4321
PA Furlong, Avenir, Inc. 215-348-8290
TN Murfreesboro, Control Comps. 615-895-5175
Can Dawn Mills, Ontario, Control Comps. .. 416-447-2128

CONAP, INC., 1405 Buffalo St., Olean, NY 14760, Tel: 716-372-9650, FAX: 716-372-1594; Empl.: 135

CONAX BUFFALO CORPORATION, 2300 Walden Ave., Buffalo, NY 14225, Tel: 716-684-4500, FAX: 716-684-7433; FSC No.: 03688; Empl.: 190; *Sls. Mgr.:* R.C. Paluch

CONCORD ELECTRONICS CORPORATION, 30 Great Jones St., New York, NY 10012, Tel: 1-212-777-6571, TWX: 710-581-4930, FAX: 1-212-995-0161; FSC No.: MFR 18310; Empl.: 225; *Sls. Mgr.:* Josie Wheaton ..... **C•1324-1325, 1595**

Local Distributors

AL Huntsville, Century Fasteners 205-883-5344
AZ Tucson, PSN Distrbn. 602-623-9800
AR Little Rock, Carlton-Bates 501-562-9100
CA Mission Hills, Coast Air 818-898-2288
CA San Jose, Bisco 408-996-8420
CO Denver, CSID/Integrated 303-292-5538
CT Danbury, Heilind 208-797-8600
DE New Castle, Electronics Exchange 302-322-5401
FL Sanford, Electronic Fasteners 407-321-4000
GA Norcross, Atlanta Hardware Specialty 404-449-3000
HI AIEA, Newark Elctrns. 808-487-8951
ID Coeurd' Alene, A-I Consolidated 208-765-3280
IL Franklin Park, Bisco 312-451-1230
IN Indianapolis, Mar Elctrns. 317-633-6699
IA Cedar Rapids, Dee Elctrns. 319-365-7551
KS Wichita, RSC Elex 216-267-5213
KY Bowling Green, Crescent Elctrns. 502-842-2444
LA New Orleans, Radio Pts. 504-581-5959
MD Gaithersburg, MS Elctrns. 301-921-0200
MA Billerica, MS Inserts 508-670-5600
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN New Brighton, Chris ELctrns. 612-631-2647
MS Jackson, Newark Elctrns. 601-956-3834
MO St. Charles, Finnegan Elctrns. 314-946-6201
NE Omaha, Omaha Elctrns. 402-341-3440
NV Reno, Richco 702-323-4939
NH Nashua, Brevan 603-889-7230
NJ Kenilworth, Federated Purchasers 201-272-0505
NM Albuquerque, Electronic Pts. 505-293-6161
NY Bohemia, Car-Lac 516-567-4200
NC Raleigh, Century Elec. Comp. 919-782-2116
OH Dayton, Stotts-Friedman 513-298-5555
OK Tulsa, Altair 918-252-5781
OR Beaverton, Comp. Resources 503-641-8488
PA Philadelphia, PEI Genesis 215-673-0400
RI Pawtucket, Major Edwards 401-725-7400
SC Charleston, Wholesale Indl. Elex 803-577-6388
TN Knoxville, Industrial Elect 615-573-7135
TX Richardson, Aero Glen 214-234-0984
UT Salt Lake City, Kimball Elctrns. 801-328-2075
VT Colchester, Hooker Elctrns. 802-864-0885
VA Springfield, Southern Fasteners 703-922-8048
WA Redmond, Olander 206-881-3488
WV Beckley, State Elec. 304-256-2219
WI Grafton, Lakeview Elex 414-377-8250
EXP Taipei, Taiwan, Gold-Tek Elec. Co. 20-717-2302
Can Mississauga, Ont., Rush Elctrns. 416-677-7280

The Condenser Products Corporation

FAX: 904-799-0221

CONDENSER PRODUCTS CORP., 2131 Broad St., Brooksville, FL 34609, Tel: 904-796-3561; FSC No.: 16727; Empl.: 30; *Sls. Mgr.:* David Bauerschmidt ..... **A•1051**

Local Sales Offices & Reps

TX Lewisville, Elctrn. Prod. Reps. 214-436-4772

CONDOR

FAX: 805-487-8911

CONDOR D.C. POWER SUPPLIES, INC., 2311 Statham Pkwy., Oxnard, CA 93033, Tel: 805-486-4565,; Empl.: 250; *Sls. Mgr.:* Michael F. Kirkowski, Exec. VP Mktg.; *Dist. Mgr.:* Deborah Perez ..... **D•1680-1689**

Local Sales Offices & Reps

AL Huntsville, Adams Elctrns. 205-882-2988
AL Huntsville, The John Todd Co. 205-828-0808
AZ Phoenix, Aztech-CPS Inc. 602-246-1097
AZ Scottsdale, Aztech-CPS Inc. 602-991-6300
CA Fremont, Telesis Sls. Grp. 415-657-8645
CA Glendale, TKI Sls. Co. 818-546-5010

CA	Milpitas, Telesis Sls. Grp.	408-946-7300
CA	Pasadena, A-F Sls. Engrg.	800-696-3442
CA	Westlake Vlg., Elkins & Assoc.	818-597-1075
CO	Denver, AKI Entprs.	303-388-4488
CT	Madison, Focus Elctrns. Sls.	203-245-4314
FL	Altamonte Springs, Semtronic Assoc.	407-831-8233
GA	Lilburn, Adams Elctrns.	404-925-9115
IL	Schaumberg, Engrg. Prods. Assoc.	708-882-7640
IN	Indianapolis, Current Elctrns. Mktg.	317-257-1861
IA	Cedar Rapids, C.H. Horn & Assocs.	319-393-8703
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Overland Park, Lorenz Sls., Inc.	913-469-1312
KS	Wichita, DLE Elctrns.	316-683-6400
MD	Lutherville, J. A. Dougherty Sls.	301-321-7890
MA	Taunton, Focus Elctrns. Sls., Inc.	508-824-3840
MI	Bloomfield Hills, ENCO Mktg., Inc.	313-338-8600
MN	Edina, Engrg. Prods.	612-835-9022
MN	Minneapolis, Electric Comp. Sls.	612-933-2594
MO	St. Louis, John G. Macke Co.	314-432-2830
MO	St. Louis, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Marlton, BGR Assocs.	609-983-1020
NJ	Medford, Comp. Consits.	609-654-5300
NY	Pittsford, C. W. Beach Co.	716-586-3200
NY	Yonkers, Sonkin Assocs.	914-968-8282
OH	Gahanna, Manufacturers Direct Sales	614-476-3310
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
SC	Lilburn, Adams Elctrns.	404-925-9115
TX	Dallas, M Rep	214-484-5711
WA	Redmond, Eclipse Mktg. Grp.	402-475-4660
Can	Toronto, Ont., Duncan Instrs.	416-742-4448
	Local Distributors	
AL	Huntsville, Allied Elctrns.	205-721-3500
AZ	Phoenix, Aerospace S.W.	602-582-2779
CA	Camarillo, Milgray	805-484-4055
CA	Costa Mesa, FLW	714-751-7512
CA	Fremont, FLW	415-651-6511
CA	San Jose, Power & Data Tech.	408-629-3550
CA	Santa Clara, Kent Elctrns.	408-727-9810
CO	Broomfield, Future Elctrns.	303-421-0123
CT	Milford, Milgray	203-878-5538
FL	Ft. Lauderdale, Allied	305-973-7103
FL	Orlando, Hammomd Elctrns.	305-841-1010
FL	Winter Pk., Milgray	407-647-5747
GA	Norcross, Milgray	404-446-9777
IL	Chicago, Dalec Distrs.	312-283-0300
IL	Palatine, Milgray	708-202-1900
IL	Schaumberg, Bortech Sls.	708-882-7640
IN	Indianapolis, Allied Elctrns.	317-875-0448
KS	Overland Pk., Milgray	913-236-8800
MD	Columbia, Vantage	301-720-5100
MD	Marlow Hgts., Allied	301-423-0161
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Billerica, Allied Elctrns.	617-667-7921
MA	Westborough, Future Elctrns.	508-366-2400
MI	Ann Arbor, McNaughton-McKay	313-995-9515
MI	Madison Heights, McNaughton-McKay	313-399-7500
MN	Eden Prairie, Allied Elctrns.	612-829-7554
MN	Edina, Bortech Sls.	612-835-9036
MN	Minneapolis, Aerospace Comp. Prod.	612-884-4725
MO	St. Louis, Future Elctrns.	314-469-6805
NJ	Marlton, Milgray	609-983-5010
NJ	Mt. Laurel, Allied Elctrns.	609-234-7769
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NJ	Parsippany, Milgray	201-335-1766
NY	Elmsford, Kintronics	914-347-2530
NY	Farmington, Milgray	516-391-9800
NY	Mineola, Allied	516-248-2360
NY	Rochester, Future Elctrns.	716-272-1120
NC	Raleigh, Allied	919-876-5845
NC	Raleigh, Milgray	919-790-8094
OH	Cleveland, Milgray	216-447-1520
OR	Portland, Eoff	503-222-9411
PA	McKean, Advacom, Inc.	814-476-7774
PA	Pittsburgh, Allied Elctrns.	412-367-4124
SC	Greenville, Hammond Elctrns.	803-232-0872
TX	Dallas, Cypress Elctrns.	214-869-1435
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Richardson, Future Elctrns.	214-437-2437
UT	Salt Lake City, Future Elctrns.	801-972-8489
UT	Salt Lake City, Milgray	801-272-4999
WA	Seattle, Allied	206-547-2827
WA	Vancouver, Eoff	206-694-7504
Can	Toronto, Ont., Duncan Inst. Ltd.	416-742-4448

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, TELEX: 65-1442, FAX: 818-713-0162; FSC No.: 24321; Empl.: 110

CONDOR SYSTEMS, INC., 2133 Branham Lane, San Jose, CA 95124, Tel: 408-371-9580, FAX: 408-371-9589; FSC No.: 62065; Empl.: 270; *Sls. Mgr.:* Dave Klinger; *Dist. Mgr.:* Ed Brown

CONDUCTIVE RUBBER TECHNOLOGY, INC., 22125 17th Ave. S.E. Ste. 117, Bothell, WA 98021, Tel: 206-486-8559, FAX: 206-487-0945; Empl.: 30; *Sls. Mgr.:* K. Grant

CONDUCTIVE SYSTEM, INC., R.D. No. 1, Box 1040, Rte. 5 South, Amsterdam, NY 12010, Tel: 518-843-5740, FAX: 518-843-5829; Empl.: 25; *Sls. Mgr.:* Eivind Johansen

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777, FAX: 419-729-3779; Empl.: 35

CONKLIN INSTRUMENT CORP., West Rd., P.O. Box 650, Pleasant Valley, NY 12569, Tel: 914-635-2136, FAX: 914-635-2510; Empl.: 110; *Sls. Mgr.:* James Taffer

CONNECT-AIR INTERNATIONAL, INC., 50 37th St. N.E., Auburn, WA 98002, Tel: 206-939-4880, FAX: 206-939-4882; Empl.: 50; *Sls. Mgr.:* Ron Jones

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 10 B Trackside Business Park, Cheshire,, CT 06410, Tel: 203-250-9678, FAX: 203-250-9688; FSC No.: 50974; Empl.: 15; *Sls. Mgr.:* Joseph W. Raines

CONNECTOR ACCESSORIES, INC., See Mueller Elec. Co.

FAX: 312-539-3825

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059; *Sls. Mgr.:* Bill Anthony ..... **C•1326-1327**

CONNECTOR INDUSTRIES OF AMERICA DIV., Microdot Mfg., 10340 Julian Dr., Cincinnati, OH 45215, Tel: 513-772-3680; FSC No.: 32076; Empl.: 60; *Sls. Mgr.:* Bob Cain

FAX: 419-537-0007

CONNECTRONICS CORP., 2745 Avondale Ave., Toledo, OH 43607, Tel: 419-537-0020; FSC No.: 0LE36; Empl.: 15; *Sls. Mgr.:* Thomas L. Ricketts ..... **C•1328**

	Local Sales Offices & Reps	
OH	Toledo, Connectronics	419-537-0020
OH	Troy, S-Tek	513-339-5882
	Local Distributors	
MI	Ann Arbor, S-TEK	313-572-0516

FAX: 708-851-5040

CONNOR-WINFIELD CORP., 1865 Selmarten Rd., Aurora, IL 60505-1335, Tel: 708-851-4722, TELEX: 270244; FSC No.: 5955; Empl.: 35; *Sls. Mgr.:* Tom Grabowski; *Dist. Mgr.:* John Hoag ..... **A•1324-1327**

	Local Sales Offices & Reps	
AL	Huntsville, Dean Assocs.	205-880-8200
AZ	Scottsdale, Spectrum Mktg. Assoc.	602-890-9000
CA	Campbell, Shur Sls.	408-374-5577
CA	San Clemente, ATA	714-661-9700
CA	San Diego, ATA	619-792-6079
CO	Denver, Spectrum Mktg. Assoc.	303-480-9991
CT	Cheshire, Scientific Comps.	203-272-2963
FL	Boca Raton, Perrott Assocs.	407-362-0191
FL	Casselberry, Perrott Assocs.	407-830-0094
FL	Clearwater Beach, Perrott Assocs.	813-443-5414
FL	Melbourne, Perrott Assocs.	407-676-0305
ID	Boise, Q.R. Crown	208-344-9588
IN	Ft. Wayne, R.O. Whitesell	219-432-5591
IN	Indianapolis, R.O. Whitesell	317-359-9283
IN	Kokomo, R.O. Whitesell	317-457-9127
KY	Versailles, R.O. Whitesell	606-873-1182
MD	Cockeysville, Koebert Assocs.	301-493-8924
MA	Needham Hgts., Kanan Technlgs.	617-449-7400
MI	Grand Blanc, R.O. Whitesell	313-695-0770
MI	Grand Rapids, R.O. Whitesell	616-942-5420
MI	Southfield, R.O. Whitesell	313-352-5454
MI	St. Joseph, R.O. Whitesell	616-983-7337
NC	Charlotte, Quantum Mktg.	704-523-8822
NC	Raleigh, Quantum Mktg.	919-846-5728
OH	Cincinnati, R.O. Whitesell	513-521-2290
OH	Cleveland, R.O.Whitesell	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R.O.Whitesell	513--298-9546
OR	Portland, Q.R. Crown	503-620-8320
PA	Glenside, Koebert Assocs.	215-887-2310
PA	Pittsburgh, R.O. Whitesell	412-963-6161
TX	Austin, Synergistic Sls.	512-346-2122
TX	Houston, Synergistic Sls.	713-937-1990
TX	Richardson, Synergistic Sls.	214-644-3500
WA	Bellevue, Q.R. Crown	206-453-5100
WV	Inwood, Koebert Assocs.	304-229-8401
WI	Oconomowoc, Artmor Ltd.	414-367-8789
Can	Scarborough, Ont., Cantronics Ltd.	416-297-8668

CONRAC DISPLAY PRODUCTS, INC., 1724 S. Mountain Ave., Duarte, CA 91010, Tel: 818-303-0095, TELEX: 67-0437, TWX: 910-584-5913, FAX: 818-303-5484; Empl.: 109; *Sls. Mgr.:* G.L. Ives, Dir. Mktg. & Sls.

FAX: 708-455-8979

CONSOLIDATED ELECTRONIC WIRE & CABLE, 11044 King St, Franklin Park, IL 60131-1412, Tel: 708-455-8830; FSC No.: 73612; Empl.: 97; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton ..... **C•1726-1743**

	Local Sales Offices & Reps	
CT	Glastonbury, Liberty Electro Mktg.	203-657-8023
AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
CA	Montrose, Signal Entprs. Inc.	818-957-0640
MA	Topsfield, Liberty Electro Mktg.	508-887-6655
CO	Boulder, The Stratford Grp.	303-530-3194
FL	Casselberry, T.Squared Mktg.	407-699-9992
IL	Franklin Pk, Con. Elec. Wire & Cable	708-455-8830
IL	Highland Pk., Bransky Sls.	708-433-2375
IN	Carmel, Frank E. Kahsar, Sls. Inc.	317-844-9353
IA	Cedar Rapids, R. W. Kunz & Assocs.	319-396-5386
KS	Prairie Village, R. W. Kunz & Assocs.	913-648-3535
MD	Walkersville, Jadelectronic Assocs.	301-845-6036
MI	Warren, Frank E. Kahsar	313-795-3530
MN	Eden Prairie, PWC Inc.	612-934-1409
MO	St. Louis, R. W. Kunz & Assocs.	314-966-4977
NY	Buffalo, NRM Mktg. Group	716-634-4300
NY	Woodside, Greater Metro Sls.	718-424-1911
OH	Cincinnati, Frank E. Kansar Sls., Inc.	513-922-3133
OR	Hillsboro, Doran Sls. Assocs., Inc.	503-640-4500
PA	Birchrunville, Jadelectronic Assocs.	215-827-7122
TX	Richardson, Barry Sls. Inc.	214-234-0255
WA	Redmond, Doran Sls. Assocs., Inc.	206-885-1885
WI	McQuon, E.A. Dickinson & Assocs.	414-241-9140

CONSOLINK, 600 S. Sunset, Longmont, CO 80501, Tel: 303-651-2642, FAX: 303-678-8360; Empl.: 25; *Sls. Mgr.:* Dan Zec

CONTACT, INC., 5 Elm Ave., Hudson, NH 03051, Tel: 603-883-7708, FAX: 603-883-6230; FSC No.: MO7015; Empl.: 11; *Sls. Mgr.:* R.Reid; *Dist. Mgr.:* R.Reid

CONTACT EAST, 335 Willow St. S., N. Andover, MA 01845, Tel: 508-682-2000, TELEX: 383088, FAX: 508-688-7829; *Sls. Mgr.:* Richard Sullivan

CONTAQ TECHNOLOGIES CORP., 15 Main St., Bristol, VT 05443, Tel: 802-453-3332, FAX: 802-453-4250; FSC No.: 6680 ..... **B•1889**

CONTEC MICROELECTRONICS USA, 2010 N. First Street, San Jose, CA 95131, Tel: 408-436-0340, FAX: 408-436-0206; Empl.: 50; *Sls. Mgr.:* Alan Yankoski

CONTINENTIAL DEVICE INDIA LIMITED, C-120 Naraina Industrial Area, New Delhi, India 110028, Tel: 536150-53 (4 lines), TELEX: 031-76209, TWX: 031-76230; FSC No.: I.J.; Empl.: 1100; *Sls. Mgr.:* Mr. P. Gulati, Gen. Mgr.

CONTINENTAL ELECTRONICS CORPORATION, P.O. Box 270879, Dallas, TX 75227, Tel: 214-381-7161, TELEX: 73-398, FAX: 214-381-4949; FSC No.: 52151; Empl.: 500

CONTINENTAL RESOURCES, Computer & Peripherals Div., 175 Middlesex Tpke., Bedford, MA 01730-1469, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-6563; Empl.: 250; *Sls. Mgr.:* Mark Berling

CONTINENTAL RESOURCES, INC, Test Instruments Div., 175 Middlesex Tpke., Bedford, MA 01730, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-2046; Empl.: 250

CONTINENTAL SPECIALTIES CORP., See Global Specialties Corp.

CONTINENTAL WIRE & CABLE, Gulton Rd., P. O. Box 1863, York, PA 17405, Tel: 717-792-2644, TELEX: 84-0437; Empl.: 250; *Sls. Mgr.:* Edward W. Holland III; *Dist. Mgr.:* Shirley A. Eisenhart

CONTOURS INC., 290 Pratt St., Meriden, CT 06450, Tel: 203-237-8331, FAX: 203-237-6353; FSC No.: 033501; *Sls. Mgr.:* Eugene D. Rodman

CONTROL CABLE, INC., 7261 Ambassador Rd., Baltimore, MD 21207, Tel: 301-298-4411, FAX: 301-265-1646; FSC No.: 510124759; Empl.: 90; *Sls. Mgr.:* Greg Jones; *Dist. Mgr.:* Greg Jones

CONTROL CONCEPTS CORP., Liebert Corp., P.O. Box 1380, Binghamton, NY 13902-1380, Tel: 607-724-2484, TELEX: 62224380, FAX: 607-722-8713; Empl.: 65; *Sls. Mgr.:* Pat Gillette, VP Sls.; *Dist. Mgr.:* Fred Zack

CONTROL DISPLAYS, INC., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, Tel: 215-822-3383, FAX: 215-997-1232; FSC No.: 27878; Empl.: 75; *Sls. Mgr.:* L. Rodrigue

CONTROL ELECTRONICS, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, Tel: 516-694-0125, FAX: 516-694-0133; FSC No.: 95924; Empl.: 35; *Sls. Mgr.:* Harold Goldstein; *Dist. Mgr.:* Barbara Kilroy

CONTROL ENGRG., INC., 190 Doty Circle, West Springfield, MA 01089, Tel: 413-781-1330, FAX: 413-732-3367; Empl.: 7; *Sls. Mgr.:* Mark Kimball

CONTROLEX, INC., 248 Francestown Tpke., New Boston, NH 03070, Tel: 603-487-5512, FAX: 603-487-2524; Empl.: 10; *Dist. Mgr.:* Patricia Butler

CONTROLEX/EANCO, See Fincor

CONTROL LASER CORP., 7503 Chancellor Dr., Orlando, FL 32809, Tel: 407-438-2500, TELEX: 514215; Empl.: 70; *Sls. Mgr.:* John Fitzgerald Sls. Mgr.

CONTROLLED ENVIRONMENTAL EQUIPMENT CORP., 3 Delta Drive, Westbrook, ME 04092, Tel: 207-854-9126, TELEX: 62903721, FAX: 207-854-4357; FSC No.: 25254; Empl.: 10; *Sls. Mgr.:* M. F. Peck

CONTROLLED POWER COMPANY

FAX: 313-528-0411

CONTROLLED POWER CO., 1955 Stephenson Hwy., Troy, MI 48083, Tel: 313-528-3700, 1-800-521-4792, TWX: 810-2323401; Empl.: 160; *Sls. Mgr.:* Reggie Peck ..... **D•2185-2189**

Local Sales Offices & Reps

AL	Homewood, Control Equip. & Sls.	205-945-8454
AK	Anchorage, Alaska Computer Environment	907-243-1429
CA	Foster City, Computer Support Sys.	415-572-9994
CA	Torrance, EDP ENV.	213-370-7446
CO	Denver, Computer Facility Components	303-778-8488
CO	Denver, Computer Facility Comps.	303-778-9131
CO	Denver, Innovative Tech.	603-624-4163
IL	Schaumburg, Protech	708-885-2040
MD	Towson, H. L. Frey Corp.	301-821-0058
MO	St.Louis, Rail Way Industry	314-966-3300
NM	Albuquerque, Sun Data Systems	505-272-1022
NC	Charlottte, Glen & Larson of Carolina	704-365-5917
OH	Westerville, Power Com Systems	614-890-1124
PA	Glenshaw, H.C. Johnson Agencies Inc.	412-487-1246
TN	Nashville, Jenkins & Associates	615-256-7606
TX	Richardson, Tubbesing Sales Corp.	214-234-3855
VA	Alexandria, ADAPT	703-684-6393
VA	Virginia Beach, Precision Environments	804-473-8767
Can	Againcourt, Ontario, Aircom Sales Inc.	416-293-3339
Can	Burnaby, BC, Datasphere Sales Ltd.	604-420-6040
Can	Calgary, AB, Datasphere Sales Ltd.	403-244-3666
Can	Dorval,PQ, Datasphere Sales Ltd.	514-631-7209
Can	Edmonton, AB, Datasphere Sales Ltd.	403-483-7979
Can	Halifax, NX, Datasphere Sales Ltd.	902-423-2246
Can	Mississauga, ON, Datasphere Sales Ltd.	416-278-5501
Can	N. Vancouver, B.C., Jerome & Francis Co. Ltd.	604-986-1286
Can	Nepan, On, Datasphere Sales Ltd.	613-723-2582
Can	Regina, SK, Datasphere Sales Ltd.	306-565-0421
Can	St. Leonard, Quebec, B. Beaudoin & Associates	514-328-2266
Can	Winnipeg, MB, Datasphere Sales Ltd.	204-943-7102

CONTROL LOGIC, See Hancock Electronics Corp.

CONTROL MICROSYSTEMS INC., 2049 Cohen St., St. Laurent, QC, Canada H4R 9Z7, Tel: 514-745-1270, FAX: 514-745-1610; Empl.: 25; *Sls. Mgr.:* Allan Erion; *Dist. Mgr.:* Scott McMeekin

CONTROL MODULE, 380 Enfield St., Enfield, CT 06082, Tel: 203-745-2433, TELEX: 643167, FAX: 203-741-6064; Empl.: 160; *Sls. Mgr.:* James W. Bianco

CONTROL PRODUCTS, INC., 280 Ridgedale Ave., E. Hanover, NJ 07936, Tel: 201-887-9400, FAX: 201-887-5083; FSC No.: 81901; Empl.: 62; *Sls. Mgr.:* H.M. Stuhler; *Dist. Mgr.:* H.M. Stuhler

CONTROL RESOURCES INC., SMART FAN DIV., POB 315, Harvard, MA 01451, Tel: 508-772-4043, FAX: 508-772-4142; Empl.: 7; *Sls. Mgr.:* James Quirk

CSI CONTROL SCIENCES INCORPORATED

FAX: 818-709-8546

CONTROL SCIENCES, INC., 9509 Vassar Ave., Chatsworth, CA 91311, Tel: 818-709-5510, TELEX: 4970496(CSI); FSC No.: 53317; Empl.: 20; *Sls. Mgr.:* Rhod Zimmerman ..... **D•1152-1157**

Local Sales Offices & Reps

CA	Luguna Niguel, Aktron Sls.	714-496-5057
CO	Broomfield, Hannah-Hill	303-460-0602
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MA	Salem, Forbes Engrg.	508-744-1693
MD	Annapolis, Homersmith Inc.	301-269-6493
MN	St. Paul, Northstar Motion & Control	612-770-5311
NY	E. Rochester, A & D Dvcs.	716-385-2778
NY	Victor, A & D Dvcs.	716-385-2778
NC	Jamestown, Homersmith, Inc.	919-883-3999
PA	Downington, Homersmith, Inc.	215-269-3637
PA	Media, Homersmith Inc.	215-543-2434
TX	Dallas, McDonald Assocs.	214-239-3293
Can	Nepean, Ont., Electrodesign, Ltd.	613-727-5220

CONTROLS UNLIMITED, INC., 4823 North Ridge Rd., Perry, OH 44081, Tel: 216-259-2500, FAX: 216-259-5015; Empl.: 45; *Sls. Mgr.:* Paul Adams

CTC

FAX: Fax 718-361-6386

CONTROL TECHNOLOGY CO., INC., 41-16 29th St., Long Island City, NY 11101, Tel: 718-361-2133; FSC No.: 14545; Empl.: 35; *Sls. Mgr.:* H. Cooper ... **D•2240-2241**

Local Sales Offices & Reps

Can	Montreal, Que., Control Tech. Elctrns. CTC Canada	514-733-3279,FAX:514-733-2132

CONTROL TECHNOLOGY, INC., 7608 N. Hudson, Oklahoma City, OK 73116, Tel: 405-840-3163, FAX: 405-848-0489; *Sls. Mgr.:* Charles Weddington; *Dist. Mgr.:* Charles Weddington

CONVER CORP., 916 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-739-9111, TWX: 910-338-2036, ESYLNK: 62024309, FAX: 408-739-9116; Empl.: 40; *Sls. Mgr.:* Robert Lloyd; *Dist. Mgr.:* Sherri Kirkpatrick

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Local Sales Offices & Reps

AL	Huntsville, Saber Assocs., Inc.	407-724-0920
AZ	Phoenix, Howe & Howe, Sls.	602-264-7971
CA	Camarillo, The Tricamo Co.	805-388-0039
CA	Redwood City, Sales One	415-369-3677
CA	San Diego, The Tricamo Co.	619-689-1000
CO	Englewood, Odyssey 1	303-773-8176
CT	Fairfield, Bossaco	203-255-2326
FL	Melbourne, Saber Assocs., Inc.	407-724-0920
FL	Orlando, Saber Assocs., Inc.	407-724-0920
GA	Lawrenceville, Saber Assocs.	404-962-8740
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
KS	Overland, Atech	913-362-1200
MD	Ellicott City, VPI	301-461-2525
MA	Scituate, N.E.A.R.	617-545-6327
MI	Livonia, Electro Sls. Assocs.	313-421-7500
MN	Minneapolis, Sector Engrg. Sls.	612-378-2123
MO	St. Charles, Atech	314-949-9075
NJ	Paramus, Eltech Sls., Inc.	201-967-1309
NM	Albuquerque, H.E.R. Elctrns.	505-265-7893
NY	Liverpool, R & D Assocs.	315-457-0100
NC	Clayton, Saber Assocs.	407-724-0920
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Tulsa, D. J. Sls.	918-663-8155
OR	Portland, SPS Elctrns.	503-697-7768
PA	Dresher, CMS Mktg.	215-885-4424
PA	Pittsburgh, Electro Sls. Assocs.	412-322-9000
TX	Austin, D.J. Sls.	512-258-3002
TX	Dallas, D.J. Sls.	214-783-8876
UT	Salt Lake City, Odyssey 1	801-485-4728
WA	Redmond, SPS Elctrns.	206-794-0154
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
Can	Mississauga, Ontario, Andy Baumen Assocs. Ltd.	416-828-2600

CONVERTER CONCEPTS, INC., Industrial Pkwy., Pardeeville, WI 53954, Tel: 608-429-2144, FAX: 608-429-9241; Empl.: 125; *Sls. Mgr.:* Rick Hartt ... **D•1692-1693**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-880-0592
CA	Hayward, Pacific Mktg.	415-887-1620
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Groh Assocs.	619-673-4321
FL	Clearwater, Tech Rep	813-572-9900
CO	Denver, NOW Devices	303-758-4884
AZ	Phoenix, Shefler-Kahn Co., Inc.	602-257-9015
IL	Des Plaines, Consult Factory	608-429-2144
KS	Shawnee, Lowell Kanges & Assocs.	913-631-0517
MD	Cockeysville, Koebert Assocs.	301-560-1926
MA	Chelmsford, Interstate Sls. Assocs.	617-256-2287
MI	Livonia, Electro Mktg.	313-421-7590
MI	Muskegon, Electro Mktg.	616-798-1912
MN	Minneapolis, Holmgren Assoc.	612-574-9983
GA	Norcross, Electro-Mech	404-447-6478
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NY	Rochester, APEX Assoc.	716-272-7040
OH	Cleveland, Electro Mktg.	216-582-0075
OH	Vandalia, Electro Mktg.	513-890-8322
PA	Glenside, Koebert Assoc.	215-887-2310
PA	Pittsburgh, JFCO	412-823-5400
TX	Houston, Scientific Sls. Co.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541
UT	Salt Lake City, Consult Factory	608-429-2144
WA	Kirkland, Northwest Comp. Sls.	206-828-2104
WV	Inwood, Koebert Assocs.	304-229-8401
WI	Sullivan, Consult Factory Inc.	608-429-2144
Can	Rexdale, Valtine Mktg.	416-851-0335
Can	Vancouver, BC, Davetek Mktg.	604-430-3680

Local Distributors

CA	San Jose, Delta Lu Research	408-403-0490
Can	Rexdale, Valtme Mktg.	416-851-0355

CONVERTER POWER, INC., 123 Brimbal Ave., Beverly, MA 01915, Tel: 508-927-8158, FAX: 508-922-9466; *Sls. Mgr.:* Barry Essig

COOKE VACUUM PRODS., INC., 13 Merritt St, Norwalk, CT 06854, Tel: 203-853-9500, FAX: 203-838-9553; Empl.: 45; *Sls. Mgr.:* Louis W. Genuario

THE COOL-AMP CONDUCTO-LUBE CO., 15834 Upper Boones Ferry Rd., Lake Oswego, OR 97035, Tel: 503-624-6426, FAX: 503-624-6436; FSC No.: 31628; Empl.: 7; *Sls. Mgr.:* Marian Bomber

COONER WIRE CO., 9186 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8311, TELEX: 353734 Cooner Wire UD, FAX: 818-709-8281; *Sls. Mgr.:* Steven W. Smith

COOPER INDUSTRIES/BELDEN DIV., P.O. Box 1980, Richmond, IN 47375, Tel: 317-983-5200, 800-BELDEN-1, TWX: 810-345-1393, FAX: 317-983-5294; Empl.: 3500; *Sls. Mgr.:* Rick Schneidewind, Dir. OEM Sls.; *Dist. Mgr.:* Mike Murphy, Dir. of Dom. Sls.

COOPER TOOLS, PO Box 30100, Raleigh, NC 27622, Tel: 919-781-7200, TELEX: 579497

CO-ORD SWITCH DIV., See LVC Inds., Inc.

COORS CERAMICS CO., Electronic Products Group, 17750 W. 32nd Ave., Golden, CO 80401, Tel: 303-277-4592, FAX: 303-277-4779; Empl.: 1700

COPAL (USA), INC., 2291 205th St, Ste. 105, Torrance, CA 90501, Tel: 213-618-0225, FAX: 213-618-9984; *Sls. Mgr.:* Hugh Namekawa

CORBY INDUSTRIES, INC., 1501 E. Pennsylvania St, Allentown, PA 18103, Tel: 215-433-1412, FAX: 215-435-1963; Empl.: 31; *Sls. Mgr.:* Sharon Cain; *Dist. Mgr.:* Sharon Cain

CORCOM, INC., 1600 Winchester Rd., Libertyville, IL 60048, Tel: 708-680-7400, FAX: 708-680-8169; FSC No.: 05245; Empl.: 800; *Sls. Mgr.:* George Mitchell, VP; *Dist. Mgr.:* Ken Bons ..... **A•1610-1611; C•1330-1331**

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AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Westrep	619-566-6580
CO	Westminster, Straube Assocs.	303-426-0890
CT	Madison, Conti-Younger Assocs.	203-245-1136
GA	Norcross, Robert O. Whitesell	404-449-9190
ID	Boise, Jas J. Backer Co.	208-343-9831
IL	Itasca, Beta Technlg. Sls. Inc.	708-250-9586
IN	Ft. Wayne, Robert O. Whitesell	219-432-5591
IN	Indianapolis, Robert O. Whitesell	317-876-9000
IN	Kokomo, Robert O. Whitesell	317-457-9127
KS	Overland Pk, Spectrum Sls.	913-648-6811
KY	Versailles, Robert O. Whitesell	606-873-1182
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grand Rapids, Robert O. Whitesell	616-942-5420
MI	Southfield, Robert O. Whitesell	313-352-5454
MI	St. Joseph, Robert O. Whitesell	616-983-7337
MN	Edina, Mel Foster Co.	612-941-9790
MO	Florissant, Spectrum Sls.	314-921-1313
MO	Hazelwood, Spectrum Sls.	314-731-5151
NJ	Englewood, MOS Mktg.	201-569-2071
NM	Albuquerque, Rontek, Inc.	505-299-4124
NY	Great Neck, MOS Mktg.	516-487-3966
NY	Skaneateles, Empire Tech Sls.	315-685-5703
NC	Raleigh, Zucker Assoc.	919-782-8433
OH	Cincinnati, Robert O. Whitesell	513-521-2290
OH	Cleveland, Robert O. Whitesell	216-447-9020
OH	Columbus, Robert O. Whitesell	614-888-9396
OH	Dayton, Robert O. Whitesell	513-298-9546
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
PA	Pittsburgh, Robert O. Whitesell	412-963-6161
PA	Trevose, Professional Svc. Assoc.	215-245-0513
TN	Knoxville, Robert O. Whitesell	615-694-9476
TX	Austin, K & H Sls.	512-339-7950
TX	Plano, K & H Sls.	214-423-6520
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Milwaukee, Beta Technlg. Sls. Inc.	414-543-6609
Can	Ontario, R.N. Longman	416-670-8100

Local Distributors

AL	Huntsville, Pioneer	205-837-9300
AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Marshall Inds.	602-496-0290
CA	Anaheim, Compumech	714-939-9100
CA	Calabasas, Lex	818-880-9686
CA	Chatsworth, Marshall Inds.	818-407-0101
CA	Gardena, Cal Switch	213-770-2330
CA	Irvine, LEX	714-863-0200
CA	Irvine, Marshall Ind.	714-458-5395
CA	Milpitas, Marshall Ind.	408-942-4600
CA	Sacramento, LEX	916-364-0222
CA	San Diego, Lex	619-495-0015
CA	San Diego, Marshall Ind.	619-578-9600
CA	San Jose, Lex	619-495-0015
CA	Sunnyvale, CAPSCO	408-734-3020
CO	Thornton, Marshall Ind.	303-451-8444
CT	Wallingford, Greene Shaw	203-265-3333
FL	Altamonte Springs, Marshall Inds.	407-767-8585
FL	Altamonte Springs, Pioneer	407-834-9090
FL	Deerfield Beach, Pioneer	305-771-7520
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	407-849-6060
FL	Tampa, Marshall Ind.	813-573-1399
GA	Norcross, Hammond	404-449-1996
GA	Norcross, Marshall Ind.	404-923-5750
ID	Boise, Radar Elec.	208-336-2227
IL	Addison, Pioneer/Chicago	708-495-9831
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, OHM Elctrns.	708-359-5500
IN	Indianapolis, Marshall	317-297-0483
IN	Indianapolis, Pioneer	317-573-0880
MD	Baltimore, Resco/Baltimore	301-529-0500
MD	Beltsville, Resco/Washington	301-937-9100
MD	Gaithersburg, Pioneer	301-921-0660
MA	Newton, Greene Shaw	617-969-8900
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Wilmington, Marshall Inds.	508-658-0810
MI	Grand Rapids, Pioneer	616-698-1800
MI	Livonia, Marshall Inds.	313-525-5820
MI	Livonia, Pioneer	313-525-1800
MN	Eden Prairie, Pioneer/Twin Cities	612-944-3355
MN	Minneapolis, Newark Elect	612-331-6350
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Bellmawr, Mid Atlantic Elctrns. Corp.	609-931-5303
NJ	Fairfield, Marshall Inds.	201-882-0320
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Fairport, Pioneer	716-381-7070
NY	Hauppauge, Sager	516-348-1300
NY	Mt. Vernon, All American	914-699-2224
NY	Rochester, Lex	716-328-3230
NY	Rochester, Summit Distrs.	716-334-8110
NY	Woodbury, Pioneer	516-921-8700
NC	Charlotte, Pioneer	919-544-5400
NC	Raleigh, Marshall Inds.	919-878-9882
OH	Cleveland, Pioneer	216-587-3600
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Marshall	513-898-4480
OH	Dayton, Pioneer	513-236-9900
OH	Solon, Marshall	216-248-1788
OR	Beaverton, Almac Elctrns.	503-629-8090
OR	Beaverton, Marshall Inds.	503-644-5050
OR	Portland, Radar	503-232-3404
PA	Horsham, Pioneer	215-674-4000
PA	Philadelphia, Sager	215-464-4336
PA	Pittsburgh, Pioneer	412-782-2300
TX	Austin, Marshall Inds.	512-837-1991
TX	Austin, Pioneer	512-835-4000
TX	Carrollton, Marshall Inds.	214-233-5200
TX	Dallas, Pioneer	214-386-7300
TX	Houston, Marshall Inds.	713-895-9200
TX	Houston, Pioneer	713-988-5555
UT	Salt Lake City, Marshall Inds.	801-485-1551
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Bellevue, Marshall Inds.	206-486-5747
WA	Seattle, Radar	206-282-2511
WA	Spokane, Almac Elctrns.	509-924-9500
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORECO, INC., 6969 Trans-Canada Hwy, Ste. 113, St. Laurent, Que., Canada H4T 1V8, Tel: 800-361-4914, 514-333-1301, TELEX: 76001120 COR UC, FAX: 514-333-1388; Empl.: 32; *Sls. Mgr.:* Pat Urbain

CORES UNLIMITED, INC., 8311 Westminster Ave., Ste. 230, Westminster, CA 92683, Tel: 714-894-3062, 800-422-CORE, FAX: 714-895-4502; Empl.: 8

CORLUND ELECTRONICS CORP., 2330 Teller Rd., Newbury Park, CA 91320, Tel: 805-499-6877, FAX: 805-499-4072; Empl.: 60; *Sls. Mgr.:* Wayne Smith

CORMAN TECHNOLOGIES INC., 75 Bathurst Dr., Waterloo, Ontario, Canada N2V 1N2, Tel: 519-884-4430, FAX: 519-884-0204; *Sls. Mgr.:* Bill Lochead; *Dist. Mgr.:* Bill Lochead

CDE CORNELL DUBILIER

FAX: 508-996-3830

CORNELL-DUBILIER ELCTRNS. (INTL. SLS., DISTBN. WAREHOUSE), 1605 E. Rodney French Blvd., New Bedford, MA. 02744, MA 02741, Tel: 508-996-8561, TELEX: 929 419; Empl.: 5000; *Sls. Mgr.:* Anthony M. Cavuto, VP Sls. ..... **A•1052-1053; B•1439**

Local Sales Offices & Reps

CA	San Diego, CK Assocs.	619-279-0420
CA	Valencia, C & N Assocs.	805-254-5844
CO	Littleton, Megatronix	303-730-6262
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	St. Petersburg, QXI Inc.	813-894-4556
KS	Overland Park, Electri-Rep	913-649-2168
MD	Gaithersburg, Naudain Assoc. Southern, Inc.	301-258-5040
MI	Madison Heights, Pine Sales, Inc.	313-589-0350
MN	Eden Praire, PWC Incorporated	612-934-1409
MO	St. Louis, Electra-Rep	314-993-4421
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806
NC	Raleigh, Prime Comps., Inc.	919-850-9866
OH	Richfield, The Lyons Corp.	216-659-9224
OR	Portland, Northwest Mktg. Assoc.	503-620-0441
SC	Easly, RA Sls.	803-859-1859
TN	Chattanooga, Indl. Mktg. & Sls., Inc.	615-894-2219
TX	Richardson, Comp. Partners, Inc.	214-644-1288
UT	Salt Lake City, Charles Fields & Assocs.	801-531-6177
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
PR	San Juan, P.R., E.T.S. Inc.	809-798-1300
Can	Mississauga, Ont., Source Elctrns.	416-676-0830

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Compton, Harper Sid	213-979-5090
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Milpitas, California Capacitor	408-262-6000
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Tustin, Projections Unlimited	714-544-2700
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Palatine, OHM Elctrns.	708-359-5500
MA	Newton, The Greene-Shaw Co.	617-969-8900
MN	St. Paul, Shelley/Ragon	612-642-2828
NY	Central Islip, Semi Cap Elctrns.	516-582-4400

NY Hauppauge, JACO Elctrns. 516-273-5500
NY Mamaroneck, New Yorker Elctrns. 914-698-7600
NY Port Chester, Zeus Comps. 914-937-7400
NY Rome, Rome Elctrns. 315-337-5400
OH Cleveland, Pioneer-Standard 216-587-3600
PA No. Versailles, CMD Elctrns. 412-678-6020
TX Dallas, Hallmark Elctrns. 214-553-4300
TX Fort Worth, TTI, Inc. 817-740-9000
TX Houston, Sterling Elctrns. 713-627-9800
WI Milwaukee, Marsh Elctrns. 414-475-6000

CORNELL-DUBILIER ELCTRNS. (CORPORATE HEADQUARTERS), 1700 Route 23 North, Wayne, NJ 07470, Tel: 201-694-8600; Empl.: 1000; *Sls. Mgr.:* A. Cavuto ..... **A•1052-1053**

Local Sales Offices & Reps
CA San Diego, C & N Assocs. 619-279-0420
CA Valencia, C & N Assocs. 805-254-5844
CO Littleton, Megatronix 303-730-6262
CT Branford, Coakley, Boyd & Abbett 203-481-2218
FL St. Petersburg, QXI, Inc. 813-894-4556
KS Overland Park, Electri-Rep. 913-649-2168
MD Gaithersburg, Naudain Assoc. Southern, Inc. 301-258-5040
MI Madison Hgts., Pine Sls., Inc. 313-589-0350
MN Eden Prairie, PWC Inc. 612-934-1409
MO St. Louis, Electri-Rep 314-993-4421
NJ Leonia, Peter E. Schmitt Co., Inc. 201-944-2806
NC Raleigh, Prime Comps. Inc. 919-850-9866
OH Richfield, The Lyons Corp. 216-659-9224
OR Portland, Northwest Mktg. Assocs. 503-620-0441
SC Easly, RA Sls. 803-859-1859
TN Chattanooga, Indl. Mktg. & Sls., Inc. ... 615-894-2219
TX Richardson, Comps. Partners, Inc. 214-644-1288
UT Salt Lake City, Charles Fields & Assocs. 801-531-6177
WI Waukesha, Eagle Tech. Sls. 414-896-0633
PR San Juan, E.T.S. Inc. 809-798-1300
Can Mississauga, Ont., Source Elctrns. 416-676-0830

Local Distributors
AZ Phoenix, Arizona Comp. Co. 602-269-5655
CA Compton, Harper Sid 213-979-5090
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, California Capacitor 408-262-6000
CA Sunnyvale, Capsco Sls. 408-734-3020
CA Tustin, Projection Unlimited 714-544-2700
CO Aurora, Capstone Elctrns. 303-375-1300
CO Denver, Integrated Elctrns. Corp. 303-292-5537
FL Boca Raton, NRC Elctrns. 407-241-8600
IL Chicago, Newark Elctrns. 312-784-5100
IL Chicago, Waldom Elctrns. 312-585-1212
IL Palatine, OHM Elctrns. 708-359-5500
MA Newton, Greene-Shaw, Co. 617-969-8900
MN St. Paul, Shelley-Ragon 612-642-2828
NY Central Islip, Semicap Elctrns. Corp. ... 516-582-4400
NY Hauppauge, Jaco Elctrns., Inc. 516-273-5500
NY Mamaroneck, New Yorker Elctrns. 914-698-7600
NY Port Chester, Zeus Comps. 914-937-7400
NY Rome, Rome Elctrns. 315-337-5400
OH Cleveland, Pioneer-Standard 216-587-3600
PA N. Versailles, CMD Elctrns. 412-678-6020
TX Dallas, Hallmark Electronics 214-553-4300
TX Ft. Worth, TTI, Inc. 817-740-9000
TX Houston, Sterling Elctrns. 713-627-9800
WI Milwaukee, Marsh Elctrns. 414-475-6000

CORNELL MANUFACTURING, An Elgin Co., 25 Ramland Road, Orangeburg, NY 10962, Tel: 914-365-0400, FAX: 914-359-6809; Empl.: 50; *Sls. Mgr.:* Lou Schnur; *Dist. Mgr.:* Lou Schnur

CORNING GLASS WORKS, Materials Business, Main Plant, MP 21-3, Corning, NY 14831, Tel: 607-974-7149, TELEX: 932498, FAX: 607-974-7618; *Sls. Mgr.:* Paul Marx; *Dist. Mgr.:* Dennis Naylor

Local Distributors
CA Los Angeles, Leed Plastics Corp. 213-746-5984
CA Santa Clara, San Jose Delta Assocs., Inc. 408-727-1448
IL Addison, Circle Fabrication, Inc. 708-543-4440
NJ Palisades Pk., Morgan Matroc Inc. 201-947-8313
NJ Washington, Accuratus Ceramic Corp. 201-689-0880
OH Cincinnati, Astro Met Assocs., Inc. 513-772-1242
TX Houston, EGC Corp. 713-447-8611
WI Hubertus, Tech. Prods., Inc. 414-628-2768
Can Ontario, Johns Scientific 416-699-1731

CORNING INCORPORATED, Opto-Electronics Group, MP-RO-03, Corning, NY 14831, Tel: 607-974-7914, FAX: 607-974-4914; Empl.: 26,000

CORTEC, INC., 15672 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529, FAX: 714-897-2170; Empl.: 35

CORTRON DIV., See ITW Cortron,Illinois Tool Works

CORTRON INC., 1 Aegean Dr., Methuen, MA 01844, Tel: 508-975-5445, FAX: 508-975-0357; Empl.: 75; *Sls. Mgr.:* Philip P. Bodoni ..... **B•1803**

CORVUS MICROWAVE INC., 6075 E. Molloy Rd., Syracuse, NY 13211-2100, Tel: 315-437-4400, FAX: 315-437-8095; FSC No.: 26058; Empl.: 35; *Sls. Mgr.:* Diane L. Conklin

COSMO CORPORATION, 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594, FAX: 216-861-0416; Empl.: 350; *Sls. Mgr.:* B. Gordon

COTO WABASH
A Kearney-National Company

FAX: 401-942-0920

COTO WABASH, Kearney National Corporation, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686; Empl.: 300; *Sls. Mgr.:* John E. Beigel, Dir. Mktg. & Sls.; *Dist. Mgr.:* David MacRae, Natl. Sls. Mgr. ..... **B•1441-1445**

Local Sales Offices & Reps
AL Owens Cross Rds., cmrCross Assocs. 205-883-5991
AZ Phoenix, Spectrum Mktg. Assocs., Inc. 602-890-9000
CA Newport Bch., Forbes Pacific Inc. 714-722-6174
CA Saratoga, Testco Inc. 408-253-1900
CO Denver, Spectrum Sls. 303-480-9991
DE Hunt Valley, Eagle Sls. Corp. 301-666-3930
DC Hunt Valley, Eagle Sls. Corp. 301-666-3930
FL Orlando, Standard Mktg. 407-856-4140
FL Sunrise, Standard Mktg. 305-749-5557
FL Tampa, Standard Mktg. 813-933-5833
IL Arlington Hgts., M.J. Petersen & Assocs. 708-577-8200
IN Ft. Wayne, M/S Sls. & Assocs. 219-436-3023
IN Greenwood, M/S Sls. & Assocs. 317-881-0110
IA Cedar Rapids, Midwest Tech. Sls. Inc. 319-393-5115
KS Goddard, Midwest Tech. Sls. Inc. 316-794-8565
KS Lenexa, Midwest Tech. Sls. Inc. 913-888-5100
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MA Andover, Crawford Assocs. 508-470-2122
MN Roseville, TLC 612-483-2226
MO Earth City, Midwest Tech. Sls. Inc. 314-298-8787
NY Clifton Pk., Net Sls. 518-371-6864
NY Cortland, Net Sls. 607-756-6592
NY Great Neck, MOS Mktg. Assocs. 516-487-3966
NY Victor, Net Sls. 716-924-1844
NC Charlotte, Godwin Assocs. 704-549-8500
NC Raleigh, Godwin & Assoc. 919-878-8000
OR Oregon City, Halbar Pacific 503-656-3714
PA Trevose, Omega Elctrn. Sls. 215-244-4000
MA Swansea, Wm. Poisson & Assocs. 508-677-3655
TX Plano, Richmar Elctrns. 214-424-8388
TX Round Rock, Richmar Elctrns. 512-255-2551
UT Ogden, Spectrum Mktg. Assocs. Inc. .. 801-972-8552
WA Redmond, Halbar Pacific 206-882-0990
Can Pointe Claire, Que., A. R. Gray Assocs. 514-694-6378

Local Distributors
CA San Diego, Pyramid Elect. Supp. Inc. .. 619-271-5404
CA Santa Clara, Pyramid Elect. Supp. Inc. 408-727-9810
CA Santa Monica, Master Distrs. 213-452-1229
CA Saratoga, Testco Inc. 408-253-1900
CA Sunnyvale, Spirox 408-739-3334
CA Torrance, Pyramid Elect. Supp. Inc. ... 714-773-0781
CO Denver, Spectrum Distrbn. 303-480-9991
FL W. Melbourne, Astro Mktg. 407-727-8817
IL Bedsville, Voyager Elect. Corp. 708-860-1300
IL Elk Grove Village, Nu-Way Elect. Dist., Inc. 708-437-7120
MA Andover, Aved Elect. Inc. 508-688-3800
MA Sandwich, J.V. Elctrns. 508-833-0700
MN Fridley, Voyager Elect. Corp. 612-571-7766
NJ Oakland, Relay Specialties 201-337-1000
NY Buffalo, Summit Dist. 716-887-2800
NY Rochester, Masline Elect., Inc. 716-546-5373
OK Tulsa, Altair Co. 918-252-5781
CA Saratoga, Testco, Inc. 408-253-1900
PA Philadelphia, SHAP Elect. Co. 215-969-3300
TX Ft. Worth, Allied Elec. 817-595-3500
TX Austin, Altair Co. 512-837-4970
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
UT Ogden, Spectrum Mktg. Assocs., Inc. .. 801-972-8552
WA Redmond, Pyramid Elect. Supp., Inc. .. 206-883-7200

COTRONICS, 3379 Shore Pkwy., Brooklyn, NY 11235, Tel: 718-646-7996, FAX: 718-646-3028; Empl.: 15; *Sls. Mgr.:* Alan Marks

COUTANT LAMBDA LTD., Kingsley Ave., Ilfracombe, Devon, England EX34 8ES, Tel: (0271) 863781, TELEX: 46310, FAX: (0271)64894; Empl.: 330; *Sls. Mgr.:* Nigel Davies; *Dist. Mgr.:* Nigel Davies

COVER CRAFT CORP., See Amherst International Corp., Cover Craft Div.

COVID, INC., 2400 W. 10th Place, Tempe, AZ 85281, Tel: 602-966-2221, FAX: 602-966-6728; Empl.: 40; *Sls. Mgr.:* Suzanne Jones

COVOX, INC., 675 Conger St., Eugene, OR 97402, Tel: 503-342-1271, FAX: 503-342-1283; Empl.: 25; *Sls. Mgr.:* Larry Quateman

CPS, INC., 47341 Bayside Parkway, Fremont, CA 94538-6517, Tel: 415-657-6363, FAX: 415-657-7220; FSC No.: 31640; Empl.: 30; *Sls. Mgr.:* Clifford Gaw

CP TECHNOLOGY, INC., 21143 Christensen Drive, Cupertino, CA 95014, Tel: 408-996-8069, FAX: 408-986-8278; Empl.: 6

CRAFT DATA, INC., 27022 Cordero Lane, Mission Viejo, CA 92691, Tel: 714-582-8284, FAX: 714-248-2390; Empl.: 4

CRAIG SYSTEMS CORP., Eastern Technologies, Ltd., 10 Industrial Way, Amesbury, MA 01913-4848, Tel: 508-388-5662, TWX: 710-347-0590, FAX: 508-388-0845; FSC No.: 81902; Empl.: 150; *Sls. Mgr.:* Roger Chouinard

Cramer

FAX: 414-377-4028

CRAMER COIL & TRANSFORMER CO., INC., 401 Progress Dr., Saukville, WI 53080, Tel: 414-284-9425, 414-377-7040; Empl.: 110; *Sls. Mgr.:* Nicholas Hayes ..... **A•2191-2193**

Local Sales Offices & Reps
CA San Dimas, Dilectron 714-394-1356
CA Santa Clara, Fischer Assocs. 408-733-7350
CO Monument, Sunbird Inds. 303-481-2900
CT Bethany, The Reps. Corp. 203-393-0024
IL Palatine, Somers-Stanton 312-994-1108
IN Frankfort, C-S Elctrn. Sls. 317-659-1874
KS Overland Park, Q D C Inds. 913-341-2214
MA Wellesley, The Reps. Corp. 617-237-6476
MI Jackson, Norwood-Scroggs 517-750-1170
MN Eden Prairie, Hanna Lind 612-942-8554
NY Fulton, Carl Truax, Inc. 315-592-7184
NC Kernersville, Wallace Elctrns. Sls. 919-996-2742
TX Richardson, Barry Sls., Inc. 214-234-0255

CRAMER CO., 139 Mill Rock Road East, Old Saybrook, CT 06475, Tel: 800-247-6784, FAX: 203-388-9831; Empl.: 210; *Sls. Mgr.:* Joe Lenzo; *Dist. Mgr.:* E. Latourette

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CRANE ELECTRONICS, INC., 4700 Smith Rd., Cincinnati, OH 45212, Tel: 800-676-7644, FAX: 513-631-5700; FSC No.: OAKZ5; Empl.: 25

CREARE INC., Etna Rd., P.O. Box 71, Hanover, NH 03755, Tel: 603-643-3800, FAX: 603-643-4657; FSC No.: 8A287; Empl.: 100

CREATIVE AUTOMATION CO., 11641 Pendleton St., Sun Valley, CA 91352, Tel: 818-767-6220, FAX: 818-767-0123; Empl.: 25; *Sls. Mgr.:* John Lee, Jr.

CREATIVE MICRO SYSTEMS, 3822 Cerritos Ave., Los Alamitos, CA 90720, Tel: 213-493-2484, FAX: 213-493-3553; Empl.: 15; *Sls. Mgr.:* Margaret E. Prossen

CRESTRONICS DIV., APPLIED ELECTRO TECHNLG., See STI-Crestronics Div.

CRISSMAN MANUFACTURING CO., 11004 Bakley St., Huntley, IL 60142, Tel: 708-669-3995, FAX: 708-699-5168

CRITERION INSTRS., LTD., 30 Progress Ave., Scarborough, Ont., CAN M1P4W8, Tel: 416-299-6666, FAX: 416-299-8398; Empl.: 16 ..... **D•1238-1239, 1694**

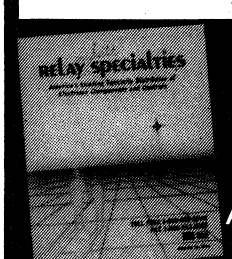
Local Sales Offices & Reps

IL	Chicago, Rock Sls. Inc.	708-351-9903
MI	Troy, Satullo Assocs. Inc.	313-585-4811
NC	Selma, Shalltronix Corp.	919-965-6346
OH	Cleveland, Abitec, Inc.	216-531-9122
PA	Abitec, Inc.	216-531-9122
TX	Lewisville, E.P.R.	214-436-4772
Can	Calgary, AI, Landel Controls	403-250-3553
Can	Montreal, Que., Projean Inst.	514-273-8331
Can	Richmond, B.C., John McMillan	604-273-1747
Can	Saskatchewan, Landel Controls	403-250-3553

CRL™

FAX: 515-573-1342

CRL COMPONENTS, INC., Roxboro Group, Highway 20 West, Fort Dodge, IA 50501, Tel: 515-573-1300; FSC No.: 71590; Empl.: 500; *Dist. Mgr.:* Jim Wood ..... **A•2031; B•1669-1672**

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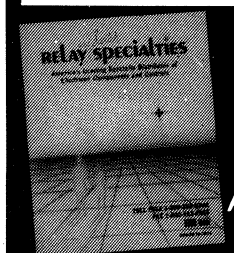
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OR	Beaverton, Norvac Elctrns.	503-644-1052

CUNO, INC., Process Filtration Products, 400 Research Pkwy., Meriden, CT 06450, Tel: 203-237-5541, TELEX: 221083; Empl.: 700; *Sls. Mgr.:* Martin Mahard

CURRENT TECHNOLOGY, INC., 101 W. Buckingham Rd., Richardson, TX 75081-4802, Tel: 214-238-5300, FAX: 214-238-0911; *Sls. Mgr.:* Barry Epstein; *Dist. Mgr.:* Steve Larson

CURTIS INDUSTRIES, P.O. Box 19910, Milwaukee, WI 53219-0910, Tel: 414-649-4200, TWX: 910-262-3035, FAX: 414-649-4279; FSC No.: 73631; Empl.: 110; *Sls. Mgr.:* W.M. Tennie; *Dist. Mgr.:* Al Hungsberg

CURTIS

FAX: 914-666-2188

CURTIS INSTRUMENTS, INC., 200 Kisco Ave., Mt. Kisco, NY 10549, Tel: 914-666-2971, TWX: 710-571-2163; FSC No.: 18530; Empl.: 115; *Sls. Mgr.:* Jim Story ..... **D•1132**

Local Sales Offices & Reps

AZ	Astrocom Mktg.	602-991-6646
CA	Burlingame, NorCal RepCo	408-988-1643
CA	Seal Beach, Texel Engrg.	213-596-9411
CO	Littleton, J.F. Hurlbut Co.	303-279-7796
FL	Longwood, NSL Assocs.	407-629-5226
GA	L & D, Inc.	404-395-7079
IL	La Grange Park, Bierhaus Sls.	312-751-8088
MD	Advanced Tech. Sls.	301-323-3140
MA	Brookline, Harman Assocs.	617-232-6687
MN	Minnetonka, S.J. Collins & Assoc.	612-933-7661
MO	Acorn Elctrns.	314-421-1751
NY	Smith Tech. Sls.	716-223-5656
NY	Manhasset, WinCor Elctrn. Sls. Corp.	516-627-9474
OH	Chagrin Falls, T.E. Murphy Co.	513-692-8713
PA	W. Reeves Assocs.	215-356-7500
TX	Lektron	214-416-4585
WA	Seattle, Evergreen Mktg.	206-485-8063

Local Distributors

MO	St. Louis, Acorn Elctrns. Inc.	314-644-2510
PA	Newton Sq., W. Reeves Assocs.	215-356-7500
TX	Carrollton, Lektron	817-464-7784

CUSTOM BOBBIN WINDINGS, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369, Tel: 614-452-6973, FAX: 614-452-4156; Empl.: 16

CUSTOM CABLE CORP., 242 Butler St., Westbury, NY 11590, Tel: 516-334-3600, TELEX: 269301, FAX: 516-334-3989; Empl.: 20; *Sls. Mgr.:* J. Michelman; *Dist. Mgr.:* D. Pollack

CUSTOM COILS INC., Box 338, Alcester, SD 57001, Tel: 605-934-2460, FAX: 605-934-2440; FSC No.: 34808; Empl.: 75; *Sls. Mgr.:* Randy Larson ..... **A•2197**

Local Sales Offices & Reps

CA	Santa Clara, Rodgers Assocs.	408-984-8110
CO	Englewood, Krebill Comp. Sls.	303-771-0955
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
MN	Edina, M F I	612-832-9017

CUSTOM CONNECTOR, 1738 E. 30th St., Cleveland, OH 44114, Tel: 216-241-1679, FAX: 216-241-1734; Empl.: 24; *Sls. Mgr.:* Larry Weider

CUSTOM CONTROL SENSORS, INC., 21111 Plummer Street, Chatsworth, CA 91313-2516, Tel: 818-341-4610, FAX: 818-709-0426; Empl.: 350; *Sls. Mgr.:* Charles Ritner

CUSTOM ELECTRONICS, Browne St., Oneonta, NY 13820, Tel: 607-432-3880, FAX: 607-432-3913; FSC No.: 23280; Empl.: 130; *Sls. Mgr.:* D. Hathaway

CUSTOM LINEAR INC., 617-E. Arques Ave., Sunnyvale, CA 94086-3832, Tel: 408-749-9933, FAX: 408-736-4720; Empl.: 15; *Sls. Mgr.:* Earl Wentworth

CUSTOM LOGIC, P.O. Box 3940, Crestline, CA 92325, Tel: 714-338-4059, FAX: 714-338-4450

CUSTOM MICRO SYSTEMS, INC., P. O. Box 9472, Livonia, MI 48151, Tel: 313-559-5397

CUSTOM POWER SYSTEMS, INC.

FAX: 516-467-5066

CUSTOM POWER SYSTEMS, 33 Comac Loop, Ronkonkoma, NY 11779-9998, Tel: 516-467-5328; Empl.: 15 ..... **D•1697**

Local Sales Offices & Reps

AZ	Tucson, Siegel & Assocs.	602-323-9655
CA	Agoura Hills, Powerdyne	818-991-0632
CA	San Jose, NES	408-293-2600
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Whitinsville, Power Factor & Assoc.	508-234-6415
FL	Oviedo, Lighthouse Mktg.	407-366-0073
NJ	Clementon, Systech Assocs.	609-784-8300
TX	Dallas, Eatman Engrg.	214-771-1903

CUSTOM SCI. INSTRS., 13 Wing Dr., Cedar Knolls, NJ 07927, Tel: 201-538-8500, FAX: 201-984-6793; Empl.: 47; *Sls. Mgr.:* Henry Piekarski

CUT CRAFT, INC., 1501 Northpark Drive, Ft. Worth, TX 76102, Tel: 817-332-6151, FAX: 817-332-3304; Empl.: 90; *Sls. Mgr.:* Fred A. Antonini ..... **C•1675, 1688**

CUTLER-HAMMER, INC., SHALLCROSS RESISTOR PRODS., See RCL Shallcross, Inc.

CVC PRODUCTS, INC., 525 Lee Rd., P.O. Box 1886, Rochester, NY 14603, Tel: 716-458-2550, TELEX: 265240, TWX: 4947142, FAX: 716-458-0424; Empl.: 160; *Sls. Mgr.:* Christopher J. Mann

CVDS INC., 6900 Trans Canada Hwy., Pte. Claire,Que., Canada H9R 1C2, Tel: 514-694-9320, FAX: 514-694-0786; Empl.: 100; *Sls. Mgr.:* K.(George) Sossoyan-Reg. Montreal

CW INDUSTRIES

FAX: 215-355-1088

CW INDUSTRIES, 130 James Way, Southhampton, PA 18966, Tel: 215-355-7080; FSC No.: 79727; Empl.: 450; *Sls. Mgr.:* Michael Klakis .... **B•1010-1011, 1678-1679; C•1332-1333**

Local Sales Offices & Reps

AL	Madison, Lamons Sls.	205-461-7871
AZ	Tempe, Westrep	602-820-9932
AR	Little Rock, Erickson Sls.	501-455-0618
CA	Garden Grove, ELSCO Elctrns.	714-892-4621
CA	Napa, Stewart-Fullerton	707-258-1160
CO	Englewood, Purdy Co. Assoc.	303-790-2211
CT	Guilford, Tynik, Inc.	203-453-1613
FL	Tampa, Standard Mktg.	813-933-5833
GA	Norcross, Lamons Sls.	404-242-2610
IL	Park Ridge, G. Mcl. Cole Co.	312-692-6040
IN	Greenfield, France Entprs.	317-462-6098
IN	Greenwood, Liberty Sls.	317-888-8396
MD	Columbia, Delta III Assocs.	301-730-4700
MD	Newton, Greene-Shaw Co.	617-969-8900
MA	Taunton, Focus Elctrn. Sls.	617-824-3840
MI	Holland, Mackinaw Sls, Inc.	616-399-4665
MN	Minneapolis, Robt. Marshall Co.	612-929-0457
MO	Kansas City, Ruffolo & Assocs.	816-471-5701
NJ	Englewood Cliffs, Ed Glass Assocs.	201-592-0200
NY	Buffalo, NRM Mktg. Grp.	716-634-4367
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Akron, Augnat Assocs.	216-273-1211
OR	Tigard, Eltech Inc.	503-684-3458
PA	Hatboro, A Q S	215-674-3562
TN	Greeneville, Lamons Sls. Co.	615-639-8711
TX	Dallas, Erickson Sls. Inc.	214-739-5833
WA	Bellevue, Eltech	206-643-4330
Can	Rexdale, True North Tech. Ltd.	416-744-2233

Local Distributors

AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Canoga Park, Acort Inds., Inc.	818-700-2991
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Santa Ana, BDS Elctrns., Inc.	714-662-1050
CA	Santa Ana, El-Com/Cabletek	714-432-6630
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Sunnyvale, Bell Inds.	408-745-0400
CA	Torrance, Kent Elctrns.	213-320-2700
CO	Arvada, Denver Wintronics	303-431-7161
CT	South Windsor, Car-Lac Elctrns.	203-282-0631
DE	Wilimington, Wholesale Elctrns., Inc.	302-652-3222
FL	Stuart, Microwave Comps., Inc.	407-286-4455
IL	Crystal Lake, Sub-Sem Inc.	312-459-4139
IL	Wheeling, Hawk Elctrns., Inc.	312-459-4030
IN	Indianapolis, Bell Inds.	317-634-8202
MD	Beltsville, Petricko Sls., Inc.	301-937-4960
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MA	Milford, Car-Lac Elctrns.	617-478-7797
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Norwood, Emtel Elctrns.	617-769-9500
MI	St. Clair Shores, Spemco	313-771-2700
MN	New Brighton, Chris Elctrns.	612-631-2647
MN	Thief River Falls, Digi-Key Corp.	800-346-5144
NJ	Roselle, Lectron Inds.	201-245-5858
NJ	Voorhees Township, PAR-TEC Comps. Co.	609-795-4884
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Baldwinsville, Scibetta Distrs.	315-622-3993
NY	Bohemia, Car-Lac Elctrns.	800-645-1192
NY	Farmingdale, Pride Elctrns.	516-293-4020
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Englewood, Argent Inds., Inc.	513-836-8633
OH	Solon, Reh-Electra	216-248-1636
PA	Bristol, AIM Elctrns.	215-785-3500
TX	Carrollton, Connec Tek, Inc.	214-245-1266
TX	Mansfield, Edison Elctrns.	817-473-3322
WA	Redmond, Pyramid Elctrns.	206-883-7200
WA	Seattle, Preibe Elctrns.	206-575-1050

CYBERPAK CO., 251 S. Frontage Rd., Ste. 23, Burr Ridge, IL 60521, Tel: 708-654-3999, FAX: 708-654-4027; Empl.: 5; *Sls. Mgr.:* R. Weinbrenner

CYBER SYS., INC., 2570 E. Cerritos Ave, Anaheim, CA 92806, Tel: 714-722-2051, 714-634-2800, FAX: 714-937-1955; Empl.: 35

CYBRID INCORPORATED, 10 Woodcrest Drive, Woodcliff Lake, NJ 07675, Tel: 201-307-0426, FAX: 201-391-7112; Empl.: 9

CYCLO-TRONICS, INC., 1345 N. Old Rand Rd., Wauconda, IL 60084, Tel: 708-526-0800, FAX: 708-526-0803; Empl.: 10

THE CYLIX CORPORATION, 2637 Townsgate Rd., Ste. 200, Westlake Vl., CA 91361, Tel: 805-379-3155, FAX: 805-379-4551; FSC No.: 59; Empl.: 15; *Sls. Mgr.:* William J. Purcell; *Dist. Mgr.:* Peter Norman

CYPRESS MAGNETICS, INC., 8751 1/2 Industrial Lane, Rancho Cucamonga, CA 91730, Tel: 714-987-3570, FAX: 714-980-2009; FSC No.: 59791; Empl.: 15; *Sls. Mgr.:* Robert C. Greenwood

CYTEC CORP.

FAX: 716-381-0475

CYTEC CORP., 2555 Baird Road, Penfield, NY 14526, Tel: 716-381-4740, 800-346-3117; Empl.: 20; *Sls. Mgr.:* Harry Turner ..... **D•1240**

Local Sales Offices & Reps

OR	Portland, Westcon, Inc.	503-283-0132
WA	Kent, Westcon, Inc.	206-824-8922

DABURN

FAX: 201-768-9642

DABURN ELECTRONICS & CABLE CORP., 225 Pegasus Ave., Northvale, NJ 07647, Tel: 201-768-5400; FSC No.: 25706; *Sls. Mgr.:* Ed Rothenstein ..... **C•1745-1751**

Local Sales Offices & Reps

AZ	Tucson, Clemick & Assocs.	602-749-4003
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	Newport Beach, SPA Elctrns.	714-863-1193
CO	Denver, Mountain Reps	303-623-0972
FL	Tampa, SRT	813-884-4805
IL	Elgin, Markar Sls.	708-888-2207
IN	Indianapolis, STB & Assocs.	317-844-9227
LA	Kenner, Assoc. Mktg. Grp.	504-443-5072
MD	Bel Air, Freedman Malta Assocs.	301-879-3848
MA	No. Scituate, W. A. Hendrickson	617-545-0652
MN	Minneapolis, R. K. Sls.	612-571-1001
MO	Blue Springs, KKB & Co.	816-229-0001
MO	St. Louis, KKB & Co.	314-647-2400
NJ	Whippany, Robert Smith Assocs.	201-540-0204
NY	E. Syracuse, Liberty Elec.	315-437-8100
NY	Plainview, Robt. Smith Assocs.	516-681-3155
PA	Pittsburgh, Catalzst Sls.	412-733-5450
OR	Hillsboro, Turn-A-Round Sls.	503-640-4641
PA	King of Prussia, Freedman-Malta	215-337-9211
TX	Ft.Worth, Reynolds Assoc.	817-429-8207
WA	Kirkland, Turn-A-Round Sls.	206-822-4634
WI	Menomonee Falls, Voss-Dent Assocs.	414-781-0555
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

Local Distributors

CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Carlos, Logan Elctrns.	415-594-0700
CA	San Diego, Shanks & Wright	619-239-0176
CT	New Haven, Hatry	203-787-5921
CT	West Hartford, Signal Ctr.	203-233-8551
FL	Miami, Small Parts	305-751-0856
GA	Atlanta, ACK Radio Supp.	404-351-6340
IA	Marion, Brenneman & Assoc.	319-377-6394
LA	Harahan, Elctrn. Parts & Supp.	504-734-0641
MD	Gaithersburg, M S Elctrns.	301-921-0200
MA	Needham, YDI Electronics	617-449-1005
MA	Woburn, Pacer	617-935-8330
NJ	Beachwood, Berkley Indl.	201-341-9366
NJ	Cranford, GSI Elctrns.	201-272-6400
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Moorestown, Marlac	908-234-4200
NY	Albany, E. E. Taylor	518-438-7811
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Hauppauge, Broadline	516-231-4100
NY	Rochester, Simcona	716-328-3230
PA	Allentown, Federated Purchaser	215-437-4481
PA	Philadelphia, AC Radio	215-462-9379
WA	Seattle, Westlake Elctrns.	206-622-6600
WI	Fond Du Lac, Fedco	414-922-6490
Can	Markham, Ont., Arma	416-475-2024

DADEN ASSOCIATES, 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653, Tel: 714-770-1522, TWX: 910-596-1324, FAX: 714-472-0805; FSC No.: 57032; Empl.: 49; *Sls. Mgr.:* Dennis Hook

DAEDAL, Sandyhill Road, Harrison City, PA 15636, Tel: 412-744-4451, FAX: 412-744-7626; *Sls. Mgr.:* R. Mitchell; *Dist. Mgr.:* R. Mitchell

DAGE-MTI, 701-N. Roeske Ave., Michigan City, IN 46360, Tel: 219-872-5514, ESYLNK: 532521, FAX: 219-872-5559; Empl.: 51; *Sls. Mgr.:* Paul Thomas

DAGE PRECISION INDUSTRIES, INC., 46701 Fremont Blvd., Fremont, CA 94538, Tel: 415-683-3930, TELEX: 4990512, FAX: 415-683-3935; Empl.: 10; *Sls. Mgr.:* Joseph M. Tosta

DAHLSTROM OF CANADA LTD., 7 Copeland Street, Toronto, Ontario, Canada M4G 37E, Tel: 416-421-5900, FAX: 414-421-3728; Empl.: 44

DAICO INDUSTRIES, INC., 2453 East Del Amo Blvd., Compton, CA 90220, Tel: 213-631-1143, FAX: 213-631-8078; FSC No.: 28983; Empl.: 200; *Sls. Mgr.:* Kevin Townsend; *Dist. Mgr.:* Diane Felando

DAIDO CORP., Sumtak Electronics Division

DAITRON, INC., 7150 S.W. Hampton, Suite 130, Tigard, OR 97223, Tel: 503-620-2879, TELEX: 910-240-4863, FAX: 503-620-2942; Empl.: 10; *Dist. Mgr.:* Karen Sempert

DALE ELECTRONICS, INC., Columbus Div., 1122 23rd Street, Columbus, NE 68601-3647, Tel: 402-563-6506, FAX: 402-563-6418; FSC No.: 91637; Empl.: 2800; *Sls. Mgr.:* Darrell Smejkal; *Dist. Mgr.:* Jon Trabert ..... **A•1194-1200, 1352-1355, 1886-1908, 2032-2037, 2198-2199; B•1046-1048, 1839-1841; C•1335**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Tempe, Dale Elctrns. Sls.	602-967-7874
CA	Fremont, Telesis Sls. Grp.	415-713-7300
CA	Redwood City, J. S. Heaton Co.	415-367-9000
CA	San Diego, Vishay EC Sls. Office	619-690-5112
CA	Tustin, Vishay EC Sls. Office	714-544-7024
CO	Colorado Springs, Vishay EC Rocky Mountains	719-593-7529
CO	Grand Junction, Vishay EC Rocky Mtns.	303-241-0150
CO	Loveland, Vishay EC Rocky Mountains	303-667-7500
CT	Riverside, Howard C. Jappe, Co.	914-937-4845
FL	Altamonte Springs, Semtronic Assocs.,Inc.	407-831-8233
FL	Clearwater, Semtronic Assocs.,Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.,Inc.	305-731-2484
GA	Roswell, JWL Assocs.	404-993-0100
IL	Skokie, Indl. Reps.	708-967-8430
IN	Fort Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
KS	Olathe, Tech. Sls. Assocs.	913-829-2800
MD	Glen Burnie, Tri-Mark	410-761-6000
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Bloomington, Industrial Reps., Inc.	612-854-8027
NJ	Flanders, K & R Engrg.	201-584-5235
NY	East Rochester, L-Mar Assocs.,Inc.	716-381-9100
MO	Ferguson, Tech. Sls. Assocs.	314-521-2044
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns., Inc.	513-294-0539
OH	Westerville, Scott Elctrns.	614-882-6100
OR	Beaverton, LD Elctrns.	503-684-8221
PA	Horsham, TMI	215-441-4300
TX	Dallas, E. F. Aymond Co.	214-349-4014
TX	Houston, E. F. Aymond Co.	713-943-3149
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Brookfield, Indl. Reps.	414-789-9393

Local Distributors

AL	Huntsville, Hamilton/Avnet	205-837-7210
AL	Huntsville, Pioneer Technlgs.	205-837-9300
AZ	Chandler, Hamilton/Avnet	602-961-6400
AZ	Chandler, Hamilton/Avnet	602-961-6613
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, Acacia Elctrns.	602-894-2874
AZ	Tempe, Shelley-Ragon, Inc.	602-894-2058
AZ	Tempe, T.T.I. Inc.	602-431-1191
CA	Chatsworth, Shelley-Ragon, Inc.	818-998-3333
CA	Costa Mesa, Hamilton Electro Sls.	714-754-6030
CA	Culver City, Hamilton/Avnet	213-558-2111
CA	Fremont, Acacia	415-623-7500
CA	Gardena, Hamilton Electro Sls.	213-217-6750
CA	Gardena, Hamilton/Avnet	213-217-6700
CA	Inglewood, Newark Elctrns.	213-671-7377
CA	Irvine, Acacia Elctrns.	213-971-2428
CA	Milpitas, T. T. I., Inc.	408-946-5577
CA	Mission Hills, T.T.I,Inc.	818-891-8885
CA	Roseville, Hamilton/Avnet	916-920-3150
CA	San Diego, Acacia Elctrns.	619-597-0577
CA	San Diego, Hamilton/Avnet	619-571-7536
CA	San Diego, Shelley-Ragon, Inc.	619-453-7133
CA	San Diego, T.T.I., Inc.	619-748-2025
CA	San Jose, Shelley-Ragon, Inc.	408-432-0600
CA	Santa Ana, T.T.I., Inc.	714-641-9393

CA Sunnyvale, Hamilton/Avnet 408-743-3358
CA Woodland Hills, Hamilton/Avnet 818-594-8224
CO Commerce City, Waco Elctrns. 303-289-4743
CO Denver, Newark Elctrns. 303-757-8531
CO Denver, T.T.I. Inc. 303-429-6806
CO Englewood, Hamilton/Avnet 303-799-7815
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
CO Lakewood, Acacia/Deanco Elctrns. 303-232-2882
CT Danbury, Hamilton/Avnet 203-797-2854
CT Norwalk, Pioneer Std. 203-853-1515
CT Wallingford, Sterling Elctrns. 203-265-9535
CT Wallingford, T.T.I., Inc. 203-284-7474
FL Altamonte Springs, Pioneer Technlgs. 407-834-9090
FL Deerfield Beach, Pioneer Technlgs. 305-428-8877
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL Orlando, T.T.I., Inc. 407-859-1000
FL St. Petersburg, Hamilton/Avnet 813-573-3930
FL Tampa, Reptron Elctrns. 813-854-2351
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
FL Winter Park, Hamilton/Avnet 407-628-3888
GA Duluth, Hamilton/Avnet 404-447-7523
GA Norcross, Pioneer Technlgs. 404-448-1711
GA Norcross, T.T.I., Inc. 404-662-0911
IL Addison, Pioneer Standard 312-495-9680
IL Bensenville, Hamilton/Avnet 708-860-7780
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove Village, Bell Ind. 708-640-1910
IL Glendale Heights, Shelley-Ragon, Inc. 708-529-9977
IL Palatine, Ohm Elctrns. 708-359-5500
IN Carmel, Hamilton/Avnet 317-844-9333
IN Ft. Wayne, Bell Ind.,Graham Div. 219-423-3422
IN Indianapolis, Bell Ind., Graham Div. 317-875-8200
IN Indianapolis, Pioneer Std. 317-573-0880
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
IA Cedar Rapids, Shelley Ragon, Inc 319-373-0525
KS Lenexa, Hamilton/Avnet 913-888-8900
KY Lexington, Hamilton/Avnet 606-259-1475
MD Baltimore, RESCO 410-931-8200
MD Beltsville, RESCO 301-937-9100
MD Columbia, Hamilton/Avnet 410-995-3526
MD Columbia, T. T. I, Inc. 410-995-1331
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
MA Billerica, Mayer Co. 617-229-2255
MA Chelmsford, Shelley-Ragon, Inc. 508-250-9666
MA Lexington, Pioneer Std. 617-861-9200
MA Peabody, Hamilton/Avnet 508-532-9861
MA Springfield, C & D Elctrns. 413-781-1776
MA Wilmington, T.T.I. Inc. 508-658-4700
MA Woburn, Sterling Elctrns. 617-938-6200
MI Grand Rapids, Pioneer Std. 616-698-1800
MI Grand Rapids, S-F Elctrn. Supp. 616-459-0216
MI Grandville, Hamilton/Avnet 616-531-0345
MI Livonia, Pioneer Std. 313-525-1800
MI Livonia, R-S Elctrns. 313-525-1155
MI Livonia, Reptron Elctrns. 313-525-2700
MI Novi, Hamilton/Avnet 313-347-4270
MI Oak Pk., Newark Elctrns. 313-967-1570
MA Springfield, C & D Electronics, Inc. 413-781-1776
MN Eden Prairie, Pioneer-Std. 612-944-3355
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minnetonka, Hamilton/Avnet 612-932-0674
MN Minnetonka, T.T.I., Inc. 612-933-8555
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828
MO Chesterfield, Hamilton/Avnet 314-537-4265
MO Independence, Shelley-Ragon, Inc. 816-254-3410
MO Hazelwood, Shelley-Ragon, Inc. 314-895-1515
NJ Cherry Hill, Hamilton/Avnet 609-424-0117
NJ Cranford, G.S.I. Elec. 201-272-6400
NJ Fairfield, Hamilton/Avnet 201-575-3490
NJ Fairfield, Pioneer-Standard 201-575-3510
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Mount Laurel, T.T.I., Inc. 609-234-6400
NM Albuquerque, Hamilton/Avnet 505-345-0001
NY Binghampton, Pioneer Std. 607-722-9300
NY Bohemia, March Elctrns. 516-563-6000
NY Buffalo, Summit Distr. 716-887-2800
NY Endwell, A.S.I. Elctrns. 607-754-3823
NY Fairport, Pioneer Std. 716-381-7070
NY Farmingdale, Command Elctrns. 516-293-1212
NY Hauppauge, Fairmont 516-231-3313
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Medford, L.I., Shelley-Ragon, Inc. 516-447-2000
NY Rochester, Hamilton/Avnet 716-272-2704
NY Rome, Rome Elctrns. 315-337-5400
NY Ronkonkoma, T.T.I., Inc. 516-737-2000
NY Syracuse, Hamilton/Avnet 315-437-2641
NY Valley Stream, L.I., L&S Elctrns. 516-561-2474
NY Woodbury, Pioneer Std. 516-921-8700
NC Charlotte, T.T.I., Inc. 704-522-0277
NC Durham, Pioneer Technlgs. 919-544-5400
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, RESCO 919-781-5700
OH Cleveland, Pioneer Standard 216-587-3600
OH Columbus, Hamilton/Avnet 614-882-7004
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Bell Inds., Military Div. 513-434-8231
OH Dayton, Hamilton/Avnet 513-439-6730
OH Dayton, Hamilton/Avnet 513-439-6700
OH Dayton, Pioneer Standard 513-236-9900
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Solon, Hamilton/Avnet 216-349-5100
OH Valley View, Newark Elctrns. 216-447-8860
OH Worthington, T.T.I. Inc. 614-848-5770
OK Tulsa, Hamilton/Avnet 918-252-7297
OK Tulsa, Radio, Inc. 918-587-9123
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Acacia Electronics 503-646-3377
OR Beaverton, Hamilton/Avnet 503-526-6209
OR Portland, Radar Elec. 503-232-3404
PA Horsham, Pioneer Technlgs. 215-674-4000
PA Mars, Hamilton/Avnet 412-281-4151
PA McKean, Advacom 814-476-7774
PA Pittsburgh, Pioneer Std. 412-782-2300
PA Trevose, Almo Elctrns. 215-953-2800
PA York, E.C.I., Inc. 717-846-5334
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Pioneer-Standard 512-835-4000
TX Austin, Sterling Elctrns. 512-836-1341
TX Carrollton, Sterling Electronics 214-243-1600
TX Dallas, Hamilton/Avnet 214-308-8111
TX Dallas, Pioneer Std. 214-386-7300
TX Ft. Worth, T.T.I., Inc. 817-595-3100
TX Ft. Worth, T.T.I., Inc. 817-831-8300
TX Ft. Worth, T.T.I.,Inc. 817-847-6666
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elctrns. 713-783-1629
TX Houston, Pioneer Std. 713-495-4700
TX Houston, Sterling Elctrns. 713-627-9800
TX Stafford, Hamilton/Avnet 713-274-9336
UT Salt Lake City, Hamilton/Avnet 801-974-9649
WA Redmond, Acacia Elctrns. 206-881-5566
WA Redmond, Hamilton/Avnet 206-867-0149
WA Redmond, Shelley-Ragon Inc. 206-883-2220
WA Redmond, T.T.I. Inc. 206-882-0291
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000

DALE ELECTRONICS, INC., El Paso Div., P.O. Box 26728, El Paso, TX 79926-6728, Tel: 915-592-3253; FSC No.: 91637; Empl.: 272; *Sls. Mgr.:* Bill Buchanan; *Dist. Mgr.:* Jon Trabert ..... **B•1839-1841**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701-2242, Tel: 402-371-0080; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Eldon Engel; *Dist. Mgr.:* Jon Trabert ..... **A•1891-1899**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282-1883, Tel: 602-967-7874; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Mike Brown; *Dist. Mgr.:* Jon Trabert ..... **A•1352-1355, 2032-2035**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078-0180, Tel: 605-665-9301; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* John Elliot; *Dist. Mgr.:* Jon Trabert ..... **A•1194-1196, 1198-1199, 2198; C•1334-1335**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DALLAS SEMICONDUCTOR, 4401 South Beltwood Pkwy., Dallas, TX 75067, Tel: 214-450-0400, FAX: 214-450-0470; Empl.: 720; *Sls. Mgr.:* John Mattis ..... **A•1529-1531**

Local Sales Offices & Reps

AL Huntsville, Glen White & Assocs. 205-882-6751
AZ Scottsdale, Haas & Assocs. 602-998-7195
AR Tusla, West Assocs. 918-665-3465
CA San Diego, Harvey King, Inc. 619-587-9300
CA Santa Clara, I Squared 408-988-3400
CO Wheat Ridge, Waugaman Assoc. 303-423-1020
CT Wallingford, Technology Sls. Inc. 203-269-8853
FL Ft. Lauderdale, Semtronic Assoc., Inc. 305-731-2484
GA Norcross, Glen White & Assocs. 404-441-1447
IL Rolling Meadows, Sumer, Inc. 708-991-8500
IN Indianapolis, Elctrn. Sls. & Eng. 317-849-4260
IA Cedar Rapids, Cahill, Schmitz & Howe 319-377-8219
KS Stanley, West Assocs. 913-897-6366
MA Woburn, Mill-Bern Assocs. 617-932-3311
MI Livonia, Geisting & Assocs. 313-478-8106
MN St. Paul, Cahill, Schmitz & Cahill 612-646-7217
MO St. Louis, Technical Sls. Assoc. 314-521-2044
NJ Haddonfield, Sunday O'Brien Inc. 609-429-4013
NJ Mt. Laurel, S-J Assocs. 609-866-1234
NY Rockville Centre, S-J Assocs. 516-536-4242
NC Huntersville, Glen & White Assoc. 704-875-3777
NC Raleigh, H & A Sls. 919-846-0082
OH Cincinnati, Geisting & Assocs. 513-385-1105
OK Tusla, West Assocs. 918-665-3465
OR Beaverton, Western Tech. Sls. 503-644-8860
TN Gray, Glen White & Assoc. 615-477-8850
TX Houston, West Assocs. 713-621-5983
UT Salt Lake City, Waugaman Assocs. 801-261-0802
VA Falls Church, S-J Chesapeake 703-533-2233
WA Bellevue, Western Tech. Sls. 206-641-3900
WA Spokane, Western Tech. Sls. 509-922-7600
WI Brookfield, Sumer, Inc. 414-784-6641
Can Kanata, Electro-Source Inc. 613-592-3214

Local Distributors

AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AZ Phoenix, Hall-Mark Elctrns. 602-437-1200
CA Irvine, Insight Elctrns. 714-727-2111
CO Wheat Ridge, Added Value Elect. Dist. 303-422-1701
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Winter Park, Milgray-Elctrns. 407-647-5747
GA Duluth, Hall-Mark Elctrns. 404-623-4400
IL Arlington Heights, Milgray Elctrns. 708-253-1212
IN Indianapolis, Added Value Elect. Dist. 317-872-4910
IA Cedar Rapids, Added Value Elect. Dist. 319-363-0221
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
MA Wilmington, Milgray Elctrns. 508-657-5900
MI Livonia, Hall-Mark Elctrns. 313-462-1205
MN Minneapolis, Sterling Elctrns. 612-831-2666
NJ Marlton, Milgray Elctrns. 609-983-5010
NY Farmingdale, Milgray Elctrns. 516-391-3000
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
OH Solon, Hall-Mark Elctrns. 216-349-4632
OK Tusla, Sterling Elctrns. 918-663-2410
OR Beaverton, Anthem Elctrns. 503-643-1114
TX Richardson, Anthem Elctrns. 214-238-1700
UT Salt Lake City, Anthem Elctrns. 801-973-8555
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Almac Elctrns. 206-643-9992
Can Ville St. Laurent, Que., ITT Multicomponents 514-335-7697

DALSA INC., 605 McMurray Road, Waterloo, Ont., Canada N2V 2E9, Tel: 519-886-6000, FAX: 519-886-8023; *Sls. Mgr.:* Dan Blacklock

DANCER COMMUNICATIONS, INC., 162 Saxer Ave., Media, PA 19064-2334, Tel: 215-543-8066, FAX: 215-543-2151; *Sls. Mgr.:* Barbara Gordon

Local Sales Offices & Reps

CO Littleton, Base Technlgs. Co. 303-979-3392

Local Distributors

WI Milwaukee, Nuvisco, Inc. 414-445-9206

D & B POWER, INC.

FAX: 516-586-5952

D & B POWER, INC., 204 N. Fehr Way, P.O. Box 40M, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Gordon Best; *Dist. Mgr.:* Dan Hall ..... **D•1698-1699**

Local Sales Offices & Reps

CA Pasadena, Electro Mecha. Instrs. 818-795-7193
MD Hunt Valley, Eagle Sls. 301-666-3930
CA Santa Clara, Veer Mktg. 408-986-1610

D & P MFG. INC., 32 Hamilton St., Chalfont, PA 18914, Tel: 215-997-1200, FAX: 215-997-1200; Empl.: 7

DMC DANIELS MANUFACTURING CORPORATION

FAX: 407-855-6884

DANIELS MANUFACTURING CORP., 526 Thorpe Rd., Orlando, FL 32824, Tel: 407-855-6161, TELEX: 564321; FSC No.: 11851; Empl.: 180; *Sls. Mgr.:* Don Malinovsky; *Dist. Mgr.:* Don Malinovsky ..... **C•1703**

Local Sales Offices & Reps
CA El Toro, DMC Western Reg. 714-588-8090

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 11952 Challenger Court, Moorpark, CA 93021, Tel: 1-805-529-3788,1-800-666-6268, FAX: 805-529-3837; FSC No.: 31690; Empl.: 10; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, TELEX: 35-5457, FAX: 209-292-9355; FSC No.: 56960; Empl.: 205; *Sls. Mgr.:* Bob Long

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55126, Tel: 612-484-2108; Empl.: 22

DARE ELECTRONICS, INC., 3245 S. County Rd., 25A, Troy, OH 45373, Tel: 513-335-0031; FSC No.: 55901; Empl.: 20; *Sls. Mgr.:* Paul J. Gilmore

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

D.A.T.A. BUSINESS PUBLISHING, Information Handling Services, 15 Inverness Way East, P.O. Box 6510, Englewood, CO 80155-6510, Tel: 303-799-0381, TELEX: 530606; Empl.: 30; *Sls. Mgr.:* Tom Littman; *Dist. Mgr.:* Ray Coakes

DATA CHECK CORPORATION, 9918 Via Pasar, San Diego, CA 92126, Tel: 619-578-0101, FAX: 619-578-9215; FSC No.: 55792; Empl.: 45; *Sls. Mgr.:* Bill Acosta

DATACHRON INC., 1150 E. Stanford Court, Anaheim, CA 92805, Tel: 714-385-1705, FAX: 714-978-2514; FSC No.: 56259; Empl.: 19; *Sls. Mgr.:* Clyde Davis

DATA CIRCUITS, COMPUTER LOGICS LTD., 6380 Viscount Rd., Mississauga, Ont., Canada L4V 1H3, Tel: 416-672-3833, TELEX: 416-672-3869; Empl.: 80; *Sls. Mgr.:* Rick Way; *Dist. Mgr.:* Rick Way

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32549, Tel: 904-244-6121, FAX: 904-244-6344; FSC No.: 32365; Empl.: 50

DATACON, INC., Interconnect Sub-Systems, 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, FAX: 617-273-4809; Empl.: 350; *Dist. Mgr.:* Lonise M. Evelyn

DATACUBE, INC., 4 Dearborn Rd., Peabody, MA 01960, Tel: 508-535-6644, TELEX: 6817540, FAX: 508-535-5643; Empl.: 130; *Sls. Mgr.:* Denny Maher

FAX: 201-773-9672

DATA DELAY DEVICES, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, Tel: 201-773-2299 ..... **A•1532-1548**

Local Sales Offices & Reps
AL Huntsville, Hughes Assocs. 205-533-9108
AZ Phoenix, Tech Sls., Inc. 602-246-1614
AR R-Squared 713-820-3210
CA Mission Viejo, Jay Mktg. Assocs. 714-768-7519
CA Mountain View, Weseloh/Swanson & Assocs. 415-961-0565
CT Dynamic Sls., Inc. 617-272-5676
DE Jack McCoy Assocs. 215-363-0350
FL Pensacola, Hughes Assocs.,Inc. 904-433-1787
GA Norcross, Hughes Assocs., Inc. 404-662-1587
IN J. M. Finnegan & Co. 216-238-5905
KY J. M. Finnegan & Co. 216-238-5905
LA R-Squared 713-820-3210
ME Dynamic Sls., Inc. 617-272-5676
MA Burlington, Dynamic Sls., Inc. 617-272-5676
MI Grand Rapids, Jim Finnegan & Co. ... 616-245-4621
MS Corinth, Hughes Assocs., Inc. 601-287-2915
NH Dynamic Sls., Inc. 617-272-5676
NJ Medford, Jack McCoy Assocs. 609-953-0770
NY Pittsford, James E. Zimmmerman Sls. 716-381-3186
NC Raleigh, Hughes Assocs., Inc. 919-467-7029
OH Dayton, Jim Finnegan & Co. 513-890-8322
OK R-Squared 713-820-3210
PA Downingtown, Jack McCoy, Inc. 215-363-0350
PA Pittsburgh, Jim Finnegan & Co. 412-823-5400
RI Dynamic Sls., Inc. 617-272-5676
SC Hughes Assocs., Inc. 919-467-7029
TN Morristown, Hughes Assocs., Inc. 615-587-2433
TX Houston, R-Squared 713-820-3210
VT Dynamic Sls., Inc. 617-272-5676
VA Jim Finnegan & Co. 216-238-5905
Can Ont., Source Elctrns. 416-676-0830

Local Distributors
CA Sunnyvale, Target Elctrns. 408-734-5611
TX Dallas, Omni Pro 214-233-0500

DATA-DESIGN LABS., P.O. Box 711, 7925 Center Ave., Cucamonga, CA 91730, Tel: 714-987-2511; Empl.: 1200

DATA DEVICE CORP., See ILC Data Device Corp.

FAX: 213-640-7639

DATA DISPLAY PRODUCTS, 445 So. Douglas St., El Segundo, CA 90245-4630, Tel: 213-640-0442, 800-421-6815; FSC No.: 15513; Empl.: 40; *Sls. Mgr.:* Anthony Toniolo; *Dist. Mgr.:* Anthony Toniolo ..... **B•1142-1144**

DATA ENGINEERING, INC., 2515 N. State Rd. 7 Ste. 207, Margate, FL 33063-3206, Tel: 305-971-0400; *Sls. Mgr.:* Mario M. Martinez

DATA ENVIRONMENT, INC., Box 91511, Beaverton, OR 97291, Tel: 503-643-4292

DATA INSTRUMENTS, INC., 100 Discovery Way, Acton, MA 01720, Tel: 508-264-9550, TELEX: 200081, FAX: 508-263-0630; Empl.: 300; *Sls. Mgr.:* Ernest C. Lutfy ..... **B•1891**

Local Sales Offices & Reps
AL Huntsville, FLW Southeast, Inc. 205-536-6207
AL Mobile, FLW S.W. 205-990-8989
AZ Scottsdale, Williams Assocs. 602-494-0790
CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CA Santa Clara, Johnson Assoc. 408-984-4626
CO Highlands Ranch, Valcomp Elctrns., Inc. 303-791-0330
FL Orlando, FLW Southeast, Inc. 407-894-9671
GA Marietta, FLW Southeast, Inc. 404-424-1731
IL Bridgeview, Finn & Conway, Inc. 708-599-0103
IA Cedar Rapids, Delltron Co. 319-393-0075
MD Forest Hill, Dick Pfeffer 301-557-9167
MA Acton, Data Instrs., Inc. 617-264-9550
MA Acton, Dave Hannon 617-264-9550
MI Sterling Hgts., Geotronix, Inc. 313-254-0520
MO Florissant, Delltron Co. 314-839-0033
MO Kansas City, Delltron Co. 816-436-6445
NM Albuquerque, Williams Assocs. 505-255-1638
NY Albany, Expert Indl. Sys., Inc. 518-869-3355
NY Buffalo, Expert Indl. Sys., Inc. 716-827-1111
NY Rochester, Expert Indl. Sys., Inc. 716-323-1305
NY Syracuse, Expert Indl. Sys., Inc. 315-455-2469
NC Charlotte, Emco, Inc. 704-372-8281
OH Richfield, Geotronix, Inc. 216-659-6100
OH Trotwood, Geotronix Inc. 513-854-5939
OK Oklahoma City, Bauman Instr. Corp. .. 405-631-8080
OK Tulsa, Bauman Instr. Corp. 918-492-8086
PA Allison Park, Geotronix, Inc. 412-487-1770
PA Richboro, Technical Dvcs. Inc. 215-953-1595
TN Memphis, FLW Southeast, Inc. 901-345-3563
TX Grand Prairie, Collingsystems, Corp. .. 214-647-3569
TX Houston, Collinsystems, Corp. 713-464-9460
WA Redmond, S.E.A. Sls. 206-883-4999
WA Vancouver, S.E.A. Sls. 206-573-5161
WI Brookfield, Finn & Conway Inc. 414-784-3300
Can Richmond, BC, Maxwell Morton Assocs. 604-273-1337
Can Woodbridge, Ont., Technel Engrg. Inc. 416-851-4244

Local Distributors
CA Milpitas, A. Biederman, Inc. 408-435-0209
CO Lafayette, Big Horn Instrmn. 303-665-4054
CT Meriden, Meriden Cooper 203-237-8448
GA Norcross, AA Elec. Inc. 404-449-8670
IN Indianapolis, C & E Sls., Inc. 317-844-9799
MD Baltimore, Bevier 301-242-8800
MA Billerica, Tanyx Meas. Inc. 508-671-0183
MI Taylor, North Cen. Engrg., Inc. 313-942-0900
MN St. Paul, Power/mation 612-645-0781
MS Jackson, B&B Controls 601-354-0405
MO St. Louis, ISL Corp. 314-423-3141
NJ Newark, Norman Bragar Co., Inc. 201-344-1100
NY Buffalo, KOM Lamb Inc. 716-874-3530
NC Charlotte, EMCO 704-372-8281
OH Cincinnati, J.N. Fauver Co., Inc. 513-891-8400
OH Twinsburg, The Stanley M. Proctor Co. 216-425-7814
OR Portland, Branom Instr. 503-283-2555
TX Dallas, Butler and Land 214-343-8800
TX Sugar Land, Alpha Process Sls. 713-240-4505
UT Salt Lake City, Rust Automation Equip. 801-486-9865
VA Richmond, Meter Metrics Div., Fidus Corp. 804-275-1431
WA Seattle, Branom Instr. 206-762-6050
WI Waukesha, Power/mation 414-542-2868
Can Don Mills, Ont., Intertechnology, Inc. ... 416-445-5500
Can Montreal, Que., Emaco(Canada) Ltd./Ltee 514-331-0551

DATA I/O CORP., 10525 Willows Rd. N.E., Redmond, WA 98073-9746, Tel: 206-881-6444, TELEX: 15-2167; Empl.: 550

DATAK CORP., 55 Freeport Blvd., No. 23, Sparks, NV 89431, Tel: 702-359-7474, FAX: 702-359-7494; *Sls. Mgr.:* Barry Brown ..... **C•1583, 1685**

Local Sales Offices & Reps
AL Huntsville, DHR Mktg., Inc. 205-722-0440
CA Foster City, Polach & Bensinger 415-578-8200
CA Gardena, Ungar Sls. Assocs. 213-532-6837
CT Lebanon, Adams McGregor Sales 203-537-5737
FL Hollywood, Mel Yarish & Assoc. 305-985-5605
GA Duluth, DHR Mktg., Inc. 404-564-0529
IL Sugar Grove, Manx Co. 708-466-4200
IN Indianapolis, Current Elec. Mktg. 317-257-3858
KS Overland Park, M.I.N.K. Associates 913-341-8309
MD Silver Spring, Mid-Atlantic Sls. 301-593-7749
MI Grand Blanc, Inter-Comm, Inc. 313-695-0665
MO Bridgeton, M.I.N.K. Assocs. 314-291-5454
NC Raleigh, DHR Mktg., Inc. 919-829-1970
OH Chagrin Falls, L.W. Bennett & Assoc. .. 216-247-2174
OR Portland, Jos. V. Belusko 503-222-4279
PA Philadelphia, Instrmn. Specialties 215-742-0898
RI Coventry, Adams McGregor 401-726-1300
SC Greenville, DHR Marketing Inc. 803-235-3594
TN Nashville, DHR Marketing Inc. 615-331-2745
TX Dallas, J & J Sls. Co. 214-328-9739
VA Charlottesville, Mid Atlantic Sales 804-973-8099
Can Montreal, Cantronics Ltd./Cantronics Intl. Ltd. 514-848-7132
Can Scarborough, Ont., Cantronics Ltd./Cantronics Intl. Ltd. 416-297-8668,FAX:416-297-0107

Local Distributors
AL Birmingham, ACK Radio Supply Co. .. 205-322-0588
AZ Phoenix, Dalis Elctrns. 602-275-2885
AZ Scottsdale, D.C. Elctrns. 602-945-7736
CA Canoga Pk., Sandys Elctrns. 818-346-8353
CA Milpitas, Zack Elctrns. 408-942-5432
CA San Jose, Quement Elctrns. 408-998-5900
CA Sunnyvale, Fry's Elctrns. 408-733-1770
CA Thousand Oaks, Pace Elctrns. 805-497-7515
CA Van Nuys, All Elctrns. 818-333-8009
CO Denver, Fistell Micro 303-393-6000
CT Greenwich, Wise Comps. 203-531-4880
DE New Castle, Electronics Exch. 302-322-5401
FL Miami, Elctrn. Equip. 305-871-3500
FL Orlando, Orlando Frame & Art 305-898-6271
GA Atlanta, Ack Radio Supply 404-351-6340
ID Boise, Kimball Elctrns. 208-232-2201
IL Berwyn, B-B & W, Inc. 312-749-1710
IL Mt. Prospect, Tri-State Elec. 312-255-0600
IL Niles, Joseph Elec. 312-297-4200
IL S. Holland, Union Elctrns. 708-333-4100
IN Ft. Wayne, Warren Radio 219-426-5344
KY Louisville, Peerless Elec. 502-637-7674
LA Lafayette, Ralph's 318-233-0105
MD Aberdeen, Harco Elctrns. 301-838-7990
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Needham, You-Do-It Elctrns. 617-449-1005
MA Norwood, Gerber Elec. 617-769-6000
MI Flint, Shand Elctrns. 313-743-8940
MI Livonia, Norwest Elctrns. 313-261-4551
MN Minneapolis, AEI/Acme Elctrn Parts. .. 612-338-4754
MO Kansas City, Elctrn. Supp. 816-931-0250
MO St. Louis, Gateway Elec. 314-427-6116
MO St. Louis, Van Sickle 314-621-5000
NE Lincoln, Scott Elec. Supp. 402-466-8221
NV Las Vegas, Hurley Elec. 702-384-5666
NV Reno, Elect. Distr. Co. 702-323-2766
NJ Greenbrook, Greenbrook Elctrns. 201-968-3500
NJ Kenilworth, Federated Purchasers, Inc. 201-272-0505
NM La Cruces, Elctrn. Parts Co. 505-523-4578
NY Buffalo, Summit Distr. 716-887-2800
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Plainview, Kelvin Elctrns. 516-349-7620
NY Rochester, Summit Elec. 716-334-8110
OH Warren, REM Elctrns. Supply 216-373-1300

OK	Oklahoma City, Radio Supp.	405-232-6127
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Philadelphia, A.C. Radio	215-462-9379
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Pawtucket, Jabbour Electronic Supply	401-728-4600
RI	Providence, W. Dandreta & Co.	401-861-2800
SC	Charleston, Wholesale Inds. Elctrns.	803-722-2634
TN	Memphis, W & W Distbg.	901-527-4627
TX	Houston, Elctrn. Parts Outlet	713-784-0140
TX	Richardson, Off The Shelf Comps.	214-238-0808
UT	Salt Lake City, Kimball Elec.	801-328-2075
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Annadale, Arcade Elctrns.	703-256-4610
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	Wausau, Electronics Inc.	715-845-4671

DATAKEY, INC., 407 W. Travelers Trail, Burnsville, MN 55337, Tel: 612-890-6850, FAX: 612-890-2726; FSC No.: 7025; Empl.: 44; *Sls. Mgr.:* Jerry Korsbon

DATALUX

FAX: 703-662-1682

DATALUX CORP., 2836 Cessna Dr., Winchester, VA 22601, Tel: 703-662-1500; Empl.: 25; *Sls. Mgr.:* R.H. Twyford ..... **B•1804**

Local Sales Offices & Reps

CA	San Jose, Peter Luiten	408-496-8578
IL	Buffalo Grove, Key Mktg.	708-459-6900
MA	Brookline, Technlg. Prods.	617-731-0858
NY	Hauppauge, Sticom	516-366-4221
TX	Richardson, R. F. Kimball	241-231-3447
WA	Renton, Jensen Sls.	206-277-2772

Local Distributors

IL	Wheeling, Hawk Elctrns., Inc.	718-459-4030
NY	Elmsford, Kintronics, Inc.	914-347-2530

DATAMEDIA CORPORATION, 11 Trafalgar Square, Nashua, NH 03063, Tel: 603-886-1570; Empl.: 300; *Sls. Mgr.:* Dan Caldwell

DATAMEGA INC.

FAX: 708-860-3672

DATA MEGA INC., Mega Data, 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6501 ..... **D•1087-1089**

DATA POWER, See Beaver Labs

DATAPROBE, 170 Coolidge Ave., Englewood, NJ 07631, Tel: 201-569-6464, TELEX: 200679-PROB-UR, FAX: 201-894-0939; Empl.: 30; *Sls. Mgr.:* D. Weiss; *Dist. Mgr.:* S. Weiss

DATAPRODUCTS CORPORATION, 6200 Canoga Ave., Woodland Hills, CA 91367-2499, Tel: 818-888-4014, TELEX: 67-4734, FAX: 818-887-4789; Empl.: 3500; *Sls. Mgr.:* Paul Depa; *Dist. Mgr.:* John Thorse

DATAPRODUCTS NEW ENGLAND, INC., 50 Barnes Park North, Wallingford, CT 06492, Tel: 203-265-7151, FAX: 203-265-7801; FSC No.: 96238; Empl.: 300; *Sls. Mgr.:* Robert Griffith

DATAQ INSTRUMENTS, INC., 825 Sweitzer Ave., Akron, OH 44311, Tel: 216-434-4284 , 800-553-9006, TELEX: 6502817028, FAX: 216-434-5551

DATA RACE, INC., 11550 IM-10 West, Ste. 395, San Antonio, TX 78230, Tel: 512-558-1900, FAX: 512-558-1929; Empl.: 50; *Sls. Mgr.:* Garrick C. Colwell

DATARAM CORP., P. O. Box 7528, Princeton, NJ 08543-7528, Tel: 609-799-0071, 800-822-0071, TWX: 510-685-2542, FAX: 609-799-6734; Empl.: 120; *Sls. Mgr.:* Carl Anderson, Sls. V.P.

DATA RAY

FAX: 303-451-1143

DATA RAY CORP., 12300 Pecos, Westminster, CO 80234, Tel: 1-800-926-5556, 303-451-1300; Empl.: 100; *Sls. Mgr.:* A. Woodley ..... **B•1050-1053**

Local Sales Offices & Reps

CA	Seal Bch., Texel	213-596-9411
OR	Beaverton, Olson Tech. Sls.	503-643-9488
WA	Bellevue, Olson Tech. Sls.	206-883-7792
Can	Vancouver, Olsen Tech. Sls.	604-980-5801

DATA SET CABLE CO., INC., 748 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-9684, TWX: 710-467-0668, FAX: 203-431-4657; Empl.: 70; *Sls. Mgr.:* T. Busch

DATASOUTH COMPUTER CORP., 4216 Stuart Andrew, P.O. Box 240947, Charlotte, NC 28217, Tel: 704-523-8500, TELEX: 6843018, FAX: 704-523-9298; Empl.: 140; *Dist. Mgr.:* Ann Vetas, National Accounts Mgr.

DATA SPECIALTIES, INC., See Zebra Technologies Corp.

DATA TECH, DIV. OF PENRIL CORP., See Moisture Register Products Div., Aqua Measure Instrument Co.

DATA TECHNOLOGY, INC., 4 Gill St, Woburn, MA 01811, Tel: 617-935-8820, FAX: 617-935-9656; Empl.: 45; *Sls. Mgr.:* L. Rizzo

DATATRAN CORP., 355 Yuma St, Denver, CO 80223, Tel: 303-778-0870, FAX: 303-778-0877; Empl.: 17; *Sls. Mgr.:* Cindi L. Kemper; *Dist. Mgr.:* Cindi L. Kemper

DATA TRANSLATION, INC., 100 Locke Dr., Marlboro, MA 01752, Tel: 508-481-3700, TELEX: 951646, FAX: 617-481-8620; FSC No.: 61867; Empl.: 270; *Sls. Mgr.:* Pam Nelson; *Dist. Mgr.:* Lori Dustin

DATATRONICS, INC., 28151 Highway 74, Romoland, CA 92380, Tel: 714-928-7700, FAX: 714-928-7701

For all States not listed, please contact factory in Romoland,CA 714-928-7700 For all states not listed, please contact factory in Romoland, CA 714-928-7700

DATATRONIC SYSTEMS CORP., Computer Sciences Div., Bx 44128 EEM/NMR, Panorama City, CA 91412-0128, Tel: 818-988-5290; Empl.: 150

DATAWARE ELECTRONICS INC., 8227 44th Ave. West, Mukilteo, WA 98275, Tel: 206-742-8577, FAX: 206-742-8900

DATAWRAP, INC., 37 Water St, Wakefield, MA 01880, Tel: 617-246-5757, FAX: 617-246-5758; Empl.: 16; *Sls. Mgr.:* Tony Lockwood

Local Sales Offices & Reps

FL	Melbourne, R REP	407-242-9800
NY	Great Neck (East), F & F Metro	516-482-4080
OH	Mount Orab, Benjenn Engrg.	513-444-3175
NY	Syracuse (West), Labtronics	315-455-7314

DA-TECH CORP., 141 Railroad Drive, Ivyland, PA 18974, Tel: 215-322-9410, FAX: 215-322-9730; Empl.: 110; *Sls. Mgr.:* Bradford W. Bentz

DATEL

FAX: 508-339-6356

DATEL, INC., 11 Cabot Blvd., Mansfield, MA 02048-1194, Tel: 508-339-3000, TELEX: 174388; Empl.: 550; *Sls. Mgr.:* A. Risley ..... **D•1158-1162**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs. Inc.	205-533-9108
AZ	Phoenix, Tech. Sls.	602-246-1614
CA	San Diego, Bestronics of San Diego	619-693-1111
CA	Santa Clara, W. J. Electrns.	408-982-9222
CO	Denver, Elcom, Inc.	303-337-2300
CT	Hamden, Datcom	203-288-7005
CA	La Mirada, Select Elctrns.	213-921-5159
FL	Largo, Q-Rep	813-397-8431
GA	Norcross, Hughes Assocs. Inc.	404-662-1587
IL	Inverness, Carvel Engrg. & Sls.	708-934-9600
IN	Indianapolis, Wilson Tech. Sales	317-872-2513
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Burtonsville, Chesapeake Technlg., Inc.	301-236-0530
MA	Waltham, Datcom	617-891-4600
MI	W. Bloomfield, Infinity, Inc.	313-932-1179
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Haddenfield, G. L. Williams Assocs.	609-428-6060
NY	Clark Mills, KLM-Garner	315-853-6126
NY	Elmont, Crane & Egert	516-872-0800
NC	Cary, Hughes Assocs., Inc.	919-467-7029
OH	Cincinnati, Arthur Baier Co.	513-779-2395
OH	Cleveland, Arthur Baier Co.	216-461-6161
OH	Columbus, Arthur Baier Co.	614-764-1144
OH	Dayton, Arthur Baier Co.	513-276-4128
PA	Pittsburgh, Arthur Baier Co.	412-367-7799
TN	Knoxville, Hughes Assocs, Inc.	615-558-0283
TX	Carrollton, Tech. Mktg., Inc.	214-387-3601
TX	Houston, Technical Mktg, Inc.	713-783-4497
TX	Round Rock, Technical Mktg, Inc	512-244-2291
UT	Murray, Elcom, Inc.	801-262-2400
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945
WA	Spokane, Advanced Power Comps.	206-928-7959
WA	Vancouver, Advanced Power Comps.	206-896-4239
WI	New Berlin, Carvel Engrg. & Sls.	414-784-7007
Can	Calgary, Alb., Future Elctrns.	403-250-5550
Can	Downsview, Ont., Future Elctrns.	416-638-4771
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Winnipeg, Man., Future Elctrns.	204-786-7711

DATRICON, Scientific Technologies, Inc., 31069 Genstar Rd., Hayward, CA 94544, Tel: 415-471-9717, FAX: 415-471-9752; Empl.: 42

DATRON INSTRUMENTS, A Wavetek Company, Hurricane Way, Norwich, England, United Kingdom NR6 6JB, Tel: 603-404824, TELEX: 851975173, FAX: 603-483670

DATRON SYSTEMS, INC., 200 West Los Angeles Ave., Simi Valley, CA 93065-1650, Tel: 805-584-1717, TWX: 910-494-2787, FAX: 805-526-0885; FSC No.: 32255; Empl.: 175; *Sls. Mgr.:* Chester Rowley

FAX: 714-533-6345

DATUM TIMING, Datum Inc., 1363 S. State College Blvd., Anaheim, CA 92806-5790, Tel: 714-533-6333, ESYLNK: 714-533-6345; FSC No.: 31160; Empl.: 280; *Sls. Mgr.:* Charles Neumann ..... **D•1067, 1120, 1164-1167**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs. Ltd.	205-534-6020
AK	Anchorage, Dryden Instrmn.	907-344-4995
CA	Anaheim, Datum	714-533-6333
CA	San Diego, M. Ficken	619-292-9392
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Littleton, Vic Meyers Assocs. Inc.	303-730-7313
CT	Mt. Carmel, Scientific Dvcs.- Connecticut	203-248-9361
FL	Longwood, Southern Mktg. Assocs. Ltd.	407-682-7317
FL	Satellite, Southern Mktg. Assocs. Ltd.	407-777-3587
GA	Marietta, Southern Mktg. Assocs. Ltd.	404-565-0603
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Brownsburg, Marsland Assoc.	317-852-8688
IA	Marion, Marsland	319-373-0566
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Waltham, Scientific Devices-New England	617-890-2252
WI	New Berlin, Marsland	414-786-6611
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NJ	Union, Friedman Assocs., Inc.	201-964-6200
NM	Albuquerque, Vic Meyers Assocs. Inc.	505-884-6878
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
NC	Durham, Southern Mktg. Assoc. Ltd.	919-479-6034

OH Dublin, Micro Sls. Corp. 614-792-9117
TX Austin, Data Mktg. Assocs. 512-338-4701
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-579-2995
TX San Antonio, Data Mktg. Assocs. 512-342-3031
UT Salt Lake City, Vic Meyers Assocs. Inc. 801-581-1760
MD Columbia, Creative Mktg. Assocs. 301-880-4161
WA Seattle, Comptronics 206-284-4842

DAVIDGE CORPORATION, 94 Commerce Dr., Buellton, CA 93427, Tel: 805-688-9598, FAX: 805-688-3306; Empl.: 6; *Sls. Mgr.:* Dean Davidge

DAVIES, HARRY, MOLDING CO., 4920 Bloomingdale Ave., Chicago, IL 60639, Tel: 312-622-8966; FSC No.: 72512; Empl.: 113; *Sls. Mgr.:* Leo A. Sera; *Dist. Mgr.:* Leo A. Sera

DAVIS INSTRUMENTS MFG. CO., INC., 4701 Mt. Hope Drive, Baltimore, MD 21215, Tel: 800-368-2516, FAX: 301-358-0252

DAYCO PRODUCTS, INC., P.O. Box 1004, Dayton, OH 45401-1004, Tel: 513-226-5926, TELEX: 288219, TWX: 810-459-1822; Empl.: 6000

DAYTRONIC CORP., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342, Tel: 513-866-3300, TWX: 810-473-2978, FAX: 513-866-3327; Empl.: 180; *Sls. Mgr.:* Ronald J. Toke

DBA SYSTEMS, INC., P.O. Drawer 550, Melbourne, FL 32902-0550, Tel: 305-727-0660, TELEX: 56-4383; Empl.: 740

DCI

FAX: 913-782-5766

DCI INC., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66062, Tel: 913-782-5672; FSC No.: 58677; Empl.: 35; *Sls. Mgr.:* Larry Shelton ..... **B•1054; D•1342**

Local Sales Offices & Reps
FL Sarasota, REP USA 813-923-2897
MA Pembroke, R.G. Assocs., Inc. 617-293-5233
MA Lowell, R.G. Assocs., Inc. 508-458-9802
NY Pittsford, L-Tron 716-383-0050
WA Seattle, Brett Assocs., Inc. 206-328-6900

Panel Meters
AZ Phoenix, J.Smith & Assoc. 602-267-0981
CA Los Angeles, Power Partners 213-215-0800
CA Mtn. View, XEL 415-969-1222
CO Colorado Springs, J. Smith & Assoc. .. 719-597-5343
CT Tolland, R.G. Assoc. 203-875-4201
FL Sarasota, REP USA 813-923-2897
IL Chicago, Commodore I 312-394-5441
IL Rolling Meadows, Commodore I-Inc. .. 708-394-5441
MO Raytown, Vertec Assocs., Inc. 816-737-0377
MI Clarkston, Bradcor Elctrns. 313-325-0941
MN Minneapolis, Trask Engrg. 612-537-2434
NJ Manchester, Vertec 314-394-6242
NV Las Vegas, Jim Smith & Assocs., Inc. 702-798-5053
NJ Cherry Hill, Analectro, Inc. 800-795-6676
NM Albuquerque, J. Smith & Assoc. Inc. ... 505-345-6501
NM Albuquerque, Jim Smith & Assocs., Inc. 505-345-6501
NC Charlotte, Zelco Assocs. Inc. 704-541-6122
NC Charlotte, Zelco Assocs., Inc. 704-541-6122
MI Clarkston, Bradcor Elctrns. 313-325-0941
OH Cleveland, Bradcor Elctrns. 216-671-1200
TX Dallas, Meas., Inc. 214-661-8292
TX Dallas, Measurements, Inc. 214-661-8292
Can Montreal, Que., Morrison & Force Dvcs. 514-737-0072

Displays
FL Longwood, CBC Elctrns. 407-831-5380
GA Norcross, The Novus Grp. 404-263-0320
IL Elmhurst, Utronix Sls. Inc. 312-834-1100
KS Olathe 913-829-2800
MI Clarkston, Bradcor Elctrns. 313-325-0941
MO Manchester 314-394-6242
MO St. Louis, Technical Sls. Assocs. 314-521-2044
NV Las vegas 702-798-5053
NJ Cherry Hill, Analectro, Inc. 800-247-3581
NY Pittsford, L-Tron Corp. 716-383-0050
NC Gary, The Novus Grp. 919-460-7771
OH Cleveland, Bradcor Elctrns. 216-671-1200
OR Portland 503-241-9776
RI Warwick, Ertronics, Inc. 401-732-3567
TX Dallas, Kay Todd Assocs. 214-458-8833
Can St.Laurent, Que., Componetics 514-331-9930

DDI INC., 5 Dodge St., Ste. 310, Beverly, MA 01915-1703, Tel: 508-927-7976, FAX: 508-921-6388; Empl.: 4; *Sls. Mgr.:* Erik Valeur; *Dist. Mgr.:* Erik Valeur

DDK

FAX: 416-470-1479

DDK ELECTRONICS, INC., 401 Bentley Street , Markham, Ont., Canada L3R 9T2, Tel: 416-470-1346; Empl.: 25; *Sls. Mgr.:* Steven Norton ..... **C•1337-1345**

Local Sales Offices & Reps
CA Fremont, DDK Elctrns., Inc. 415-226-0400
CA Laguna Hills, DDK Elctrns., Inc. 714-455-9874
CT Guilford, DDK Elctrns. 203-458-2563
NC Cary, DDK Elctrns., Inc. 919-460-8577
TX Dallas, DDK Elctrns., Inc. 214-480-1346
Can Markham, DDK Elctrns. 416-470-1346

Local Distributors
IL Bensenville, Voyager Elctrns. 708-860-1300
MN Fridley, Voyager Elctrns. 708-860-1300
OH Akron, AESCO 216-762-8818
TX Richardson, Altair 214-231-5166
UT Salt Lake City, Kimball Elctrns. 801-328-2075
Can Montreal, Elctrn. Wholesalers 514-769-8851

DEAK TECHNOLOGY, INC., See Elpaz Instruments, Inc.

DE ANZA MFG. SVCS. INC., 310 E. Caribbean Dr., Sunnyvale, CA 94089, Tel: 408-734-2020, FAX: 408-734-2580; FSC No.: 5935 & 5965; Empl.: 100; *Sls. Mgr.:* Michael A. Takahara

DEARBORN WIRE & CABLE, INC., 250 W. Carpenter, Wheeling, IL 60090, Tel: 708-459-1000, 800-323-0198, FAX: 708-459-0170; FSC No.: 28105; Empl.: 135; *Sls. Mgr.:* Ray Grabowski; *Dist. Mgr.:* Donna Kudlicki

DE COURSEY ENGINEERING LABORATORY, 11828 W. Jefferson, Culver City, CA 90230, Tel: 213-EX7-9668; Empl.: 7

DEGUSSA CORP., Temperature Sensing Products, 104 New Era Drive, So. Plainfield, NJ 07080, TELEX: 4754247, FAX: 908-757-8561; FSC No.: 630673043; *Sls. Mgr.:* Ron Fichter

DEI, 230 N. Market Pl., Escondido, CA 92029, Tel: 619-743-8344, FAX: 619-743-5297; Empl.: 30; *Sls. Mgr.:* Matt Pedote

DEK, INC., 3840 Swenson Drive, St. Charles, IL 60174, Tel: 708-377-2575, FAX: 708-377-0372; Empl.: 115; *Sls. Mgr.:* Mark N. Cohen

DELBERT BLINN CO., Box 2007, Pomona, CA 91769, Tel: 714-629-3900, FAX: 714-622-6218; Empl.: 6

DEL

FAX: 914-699-4005

DEL ELCTRNS. CORP., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000, TWX: 710-562-0130; FSC No.: 01378; Empl.: 95 .. **A•1056-1057, 2200; D•1700-1705**

Local Sales Offices & Reps
CA Alhambra (So. CA), M.W.Riedel & Co. 213-283-7694
CA Santa Clara (N.CA), Sourcetronics, Inc. 408-988-8801
MA Burlington, Tritek Inc. 617-272-4550
PA Glenside, Koebert Assoc. 215-887-2310
WV Inwood, Koebert Assoc. 304-229-8401
MD Kensington, Koebert Assoc. 301-493-8924

DELEVAN DIV., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052-0449, Tel: 716-652-3600, FAX: 716-652-4814; FSC No.: 99800; Empl.: 300; *Sls. Mgr.:* Denis Kohlhagen ..... **A•1202-1205**

Local Sales Offices & Reps
AL Decatur, El Tech 205-353-7899
AZ Phoenix, Toward Engrg. 602-955-3193
CA Chatsworth, First Rep. of S. CA 818-718-6155
CA Milpitas, Advanced Technlg. Sls. 408-946-4111
CA Solana Bch, Cerco 619-792-5555
CO Parker, TMA 303-841-3435
FL Deerfield Bch., Electro Comp. 305-429-0802
IL Downers Grove, Momak Sls. 312-963-6400
IN Fort Wayne, Liberty Sls. 317-888-8396
IN New Albany, Liberty Sls. 317-888-8396
IA Cedar Rapids, C. Horn & Asst. 319-393-8703
KS Parker, S. W. Wollard 913-898-6552
MD Lutherville, D. A. Dougherty Sls. Co. ... 301-321-7890
MA Sterling, Compatible Comps. 508-422-3327
MN Mendota Hgts., G-II Sls. 612-454-3086
NJ Morrestown, TAI 609-778-5353
NJ Ridgewood, Ballou 201-444-6990
NY Manhassett, Ballou, Inc. 516-627-1151
NY Mendon, Tech-Mark 716-624-3840
NY Utica, Tech-Mark 315-733-0575
NC Raleigh, Godwin 919-878-8000
OH Mason, S-Tek 513-398-5843
TX Irving, Kite Elctrn. Sls. Co. 214-986-0321
WA Bellevue, N.R. Schultz 206-746-1890
Can Mississauga, J. G. Weiss Co. Ltd. 416-673-0011
Can Nepean, J. G. Weiss Co. Ltd. 613-825-0545
Can St. Laurent, J. G. Weiss Co. Ltd. 514-337-5022
Can Vancouver, J. G. Weiss Co. Ltd. 604-873-1112
Can Winnipeg, J. G. Weiss Co. Ltd. 204-783-4387

Local Distributors
CA Fountain Valley, Ecliptek 714-963-4009
CA Garden Grove, National Elctrns. 714-892-7749
CA Irvine, ITT Multicomponents 714-727-4001
CA San Diego, Neumann 619-695-3005
CA Santa Clara, Trinity Elctrns. 408-980-9014
CA Stanton, Inductive Comps. 716-828-3420
FL Ft. Lauderdale, Bros. Elec. of Fl 800-342-6700
MD Savage, Pyttronics Ind. 301-792-0708
MA Sterling, Compatible Comps. 617-422-6762
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Fairfield, Micross Comps. 201-227-8007
NY Bohemia, Car-Lac 516-567-4200
NY Buffalo, Summit Distrs. 716-887-2800
NY Farmingdale, Milgray/New York 800-645-4729
NY Plainview, ACI Elctrns. 516-293-6630
PA Norristown, Century Elctrn. Comp. 215-631-5400
TX Fort Worth, Patco Supply 817-429-8596
Can Burnaby B.C., R-A-E Indl. Elctrns. Ltd. 604-291-8866
Can Don Mills, Ontario, Saynor Varah Elctrns. 416-445-2347
Can Montreal, Quebec, Prelco Elctrns. Ltd. 514-389-8051
Can Pointe-Claire Quebec, Future Elctrn. .. 514-694-7710
Can Willowdale, Ont., Milgray Elctrns. 416-756-4481

DELTA CONTROLS CORP., 585 Fortson St., Shreveport, LA 71107, Tel: 318-424-8471, TELEX: 784554, FAX: 318-425-2421; Empl.: 32; *Sls. Mgr.:* Howard Entwistle, V.P. Sls.

DELTA WIRE & CABLE CO., 2550 Commonwealth Ave., P.O. Box 833, North Chicago, IL 60064, Tel: 708-473-4990, FAX: 708-473-2425; Empl.: 12; *Sls. Mgr.:* Perry Stein

DELTA ELECTRONICS MFG. CORP., 416 Cabot St., Beverly, MA 01915, Tel: 508-927-1060, TELEX: 710-347-0631, FAX: 508-922-6430; FSC No.: 00795; Empl.: 108; *Sls. Mgr.:* Colleen Lassiter; *Dist. Mgr.:* Colleen Lassiter

DELTA M CORPORATION, 525 Warehouse Rd., Oak Ridge, TN 37830, Tel: 615-483-1569, FAX: 615-483-1142; Empl.: 18; *Sls. Mgr.:* Robert Cline

DELTA

FAX: 415-770-0122

DELTA PRODUCTS CORPORATION, 3823 Spinnaker Ct., Fremont, CA 94538, Tel: 415-770-0660; Empl.: 3000; *Dist. Mgr.:* Karen McMillan ..... **A•1612-1613; C•1346, 1610-1611; D•1706-1707**

Local Sales Offices & Reps
AL Huntsville, Electra-Mark 205-830-4400
CA Newport Bch., Elkins, Assocs. 714-646-6475
CA San Diego, Falcon Sls., Technlg. 619-591-0504
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CT North Haven, Kitchen & Kutchen 203-239-0212
CO Denver, Moss Mkt. 303-340-8535
IL Rolling Meadow, Eagle Tech. Sls. 708-991-0700

IL Wheeling, United Prods. Co. 312-459-1222
MA Burlington, Kitchen & Kutchen 617-229-2660
MN Edina, Hanna Lind Ltd. 612-925-5700
NJ Berkley Hgts., Cambridge & Allen Assocs. 201-464-0203
OH Shaker Hgts., Omega Sls., Inc. 513-434-5507
OH University Hgts., Omega Sls.-Cleveland 216-751-9600
OK Tulsa, Advance Tech. Sls. 918-664-0482
OR Portland, Turn Around Sls. 503-640-4641
PR San Juan, Elctrn. Tech. Sls. 809-720-1300

Local Distributors

AL Huntsville, Hammond Elctrns. 205-830-4764
AZ Phoenix, Future Elctrns. 602-968-7140
CA Buena Park, Cypress Elctrns. 714-521-5230
CA Fullerton, Kent Elctrns. 714-773-0781
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Sigma Elctrns. 619-565-2000
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NC Raleigh, Comp. Distrs. 919-834-9465
PA Philadelphia, Powell Electr. 215-365-1900

DILL INSTRUMENTS INC., 436 W. Willard, Kalamazoo, MI 49005, Tel: 616-388-5708, FAX: 616-388-5704; Empl.: 10; *Sls. Mgr.:* Terry Simpson; *Dist. Mgr.:* Robert Boyle

DILLON, Weigh-Tronix, Inc., 1000 Armstrong Dr., Fairmont, MN 56031, Tel: 507-238-4461, TELEX: 756594, FAX: 507-238-4195; Empl.: 500; *Sls. Mgr.:* Randy Newlin; *Dist. Mgr.:* Tom Gallagher

DILOG, 1555 S. Sinclair St., Anaheim, CA 92806, Tel: 714-937-5700, 1-800-DILOG 32, TELEX: 6836051, FAX: 714-978-2420; FSC No.: 95-3205555; Empl.: 250; *Sls. Mgr.:* Dennis Edwards

DILWOL WIRE & CABLE INC., 435 Enfield Rd., Burlington, Ont., Canada L7T 2X5, Tel: 416-681-2343, FAX: 416-681-8440; *Sls. Mgr.:* J. R. Mattie

DIMCO-GRAY, 8200 S. Suburban Rd., Dayton, OH 45458, Tel: 513-433-7600, FAX: 513-433-0520; Empl.: 120; *Sls. Mgr.:* James L. Harl

DIMENSIONS UNLIMITED, INC., 1636 Gervais Ave., St. Paul, MN 55109, Tel: 612-770-5630, FAX: 612-770-0847; *Sls. Mgr.:* David Flod

DIODES INC., 9957 Canoga Ave., Chatsworth, CA 91311, Tel: 818-882-4920, 800-821-1178, FAX: 818-341-1736; FSC No.: 12060; Empl.: 55; *Sls. Mgr.:* Marvin Zidel; *Dist. Mgr.:* Sue Reinish ..... **A•2093**

Local Sales Offices & Reps

AL Huntsville, Hughes Assocs. 205-533-9108, FAX:205-533-4667
AZ Phoenix, Sanford Sls. 602-957-3570, FAX:602-955-2836
CA Los Angeles, Landa & Assoc. 213-879-0770, FAX:213-478-0190
CA Los Gatos, Norcal 408-356-7771
CA San Diego, Costal Elctrns. Sls. 619-459-4148, FAX:619-454-2611
CA Santa Ana, Landa & Assocs. 714-543-7805, FAX:714-543-1380
CO Denver, AKI Entprs. 303-388-4488
FL Maitland, Hughes Assocs. 407-629-5933
FL Tamaroc, Hughes Assocs. 305-720-1674
GA Norcross, Hughes Assocs. 404-662-1587, FAX:404-662-1561
IL Highland Park, Bransky Sls. 708-433-2375, FAX:708-433-2377
IL McHenry, Mesa 815-344-2820;FAX:815-344-2730
IN Indianapolis, Mktg. Engrs. Inc. 317-872-5665, FAX:317-872-5668
IA Cedar Rapids, KKB & Co. 319-373-1730, FAX:319-373-2019
KY Louisville, Mktg. Engrs. Inc. 502-267-7093, FAX:502-267-6533
MD Randallstown, Beacon North 301-655-2265
MA Needham Heights, The Newscott Co., Inc. 617-444-1923,FAX:617-449-4689
MI Farmington Hills, J.L. Montgomery Assoc. 313-489-0099,FAX:313-489-0189
MN St. Paul, Proud Inds. 612-646-9428, FAX:612-646-6109
MS Corinth, Hughes Assocs. 601-287-2915
MO Blue Springs, KKB & Co. 816-229-0001, FAX:816-228-1466
MO St. Louis, KKB & Co. 314-647-2400, FAX:314-647-3773
NJ Berkeley Heights, Cambridge Allen & Assoc. 201-464-0203,FAX:201-464-3030
NY Binghamton, Ontec Elctrn. Mkg., Inc. .. 607-724-5266
NY Forest Hills, Cambridge Allen & Assoc. 718-592-6361
NY Rochester, Ontec Elctrn. Mkg., Inc. 716-464-8636, FAX:716-464-0122
NY Syracuse, Ontec Elctrn. Mkg., Inc. 315-425-9800, FAX:315-478-6108
NY Wappingers Falls, Ontec Elctrn. Mkg., Inc. 914-462-7188,FAX:914-462-8706
NC Gary, Huges Assocs. 919-467-7029, FAX:919-481-9255
OH Dayton, J.C. Hofstetter Co. 513-296-1010, FAX:513-296-1274
OH Medina, J.C. Hofstetter Co. 216-241-4880, FAX:216-725-4471
OK Bethany, Design Mktg. 405-789-5911
OR Beaverton, Westmark Elctrns. Inc. 503-641-8780, FAX:503-641-8783
OR Tigard, Elctrns. Comps. Sls. 503-245-2342
PA Erie, J.C. Hofstetter Co. 412-356-7303
TN Hemitage, Hughes Assocs. 615-871-0908
TN Knoxville, Hughes Assocs. 615-558-0283
TX Austin, Design Mktg. 512-263-9151, FAX:512-263-3447
TX Dallas, Design Mktg. 214-480-8151, FAX:214-480-8214
TX Fort Worth, Design Mktg. 817-232-3155
TX Houston, Design Mktg. 713-550-3318, FAX:713-550-9114
UT Salt Lake City, Wasatch Reps. 801-268-3434, FAX:801-266-9021
VA Lynchburg, Jim Griffin 804-237-0598
VA Sterling, Beacon North 703-478-2480, FAX:703-435-7115
WA Bellevue, Westmark Elctrns. Inc. 206-454-1944, FAX:206-454-2488
WA Mercer Island, Elctrns. Comps. Sls. 206-232-9301
PR Caguas, Caribbean Elctrns. 809-746-9897, FAX:809-746-9441
Can Calgary, Cana Rep. Grp. Inc. 403-255-0294, FAX:403-255-4902
Can Montreal, Cana Rep Grp. Inc. 514-276-4477, FAX:514-276-3646
Can Surrey, Cana Rep Grp. Inc. 604-599-1232, FAX:604-599-3616
Can Willowdale, Cana Rep Grp. Inc. 416-250-6683, FAX:416-250-6684

DIONICS, 65 Rushmore St., Westbury, NY 11590, Tel: 516-997-7474, FAX: 516-997-7479; FSC No.: 50857; Empl.: 45; *Sls. Mgr.:* Ron Colino

DIO-REY, Div. of Info-Lite Corp., 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455, FAX: 201-941-4919; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli ..... **B•1058-1064**

DIRECT AID, 31332 Via Colinas, Ste. 102, Westlake Vl., CA 91362, Tel: 818-889-1013, 800-443-8080; *Sls. Mgr.:* Todd Smith; *Dist. Mgr.:* Todd Smith

DIRECT CONVERSION TECHNIQUE, INC., 1245 Fogest Ave. 12, Des Plaines, IL 60016, Tel: 708-827-2282, FAX: 708-827-2280; Empl.: 6; *Sls. Mgr.:* Thomas A. Ochal

DIRECT SOUND CORPORATION, 150 Fifth Ave., Suite 845, New York, NY 10011, Tel: 212-691-9050, FAX: 212-807-1598; Empl.: 3; *Sls. Mgr.:* A. Takayama ..... **B•1681; C•1349**

Local Sales Offices & Reps

NY New York, Dai-Ichi Shoji of America, Inc. 212-691-9050

DISC INSTRUMENTS, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, Tel: 714-433-0343, TWX: 910-595-1987, FAX: 714-432-7567; Empl.: 150

DISPLAY DEVICES, INC., P.O. Box 230677, Encinitas, CA 92023, Tel: 619-753-0113; FSC No.: 26107

DISPLAYS, INC., 31 Industrial Park Rd., Lewistown, PA 17044, Tel: 717-242-2541, FAX: 717-248-8680; Empl.: 65; *Sls. Mgr.:* Richard Crawford

DISPLAYTECH, INC., 2200 Central Ave., Boulder, CO 80301, Tel: 303-449-8933, FAX: 303-449-8934; Empl.: 26; *Sls. Mgr.:* Ann Perry; *Dist. Mgr.:* Ann Perry

DISPLAY TECHNOLOGIES, 1355 Holmes Rd., Elgin, IL 60123, Tel: 708-931-2100, FAX: 708-931-2120; Empl.: 220; *Sls. Mgr.:* Robert Valentine; *Dist. Mgr.:* Timothy Knutsen

DISTRIBUTED LOGIC CORP., See DILOG

DISTRIBUTED PROCESSING TECHNLG. CORP., 140 Candace Dr., Maitland, FL 32751, Tel: 407-830-5522, FAX: 407-260-5366; *Sls. Mgr.:* Steve Holler

DISTRIBUTOR & SPECIAL PRODUCTS, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd, Deptford, NJ 08096, Tel: 609-853-2525, FAX: 609-853-2231; Empl.: 250; *Sls. Mgr.:* M.J. Cashen; *Dist. Mgr.:* R. McKinstry, R.M.

DISTRIBUTOR SPECIALISTS, 1942 14th Street, Santa Monica, CA 90404-4606, Tel: 213-452-3445

DIVELBISS CORP., 9776 Mt. Gilead Road, Fredericktown, OH 43019, Tel: 614-694-9015, FAX: 614-694-9035; Empl.: 40; *Sls. Mgr.:* Terry Divelbiss; *Dist. Mgr.:* Tim Knaul, Rick Reed

DIVERSIFIED CASE CO., Ellis Ave., Off. 2, Whitesboro, NY 13492, Tel: 315-736-3028, FAX: 1-315-736-2049; Empl.: 75; *Sls. Mgr.:* Charlie Fisher

DIVERSIFIED ELECTRONICS, INC., P.O. Box 1140, Evansville, IN 47706-1140, Tel: 812-426-2806, FAX: 812-425-8930; Empl.: 55; *Sls. Mgr.:* John L. Smith

DIVERSIFIED OPTICAL PRODUCTS, INC., 282 Main St., Salem, NH 03079, Tel: 603-898-1880, TWX: 7103386747, ESYLNK: 62229740, FAX: 603-898-3970; FSC No.: IHT10; Empl.: 49; *Sls. Mgr.:* James A. Greene

DIVERSIFIED SYSTEMS, INC., 6232 La Pas Trail, Indianapolis, IN 46268, Tel: 317-299-9547, FAX: 317-298-2055; FSC No.: 5693;5999;R212;R498;R698;S901;S902;S903;S908; Empl.: 100ò; *Sls. Mgr.:* Paul Madden

DIVERSIFIED TECHNLG., P.O. Box 748, Ridgeland, MS 39157, Tel: 601-856-4121, TELEX: 585326, FAX: 601-856-2888; Empl.: 100ò; *Sls. Mgr.:* Barrie McArthur; *Dist. Mgr.:* Barrie McArthur

DIXSON, INC., 287 27 Rd., Grand Junction, CO 81503, Tel: 303-244-1241, FAX: 303-245-6267; Empl.: 250; *Sls. Mgr.:* Ray Carlson

DJ INSTRUMENTS, INC., 18 Republic Rd., N. Billerca, MA 01862, Tel: 508-667-5301, FAX: 508-667-6804; FSC No.: 57747; Empl.: 30; *Sls. Mgr.:* David First

DLCustom

FAX: 416-475-0602

D. L. CUSTOM, 7250 Victoria Park Ave., Markham, Ont, Canada L3R 2M5, Tel: 416-475-0275; *Sls. Mgr.:* Les Hull, Jr. ..... **C•1026**

D. O. INDUSTRIES, 200 Commerce Dr., Rochester, NY 14623, Tel: 716-359-4000, TELEX: 200802, FAX: 716-359-4999; *Sls. Mgr.:* Jeremy Goldstein

DOLAN-JENNER INDS., Box 1020, Woburn, MA 01801, Tel: 617-935-7444, TELEX: 94-8161, FAX: 617-938-7219; Empl.: 120; *Sls. Mgr.:* B.J. Dolan; *Dist. Mgr.:* S. Futran

DOLPH, JOHN C., CO., New Rd., Monmouth Junction, NJ 08852, Tel: 201-329-2333, FAX: 201-329-1143; *Sls. Mgr.:* J. E. Rooze

DOMINO, INC., P.O. Box 9309, Fort Wayne, IN 46899, Tel: 219-456-5512; FSC No.: 9Y350; Empl.: 19; *Sls. Mgr.:* Rick Smith

D1 INTERNATIONAL, INC., 95 E. Main St., Huntington, NY 11743, Tel: 516-673-6866, FAX: 516-673-6893; Empl.: 24; *Sls. Mgr.:* Bron Kutny ..... **D•1343**

DONTECH, INC., 700 Airport Industrial Blvd., Doylestown, PA 18901, Tel: 215-348-5010, TELEX: 685 1155 DONTK, FAX: 215-348-9959; FSC No.: 63009; *Sls. Mgr.:* Jordan C. Miller, Sls. Mgr.

Local Sales Offices & Reps

CA Cupertino, Solarise Sls. Inc. 408-446-9343
CA Tarzana, Automated Mech. Prod. Sls. 818-881-4481
MD Rockville, Integral Sls. Inc. 301-670-0373
MA S. Easton, Intek Sls. 508-238-9283
MN Golden Valley, J.H. Hanson Co. 612-377-4997
NJ Brielle, EMC Technologists 201-223-6699
OR Beaverton, Elctrns. Northwest Inc. 503-629-9241
PA Sewickley, Teplitz- Byrne Assocs. 412-741-3628
TX Richardson, Scientific Dvcs. 214-231-8106
WA Redmond, Elctrns. Northwest Inc. 206-883-1959
Can British Columbia, Asten Holdings 604-853-5724
Can Montreal, Tekron Comms. Inc. 514-335-0152

DORAN MANUFACTURING CO., 2834 Sidney Ave., Cincinnati, OH 45225, Tel: 513-681-5424, FAX: 513-681-5604; Empl.: 60; *Sls. Mgr.:* Jeff Stegman

DORMEYER INDS., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, Tel: 312-283-4000, FAX: 312-283-4927; Empl.: 250; *Sls. Mgr.:* R. Steinberg; *Dist. Mgr.:* Ken Harthun ..... **B•1621-1623**

Local Sales Offices & Reps

CA	Valencia, T & C Engrg.	805-254-8778
IL	Chicago, Dormeyer Inds.	312-283-4000
NY	Rochester, H.C. Johnson Agencies	716-586-0777

Local Distributors

AZ	Tempe, Anjon Entprs.	602-894-1332
CA	Santa Monica, Master Distrs.	213-452-1229
FL	Lakeland, AA Electric	800-237-8274
GA	Norcross, A A Electric	404-449-8670
MA	Lynn, Land Elctrns.	617-592-2220
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Mamaroneck, Logicomp Elctrns.	914-698-9332
NY	Rochester, Summit Distrs.	716-334-8110
OH	Akron, Sun Radio Co.	216-434-2171
OH	Dayton, Stotts Friedman	513-298-5555
PA	Montgomeryville, Pyttronic Inds., Inc.	215-643-2850
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
WI	Milwaukee, Elctrn. Expeditors, Inc.	800-558-8547

DOTRONIX, 160 First St. SE, New Brighton, MN 55112, Tel: 612-633-1742, TWX: 910-563-3541, FAX: 612-633-7025; Empl.: 470; *Sls. Mgr.:* Len Stewart, Natl. Sls. Mgr.

DOUGLAS ELECTRONICS, INC., 2777 Alvarado St., San Leandro, CA 94577, Tel: 510-483-8770, FAX: 510-483-6453; Empl.: 15

DOUGLAS RANDALL, P.O. Box 156, 100 Mechanic St, Bldg 26, Pawcatuck, CT 06379, Tel: 203-599-2075, FAX: 203-599-1754; Empl.: 125; *Sls. Mgr.:* Gary Polkow ..... **B•1458-1461; D•1133**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Oakland, Powermatic Assoc.	415-635-6825
CA	San Clemente, ATA Assocs.	714-661-9700
CO	Wheat Ridge, Trembly Assoc.	303-421-8900
CT	Yalesville, JMG-Glynn Connecticut	203-265-9452/2498
FL	Oldsmar, Boggs & Assocs.	813-855-1812
IL	Arlington Hgts., Thermek Inc.	708-577-6900
MA	Norwood, JMG, Inc.	617-762-5333
MN	St. Anthony, RCOM	612-788-3605
NV	Las Vegas, Trembly Assoc.	702-739-9770
NJ	Watchung, Dolan Assocs.	201-753-2671
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Roochester, J. G. Welch Assoc.	716-244-1100
NY	Syracuse, Mullahy/Welch	315-685-6280
OH	Cleveland, Geotronix Mktg. Assoc.	216-659-6100
OH	Trotwood, Geotronix, Inc.	513-252-6700
PA	Newtown, Total Control	215-860-5333
TX	Carrollton, High Point Sls.	214-446-0406
Can	Mont., Que., Solid State Engrg. Co.	514-481-3313

Local Distributors

CA	Chatsworth, Mill-Comm Dist.	213-998-3111
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	San Clemente, ATA Assocs.	714-661-9700
FL	Hollywood, MRO Elctrn. Distrs.	305-966-4847
FL	Orlando, Accurate Temperature Controls.	407-292-6800
IL	Palatine, Promark Sys.	708-806-0066
LA	New Orleans, Butler & Land	504-734-8888
MA	Middleboro, Glynn Elec.	508-947-4262
MN	Minneapolis, Control Design	612-721-1628
NC	Burlington, AC DC Elctrns.	919-226-0496
OH	Cleveland, Alpha Corp.	216-659-7100
OK	Tulsa, Butler & Land	918-665-7979
PA	Narberth, Power Modules	215-668-0664
PA	Yeadon, Y-L Prods.	215-583-2800
TX	Dallas, Butler & Land	214-343-8800
TX	Houston, Butler & Land	713-896-0808

DOVA CONTROLS, 4052 148th Ave. N.E., Redmond, WA 98052-5165, Tel: 206-881-7414, FAX: 206-861-8080; Empl.: 6; *Sls. Mgr.:* Phil Johnson

DOVER ELECTRONICS MANUFACTURING, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212, Tel: 607-772-7563, 1-800-PWB-ASSY, TWX: 510-252-1990, FAX: 607-772-9274; Empl.: 371; *Sls. Mgr.:* Robert P. Egan ..... **D•2234**

Local Sales Offices & Reps

NY	Binghamton, Dover Elctrns. Mfg.	607-772-7563

DOW CORNING CORP., Box 0994, Midland, MI 48686-0994, Tel: 517-496-4000, TELEX: 227450, TWX: 810-266-9006; Empl.: 7,000

DowKey®
Division of Krilovac Corporation

FAX: 805-650-1734

DOW-KEY MICROWAVE CORPORATION, 1667 Walter St., Ventura, CA 93003, Tel: 805-650-0260; FSC No.: 00471; Empl.: 69; *Sls. Mgr.:* Nick Pena, Jayne Larson; *Dist. Mgr.:* Jack Dysart ..... **B•1682**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs.	205-534-6020
AZ	Scottsdale, Detomasi & Grupp., Inc.	602-947-3724
CA	Mission Hills, Detomasi & Grupp Inc.	818-365-8285
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CA	San Diego, Detomasi & Grupp Inc.	619-277-0178
CA	Torrance, Detomasi & Grupp, Inc.	213-618-8898
CO	Englewood, Sierra Tech. Grp., Inc.	303-790-1700
FL	Longwood, Southern Mktg. Assocs.	407-682-7317
GA	Marietta, Southern Mktg. Assocs.	404-565-0603
IL	Palatine, Wave Mktg.	708-934-8008
IN	Fort Wayne, Naunas Sls, Co.	219-432-4792
MO	Maryland Hts., Dytec/South, Inc.	314-739-0665
KS	Lenexa, Dytec/South, inc.	913-888-0215
KS	Wichita, Dytec/South, Inc.	316-263-7090
MD	Ellicott City, VPI, Inc.	301-461-2525
MA	Chelmsford, Matrix Sls. Inc.	508-459-4000
MA	Lowell, Matrix Sls., Inc.	508-459-4000
MN	Bloomington, Bill Deming & Assocs.	612-888-5000
MO	Maryland Hgts., Dytec/South, Inc.	314-739-0665
NY	Hartsdale, Spectrum Sls. Inc.	914-472-8600
NY	Rochester, Lamb Comps., Inc.	716-272-7720
NC	Durham, Southern Mktg. Sls.	919-479-6034
OH	Dayton, Delta Sls.	513-435-9735
OH	Miamisburg, Elctrns. Comps.	513-866-3340
PA	Spring City, W. M. Assocs. Inc.	215-948-0505
TX	Garland, Carey, McMahill & Assoc.	214-681-1414
WA	Kirkland, Anzak Corp.	206-822-1510
Can	Nepean, Ont., Dynasty Comps.	613-723-0725

DOW SWITCH, 271 Ballardvale St., P.O. Box 1332, Wilmington, MA 01887, Tel: 617-935-6395, FAX: 617-658-2307; Empl.: 22; *Sls. Mgr.:* Toni Stevens

DOWTY AVIONICS, 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-445-5955, FAX: 818-447-0880; FSC No.: 10412; Empl.: 164; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Mgr. Business Dev.

DOWTY CONTROL TECHNOLOGIES, Powerville Rd., Boonton, NJ 07005-0239, Tel: 201-334-3100, TELEX: 215071, FAX: 201-334-3863; FSC No.: 49673; Empl.: 300; *Sls. Mgr.:* Kenneth J. Fodero, Tech. Sls. Mgr.

DOWTY CUSTOM ELCTRNS., INC. , Thermocontrol Div., Prospect St., P.O. Box 250, Brandon, VT 05733, Tel: 802-247-6811, FAX: 802-247-3946; Empl.: 150; *Sls. Mgr.:* John DeCicco; *Dist. Mgr.:* John DeCicco

DOWTY INTERCONNECT, Dowty Electronic Components LTD, Knaves Beech Business Centre, Loudwater, High Wycombe, Bucks, ENGLAND HP10 9UT, Tel: 0-628-810810, TELEX: 846874 DEI UKG, FAX: 0-628-810813

DOWTY RFL INDS. INC./INSTRUMENTATION DIV., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239, Tel: 201-334-3100, TELEX: 215071 (ANS BK: DRFL UR), FAX: 201-334-3863; FSC No.: 49673; Empl.: 300

DRACON DIV., See Harris Corp., Dracon Div.

DRANETZ TECHNOLOGIES, INC., 1000 New Durham Rd., P.O. Box 4019, Edison, NJ 08818-4019, Tel: 908-287-3680, TELEX: 499-708, TWX: 710-997-9553, FAX: 908-287-8627; FSC No.: 23207; Empl.: 230; *Sls. Mgr.:* Chris Fensham

DREEFS SWITCH, INC., 3782 Hawthorn Ct., Waukegan, IL 60087, Tel: 708-662-7667, 800-323-9605, TELEX: 703784 MTL DREEFS UD, FAX: 708-662-0906; Empl.: 29; *Sls. Mgr.:* Ed Magiera; *Dist. Mgr.:* Ed Magiera

DRUMLIN, Micro/Sys, Inc., 1011 Grand Central Ave., Glendale, CA 91201-3010, Tel: 818-244-4600, FAX: 818-244-4246

DSA, INC. DIRECT SOUND CORPORATION, See Direct Sound Corporation

DSP TECHNOLOGY, 48500 Kato Rd., Fremont, CA 94538-7338, Tel: 415-657-7555, TELEX: 263608, FAX: 415-657-7576; Empl.: 60; *Sls. Mgr.:* Robert LeBrun

DUBBELDEE HARRIS DIAMOND CORP.:D. DRUKKER & ZN. N.V., 100 Stierli Ct., Mt. Arlington, NJ 07856, Tel: 201-770-1420, TELEX: RCA 236064, FAX: 201-770-1549; *Sls. Mgr.:* Keith Harris

DUKANE CORP., Communications Sys. Div., 2900 Dukane Dr., St. Charles, IL 60174-9984, Tel: 708-584-2300, TELEX: 720426, FAX: 708-584-2370; Empl.: 650; *Sls. Mgr.:* Warren Anderson, Dir. Sls. & Mktg.; *Dist. Mgr.:* Sam Boskovich, Distr. Devel. Mgr.

DUMONT/E & R ELECTRONICS, INC., 26 Fairfield Pl, W. Caldwell, NJ 07006, Tel: 201-575-8666, TELEX: 219236 DOLI-UR; FSC No.: 30669; Empl.: 30; *Sls. Mgr.:* Edward Petrasek

DUNCAN ELECTRONICS

FAX: 714-557-6240

DUNCAN ELECTRONICS, INC., 2865 Fairview Rd., Costa Mesa, CA 92626, Tel: 714-545-8261; FSC No.: 5905;Multiple; Empl.: 110; *Sls. Mgr.:* J. Colligan; *Dist. Mgr.:* S. Anderson ..... **A•2038-2039**

Local Sales Offices & Reps

AL	Huntsville, L. & D., Inc.	205-837-1469
AZ	Tempe, Southwest E/M Engrg.	602-941-2828
AR	El Dorado, Kemp Instruments, Inc.	501-862-5869
CA	Laguna Beach, Comar Co.	714-768-4767
CA	Santa Clara, Caltron Comps.	408-980-0181
CO	Denver, Elcom	303-337-2300
CT	Cheshire, The MacInnis Co.	203-272-3797
FL	Boca Raton, R.O. Whitesell & Assoc.	407-393-6139
FL	Dunedin, R.O. Whitesell & Assoc.	813-736-4100
FL	Longwood, R.O. Whitesell & Assoc.	407-682-6662
GA	Atlanta, L. & D., Inc.	404-395-7079
IL	Arlington Hgts., KMA Sales Co.	708-398-5300
IN	Indianapolis, Mktg. Engrs., Inc.	317-872-5665
KS	Shawnee Mission, Florence & Meyer	913-722-5210
LA	Lafayette, Kemp Instruments, Inc.	318-269-9452
MA	Norwood, The MacInnis Co.	617-762-8090
MI	Farmington Hills, Elcon O.E.M. Sls.	313-855-3240
MN	New Brighton, The Mackubin Grp.	612-636-5533
NY	Dix Hills, Sencor	518-499-6759
NY	Endicott, Advanced Comps.	607-785-3191
NY	N. Syracuse, Advanced Comps.	315-699-2671
NY	Rochester, Advanced Comps.	716-544-7017
NY	Scottsville, Advanced Comps.	716-889-1429
NC	Raleigh, L. & D., Inc.	919-876-5301
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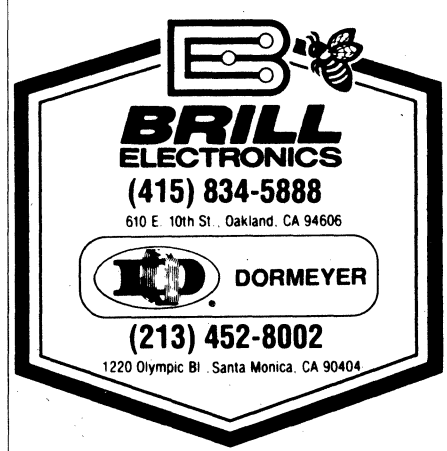
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NY	Commack, R.C. Engrg.	516-543-3325
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CA	Torrance, O'Donnell Assoc.	213-539-9664
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CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Longwood, NSL Assocs., Inc.	305-629-5226
GA	Atlanta, L & D Inc.	404-395-7079
IL	Downers Grove, Golten Assocs.	708-512-0093
KS	Overland Park, Spectrum Sls.	913-648-6811
MA	Westboro, Zaslow Sls. Co.	617-393-8150
MI	Livonia, Electro-Mktg. Grp., Inc.	313-421-7590
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Londonderry, Zaslow Sls. Co.	603-432-8907
NY	Massapequa Pk., HC Assocs.	516-541-0262
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OH	Dayton, Electro-Mktg. Grp., Inc.	513-890-8322
OH	Dayton, Lyons Corp.	513-278-0714
OR	Beaverton, Pacific Mktg. Spec.	503-641-9373
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MA	Hingham, Sager Elctrns.	617-749-6700
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OH	Cincinnati, M & B Battery	513-385-5900
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TX	Dallas, Wofford Elctrns.	214-320-0294
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EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, TELEX: 96-4347, FAX: 203-877-3694; FSC No.: 61706; Empl.: 19; *Sls. Mgr.:* George T. Bracci ..... **B•1684-1685**

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CA	San Diego, Luscombe Engrg. Co. of S.D.	619-292-4323
CO	Longmont, Luscombe Engrg. Co. of CO	303-772-3342
CT	Bethel, Ray Perron & Co.	203-798-0261
CT	Waterbury, Ray Perron & Co., Inc.	203-756-9684
FL	Tampa, Florida Comp. sls.	813-873-3622
GA	Norcross, Mtn. Electro Mktg.	404-448-5594
IL	Arlington Hgts., Brainard-Nielsen Mktg., Inc.	708-437-2700
IN	Ft. Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Cedar Rapids, Delltron Co., Inc.	319-393-0075
MD	Columbia, Delta III Assocs., Inc.	301-730-4700
MA	Needham, Ray Perron & Co., Inc.	800-225-4280, 617-449-6162
MI	Plymouth, Jay Mktg. Assocs., Inc.	313-459-1200
MN	Golden Valley, Highland Elctrn. Sls.	612-546-2123
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Gladstone, Delltron Co., Inc.	816-436-6445
NM	Albuquerque, Luscombe Engrg. Co.	505-888-0333
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NY	Rochester, Apex Assocs., Inc.	716-272-7040
NC	Raleigh, C-Tech Sls., Inc.	919-782-8100
OR	Lake Oswego, Luscombe Engrg. Northwest	503-636-6664
PA	Horsham, Jacobsen Assocs.	215-674-2937
PA	Pittsburgh, R. W. Kneip	412-823-0169
TX	Dallas, Glidden Electro Equip. Co	214-341-0610
TX	Houston, Glidden Electro Equip. Co.	713-681-1415
UT	Midvale, Luscombe Engrg. Co.	801-565-9885
WA	Bellevue, Luscombe Engrg. N.W.	206-223-1541
WI	Mequon, Badgerep	414-241-9200

Local Distributors

AZ	Phoenix, Minarik Elec.	602-233-3000
AZ	Scottsdale, Electronic Supp.	1-800-622-3726
CA	Anaheim, Minarik Elec. Co.	714-994-2251
CA	Fremont, KEA Elctrns.	415-651-2600
CA	Gardena, California Switch & Sig.	213-770-2330
CA	Glendale, Minarik Elec. Co.	818-507-6500
CA	Riverside, Electronic Supp.	714-683-7300
CA	S. San Francisco, Bell Elctrl. Supp.	415-589-7055
CA	Salinas, Bell Elctrl. Supp.	408-758-6110

CA San Diego, Electronic Supp. 619-693-8222
CA San Diego, Minarik Elec. Co. 619-560-6632
CA San Jose, Electronic Supp. 408-453-3770
CA Santa Clara, Bell Elctrl. Supp. 408-727-2355
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CA Sunnyvale, Target Elctrns., Inc. 408-733-0384
CO Commerce City, Minarik Elec. Co. 303-289-5800
CO Denver, CSID, Inc. 303-292-9594
CT Wallingford, Sager Elec. Supp. co. 203-265-4600
FL Lakeland, Wes-Garde/Switch Controls, Inc. 813-644-7564
FL Orlando, Sager Elctrns. 407-240-3114
FL Oviedo, Dixie Sls. 407-365-5211
FL Pompano Beach, Control Design Supp., Inc. 305-782-1331
GA Atlanta, Motion Elctrns. 404-455-8262
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Elk Grove, Martec Assoc. 708-956-8090
IL Rosemont, Advent Elctrns., Inc. 708-297-6200
IL Schaumburg, Marsh Elctrns. 708-240-9290
IL Schaumburg, Minarik Elec. Co. 708-885-9337
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Mar Elctrns. 317-633-6699
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
KS Wichita, Radio, Inc. 316-264-2798
KY Louisville, Peerless Elctrns. 502-637-7674
LA Baton Rouge, Menard Elctrns. 504-355-0323
LA New Orleans, Menard Elctrns. 504-734-8445
ME W. Buxton, Nelson & Wright 207-929-8238
MD Columbia, Sager Elctrns. 301-995-6580
MD Gaithersburg, Axis Elctrns. 301-840-9640, 800-492-3190
MD Jessup, Treeko Sls. 301-792-0112
MA Canton, Richey Impact Elctrns. 617-821-1500
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA N. Billerica, Minarik Elec. Co. 508-663-0740
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Grand Rapids, R. M. Elctrns. Co. 616-531-9300
MI St. Claire Shores, SPEMCO Switches 313-771-2700
MN Fridley, Voyager Elctrns. 612-571-7766
MN Minneapolis, Electronic Ctr., Inc. 612-378-2442
MO St. Louis, Beckwith, Inc. 314-343-6463
NH Salem, Sager Elec. Supp. Co. 603-898-1348
NJ Cranford, Garden State Indl. Elctrns., Inc. 201-272-6400
NY Bohemia, Key Comps., Inc. 516-567-7500
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Hauppauge, Sager Elctrl. Supp. 516-348-1300
NY New York, Martin-Audio/Video 212-541-5900
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Elctrns., Inc. 716-334-8110
NY Woodside, Switches Unlimited 718-478-5000
NC Charlotte, Dixie Elctrns. 704-377-4348
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Raleigh, Sager Service Plus 919-850-9550
NC Winston-Salem, Kirkman Elctrns., Inc. 919-722-9131,800-334-8688
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Highland Hgts., Electronics Mktg. Corp. 216-442-3441
OK Tulsa, Radio, Inc. 918-587-9123
OR Portland, Minarik Elc. Co. 503-253-3402
PA Harrisburg, Ad-Tech Elctrns. 717-561-9905
PA Mars, Sager Elctrns. 412-772-2233
PA McKean, Advacom 814-476-7774
PA Norristown, Kimberly-James Co. 215-666-7286
PA Philadelphia, Sager Elctrns. 215-464-4336
PA Pittsburgh, Grant Indl. Controls, Inc. 412-787-9770
PA Wayne, Peak Elctrns. Corp. 215-293-9000
SC Columbia, Dixie Elctrns. 803-779-5332
TX Houston, Minarik Elec. Co. 713-748-0808
TX Irving, Harper S.I.D. 214-621-0500
TX Irving, Minarik Elec. Co. 214-402-8188
WA Redmond, Minarik Elec. Co. 206-885-0832
TX San Antonio, Minarik Elec. Co. 512-822-7097
WA Seattle, Platt Elec. 206-624-4083
WI Milwaukee, Marsh Elctrns. Corp. 414-475-6000

E-A-R SPECIALTY COMPOSITES, Cabot Safety Corp., 7911 Zionsville Rd., Indianapolis, IN 46268, Tel: 317-872-1111, TWX: 810-341-3412; *Sls. Mgr.:* Greg R. Handy

EASCO/K D TOOLS, See Hunter Tools, Easco/K D Tools

EASI FILE CORPORATION, 6 Wrigley St., Irvine, CA 92718, Tel: 714-855-4121, FAX: 714-380-0561; Empl.: 10; *Sls. Mgr.:* Jean A. James

EAST CONTROLS, 6851 Church St., Hanover Park, IL 60103, Tel: 708-837-7709, TELEX: 708-837-6235; Empl.: 1

EASTERN AIR DEVICES, INC., 1 Progress Dr., Dover, NH 03820, Tel: 603-742-3330, FAX: 603-742-9080; Empl.: 150 ..... **B•1254**

Local Sales Offices & Reps
CA Glendale, Electric Motor Engr. 818-502-1866
CA San Jose, Motion Sys. 408-246-0641
CO Boulder, R. G. Entprs. 303-447-9211
FL Winter Park, HHP Assocs. 407-740-0320
KS Shawnee Mission, LSC Co. 913-362-2121
MN Edina, Jay Borman Sls. 612-922-5525
NH Dover, Eastern Air Dvs. 603-742-3330
NJ Ridgefield, Rical Assocs. 201-945-5250
NY Rochester, Elcom Sls. 716-385-1400
NY Syracuse, ELCOM Sls. 315-685-8245
NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Cincinnati, KCH Co. 513-931-1686
OR Portland, D.A. Sullivan Co. 503-292-2448
PA Paoli, ETC Sales 215-296-3527
TX Dallas, D.J. Sls. Co. 214-783-8876
TX Richardson, D.J. Sls. 214-783-8876
WI Racine, KMG Sls., Inc. 414-639-9005

Local Distributors
CT Hartford, Bearings, Inc. 203-249-1691
CT No. Haven, Bearings, Inc. 203-288-2201
CT Waterbury, Bearings, Inc. 203-755-3151
ME Auburn, Bearings, Inc. 207-784-3769
ME Bangor, Bearings, Inc. 207-947-6583
MA Avon, Bearings, Inc. 508-584-9200
MA W. Springfield, Bearings, Inc. 413-739-4701
MA Wakefield, Bearings, Inc. 617-246-3906
MA Worcester, Bearings, Inc. 617-852-1050
NH Berlin, Bearings, Inc. 603-752-6001
NH Dover, Bearings, Inc. 603-749-2121
NH Manchester, Bearings, Inc. 603-623-8897
NY Plainview, Controls Sls. Inc. 516-756-5652
NC Charlotte, Motionex 704-377-6901
PA Pittsburgh, EXONIC Sys. 412-784-8400
RI Warwick, Bearings, Inc. 401-732-2600
VT Rutland, Bearings, Inc. 802-775-3550

EASTERN ELECTRONICS MFG. CORP., National Patent Dev. Corp., 180 Roberts St., East Hartford, CT 06108, Tel: 203-528-9821, FAX: 203-289-7639; FSC No.: 203-289-7639; Empl.: 200; *Sls. Mgr.:* Wayne M. Baker

EASTERN MARKING MACHINES, 422 S Franklin St., Hempstead, NY 11550, Tel: 516-483-7070, TELEX: 968095, FAX: 516-483-7071; Empl.: 8; *Sls. Mgr.:* L. Sherman; *Dist. Mgr.:* L. Sherman

EASTERN MICROWAVE, 40 Ray Ave., Burlington, MA 01803, Tel: 617-273-4700; FSC No.: 30616; Empl.: 25; *Sls. Mgr.:* S. C. Lowe

EASTMAN KODAK COMPANY, Motion Analysis Systems Division, 11633 Sorrento Valley Road, San Diego, CA 92121-1095, Tel: 619-535-2908, FAX: 619-481-6254; *Sls. Mgr.:* Don Pike

EAST PENN MANUFACTURING, Lyon Station, PA 19536, Tel: 215-682-6361, FAX: 215-682-4781; Empl.: 2000; *Sls. Mgr.:* Peter Grimes

EASY HEAT WIREKRAFT, See Electrical Systems, Div. of Bristol Corp.

EATON CORP, Durant Products, 901 S. 12th St., Watertown, WI 53094, Tel: 414-261-4070, 800-289-3866, TWX: 910-260-3713, FAX: 414-261-9097; Empl.: 350

EATON CORPORATION, Electric Drives Division, 3122-14th Avenue, Kenosha, WI 53141, Tel: 414-656-4011, TELEX: 910-274-2356, FAX: 414-656-4370; Empl.: Approx. 300

EATON CORP., Electronic Instrument Div., 5340 Alla Rd., Los Angeles, CA 90066, Tel: 213-822-3061, TWX: 910-343-6969; Empl.: 200; *Sls. Mgr.:* Lawrence Caney Jr.

EATON (LORLIN) CORP., See Lorlin, Div. of Axiam, Inc.

EATON CORP./CUTLER-HAMMER PRODS, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216, Tel: 414-449-7487, TELEX: 26-716, FAX: 414-449-6760; FSC No.: 81640; *Sls. Mgr.:* Bernard C. Hay

Local Sales Offices & Reps
CA Los Angeles, Eaton Corp./A & CCD ... 714-548-8553
CA San Francisco, Eaton Corp./A & CCD 415-967-0606
FL Tampa, Eaton Corp./A & CCD 813-628-4717
GA Atlanta, Eaton Corp./A & CCD 404-394-0911
IL Chicago, Eaton Corp./A & CCD 708-530-7980
KS Kansas City, Eaton Corp./A & CCD ... 913-384-0081
MD Baltimore, Eaton Corp./A & CCD 301-296-9640
MA Boston, Eaton Corp./A & CCD 617-863-5427
MI Detroit, Eaton Corp./A & CCD 313-354-7513
MN Minneapolis, Eaton Corp./A & CCD ... 612-831-8668
NJ Mt. Laurel, Eaton Corp./A & CCD 609-778-1100
NY Long Island, Eaton Corp./A & CCD ... 516-864-6065
OH Cleveland, Eaton Corp./A & CCD 216-835-4554
OH Dayton, Eaton Corp./A & CCD 513-294-1877
Can Burnaby, B.C., Solution Elctrns. Ltd. ... 604-439-9004
TX Dallas, Eaton Corp./A & CCD 214-386-4121
WA Seattle, Eaton Corp./A & CCD 206-946-5157
WI Milwaukee, Eaton Corp./A & CCD 414-449-6709
Can Scarborough, Ont., Eaton Ltd. 416-291-2563

EBERHARD MFG. CO., DIV., Eastern Co., 21944 Drake Rd., Strongsville, OH 44136, Tel: 216-238-9720, FAX: 216-572-2732; FSC No.: 19220; *Sls. Mgr.:* Edward Hongosh

EBG-ELEKTRONISCHE BAUELEMENTE, Gesellschaft m.b.H., 8082 Kirchbach 384, Austria, Tel: (43) 03116 2625, TELEX: 312540, FAX: 43/3116/27540; Empl.: 63; *Sls. Mgr.:* Mag. G. Klauser

EBM INDUSTRIES, INC., 110 Hyde Road, Farmington, CT 06034, Tel: 203-674-1515, TWX: 710-423-8723, FAX: 203-674-8536; FSC No.: 62292; *Sls. Mgr.:* Robert Sobolewski ..... **C•1612-1613**

Local Sales Offices & Reps
AL Huntsville, Cartwright & Bean 205-830-1540
AZ Phoenix, C.T. Carlberg 602-468-0750
CA Los Angeles, Wiley Co. 213-666-1611
CA San Diego, Wiley Co. 619-453-9018
CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
CO Littleton, Simpson Assocs. 303-794-8381
CT Clinton, Selmark Assocs. 203-573-9088
FL Apopka, Cartwright & Bean 407-889-9100
FL Deerfield, Cartwright & Bean 305-429-3400
GA Norcross, Cartwright & Bean 404-368-0160
IL Chicago, Vogel & Assoc. 708-286-6833
IL Itasca, Beta Technlg. Sls. 708-250-9586
IN Greenwood, Liberty Sls. 317-888-8396
IN Noblesville, Powercon 317-773-7745
KS Overland Park, Web Elctrns. 913-381-7986
MD Baltimore, Bramman Co. 301-367-9111
MA Millis, Selmark Assocs. 508-376-2914
MI Warren, Burcaw Co. 313-573-4605
MN St. Paul, Arkco Sls. 612-777-7454
MS Jackson, Cartwright & Bean 601-981-1170
MO Florissant, Web Elctrns. 314-921-5720
NH Hopkinton, Selmark Assocs. 603-746-3299
NJ Marlton, b.g.r. Assocs. 609-983-1020
NM Albuquerque, C.T. Carlberg 505-899-2155
NY Buffalo, NRM Mktg. Grp. 716-634-4300
NY Frankilin Sq., Cooper-Simon & Co., Inc. 516-489-4636
NY Skaneateles, NRM Mktg. Grp. 315-685-8991
NC Raleigh, Cartwright & Bean 919-876-4130
OH Kettering, Versatron 513-293-8506
OH Willoughby Hills, Versatron 216-944-0082
OR Hillsboro, Temco Northwest 503-645-2030
TN Knoxville, Cartwright & Bean 615-693-7450
TN Memphis, Cartwright & Bean 901-362-8345
TX Austin, Bonser-Philhower Sls. 512-346-9186
TX Houston, Bonser-Philhower Sls. 713-782-4144
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Midvale, Simpson Assocs. 801-566-3691
VA Birch Bay, Temco Northwest 206-371-0423
VA Chantilly, Colrud 703-904-0240
WA Bothell, Temco Northwest 206-481-6150
WA Spokane, Temco Northwest 509-927-9392
WI Milwaukee, Beta Technolg. Sls., Inc. ... 414-543-6609
PR Bayamon, Selmark 809-797-9176

Local Distributors
AL Huntsville, Powell Elec. 205-837-5300
AK Anchorage, Alaska Elctrns. 907-563-3774
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Tucson, Southwest Sls. 602-628-1613
CA Anaheim, Deco Elec. 714-630-8252
CA Costa Mesa, Powell 714-754-1717
CA Hollywood, Yale Elctrns. 213-465-3186
CA Irvine, Integrated Elctrns. 714-837-9960
CA Sacramento, Integrated Elctrns. 916-363-6030
CA San Diego, Deco Elctrns. 619-693-1595
CA San Diego, Pyramid 619-271-5404
CA San Jose, Integrated 408-435-1000
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Powell Elec. 408-943-9020
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Sunnyvale, Power Supply Comps. 408-737-1333
CA Torrance, Pyramid 213-320-2700
CO Denver, Integrated Elctrns. 303-292-6121
CO Denver, Integrated Elctrns. 303-292-5537
CO Wheat Ridge, Added Value 303-422-1701
CT Danbury, Pilgrim Elctrns. 203-792-7274
CT E. Haven, J. V. Elctrns. 203-469-2321
CT Southbury, Heilind Elctrns. 203-262-1700
CT Wallingford, Cronin Elec. 203-265-3134
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Ft. Lauderdale, Powell Elec. 305-484-8377
FL Largo, Electronic Precepts 813-544-3636
GA Atlanta, ACK Radio Supp. 404-351-6340

GA	Fayetteville, Frankland	404-461-4026
IL	Chicago, Leeds Elctrns. Comps.	708-625-3800
IL	Hoffman Estates, I.E.C. Intercomp	708-843-2040
IL	Rosemont, Advent Elctrns.	708-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Chelsea/RS Elctrns.	317-253-9065
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Overland Park, Chelsea/RS Elctrns.	913-362-1923
KY	Florence, U.R.I. Elctrns.	606-371-4423
MD	Annapolis Jct., Powell Elctrns.	301-880-3255
MD	Baltimore, Resco/Baltimore	301-931-8200
MD	Beltsville, Resco/D.C.	301-937-9100
MD	Columbia, Peerless Radio	301-997-1717
MA	Canton, Richey Impact	617-821-1500
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin	617-449-5000
MA	Westborough, Powell	508-366-6100
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, Chelsea/RS Elctrns.	616-241-3483
MI	Grand Rapids, S.F. Elctrns.	616-459-0216
MI	Livonia, Chelsea/RS Elctrns.	313-525-1155
MN	Minneapolis, Control Des. Supp.	612-721-1628
MN	Plymouth, Leeds Elctrn. Comps.	612-557-1277
MO	Kansas City, L Comp	816-221-2400
MO	Maryland Hgts., Chelsea/RS Elctrns.	314-997-7709
MO	Maryland Hgts., L Comp	314-291-6200
MO	St. Louis, Control Design Supply	314-426-3150
NH	Manchester, Cronin	603-624-0105
NH	Manchester, Glynn Elctrns.	603-622-8131
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Englewood, Powell Elec.	201-890-0010
NJ	Rockaway, Tonar	201-586-9000
NJ	W. Berlin, General Comps.	609-768-6767
NM	Albuquerque, Betatron	505-821-1122
NY	Falconer, Falconer Elctrns.	716-665-4176
NY	Hauppauge, Addem Distbg. Grp.	516-273-6777
NY	Hauppauge, Broadline Elec. Distr.	516-231-4100
NY	Hauppauge, Chelsea/RS Elctrns.	516-231-3313
NY	Hicksville, Janesway Elctrns.	516-935-1827
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Mt. Vernon, Janesway Elctrns.	914-699-6710
NY	Rochester, Simcona	716-328-3230
NY	Suffern, Nobel Elctrns.	914-357-4500
NY	Syracuse, Stewart W. Smith	315-437-7836
NC	Boone, I.R.S./Tresco	704-264-8861
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Century	919-782-2116
OH	Akron, Akron Elctrns.	216-762-8818
OH	Broadview Hgts., Related Comps.	216-838-4838
OH	Cincinnati, Chelsea/RS Elctrns.	513-793-2450
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Dayton, Related Comps.	513-253-6116
OH	Maumee, Chelsea/RS Elctrns.	419-893-0721
OH	Stow, Advacom Inc.	216-688-5311
OR	Beaverton, Integrated Elctrns.	503-641-1690
PA	Export, Advacom	412-733-5400
PA	Malvern, Control Design Supp.	215-296-0150
PA	McKean, Advacom/Erie	814-476-7774
PA	Norristown, Century Elctrn. Comp. Co.	215-631-5400
PA	Philadelphia, Powell	215-365-1900
TN	Saddy Daisy, Techni-Tronics	615-332-2119
TX	Austin, Omni Pro Elctrns.	512-794-9200
TX	Dallas, Omni Pro Elctrns.	214-233-0500
TX	Houston, Kent Elctrns.	713-780-7770
TX	Irving, Powell Elctrns.	214-550-0547
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
UT	West Valley, Integrated Elctrns.	801-977-9750
WA	Bellevue, Integrated Elctrns./Jaco	206-455-2727
WA	Redmond, Pyramid Elctrns.	206-883-7200
WA	W. Seattle, Radar Elctrns.	206-282-2511
WI	Mequon, Taylor Elec. Co.	414-241-4321
WI	Milwaukee, Progressive Image	414-321-4722
WI	New Berlin, Control Design Supp.	414-784-1015

EBY COMPANY, 4300 H Street, Philadelphia, PA 19124, Tel: 215-537-4700, FAX: 215-537-4780; FSC No.: 72825; Empl.: 75; *Sls. Mgr.:* Alan S. Olshansky

ECLYPSE INTERNATIONAL CORP., 2042 S. Grove Ave., Ontario, CA 91761-9925, Tel: 714-947-8839, FAX: 714-947-9395; Empl.: 9; *Sls. Mgr.:* Christopher J. Gilbert; *Dist. Mgr.:* Christopher J. Gilbert

ECOSOFT, INC., 8295 Indy Court, Indianapolis, IN 46214, Tel: 317-271-5551, FAX: 317-271-5561; Empl.: 2; *Sls. Mgr.:* Emma Alkire

ECS COMPOSITES

FAX: 503-474-2479

ECS COMPOSITES, 3560 Rogue River Hwy., Box 188, Grants Pass, OR 97526, Tel: 503-476-8871, TWX: 510-755-0777; FSC No.: 24995; Empl.: 165; *Sls. Mgr.:* Jill K. Gleysteen ..... **C•1027**

Local Sales Offices & Reps

AL	Huntsville, EMA	205-830-4030
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
CA	Mtn. View, Kim Buurma	415-962-9027
CO	Englewood, Electronic Comp. Sys.	303-762-9576
FL	Largo, Burke Assocs. Inc.	818-536-4335
IL	Wilmette, Joel Wasserman Assocs.	708-256-3566
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Westwood, Apex Assocs.	617-326-5042
MN	Minneapolis, MS J Mktg., Inc.	612-755-1685
NY	New York City, Smith Engrg. Sls.	516-689-6514
OH	Cleveland, Ashby Assocs., Inc.	216-461-0826
OR	Grants Pass, ECS Inc.	503-476-8871
TX	Dallas, Advance Tech. Sls.	214-340-1300
WA	Bellevue, Comtec	206-453-1188
Can	Stittsville, Ont., Production Case Co.	613-836-2248

Ectron CORPORATION

FAX: 619-278-0372

ECTRON CORP., 8159 Engineer Rd., San Diego, CA 92111-1980, Tel: 619-278-0600, TWX: 910-335-1259; FSC No.: 24856; Empl.: 50; *Sls. Mgr.:* W. W. Hanford ..... **D•1010**

Local Sales Offices & Reps

AZ	Tempe, Aztec Entprs.	602-431-8401
CA	Canoga Pk., FLW Inc.	818-719-0037,
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Fremont, FLW Inc.	415-651-6511
CO	Denver, Aztec Entprs.	303-779-5285
FL	Melbourne, Saber Assocs.	407-724-0920
GA	Norcross, Saber Assoc. Inc.	800-327-0853
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
KS	Overland Pk., Ramsey Assocs.	913-541-1007
MD	Laurel, Elctrn. Mktg. Assoc.	301-792-9300
MA	Needham, Addelco Corp.	617-444-4754
MI	Troy, Satullo Assocs.	313-585-4811,
MN	Minneapolis, Sector Eng. Sls. Inc.	612-378-2123
MO	St. Louis, Ramsey Assocs.	314-532-9386
NM	Albuquerque, Westfhal & Assocs.	505-268-1433
NY	Plainview, Eastern-Metro Assoc.	516-931-1414
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KS	Wichita, Baka Corp.	316-682-8411
MD	Gaithersburg, Carwithen	301-921-9545
MA	Needham, Comp. Technlg, Inc.	617-449-8490
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Bloomington, Northmark Assocs.	612-854-9299
MO	St. John, Baka Corp.	314-878-4224
NJ	Hasbrouck Hgts., Comp-Tech	201-288-7400
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, C-Tech Sls. Co.	919-782-8100
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Tigard, L. D. Elctrns.	503-684-8221
PA	Hatboro, A.Q.S. Electro	215-674-3562
PA	Pittsburg, Arthur Baier Co.	412-367-7799
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-REP	713-271-5635
UT	Ogden, Sunbird Inds., Inc.	801-479-7151
WA	Snohomish, L. D. Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Janesville, Lincoln,Hodges	608-754-4214

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, FAX: 814-643-0426; Empl.: 500; *Sls. Mgr.:* W. J. Graef; *Dist. Mgr.:* W.J. Graef

U.S. ELCO INC., 2930 Scott Blvd., Santa Clara, CA 95054, Tel: 1-800-888-ELCO, FAX: 408-980-9754; *Sls. Mgr.:* Douglas Hemingway

EL-COM CABLETEK, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-432-6630

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100, FAX: 314-429-9706; Empl.: 25; *Sls. Mgr.:* Thomas C. Noel

ELCOM SYSTEMS, INC., 932 Clint Moore Rd., Boca Raton, FL 33487, Tel: 407-994-1774, FAX: 407-994-1770; FSC No.: 32424; Empl.: 8; *Sls. Mgr.:* D. Pollachek ..... **A•1747**

ELCON INSTRUMENTS, INC., 135-137-139 Gibralter Street, Annapolis, MD 21401, Tel: 301-280-6686, FAX: 301-263-5790; Empl.: 5; *Sls. Mgr.:* Paolo Landrini

ELCON PRODUCTS INTERNATIONAL COMPANY, 42700 Lawrence Place, Fremont, CA 94538, Tel: 415-490-4200, FAX: 415-490-3740; FSC No.: 85901; Empl.: 33; *Sls. Mgr.:* Shirlee Gendreau (inside Sls. Mgr.)

ELDRE CORPORATION, 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-427-7280, FAX: 716-272-0018; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* James N. Fitzpatrick

Local Sales Offices & Reps

AL	Huntsville, Elctrns. Mktg. Assocs.	205-880-8050
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Carlsbad, Prime Source Comps.	619-434-1297
CA	Los Gatos, Norwest Elctrns.	408-395-1190
CO	Wheat Ridge, Waugaman Assocs.	303-423-1020
FL	Tampa, APM Assocs.	813-886-2457
GA	Atlanta, Electronic Mktg. Assocs.	404-448-1215
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
MD	Towson, Arbotek Assocs.	301-825-0775
MA	Brookline, Harman Assocs.	617-232-6687
MO	St. Louis, Cadon Techn. Sls.	314-645-8670
NJ	Haddonfield, Tritek Sls.	609-429-1551
NY	Rochester, ELDRE Corp.	716-427-7280
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Raleigh, Electronic Mktg. Assocs.	919-847-8800
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
OH	Centerville, Omega Sls.	513-434-5507
UT	Salt Lake City, Waugaman Assocs./Utah	801-261-0802
SC	Greenville, Elctrns. Mktg. Assocs.	803-233-4637
Can	St. Laurent, Que., Componetics, Ltd.	514-331-9930
WA	Redmond, Electronic Mktg. Grp.	206-882-0962

ELECSYS,INC., Div. of C & C Jetronic, 320 Wall St., Princeton, NJ 08540, Tel: 609-921-2726, TELEX: 4971717, FAX: 609-921-7971; Empl.: 1; *Sls. Mgr.:* C. Jerry Chiang

ELECTRA-SSEMBLY, Lancer Chemical, 80 Cutter St. - Box 30, Warren, RI 02885, Tel: 401-245-5493

ELECTRA-TEC, Impert Industries, Inc., 557 W. M-89, Otsego, MI 49078, Tel: 800-225-3532, 616-694-2058, FAX: 616-694-5880; FSC No.: 4J966; Empl.: 20; *Sls. Mgr.:* William Robinson ..... **C•1033**

ELECTRICAL INDUSTRIES CORP., 691 Central Ave., Murray Hill, NJ 07974, Tel: 908-464-3200, FAX: 908-464-7619; FSC No.: 20093; Empl.: 300; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTRUMENT SERVICE, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1322-1323**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CO	Commerce City, Williams Assocs.	303-289-5647
IL	Lincolnwood, Saffro & Assocs.	708-677-9722
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Columbus, Comtel Instrs. Co.	614-876-8305
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-954-5020
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WI	Lake Mills, Saffro & Assocs.	1-800-327-0312
Can	Beaconsfield, Que., Mesurina Ltee/Ltd.	514-630-5990

ELECTRICAL INSULATION SUPPLIERS, INC., 300 N. Mannheim Road, Hillside, IL 60162, Tel: 708-574-5400, FAX: 708-547-7538; Empl.: 450; *Sls. Mgr.:* Robert Gannon

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224; Empl.: 6

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-1111, FAX: 216-533-2639

ELECTRIC INDICATOR COMPANY INC., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861, FAX: 203-846-3933; FSC No.: 73693; Empl.: 60

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ELECTRIC TIME COMPANY, INC., P.O. Box 466, Medfield, MA 02052, Tel: 508-359-4396, FAX: 508-359-4482; FSC No.: 6645; Empl.: 10

ELECTRO ASSEMBLIES CORP., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062-2319, Tel: 708-498-6520, FAX: 708-272-2915; FSC No.: 09250; Empl.: 60; *Sls. Mgr.:* Greg Andrews

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FL	Lutz, Engrd. Assemblies Corp.	813-971-9471
GA	Marietta, Engrd. Assemblies & Comps. Corp.	404-951-8935
IL	Morton Grove, Power Pak	708-966-6000
MA	Sharon, Adcour, Inc.	617-784-8123
MI	Ann Arbor, Wedemeyer Elctrns. Supp. Co.	313-665-8611
NJ	Teterboro, Engrd. Assemblies Corp.	201-288-4477
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
NC	Raleigh, Engrd. Assemblies Corp.	919-790-9700
OR	Beaverton, Micro Power	503-626-7086
PA	McKean, Advacom, Inc.	814-476-7774
TX	Houston, K Power Elctrns.	713-783-2288
TX	Stafford, Southwest Elctrns. Inc.	713-240-4000
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Brampton, Innovative Power Pak	416-791-2132
Can	Calgary, Alberta, Electro-Sonic, Inc.	403-255-9550
Can	Don Mills, Ont., Saynor Varah Inc.	416-445-2340
Can	Quebec, Saynor-Varah	514-630-7470
Can	Richmond, BC, Electro Sonic, Inc.	604-273-2911
Can	Victoria, BC, Pacific Coast Elctrns. Ltd.	604-385-5111

ELECTROCOM INDUSTRIES, 1105 N. Ironwood Dr., S. Bend, IN 46615, Tel: 219-232-2743; FSC No.: 27114; *Sls. Mgr.:* B. Jaffe

ELECTRODATA, INC., 23020 Miles Rd., Bedford Heights, OH 44128, Tel: 216-663-3333, TWX: 810-427-2280, FAX: 216-663-0507; FSC No.: 34-1173465; Empl.: 15; *Sls. Mgr.:* Anthony Cardone; *Dist. Mgr.:* Anthony Cardone

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ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 708-259-0740; FSC No.: 10236; Empl.: 200; *Sls. Mgr.:* Frank Rafferty ..... **D•1134**

Local Sales Offices & Reps

CA	Alameda, Liaison, Inc.	415-769-1991
CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CO	Denver, West High-Tech, JV	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Altamonte Spgs., Quantum Sls.	407-788-0550
IL	Collinsville, Magna Engrg. Sls.	618-345-5583
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
KS	Wichita, Magna Engrg. Sls.	316-744-0851
MD	Severna Park, Delmarva Engrg. Assocs., Ltd.	301-647-8007
MA	Burlington, FJS Assocs.	617-273-5959
NJ	Basking Ridge, Churchill Assocs.	201-204-0744
NY	E. Rochester, Noeth Honsinger Assocs.	716-381-4430
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
OR	Tigard, ElTech, Inc.	503-684-3458
PA	Norristown, Rivco January Inc.	215-631-1414
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ELECTRO-DYN ELECTRONICS, 1201-19th St., Niagara Falls, NY 14301, Tel: 716-284-8747, FAX: 716-284-9112; *Sls. Mgr.:* H. Emes

THE ELECTRODYNE COMPANY, INC., 4188 Taylor Rd., Batavia, OH 45013, Tel: 513-732-2822, TELEX: 241 463, FAX: 513-732-6953

ELECTROFILM, 27727 Avenue Scott, P.O. Box 55669, Valencia, CA 91355, Tel: 805-257-2240, TELEX: 65-1438; FSC No.: 85932; Empl.: 95; *Sls. Mgr.:* Richard W. Pearson

ELECTRO-FILMS

FAX: 401-738-4389

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150, TWX: 710-382-0405; FSC No.: 57252; Empl.: 275; *Sls. Mgr.:* Jean Madden .. **A•1748, 1910-1912; C•1680-1681**

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	San Jose, NES Assocs.	408-437-9300
CA	Santa Ana, Weatherman Assocs.	714-544-1304
CA	Sunnyvale, NES Assocs.	408-738-3259
CO	Ft. Collins, Rep Sls.	303-226-1504
FL	Apopka, Micro Mktg., Inc.	407-889-2022
GA	Chamblee, BCI, Inc.	404-455-0405
IL	Palatine, M & S Sls.	708-934-1200
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Greenfield, Corrao Marsh, Inc.	317-462-4446
MA	Bedford, Vector Assocs.	617-271-0000
MN	Minneapolis, Ferrian Sls.	612-721-8915
NM	Albuquerque, Western High Tech. Mktg.	505-884-2256
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NY	Plainview, Robert Smith Assocs.	516-681-3155
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ELECTRO INDUSTRIES, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590, Tel: 516-334-0870, TELEX: 4948652 ELECTRO, FAX: 516-338-4741; Empl.: 40; *Sls. Mgr.:* S. Kagan

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ELECTRO INSULATION CORP./REMTEK CORP., 3921 Ventura Drive, Arlington Hgts., IL 60004, Tel: 708-632-1020, FAX: 708-632-1089; Empl.: 25; *Sls. Mgr.:* Mike Kamperschroer; *Dist. Mgr.:* Mike Kamperschroer

ELECTROL CO., 321 Dewey St, P.O. Box 29, York, PA 17405, Tel: 717-848-1722, FAX: 717-848-4514; Empl.: 30; *Sls. Mgr.:* Debra Dudley; *Dist. Mgr.:* Debra Dudley

ELECTROL, Hamlin, Inc., 612 East Lake St, Lake Mills, WI 53551, Tel: 414-648-3000; Empl.: 450; *Sls. Mgr.:* Mike Bucher

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ELECTRO MAGNETIC PROCESSES, INC., 9616 Owensmouth Ave., Chatsworth, CA 91311-4858, Tel: 818-882-6333, TELEX: 499 2240 EMP UI; FSC No.: 51290; Empl.: 100

ELECTROMATIC CONTROLS CORP., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010, Tel: 708-882-5757, TWX: 910-222-3452; FSC No.: 75203; Empl.: 400; *Sls. Mgr.:* Mike Meurer; *Dist. Mgr.:* Mike Meurer

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ELECTROMECH, INC., 528 Elm Street, Kearny, NJ 07032, Tel: 201-997-0950; Empl.: 40; *Sls. Mgr.:* Solomon Ezra ..... **A•2208-2209; D•1717**

Local Sales Offices & Reps

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ELECTRO MECHANICAL SYSTEMS, INC., 801 W. Bradley Ave., Champaign, IL 61820, Tel: 217-359-7125, FAX: 217-359-2075; Empl.: 26; *Sls. Mgr.:* Julie L. Redman

ELECTRO-MECHANISMS, INC., 2745 E. Huntington Dr., Duarte, CA 91010, Tel: 818-359-2535, FAX: 818-303-2189; FSC No.: 52592; Empl.: 27 ..... **B•1624-1625**

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ELECTRONIC APPLICATIONS CO., 4918 Santa Anita Ave., PO Box 4308, El Monte, CA 91734, Tel: 818-442-3212, FAX: 818-442-6873; Empl.: 70; *Sls. Mgr.:* Harvey Smith

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IN	Indianapolis, STB & Assocs., Inc.	317-844-9227
KS	Overland Pk, Electri-Rep	913-649-2168
LA	Covington, Cartwright & Bean, Inc.	504-892-1780
MA	Amherst, Bennetron	603-880-7008
MI	Ypsilanti, Tech Rep	313-572-1950
MD	Glen Burnie, Macrotech Assoc.	301-766-1111
MN	Oakdale, Complete Sls.	612-731-2923
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170
MO	St. Louis, Electri-Rep	314-993-4421
NH	Amherst, Bennetron	603-880-7008
NY	Islip, Cogent Technlg. Assoc., Inc.	516-277-7101
NY	Syracuse, Pi'Tronics	315-455-7346
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
OH	Centerville, Components Inc.	513-436-0255
OH	Cleveland, Components, Inc.	216-243-9200
OR	Hillsboro, Turn-Around Sls.	503-640-4641
TN	Knoxville, Cartwright & Bean	605-693-7450
TN	Memphis, Cartwright & Bean, Inc.	901-362-8345
TX	Dallas, Rem Air Comps. Corp.	214-234-1069
WA	Kirkland, Turn-Around Sls.	206-822-4634
WI	Madison, Golbeck Milota Assocs.	608-222-7037

Local Distributors

AL	Huntsville, C.D.I.	205-883-7501
AZ	Phoenix, Beswitched	602-275-4805
AR	Little Rock, C.D.I.	501-227-6278
CA	Hollywood, Yale Elec.	213-465-3186
CA	Manhattan Beach, Prime Electro	213-379-3642
CA	San Carlos, Logan Elec.	415-594-0700
CA	San Diego, Sigma Elctrns.	619-565-7000
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Ana, Sigma Elctrn.	714-558-8600
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Target Elctrns.	408-734-5611
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Englewood, CDI	303-799-4916
CO	Littleton, Indelco	303-795-3431
CT	Norwalk, Cobra Comps.	203-847-6442
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Melbourne, C.D.I.	305-724-9910
GA	Norcross, C.D.I.	404-441-3320
IL	Bensenville, Voyager Elctrns.	708-860-1300
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Wichita, Radio Inc.	316-264-2798
MD	Beltsville, PSI	301-937-4960
MD	Columbia, D. K. Elctrns.	301-995-1950
MD	Elk Ridge, Interconnect Elect.	301-621-5424
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MA	Nashua, Brevan Elctrns.	603-889-7230
MA	Salem, Diamond Elctrns.	603-894-4420
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	Florrissant, Delltron Co., Inc.	314-839-0033
NJ	W. Berlin, G.C.I.	609-768-6767
NY	Rochester, CAM-RPC	716-427-9999
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Woodside, Switches Unlimited	800-221-0487
NC	Raleigh, C.D.I.	919-834-9465
OH	Cleveland, CAM-RPC	216-461-4700
OH	Columbus, CAM-RPC	614-888-7777
OH	Dayton, CAM-RPC	513-898-1111
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Radio Inc.	918-587-9123
OR	Beaverton, Comp. Resources	503-641-8488
OR	Portland, Radar Elec.	503-232-3404
PA	Pittsburgh, CAM-RPC	412-963-6202
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, C.D.I.	214-644-0373
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	Houston, Wofford Elctrns.	713-847-3593
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
WA	Kent, Comp. Resources	206-454-8666
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Progressive Image	414-321-4722

FAX: 908-452-0524

ELECTRONIC CONCEPTS, INC., Box 1278, Eatontown, NJ 07724, Tel: 908-542-7880, TELEX: 7107226661; FSC No.: 50558; Empl.: 240; *Sls. Mgr.:* Philip N. Lepore ..... **A•1058-1063**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	La Mirada, Select Elctrns.	714-739-8891
CO	Englewood, TMC	303-770-8995
IL	Wheaton, Elctrn. Concepts, Inc.	312-668-8747
MN	Minneapolis, Components Grp.	612-374-1250
MO	Grandview, Harris-Hanson Co.	816-763-6200
NJ	Eatontown, Elctrn. Concepts, Inc.	908-542-7880
NM	Albuquerque, Piper Sls. Co.	505-883-9090
MO	St. Louis, Harris-Hanson Co.	314-432-3611

Local Distributors

NJ	Clifton, Elcon Sls.	201-546-5022

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ELECTRONIC CONTROLS DESIGN, 4287-A SE International Way, Milwaukie, OR 97222, Tel: 503-659-6100; Empl.: 100; *Sls. Mgr.:* Steven Glass ..... **D•1169**

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ELECTRONIC DESIGN ENGINEERING, 1820 Temescal Av., Norco, CA 91760, Tel: 714-735-1761; Empl.: 3

ELECTRONIC DEVELOPMENT ASSOCIATES, INC., 1 Westcliff Drive, Dix Hills, New York 11746, Tel: 516-673-3881, FAX: 516-673-5979; FSC No.: 9V841

FAX: 617-268-6754

ELECTRONIC DEVELOPMENT CORP., EDC, 11 Hamlin St., Boston, MA 02127-4198, Tel: 617-268-9696, TELEX: 951596; FSC No.: 12619; Empl.: 25; *Sls. Mgr.:* R. B. Ross ..... **D•1242-1243**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer	205-883-4163
AZ	Tempe, Mesa Tech.	602-279-5243
CA	All of CA, F.L.W.	800-339-6030
CO	Englewood, R. A. Mayes Co.	303-761-9447
FL	Orlando, Gentry Assocs.	407-859-7450
FL	Tampa, Gentry Elec. & Instr.	813-886-0720
IL	Arlington Heights, Berndt Assoc.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-541-1007
MA	Boston, Elctrn. Dev. Corp.	617-268-9696
MA	Needham, Addelco Corp.	617-444-4754
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Minneapolis, The Mark Co.	612-933-3026
MO	Chesterfield, Ramsey Assocs.	314-532-9386
NJ	Union, Friedman Assocs.	201-964-6200
NM	Albuquerque, Mesa Technlg.	505-883-8833
NY	Victor, SAN WAL Technlg.	716-924-1950
NC	Raleigh, Lee Assocs.	919-848-8818
OH	Cleveland, Tiby Co.	216-371-5335
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Hatboro, Rhodes Technlg.	215-672-3336
TX	Richardson, Scientific Sls.	214-231-6541
VA	Richmond, Advance Control Equip.	804-282-9499
WI	Milwaukee, Berndt Assoc.	414-545-8400
Can	Mississauga, Ont., Omnitronix Ltd.	416-828-6221

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELECTRONIC DEVICES, INC., 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, TELEX: 681-8047, FAX: 914-965-5531; Empl.: 200; *Sls. Mgr.:* Paul Dengler; *Dist. Mgr.:* Paul Dengler ..... **A•2094**

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls.	602-345-1276
CA	Northridge, Myco Sls.	818-886-7101
CA	San Jose, Nelson Elctrn. Sls., Inc.	408-437-9300
CO	Golden, Dossett Elctrn. Mktg. Inc.	303-278-4620
FL	Melbourne, Kennedy Assocs.	407-676-6875
IN	Carmel, Berndt Assocs.	317-844-0114
MA	Sharon, Cummings Assocs.	617-784-5600
MI	Livonia, Amtech	313-474-8300
MN	Brooklyn Ctr., Lydon Assoc.	612-535-6526
MO	St. Louis, Rep-tronics Inc.	314-997-4707
NY	Patchogue, Optimum Sls. Co.	516-758-0644
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, B.T. Funderburk Inc.	919-846-2373
OH	Cleveland, Versatron	216-581-0090
OR	Portland, Index, Inc.	503-297-3364
PA	Pipersville, Yax Assocs.	215-776-2100
TX	Dallas, Kruvand Assocs. Inc.	214-437-3355
WI	Mequon, Stumm Sls.	414-241-8414
Can	Montreal, Que., Elcom GMB Inc.	514-668-3361

Local Distributors

AL	Huntsville, Comp. Dists.	205-883-7501
CA	San Jose, Compass	408-432-7575
CA	Costa Mesa, Orange Cty. Comps.	714-979-3597
CO	Englewood, Comp. Distrs.	303-799-4916
CT	Greenwich, Wise Comps.	203-531-4880
FL	Melbourne, Comp. Dists.	305-724-9910
GA	Norcross, Comp. Dists.	404-449-9508
IL	Chicago, E M D	312-577-0067
IN	Indianapolis, Gateway Megatech	317-844-3906
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
MA	Billerica, Mayer Elctrns. Inc.	617-229-2255
MI	Grand Rapids, SF Elctrns.	616-459-0216
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	St. Louis, Ric-Tronics	314-576-9816
NJ	Fairfield, Verdura Sls. Co.	201-227-0414
NY	Albany, Edwin Taylor Co.	518-438-7811
NM	Albuquerque, Walker Radio	505-247-2288
NY	Buffalo, Summit Dists.	716-334-8110
NY	Elmsford, Multmetrics	914-347-3666
NC	Raleigh, Comp. Distrs.	919-787-2116
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Tulsa, Quality Comps.	918-664-8812
OR	Portland, Radar Elec. Co.	503-232-3404
TX	Houston, Jaco/QC	713-240-2255
PA	Pittsburgh, Advacom	814-476-7774
VA	Roanoke, Peoples Elctrns.	703-342-8933
WA	Seattle, Radar Elec.	206-282-2511
WI	Racine, Badger Elctrns.	414-637-1256
Can	Ontario, Westburne	613-737-5570

ELECTRONIC DISPLAYS, INC., 780 Creel Dr., Wood Dale, IL 60191, Tel: 708-860-5838, FAX: 708-860-0502

ELECTRONIC ENCLOSURES, Div. Wyle Laboratories, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 213-643-8181, FAX: 213-643-8565; FSC No.: 09097; Empl.: 230; *Sls. Mgr.:* Robert Sproul ..... **C•1030-1032**

Local Sales Offices & Reps

AL	Huntsville, FLW Southeast	205-990-8989
AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
CA	Campbell, Carlson & Assocs.	408-370-1284
CA	El Segundo, Wyle Labs.;Elctrn. Encl.	213-643-8181
CA	San Diego, McKinley Elctrn. Sls.	619-271-7221
FL	Casselberry, T-Squared Mktg.	407-699-9992
FL	Ft. Lauderdale, T-Squared Mktg.	305-735-3246
GA	Marietta, FLW Southeast	404-424-1731
IL	Arlington Heigts, Coombs Assoc.	708-439-9810
MD	Upperco, Imigtron Sls. Co.	301-374-5600
MA	Needham Heights, Todino Engrg. Sls. Inc.	617-444-7925
MI	Jackson, Norwood Scroggs Co.	517-750-1170
NJ	Pennsauken, Wyle Labs.;Elctrn. Encl.	609-665-6810
NY	Sanquoit, JBR Engrg. Inc.	315-737-9432
OH	Galion, J. R. Bright Agy.	419-468-3787
TX	Ft. Worth, Zonk Engrg. Co.	214-238-7651
TX	Houston, Zonk Engrg. Co.	713-579-7777
TX	Richardson, Zonk Engrg. Co.	214-238-7651
WI	Milwaulkee, Coombs Assoc.	414-351-6123

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EEM/ELECTRONIC ENGINEERS MASTER, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

ELECTRONIC ESSENTIALS, 60-20 34th Avenue, Woodside, NY 11377, Tel: 718-898-8300, TELEX: 384-873, ESYLNK: 6275-6172, FAX: 718-899-7995; Empl.: 49

ELECTRONIC FILM CAPACITORS, INC., 41 Interstate Lane, Waterbury, CT 06705, Tel: 203-755-5629, FAX: 203-755-0659; Empl.: 65; *Sls. Mgr.:* A. Jewel Quinn; *Dist. Mgr.:* A. Jewel Quinn

ELECTRONIC HARDWARE, 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950, FAX: 516-752-1971; Empl.: 110; *Sls. Mgr.:* June Franke

ELECTRONIC INDUSTRIES ASSOC., 2001 Pennsylvania Ave. NW, Washington, DC 20006, Tel: 202-457-4900, FAX: 202-457-4985

ELECTRONIC INNOVATIONS CORP., 3107 W. Hampden Ave., Englewood, CO 80110, Tel: 303-789-0424, FAX: 303-789-0809; Empl.: 4

ELECTRONIC MEASUREMENTS INC.

FAX: 908-922-9334

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 908-922-9300, TELEX: 132-424; FSC No.: 89022; Empl.: 250; *Sls. Mgr.:* Charles Lehmann ..... **D•1718-1727**

Local Sales Offices & Reps

AZ	Phoenix, Sci. Devices	602-957-0401
CA	Huntington Beach, Sci. Devices	714-840-3501
CA	San Diego, Sci. Devices	619-573-0157
CA	San Jose, Sci. Devices	408-554-0455
CO	Broomfield, Sci. Devices	303-469-5145
GA	Marietta, Elctrn. Measurements	404-427-8660
IL	Chicago, Comtel	312-539-4838
IN	Indianapolis, Comtel	317-253-1681
IA	Cedar Rapids, Comtel	319-377-9434
MA	Winchester, FJS Assoc.	617-729-3135
MI	Southfield, Comtel	313-358-2510
MN	Wayzata, Comtel	612-476-1551
NM	Albuquerque, Sci. Devices	505-883-3668
NY	Syracuse, T-Squared	315-463-0355
OH	Dayton, WKM Assoc.	513-434-7500
PA	Pittsburgh, WKM Assoc.	412-892-2953
PA	Plymouth Meeting, Electronic Mktg. Assocs.	215-828-7400
TX	Houston, AccuData	713-580-2451
WA	Redmond, Sci. Dvcs.	206-885-0004
WI	New Berlin, Comtel	414-544-6042

ELECTRONIC MODULES, INC., 10410 Vista Park Rd., Dallas, TX 75238-1687, Tel: 214-340-6789; Empl.: 40-50; *Sls. Mgr.:* Leo Rios; *Dist. Mgr.:* Paul Stolar

ELECTRONIC NAVIGATION INDUSTRIES, See ENI, Inc.

ELECTRONIC PRECISION COMPONENTS CORPORATION, 519 South 5th Ave., Mt. Vernon, NY 10550-4430, Tel: 914-664-2333, FAX: 914-664-4729; FSC No.: 59131; Empl.: 8; *Sls. Mgr.:* Don Edwards ... **A•1670**

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FAX: 617-661-2989

ELECTRONIC PRECISION TECHNOLOGY INC., 126 Jackson St., Cambridge, MA 02140, Tel: 617-661-2454; Empl.: 4; *Sls. Mgr.:* Werner Christ ... **C•1359-1361**

Local Sales Offices & Reps

AL	Huntsville, McKay Smith Assocs.	205-539-8000, FAX:205-539-2472
AZ	Mesa, McDonald Kerr Technlg. Assocs.	602-833-7734,FAX:602-834-8339
CA	Campbell, PCA Mktg. & Sls. Engrg.	408-559-2866, FAX:408-559-8277
CA	Dana Point, P C A	714-493-9822, FAX:714-240-1894
FL	Orlando, McKay Smith Assocs.	407-423-4353, FAX:407-841-8554
FL	Pinellas Pk., P & M Mktg. Assocs.	813-546-4175, FAX:813-544-3826
GA	Tucker, McKay Smith Assocs.	404-496-9913, FAX:404-496-5743
IN	Fishers, Carter, McCormic & Peirce Inc.	317-842-9277,FAX:317-577-2741
MD	Randallstown, Chesepeak Indl. Mktg.	301-653-0476,FAX:301-653-4675
MA	Concord, Noyes Assoc.	508-369-0425, FAX:508-371-2931
MI	Farmington Hills, Carter, McCormic & Pierce Inc.	313-477-7700,FAX:313-477-4149
NC	Raleigh, McKay Smith Assocs.	919-847-2277, FAX:919-847-0956
OH	Englewood, Carter, McCormic & Peirce Inc.	513-836-0951,FAX:513-836-2358
OH	Parma, Carter,McCormic & Peirce Inc.	216-398-0400,FAX:216-398-0766
PA	Pittsburgh, Carter, McCormic & Peirce Inc.	412-826-3800,FAX:412-826-3800
TX	Plano, Connector Specs.	214-517-3660, FAX:214-517-1207

Local Distributors

CA	Costa Mesa, Eric Elctrns.	714-751-1185, FAX:619-236-9910
CA	San Jose, Eric Elctrns.	408-432-1111, FAX:408-433-0570
CA	Santa Anna, Elcom Cabletek	714-432-6630, FAX:714-556-0468
CA	Sunnyvale, PSC ...	800-654-1518,FAX:408-737-0502
MD	Beltsville, PSC/Petricko Sls.	800-333-5292, FAX:301-937-5299
MD	Gaithersburg, Axis Elctrns.	800-368-2815, FAX:301-840-9299
MA	Ashland, Quality Components	508-881-6504, FAX:508-881-1704
TX	Arlington, Bell Comp. Sls. Inc.	817-461-5303
Can	Mississagua, Ont., R. Theta	416-890-0221, FAX:416-890-1628

ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1444

ELECTRONIC RESEARCH CO., 7618 Wedd St, Overland Park, KS 66204, Tel: 913-631-6700, TWX: 910-749-6477; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler

ELECTRONIC RESOURCES INC., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089, Tel: 408-745-1420, FAX: 408-745-0533; Empl.: 6; *Dist. Mgr.:* Cari Ikya

THE ELECTRONICS GROUP, INC., 2828 Interstate St, Charlotte, NC 28208, Tel: 704-391-9500, FAX: 704-597-9500 Ext. 20; Empl.: 30; *Sls. Mgr.:* Doug Mckenzie

ELECTRONIC SOLUTIONS, A Unit of Zero Corp., 6790 Flanders Dr., San Diego, CA 92121, Tel: 619-452-9333, TELEX: 910-335-1169, FAX: 619-452-9464; Empl.: 150

ELECTRONIC SPACE SYSTEMS CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 508-369-7200, TELEX: 923480 ESSCO WCRD, FAX: 508-369-7641; FSC No.: 15175; Empl.: 150; *Sls. Mgr.:* Susan M. Cuevas

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 508-655-1532, 800-225-4876, TELEX: 955-329 ATTN: ESP; Empl.: 42; *Sls. Mgr.:* Frank Brown

FAX: 206-573-4635

ELECTRONIC SPECIALTY CORP., 14511 N.E. 13th Ave., Vancouver, WA 98665, Tel: 206-574-5000; FSC No.: 98927; Empl.: 100; *Sls. Mgr.:* Leon Fuller ..... **B•1467, 1626**

Local Sales Offices & Reps

CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	San Jose, Westron Assocs.	408-997-7332
CO	Longmont, Tri Tec Sls.	303-440-7862
GA	Atlanta, &	404-395-7079
IA	Des Moines, SPS Assocs. Ltd.	515-225-0607
KS	Olathe, SPS Assocs. Ltd.	913-764-4460
MD	Baltimore, Eastern Comps.	301-788-7050
MD	Gaithersburg, Eastern Comp.	215-825-8610
MA	Lexington, Hathaway Elctrns.	617-861-7010
MN	Hopkins, The Kits Co.	612-933-1888
MN	Stillwater, The Kits Co.	612-439-8088
MO	Earth City, SPS Assocs. Ltd.	314-291-0520
NE	Panama, SPS Assocs. Ltd.	913-764-4460
NJ	Ft. Lee, Neptune Elctrns. Co.	201-461-2789
NM	Albuquerque, Tri Tec Sls.	505-293-3730
NY	Glen Head, Neptune Elctrns. Co.	516-349-1600
NC	Raleigh, Eastern Comp.	919-787-3416
NC	Raleigh, L & D Inc.	919-876-5301
OH	Cleveland, Components Inc.	216-243-9200
OR	Beaverton, Earl & Brown Co., Inc.	503-643-5500
PA	West Conshohocken, Eastern Comp.	215-825-8610
TX	Dallas, Barry Sls.	214-234-0255
TX	Houston, Barry Sls. Inc.	713-784-5860
TX	Richardson, Barry Sls. Inc.	612-439-8088
VA	Annandale, Eastern Comp.	703-354-0723
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064

EP/ELECTRONICS PRODUCTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, TELEX: 516-227-1901

ELECTRONICS REPRESENTATIVE ASSOC., 20 E. Huron St., Chicago, IL 60611, Tel: 312-649-1333, FAX: 312-649-9509

ELECTRONICS RESEARCH ASSOCIATES INC., West Hill Rd., Winsted, CT 06098, Tel: 203-379-2731, TWX: 710-449-6464, FAX: 203-379-8861; FSC No.: 28564; Empl.: 200; *Sls. Mgr.:* Phillip J. Brown

ELECTRONIC SYS. & PROGRAMMING, See Augat/ES)sP, Inc.

ELECTRONIC SYSTEMS DIVISION, Boeing Defense & Space Grp., P.O. Box 3999, M/S 9/F-UA, Seattle, WA 98124-2499, Tel: 206-657-7474, TELEX: 329430, FAX: 206-657-9874; FSC No.: 81205; Empl.: 4,000; *Sls. Mgr.:* R.F. Priebe

ELECTRONICS SYSTEMS, INC., P.O. Box 5013, Sioux Falls, SD 57117, Tel: 605-338-6868, FAX: 605-338-5061; Empl.: 98; *Sls. Mgr.:* Leo Reynolds

ELECTRONICS TEST CENTRE, Alberta Research Council, 250 Karl Clark Road, Edmonton, AB, Canada T6N 1E4, Tel: 403-450-5370, TELEX: 0372147, FAX: 403-462-7285; Empl.: 16; *Sls. Mgr.:* Chris Talliss

ELECTRONIC TELE-COMMUNICATIONS, INC., 3620 Clearview Parkway, Atlanta, GA 30340-2178, Tel: 404-455-4890, FAX: 404-455-7972; Empl.: 145; *Sls. Mgr.:* Doug Altman; *Dist. Mgr.:* Doug Altman

ELECTRONIC TESTING & CONSULTING, Rt 4 Box 933, Decatur, TX 76234, Tel: 817-627-2929; Empl.: 2

ELECTRONIC TRANSFORMER CORP., P.O. Box 188, Totowa, NJ 07511, Tel: 201-942-2222, FAX: 201-942-9014; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELEC-TRON, INC., 2050 Northern St., Wichita, KS 67216, Tel: 316-522-3401, FAX: 316-524-6767; Empl.: 65; *Sls. Mgr.:* Gary Beddow

ELECTRON PRODUCTS, 5367 Third St., Irwindale, CA 91706, Tel: 818-960-2299, ESYLNK: 910-333-9810, FAX: 818-814-4434; FSC No.: 99515; Empl.: 65; *Sls. Mgr.:* Cliff Sailor; *Dist. Mgr.:* Ann Meunier

FAX: 714-250-0958

ELECTRO-NUMERICS, INC., 1811 Reynolds, Irvine, CA 92714, Tel: 714-250-1501; FSC No.: 51666; Empl.: 16; *Sls. Mgr.:* Ro Shultz ..... **D•1344**

Local Distributors

IL	Chicago, Dalec Distrs.	312-283-0300
CA	Costa Mesa, FLW, Inc.	714-751-7512
GA	Atlanta, FLW S.E., Inc.	404-424-1731
MI	Detroit, RAM Meter, Inc.	313-398-6767
NY	Syracuse, W.E.I., Inc.	315-437-4281

ELECTRO OPTICAL INDUSTRIES INC., 859 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-6701 (ext. 280), TELEX: 65-8427 EOIND SNC, FAX: 805-967-8590; Empl.: 130

ELECTRO-PACIFIC, 5770 Thornwood Dr., Goleta, CA 93117, Tel: 805-964-0751; FSC No.: 29853; Empl.: 60; *Sls. Mgr.:* T. Calhoun

ELECTRO PHYSICS CO., INC., 3009 Central Ave., Waukegan, IL 60085, Tel: 708-249-5801; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 48 Spruce St., Nutley, NJ 07110, Tel: 201-667-0170; Empl.: 25; *Sls. Mgr.:* Frank J. Vallese

ELECTRO PREP INC. & N-E-D CABLE, 14 Kendrick Rd, Unit 3, Wareham Ind. Park, Wareham, MA, MA 02571, Tel: 508-291-2880, FAX: 568-291-2882; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

ELECTRORACK PRODUCTS CO., 1443 S. Sunkist St., Anaheim, CA 92806, Tel: 714-776-5420, FAX: 714-776-9683; FSC No.: 26073; Empl.: 50; *Sls. Mgr.:* Chris Allen

ELECTRO RENT CORP., 6060 Sepulveda Blvd., Van Nuys, CA 91411, Tel: 818-787-2100, FAX: 818-786-4224; Empl.: 480; *Sls. Mgr.:* Gary Phillips

ELECTRO-SCIENCE LABS., INC., 416 E. Church Rd., Po Box 1533, King of Prussia, PA 19406-1533, Tel: 215-272-8000, TELEX: 83-4788, FAX: 215-272-6759; Empl.: 120

ELECTRO SCIENTIFIC INDUSTRIES, INC. (ESI), 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, TELEX: 474-2064; FSC No.: 11837; Empl.: 600; *Sls. Mgr.:* Dick Donaca, Sys.

FAX: 215-682-2133

ELECTRO SPACE FABRICATORS, 300 W. High St, P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* T. Roth ..... **C•1034-1037**

Local Sales Offices & Reps

CA	Campbell, Shursales	408-374-5577
CA	Irvine, Vale Assocs.	714-551-4004, 4821
FL	Melbourne, Winter Assocs.	305-254-6556
FL	Vero Beach, S.E. Pro. Sls.	407-778-0454
GA	Norcross, Benchmark Tech. Sls.	404-448-2854
IL	Northbrook, Howard Benjamin Assocs.	312-272-2900
MD	Monkton, Imagitron Sls. Co.	800-638-3592
MD	Upperco, Imagitron Sls. Co.	800-638-3592
MA	Needham Heights, TESCO	617-444-7925
NJ	Boonton, Winter Assocs.	201-334-3434
NY	Buffalo, Promark Elctrns., Inc.	716-877-6300
NY	Morrisville, Promark Elctrns., Inc.	315-662-3310
OH	Galion, James R. Bright	419-468-3787
PA	Huntingdon Valley, OMEGA Elctrn. Sls., Inc.	215-947-4135
TX	Dallas, Dynamark	214-437-3333

Local Distributors

CA	Irvine, McGillis Inds.	714-551-4004
CA	Redwood City, HdB Elctrns.	415-368-1388
MD	Columbia, DK Elctrns.	301-995-1950
NY	Baldwin, Accessories for Elctrns.	516-546-1751

ELECTROSPACE SYSTEMS, INC., P. O. Box 831359, Richardson, TX 75083-1359, Tel: 214-470-2137, TELEX: 163590 ESIUT, TWX: 910-867-4768, FAX: 214-470-2466; FSC No.: 33875; Empl.: 1283; *Sls. Mgr.:* John E. Cochran, Dir. Bus Dev.

ELECTRO STANDARDS LAB., INC., Data Communications Products Div., 36 Western Industrial Dr., Cranston, RI 02921, Tel: 401-943-1164, FAX: 401-946-5790; Empl.: 25; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATIC CONSULTING ASSOCS., 556 Lowell Rd., P.O. Box 552, Groton, MA 01450, Tel: 508-448-5583, FAX: 508-448-5583; Empl.: 5; *Sls. Mgr.:* Paul Malinaric

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414, FAX: 619-279-1126; FSC No.: 34538; Empl.: 10

ELECTRO-SUPPORT SYSTEMS, 43445 Business Park Dr., Temecula, CA 92390, Tel: 714-676-2751, FAX: 714-694-0097; FSC No.: 66760; Empl.: 37; *Sls. Mgr.:* Don Pretot

ELECTROSWITCH, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, Tel: 617-335-5200, FAX: 617-335-4253; FSC No.: 82121; Empl.: 290; *Sls. Mgr.:* W. M. Mello ..... **B•1694**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Irvine, Vale Elctrns.	714-551-4004
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Vale Elctrns.	619-693-0113
CA	San Diego, Wiley Co.	619-453-9018
CA	San Ramon, W. Nott & Co.	415-820-8102
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Apopka, Floritronics	407-886-4818
GA	Albany, Holman-Gillespie	912-883-5565
GA	Atlanta, Holman-Gillespie	404-992-8820
IL	Elk Grove Village, Electroswitch	708-593-2225
IA	Bettendorf, Weisler & Assocs.	319-355-5911
MD	Baltimore, Eastern Comps. Sls.	301-788-7050
MD	Gaithersburg, Naudain Assocs.-Southern	301-258-5040
MA	Weymouth, Electroswitch	617-340-0066
MI	Grand Haven, Hilltronics, Inc.	616-847-1010
MI	Royal Oak, Hilltronics	313-435-0920
MN	Roseville, Pro Tech Power Sls., Inc.	612-483-0409
MO	Chesterfield, Weisler & Assocs.	314-537-0010
MO	Kansas City, Weisler & Assocs.	816-421-1679
NH	Salem, Sales Engrg. Co.	603-893-5521
NJ	Fairfield, Electroswitch	201-227-6559
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Buffalo, Upstate Engrg.	716-632-0011
NY	Johnson City, Upstate Engrg.	607-729-0827
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NY	Utica, Upstate Engrg. Sls.	315-797-6721
NC	Raleigh, L.G. White Southern	919-872-6049
NC	Winston-Salem, L.G. White Southern	919-725-3612
OH	Medina, Rockford Controls OH, Inc.	216-725-3705
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Pittsburgh, R. F. Clark	412-242-9500
PA	W. Conshohocken, Eastern Comps.	215-825-8610
SC	Greenville, L.G. White Southern	803-271-0630
WA	Olympia, Alster Comm.	206-754-7965
TX	Plano, Brice Co.	214-442-9808
TX	Stafford, Brice Co.	713-240-1788
VA	Ashland, L.G. White Southern	804-752-7055
WA	Bellevue, Luscombe Engrg.	206-223-1541
WA	Kent, C.B. Parsons & Co.	206-762-7373
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
GA	Atlanta, Georgia Control Ctr.	404-876-8833
IL	Bridgeview, Midco Comp. Sls.	312-599-7777
MN	St. Paul, K. D. I.	612-645-7717
NC	Raleigh, Wholesale Elctrns.	919-878-9400
OH	Medina, R.C.O.	216-725-3705
TX	Stafford, Barclay Whls.	713-240-1788
WA	Seattle, C.B. Parsons Co.	206-762-7373

ELECTRO-TEC CORPORATION A KAYDON COMPANY, 1501 North Main St., Blackburg, VA 24060, Tel: 703-552-2111, FAX: 703-951-3832; Empl.: 200; *Sls. Mgr.:* John J. Daly

ELECTRO-TECH SYSTEMS, INC., 115 E. Glenside Ave., Glenside, PA 19038, Tel: 215-887-2196, TELEX: 797137; Empl.: 13; *Sls. Mgr.:* Sharon Sandy; *Dist. Mgr.:* Stanley Weitz

ELECTROVERT USA CORP., 3440 Beltway Place, Suite 340, Arlington, TX 76018, Tel: 817-468-5171, FAX: 817-468-1959; Empl.: 500; *Sls. Mgr.:* John Gammer, Eastern Zone

ELECTROWEAVE, INC., 425 Shrewsbury St., Worcester, MA 01604, Tel: 508-752-8932, FAX: 508-753-2173; FSC No.: 54207; Empl.: 25; *Sls. Mgr.:* Peter Andrews

ELEKTRISOLA INC., 126 High Street, Boscawen N, NH 03303, Tel: 603-796-2114, FAX: 603-796-2119; Empl.: 150; *Sls. Mgr.:* John W. Mueller

ELETECH ELECTRONICS, INC., 1262 E. Katella Ave., Anaheim, CA 92805, Tel: 714-385-1707, FAX: 714-385-1708; Empl.: 5

ELFORM, INC., P.O. Box 7362, Reno, NV 89510, Tel: 702-829-1905, FAX: 702-829-1693; *Sls. Mgr.:* Roger R. Reinke







FAX: 619-458-0267

ELGAR ELECTRONICS CORPORATION, 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-450-0085, 800-733-5427, TELEX: 211063 ELSD UR; FSC No.: 25965; Empl.: 275 ..... **D•1728-1729, 2191-2193**

Local Sales Offices & Reps

CA	Carpenteria, Elgar Corp.	805-684-4400
CA	Redondo Beach, Ward/Davis Assocs.	213-643-6977
CA	San Diego, Ward/Davis Assocs.	619-292-1000
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
FL	Clearwater, Beacon	813-796-2378
FL	Longwood, Beacon	407-332-1940
FL	Satelitte Beach, Beacon	407-711-6303
GA	Atlanta, Beacon	404-256-9640
GA	Norcross, Beacon	404-449-8464
IL	Arlington Heights, Dytec/Midwest	708-255-3200
IN	Indianapolis, Dytec/Midwest	317 849-9898
KS	Lenexa, Dytec/South	913-888-0215
KS	Wichita, Dytec/South	316-263-7090
KS	Wichita, Dytec/Souyh, Inc.	316-263-7090
MD	Laurel, Elctrn Mktg. Assocs.	301-953-7800
MA	Beverly, P. Jenks Assocs.	508-921-4600
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Edina, Dytec Instrs.	612-831-7169
NM	Albuquerque, Gary Brooks	505-884-3444
NY	Great Neck, RTI	516-829-3770
NY	Syracuse, Labtronics	315-455-7314
NC	Raleigh, Beacon	919-781-8118
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
PA	Pittsburgh, WKM Assocs.	412-892-2953
TX	Richardson, Testech, Inc.	214-644-5010
TX	San Antonio, Jack Howard Assoc.	512-828-5741
WA	Bellevue, Syntek	206-462-7700
WA	Spokane, Syntek	509-466-0451
WI	Brookfield, Dytec Midwest	414-367-4550
WI	Brookfield, Dytec/Midwest	414-367-4550
Intl	CA San Diego, Elgar Intl. Corp.	619-450-0085

Local Distributors

AZ	Phoenix, Tech. Mktg. Spec.	602-678-4940
CA	Irvine, Ward/Davis Assoc.	714-756-9084
CO	Englewood, Tech. Mktg. Spec.	303-781-8819
GA	Sylvester, Beacon	912-776-4100
MI	Livonia, Elgar Corp.	313-591-2529
TX	Austin, Testech	512-338-9246
TX	Austin, Testech	512-338-9426
TX	Dallas, Beacon	214-437-1505
TX	Houston, Testech	713-893-9661

ELGAR/INTEPRO SYSTEMS, 9250 Brown Deer Road, San Diego, CA 92121, Tel: 619-458-0261, 1-800-733-5427, TELEX: 211063 ELSO UR, FAX: 619-458-0267; Empl.: 250; *Sls. Mgr.:* Mike Cagney ..... **D•1728-1729**

Local Sales Offices & Reps

AZ	Phoenix, Tech. Mktg. Spec.	602-678-4940
CA	Redondo Bch., Ward/Davis Assocs.	213-643-6977
CA	San Diego, Ward/Davis Assocs.	619-292-1000
CA	Santa Clara, Ward Davis Assocs.	408-245-3700
CO	Englewood, Tech. Mktg. Spec.	303-781-8819
FL	Clearwater, Beacon	813-796-2378
GA	Atlanta, Beacon	404-256-9640
GA	Norcross, Beacon	404-449-8464
IL	Arlington Heights, Dytec/Midwest	708-255-3200
IN	Indianapolis, Dytec/Midwest	317-849-9898
KS	Lenexa, Dytec/South	913-888-0215
KS	Wichita, Dytec/South, Inc.	316-263-7090
MD	Laurel, Elctrn. Mktg. Assocs.	301-953-7800
MD	Maryland Hgts., Dytec/South	314-739-0665
MA	Beverly, P. Jenks Assocs.	508-921-4600
MI	Madison Hgts., WKM Assocs.	313-588-2300
MN	Edina, Dytec Instrs.	612-831-7169
NM	Albuquerque, Gary Brooks	505-884-3444
NY	Great Neck, RTI	516-829-3770
NY	Syracuse, Labtronics	315-455-7314
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
TX	Austin, Testech	512-338-9246
TX	Houston, Testech	713-893-9661
TX	Richardson, Testech, Inc.	214-644-5010
TX	San Antonio, Jack Howard Assoc.	512-828-5741
WA	Bellevue, Syntek	206-462-7700
WA	Spokane, Syntek	509-466-0451
WI	Brookfield, Dytec Midwest	414-367-4550
EXP	CA/San Diego, Elgar Intl. Corp.	619-450-0085

ELGENCO, INC., Box 460, Hurricane, UT 84737, Tel: 801-635-4954, FAX: 801-635-2158; FSC No.: 15455; *Sls. Mgr.:* D. E. Beecher ..... **D•1244**

Local Sales Offices & Reps

CA	Sherman Oaks, Windsor Dynamics	818-990-4173
CA	Sunnyvale, N-S Westronics	408-745-1102
CT	Meriden, Polytek Assoc.	203-634-4499
MA	Ashland, Polytek Assoc.	508-881-4741
NJ	Marmore, SWR Tech., Inc.	609-390-0094
NM	Albuquerque, Technology Mktg. Assoc.	505-345-8921
PA	Broomall, SWR Tech., Inc.	215-353-6639

ELGIN ELECTRONICS, 5533 New Perry Hwy., Erie, PA 16509-3570, Tel: 814-864-4921, FAX: 814-864-1260; Empl.: 300; *Sls. Mgr.:* Paul R. Barlock; *Dist. Mgr.:* Stanley R. Carlburg

ELITE ELECTRONIC ENGINEERING CO., 1516 Centre Circle, Downers Grove, IL 60515, Tel: 708-495-9770, FAX: 708-495-9785; FSC No.: 099-9999; Empl.: 34

ELITE ELECTRONICS, INC., 1408 Summit - Suite 65, Plano, TX 75074, Tel: 214-881-0026, 800-553-4376, FAX: 214-424-7299; Empl.: 4

ELITE SOFTWARE DEVELOPMENT, INC., P.O. Drawer 1194, Bryan, TX 77806, Tel: 409-846-2340, FAX: 409-846-4367; Empl.: 9; *Sls. Mgr.:* Terri J. King

ELIWELL-USA LTD., EliWell, S.P.A., 226 East 54th St. Ste. 800, NYC, NY 10022, Tel: 212-832-9393, FAX: 212-832-0738; *Sls. Mgr.:* Paul R. de Ridder

ELLIOTT/JORDAN, A Company of Vishay, 461 N. 22nd St., P.O. Box 1090, Grand Junction, CO 81502, Tel: 619-690-2401, FAX: 619-690-0132; Empl.: 500; *Dist. Mgr.:* Iris Demeritt ..... **A•1914-1915**



FAX: 415-656-3783

ELMA ELECTRONIC INC., 41440 Christy Street, Fremont, CA 94538, Tel: 415-656-3400; Empl.: 40; *Sls. Mgr.:* Kris Holla .... **B•1695, 1806; C•1039-1041, 1584**

Local Sales Offices & Reps

AL	Huntsville, Pen-Tech	205-881-9298
AZ	Scotsdale, I.M. Systems	602-948-1495
CA	Fremont, Bear Resources	415-793-1064
CA	Fremont, ELMA Elctrn. Inc.	415-656-3400
CA	Orange, Viatek	714-634-8411
FL	Oviedo, Pen-Tech	407-366-8706
FL	W. Palm Bch., Pen-Tech	407-640-0800
GA	Roswell, Pen-Tech	404-642-4110
MN	Plymouth, James R. Johnson & Assocs.	612-478-9442
NH	Nashua, Bell Controls Inc.	603-882-6984
NY	Amsterdam, Traxonics Inc.	518-843-1445
NY	Port Chester, Radiation Elctrns., Inc.	914-937-2300
NC	Greensboro, Pen-Tech	919-852-6000
OH	Strongville, Dolfuss-Root & Co.	216-899-9370
PA	King of Prussia, KSI	215-783-6400
TX	Plano, EITA Elctrns., Inc.	214-578-9406

ELMA ENGINEERING, 1066 E. Meadow Circle, Palo Alto, CA 94303, Tel: 415-494-7303, TELEX: 345-560, FAX: 415-494-1093; FSC No.: 59810; Empl.: 38; *Sls. Mgr.:* T. A. Beno; *Dist. Mgr.:* T. A. Beno

ELMAG DIVISION, Lindgren RF Enclosures, 3750 Prospect Ave., Riviera Bch., FL 33404, Tel: 407-881-9292, FAX: 407-844-4175; FSC No.: 23160; Empl.: 15

ELMEC, INC., Technautic Corp., 300 N. McKemy Ave., Chandler, AZ 85226, Tel: 602-961-7100, FAX: 602-961-7173; FSC No.: 50691; Empl.: 70; *Sls. Mgr.:* Ron Pittman

ELMEC TECHNOLOGY OF AMERICA, INC., 1255 Corporate Center Dr. Suite 406, Monterey Park, CA 91754, Tel: 213-265-1861, FAX: 213-265-1908; *Sls. Mgr.:* Steve Sameshima ..... **A•1549-1557**

Local Sales Offices & Reps

CA	Monterey Pk., ELMEC Technlg. of America	213-265-1861
CA	San Jose, Prime Source	408-943-0344
CA	Seal Bch., Texel Engrg.	213-596-9411
IL	Northfield, Feller Assocs. Inc.	708-446-8065
IN	Ft. Wayne, Outman Sls.	219-487-7699
KS	Overland Pk., Web Elctrns.	913-381-7986

MA Natic, Wayland Engrg. Sls. 508-655-6080
MO Florissant, Web Assoc. Elctrns., Inc. ... 314-921-5720
NJ Paramus, Eltech Sls., Inc. 201-967-1309
TX Dallas, Orion Assocs. 214-241-3505

Local Distributors
CA Monterey Park, ELMEC TECHNLG OF AMERICA INC. 213-265-1861

ELM SYSTEMS, 1101 Brown St., Wauconda, IL 60084, Tel: 708-526-5003, FAX: 708-526-5022

HAWKER SIDDELEY
Elmwood Sensors

FAX: 401-728-5390

ELMWOOD SENSORS, 500 Narragansett Park Drive, Pawtucket, RI 02861, Tel: 401-727-1300, TELEX: 6814066 ELMWOOD; Empl.: 1,000ò; *Sls. Mgr.:* Steve Hecht ..... **B•1842-1843**

Local Sales Offices & Reps
AL Decatur, Tenn. Tech. Sls. 205-350-0630
AZ Phoenix, O'Donnell SW 602-944-9542
CA San Diego, O'Donnell Assocs. 619-578-1645
CA San Jose, O'Donnell Assocs. 408-432-1940
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Boulder, Front Range Mktg. 303-443-4780
FL Coral Springs, CBC Electronics 305-755-1111
FL Longwood, CBC Elctrns. 407-831-5380
FL Tampa, CBC Elctrns. 813-969-1901
GA Marietta, Tenn. Tech. Sls. 404-971-1419
IL Arlington Heights, Thermek 708-577-6900
IN Fort Wayne, O. Bromberg 219-456-6010
KY Alexandria, O. H. Bromberg & Assocs. 502-635-3063
KY Louisville, O. Bromberg 502-456-1498
MD Towson, Arbotek 301-825-0775
MA Danvers, C. H. Burnham Assoc. 508-774-0111
MA Topsfield, Whitehead Associates, Inc. 508-887-8050
OH Toledo, Engineered Comps. 419-475-4900
MN Minneapolis, C. Listug Sls. 612-881-8143
MO Kansas City, Hill & Company 816-361-1669
MO St. Louis, Hill & Co. 314-842-6868
NH Durham, C. H. Burnham Assoc. 603-868-2282
NJ Pitman, Colrud Corp. 609-589-5866
NM Albuquerque, O'Donnell Assocs. 505-889-4522
NY E. Syracuse, Bastian Sales Agency ... 315-437-1482
NY Fairport, Bastian Sls. 716-223-0237
NY Islip, Cogent Technlgs. 516-277-7101
NY Larchmont, Cogent Technlg. Assocs. 914-834-3530
NC Garner, Tenn-Tech 919-779-3309
OH Cleveland, Allied Entprs. 216-779-0080
OH Dayton, O. H. Bromberg 513-434-8788
OK Tulsa, Advance Technical Sales 918-664-0482
OR Hillsboro, Temco-Northwest 503-645-2030
NJ Pittman, Colrud Corp. 609-589-5866
PA Pittsburgh, Allied Entprs. East 412-788-2992
RI Woonsocket, C. H. Burnham Assoc. ... 401-762-9889
TX Austin, Advance Technical Sales 512-467-9209
TX Austin, Ion Assocs. 512-331-7251
TX El Paso, Advance Technical Sales 915-591-3142
TX Grand Prairie, Ion Assocs. 214-647-8225
TX Houston, Ion Assocs. 713-537-7717
TX Dallas, Advance Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
WA Birch Bay, Temco B.C. 206-371-0423
WA Bothell, Temco Northwest 206-481-6150
WA Spokane, Temco Northwest 509-927-9392
WI Milwaukee, R. Zingler 414-351-5005
Can Mississauga, Ont., Andy Baumen Assocs. 416-828-2600

ELNA AMERICA, INC., 5686 Corporate Ave., Cypress, CA 90630, Tel: 714-761-8600, FAX: 714-761-9188; Empl.: 5,011 Nationwide; *Sls. Mgr.:* Dennis King; *Dist. Mgr.:* Dennis King

ELNETIC ELECTRONICS, INC.:PLANT LOCATIONS, 1332 130th St., Gardena, CA 90247, Tel: 213-515-1546; FSC No.: 9e30; Empl.: 25; *Sls. Mgr.:* Ernest H. Carlson, Jr.

ELOGRAPHICS INC., 105 Randolph Rd., Oak Ridge, TN 37830, Tel: 615-482-4100, FAX: 615-482-4943; *Sls. Mgr.:* Richard Brooks

FAX: 714-241-7293

ELPAC COMPONENTS, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440; Empl.: 130; *Dist. Mgr.:* Jim Degerstrom ..... **A•1065, 1619**

Local Sales Offices & Reps
AZ Phoenix, Eltron 602-266-2164
CA San Diego, Addem 619-729-9216
CA Santa Ana, Elpac Comps. 714-979-4440
OR Beaverton, Harry Levinson Co. 503-690-1312
IL Highland Park, Bransky Sls. 312-433-2375
IN Indianapolis, J.C. Hofstetter Co. 317-897-7914
MA Needham Heights, Todino Engr. Sls. .. 617-444-7925
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
WA Seattle, Harry Levinson Co. 206-382-1300
WI Cedarburg, Bransky Sls. 414-377-6837

Local Distributors
CA Chatsworth, Mil-Comm 818-998-3111
CA Irvine, Kelex 714-863-1230
CA Santa Ana, BDS Elctrns. 714-662-1050
CA Santa Clara, PSC Elctrns. 800-654-1518
FL Melbourne, New Yorker 407-727-0955
WI Milwaukee, Progressive 414-321-4722
IL Northbrook, Classic Components 312-272-9650
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MA Andover, Aved Elctrns. 508-688-3800
MN Roseville, Parts 1 612-633-8079
NJ S. Hackensack, Waltech 201-641-7300
NY Mamaroneck, New Yorker Elec. 914-698-7600
NJ Wiippany, American Distr. Inc. 201-428-0510
NY Elmsford, Ancar 914-592-7100
OH Dayton, Electro Supp. 513-299-5020
OK Tulsa, Altair Co. 918-252-5781
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair 214-231-5166
VA Charlotte, Kellner 802-425-3250
WA Seattle, Kam Elec. 206-382-1300
WI New Berlin, Classic 414-786-5300
WI Racine, Badger Elctrns. 414-637-1256

ELPAC

FAX: 714-241-7293

ELPAC POWER SYSTEMS, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440; Empl.: 115; *Sls. Mgr.:* H. Myers; *Dist. Mgr.:* H. Myers ..... **D•1731**

Local Sales Offices & Reps
AL Huntsville, Hughes Assoc. 205-533-9108
AZ Scottsdale, BSE 602-483-0373
CA San Jose, Ruppert Sls. 408-998-8717
CA Woodland Hills, Varigon, Inc. 818-594-5080
CO Englewood, Purdy Co.Assoc. 303-790-2211
FL Tamarac, Hughes Assoc 305-720-1674
GA Norcross, Hughes Assoc. 404-662-1587
MN Minneapolis, RK Sls. 612-571-1001
MS Corinth, Hughes Assoc. 601-287-2915
NC Cary, Hughes Assoc 919-467-7029
TN Knoxville, Hughes Assoc. 615-558-0283
TX Arlington, T-Tec Sls. 817-429-9151
Can Willow Dale, Ont., Cana-Rep Grp. 416-250-6684

Local Distributors
AL Huntsville, Bell Inds. 205-837-1074
AZ Phoenix, Marshall Inds. 602-496-0290
AR Little Rock, Newark Elctrs. 501-225-3130
CA El Monte, Marshall Indus. 800-522-0084
CO Denver, Marshall Indus. 303-451-8383
CT Bloomfield, Newark Elctrns. 203-243-1731
FL Deerfield Beach, Bell Indus. 305-421-1997
GA Norcross, Marshall Indus. 404-923-5750
ID Boise, Marshall Inds. 208-342-4311
IL North Brook, Classic Components 312-272-9650
IN Indianapolis, Marshall Inds. 317-297-0483
IA Cedar Rapids, Newark Elctrns. 319-393-3800
KS Lenexa, Marshall Ind. 913-492-3121
KY Louisville, Newark Elctns. 502-423-0280
LA Metaire, Newark Elctrns. 504-838-9771
MD Silver Springs, Marshall Ind. 301-622-1118
MA Wilmington, Helind Elctrns. 508-657-4870
MI Ann Arbor, Bell Indus. 313-971-9093
MN Plymouth, Marshall Inds. 612-559-2211
NY Hauppauge, Marshall Inds. 516-231-4100
OH Dayton, Marshall Inds. 513-236-8088
PA Pittsburgh, Marshall Inds. 412-963-0441
TX Austin, Marshall Inds. 512-837-1991
UT Salt Lake City, Marshall Inds. 801-485-1551
WI New Berlin, Classic Comps. 414-786-5300

ELPAZ INSTRUMENTS, INC., 160 N. Craig St., Pittsburgh, PA 15213, Tel: 412-687-8700, FAX: 412-687-8702; FSC No.: OA2J2; Empl.: 15; *Sls. Mgr.:* Stephen Phelps; *Dist. Mgr.:* Stephen Phelps

E-L PRODUCTS CORP., Sub.of Astronics Co., 77 Olean Rd., E. Aurora, NY 14052, Tel: 716-655-0800, FAX: 716-655-0309; Empl.: 134; *Sls. Mgr.:* Patrick McCann

ELTECH, 181 Gibraltar Rd., Horsham, PA 19044, Tel: 215-441-0404, FAX: 215-441-8299; Empl.: 40; *Sls. Mgr.:* Brad Lizotte

ELTEC INSTRUMENTS INC., P.O. Box 9610, Daytona Bch., FL 32120, Tel: 904-253-5328, TWX: 810-832-6294, FAX: 904-258-3791; Empl.: 100; *Sls. Mgr.:* Douglas S. Armstrong

ELTEK CORPORATION, 445 E. Main St., Hagerstown, IN 47346, Tel: 317-489-6121, FAX: 317-489-5491; Empl.: 7

ELTROL CORPORATION, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, Tel: 818-709-0131, FAX: 818-709-0132; FSC No.: IER54; Empl.: 6; *Sls. Mgr.:* Terry E. Donovan ..... **B•1255**

Local Sales Offices & Reps
CA Van Nuys, Halbar Assocs. 818-906-3941
OH Broadview Hgts., Controlled Prods. ... 216-838-5700

ELVO:DIVISION OF ZUMBACH ELECTRONICS CORPORATION, 140 Kisco Avenue, Mt. Kisco, NY 10549-1407, Tel: 914-241-1008, TWX: 910-250-5181, FAX: 914-241-7096; *Sls. Mgr.:* Thomas H. Stein

EMCA-REMEX PRODUCTS, National Starch & Chem. Co., 160 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-855-1000, TWX: 710-566-1128; Empl.: 50; *Sls. Mgr.:* Jeff Gausepohl; *Dist. Mgr.:* John Wagnon

EMCO ELECTRONICS, 1172 Rte. 109, Lindenhurst, NY 11803, Tel: 516-845-7080, FAX: 516-845-7082; Empl.: 12; *Sls. Mgr.:* M. Sachar; *Dist. Mgr.:* Jay Robinson

EMCO HIGH VOLTAGE CO.

FAX: 209-223-2779

EMCO HIGH VOLTAGE CO., 11126 Ridge Road, Sutter Creek, CA 95685, Tel: 209-223-3626, TELEX: 5101008006; FSC No.: 3T243; Empl.: 38; *Sls. Mgr.:* Roxanne McCoy ..... **D•1732-1738**

Local Sales Offices & Reps
PA Downington, Grasso & Assoc. 215-458-8967
PA Pipersville, Yax & Assoc. 215-766-2100

E/M CORPORATION, 2801 Kent Avenue, P.O. Box 2400, W. Lafayette, IN 47906, Tel: 317-497-6346, FAX: 317-497-6348; FSC No.: 11770; Empl.: 300; *Sls. Mgr.:* Nathan B. Barlow; *Dist. Mgr.:* Nathan B. Barlow

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371, FAX: 507-287-3405; *Sls. Mgr.:* Dan Estes ..... **C•1043**

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, FAX: 609-429-6814; FSC No.: 24602; Empl.: 70; *Sls. Mgr.:* Peter Semitschew

EMDS

FAX: 301-840-8589

EMDS, INC., 16618 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710; *Sls. Mgr.:* Patrick E. Roney ..... **D•1245**

EMERSON COMPUTER POWER, 15041 Bake Parkway No. L, Irvine, CA 92718, Tel: 714-380-1005, FAX: 714-380-0456; Empl.: 50; *Sls. Mgr.:* R.L. Calvin; *Dist. Mgr.:* R. Braud

Please call factory for sales offices and nearest reps.

EMHART CANADA, LTD., See Mallory Components Div.

EMICO INC., Box 368, Dublin, PA 18917, Tel: 215-249-9330, FAX: 215-249-9336; FSC No.: 85925; Empl.: 100; *Sls. Mgr.:* C. Davis

EMI GENCOM INC., See THORN EMI Gencom Inc.

EMI TECHNOLOGY INC., See THORN EMI Technology Inc.

EMM SEMI, SUB OF EM & M, See GTE Microcircuits

EMPIRE MAGNETICS, 5780 B LaBath Ave, Rohnert Park, CA 94928, Tel: 707-584-2801, FAX: 707-584-3418; Empl.: 10

Empro SHUNTS ®

FAX: 317-823-4835

EMPRO MANUFACTURING COMPANY, INC., P.O. Box 26060, Indianapolis, IN 46226, Tel: 317-823-4478; Empl.: 25 ..... **D•1246**

Local Sales Offices & Reps

CA	Montrose, Signal Entprs. Inc.	818-957-0640
GA	Atlanta, Brownell Electro Inc.	404-362-9009
IL	Chicago, Best Rep Co.	708-632-0473
MA	Burlington, E.I.L. Instr.	617-272-9450
NJ	Franklin, D. F. Tobias & Co.	201-209-8825
OH	Cleveland, Weschler Elec. Corp.	216-238-2550
OK	Portland, Westcon, Inc.	503-283-0132
PA	Philadelphia, Sunshine Sci. Instr. Inc.	215-673-5600
TX	Houston, Ev Smith Sls.	713-931-0403
WA	Seattle, Branom Instr. Co.	206-762-6050

Local Distributors

CA	Glendale, Instr. Meter Specialties	818-243-0416
CA	Livermore, Std. Meter Lab	415-449-0220
CA	S. Pasadena, Dae Instr. & Svc., Inc.	213-942-8843
LA	Harahan, Indl. Instrs. Works	504-733-8355
MD	Sparks, E.I.L. Instrs.	301-771-4800
NJ	Belleville, Miscorp	201-751-1190
PA	Norristown, Kimberly-James	215-666-7286
TX	Beaumont, Straughn Elctrns.	409-838-4563
TX	Houston, American Analog	713-941-7265
TX	Houston, Meters & Instrs.	713-644-1631
WA	Seattle, Branom Instr. Co.	206-762-6050
WI	Milwaukee, E-M Instrs.	414-272-7799

EMS

FAX: 714-838-2967

E.M.S., Div. of Sandberg Industries, 14251 Chambers Rd., Tustin, CA 92680, Tel: 714-669-9473; Empl.: 125; *Sls. Mgr.:* Duane Halverson, VP Sls.; *Dist. Mgr.:* Bruce Flemming ..... **C•1682**

E M S DEVELOPMENT CORP., 100 Sea La., Farmingdale, NY 11735, Tel: 516-293-7900, FAX: 516-694-1093; FSC No.: 51435; Empl.: 100

ET
Emulation Technology, inc.

FAX: 408-982-0664

EMULATION TECHNOLOGY, INC., 2344 Walsh Ave., Bldg. F, Santa Clara, CA 95051, Tel: 408-982-0660, TELEX: 981866; Empl.: 18; *Sls. Mgr.:* Joseph J. Bagliere, Jr. ..... **C•1358**

Local Distributors

CO	Denver, Alliance Elctrns. CO	303-433-1648
MI	Bloomfield Hills, Mackellar Assocs.	313-335-4440
NJ	Union, Meridian Supply Co.	201-687-6220
TX	Allen, Prime Distributing Co.	214-231-0170
TX	Richardson, Off The Shelf Comps., Inc.	214-238-0808

ENCLOSURE CORP., 2900 Wharton Rd., Bristol, PA 19007, Tel: 215-785-2900, FAX: 215-785-2960; FSC No.: 32360; Empl.: 75; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODUCTS, 1601 B Dover Rd.-Hwy.2, Sandpoint, ID 83864, Tel: 208-263-8541, FAX: 208-263-0541; Empl.: 100; *Sls. Mgr.:* Jim Burcham; *Dist. Mgr.:* Jim Burcham

ENCORE ELECTRONICS, INC., 4400 Route 50, Saratoga Springs, NY 12866, Tel: 518-584-5354, FAX: 518-584-5963; Empl.: 20

ENDEVCO CORPORATION, Allied Signal Aerospace Co., 30700 Rancho Viejo Rd, San Juan Capistrano, CA 92675, Tel: 714-493-8181, TELEX: 68-5608, TWX: 910-596-1415, FAX: 714-661-7231; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* D. McMahon

ENDICOTT COIL CO., INC., 24 Charlotte St, Binghamton, NY 13905, Tel: 607-797-1263, FAX: 607-797-0151; Empl.: 110; *Sls. Mgr.:* Thomas E. Frank

ERG™ Endicott Research Group, Inc.

FAX: 607-754-9255

ENDICOTT RESEARCH GROUP, 2601 Wayne St, P.O. Box 269, Endicott, NY 13760, Tel: 607-754-9187; FSC No.: 63312; Empl.: 120 ... **B•1066-1067, 1151; D•1740-1741**

Local Sales Offices & Reps

AZ	Phoenix, Finn-Pat Co., Inc.	602-954-0301
CA	Saratoga, Testco	408-253-1900
CO	Littleton, MRC	303-794-4684
CT	Bloomfield, Sands Co./Sir Assocs.	203-243-9343
FL	Maitland, EIR, Inc.	407-660-9600
GA	Atlanta, Wallace Electronics	800-334-3518
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-378-1450
MA	Westford, SIR Assocs.	617-692-2500
MI	West Bloomfield, Granneman & Mize	317-849-2000
MN	Minneapolis, OEM Prods.	612-831-7373
NC	Kernersville, Wallace Electronics	919-996-2742
OH	Dayton, Elctrn. Sls. & Technlg.	513-433-2800
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
UT	Salt Lake City, MRC	303-794-4684
WA	Bellevue, Testco	206-454-7422
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790
Can	Toronto, Ont., Norgay Entprs., Ltd.	416-259-9663

ENEGREN ELECTRONICS, INC., 15605-C S. Keeler Terr., Olathe, KS 66062, Tel: 913-782-4720, FAX: 913-782-4752; Empl.: 7; *Sls. Mgr.:* Floyd Enegren ..... **A•2210**

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGY

FAX: 301-699-8107

ENERGY, LTD., 4714 Upshur Street, Bladensburg, MD 20710, Tel: 301-699-1144; Empl.: 10 ..... **D•2194**

Local Sales Offices & Reps

MD	Bladensburg, Energy, Ltd.	301-699-1144

Local Distributors

MD	Bladensburg, Energy, Ltd.	301-699-1144

ENERGY SYSTEMS, 12004 NE 95th St., No. 840, Vancouver, WA 98682, Tel: 206-896-8310, FAX: 206-896-8457; Empl.: 25 ..... **D•1247**

ENGINEERED ASSEMBLIES & COMPONENTS CORP., 380 North St., Teterboro, NJ 07608, Tel: 201-288-4477, 800-447-5639, FAX: 201-288-1515; Empl.: 100; *Sls. Mgr.:* John Deleodice; *Dist. Mgr.:* P. Teen ..... **D•1452-1455**

Local Sales Offices & Reps

FL	Orlando, Engrd. Assemblies & Comp. Corp.	407-291-6710
GA	Atlanta, Engrd. Assemblies & Comp. Corp.	404-525-0676
MA	Boston, Engrd. Assemblies & Comp. Corp.	407-291-6710
NC	Raleigh, Engrd. Assemblies & Comp. Corp.	919-790-9700

ENGINEERED COMPONENTS CO., P. O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-3800, FAX: 805-544-8091; FSC No.: 32440; Empl.: 193

ENGINEERED MAGNETICS, INC., 18435 Susana Rd, Rancho Dominguez, CA 90221, Tel: 213-635-9555, TWX: 910-325-6208, FAX: 213-631-0313; FSC No.: 06509; Empl.: 200; *Sls. Mgr.:* S. Miller

ENGINEERING DESIGN & SLS., One E.D.S. Way, Danville, VA 24541, Tel: 804-792-6405, FAX: 804-792-6415; Empl.: 75; *Sls. Mgr.:* Mark Gignac

ENGLER INSTRUMENTS OPERATION, See Stemco Instruments, Colt Inds.

ENI, DIV. OF ASTEC AMERICA, INC., 100 Highpower Road, Rochester, NY 14623, Tel: 716-427-8300, FAX: 716-427-7839; Empl.: 390

ENM COMPANY, 5617 Northwest Highway, Chicago, IL 60646, Tel: 312-775-8400, TELEX: 25-4068, FAX: 312-775-5968; Empl.: 1000; *Sls. Mgr.:* Lee Bryant

ENNOVATION OF WISCONSIN, INC., 806 Elm St.-P.O. Box 258, Watertown, WI 53094, Tel: 414-261-2996, FAX: 414-261-3432; Empl.: 5; *Sls. Mgr.:* Enno Knief; *Dist. Mgr.:* Enno Knief

ENPROTECH CORP., 445 West Michigan Ave., Kalamazoo, MI 49007, Tel: 616-381-0665, FAX: 616-381-9810; Empl.: 125

ENSIGN CORP., 7960 S. Madison Street, Burr Ridge, IL 60521, Tel: 708-325-9343, FAX: 708-789-3206; Empl.: 150; *Sls. Mgr.:* D. Brent Ensign

ENTECH CORPORATION, 17A Herman Drive, Simsbury, CT 06070, Tel: 203-658-2740, 203-651-9557, FAX: 203-658-2740

ENTECH SYSTEMS, INC., 17B Herman Dr., Simsbury, CT 06070, Tel: 203-651-9557, FAX: 203-658-2740; *Sls. Mgr.:* A. D. Jorczak

ENTERPRISE SYSTEMS CORP., PO Box 698, Dover, NH 03820, Tel: 603-742-7363, FAX: 603-742-9284; FSC No.: 79543; Empl.: 5; *Sls. Mgr.:* George Perrine

ENTRA CORPORATION, 8651 Castle Park Drive, Indianapolis, IN 46256, Tel: 317-849-8270, FAX: 317-849-7041; Empl.: 75; *Sls. Mgr.:* F. Paul McDonald

Entran

FAX: 201-227-6865

ENTRAN DEVICES, 10 Washington Ave., Fairfield, NJ 07004, Tel: 201-227-1002, 800-635-0650, TELEX: 130-361; *Sls. Mgr.:* Robert L. Morrell ..... **B•1892-1901**

Local Sales Offices & Reps

AZ	Phoenix, J. Smith & Assocs.	602-267-0981
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mtn. View, Saber Entprs.	415-968-0427
CA	San Diego, Saber Entprs.	619-271-1523
CO	Colorado Springs, J. Smith & Assoc.	719-597-5343
CT	Wallingford, Pond Tech. Sls.	203-284-1500,
FL	Indian Rocks Bch., PAR Assocs.	813-596-8841
GA	Atlanta, PAR Assocs.	404-391-9117
IL	Woodstock, TMI Inc.	815-385-2212
ME	North Windham, Pond Tech. Sls.	207-892-9629
MA	Waltham, Pond Tech. Sls.	617-890-5535,
MI	St. Clair Shores, Stress Analysis Svcs.	313-776-9734

MN Eden Prairie, TMI Inc. 612-934-8665
NJ Budd Lake, Measurements, Inc. 201-770-1281
NM Albuquerque, J. Smith & Assocs. 505-345-6501,
NY Clarence, Trott Elctrns./E.I.L. 716-634-8500
NY Pittsford, Trott Elctrns./E.I.L. 716-586-8251
NC Charlotte, PAR Assocs. 704-535-9858
OH Bellbrook, Stress Analysis Svcs. 513-848-8215
OH Cincinnati, Stress Analysis Svs. 513-521-3967
OH Maumee, Stress Analysis Svs. 419-893-4591
OH Medina, Stress Analysis Svc. 216-725-7733
PA Exton, Measurements, Inc. 215-524-0310
PA Murrysville, Stress Analysis 412-733-1766
TX Dallas, Pace Tech. Sls. 214-368-0135
VA Fredericksburg, Measurements, Inc. 703-373-5520
WA Renton, Westech 206-271-5490
WI Oregon, TMI Inc. 608-835-5527
Can Ontario, Intertechnology 416-445-5500

ENTRELEC DIV/GEC ALSTHOM INTERNATIONAL, INC., 1950 Hurd Drive, Irving, TX 75038, Tel: 214-550-9025, FAX: 214-550-9215; Empl.: 50; *Sls. Mgr.:* F. D. Leynaert

ENVIRONMENTAL CONTAINER SYS., INC., See ECS Composites

ENVIRONMENTAL STRESS SYSTEMS, INC., 16310 N. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117; *Sls. Mgr.:* Gino DiBartolomeo; *Dist. Mgr.:* Gino DiBartolomeo ..... **D•1200**

Local Sales Offices & Reps
AZ Chandler, Blackhart Assocs. 602-893-3488
CA San Jose, Microwave Meas. 415-846-0377
FL Ft. Lauderdale, Sun Elctrn. Sys. 305-587-5577
NY Stony Brook, L.I., Gama Metro 516-751-2072
PA North Wales, Scientific Dvcs. 215-699-7707
TX Dallas, Textec 214-233-1928
EXP Santa Cruz, CA, Step Elctrns. 408-423-8722

ENVIRONMENTAL TELESIS & CONTROLS, P.O. Box 180206, Austin, TX 78718, Tel: 512-835-0330, TWX: 910-350-5536, FAX: 512-832-1775; Empl.: 12; *Sls. Mgr.:* Sharon Grimm

ENVIROPLAN, 3 Becker Farm Rd., Roseland, NJ 07068, Tel: 201-994-2300, FAX: 201-994-5100; Empl.: 50; *Sls. Mgr.:* Robert Mullowney

EOG, INC., OMX, INC., 10947 Golden West Drive, Hunt Valley, MD 21030, Tel: 301-785-3000, FAX: 301-771-5814; FSC No.: 17521; Empl.: 130; *Sls. Mgr.:* Arthur C. Rutledge, Jr.; *Dist. Mgr.:* Arthur C. Rutledge, Jr.

EPC IDENTIFICATION SYS., 505 Martin Ave., Rohnert Park, CA 94928, Tel: 707-585-8811, TWX: 910-3382-311, FAX: 707-585-8688; FSC No.: 67041; Empl.: 16; *Sls. Mgr.:* William Bolster; *Dist. Mgr.:* William Bolster

EPCO PRODUCTS INC., P.O. Box N. Cottage St., WAllkill, NY 12589, Tel: 914-895-2033, FAX: 914-895-2279; Empl.: 45; *Sls. Mgr.:* Mark Giegel

E.P.D./GENERAL POWER CORP., 1045 So. East Street, Anaheim, CA 92805-8508, Tel: 714-520-0881, 1-800-343-1813, TELEX: 678870 ATTN:EPD, FAX: 714-491-8644; Empl.: 150; *Sls. Mgr.:* Don Royer,Sls. Dir.; *Dist. Mgr.:* Connie Kouri ..... **D•1069**

Local Distributors
CA Santa Ana, Micro D 800-642-7631
IL Des Moines, United Stationers 800-323-1783
MN Edina, Radix 800-328-3004
NY Buffalo, Ingram Software 800-828-7250
NY Melville, Arrow Elctrns. 516-391-1847
NY Plainview, Global Computers 516-752-2299
TX Dallas, Hall-Mark Elctrns. 214-343-5000
TX Ft. Worth, Allied Elctrns. 817-336-5401

EPD ELECTRONICS, INC., 16921 S. Western Ave.-Bldg. 300, Gardena, CA 90247, Tel: 213-515-4996, TELEX: 691-738, FAX: 213-515-5011; Empl.: 6 ..... **D•1742**

Local Sales Offices & Reps
IA Burlington, JS Ridge Entprs., Inc. 319-754-8745
NJ Bricktown, Bryan Elctrn. Sls. Co. 201-840-8487
OR Portland, Dale G. Weber Co. 503-234-0686
TN White House, Apple Sls. & Mktg. 615-672-4498

EPE TECHNOLOGIES, INC., Subsidiary of Merlin Gerin, 1660 Scenic Avenue, Costa Mesa, CA 92626, Tel: 714-557-1636, FAX: 714-957-1103; Empl.: 350; *Sls. Mgr.:* Joe T. Amos, Jr.; *Dist. Mgr.:* Todd Hunter

EPH ENGINEERING ASSOCIATES, INC., 31 E. 400 S., Orem, UT 84058, Tel: 801-226-1383, FAX: 801-226-1437

EPIC, INC., 150 Nassau St., New York, NY 10038, Tel: 212-349-2470, FAX: 212-406-2508; Empl.: 8; *Sls. Mgr.:* Marge Couteau

EPIC RESINS, General Fiberglass Supply, Inc., 1415 Ellis St., Waukesha, WI 53186, Tel: 414-521-2255, FAX: 414-521-1320; Empl.: 20; *Sls. Mgr.:* Daniel Veenhuis

EPM CORPORATION, 8866 Kelso Dr., Baltimore, MD 21221, Tel: 301-686-7800, TELEX: 87569, FAX: 301-686-4662; Empl.: 75

EPOXY TECHNOLOGY, INC., 14 Fortune Dr., Billerica, MA 01821, Tel: 508-667-3805, 800-227-2201, TELEX: 94-7140, FAX: 508-663-9782; FSC No.: 33246; Empl.: 24

EPSCO INCORPORATED, 1115 Hilltop Dr., Unit A2, Itasca, IL 60143-1120, Tel: 708-250-0410, FAX: 708-250-0521; FSC No.: 53003; Empl.: 8; *Sls. Mgr.:* Wendie Amerena ..... **D•1743**

Local Distributors
AZ Phoenix, Fisher Sci. 602-995-1556
AR Little Rock, Carlton-Bates Co. 501-562-9100
CA San Francisco, Delray Distr. 415-861-6318
CO Denver, Sargent-Welch 303-399-8220
FL Mirimar, Aero Quality Sls. 305-432-2288
IL Carpentersville, Frank Fryer Co. 708-426-6731
IL Elmhurst, McMaster-Carr Supp. 312-834-9600
IN East Chicago, Acro Elctrns. Corp. 219-397-8681
KY Louisville, Peerless Elctrn. Equip. 502-637-7674
LA Lafayette, Ralph's Inc. 318-233-0105
MD Rockville, Capital Radio Whlsrs. 301-881-2270
MA Woburn, Rainin Instr. 617-935-3050
MI Farmington Hills, Motion Control Corp. 313-478-1640
MN Eden Prairie, Allied Elctrns. 612-829-7554
NJ Bridgeport, VWR Scientific 609-467-2600
NM Albuquerque, Walker Elec. Supp. 505-883-2992
NY Syracuse, Stewart Smith 315-437-7836
OH Warren, Rem Elctrns. Supp. 216-373-1300
PA Pittsburgh, Allied Elctrns. 412-367-4124
RI Providence, A & J Distrs., Inc. 401-421-0991
SC Charleston, Wholesale Inds. Elec. 803-722-2634
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Angie Elctrns. 713-659-8686
WA Kent, Fisher Scientific 206-872-0330
WI Milwaukee, Industrial Elctrns. Supp. 414-276-1212

EPSILON-LAMBDA ELCTRNS. CORP., 427 Stevens St., Geneva, IL 60134, Tel: 708-232-9611, TELEX: 708-232-9613; Empl.: 20; *Sls. Mgr.:* R. Knox

EPSON AMERICA, INC./OEM DIV., 20770 Madrona Ave., Torrance, CA 90503, Tel: 213-534-4500, FAX: 213-534-4449; Empl.: 900; *Sls. Mgr.:* John R. Confrey

EPSON

FAX: 213-782-5320

EPSON AMERICA INC., Component Sales Dept., 20770 Madrona Ave., Torrance, CA 90503, Tel: 213-787-6300; *Sls. Mgr.:* Hideo Akiyama; *Dist. Mgr.:* Craig Dyer ..... **A•1358-1363**

Local Sales Offices & Reps
AL Madison, Concord Comp Reps 205-772-8883, FAX:205-772-8262
AZ Scottsdale, Fred Board Assocs. 602-994-9388, FAX:602-994-9477
AZ Tucson, Fred Board Assocs. 602-299-1508, FAX:602-797-1683
CA Cupertino, Costar, Inc. 408-446-9339, FAX:408-446-4885
CA Encinitas, Bager Elctrns. Inc. 619-944-4108, FAX:619-632-8810
CA Woodland Hills, Bager Elctrns.Inc. 818-712-0011, FAX:818-712-0160
CO Broomfield, Western Region Mktg. 303-469-8088, FAX:303-469-8585
CO Colorado Springs, Western Region Mktg. 719-548-8282,FAX:719-548-0462
FL Casselberry, Dyne-A-Mark 407-831-2822, FAX:407-834-4524
FL Clearwater, Dyne-A-Mark 813-441-4702, FAX:813-447-4120
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501, FAX:305-772-0114
GA Norcross, Concord Comp. Reps 404-416-9597, FAX:404-441-0790
IL Itasca, LTD Technlgs. 708-773-2900, FAX:708-773-0358
IN Indianapolis, C.C. Electro Sls. 317-921-5000, FAX:317-921-5005
KS Shawnee Mission, Microtronics, Inc. 913-262-1444, FAX:913-262-1445
MD Ellicott City, Technlg. Sls. Assocs. 301-461-7802, FAX:301-461-7888
MA Needham Heights, Rosen Assocs. Inc. 617-449-4700,FAX:617-449-5245
MA Needham Heights, Rosen Assocs., Inc. 714-957-3367,FAX:714-546-2654
MN Eden Prairie, Electromark 612-944-5850, FAX:612-944-5855
NJ Parlin, JMR Sls; Inc. 201-525-8000, FAX:201-525-8805
NY Pittsford, Elcom Sls., Inc. 716-385-1400, FAX:716-248-8531
NY Skaneateles, Elcom Sls., Inc. 315-685-8967, FAX:315-685-6273
NY Wading River, Niktronics 516-929-4671, FAX:516-929-1683
NC Raleigh, WLA Assocs. 919-231-9939, FAX:919-231-9949
OH Sheffield, J.D. Babb 216-934-4454, FAX:216-934-4454
OR Tigard, Matrex Sls. 503-245-8080, FAX:503-246-1848
PA Trevose, Omega Sls. 215-244-4000, FAX:215-244-4104
TX Austin, Component Technlg. Sls. 512-250-2450, FAX:512-288-7328
TX Dallas, Component Technlg. Sls. 214-783-8831, FAX:214-783-4801
TX Houston, Component Technlg. Sls. 713-961-1262, FAX:713-462-9906
UT Salt Lake City, Western Region Mktg. 801-268-9768,FAX:801-268-9796
WA Bellevue, Matrex Sls. 206-643-0363, FAX:206-746-3672
WI Milwaukee, LTD Technlgs. 414-774-1000, FAX:414-774-0593

Local Distributors
AL Bell Inds., Inc. 205-837-1074,FAX:205-830-5598
AZ Tempe, Bell Inds., Inc. 602-966-7800, FAX:602-967-6584
CA Agoura Hills, Bell Inds., Inc. 818-706-2608, FAX:818-991-7695
CA Cypress, Bell Inds., Inc. 714-895-7801, FAX:714-891-4570
CA Irvine, IEC Irvine ... 714-837-9960,FAX:714-837-8308
CA Los Angeles, Bell Inds., Inc. 213-826-6778, FAX:213-447-3265
CA Orange, Orange Electro Mechanical ... 714-937-0714, FAX:714-937-0916
CA Rocklin, Bell Inds., Inc. 916-652-0414, FAX:916-652-0403
CA Sacramento, Integrated Elctrns. (IEC) 916-363-6030,FAX:916-362-6926
CA San Diego, Bell Inds., Inc. 619-268-1277, FAX:619-268-3733
CA San Jose, IEC San Jose 408-435-1000, FAX:408-435-8709
CA Santa Fe Springs, Cable & Comps./CCD 213-921-3611,FAX:213-921-9385
CA Santa Fe Springs, Corporate Warehouse 213-921-3611,FAX:213-921-9385
CA Santa Fe Springs, Just-In-Time 213-921-3611, FAX:213-404-0732
CA Sunnyvale, Bell Inds., Inc. 408-734-8570, FAX:408-734-8875
CO Denver, Integrated Elctrns. (IEC) 303-292-5537, FAX:303-292-0114
CO Wheatridge, Bell Inds., Inc. 303-424-1985, FAX:303-424-0932
CT Cronin Elctrns., Inc. 203-265-3134
CT Wallingford, Bell Inds., Inc. 203-269-6801, FAX:203-269-6527
CT Wallingford, Greene-Shaw Co. Inc. 203-265-3333, FAX:203-265-3583
FL Altamonte Springs, Bell Inds., Inc. 407-339-0078, FAX:407-339-0139
FL Ft. Lauderdale, Bell Inds., Inc. 305-421-1997
FL Melbourne, Greene-Shaw Co. Inc. 407-951-3636, FAX:407-951-3637
FL Tampa, Bell Inds., Inc. 813-541-4434
GA Norcross, Bell Inds., Inc. 404-662-0923, FAX:404-449-6901
IL Bensenville, Voyager Elctrns. 708-860-1300, FAX:708-860-1573
IL Elk Grove Village, Bell Inds., Inc. 708-640-1910, FAX:708-640-0474
IL Hoffman Estates, IEC IL (Hoffman Estates) 708-843-2040,FAX:708-843-2320
IL Urbana, Bell Inds., Inc. 217-328-1077, FAX:217-328-1148
IN Ft. Wayne, Bell Inds., Inc. 219-423-3422, FAX:219-424-2433
IN Indianapolis, Bell Inds., Inc. 317-875-8200, FAX:317-875-8219

IN Indianapolis, Custom Svc. Elect. 317-879-9119, FAX:317-879-9136
IN Indianapolis, Just-In-Time 317-299-5487, FAX:317-293-8256
IN Indianapolis, Mar Elctrns. 317-633-6699, FAX:317-633-6687
IA Bell Inds., Inc. 319-395-0730,FAX:319-875-8219
KS Olathe, ECS Inc. ... 913-782-7787,FAX:913-782-6991
MD Jessup, Bell Inds., Inc. 301-953-2566, FAX:301-953-0039
MA Andover, Bell Inds., Inc. 508-474-8880, FAX:508-474-8902
MA Needham, Cronin Elctrns., Inc. 617-449-5000, FAX:617-444-8395
MI Wixon, Bell Inds., Inc. 313-347-6633, FAX:313-347-3356
MN Bell Inds., Inc. 612-941-1493,FAX:612-938-7410
MN Fridley, Voyager Elctrns. Corp. 612-571-7766, FAX:612-571-9519
MO Bell Inds., Inc. 314-647-2355,FAX:317-875-8219
NH Golfstown, Key Comps. 603-626-1717, FAX:603-626-1720
NJ East Brunswick, Bell Inds., Inc. 201-613-0200, FAX:201-613-9689
NJ Hopelawn, Dove Elctrns. 201-324-7830, FAX:201-442-6789
NM Albuquerque, Bell Inds., Inc. 505-292-2700, FAX:505-275-2819
NY Bohemia, Key Comps. 516-567-7500, FAX:516-576-2920
NY Stony Brook, Dove Elctrns. 516-689-7733, FAX:516-689-7362
NC Bell Inds., Inc. 919-821-4041,FAX:919-821-4953
NC Raleigh, Greene-Shaw Co. Inc. 919-954-7138, FAX:919-954-7139
OH Dayton, Bell Inds., Inc. (Industrial) 513-435-8660, FAX:513-435-6765
OH Dayton, Bell Inds., Inc. (Military) 513-434-8231, FAX:513-434-8103
OR Beaverton, IEC Beaverton (OR) 503-641-1690, FAX:503-646-3737
OR Lake Oswego, Bell Inds., Inc. 503-635-6500, FAX:503-635-4095
PA Trevose, Bell Inds., Inc. 215-953-2899, FAX:215-364-4928
SC Bell Inds., Inc. 800-322-7908,FAX:407-339-0139
TN Bell Inds., Inc. 615-367-4400,FAX:407-339-0139
TX Austin, Norvell Austin 512-837-5555, FAX:512-837-3729
TX Austin, Omni Pro Elctrns. 512-794-9200, FAX:512-338-9576
TX Dallas, Norvell Elctrns., Inc. 214-233-0020, FAX:214-490-7245
TX Dallas, Omni Pro Elctrns. 214-233-0500, FAX:217-385-7508
TX Houston, Norvell Houston 713-462-1666, FAX:713-462-3210
TX Richardson, Bell Inds., Inc. 214-690-0466, FAX:214-690-0822
UT Midvale, Bell Inds., Inc. 801-255-9611, FAX:801-255-2477
UT West Valley City, IEC Utah (Salt Lake) 801-977-9750,FAX:801-975-1207
WA Bell Inds., Inc. 206-867-5410,FAX:206-867-5159
WA Bellevue (WA), IEC Bellevue (MA) 206-455-2727, FAX:206-453-2963
WI Waukesha, Bell Inds., Inc. 414-547-8879, FAX:414-547-6547

EQUIPMENT REMARKETING COMPANY, Boston Financial & Equity Corporation, 20 Overland Street, Boston, MA 02215, Tel: 617-267-8600, FAX: 617-267-2370

EQUIPTO, 225 S. Highland Ave., Aurora, IL 60506, Tel: 708-859-1000, 800-323-0801, TWX: 910-232-0845, FAX: 708-859-3255; Empl.: 300; *Sls. Mgr.:* Tom Nilles; *Dist. Mgr.:* Jerry Reidy

EQUIPTO ELECTRONICS CORP., 351 Woodlawn Ave., Aurora, IL 60506, Tel: 708-897-4691, FAX: 708-897-5314; FSC No.: 14002;Multiple; Empl.: 100; *Sls. Mgr.:* Kent Jarnig ..... **C•1044-1049**

ERA POLY-PLANAR DIV., See Poly-Planar, Inc.

ERASER CO., Box 4961, Syracuse, NY 13221, Tel: 315-454-3237, TELEX: 93-7442, FAX: 315-454-3090; Empl.: 45; *Sls. Mgr.:* Linda S. Cahill

ERC, See Electronic Research Co.

ERCONA, 979 North Ocean Ave., Patchogue, NY 11772, Tel: 516-758-0700, FAX: 516-758-0422; Empl.: 10; *Sls. Mgr.:* G. Moore; *Dist. Mgr.:* L. Mills

ERCON INCORPORATED, 26 Emerson Road, Waltham, MA 02154, Tel: 617-899-1497, FAX: 617-899-2650; *Sls. Mgr.:* Dennis Ehrreich

ERGOTRON, INC., 3450 Yankee Dr., Eagan, MN 55122, Tel: 612-452-8135, TELEX: 4310015, FAX: 612-452-8346; Empl.: 32; *Sls. Mgr.:* Harry C. Sweere

ERICSSON

FAX: 214-680-1059

ERICSSON COMPONENTS, INC., 403 International Parkway, Richardson, TX 75081, Tel: 214-480-8300, TELEX: 735389 ERICS RCHN ..... **D•1744-1748**

Local Sales Offices & Reps

AL Huntsville, The Novus Grp.,Inc. 205-534-0044
AZ Phoenix, CPS Assocs., Inc. 602-246-1097
CA Cupertino, PEI Assocs. Inc. 408-253-1960
CA Garden Grove, Elsco Elctrns. 714-891-4621
CA Grass Valley, Unitronics, Inc. 916-268-1737
CA San Diego, Elsco Elctrns. 619-292-1771
CO Denver, NOW Dvcs. 303-758-4884
CT Greenwich, Ericsson Comps. Inc. 203-625-7300
CT Woodbury, Power Factor & Assocs. ... 203-264-9812
FL Boynton Bch., Burke Assoc., Inc. 407-364-8203
FL Largo, Burke Assoc. Inc. 813-536-4335
FL Oldsmar, Burke Assoc. Inc. 813-786-8105
FL Winter Springs, Burke Assoc. Inc. 407-699-1888
GA Norcross, The Novus Grp., Inc. 404-263-0320
IL Elk Grove Village, Carlson Elctrns. Sls. 708-956-8240
IA Cedar Rapids, Carlson Elec. Sls. Assoc. 319-378-1450
MA Whitinsville, Power Factor & Assoc. ... 508-234-6415
MN Richfield, Clay Rep. Co. 612-861-2191
NJ Marlton, Naudain Assocs., Inc. 609-983-5300
NJ Parlin, JMR Sls., Inc. 201-525-8000
NY Fayetteville, H.C. Johnson 315-637-1143
NY Rochester, H.C. Johnson 716-586-0777
NY Wading River, Niktronics 516-929-4671
NC Cary, The Novus Grp., Inc. 919-460-7771
OH Cleveland, RK Comp. Sls., Inc. 216-642-9312
PA Glenshaw, H. C. Johnson 412-487-1246
TX Dallas, Dynamark 214-437-3333
VA Herndon, Stinson Assocs. 703-620-1331
WA Chattaroy, EMG-Elec. Mktg. Grp. 509-238-6476
WA Redmond, EMG-Elec. Mktg. Grp. 206-882-0962
WA Vancouver, EMG Elec. Mktg. Grp. 206-254-4572
WI Milwaukee, Carlson Elctrns., Sls. 414-476-2790
Can Markham, Ont., Deskin Sls. 416-475-1412

ERICSON MANUFACTURING CO., 4215 Hamann Pkwy., Willoughby, OH 44094, Tel: 216-951-8000, TELEX: 98-5390, FAX: 216-951-1867; Empl.: 110; *Sls. Mgr.:* Keith E. Wigman

ERIE TECHN. PRODS., See Murata Erie No. Amer., Inc.

ERNI COMPONENTS, 520 Southlake Blvd., Richmond, VA 23236, Tel: 804-794-6367, FAX: 804-379-2109; Empl.: 700; *Sls. Mgr.:* Thomas Noack

ESCAP PRODUCTS, 36 Central Ave., Hauppauge, NY 11788, Tel: 516-234-3900, FAX: 516-234-3986; *Sls. Mgr.:* Dave Hall

ESC ELECTRONICS CORPORATION

FAX: 201-947-0406

ESC ELECTRONICS CORP., 534 Bergen Blvd., Palisades Pk., NJ 07650, Tel: 201-947-0400; Empl.: 120 ..... **A•1558-1571, 1671, 2211**

Local Sales Offices & Reps

AL Huntsville, Murcota Corp. 205-539-8476
AZ Mesa, Sedco Sls. 602-461-9069
CA Newbury Pk., Westaironics 805-499-9844
CA Santa Clara, Rodgers Assocs. 408-984-8110
CO Denver, Donohue Sls. Co. 303-455-1719
FL Palm Harbor, Sigma Tech. Assocs. ... 813-789-5522
IL Elk Grove, Carlson Elctrn. Sls. Co. 312-956-8240
NJ Kenvil, Comps. for Elctrns., Inc. 201-927-6662
IA Cedar Rapids, Carlson Elctrn. Sls. Co. 319-378-1450
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MA Taunton, Sutton Associates 508-366-2102
MI Livonia, Electro-Mktg. Grp., Inc. 313-421-7590
MI Muskegon, Electro-Mktg. Grp. Inc. 616-798-1912
MN Minneapolis, R-J, Inc. 612-866-3661
MO Earth City, Midwest Tech. Sls. 314-298-8787
NC Winston-Salem, Murcota Corp. 919-722-9445
OH Dayton, Electro-Mktg. Grp. Inc. 513-890-8322
OH No. Royalton, Electro-Mktg. Grp. Inc. .. 216-582-0075
OR Beaverton, Ravencraft 503-646-9261
PA Ft. Washington, Simon Mktg. Consits. 215-628-3394
TX Plano, Zeus Engrg. 214-423-2027
VA Reston, Tytronics Tech. Sls. 703-620-4600
WI Milwaukee, Carlson Elctrn. Sls. Co. 414-476-2790
EXP NJ, Palisades Pk., ESC Elctrns. Corp. 201-947-0400
Can Toronto, Ont., CEA Assocs. 416-231-9717

ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 213-322-2136; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* R. Mayers; *Dist. Mgr.:* R. Mayers ..... **D•1135**

Local Distributors

AL Birmingham, Midwest 0 205-942-8585
AZ Phoenix, Midwest 602-220-9440
CA Burbank, Midwest 818-954-0150
CA Hollywood, Shoreline 213-461-9800
DC Washington, Bradley Broadcast 301-948-0650
DC Washington, Midwest 301-577-4903
FL Miami, Midwest 305-592-5355
FL Ocala, Broadcast Gen. Store 904-622-9058
GA Atlanta, Midwest 404-449-0900
HI Honolulu, Midwest 808-521-4644
IL Chicago, Midwest 312-981-1107
IN Richmond, Allied 317-962-8596
IA Davenport, Video Midwest 319-322-1525
KY Edgewood, Midwest 606-331-8990
LA New Orleans, MZB/Gray 504-733-7265
MD Baltimore, Midwest 301-484-0131
MI Detroit, Midwest 313-350-3038
MN Minneapolis, Video Midwest 612-831-2248
MO St. Louis, Midwest 314-569-2240
NJ Cherry Hill, Landy 609-424-4660
NM Los Lunas, Dyma 505-865-6700
NY NYC, Midwest 212-473-6262
NY So. Glens Falls, N.E. Broadcast Labs 518-793-2181
NC Charlotte, Midwest 704-399-6336
PA Philadelphia, Pierce Phelps 215-879-7236
PA Pittsburgh, Midwest 412-364-6780
TN Nashville, Midwest 615-255-2801
TX Dallas, Midwest 214-929-6400
TX Houston, MZB/Gray 713-782-8611
VA Richmond, Midwest 804-426-8434
WA Tacoma, Broadcast Supp. West 800-426-8434
WI Milwaukee, Roscor 414-527-4200
Can Toronto, Allied Broadcast 416-731-3697

ESICO/TRITON, Triton Industries Inc., Box 247, Deep River, CT 06417, Tel: 203-526-5361, TELEX: 955439, FAX: 203-526-9524; FSC No.: 54195; *Sls. Mgr.:* Robert W. Mead

E-SQUARED TECHNOLOGY CORP., 4475 Dupont Ct 69, Ventura, CA 93003, Tel: 805-644-9544, FAX: 805-644-9584; Empl.: 19; *Sls. Mgr.:* Larry D. Emery

ESS, INC., 16310 No. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117

ESTERLINE ANGUS INSTRUMENT CORP., Box 24000, Indianapolis, IN 46224, Tel: 317-244-7611, TELEX: 027-419, FAX: 317-247-4749; FSC No.: 72264; Empl.: 2006; *Sls. Mgr.:* Thurman Teets, NTL. Sls. Mgr.

E-SYSTEMS, Greenville Div., P.O. Box 6056, Greenville, TX 75403-6056, Tel: 903-455-3450, FAX: 903-457-4413; *Sls. Mgr.:* C. L. Byrom

E-SYSTEMS, Melpar Div., 7700 Arlington Blvd., Falls Church, VA 22046, Tel: 703-560-5000, TELEX: 89-9494, TWX: 710-831-9802, FAX: 703-280-4627; Empl.: 2400

E-SYSTEMS, See Memcor-Truohm, Inc.

E-T-A®

FAX: 708-647-7494

E-T-A CIRCUIT BREAKERS, 7400 N. Croname Rd., Chicago, IL 60648, Tel: 708-647-8303; FSC No.: 06402; Empl.: 30; *Sls. Mgr.:* John J. Palsir ..... **B•1361-1364**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Tucson, Clemick & Assoc.	602-749-4003
CA	Los Angeles, Sierra-Pacific Eng.	714-731-3411
CA	San Francisco, Ross Mktg.	408-988-8111
CO	Denver, Candal, Inc.	303-935-7128
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Winter Springs, Sunland Assocs.	407-365-9533
GA	Atlanta, Macro Mktg.	404-662-5580
IN	Ft. Wayne, Needler Sls. Co.	219-447-2123
IN	Indianapolis, Needler Sls. Co.	317-255-8056
KS	Kansas City, Midtec Assoc.	913-541-0505
MA	Boston, Eagle Assocs.	617-444-3446
MI	Grand Haven, Hilltronics, Inc.	616-847-1010
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, PWC, Inc.	612-934-1409
MO	St. Louis, Midtec Assoc.	314-275-8666
NY	Islandia, Schmitt Inds.	516-582-5888
NY	Rochester, Lamb Comps.	716-272-7720
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Cleveland, Del Steffen & Assoc.	216-461-8333
OH	Columbus, Del Steffen & Assoc.	419-884-2313
OH	Dayton, Del Steffen & Assoc.	513-293-3145
OR	Portland, Eltech	503-684-3458
PA	Philadelphia, Jacobsen Assoc.	215-674-2937
PA	Pittsburgh, Del Steffen & Assoc.	412-276-7366
TX	Dallas, Delta Comps.	214-287-6333
UT	Salt Lake City, Frank Merchant	801-277-3775
VA	Sterling, Beacon North Inc.	703-478—2480
WA	Seattle, Eltech	206-643-4330
WI	Milwaukee, Star Engineering	414-645-3680

ET&T CORPORATION, 300A Redhill Ave., 5-A03, Costa Mesa, CA 92626, Tel: 714-557-2703, TELEX: 678352; Empl.: 400ò; *Sls. Mgr.:* B.A. Mylar Rao

ETA POWER, See JETA Power Systems

ETI SYSTEMS

FAX: 619-757-2305

ETI SYSTEMS, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, Tel: 619-757-7770; FSC No.: 952 762672; *Sls. Mgr.:* Bill Tice; *Dist. Mgr.:* Liane Glover ..... **A•2040-2041; B•1256-1260; D•1136**

Local Distributors

AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Fremont, Allied Elctrns.	415-770-0590
CA	S. San Francisco, Allied Elctrns.	415-952-9599
CA	San Diego	619-279-2550
CA	San Diego, Allied Elctrns.	619-279-2550
CA	Torrance, Allied Elctrns.	213-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Pompano Beach, Allied Elctrns.	305-978-3008
GA	Atlanta, Motion Elctrns.,Inc.	404-455-8262
GA	Norcross, Allied Elctrns.	404-446-8595
IL	Lisle, Components, Inc.	312-852-7707
IL	Wood Dale, Allied Elctrns.	708-860-0007
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Billerica, Allied Elctrns.	508-667-7921
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OK	Tulsa, Allied Elctrns.	918-664-0844
PA	Newton Square, QDI	215-359-1000
PA	Pittsburgh, Allied Elctrns.	412-367-4124
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Humble, Allied Elctrns.	713-446-8005
VA	Virginia Bch., Allied Elctrns.	804-363-8662
WA	Seattle, Allied Elctrns.	206547-2827
WI	New Berlin, Allied Elctrns.	414-796-1280
WI	Oshkosh, Electronic Inds.	414-235-4233

ETM ELECTROMATIC INC, 35451 Dumbarton Ct., Newark, CA 94560, Tel: 415-797-1100, FAX: 415-797-4358; Empl.: 85; *Sls. Mgr.:* Kenneth F. Lillis

ETRI

FAX: 704-283-7170

ETRI, INC., 1503 Rocky River Rd., North, Monroe, NC 28110, Tel: 704-289-5423; *Sls. Mgr.:* Peter Pignetti ..... **B•1261; C•1615-1620**

Local Sales Offices & Reps

CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Bestronics	619-693-1111
CO	Boulder, Comp. Prods. Sls.	303-530-2800
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
KS	Overland Pk., Spectrum Sls.	913-648-6811
MI	Farmington Hills, Tritech Sls., Inc.	313-553-3370
MI	Kalamazoo, Tritech Sls., Inc.	616-382-5570
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	Hazelwood, Spectrum Sls.	314-731-5151
NH	Salem, Sls. Engrg. Co.	603-893-5521
NY	Port Washington, Ashtec, Inc.	516-767-0336
OH	Cincinnati, Makin & Assocs., Inc.	513-871-2424
OH	Columbus, Makin & Assocs., Inc.	614-848-5454
OH	Solon, Makin & Assocs., Inc.	216-248-7370
WI	Janesville, Antek/Lincoln Hodges & Assocs.	608-754-4214
Can	Mississauga, Ont., R-Theta	416-890-0221

Local Distributors

AZ	Tempe, Acacia/Deanco	602-894-2874
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FL	Winter Park, Milgray Elctrns.	407-647-5747
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IL	Bensenville, Milgray Elctrns.	312-350-0490
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NH	Hudson, Bell Inds.	603-882-1133
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PA	Mendenhall, Clark H. Bach & Assocs.	215-388-7903
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NC Raleigh, Prime Comps., Inc. 919-850-9866
PA Pittsburgh, Bear Mktg., Inc. 412-531-2002
PA Wynnewood, Metz-Benham Assoc., Inc. 215-896-7300
TX Austin, W. Pat Fralia Co. & Assoc., Inc. 512-835-7911
TX Euless, W. Pat Fralia Co. & Assoc., Inc. 817-267-3577
TX Houston, W. Pat Fralia Co. & Assoc., Inc. 713-772-1572
UT Ogden, Spectrum Mktg. Assocs., Inc. .. 801-972-8552
WA Bellevue, Elctrn. Sources, Inc. 206-451-3500
EXP MA, Milford, Fenwal-Elctrns. 508-478-5255
Can Que., John G. Weiss Co., Ltd. 514-337-5022

Local Distributors
CA Chatsworth, Mil-Comm Distr. 818-998-3111
CA San Jose, Rose Elctrn. Distr. 408-943-0200
CO Denver, Newark-Denver Elctrn. Supp. 303-757-3351
CO Englewood, Indl. Elctrns. Corp. 303-694-9444
FL Clearwater, Newark Elctrns. 813-443-0661
GA Norcross, Newark Elctrns. 404-448-1300
IL Chicago, Newark Elctrns. Corp. 312-784-5100
IN Indianapolis, Bell Inds. 317-875-8200
MD Ellicott City, Newark Elctrns. 301-461-2300
MA Woburn, Newark Elctrns. 617-935-8350
MI Oak Park, Newark Elctrns. 313-967-0600
MN Hopkins, The Joel Co. 612-935-6202
MN Minneapolis, Stark Elec. 612-332-1325
NJ Pennsauken, Newark Elctrns. 609-663-9490
NY Buffalo, Summit Dists. 716-887-2800
NY Huntington, CDB Dev. Corp. 516-692-5200
NY Rochester, Summit Elctrns. 716-334-8110
NY Ronkonkoma, Arrow Elctrns., Inc. 516-467-1000
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Newark Elctrns. 216-391-9330
OK Tulsa, Radio, Inc. 918-587-9123
PA Wynnewood, Metz-Benham Assoc., Inc. 215-896-7300
TX Fort Worth, Patco Supply 817-429-8596
TX Garland, Newark Elctrns. 214-494-5911
UT Salt Lake City, Standard Supp. 801-486-3371
WI Grafton, Lake-View Elctrns. Corp. 414-377-8250
Can Que., John G. Weiss Co., Ltd. 514-337-5022

FERNO-SALESMAKER, Ferno-Washington, Inc., 70 Weil Way, Wilmington, OH 45177, Tel: 513-382-1451, TELEX: 214282, FAX: 513-382-1191; Empl.: 480

FERNWOOD TRANSFORMER CO., Transistor Devices Inc., 560 Independence St., Belvidere, NJ 07823, Tel: 908-475-3207, FAX: 908-475-3242; FSC No.: 3S657; Empl.: 90 .... **A•2227**

FERRANTI-PACKARD, See F-P Electronics

FERRANTI INTERNATIONAL
Ferranti Venus

FAX: 516-752-7976

FERRANTI VENUS, INC., Ferranti International, 399 Smith St., Farmingdale, NY 11735, Tel: 516-293-4100, TWX: 510-224-6492; Empl.: 450; *Sls. Mgr.:* Herbert Mordkoff .... **D•1752-1753**

Local Sales Offices & Reps
AZ Scottsdale, Ferranti Venus, Inc. 602-991-9684
MA Chelmsford, B B C 508-937-3400
Can Nepean, Ont., Subtec Ltd. 613-723-7720

Local Distributors
AL Huntsville, W.A. Brown Inst. 205-890-9224
AZ Scottsdale, Ferranti Venus 602-991-9684
CA San Mateo, Halbar North 415-349-4700
CA Westlake Village, Cal Rep 805-371-4586
FL Orlando, W.A. Brown Inst. 407-648-9660
GA Norcross, W.A. Brown Inst. 404-449-7160
MD Annapolis, EES 301-269-6573
MA Chelmsford, B B C 508-937-3400
NC Cary, W.A. Brown, Inst. 919-460-1120
TX Richardson, Barry Sls. 214-234-0255
WA Bellevue, Western Instr. 206-881-5110
Can Nepean, Ont., Subtec, Ltd. 613-723-7720

FERRAZ CORPORATION, 14 Eastmans Rd., Parsippany, NJ 07054, Tel: 201-428-8400, 800-526-9067, TELEX: 136045, FAX: 201-428-0599; Empl.: 100; *Sls. Mgr.:* Douglas L. Bennett; *Dist. Mgr.:* Douglas L. Bennett

FERRETEC INC., 47697 Westinghouse Dr., Fremont, CA 94539-7474, Tel: 415-226-1216, FAX: 415-651-8771; FSC No.: 7W279; Empl.: 65; *Sls. Mgr.:* Desmond G. Killen

FERRITE INTERNATIONAL, 15280 Wadsworth Rd., Wadsworth, IL 60083, Tel: 708-249-4900, FAX: 708-249-4988; Empl.: 60; *Sls. Mgr.:* Theodore H. Beahm

FERRO CORPORATION, Filled & Reinforced Plastics Div., 5001 O'Hara Dr., Evansville, IN 47711, Tel: 812-423-5218, FAX: 812-423-1864; *Sls. Mgr.:* J. C. Vaughn

FERRO CORPORATION, Electronic Glass Department, 4150 East 56th Street, Cleveland, OH 44101, Tel: 216-641-8580, FAX: 216-641-8857; *Sls. Mgr.:* Tack Whang, Bus. Mgr.

FERRO CORPORATION, Electronic Materials Div., 27 Castilian Dr., Santa Barbara, CA 93117-3092, Tel: 805-968-5000, TELEX: 98-0165, FAX: 805-968-8624; *Sls. Mgr.:* William T. Faix, Nat. Sls. Mgr.

FERRO CORPORATION, Frit Division, 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165, FAX: 216-641-2049; *Sls. Mgr.:* James Stalder

FERRO CORPORATION, Powder Coatings Div., 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165, FAX: 216-641-8596; Empl.: 300 ò

FERRO CORPORATION, Plastic Colorants & Dispersions, 3 Railroad Ave., P.O. Box 603, Stryker, OH 43557, Tel: 419-682-3311, TELEX: 419-682-4924; *Sls. Mgr.:* Robert T. Schneider

FERRO CORPORATION, Transelco Div., P.O. Box 217, Penn Yan, NY 14527-0127, Tel: 315-536-3357, FAX: 315-536-8091; *Sls. Mgr.:* J. F. Arthur/W. Germond

FERRONICS, 45 O'Connor Rd., Fairport, NY 14450, Tel: 716-388-1020, FAX: 716-388-0036; FSC No.: 33062; Empl.: 35; *Sls. Mgr.:* Mark Northrup

Local Sales Offices & Reps
AL Huntsville, L & D 205-837-1469
AZ Tempe, Gassner & Clark 602-968-9037
CA San Diego, Texel 619-576-2162
CA San Jose, Texel/North 408-272-6836
CA Seal Beach, Texel 213-596-9411
CO Denver, West Inc. 303-477-8180
FL Ft. Lauderdale, Hughes Assoc. 305-720-1674
GA Atlanta, L & D 404-395-7079
IL Rolling Meadows, Sumer, Inc. 708-991-8500
IN Indianapolis, John H. Weaver Co. Inc. 317-257-7661
MD Baltimore, Bernard White 301-484-5400
MA Canton, New England Elctrn. Sls. 617-828-4835
MI Birmingham, Forand Sls. 313-644-0087
MN St. Paul, Countryman Assoc. 612-645-9151
NC Raleigh, L & D 919-876-5301
NC Wilmington, L & D 919-256-8110
OH Cleveland, C. J. Voneman Co. 216-226-8000
OR Portland, General Elctrns. 503-297-8500
PA Hatboro, Joe Oberlies Co. 215-675-4226
TX Dallas, Comp. Tech. 214-783-8831
TX El Paso, Alexander Entprs. 915-591-3142
TX Houston, Comp. Tech. 713-961-1262
UT Centerville, West, Inc. 208-888-6227
WA Renton, General Elctrns. 206-864-0969
WI Brookfield, Sumer, Inc. 414-784-6641
Can Don Mills, Ont., R.D. Assocs. 416-444-0959

FERROXCUBE, See Philips Components Discrete Products Division

FIBERGUIDE INDUSTRIES INC., 1 Bay St., Stirling, NJ 07980, Tel: 908-647-6601, FAX: 908-647-8464; Empl.: 80; *Sls. Mgr.:* Sharon Venzke, Ind.

FIBEROPTICS TECHNOLOGY, INC., Quassett Rd., Pomfret, CT 06258, Tel: 203-928-0443, 800-433-5248, FAX: 203-928-7664, 800-543-2558

FIBEROPTIC SYSTEMS, INC., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, Tel: 805-583-2088, FAX: 805-583-4018; Empl.: 30; *Sls. Mgr.:* Richard Lockett

FIBERTEK INC., P.O. Box 4000, 305 Beasley Dr., Franklin, TN 37065, Tel: 615-794-1400, FAX: 615-790-8289; Empl.: 30

FIBRONICS INTERNATIONAL INC., Communications Way, Independence Park, Hyannis, MA 02601-1892, Tel: 508-778-0700, TELEX: 951297; Empl.: 500; *Sls. Mgr.:* Len Julius; *Dist. Mgr.:* Jim Sproul

FAX: 301-881-0530

FIC CORP., 12216 Parklawn Dr., Rockville, MD 20852, Tel: 301-881-8124, 800-638-6594, TWX: 710-828-9809; FSC No.: 3613; Empl.: 46; *Sls. Mgr.:* Robert E. Frye, V.P.; *Dist. Mgr.:* Robert E. Frye, V.P. ..... **B•1365**

FIDELITY CHEMICAL PRODUCTS CORP., 472 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4110, FAX: 201-242-5796; Empl.: 55; *Sls. Mgr.:* Michael Aleksinas

FIELDPIECE INSTRUMENTS, 8322 B Artesia, Buena Park, CA 90621, Tel: 714-992-1239, FAX: 714-992-1239; Empl.: 5; *Sls. Mgr.:* Jan Nall; *Dist. Mgr.:* Rey Harju

FAX: 609-599-9508

FIFTH DIMENSION, INC., 801 New York Ave., Trenton, NJ 08638, Tel: 609-393-8350, TWX: 510-681-8412; Empl.: 60; *Sls. Mgr.:* Dick Clawges, Prod. Mgr. ..... **B•1268-1269, 1468-1469, 1696-1697**

Local Sales Offices & Reps

NJ Trenton, Fifth Dimension 609-393-8350

FIL-COIL COMPANY, INC., 800 Axinn Ave., Garden City, NY 11530, Tel: 516-228-9445, TELEX: 960127 SWIFT NYK, FAX: 516-228-9064; FSC No.: 56528; Empl.: 85; *Sls. Mgr.:* William Goldman

FILM MICROELECTRONICS, See General Microcircuits

FILM MICROELECTRONICS INC., 10 B Centennial Drive, Peabody, MA 01960, Tel: 508-532-9913, FAX: 508-532-9954; FSC No.: 27851; Empl.: 101; *Sls. Mgr.:* Karl Cyr

FILTER CONCEPTS INC., 2624 S. Rousselle, Santa Ana, CA 92707, Tel: 714-545-7003, FAX: 714-545-4607; *Sls. Mgr.:* Les Edelberg ..... **A•1620-1623**

BRILL ELECTRONICS
(415) 834-5888
610 E. 10th St., Oakland, CA 94606
FLUKE
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

FILTER PRODUCTS, Rockwell International, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532(COLLINS CSMA), FAX: 714-641-5320; FSC No.: 2X491; Empl.: 60; *Sls. Mgr.:* Bob Johnson

FILTRON CO., INC., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, Tel: 516-752-1144, FAX: 516-752-0905; FSC No.: 81831; Empl.: 90; *Sls. Mgr.:* Richard Michelson ..... **A•1673**

Local Sales Offices & Reps

CA	Felton, Gilland Mtkg.	408-335-3884
CA	La Habra, Cygnus	213-691-2993
CO	Boulder, A. Bissell Co.	303-444-1173
OH	Kettering, J. May Assocs.	513-296-1746
PA	Furlong, Avenir, Inc.	215-348-8290
IL	Palatine, Technical Sls. Assoc.	312-991-6600
MD	Baltimore, Bernard White & Co.	301-484-5400
MA	North Andover, Russet	508-794-4995
NY	E. Syracuse, Matl. Svcs.	315-437-7093
NY	Melville, Carnes Assoc.	516-694-1600
NY	Melville, Carnes Assocs.	516-694-1600
OH	Kettering, J. May Assocs.	513-296-1746
NY	Syracuse, Material Svcs.	315-437-7093
PA	Furlong, Avenir, Inc.	215-348-8290
TX	Bedford, De Armond Ent.	817-267-2048
TX	Bedford, DeArmond Entprs.	817-267-2048
WA	Mercer Island, Eagle Enterprises	206-232-7401

FILTRONICS, INC., 6010 Parretta, Kansas City, MO 64120, Tel: 816-231-7375, FAX: 816-241-0368; FSC No.: 53733; Empl.: 70; *Sls. Mgr.:* Brenda Gabbert

FINISHERS, INC., 517 Aldo Avenue, Santa Clara, CA 94054, Tel: 408-988-0222; Empl.: 10; *Sls. Mgr.:* Denise Firebaugh

THE FIRST ELECTRONICS CORP., 71 Von Hillern St., Boston, MA 02125, Tel: 617-288-2430, FAX: 617-288-0332; FSC No.: 14532; Empl.: 65; *Sls. Mgr.:* Chris Nastopoulos

FISCHER CONNECTORS INCORPORATED

FAX: 805-295-0090

FISCHER CONNECTORS, 28245 Avenue Crocker, Valencia, CA 91355, Tel: 805-295-0600, 1-800-344-0445, TELEX: 499-4182 ..... **C•1365-1371**

Local Sales Offices & Reps

AL	Huntsville, South Design & Mktg.	205-880-3623, FAX:205-880-3624
AZ	Scottsdale, T.C. Elctrnc. Sls., Inc.	602-994-5153, FAX:602-990-8648
CA	Fairfield, Baribeault Assocs.	707-428-6095, FAX:707-428-6099
CA	Mission Viejo, Wayne Champa Assocs.	714-581-3459,FAX:714-581-2432
CA	Moorpark, Interconn Tech. Mktg.	805-523-1582, FAX:805-523-1583
CA	Valencia, Fischer Connectors, Inc.	805-295-0600, FAX:805-295-0090
CO	Golden, J.F. Hurlbut Co.	303-279-7796, FAX:303-278-9909
FL	Indian Harbour Bch., Bill Toy & Assocs.	407-773-5805,FAX:407-773-4961
IN	Greenwood, Valentine & Assocs.	317-888-2260, FAX:317-881-4904
MD	Baltimore, Chesapeake Indl. Mktg.	301-653-0476, FAX:301-653-4675
MA	Newton, M. A. Olson Assocs. Inc.	617-244-4030, FAX:617-244-6572
MI	Madison Heights, Pine Sls., Inc.	313-589-0350, FAX:313-589-3420
MN	Minneapolis, Electro-Tec Assocs.	612-853-0242, FAX:612-854-8601
NJ	Corbin City, Brown Assocs.	609-628-3434, FAX:609-628-4012
NJ	Wayne, G.T. Assocs., Inc.	201-694-6040, FAX:201-694-6493
NY	Unadilla, J.E.F. Assocs.	607-369-9239, FAX:607-369-5056
OH	Cleveland, KT/DEPCO	216-442-6200, FAX:216-461-2101
TX	Irving, Aid Elctrns., Inc.	214-790-4761, FAX:214-790-9792
WA	Redmond, Eclipse Mktg.	206-885-6991, FAX:206-883-9481
Can	Richmond Hill, Ont., Renmark Elctrns. Ltd.	416-881-8844,FAX:416-881-8848

FISHER-BAKER CORP., 3108 Industrial 31st, Fort Pierce, FLA 34957, Tel: 407-466-0750, FAX: 407-466-7679; *Sls. Mgr.:* R. Peck

FISHERCAST, Fisher Gauge Limited, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, FAX: 705-745-8818; Empl.: 180ò; *Sls. Mgr.:* Larry Hatfield

FISHERTECH, Fisher Gauge Limited, 194 Sophia Street, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, TELEX: 06-962838, FAX: 705-748-6312; Empl.: 200ò; *Sls. Mgr.:* Earl Belsey

FISONS INSTRUMENTS, 24911 Stanford Ave., Valencia, CA 91355, Tel: 805-295-0019, TELEX: 4720130, FAX: 805-295-0419; Empl.: 200; *Sls. Mgr.:* Robert Boyd

FITCHBURG COATED PRODUCTS, Technographics, Inc., P.O. Box 1106, Scranton, PA 18501, Tel: 717-347-2035; Empl.: 300

THE FIVE STAR CO., 120 W. Main St., Plantsville, CT 06479, Tel: 203-628-5561, FAX: 203-621-5152; *Sls. Mgr.:* Robert Murphy

FJA INDUSTRIES, P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, TWX: 910-338-0260; *Sls. Mgr.:* Frank J. Ardezzone

FLANN MICROWAVE INC., Ste. 2200, One Kendall Square, Cambridge, MA 02139, Tel: 1-800-937-3772, FAX: 617-577-8234; *Sls. Mgr.:* Lawrie Lansdell

FLEX-CORE DIV., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, Tel: 614-889-6152, FAX: 614-876-8538; Empl.: 10; *Sls. Mgr.:* D. Morlan ..... **A•2228**

MCi
FLEXIBLE FURNITURE DIVISION

FAX: 616-685-9195

FLEXIBLE FURNITURE DIVISION, Metal Components, Inc., 323 Acorn Street, Plainwell, MI 49080, Tel: 616-685-6831; Empl.: 32; *Sls. Mgr.:* Lynn D. Middlebrook ..... **C•1053**

Local Sales Offices & Reps

CA	Rancho Cucamonga, B & E Assocs.	818-282-3224
CO	Westminster, Fine Line Tech.	303-429-3593
MN	Minneapolis, Haldeman-Homme Co.	612-331-4880
NJ	Ringwood, Eastern Scientific Prods.	201-728-7200
OH	Medina, Danco Equip.	216-723-3233
VA	Vienna, Morgan Scientific	703-893-4306

FLEXIBLE TECHNOLOGIES, Arlon, P.O. Box 4305, 199 Amaral St., E. Providence, RI 02914, Tel: 401-434-2340, TELEX: 6972602, FAX: 401-434-2557; Empl.: 65; *Sls. Mgr.:* Herb Howard

For sales offices and reps. in the Northeastern region, call Ron Sencer- 401-434-2340 For sale offices and reps. in California, call Rick Kirchhoff- 714-540-2811 For sales offices and reps. in Michigan, Ohio, and Indiana, call STAFFCO- 216-331-5100 For sales offices and reps in Chicago, Minnesota, and Colorado, call Phil Hansen- 612-942-9902

FLEX-KEY CORPORATION, Emerson Ave., Gloucester, MA 01930, Tel: 508-281-2040, FAX: 508-281-4730; FSC No.: 51163; Empl.: 50; *Sls. Mgr.:* Robert Keane ..... **B•1807**

Local Sales Offices & Reps

AZ	Scottsdale, DGI	602-947-3724
CA	Anaheim, Gabriel	714-666-0660
CA	Los Angeles, Detomasi & Grupp	213-618-0929
CA	Santa Clara, DGI	408-492-9266
CO	Denver, Advent Corp.	303-455-1985
DC	Rockville, Marktron	301-251-8990
IA	Cedar Rapids, Tech. Elctrns. Inc.	319-366-5443
MD	Hunt Valley, Marktron	301-628-1111
MI	Birmingham, Riley-Cotter Sls.	616-264-5744
NY	Huntington, J. A. Keeneth Co.	516-351-7008

FLEX-LINK PRODUCTS, INC., 599 Fourth St., San Fernando, CA 91340, Tel: 818-898-1451, FAX: 818-365-3022; FSC No.: 6Z867; Empl.: 80; *Sls. Mgr.:* Al Wasserzug

FLEXSTAR CORP., 2040 Fortune Dr., No. 101, San Jose, CA 95131-1823, Tel: 408-433-0770, FAX: 408-433-1766; Empl.: 57; *Sls. Mgr.:* Michael Witte, Dir. Sls./Mktg.

FLEXTRONICS INTERNATIONAL, 48001 Fremont Blvd., Fremont, CA 94538, Tel: 510-226-3539, FAX: 510-226-3535; Empl.: 1800

FLUID COMPONENTS, INC., 1755 La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-744-6950, TELEX: 695092, FAX: 619-744-8095; Empl.: 130; *Sls. Mgr.:* Glen Fishman

JOHN FLUKE MFG. CO., INC., 6920 Seaway Blvd., Everett, Wa 98206, WA 98203, Tel: 206-347-6100, TELEX: 185102, TWX: 810-445-2943, FAX: 206-356-5962; Empl.: 2400; *Sls. Mgr.:* R. Wambolt; *Dist. Mgr.:* R. Mewett ..... **D•1248-1249, 1408-1409**

Local Sales Offices & Reps

AL	Huntsville, John Fluke Mfg. Co., Inc.	205-837-0581
AZ	Phoenix, John Fluke Mfg. Inc.	602-438-8314
CA	Fremont, John Fluke Mfg. Co., Inc.	415-651-5112
CA	Irvine, John Fluke Mfg. Co., Inc.	714-863-9031
CA	San Diego, John Fluke Mfg. Co., Inc.	619-587-4664
CO	Denver, John Fluke Mfg. Co., Inc.	303-695-1000
CT	Hartford, John Fluke Mfg. Co., Inc.	203-659-3541
DC	Washington, John Fluke Mfg. Co., Inc.	301-770-1570
FL	Orlando, John Fluke Mfg. Co., Inc.	407-331-4881
GA	Atlanta, John Fluke Mfg. Co., Inc.	404-953-4747
IL	Chicago, John Fluke Mfg. Co., Inc.	708-705-0500
IN	Indianapolis, John Fluke Mfg. Co., Inc.	317-875-7870
MA	Boston, John Fluke Mfg. Co., Inc.	508-663-2400
MI	Detroit, John Fluke Mfg. Co., Inc.	313-453-3373
MN	Minneapolis, John Fluke Mfg. Co., Inc.	612-452-4264
NJ	Paramus, John Fluke Mfg. Co., Inc.	201-262-9550
NY	Rochester, John Fluke Mfg. Co., Inc.	716-323-1400
NC	Greensboro, John Fluke Mfg. Co., Inc.	818-294-8618
OH	Cleveland, John Fluke Mfg. Co. Inc.	216-234-4540
OH	Dayton, John Fluke Mfg. Co., Inc.	513-436-2224
PA	Philadelphia, John Fluke Mfg. Co.,Inc.	215-647-9550
TX	Dallas, John Fluke Mfg. Co., Inc.	214-406-1000
TX	San Antonio, John Fluke Mfg. Co., Inc.	512-340-0498
WA	Seattle, Fluke Elctrns. Canada Inc.	206-356-5512
WA	Seattle, John Fluke Mfg. Co., Inc.	206-881-6966
Can	Mississauga, Ont., Fluke Elctrns. Canada Inc.	416-890-7600

Fluke Dist. Prods. are available from Fluke authorized dist. Call 800-443-5853 for your nearest dist.

FORCE, INC., 825 Park St., Christiansburg, VA 24073, Tel: 703-382-0462, FAX: 703-381-0392; FSC No.: 64871; Empl.: 40; *Sls. Mgr.:* James W. Vanhoozier

FOREDOM ELEC. CO., Blackstone Inds. Inc., Route 6, Bethel, CT 06801, Tel: 203-792-8622, TELEX: 643483 Blckstone,, FAX: 203-790-9832; Empl.: 80; *Sls. Mgr.:* Sandi Pascoe, Sls. Mgr.

FORMA SCIENTIFIC, INC., Box 649, Marietta, OH 45750, Tel: 614-373-4763, FAX: 614-373-6770; Empl.: 425; *Sls. Mgr.:* Art Fad, VP of Domestic Sls.

FORMAX, 1120 Federal Road, Brookfield, CT 06804, Tel: 203-775-9492, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* Frank Barbera

FORTE TECHNOLOGY, INC., 201 Carnegie Row, Norwood, MA 02062, Tel: 617-769-9150, TWX: 710-348-0872, FAX: 617-769-5308

FORTRON/SOURCE CORP., Power Supplies, 6818-G Patterson Pass Rd., Livermore, CA 94550, Tel: 415-373-1008, TELEX: 559291 FORTRON UD, FAX: 415-373-1168; Empl.: 150; *Sls. Mgr.:* Louie Aldama

FOUNDATION INSTRUMENTS INC., 24 Colonnade Rd., Nepean, ON, Canada K2E 7J6, Tel: 613-226-4000, TELEX: 053-4153, FAX: 613-226-4602; *Sls. Mgr.:* Jean Paul Clermont

FOURJAY INDUSTRIES, Box 14617 Northridge Br., Dayton, OH 45413-0617, Tel: 513-890-6444, FAX: 513-890-1692; Empl.: 42; *Sls. Mgr.:* M. W. Frawley

FOXCONN®

FAX: 714-256-2068

FOXCONN INTERNATIONAL, Hon Hai, 590 W. Lambert Rd., Brea, CA 92621, Tel: 714-256-1888; Empl.: 120; *Sls. Mgr.:* Al Lorenzen; *Dist. Mgr.:* Al Lorenzen ..... **C•1372-1374**

Local Sales Offices & Reps

CA	Sunnyvale, Foxconn	408-749-1228
IL	Wheeling, Foxconn	708-215-4670
OR	Hillsboro, Foxconn	503-648-6998

Local Distributors

CA	San Jose, Hallmark Elctrns.	408-432-4000
CO	Englewood, Hallmark Elctrns.	303-790-1662
MN	Eden Prairie, Hallmark Elctrns.	612-941-2600
TX	Dallas, Hallmark Elctrns.	214-553-4300
WA	Seattle, Hallmark Elctrns.	205-547-0415

FOX ELECTRONICS

FAX: 813-693-1554

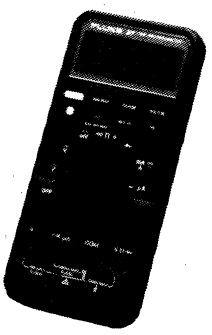
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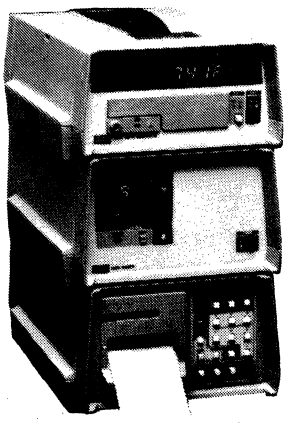
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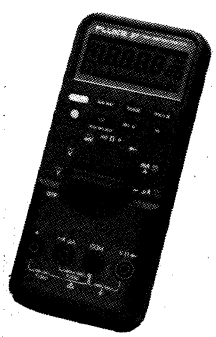
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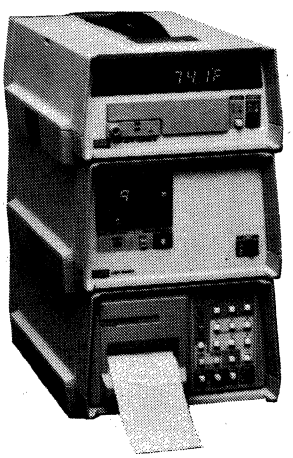
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TX Austin, Barnhill Assocs. 512-343-6448
TX Austin, Data Mktg. 512-338-4701
TX Dallas, Data Mktg. 214-661-0300
TX Houston, Barnhill Assocs. 713-776-2382
TX Houston, Data Mktg. 713-954-5020
TX Richardson, Barnhill Assocs. 214-231-2573
TX San Antonio, Data Mktg. 512-342-3031
UT Orem, Barnhill Assocs. 801-226-1239
UT Salt Lake City, Vic Myers Assocs. Inc. 801-581-1760
VA Reston, Austron 703-471-7963
WA Bellevue, Control Comms. 206-454-9297

FTS AUSTRON DATUM, INC., See Frequency & Time Sys. Inc., Datum Inc.

FTS SYSTEMS, INC., Rte. 209, P.O. Box 158, Stone Ridge, NY 12484, Tel: 914-687-0071, TWX: 510-247-0547, FAX: 914-687-7481; Empl.: 100ò; *Sls. Mgr.:* Brian Adams

FUJI ELECTRIC CORP. OF AMERICA, 515 South Flower St. No. 1660, Los Angeles, CA 90071, Tel: 213-622-4490, FAX: 213-488-9382; Empl.: Yasuko Suzuki; *Sls. Mgr.:* Hisao Ohno; *Dist. Mgr.:* Masanao Deguchi

fujipoly® Inc

FAX: 908-272-2241

FUJIPOLY, INC., 750 Walnut Ave., Cranford, NJ 07016, Tel: 908-272-3850; Empl.: 100 ..... **C•1375-1379, 1676, 1690**

Local Sales Offices & Reps

AZ	Tempe, Electronics Dev. & Sls.	602-438-1547
CA	Conaga Pk, C&W Comp. Sls.	818-700-2684
CA	Mountainview, Frauman Assoc.	415-964-9464
CO	Longmont, Butler Tech. Sls.	303-651-7703
FL	Maitland, E.I.R. Inc.	407-660-9600
IL	Palatine, Technlgy. Sls.	708-991-6600
MN	Eden Prairie, Electronic Innovators Inc.	612-941-0830
NY	Clarence, R.W. Mitscher Co. Inc.	716-759-2350
NC	Raleigh, R. W. Mitscher Co.	919-848-0941
OH	Brecksville, Bill Putich Sls.	216-526-8600
TX	Dallas, Innovative Tech. Sls.	214-699-3485
WA	Bellevue, Quest Mktg. Inc.	206-747-9424
EXP	Israel, Elimec	972-3-9643441
Can	Toronto, Norgay Entprs. Ltd.	416-234-8966

FUJITSU

FAX: 408-432-1318

FUJITSU AMERICA, INC., Computer Products Group, 3055 Orchard Dr., San Jose, CA 95134, Tel: 408-432-1300, TWX: 910-338-2193; *Sls. Mgr.:* Roger Baldelli; *Dist. Mgr.:* Dave Krevanko ..... **D•1091-1096**

Local Sales Offices & Reps

CA	Irvine, Fujitsu America	714-553-1250
CA	San Jose, Fujitsu America	408-452-0890
CA	Sherman Oaks, Fujitsu America	818-905-1985
CO	Golden, Fujitsu America	303-278-8717
FL	Ft. Lauderdale, Fujitsu America	305-771-7705
GA	Marrietta, Fujitsu America	404-953-0130
IL	Itasca, Fujitsu America	312-250-8230
MA	Burlington, Fujitsu America	617-229-6310
MN	Minnetonka, Fujitsu America	612-932-9800
NJ	Manasquan, Fujitsu America	201-223-8222
OR	Lake Oswego, Fujitsu America	503-624-9266
PA	Malvern, Fujitsu America	215-648-3958
TX	Austin, Fujitsu America	512-343-4514
TX	Irving, Fujitsu America	214-650-7701
WA	Kirkland, Fujitsu America	206-828-7450
VA	Vienna, Fujitsu America	703-356-5758

Local Distributors

AZ	Phoenix, Frontier Technlg.	602-998-4438
CA	Carlsbad, Vitek Distribution Grp.	619-431-2500
CA	El Monte, Marshall Inds.	818-459-5500
CA	Garden Grove, Wyle Labs.	714-891-1717
CA	Irvine, Modern Info. Sys.	714-756-8632
CA	San Jose, Law/Cypress Distrbg.	408-297-9800
CA	San Jose, Microland	408-922-0242
CO	Englewood, R-Squared Distrbg.	303-799-9292
IL	Mt. Prospect, PC Dist.	312-288-0700
MN	Eden Prairie, Avnet Computer Technlgs.	612-944-1114
MN	Eden Prairie, Northern Computer Sys.	612-934-8856
MN	Minneaplis, Datalink, Corp.	612-944-3462
NY	Rochester, Cameron Computer	716-427-8190
NY	Westbury, Schweber Elctrns.	516-334-7555
NC	Greenville, Gates/FA	803-234-0736
OH	Cleveland, Pioneer Standard Elec.	216-587-3600
OH	Worthington, Cranel, Inc.	614-433-0045
TX	Plano, Dallas Digital	214-424-2800
VA	Vienna, Decision Syspport Sys.	703-448-0988

FUJITSU

FAX: 408-432-9044

FUJITSU COMPONENT OF AMERICA, INC., Subsidiary of Fujitsu Microelectronics, Inc., 3545 N. First St., San Jose, CA 95135, Tel: 408-922-9000, TWX: 910-338-0190; Empl.: 40; *Sls. Mgr.:* Don Dealtry; *Dist. Mgr.:* Hal Mumma ..... **B•1470-1480, 1608; C•1380-1385**

Local Sales Offices & Reps

AL	Huntsville, C.S.R. Elctrn.	205-533-2444
AZ	Tempe, F.P. Sls.	602-894-5303
CA	Irvine, Balzer-Wolf	714-261-6877
CA	Newport Bch., Infinity Sls.	714-883-0300
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CA	Santa Clara, Norcomp	408-727-7707
CO	Denver, Candal	303-692-8484
CT	Cheshire, Connecticut Applied Technlg.	203-272-6564
FL	Altamonte Springs, Semtronics Assocs.	305-831-8233
FL	Clearwater, Semtronics	813-461-4675
FL	Ft. Lauderdale, Semtronics	305-731-2484
GA	Atlanta, C.S.R. Elctrns.	404-396-3720
IL	Highland Park, Bransky Sls.	708-433-2375
IA	Marion, A.E.M. Inc.	319-377-1129
KS	Lenexa, A.E.M. Inc.	913-888-0022
MD	Towson, Arbotek	301-825-0775
MA	Woburn, Mill-Bern Assocs., Inc.	617-932-3311
MI	Farmington Hills, R.C. Merchant	313-476-4600
MI	St. Joseph, R.C. Merchant	616-983-7378
MN	Burnsville, Electromec Sls., Inc.	612-894-8200
MO	St. Louis, A.E.M. Inc.	314-298-9900
NJ	Fairfield, Tech. Applications & Mktg.	201-575-4130
NJ	Marlton, BGR Assocs.	609-983-1020
NM	Albuquerque, F.P. Sls.	505-345-5553
NY	Rochester, H.C. Johnson Agy.	716-586-0777
NC	Charlotte, C.S.R. Elec.	704-847-5806
NC	Raleigh, C.S.R. Elctrn.	919-878-9200
OH	Columbus, McFadden Sls. Inc.	614-761-3177
OR	Beaverton, L-Squared Ltd.	503-629-8555
PA	Glenshaw, H.C. Johnson Agy.	412-487-1246
TN	Knoxville, C.S.R. Elctrn.	615-689-7911
TX	Carrollton, Tech. Mktg. Inc.	214-387-3605
TX	Houston, Tech. Mktg. Inc.	713-783-4497
TX	Roundrock, Tech Mktg. Inc.	512-244-2291
UT	Salt Lake City, Hendrickson Sls.	801-467-1445
WA	Kirkland, L-Squared Ltd.	206-827-8555
WI	Cedarburg, Bransky Sls.	414-377-6837
Can	British Columbia, Davetek Mktg.	604-430-3680
Can	Ontario, Canadian Mktg. Tech.	416-612-0900

Local Distributors

AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Marshall Inds.	602-496-0290
CA	Agoura Hills, Western Micro	818-707-0377
CA	Buena Pk., Cypress Elctrns.	714-521-5230
CA	Camarillo, Milgray Elctrns.	805-484-4055
CA	Chatsworth, Marshall Inds.	818-407-4150
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	El Monte, Marshall Inds.	818-307-6000
CA	Irvine, Kensington Elctrns.	714-588-0575
CA	Irvine, Marshall Inds.	714-458-5394
CA	Irvine, Milgray Elctrns.	714-753-1282
CA	Milpitas, Marshall Inds.	408-942-4600
CA	Orange, Western Micro	714-637-0200
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Sacramento, Integrated Elctrns.	916-363-6030
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Marshall Inds.	619-578-9606
CA	San Diego, Western Micro	619-453-8430
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, Eric Elctrns.	408-432-1111
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Saratoga, Western Micro	408-725-1660
CO	Denver, CSIO	303-292-9594
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Littleton, Indelco	303-795-3431
CO	Thornton, Marshall Inds.	303-451-8444
CT	Milford, Milgray Elctrns.	203-878-5538
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Winter Pk., Milgray Elctrns.	407-647-5747
FL	Altamonte Springs, Marshall Inds.	407-767-8585
FL	Altamonte Springs, Vantage Comps.	407-682-1199
FL	Ft. Lauderdale, Marshall Inds.	407-977-4880
GA	Norcross, Marshall Inds.	404-923-5750
GA	Norcross, Milgray Elctrns.	404-446-9777
IL	Arlington Hgts., Milgray Elctrns.	708-350-0490
IL	Carol Stream, Lectro Comps.	708-690-0520
IL	Chicago, Milgray Elctrns.	708-784-5100
IL	Indianapolis, Marshall Inds.	317-297-0483
IL	Schaumburg, Marshall Inds.	312-490-0755
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, Custom Svc. Elctrns.	317-879-9119
IN	Indianapolis, RS Elctrns.	317-253-9065
KS	Lenexa, Marshall Inds.	913-492-3121
KS	Overland Pk., Milgray Elctrns.	913-236-8800
ME	Gray, Longhill Electro	207-657-2183
MD	Columbia, Milgray Elctrns.	301-621-8169
MD	Columbia, Vantage Comps.	301-720-5100
MD	Silver Springs, Marshall Inds.	301-622-1110
MA	Andover, Vantage Comps.	508-687-3900
MA	Burlington, Western Micro	508-273-2800
MA	Hopkinton, Interface Elctrns.	508-435-6858
MA	Middleboro, Glynn Elctrns	508-947-4262
MA	Westwood, Semad Sys.	508-329-7373
MA	Wilmington, Marshall Inds.	617-658-0810
MA	Wilmington, Milgray Elctrns.	617-657-5900
MI	Flint, RS Elctrns.	313-742-5000
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Livonia, Marshall Inds.	313-525-5850
MI	Livonia, RS Elctrns.	313-525-1155
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Plymouth, Marshall Inds.	612-559-2255
MO	Bridgeton, Marshall Inds.	314-291-4650
MO	Maryland Hgts., RS Elctrns.	314-997-7709
NE	Omaha, Radio Equip.	402-341-7700
NJ	Clifton, Vantage Comps.	201-777-4100
NJ	Fairfield, Marshall Inds.	201-882-0169
NJ	Fairfield, Western Micro	201-882-4999
NJ	Marlton, Milgray Elctrns.	609-983-5010
NJ	Mt. Laurel, Marshall Inds.	609-778-8720
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Marshall Inds.	516-273-1515
NY	Johnson City, Marshall Inds.	607-729-4351
NY	Penn Yan, Advacom	716-751-1185
NY	Pittsford, Milgray Elctrns.	716-381-9700
NY	Rochester, Marshall Inds.	716-235-7620
NY	Smithtown, Vantage Comps.	516-543-2000
NC	Charlotte, Control Design Supp.	704-588-4410
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Dayton, Marshall Inds.	513-898-4480
OH	Maumee, RS Elctrns.	419-893-0721
OH	Solon, Marshall Inds.	216-248-1788
OH	Solon, Repco Elctrns.	216-248-8900
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Beaverton, Marshall Inds.	503-643-5555
OR	Beaverton, Western Micro	503-629-2082
PA	McKean, Advacom	814-476-7774
PA	Pittsburgh, Marshall Inds.	412-788-0441
TX	Austin, Marshall Inds.	512-837-1991
TX	Carrollton, Marshall Inds.	214-233-5200
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Dallas, Western Micro	214-416-0103
TX	El Paso, Marshall Inds.	915-593-0706
TX	Houston, Marshall Inds.	713-895-9200
TX	Irving, Cypress Elctrns.	214-255-0065
UT	Salt Lake City, Marshall Inds.	801-266-2428
UT	Salt Lake City, Marshall Inds.	801-485-1551
UT	Salt Lake City, Milgray Elctrns.	801-272-4999
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bothell, Marshall Inds.	206-486-5747
WA	Redmond, Western Micro	206-881-6737
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Racine, Badger Elctrns.	414-637-1256
WI	Waukesha, Hawk Elctrns.	414-547-4457
WI	Waukesha, Marshall Inds.	414-797-8400
Can	Burnaby, B.C., ITT Multi Comp.	604-291-8866
Can	Burnaby, B.C., Semad Sys.	604-420-9889
Can	Calgary, Future	403-235-5325
Can	Calgary, Alb., Semad Sys.	403-252-5664
Can	Concord, Ont., ITT Multi Comp.	416-736-1144
Can	Downsview, Future Elctrns.	416-638-4771
Can	Edmonton, Future Elctrns.	403-438-2858
Can	Markham, Ont., Matrix Tech.	416-477-4442
Can	Markham, Ont., Semad Sys.	416-475-8500
Can	Ontario, Marshall Inds.	416-458-8046
Can	Ottawa, Future Elctrns.	613-820-8313
Can	Ottawa, Ont., Semad Sys.	613-727-8325
Can	Pointe Claire, Future Elctrns.	514-694-7710
Can	Pointe Claire, Marshall Inds.	514-683-9440
Can	Pointe Claire, Semad Sys.	514-694-0860
Can	Vancouver, Future Elctrns.	604-294-1166
Can	Willowdale, Ont., Milgray Elctrns.	416-756-4481

FUJITSU MICROELECTRONICS INC., Integrated Circuits Division, 3545 North First St., San Jose, CA 95134, Tel: 408-922-9000, TWX: 910-338-0190, FAX: 408-432-9044; Empl.: 1000; *Sls. Mgr.:* Rich Christopher, Sr. VP & GM; *Dist. Mgr.:* Clyde Brewer, Dir. Distr. Sls. ..... **D•1091-1096**

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.	205-534-0044
AZ	Scottsdale, Aztech Comp. Sls., Inc.	602-991-6300
CA	Cupertino, Fujitsu Microelctrns.	408-996-1600
CA	Irvine, Fujitsu Microelctrns.	714-724-8777
CA	Newport Beach, Infinity Sls., Inc.	714-833-0300
CA	Roseville, Norcomp	916-782-8070
CA	San Diego, Harvey King, Inc.	619-587-9300
CA	Santa Clara, Norcomp	408-727-7707
CO	Boulder, Front Range Mktg.	303-443-4780
CT	Waterbury, Conntech Sls., Inc.	203-754-2823
FL	Altamonte Springs, Semtronic Assocs., Inc.	407-831-8233
FL	Clearwater, Semtronic Assoc., Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assoc., Inc.	305-731-2484

GA	Norcoss, Fujitsu Microelctrns.	404-449-8539
GA	Norcross, The Novus Grp.	404-263-0320
ID	Boise, Cascade Comps.	208-343-9886
IL	Itasca, Beta Technlg.	708-256-9586
IL	Itasca, Fujitsu Microelctrns.	708-250-8580
IN	Carmel, Fred Dorsey & Assocs.	317-844-4842
IA	Cedar Rapids, Electromec Sls.	319-362-6413
MD	Towson, Arbotek Assocs.	301-825-0775
MA	Newton Center, Fujitsu Microelctrns.	617-964-7080
MA	Woburn, Mil-Bern Assocs.	617-932-3311
MI	Grosse Point Park, Greiner Assocs., Inc.	313-499-0188
MN	Burnsville, Electromec Sls.	612-894-8200
MN	Eagan, Fujitsu Microelctrns.	612-454-0323
NJ	Marlton, BGR Assocs.	609-983-1020
NJ	Fairfield, Tech Applications & Mktg.	201-575-4130
NJ	Mt. Laurel, Fujitsu Microelctrns.	609-727-9700
NY	Hauppauge, Fujitsu Microelctrns.	516-361-6565
NY	Manlius, Quality Comps.	315-682-8885
NY	Rochester, Quality Comps.	716-342-7229
NY	Buffalo, Quality Comps.	716-837-5430
NC	Cary, The Novus Grp.	919-460-7771
OH	Morrow, Spectrum ESD	513-899-3260
OH	Novelty, Spectrum ESD	216-338-5226
OR	Beaverton, L-Squared Ltd.	503-629-8555
OR	Lake Oswego, Fujitsu Microelctrns.	503-684-4545
TX	Carrollton, Technical Mktg., Inc.	214-387-3601
TX	Dallas, Fujitsu Microelctrns.	214-233-9394
TX	Houston, Technical Mktg., Inc.	713-783-4497
TX	Round Rock, Technical Mktg., Inc.	512-244-2291
VA	Charlottesville, Arbotek Assocs.	804-971-5736
WA	Kirkland, L-Squared Ltd.	206-827-8555
WI	Milwaukee, Beta Technlg.	414-543-6609
Intl	Guadalajara, Jal., PanAmtek	36-303029
Intl	Mexico, D.F., PanAmtek	5-586-8443
PR	Hato Rey, Semtronic Assocs.	809-766-0700
Can	Ontario, Pipe Thompson Ltd.	613-258-4067
Can	Ontario, Pipe Thompson Ltd.	416-236-2355

FURMAN SOUND, INC., 30 Rich St, Greenbrae, CA 94904, Tel: 415-927-1225, TELEX: 425900, FAX: 415-927-4548; FSC No.: 5830; Empl.: 44; *Sls. Mgr.:* Joe Desmond; *Dist. Mgr.:* Joe Desmond

FURNAS ELEC., 1000 Mckee Street, Batavia, IL 60510, Tel: 708-879-6000, TELEX: 72-0458; Empl.: 1,500; *Sls. Mgr.:* Paul P. Welch

FURY PRODUCTS, INC, 4626 Eucalyptus Ave., Chino, CA 91710, Tel: 714-597-7861, FAX: 714-597-2284; FSC No.: CAGE OJTXO; Empl.: 200; *Sls. Mgr.:* Dan Fury

Distributor

FAX: 818-786-8222

FUSES UNLIMITED, D.E.I., 16216 Raymer St, Van Nuys, CA 91406, Tel: 818-786-8111; Empl.: 35; *Dist. Mgr.:* Pat White ..... **B•1366**

FUSION INC., 4658 E. 355th. St, Willoughby, OH 44094, Tel: 216-946-3300, FAX: 216-942-9083; Empl.: 85; *Sls. Mgr.:* Raymond C. Yuhasz

FUTABA CORPORATION OF AMERICA, Electronic Components Div., 711 East State Pkwy., Schaumburg, IL 60173, Tel: 708-884-1444, FAX: 708-884-1635; Empl.: 50; *Sls. Mgr.:* Bill Lichtner; *Dist. Mgr.:* Bill Lichtner

FUTURETECH, 525 Auburn St., Auburndale, MA 02166, Tel: 617-965-3834, TWX: 510-600-6663, FAX: 617-332-4760; Empl.: 2

F. W. CAPACITORS INC., 98 Toledo Rd.Hwy. 301 South, Florence, SC 29504-0636, Tel: 803-662-4728, TELEX: 220 883 TAUR, FAX: 803-667-6142; FSC No.: 58368; Empl.: 15; *Sls. Mgr.:* Joseph A. (Jay) Falcone Jr.

GABRIEL ELECTRONICS, Box 70, Scarborough Indl. Pk., Scarborough, ME 04074, Tel: 207-883-5161, FAX: 207-883-4469; Empl.: 225; *Sls. Mgr.:* D. B. Crisman

GAGE APPLIED SCIENCES INC., 2695 Paulus Rd., St. Laurent, Que., Canada H4S 1E9, Tel: 514-337-6893, FAX: 514-337-8411; Empl.: 4; *Sls. Mgr.:* Mark Diamond; *Dist. Mgr.:* Stanley M. Diamond

GALILEO ELECTRO-OPTICS CORP., Galileo Park, P.O. Box 550, Sturbridge, MA 01566, Tel: 508-347-9191, TELEX: 4999014; FSC No.: 28719; Empl.: 450

GALIL MOTION CONTROL, INC., 575 Maude Court, Sunnyvale, CA 94086, Tel: 408 746-2300, FAX: 408 746-2315; Empl.: 13; *Sls. Mgr.:* Lisa Wade

GAMMA-F CORP., Electromagnetic Sciences, Inc., 3051 Fujita St, Torrance, CA 90505, Tel: 213-539-6704, TELEX: ITT 429694, FAX: 213-539-7463; FSC No.: (CAGE) 50478; Empl.: 70; *Sls. Mgr.:* Manfred Stupnik

Local Sales Offices & Reps

CA	Mountain View, Disman-Bakner	415-969-3010
NH	Merrimack, Callahan Assocs.	603-424-5700
NJ	Totowa, Tech Mktg. Assocs.	201-812-0356

FAX: 904-677-3039

GAMMA HIGH VOLTAGE RESCH. INC., 1096 N. U.S. Hwy, No. 1, Ormond Beach, FL 32174, Tel: 904-677-7070; Empl.: 15 ..... **D•1758-1761**

Local Sales Offices & Reps

CA	Nevada City, Le Rep	916-477-5753
CA	Pasadena, A-F Sls. Engrg.	213-681-5631
NY	Smithtown, T&K Sls.	516-724-3546
NM	Albuquerque, Cleveland Entprs.	505-265-7893

GANDALF DATA INC., Gandalf Technologies Inc., 1020 S. Noel Ave., Wheeling, IL 60090, Tel: 708-541-6060, 800-GANDALF, FAX: 708-541-6803; Empl.: 200; *Sls. Mgr.:* Kerry Hawkins

GANDALF TECHNOLOGIES, INC, See Gandalf Data, Inc.

GAP INSTRUMENT CORP., 40 Oser Ave., Hauppauge, NY 11788, Tel: 516-273-0909, FAX: 516-273-0948; FSC No.: 00607; Empl.: 50

GARDINER SOLDER CO., Div. of Gardiner Metal Co., 4820 S. Campbell Ave., Chicago, IL 60632, Tel: 312-847-0100, FAX: 312-847-2314; Empl.: 100; *Sls. Mgr.:* Robert Nesnidal; *Dist. Mgr.:* Robert Nesnidal

GAR ENTERPRISES DBA KGS ELECTRONICS, 2029 N. Lincoln Ave., Pasadena, CA 91103, Tel: 818-798-0785, FAX: 818-798-1466; FSC No.: 16017; Empl.: 60; *Sls. Mgr.:* Nathan Sugimoto

GARNER GLASS CO., 177 S. Indian Hill Blvd., Claremont, CA 91711, Tel: 714-624-5071, FAX: 714-624-7212; FSC No.: 53101; Empl.: 50; *Sls. Mgr.:* Joseph C. Hyatt

GARRY ELECTRONICS AN LPL CO., 9 Queen Anne Ct., Langhorne, PA 19047, Tel: 215-949-2300, FAX: 215-943-8742; Empl.: 100; *Sls. Mgr.:* Kate Simpson; *Dist. Mgr.:* Joan Feevish

GASKET DYNAMICS, INC., 14 King St, P.O. Box 45, Mt. Holly, NJ 08060, Tel: 609-261-8100, 800-541-2500, 215-922-6046, FAX: 609-261-7300; Empl.: 19; *Sls. Mgr.:* Edward Rosenthal; *Dist. Mgr.:* Robert LaVigne

GASKET INTERNATIONAL INC., 49 Ackerman St, Bloomfield, NJ 07003, Tel: 201-338-6814; Empl.: 5; *Sls. Mgr.:* Russell L. Steinman

GATES, GEO. W., & CO., INC., 1209 Hempstead Tpke., Franklin Sq., NY 11010, Tel: 516-352-2904; Empl.: 6; *Sls. Mgr.:* T. E. Schulz, Jr

Gates Energy Products

FAX: 904-462-4726

GATES ENERGY PRODUCTS, INC., P.O. Box 861, Gainesville, FL 32602, Tel: 904-462-3911, TWX: 810-836-8500; Empl.: 3300; *Sls. Mgr.:* C. W. Garstang; *Dist. Mgr.:* K. Sparks ..... **D•1458-1465**

Local Sales Offices & Reps

CA	Brea	714-529-2117
CT	Meriden	203-238-6812
GA	Atlanta	404-446-8090
IL	Itasca	708-250-0989

Local Distributors

CA	Los Angeles, Battery Specialties	213-437-1809
CA	San Jose, Rose Elctrns.	408-943-0200
GA	Marietta, Engrd. Assemblies	404-951-8935
IL	Chicago, Joseph Elctrns.	312-297-4200
IL	Chicago, Power-Pak, Inc.	312-966-6000
IL	Downers Grove, T.D.I. Batteries	708-971-3460
IL	Lisle, JaBro Batteries	708-964-9358
MA	Boston, Adcour	617-784-8123
MN	St. Paul, Shelley-Ragon	800-328-9427
NJ	Teterboro, Engrd. Assemblies	201-288-4477
NC	Raleigh, Engrd. Assemblies	800-950-9111
OH	Columbus, Promark	614-876-8885
OR	Beaverton, Micro Power Elctrns.	503-626-7086
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Southwest Elctrns.	713-240-4000
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GAVITT WIRE & CABLE, 20 Central St., Brookfield, MA 01506, Tel: 508-867-6476, FAX: 508-867-5126; Empl.: 75

GAYNOR ELECTRIC CO., 135 South Main St, P.O. Box 316, Thomaston, CT 06787-0316, Tel: 203-283-4388, FAX: 203-283-4107; Empl.: 50; *Sls. Mgr.:* Robert Heche; *Dist. Mgr.:* Robert Heche

GBC, INC., Lamp Division, P.O. Box 2205, Ocean, NJ 07712, Tel: 908-774-8502, FAX: 908-774-8041; Empl.: 25; *Sls. Mgr.:* W. Savage

G.C. INDUSTRIES, INC., 8967 Oso Ave., Unit C, Chatsworth, CA 91311, Tel: 818-882-7852, TELEX: 497 4262, TWX: GCINDUI, ESYLNK: 62656449, FAX: 818-709-7341; Empl.: 12; *Sls. Mgr.:* Ramesh Chand; *Dist. Mgr.:* Ramesh Chand

GC INTERNATIONAL INC., P.O. Box 851198, Richardson, TX 75085-1198, Tel: 214-234-3240, FAX: 214-234-2563; Empl.: 16; *Sls. Mgr.:* Paul McInnish ..... **A•1207**

Local Sales Offices & Reps

AL	Huntsville, R.O. Whitesell & Assocs.	205-883-5110
AL	Huntsville, R.O. Whitesell and Assoc.	205-883-5110
CA	San Jose, Loroco Sls.	408-436-8770
FL	Deerfield Beach, R.O. Whitesell and Assoc.	305-429-0802
GA	Norcross, R.O. Whitesell and Assoc.	404-449-9190
IL	Arlington Ht., KMA Sls.	708-398-5300
IN	Fort Wayne, R.O. Whitesell and Assoc.	219-432-5591
IN	Indianapolis, R.O. Whitesell and Assoc.	317-876-9000
IN	Kokomo, R.O. Whitesell	317-457-9127
KY	Versailles, R.O. Whitesell Assoc.	606-873-1182
MA	Holliston, Promerge Sls.	508-429-3188
MI	Grand Blanc, R.O. Whitesell and Assoc.	313-695-0770
MI	Grand Rapids, R.O. Whitesell and Assoc.	616-942-5420
MI	Southfield, R.O. Whitesell and Assoc.	313-352-5454
MI	St. Joseph, R.O. Whitesell and Assoc.	616-983-7337
MO	St. Louis, The John G. Macke Co.	314-432-2830
NC	Greensboro, R.O. Whitesell and Assoc.	919-273-1945
NC	Wake Forest, R.O. Whitesell and Assoc.	919-556-8448
OH	Cincinnati, R.O. Whitesell and Assocs.	513-528-5644
OH	Cleveland, R.O. Whitesell and Assoc.	216-447-9020
OH	Columbus, R.O. Whitesell and Assoc.	614-888-9396
OH	Dayton, R.O. Whitesell and Assoc.	513-298-9546
PA	Broomall, Lowery Assoc.	215-356-5300
PA	Exton, Wright Rep Co.	215-594-9654
PA	Pittsburgh, R.O. Whitesell and Assoc.	412-963-6161
RI	Westerly, Promerge Sls.	401-348-1037
TN	Knoxville, R.O. Whitesell and Assoc.	615-694-9476
TX	Austin, Ion Assoc.	512-794-9006
TX	Brownsville, R.O. Whitesell and Assoc.	512-542-1718
TX	Grand Prairie, Ion Assoc.	214-647-8225
TX	Houston, Ion Assoc.	713-537-7717
TX	Richardson, GC Intl.	214-234-3240
WI	Milwaukee, KMA Sls.	414-259-1771

Local Distributors

CT	Danbury, Pilgrim Elctrns.	203-792-7274
RI	Westerly, Promege Sls.	401-348-1037

GC-THORSEN, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209, Tel: 815-968-9661, FAX: 815-968-9731; Empl.: 260; *Sls. Mgr.:* Alan Walter, VP Mktg.; *Dist. Mgr.:* Vito Giovingo

GEC-MARCONI ELECTRONIC SYSTEMS CORP., 164 Totowa Rd., P.O.Box 975, Wayne, NJ 07474-0975, Tel: 201-633-6000, FAX: 201-633-6167; FSC No.: 0D0D0; Empl.: 2030; *Sls. Mgr.:* M. G. Gordon, VP

GECO, 145 Penn St., Millheim, PA 16854, Tel: 814-349-5555, FAX: 814-349-5657; Empl.: 20

GE FANUC AUTOMATION NORTH AMERICA INC., P.O. Box 8106, Charlottesville, VA 22906, Tel: 804-978-5000, 800-648-2001, FAX: 804-978-5205

FAX: 507-263-5987

GEMINI INC., 103 Mensing Way, Cannon Falls, MN 55009, Tel: 507-263-3957, 800-533-3631; *Sls. Mgr.:* Jim Weinel ..... **C•1054-1055**

Local Sales Offices & Reps

AR	Taylor, Gemini Inc.	512-352-5027
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CA	Upland, Gemini Inc.	714-920-3442
FL	Orlando, Gemini Inc.	404-299-3330
IL	Palatine, JRS Assocs.	708-991-6626
IN	Noblesville, R & D Elctrns.	317-849-2026
IA	Cannon Falls, Gemini Inc.	800-533-3631
KS	Lenexa, Gemini Inc.	913-492-8267
MA	Brookline, Harman Assocs.	617-232-6687
MI	Dearborn, Pitcher-Poulin, Inc.	315-582-5450
MN	Cannon Falls, Gemini Inc.	507-263-3957
NY	Endwell, Reagan Compar Inc.	607-754-2171
NC	Kernersville, Wallace ELctrns. Sls.	800-334-3518
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
PA	Plymouth Meeting, Gemini Inc.	215-825-6736
TX	Carrolltown, Multi Line	214-242-9093
TX	Taylor, Gemini, Inc.	512-352-5207
WI	Wauwatosa, Larsen Assocs.	414-258-0529

GEMS SENSORS DIVISION, Div. of IMO Industries Inc., Cowles Rd, Plainville, CT 06062-1198, Tel: 203-677-1311, TELEX: 99-306, FAX: 203-747-4244; FSC No.: 04034; Empl.: 233; *Sls. Mgr.:* M. W. Brown; *Dist. Mgr.:* M. W. Brown

Local Sales Offices & Reps

CA	Sante Fe Springs, IMO Inds. Inc.	213-868-2268
CT	Rocky Hill, IMO Inds. Inc.	203-563-3737
GA	Atlanta, IMO Inds.Inc.	404-261-7063
OH	Cleveland, IMO Inds. Inc.	216-333-1805
Can	Mississauga, Ont., IMO Inds. (Canada) Inc.	416-678-6141

GEN/COMP INC., 6 Algonquin Rd., Canton, MA 02021, Tel: 617-828-2008; *Sls. Mgr.:* G. Nutter

GENERAL AUTOMATIC CORP., See E-Tron Corp.

GENERAL AUTOMATION, A Div. of 769442 Ont. Ltd., RR No. 4 McMullen Rd., Kemptville, Ont., Canada KOG 1JO, Tel: 613-724-1993, FAX: 613-258-4701; FSC No.: 1429-1592; Empl.: 4-6; *Sls. Mgr.:* Bruce Murison

GENERAL CABLE CO., Fiber Optics Div., 1 Cragwood Rd., S. Plainfield, NJ 07080, Tel: 201-769-3200, TELEX: 642892; *Sls. Mgr.:* Pieter deBruijn

GENERAL CABLE CO., 250 Overton Dr., Kenly, NC 27542, Tel: 919-284-5144, FAX: 919-284-5148; *Sls. Mgr.:* Dee Stinnette

GENERAL CABLE CO., Guardian Prods. Div., 411 West Putnam Ave., Greenwich, CT 06830, Tel: 800-243-8020, 203-661-0100, FAX: 203-661-4366; *Dist. Mgr.:* Mr. E.A. Luciano ..... **C•1753**

Local Sales Offices & Reps

AZ	Phoenix, Verlin Cink	602-997-4568
CA	Commerce, Michel Brothers	213-887-9383
CO	Denver, Trilogy Mktg.	303-989-0378
FL	Orlando, Hytech Sls.	407-578-3667
GA	Atlanta, Cenco	404-446-1787
IL	Niles, Bensdorf & Johnson	708-647-8512
MD	Gaithersburg, Mitchell Sls.	301-670-0022
MA	Braintree, Century Cable Sls.	617-843-5100
MN	Minneapolis, Rouser Sls.	612-544-3145
MS	Pearl, GS & G Sls. Assoc.	601-932-3720
MO	St. Louis, Jones Electl. Sls.	314-428-5665
NJ	Bridgeton, Harvey Assocs.	609-451-8785
OR	Portland, Pacific Western Agcy.	503-227-5555
TN	Memphis, J. C. Woollums & Assoc.	901-323-0024
TX	Dallas, Brenner Sls.	214-247-4545
WA	Seattle, Pacific Western Agcy.	206-763-1802

GENERAL CHEMICAL CORPORATION, 400 Nichols Road, Pittsburg, CA 94565, Tel: 415-685-1450, FAX: 415-458-9271

GENERAL CONTROLS, INC., 2350 Brickvale Ave., Elk Grove Village, IL 60007, Tel: 312-595-2152, FAX: 312-595-2271

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GENERAL DEVICES CO., INC., Box 39100, Indianapolis, IN 46239-9632, Tel: 317-897-7000; Empl.: 250; *Sls. Mgr.:* Jack Bradford; *Dist. Mgr.:* Dan McCauley ..... **C•1056**

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg., Inc.	205-539-1485
AZ	Phoenix, Snyder Engrg.	602-279-2010
CA	Canoga Park, Groh Assocs.	818-884-9550
CA	Irvine, Groh Assoc.	714-837-9871
CA	North Hollywood, Groh Assocs.	818-509-9111
CA	Poway, Groh Assocs.	619-673-4321
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CA	West Covina, Groh Assocs.	818-337-7831
CO	Broomfield, Summitwest Mktg.	303-460-9600
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Deerfield Beach, J. Krutek & Assoc.	305-427-4202
FL	Maitland, J. Krutek & Assoc.	305-628-4837
GA	Duluth, Dixie Tech. Mktg., Inc.	404-381-5592
IL	Northbrook, Howard Benjamin	708-272-2900
IN	Fishers, R & D Elctrns., Inc.	317-849-2026
IA	Cedar Rapids, Thomas Dowell & Assocs.	319-364-3880
KS	Overland Pk., Thomas Dowell & Assocs.	913-599-1100
MD	Towson, Arbotek, Inc.	301-825-0775
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MA	West Bridgewater, Coakley, Boyd & Abbett	508-559-6700
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	South St. Paul, Northport Engrg.	612-457-8000
MS	Dixie Tech. Mktg.	404-381-5592
MO	St. Louis, Thomas Dowell & Assocs.	314-849-4234
NJ	Mountainside, Henry G. Ritcher, Inc.	201-233-4615
NY	Fayetteville, Henry G. Ritcher, Inc.	315-637-6713
NC	Raleigh, Dixie Tech. Mktg., Inc.	919-781-7004
OH	Burton, Electronic Comps.,Inc.	216-834-0011
OH	Cleveland, Electronic Comps., Inc.	216-331-5330
OH	Columbus, Electronic Comps.,Inc.	614-231-2318
OH	Dayton, Electronic Comps., Inc.	513-866-3340
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TN	Tazwell, Dixie Tech. Mktg., Inc.	615-626-6009
TX	Austin, Advance Tech. Sls.	512-467-9209
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	El Paso, ATS-Alexander Entprs.	915-591-3142
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Olympia, Bergford & Assocs.	206-866-2001
Can	Kanata, Ontario, Birde Mktg.,Inc.	613-592-5411
Can	Markham, Ontario, Birde Mktg.,Inc.	416-477-7722
Can	Saint Laurent, Quebec, Birde Mktg.,Inc.	514-335-4050

Local Distributors

AZ	Tempe, Acacia/Deanco	602-894-2874
CA	Irvine, Acacia/Deanco	714-660-0834
CA	San Diego, Acacia/Deanco	619-565-4365
IL	Chicago, Newark Elctrns.	312-784-5100
MA	Westborough, In-Stock Products Co.	508-870-5750
MO	Maryland Heights, French Gerleman Elec. Co.	314-569-3122
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
Can	Markham,Ontario, Birde Mktg.,Inc.	416-477-7722

GENERAL DIGITAL CORP., 198 Freshwater Blvd., Enfield, CT 06082, Tel: 203-741-7171, FAX: 203-741-7071; Empl.: 50

GENERAL ELECTRIC CO., Accessory Equipment Plant, 1285 Boston Ave., Bldg. 25BE, Bridgeport, CT 06602, Tel: 203-382-3023, FAX: 203-382-2739; Empl.: 250; *Sls. Mgr.:* J. M. Collins

GENERAL ELEC. CO., Electromaterials Dept., 1350 South Second Street, Coshocton, OH 43812, Tel: 614-622-5310, TELEX: 810-255-2921; Empl.: 600; *Sls. Mgr.:* D.E. Allen

GENERAL ELECTRIC CO., Instrument Prods. Section, See Yokogawa Corp. of America

GE MICROELECTRONICS CENTER, GE Aerospace, P.O. Box 13049, Research Triangle Park, NC 27709, Tel: 919-549-3100, FAX: 919-549-3598; FSC No.: 1HL38; Empl.: 400; *Sls. Mgr.:* Donald B. Dickerman, Jr.

GENERAL ELECTRIC CO., RELAY OPERATION, See Genicom Corp.

GENERAL ELECTRIC MATERIALS TECHNOLOGY, 6161 Lincoln Ave., Suite 12B, Buena Park, CA 90620, Tel: 714-761-5684, FAX: 714-761-8257; Empl.: 12; *Sls. Mgr.:* Jerry Wang; *Dist. Mgr.:* George Olenczuk

GENERAL FIBER OPTICS, INC., 98 Commerce Rd., Cedar Grove, NJ 07009, Tel: 201-239-3400, FAX: 201-239-4258; *Sls. Mgr.:* Hugh Felger

GENERAL HARDWARE MFG., 80 White St., New York, NY 10013, Tel: 212-431-6100, FAX: 212-431-6499; *Sls. Mgr.:* Tom McGannon

GENERAL INDUSTRIES, Taylor & Olive St., Elyria, OH 44035, Tel: 216-323-3136, FAX: 216-323-4017; Empl.: 1000

GENERAL INSTRUMENT, Govt. Systems, 600 W. John St., C. S. 710, Hicksville, NY 11802-0709, Tel: 516-933-3000, TELEX: 311512, TWX: 510-221-1865, FAX: 516-933-3432; Empl.: 548; *Sls. Mgr.:* T.Turco/J.Zielezienski

GENERAL INSTRUMENT, Power Semiconductor Div., 600 W. John St., Hicksville, NY 11802, Tel: 516-933-3333, FAX: 516-933-3881; *Sls. Mgr.:* Tony Solla, Natl. Sls. Mgr.; *Dist. Mgr.:* Robert Graziano

GENERAL LASER, INC., 7950 E. Redfield Rd., Scottsdale, AZ 85260, Tel: 602-991-0674, FAX: 602-991-1462

GENERAL MANUFACTURING, 724 Ruberta Ave., Glendale, CA 91201, Tel: 818-243-2069; FSC No.: 10454

GENERAL MIRCOCIRCUITS, 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-9101, FAX: 508-663-9132; Empl.: 25; *Sls. Mgr.:* Michael Lioz



FAX: 516-226-8966

GENERAL MICROWAVE CORPORATION, 5500 New Horizons Blvd., Amityville, NY 11701, Tel: 516-226-8900, TELEX: 310-287-780; FSC No.: 11332; Empl.: 200 ..... **A•1749; D•1251**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
CA	Los Angeles, RF Assocs.	213-478-1586
CA	Palo Alto, RF Assocs. North	415-494-3331
FL	Apopka, Saber Assocs.	800-432-6288
FL	Melbourne, Saber Assocs.	800-432-6288
IL	Mt. Prospect, Cain Forlaw	708-253-3578
MA	Billerica, Microwave Mktg. Specialists	508-667-1440
NJ	West Orange, EF Tech. Sls.	201-731-7203
NY	Plainview, EF Tech. Sls.	516-942-7400
NY	Rochester, TCS (Technical Comp. Sls.)	716-342-2406
NC	Clayton, Saber Assocs.	800-327-0853
OH	Worthington, Cain Forlaw	614-436-3004
TX	Dallas, Cain & Co.	214-247-3901

GENERAL NUMERIC CORPORATION, 390 Kent Avenue, Elk Grove Village, IL 60007, Tel: 708-640-1595, TELEX: 210036, FAX: 708-228-5490; Empl.: 125; *Sls. Mgr.:* James Scott

GENERAL POWER CORPORATION, 1045 S. East St., P.O. Box 65008, Anaheim, CA 92815, Tel: 714-956-9321, FAX: 714-491-8644; FSC No.: 04801; Empl.: 75; *Sls. Mgr.:* Ernest R. Murillo; *Dist. Mgr.:* Ernest R. Murillo

GENERAL PROTECTION CO., INC., Circuit Protection Group, 6149 N. Talman Ave., Chicago, IL 60659, Tel: 312-761-0403, FAX: 312-262-9605; Empl.: 15; *Sls. Mgr.:* N.Pierson; *Dist. Mgr.:* N.Pierson

GENERAL RESISTANCE, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 05591; Empl.: 60; *Sls. Mgr.:* J. L. Jamiesen; *Dist. Mgr.:* Keith MacDowall ..... **A•1913; D•1252-1253**

All States Not Listed Consult Factory, N. Branford, NJ 203-481-5721

Local Sales Offices & Reps

CA	Mountain View, Saber Entprs.	415-968-0427
NV	Clark County, Qualtech	602-967-4655
TX	Austin, Inotek	512-892-2490
EXP	Rajajinagar, Banaglore, Elctrns. Continental	366665

Instruments

AZ	Tempe, Qualtech, Inc.	602-967-4655
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mountain View, Saber Entprs.	415-968-0427
CO	Littleton, Radco	303-794-4279
CT	Watertown, May Technlg.	203-274-3777
IL	Des Plaines, Marsland Assocs.	312-298-2620
LA	Baton Rouge, Inotek	512-892-2490
MD	Joppa, Please Consult Factory	203-481-5721
MA	Reading, May Technlg.	617-942-7135
MO	St. Louis, Marsland Assocs.	312-298-2620
NJ	Branchville, CB Associates	201-948-5100
NY	Schenectady, CB Assocs.	201-948-5100
NY	Whitney Point, TAE-REP, Inc.	607-692-3705
OH	Dayton, RIXAN Assocs.	513-278-4216
TN	Hixson, Inotek	512-892-2490
TX	Austin, Inotek	512-892-2490
TX	Plano, Qualtech	602-967-4655
VA	Dumfries, Consult Factory	203-481-5721
WA	Seattle, Datacom Assocs.	206-285-2525
WI	New Berlin, Marsland Assocs.	312-298-2620

Components

AZ	Tempe, Qualtech, Inc.	602-967-4655
CA	Saratoga, TESTCO	408-253-1900
CO	Golden, J. F. Hurlbut Co.	303-279-7796
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Farmington, W. R. Hummon & Assoc.	313-474-0661
OH	Dayton, RIXAN Assocs.	513-278-4216
TX	Dallas, Blackburn Assocs.	214-750-8927
VA	Sterling, Beacon North, Inc.	703-478-2480

Local Distributors

CA	Saratoga, TESTCO	408-253-1900
OH	Dayton, RIXAN Assocs.	513-278-4216

GENERAL SCANNING RECORDER PRODUCTS DIVISION, 37 Broadway, Arlington, MA 02174, Tel: 617-641-2702, TELEX: 212838, FAX: 617-648-4906; *Sls. Mgr.:* Donald Follansbee ..... **D•1419**

GENERAL SECURITY INC., 16 Newtown Plaza, Plainview, NY 11803, Tel: 516-753-0700, ESYLNK: 800-572-8989, FAX: 516-753-0839; Empl.: 10; *Sls. Mgr.:* J.N. Benjamin

GENERAL SEMICONDUCTOR IND., INC., Square D Company, 2001 W. 10th Place, Tempe, AZ 85281, Tel: 602-968-3101, FAX: 602-966-6396; FSC No.: 24444;19500; Empl.: 591; *Sls. Mgr.:* William Hennigan; *Dist. Mgr.:* Christopher Dingley

GENERAL TECHNOLOGY CORP., 6816 Washington Avenue, NE, Albuquerque, NM 87109, Tel: 505-345-5591, FAX: 505-344-3227; Empl.: 150; *Sls. Mgr.:* Ralph H. Anderson

GENERAL TRANSISTOR CORP., GTC, 216 W. Florence Av., Inglewood, CA 90301, Tel: 213-673-8422, FAX: 213-672-2905; FSC No.: 04662; Empl.: 66

GENERAL VIBRATIONS MFG. CO., 422 North Main St., Manchester, CT 06040, Tel: 203-646-0090, FAX: 203-643-8913; Empl.: 4

GENERAL WIRE PRODUCTS, INC., 425 Shrewsbury Street, Worcester, MA 01604, Tel: 617-752-8260, FAX: 617-753-2173; FSC No.: 5F262; Empl.: 58; *Sls. Mgr.:* Thomas P. Andrews, Jr.

GENICOM®

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GENICOM CORP., 1 Genicom Dr., Waynesboro, VA 22980, Tel: 703-949-1471, TWX: 710-839-0407; FSC No.: 01526; Empl.: 3000; *Sls. Mgr.:* G.F. Peltier ..... **B•1012-1014, 1482-1485**

Local Sales Offices & Reps

CA	Santa Ana, Genicom Corp.	714-549-5101
CT	Suffield, Genicom Corp.	203-668-6530
FL	Bonita Springs, Genicom, Corp.	813-947-5622
VA	Waynesboro, Genicom Corp.	703-949-1666

Local Distributors

CA	San Jose, JACO/Distel Inc.	408-432-9290
CA	Santa Ana, Norstan	800-854-8344
CA	Tustin, JACO/Distel Inc.	714-258-9003
CA	Westlake Village, JACO/Distel Inc.	800-824-0151
FL	Boca Raton, JACO/QC	407-241-7950
FL	Orlando, T & T Prods., Inc.	305-857-2282
GA	Norcross, JACO/QC	404-449-9508
MD	Baltimore, Elctrn. Comp. Sls.	301-728-2772
MA	Columbia, JACO Elctrns. Inc.	301-995-6620
MA	Tewksbury, JACO Elctrns. Inc.	508-640-0010
NY	Hauppauge, JACO/Elctrns. Inc.	516-273-5500
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
NC	Raleigh, JACO/QC	919-876-7767
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Elctrns Mktg. Corp.	513-278-5745
OH	Highland Heights, Electronics Mktg. Corp.	216-442-3441
TX	Addison, JACO/QC	214-733-4300
TX	Austin, JACO/QC	512-835-0220
TX	Dallas, Associated Aircraft Supp. Co.	214-331-4381
TX	Sugarland, JACO/QC	713-240-2255
WA	Redmond, Pan Pacific Elctrns., Inc.	206-881-7252



FAX: 619-661-5120

GENISCO ELECTRONICS CORPORATION, 1657 Pacific Rim Court, San Diego, CA 92173, Tel: 619-661-5100; FSC No.: 07294; Empl.: 100; *Sls. Mgr.:* Dick Gurena ..... **A•1624-1625, 1677; B•1153**

Local Sales Offices & Reps

AL	Birmingham, Electro-South Inc.	205-822-5713
AL	Huntsville, EMA	205-830-4030
AZ	Phoenix, Mayco	602-867-3076
CA	Claremont, Cook Entprs.	714-626-3997
CA	San Jose, Kottmeier Assoc. Inc.	408-371-8700
CA	Sunnyvale, DJM Elctrns.	408-749-8936
CA	Valencia, DJM Elctrns.	805-254-2677
CA	Vista, DJM Elctrns.	619-726-1266
CO	Englewood, R.A. Mays Co.	303-761-9447
GA	Roswell, E M A	404-992-7240
KS	Lenexa, Midtech Assoc.	913-541-0505
MD	Baltimore, Eastern Comps.	301-788-7050
NH	Brookline, EMC Sls.	603-672-4455
NM	Mayco	505-299-4002
NY	Roslyn Hgts., November Elctrn. Sls.	516-621-6378
OH	Dayton, Jay Engrg.	513-253-2151
PA	W. Conshohocken, Eastern Comps.	215-825-8610
WA	Bellevue, Underwood-Hanify Inc.	206-643-1793

GENISCO TECHNOLOGY CORP., 14930 E. Alondra Blvd., La Mirada, CA 90638, Tel: 714-523-7001, TWX: 910-346-6773, FAX: 714-522-1058; FSC No.: 07249; Empl.: 450; *Sls. Mgr.:* Rita Deidrich

GENISCO TECHNOLOGY CORP., 14930 E. Alondra Blvd., La Mirada, CA 90638, Tel: 714-523-7001, TWX: 910-346-6773, FAX: 714-522-1058; FSC No.: 07294; Empl.: 380

GENNUM CORPORATION, Linear Technology Inc., P.O. Box 489, Sta. A, Burlington, ON, Canada L7R 3Y3, Tel: 800-263-9353, 416-632-2996, TELEX: 061-8525, FAX: 416-632-2055; Empl.: 180; *Sls. Mgr.:* C. Marshall/I. H. Scott

GENROCO, INC., 205 Kettle Moraine Drive North, Slinger, WI 53086-9407, Tel: 414-644-8700, TELEX: 158279420, FAX: 414-644-6667; *Sls. Mgr.:* Donald D. Woelz; *Dist. Mgr.:* Barbara Pick

GENSTAR RENTAL ELECTRONICS, INC., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, Tel: 800-331-3440 (in CA), 800-227-8409, FAX: 818-715-9249

GENTRON CORPORATION, 7345 E. Acoma, Ste. 101, Scottsdale, AZ 85260, Tel: 602-443-1288, FAX: 602-443-1408; Empl.: 50; *Sls. Mgr.:* Rick Heinz; *Dist. Mgr.:* Rick Heinz

GEOPHYSICAL SURVEY SYSTEMS, INC., 13 Klein Dr., North Salem, NH 03073-0097, Tel: 603-893-1109, FAX: 603-889-3984; FSC No.: 02-0278634; Empl.: 50; *Sls. Mgr.:* J. V. Rosetta, Jr.

GEORATOR CORP., Box 70, Manassas, VA 22110-0070, Tel: 800-523-9938, FAX: 703-368-1078; FSC No.: 91723; *Sls. Mgr.:* Jay Gormley ..... **D•2195-2198**

FAX: 308-235-2609

GEORGE RISK INDUSTRIES, INC., 802 S. Elm St., Kimball, NE 69145, Tel: 308-235-4645; FSC No.: 24229; Empl.: 135; *Sls. Mgr.:* Mohammed A. Ghani; *Dist. Mgr.:* Mohammed A. Ghani ..... **B•1809**

Local Sales Offices & Reps

OR	Portland, Adapt Elctrns.	503-297-2151
AZ	Phoenix, J. F. Hurlbut Co.	602-997-7285
VA	Alexandria, Tech-Reps, Inc.	703-370-2600
CA	Sunnyvale, W.W. Posey Co.	408-746-0771
Can	Toronto, Reptech Elctrns. & Design	416-863-9510
FL	Deerfield Beach, Newell-Hynes Assocs.	305-429-3207
IL	Wheaton, CS Tech. Sls.	708-653-8126
MA	Lexington, Jodan Technlg.	617-863-8898
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Eden Prairie, O'Reilly Assocs.	612-941-6480
MO	St. Charles, Buckman & Assocs.	314-946-6201
NY	Huntington Station, Morgan Elctrns.	516-549-5180
CA	Orange, VR Elctrns.	714-532-3730
PA	Horsham, Jacobsen Assocs.	215-674-2937
TX	Dallas, Barry Sls.	214-234-0255
GA	Deluth, Stelmack Comps.	404-441-7927
CO	Golden, J. F. Hurlbut Co.	303-279-7796

GERMANIUM POWER DEVICES, Box 3065, Shawsheen Village Sta., Andover, MA 01810-3065, Tel: 508-475-5982, TELEX: 94-7150, FAX: 508-470-1512; FSC No.: 53399; Empl.: 100; *Sls. Mgr.:* R. W. Kassiotis

GETTYS, an AEG Company, 2701 N. Green Bay Rd., Racine, WI 53404, Tel: 414-637-6591, TELEX: 201-309, FAX: 414-637-8400; Empl.: 173; *Sls. Mgr.:* Thomas J. Joyal, VP of Mktg./sls.

GETTYSBURG TRANSFORMER CORPORATION, 1380 Old Harrisburg Rd., P.O. Box 4356, Gettysburg, PA 17325, Tel: 717-334-2191, FAX: 717-334-4961; Empl.: 65; *Sls. Mgr.:* Charles A. Ritter

GEYER SYSTEMS, See GSI Corp.

GFC POWER LTD., 95 Curtis Drive, Guelph, CAN N1K 1E1, Tel: 519-763-3051, FAX: 519-822-9537; Empl.: 80; *Sls. Mgr.:* David Oliver; *Dist. Mgr.:* David Oliver

GGB INDUSTRIES, INC., Picoprobe Division, PO Box 10958, Naples, FL 33941, Tel: 813-643-4400, TELEX: 136692 GGB, FAX: 813-643-4403; *Sls. Mgr.:* Greg Boll

GHIELMETTI, INC., 30961 West Aguora Rd., Ste. 309, Westlake Village, CA 91361, Tel: 800-228-1097, FAX: 818-707-1754; Empl.: 4; *Sls. Mgr.:* Rick Odorfer

GIANNINI INSTITUTE, 51-555 Madison St., Indio, CA 92201, Tel: 619-347-2833, FAX: 619-342-4006; FSC No.: 24727; Empl.: 10; *Sls. Mgr.:* John Phillips

GIBSON/EGAN, See Textool Test & Interconnect Prods. Dept., 3M, Electronic Prods. Div.

GIC THERMODYNAMICS, 2611 Parmenter, Royal Oak, MI 48073, Tel: 313-280-1648, FAX: 313-280-0998; Empl.: 20; *Sls. Mgr.:* Denny Desmond

GIDDINGS & LEWIS-NEXES AUTOMATION, Giddings & Lewis, Inc., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54936-1658, Tel: 414-921-7100, TELEX: 26-2722, TWX: 910-275-1100; Empl.: 175

Gilway Technical Lamp

FAX: 617-938-5867

GILWAY TECHNICAL LAMP, 800 W. Cummings Pk., Woburn, MA 01801, Tel: 617-935-4442; FSC No.: 3T059; Empl.: 17; *Sls. Mgr.:* Clark Benjamin III; *Dist. Mgr.:* Erin Hurley ..... **B•1155-1163**

GIMIX, INC., 3223 Arnold Lane, Northbrook, IL 60062-2406, Tel: 708-559-0909, FAX: 708-559-0942; Empl.: 14; *Sls. Mgr.:* Robert Phillips

GLAR-BAN, A MARK IV COMPANY, 199 Wales Ave., Tonawanda, NY 14150, Tel: 716-694-5076, FAX: 716-694-4662; FSC No.: 22973; Empl.: 50; *Sls. Mgr.:* Robert G. Mencer, Jr.

GLASGAL COMMUNICATIONS, INC., 151 Veterans Dr., Northvale, NJ 07647, Tel: 201-768-8082, FAX: 201-768-2947; Empl.: 130; *Sls. Mgr.:* Ingemar Sjunnemark

GLASSMAN EUROPE LIMITED, Studio 4 Intec 2 Wade Rd., Basingstoke, Hampshire RG24 0NE, Tel: (0256) 810808, FAX: (0256) 810815; Empl.: 60; *Sls. Mgr.:* J. Ellis

FAX: 908-534-5672

GLASSMAN HIGH VOLTAGE INC., P.O. Box 551, Salem Indl. Pk., Rte. 22 (East), Whitehouse Sta., NJ 08889, Tel: 908-534-9007, TWX: 710-480-2839; Empl.: 60; *Sls. Mgr.:* John R. Belden ..... **D•1762-1773**

GLASSMAN JAPAN HIGH VOLTAGE LTD., Tiara Bldg. 1-17, Tiara 1-Chome, Miyamae-Ky, Kawasaki 213 Japan, Tel: (044) 877-4546, FAX: (044) 877-3395

GLATZER INDUSTRIES CORP., 15 River St., New Rochelle, NY 10801, Tel: 914-576-2700, FAX: 914-576-7075; Empl.: 25; *Sls. Mgr.:* Patricia M. Wyllie

GLENAIR INC., 1211 Air Way, Glendale, CA 91201-2497, Tel: 818-247-6000, TELEX: 67-3485, TWX: 910-437-2066, FAX: 818-500-9912; FSC No.: 06324; Empl.: 485; *Sls. Mgr.:* Ronald E. Platz

GLENMARC MANUFACTURING INC., 970 Woodlands Pkwy., Vernon Hills, IL 60061, Tel: 708-634-6080, FAX: 708-634-9527; Empl.: 13; *Sls. Mgr.:* David Greenwood

GLEN MILLS INC., 203 Brookdale St., Maywood, NJ 07607, Tel: 201-845-4665, TELEX: 134 656, FAX: 201-487-8469; Empl.: 11; *Sls. Mgr.:* Stanley I. Goldberg

GLENRO, INC., 39 McBride Ave., Paterson, NJ 07501-1715, Tel: 201-279-5900, 800-922-0106, FAX: 201-279-9103; Empl.: 50; *Sls. Mgr.:* Sterling Pitt

GLOBAL COMPONENTS & CONTROLS, 1 Main Street Ste. 210, Eatontown, NJ 07724, Tel: 201-389-1470, FAX: 201-389-8781; Empl.: 4; *Sls. Mgr.:* John M. Chapski

GLOBAL SPECIALTIES, Interplex Electronics, Inc., 70 Fulton Terrace, P.O. Box 1942, New Haven, CT 06509, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 50; *Sls. Mgr.:* Rachael Fernicola; *Dist. Mgr.:* Rachael Fernicola

Local Distributors

CA	El Monte, Marshall Inds.	818-459-8310
FL	Ft. Lauderdale, Southeastern Elctrn.	305-563-4131
IN	Indianapolis, Meunier Elctrns.	317-635-3511
MA	N. Andover, Contact East	508-682-2000
NY	Hauppauge, Fordham Radio	516-435-8080
SC	Greenville, EMSCO	813-233-4121
TX	Ft. Worth, Allied Elctrn.	817-336-5401
TX	Irving, Specialized Prods.	214-550-1923
WA	Seattle, Radar Elctrns.	206-282-2511
Can	Willowdale, Ont., Electro Sonic	416-494-1666

GLOBE BATTERY DIV., See Johnson Controls, Globe Battery Div.

GLOBE MOTORS, 2275 Stanley Avenue, Dayton, OH 45404, Tel: 513-228-3171, TELEX: 288-224, TWX: 810-459-1642, FAX: 513-229-8531; Empl.: 580; *Dist. Mgr.:* Derek Keegan

GLOBE UNION, See Johnson Controls, Globe Battery Div.

GlobTek

FAX: 201-861-0740

GLOBTEK, INC., 7700 Marine Rd., N. Bergen, NJ 07047, Tel: 201-861-0246, TELEX: 755579; Empl.: 20; *Sls. Mgr.:* Eugene Goldberg; *Dist. Mgr.:* Tom Devaney ... **A•2229; B•1367; C•1386, 1754; D•1775**

Local Sales Offices & Reps

CA	Arcadia/San Diego, HMC Inc.	818-447-0958
CA	San Jose, Silicon Valley Sls.	408-432-1967
CO	Denver, C-Tech	303-451-7100
CT	Ridgefield, Harbor Elctrns.	203-438-9625
IL	Alsip, M & E Comps.	708-396-0700
IA	Cedar Rapids, Technical Elctrns.	319-366-5443
MD	Lisbon, S. K. MacDonald	301-982-1088
MA	Topsfield, Whitehead Assoc. Inc.	508-887-8050
MN	Golden Valley, Highland Elctrns.	612-546-2123
MO	St. Louis, MPC Mktg.	314-652-0139
TX	Dallas, Comp. Technlg.	214-783-8837
TX	Dallas, Exel Tech	214-239-3935
Can	St. Laurent, Que., Componetics	514-331-9930

Glowlite

FAX: 405-238-3029

GLOLITE SALES LTD/GLOWLITE DIV., PO Box 688 Hwy 77 South, Pauls Valley, OK 73075, Tel: 405-238-5541, 800-654-3662; Empl.: 77; *Sls. Mgr.:* John Crego; *Dist. Mgr.:* Stan Ferrell ..... **B•1154, 1811**

Local Sales Offices & Reps

AZ	Peoria, SEM of Arizona	602-486-1191
AR	Little Rock, Doby Assocs.	501-221-0326
CA	Laguna Hills, Jack Fitch Assocs.	714-951-0196
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IN	Indianapolis, Schank Elctrn. Mktg.	317-842-6204
KS	Kansas City, E.P.I. Inc.	816-523-8911
MD	Randallstown, Chesapeake Indl. Mktg.	301-653-0476
MA	Tyngsboro, Comptech	508-649-3030
MI	Farmington Hills, Schank Elctrn. Mktg.	313-626-2551
MN	Hopkins, Pathway Sls. Inc.	612-933-8267
MS	Jackson, Doby Assocs.	601-981-1138
MO	St. Louis, E.P.I. Inc.	314-962-1411
NM	Albuquerque, Sytech Mktg. Sys.	505-266-7951
NY	Hauppauge, Aurora-Schmitt Assocs.	516-434-1313
NC	Raleigh, Vantage Mktg.	919-870-7123
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
SC	Greenville, Vantage Mktg.	803-268-2186
TX	Hurst, El-Tec Sls.	817-268-2896
UT	Salt Lake City, Butterworth Mktg.	801-969-5566
Can	Aurora, Ont., JRL Assocs.	416-727-1452

Local Distributors

AL	Huntsville, Resistor Cap Elctrn.	205-883-4270
AR	Little Rock, Carlton Bates	501-562-9100
IL	Chicago, Kennedy-Webster Elctrns.	312-876-1612
IL	Chicago, Leeds Electro Comps.	312-625-3800
IL	Schaumburg, QPS Elctrns.	312-884-6620
LA	Shreveport, Carlton Bates	318-636-9975
MD	Columbia, SHP Elctrns.	301-290-8770
MA	Winchester, Webb Dist.	617-729-5800
MN	Plymouth, Leeds Electro Comps.	612-557-1277
MO	Richland, ATR Lighting	314-765-5219
MO	Spingfield, Carlton Bates	417-862-1699
NY	Setauket, KC Electrn. Dist.	516-689-2200
OH	Cleveland, Advacom Elctrns.	216-826-3300
OH	Columbus, Advacom Elctrns.	614-833-9550
OK	Oklahoma City, Carlton Bates	405-681-4446
OK	Tulsa, Carlton Bates	918-250-1626
PA	Lancaster, Advacom Elctrns.	717-741-9277
PA	McKean, Advacom Elctrns.	814-476-7774
TN	Memhpis, Carlton Bates	901-365-3539
TN	Nashville, Carlton Bates	615-244-3562
TX	Austin, Carlton Bates	512-458-1175
TX	Ft. Worth, Carlton Bates	817-831-0395
TX	Ft. Worth, Tandy Nat. Pts.	817-870-5600
WI	Grafton, Lakeview Elctrns.	414-377-8250
WI	Milwaukee, Badger Sls.	414-281-1330

GME SYSTEMS, INC., 12300 Perry Highway, Pittsburgh, PA 15090, Tel: 412-935-0440, FAX: 412-935-9640; Empl.: 7; *Sls. Mgr.:* Bjorn Karlstrom

GML CHIP COMPONENTS LIMITED, Hig, Phasell, Block 2 Flat 16 Baghlingampally, Hyderabad A.P., India 500 044, Tel: (91) 842-60106, 61593, TELEX: 0425-2105 GML IN, FAX: (91) 842-61484; Empl.: 50

GM NAMEPLATE, INC., 2040 15th Ave. West, Seattle, WA 98119, Tel: 206-284-2200, FAX: 206-284-3705; Empl.: 350; *Sls. Mgr.:* Gerry Gallagher

GMR CO., 804 Main St., Venice, CA 90291, Tel: 213-399-1490, TELEX: 499 2468; Empl.: 93; *Sls. Mgr.:* Harvey Mushman

GN NATIONAL ELECTRIC INC., 20639 Lycoming St, Unit B-1, Walnut, CA 91789, Tel: 714-598-1919, 714-598-1337, 800-321-1266, FAX: 714-594-7938; Empl.: 7; *Sls. Mgr.:* John Huang; *Dist. Mgr.:* Kathy Yang

GPE

FAX: 714-993-6023

GOLDEN PACIFIC ELECTRONICS, INC, 560 S. Melrose St, Placentia, CA 92670, Tel: 714-993-6970; Empl.: 15; *Sls. Mgr.:* James Au; *Dist. Mgr.:* James Au ..... **D•1032-1035, 1776-1777**

Local Sales Offices & Reps

CA	Garden Grove, ELSCO Elctrns	714-891-4621
CA	Norwalk, Ed Rivers Assocs.	213-868-1471
CA	San Jose, Applied Eltcrns Mktg	408-441-9610
CO	Longmont, Butler Tech. Sls.	303-651-7703
IL	Arlington Heights, M.J. Peterson & Assocs.	708-577-8200
NJ	Wayne, Breen Assocs	201-696-8683
NY	Elbridge, Northeastern Elctrns., Inc.	315-689-2143
OR	Beaverton, Core II Mktg	503-641-0877

GOLDEN POWER SYSTEMS, INC., 2125-B Madera Rd., Simi Valley, CA 93065, Tel: 805-582-4400, FAX: 805-582-3230; *Sls. Mgr.:* Ron Jones

GOLDSTAR PRECISION CO. LTD., Lucky Goldstar, 13013 E. 166th St, Cerritos, CA 90701, Tel: 213-404-0101, TELEX: 910-583-5719, FAX: 213-926-0849; Empl.: 12; *Sls. Mgr.:* Reginald Bale; *Dist. Mgr.:* Reginald Bale

GOOD-ALL ELECTRIC, INC., 3725 Canal Drive, Fort Collins, CO 80524, Tel: 303-484-3080, 800-826-7891, TWX: 910-930-9015, FAX: 303-484-8649; FSC No.: 22096; Empl.: 135; *Sls. Mgr.:* Sandi K. Salvhus

GORDON BRUSH MFG. CO., INC., 2150 Sacramento St, Los Angeles, CA 90021-1786, Tel: 213-627-6889, FAX: 213-623-4397; FSC No.: 17987; Empl.: 35

GORDON CO.:WATLOW, 5710 Kenosha St., Richmond, IL 60071, Tel: 815-678-2211, TELEX: 72-2427, FAX: 815-678-3961; Empl.: 300

GORDON INSTRUMENTS, INC., 3645 California Rd., Orchard Park, NY 14127, Tel: 716-662-5353, 1-800-333-2672, FAX: 716-662-7839; Empl.: 20; *Sls. Mgr.:* John Savage

GORDON, L., PACKAGING, 1050 S. Paca St., Baltimore, MD 21230, Tel: 301-539-6537, FAX: 301-625-7510; Empl.: 150

GORDON PRODUCTS, 67 Del Mar Dr., Brookfield, CT 06804, Tel: 203-775-4501, FAX: 203-775-1162; Empl.: 45; *Sls. Mgr.:* Leon Najman; *Dist. Mgr.:* Leon Najman

GORDOS

FAX: 501-636-2305

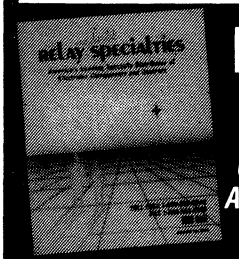
GORDOS, A Flint Industries Company, 1000 N. Second St., Rogers, AR 72756, Tel: 501-636-5000 ..... **A•1725; B•1486-1488; D•1170-1173**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assoc. Inc.	205-880-8050
CA	Costa Mesa, Jim Pancake	714-751-6760
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	Tustin, Schoenbachler-Dobson	714-544-1888
CO	Arvada, Gemini Elctrns.	303-428-5600
FL	Deerfield Bch., Florida Comps., Inc.	305-429-1758
FL	Tampa, Florida Comps., Inc.	813-873-3622
GA	Atlanta, Elctrn. Mktg. Assoc.	404-448-1215
IL	Schaumberg, Martan, Inc.	708-303-5660
IN	Indianapolis, Hy-Tek Sls. Co.	317-887-2564
MA	Burlington, Anacon Sls. Assocs.	617-272-9080
MI	Troy, Pyramid Integrated Control Sys.	313-528-8040
MN	Eden Prairie, Busch Elctrns.	612-934-7922
NM	Albuquerque, Syntech	505-266-7051
NJ	Budd Lake, Guido Assocs.	201-347-4643
AR	Rogers, Bill Wilberg	800-643-3500
NC	Raleigh, Elctrn. Mktg. Assocs., Inc.	919-847-8800
OH	Centerville (Dayton), Omega Sls., Inc.	513-434-5507
OH	Shaker Hgts., Omega Sls., Inc.	216-751-9600
OK	Tulsa, Advanced Tech. Sls.	918-664-0482
PA	Valley Forge, Providence Mktg. Assocs., Inc.	215-935-3300
SC	Greenville, Elctrn. Mktg. Assocs., Inc.	803-233-4637
TX	Austin, Advanced Tech. Sls.	512-467-9209
TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, Advanced Tech. Sls.	713-440-3888
WI	Mequon, Martan, Inc.	414-241-4955
Intl	AR Rogers, Gordos	501-636-5000
Can	Mississauga, Ont., Gidden and Morton Assocs., Inc.	416-671-8111

Local Distributors

AL	Auburn, Interstate Elctrl. Supp.	205-821-3341
AL	Montgomery, Control Comps.	205-264-3325
AL	Tempe, Control Design	602-829-7981
AZ	Tempe, Control Design	602-829-7981
AR	Eldorado, Electra, Inc.	501-862-4901
AZ	Phoenix, Elctrn. Supp.	602-276-1199
AZ	Phoenix, Future	602-272-7952
AZ	Tempe, Time Elctrns.	602-967-2000
AZ	Tucson, Future	602-882-0808
CA	Anaheim, Control Design	213-821-1516
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Irvine, Future	714-250-4141
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Los Angeles, Master Distrs.	215-452-1229
Can	Ontario, Harston & Carlock	714-984-4666
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Carlos, Control Design	415-592-4808
CA	San Diego, Time Elctrns.	619-586-1331
CA	San Francisco, Control Design	408-996-9197
CA	San Jose, Future	408-434-1114
CA	San Jose, Integrated Elctrns.	408-435-1000
CA	Santa Clara, Future	408-748-8550
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CT	Wallingford, Control Design	203-269-9955
CO	Denver, Control Design	303-296-1922
CO	Denver, Integrated Elctrns.	303-292-5537
CO	Englewood, Time Elctrns.	303-799-8851
CO	Westminster, Future	303-650-0123
CT	Bethel, Future Elctrns.	203-743-9594
CT	Cheshire, Time Elctrns.	203-271-3200
FL	Altamonte Springs, Control Design	305-788-3220
FL	Clearwater, Future	813-578-2770
FL	Clearwater, General Control, Inc.	813-791-1903
FL	Ft. Lauderdale, Control Design	305-782-1388
FL	Ft. Lauderdale, Hammond	305-973-7103
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Lakeland, AA Elec.	813-665-6941
FL	Orlando, Future	305-767-8414
FL	Orlando, Hammond	305-849-6060
FL	Orlando, Time Elctrns.	305-841-6565
FL	Pompano Bch., Control Deseign	305-782-1388
GA	Columbus, Interstate Elctrl. Supp.	404-324-1000
GA	Norcross, AA Elec.	404-449-8670
GA	Norcross, Future	404-441-7676
GA	Norcross, Time Elctrns.	404-448-4448
GA	Stone Mtn., Control Design	404-979-3502
IL	Addison, L Comp	312-628-1400
IL	Addison, Pyramid Controls	312-543-0110
IL	Algonquin, Marshal Wolf	312-658-8130
IL	Chicago, Control Design	312-307-8944
IL	Chicago, Newark	312-784-5100
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
IN	Indianapolis, Custom Svc. Elctrns.	317-879-9118
IL	Schaumburg, Future	312-882-1255
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MD Baltimore, Resco/Baltimore 301-931-8200
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
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NY Binghamton, Pioneer STD Elctrns. 607-722-9300
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NY Buffalo, Summit Distrs. 716-887-2800
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NY Fairport, Pioneer-Standard Elctrns., Inc. 716-381-7070
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OH Cincinnati, URI Elctrns. 800-582-7080
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OR Portland, Radar Elec. Co. 503-232-3404
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PA King of Prussia, Applied Controls, Inc. 215-265-3832
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PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, Pioneer STD Elctrns. Inc. 412-782-2300
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RI Pawtucket, Major/Edwards 401-725-7400
SC Columbia, Dixie Elctrns. 803-779-5332
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SC Greenville, EMSCO, Div. of Hammond Elctrns. 803-233-4121
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TX Ft. Worth, Allied Elctrns. 817-595-3500
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TX Houston, Norvell Elctrns. 713-462-1666
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TX Stafford, Harrison Equip. 713-879-2600
UT Salt Lake City, Standard Supp. 801-486-3371
WA Kent, Component Resources, Inc. 800-547-6523
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WA Seattle, Radar Elect. Co., Inc. 206-282-2511
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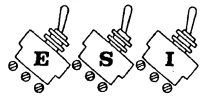
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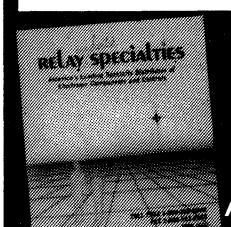
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GTE SUPPLY, GTE SUPPLY, GTE Place D01A37, W. Airfield Dr., DFW Airport, TX 75261, Tel: 800-433-4837, FAX: 214-456-3366; Empl.: 2800

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GTE TESTMARK LABS, GTE Industry Sls., 220 E. Las Colinas Blvd. MC, T11090, Irving, TX 75039, Tel: 214-718-3647, FAX: 214-718-7783; Empl.: 800; *Sls. Mgr.:* Clifton E. Miller

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HALMA ENTERPRISES, Tettex Instruments, 1055 W. Germantown Pike, Fairview Village, PA 19409-0281, Tel: 215-539-6050, FAX: 215-539-8005

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HAMILTON AVNET, 10950 West Washington, Culver City, CA 90230, Tel: 213-558-2645

HAMILTON METALCRAFT, 848 N. Fair Oaks Ave., Pasadena, CA 91103, Tel: 818-795-4811, FAX: 818-795-9705; *Sls. Mgr.:* Mel Stahler

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GA	Norcross, Electramark	404-446-7915
IL	Itasca, LTD Technlgs.	708-773-2900
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IN	Fort Wayne, TMC	219-432-5553
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MA	W. Bridgewater, Coakley, Boyd & Abbett	508-559-6700
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MO	Blue Springs, Palatine Sls.	816-229-4007
MO	Florissant, Palatine Sls.	314-839-0800
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NJ	Marlton, Naudain Assoc.	609-983-5300
NJ	Pinebrook, Coakley, Boyd, Abbett, Metro	201-227-5660
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NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Wantagh, Coakley, Boyd, Abbett, Metro	516-783-4102
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OH	Centerville, Bear Mktg.	513-436-2061
OH	Richfield, Bear Mktg.	216-659-3131
OR	Tigard, Earl & Brown	503-639-2100
PA	Pittsburgh, Bear Mktg.	412-531-2002
TN	Tullahoma, Wallace Elctrn. Sls.	615-455-0501
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TX	Dallas, Allied Comps.	214-238-0408
TX	Hurst, Allied Comps.	817-589-0456
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WI	Watertown, Deaken Tech.	414-261-7600
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Can	Richmond, B.C., Blackwood Elctrn.	604-273-9910

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CA	Torrance, Kent	213-320-2700
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FL	Orlando, Hammond Elctrn.	407-849-6060
IN	Indianapolis, Bell Inds.	317-875-8200
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NC	Greensboro, Hammond Elctrns.	919-272-6391
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AR	Little Rock, Carlton Bates	501-562-9100
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CA	San Jose, Quement Elctrns.	408-998-5900
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CO	Denver, Fistell Elctrns.	303-629-1312
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CT	Danbury, Pilgrim Elec.	203-792-7274
CT	Hartford, Hatry Elec.	203-527-1881
CT	New London, Jan Elctrn. Supp.	203-442-4386
CT	Norwalk, Cobra	203-847-6442
CT	Stratford, Hatry Elec.	203-375-5866
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FL	Orlando, EMSCO	407-849-6060
FL	Tampa, EMSCO	813-253-2684
GA	Atlanta, Ack, Inc.	404-351-6340
GA	Norcross, Whitehead Elctrns.	404-923-6667
GA	Norcross, Wholesale Inds. Elec.	404-447-8431
IL	Bensenville, Magnuson Elctrns.	708-595-7575
IL	Chicago, Newark Elec.	312-784-5100
IL	Joliet, Mainline Elec.	815-436-3900
IL	Niles, Joseph Elec.	708-312-297-4200
IL	Wheeling, Hawk Elec.	708-459-4030
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, Advent Elec.	317-872-4910
IN	Indianapolis, Mar Elec.	317-633-6699
IA	Cedar Rapids, Dee Elec.	319-365-7551
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	New Orleans, W. B. Allen Supp.	504-525-8222
MD	Aberdeen, Harco Elctrns.	301-838-7990
MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Gaithersburg, M. S. Elec.	301-921-0200
MA	Haverhill, Spartan Elctrns.	508-373-1200
MA	Lynn, Land Elec. Supp.	617-592-2220
MA	Needham, Y.D.I.	617-449-1005
MA	Wellesley Hills, Target Elctrns. Supp.	617-235-2545
MA	Woburn, Abbott Elec.	617-935-2040
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, Bergquist	612-835-2322
MN	Minneapolis, Tortec Corp.	612-866-3662
MO	Kansas City, Electronic Supp.	816-931-0250
MO	St. Louis, Van Sickle Radio	314-621-5000
NH	Dover, American Radio Corp.	603-335-3118
NJ	Camden, GRS Elctrns.	609-964-8560
NJ	Edison, Brownell Elctrns.	201-287-2037
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Raritan, Masters Elctrn. Supp.	201-725-3533
NM	Albuquerque, Beta Tron Elctrns.	505-821-1122
NY	Buffalo, Genesee Ind. Elec.	716-873-9661
NY	Buffalo, Summit Dist.	716-887-2800
NY	Commack, Spartan Elctrns.	516-499-9500
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Poughkeepsie, Chief Elctrns.	914-471-1300
NY	Rochester, Goldcrest Elec.	716-546-8464
NY	Rochester, Masline Elec.	716-546-5373
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elec.	315-337-5400
NY	Syracuse, Salina Elec.	315-422-2336
NY	Troy, Trojan Elec.	518-272-4481
NC	Greensboro, Hammond Elec.	919-275-6391
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Roberts Elec.	216-238-1711
OH	Columbus, Thompson Elec. Supp.	614-228-6191
OH	Dayton, Stotts Friedman	513-298-5555
OK	Oklahoma City, Radio, Inc.	405-528-2391
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Toledo, International Co.	503-336-2221
PA	Drexel Hill, Kass Elec.	215-449-2300
PA	McKean, Advacom	814-476-7774
PA	Wayne, Peak Elec.	215-293-9000
RI	Pawtucket, Major Elec. Supp.	401-725-7400
SC	Charleston, Wholsale Inds. Elctrns.	803-722-2634
SC	Greenville, EMSCO	803-233-4121
TN	Knoxville, Bondurant Bros.	615-573-9151
TX	Austin, Galtronics	512-837-7470
TX	Corpus Christi, Douglas Elec.	512-883-5103
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Dallas, Wholesale Elec.	214-969-9400
TX	Ft. Worth, Allied Elec.	817-336-5401
TX	Houston, Electrotex	713-526-3456
TX	Houston, The Altair Co.	713-462-3029
TX	Midland, ESI Supp.	915-694-9657
TX	San Antonio, Altex Elctrns.	512-828-0503
TX	San Antonio, Sherman Elec.	512-224-1001
UT	Salt Lake City, Standard Elec. Supp.	801-486-3371
VA	Annandale, Arcade Elctrns.	703-256-4610
VA	Arlington, Arlington Elctrns.	703-524-2412
VA	Charlottesville, Virginia Elec. Comps.	804-296-4184
VA	Norfolk, Norfolk Wire	804-499-1100
WA	Bellevue, Integrated Elec.	206-455-2727
WI	Mequon, Taylor Elec.	414-241-4321
WI	Oshkosh, Elctrn. Inds.	414-235-8930
WI	Racine, Badger Elctrn. Supp.	414-637-1256

HANCOCK ELECTRONICS CORP., 75 Terry Drive, Hingham, MA 02043, Tel: 617-740-4190, FAX: 617-740-4192; FSC No.: 66851; Empl.: 8; *Sls. Mgr.:* Robert H. Sturdy

HAND HELD PRODUCTS, INC., 8008 Corporate Center Dr., Charlotte, NC 28226, Tel: 704-541-1380, TWX: 810-621-0380 PROTECH, FAX: 704-541-1333; *Sls. Mgr.:* Jim Trautwein; *Dist. Mgr.:* Jim Trautwein

H & L INSTRUMENTS, 1440 Rollins Road, Burlingame, CA 94010, Tel: 415-342-7850, FAX: 415-347-1065; Empl.: 7; *Sls. Mgr.:* Jenifer H. Landman

HANDY & HARMAN ELCTRN. MATLS. CORP., 72 Elm St., N. Attleboro, MA 02760, Tel: 508-695-1401, FAX: 508-695-7565; Empl.: 300; *Sls. Mgr.:* T. Longo

HANKSCRAFT MOTORS, Div. of Gerber Prods. Co., P.O. Box 120, Reedsburg, WI 53959, Tel: 608-524-4341, FAX: 608-524-6779; Empl.: 550

HANOVIA, Canrad, 100 Chestnut St., Newark, NJ 07105, Tel: 201-589-4300, TELEX: 13-8531, FAX: 201-589-4430; Empl.: 250; *Sls. Mgr.:* Dennis M. Priscandaro; *Dist. Mgr.:* Dennis M. Priscandaro

HANSCOM, H. F., CO., INC., 225 Chapman St, Providence, RI 02905, Tel: 401-941-1455, FAX: 401-781-8835; Empl.: 50; *Sls. Mgr.:* John E. Christiansen

HANSEN MANUFACTURING COMPANY, INC., Subsidiary of IMC Magnetics Corp., Box 23, Princeton, IN 47670-0023, Tel: 812-385-3415, FAX: 812-385-3013; Empl.: 400; *Sls. Mgr.:* George A. Gilbert

HANTRONIX

FAX: 408-749-0477

HANTRONIX, INC., Liquid Crystal Display, 250 Santa Ana Ct, Sunnyvale, CA 94086, Tel: 408-736-3191, TELEX: 880165; Empl.: 25; *Sls. Mgr.:* David Kim; *Dist. Mgr.:* Jake B. Yu ..... **B•1078-1079**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Carlsbad, Zerimar Sls.	619-436-3379
CA	Laguna Hills, 4 Star Elctrn. Sls.	714-583-9781
CA	Los Gatos, Luscombe Engrg. of S.F.	408-370-2020
CO	Longmont, Butler Tech. Sls.	303-651-7703
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Farmington, Ray Perron & Co., Inc.	203-673-4825
FL	Melbourne, Synergistic Tech. Sls.	407-242-9661
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Arlington Heights, Phoenix Elctrn. Sls.	708-394-4422
KS	Prairie Village, Crosslink	913-649-7100
MD	Ellicot City, Technology Sls.	301-461-7802
MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MN	Minneapolis, Technical Comp. Grp.	612-536-9512
MO	St. Louis, Reptronics	314-576-9816
NY	Coram, Sylvester Assocs. Sls. Inc.	516-473-2018
NY	Webster, Impaq Elctrns., Inc.	716-265-0995
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Columbus, Scientific Sys.	614-861-0129
OR	Hillsboro, Temco Northwest	503-645-2030
PA	Hatboro, Delta Tech. Sls.	215-957-0600
TX	Austin, RAm Elctrn. Sls., Inc.	512-345-2982
TX	Plano, RAM Elctrn. Sls. Inc.	214-424-4455
WA	Birch Bay, Temco Northwest	206-371-0423
WA	Bothell, Temco Northwest	206-481-6150
WA	Spokane, Temco Northwest	509-927-9392

Local Distributors

CA	Industry, Ital Elctrns Sls.	818-968-8515
CA	Mission Viejo, Opto Plus	714-380-8654
CA	San Jose, Spectra Elctrn. Inc.	408-452-1590
CO	Littleton, Displays Plus	303-730-7333
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
NJ	Rockaway, Tonar Inds., Inc.	201-586-9000
TX	Austin, Omni Pro Elctrns.	512-794-9200
TX	Dallas, Omni Pro Elctrns.	214-233-0500
WI	New Berlin, Classic Comps.	414-786-5300
Can	Nippean, Ont., Carsten Elctrns. Ltd.	613-726-9250
Can	Scottsborough, Ont., Carsten Elctrn. Ltd.	416-495-9999

HARBOUR IND. (CANADA) LTD., 1365 Industriel Blvd., Farnham, Quebec, Canada J2N 2X3, Tel: 514-293-5304, FAX: 514-293-2421; Empl.: 31; *Sls. Mgr.:* Marc Longpre

HARDIGG

FAX: 413-665-4801

HARDIGG INDS., INC., 393 N. Main St. P.O. Box 201, South Deerfield, MA 01373, Tel: 413-665-2163; FSC No.: 11214; Empl.: 200; *Sls. Mgr.:* Stanley J. Morgan ..... **C•1059-1061**

HARDMAN INC. A HARCROS CHEMICAL GROUP COMPANY, 600 Cortlandt St, Belleville, NJ 07109, Tel: 201-751-3000, FAX: 201-751-8407; Empl.: 85

HAROWE SERVO CONTROLS, INC.:A FASCO CO., 110 Westtown Rd. P.O. Box 547, West Chester, PA 19380, Tel: 215-692-2700, TELEX: 685-1176; FSC No.: 06989; Empl.: 300; *Sls. Mgr.:* Clayton A. Walters

HARREL, INC., 16 Fitch St., E. Norwalk, CT 06855, Tel: 203-866-2573; *Sls. Mgr.:* Richard Decew

HARRIS CORP., Dracon Div., 809 Calle Plano, Camarillo, CA 93012, Tel: 805-987-9511, TELEX: 182327; Empl.: 350; *Sls. Mgr.:* Tom Erdmann; *Dist. Mgr.:* Keith Boutillier

HARRIS MICROWAVE SEMICONDUCTOR, Harris Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2222, TWX: 910-338-2247, FAX: 408-432-3268; *Sls. Mgr.:* Vic Kovacevic

HARRIS SEMICONDUCTOR, Box 883, Melbourne, FL 32902, Tel: 305-724-7400, TWX: 510-959-6259; FSC No.: 34371; Empl.: 2300; *Sls. Mgr.:* Gary Pinelli; *Dist. Mgr.:* George Giozinski

HARTING ELEKTRONIK, INC., 2155 Stonington Ave., Ste. 212, Hoffman Estates, IL 60195, Tel: 708-519-7700, FAX: 708-519-9771; Empl.: 15; *Sls. Mgr.:* Donald G. Blummer

HARTLEY PRODUCTS, 1200 N. 23rd St., Ste. 105, Wilmington, NC 28405, Tel: 919-763-7422, FAX: 919-763-7422; *Sls. Mgr.:* R. Schmetterer

HARWIL, 1548 17th St, Santa Monica, CA 90404, Tel: 213-829-2310, FAX: 213-829-2259; Empl.: 10

HASCO COMPONENTS INTERNATIONAL CO., 247-40 Jericho Tpke., Bellrose Village, NY 11001, Tel: 516-328-9292, FAX: 516-326-9125; Empl.: 30; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Christa Mundelos ..... **B•1494-1500, 1707**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AL	Huntsville, Rick Burns Assocs.	800-852-5050
AK	Anchorage, Hasco Comps.	800-852-5050
AZ	Phoenix, Sanford Sls.	602-957-3570
AZ	Phoenix, Sanford Sls.	800-852-5050
CA	Irvine, Groh Assocs.	714-837-9871
CA	Los Angeles, RD&D	800-852-5050
CA	San Francisco, Silicon Valley	800-852-5050
CT	Hartford, Gallagher Assoc.	800-852-5050
GA	Atlanta, Rick Burns Assoc.	800-852-5050
IL	Chicago, Rendell Sls.	312-852-5050
KS	Kansas City, Logsden Assoc.	800-852-5050
LA	New Orleans, TANE	800-852-5050
MA	Framingham, Gallagher	800-852-5050
MO	Kansas City, Logsdan	800-852-5050
NM	Albuquerque, Sanford	800-852-5050
NY	Port Washington, Ashtec	800-852-5050
NY	Rochester, Andres	800-852-5050
NC	Raleigh, Rick Burns Assoc.	800-852-5050
OH	Cleveland	800-852-5050
TX	Dallas, Sls. Assoc.	800-852-5050
VA	Charlottesville, Pacesetter	800-852-5050
WA	Seattle, Jensen Sls.	800-852-5050
WI	Milwaukee, Rendell Sls.	800-852-5050

HATHAWAY CORPORATION:MOTION CONTROL DIV., 10837 E. Marshall, Tulsa, OK 74116, Tel: 918-438-7800, FAX: 918-438-7629; Empl.: 80; *Sls. Mgr.:* David Richards

Local Sales Offices & Reps

CA	Los Angeles, Hathaway: Motion Control Div.	213-398-5369
MA	Boston, Hathaway:Motion Control Div.	617-469-5054

HAUMAN, INC., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, TELEX: 510-101-2820, TWX: 408-434-9832; *Sls. Mgr.:* Willis Yeh ..... **D•1782-1783**

Local Sales Offices & Reps

AL	Huntsville, B & C Instruments, Inc.	205-883-6530
CA	Canoga Pk., RAG Elctrns., Inc.	818-998-6500
CA	San Diego, Instr. Engrs.	619-268-8344
CO	Broomfield, Instr. Repair Labs.	303-469-5375
CT	Newtown, Connecticut Cal Labs	203-270-1263
FL	Tampa, Tampa Instrmn.	813-623-3979
GA	Norcross, Allied Elctrns.	404-446-8595
IN	Indianapolis, Loren Green	317-293-9827
MN	Minneapolis, Tonka Tech. Labs.	612-593-1770
NY	Great Neck, Instr. Mart	516-487-7430
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OR	Portland, Westcon Inc.	503-283-0132
PA	New Hope, John Bell	215-862-3762
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Garland, Tucker Elctrns.	214-348-8800
WA	Bellevue, Vetco	206-869-7025

Local Distributors

AK	Anchorage, Alaska Elctrnc. Supp.	907-563-3774
MD	Columbia, Allied Elctrns.	301-381-1560
PA	Pittsburgh, Allied Elctrns.	412-367-4124
WA	Seattle, Allied Elctrns.	206-547-2827

HAVERLY SYSTEMS, INC., 12 Hinchman Ave., Box 919, Denville, NJ 07834, Tel: 201-627-1424, FAX: 201-625-2296; Empl.: 33; *Sls. Mgr.:* Ken Spencer

HAYDON SWITCH & INSTRUMENT, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-756-7441, TELEX: 643852-HSIINTLWBY, FAX: 203-756-8724; FSC No.: 02005; Empl.: 100

HAYES INSTRUMENT SERVICE INC., 530 Boston Rd., Billercia, MA 01821, Tel: 508-663-4800, FAX: 508-663-3812; Empl.: 45; *Sls. Mgr.:* Alan Brown; *Dist. Mgr.:* Alan Brown

HBM, INC., 19 Bartlett Street, Marlboro, MA 01752, Tel: 508-624-4500, FAX: 508-485-7480; Empl.: 200; *Sls. Mgr.:* Robert Gray

HBS EQUIPMENT CORPORATION, 3000 Supply Ave., Los Angeles, CA 90040, Tel: 213-726-3033, FAX: 213-888-9982; Empl.: 60; *Sls. Mgr.:* Mark Pedersen

HC Power, inc.

FAX: 714-261-6584

HC POWER INC., 17032 Armstrong Ave., Irvine, CA 92714-5716, Tel: 714-261-2200; FSC No.: 0D6P8; *Sls. Mgr.:* Jack Graham ..... **D•1784-1785**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Phoenix, Morrison & Fern	602-296-8181
CA	Laguna Hills, Electro Venture	714-581-9244
CA	Santa Clara, Electro Venture	408-727-1553
CA	Woodland Hills, Electro Venture	818-884-6574
CO	Englewood, Taylor Mktg.	303-850-0207
CO	Littleton, Taylor Mktg.	303-850-0207
FL	Largo, Graham Assoc.	813-539-6779
FL	Melbourne, Graham Assoc.	407-773-6631
FL	Orlando, Graham Assoc.	407-299-1001
FL	Palm Beach Gardens, Graham Assoc.	407-622-4049
FL	Winter Garden, Graham Assoc.	407-656-9369
IL	Barrington, Omni	708-381-9087
IN	Indianapolis, JC Hofstetter	317-897-7914
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Franklin, OEM Mktg. & Sls.	508-528-4983
MN	Minneapolis, Electro-Serv	612-338-3475
MO	St. Louis, The Beams Co.	314-434-8448
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NC	Winston-Salem, Murcota	919-722-9445
OH	Dayton, JC Hofstetter	513-296-1010
OH	Medina, JC Hofstetter	216-725-4477
OR	Portland, Power Factor Assocs.	503-233-6969
PA	Pittsburg, JC Hofstetter	412-356-2305
TX	Dallas, Dynamark	214-437-3333
UT	Ogden, Taylor Mktg.	801-546-9570
NY	Spring Valley, Powertronics	914-735-3775
Can	Lachine, Digidyne	514-631-1891
Can	Napean, Digidyne	613-727-5632
Can	Toronto, Digidyne	416-674-0444

HDR POWER SYSTEMS, INC., 4242 Reynolds Dr., Hilliard, OH 43026, Tel: 614-771-5500, FAX: 614-771-7219; Empl.: 90; *Sls. Mgr.:* Harlan W. Bates

HDS INC., 12310 Pinecrest Rd., Reston, VA 22091, Tel: 703-620-6200, TELEX: 64585, FAX: 703-620-3169; Empl.: 120

H D SYSTEMS, INC., 89 Cabot Court, Hauppauge, NY 11788, Tel: 516-231-6630, FAX: 516-231-6803; Empl.: 5; *Sls. Mgr.:* Tetsuo Ikuta

HEADWAY RESEARCH, INC., 3713 Forest La., Garland, TX 75042, Tel: 214-272-5431, FAX: 214-272-7817; Empl.: 45

HEATH CO., Hilltop Road, St. Joseph, MI 49085, Tel: 616-982-3200, TELEX: 72-9421; Empl.: 2000

HEAT SYSTEM, INC., 1938 New Hwy., Farmingdale, NY 11735, Tel: 516-694-9555, TELEX: 825-339; Empl.: 35; *Sls. Mgr.:* Irwin Leibson

HEDRICH USA, INC., 684 N. Spence Ave., Goldsboro, NC 27534, Tel: 919-751-1144, FAX: 919-751-0215

HEEGER, INC., 6400 Fleet St., City of Commerce, CA 90040, Tel: 213-728-5108, 728-4729, 728-6913, FAX: 213-728-4740; Empl.: 10; *Sls. Mgr.:* Robert A. Heeger

HEI CORPORATION, P.O. Box 88806, Carol Stream, IL 60188, Tel: 708-665-5500, FAX: 708-665-5769; Empl.: 20

HEIDENHAIN CORP., 115 Commerce Dr., Schaumberg, IL 60173, Tel: 708-490-1191, FAX: 708-490-3931; Empl.: 72; *Sls. Mgr.:* Thomas Wyatt; *Dist. Mgr.:* Rick Glos

HEI, INC., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, Tel: 612-443-2500, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 200; *Sls. Mgr.:* Leonard Klun ..... **A•1726**

Local Sales Offices & Reps

MN Victoria, HEI Inc. 612-443-2500

HEI, INC., Optoelectronics Div., 1495 Steiger Lake La.,P.O.Box 5000, Victoria, MN 55386, Tel: 612-443-2500, TWX: 510-601-7785, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 150; *Sls. Mgr.:* Dale Nordquist

HEINEMANN ELECTRIC CO., 2630 Brunswick Pike, Aft. Rte. 1, P.O. Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-882-4800, TELEX: 843431; FSC No.: 74193; Empl.: 350 ..... **B•1368-1371**

Local Sales Offices & Reps

AZ Phoenix, O'Donnell Assocs. SW 602-944-9542
CA San Diego, O'Donnell Assocs., Inc. 619-578-1645
CA San Jose, O'Donnell Assocs. No. 408-456-2950
CA Torrance, O'Donnell Assocs., Inc. 213-539-9664
CO Englewood, CompuTech Mktg. 303-773-3981
FL Oviedo, Conley & Assocs. 407-365-3283
FL Wellington, Conley & Assocs., Inc. 407-790-3926
GA Duluth, Dixie Mktg. 404-381-5592
IL Northbrook, D. Dolin Sls. 708-498-6770
IN Ft. Wayne, O.H. Bromberg & Assocs. .. 219-456-6010
IA Hiawatha, Ard Sls. Co. 319-393-6392
KY Alexandria, O.H. Bromberg & Assoc. .. 606-635-3063
KY Louisville, O.H. Bromberg & Assocs. .. 502-456-1498
MD Upperco, Imagitron Sls. Co., Inc. 301-374-5600
MA Southboro, Sullivan Tech. Sls. 617-485-2215
MI Southfield, L. H. Dickelman Co. 313-353-8210
MN Minneapolis, Furber Sls. Co., Inc. 612-881-3620
MO Kansas City, Hill & Co. 816-361-1669
MO St. Louis, Hill & Co. 314-432-1136
NJ Ridgewood, Ballou, Inc. 201-444-6990
NM Albuquerque, O'Donnell Assocs. SW .. 505-889-4522
NY Farmington, R. M. Scanlon & Assocs. 716-924-7450
NY Syracuse, R.M. Scanlon & Assoc., Inc. 315-463-7682
NC Charlotte, J. Rudisill Assocs. 704-377-6901
OH Cleveland, Brown Elect. Prod. 216-331-2072
OH Dayton, KW Elctrn. Sls. 513-890-2150
OH Dayton, O. H. Bromberg & Assocs. 513-434-8788
FL Wellington, Conley & Assoc., Inc. 305-790-3926
NJ Lawrenceville, DVS Co. 609-896-1112
PA Pittsburgh, KW Electrn. Sls. 412-366-9396
TX Dallas, Glidden Electro Equip. 214-341-0610
TX Houston, Glidden Electro Equip. 713-681-1415
WI Milwaukee, Key Entpr. 414-762-2323

Local Distributors

AL Montgomery, Southern Controls 205-277-5030
CA Chatsworth, POCO Sls. 818-700-8727
CA Inglewood, Newark Elctrns. 213-671-7066
CA Los Angeles, Master Distrs. 213-452-1229
CA Oakland, Brill Elctrns. 415-834-5888
CA San Carlos, Campbell & George 415-594-1994
CA Santa Clara, Cypress Elctrns. 408-980-8400
CA Van Nuys, Fuses, Unltd. 818-786-8111
CO Aurora, Jet Elctrns. 303-364-1000
CO Denver, CSID Inc. 303-292-9594
CO Denver, Newark Elctrns. 303-757-3351
CT Hartford, L. E. Whelan Co. 203-296-5000
CT Wallingford, Green Shaw Co. 203-265-3333
FL Oviedo, Dixie Sls. 407-365-5211
GA Atlanta, Georgia Control Cen. 404-876-8833
IL Chicago, Newark Elctrns. 312-784-5100
IL Morton Grove, Nedco Elctrns. 312-967-0500
IL Northbrook, Classic Comps. Supp. 312-272-9650
IN Indianapolis, Bell Inds. 317-875-8200
KS Edwardville, C. Tennant & Sons 913-441-1801
MD Columbia, DK Elctrns., Inc. 301-995-1950
MD Crofton, Custom Marine Svcs. 301-793-3955
MA Needham, Power Electro Supp. 617-444-6866
MA Newton, Green Shaw Co. 617-969-8900
MA Woburn, Apparatus Svc. 617-933-5999
MI Oak Pk., Newark Elctrns. 313-967-1570
MI Southfield, Michigan Lectrols Corp. ... 313-353-1350
MN Minneapolis, Newark Elctrns. 612-331-6350
MO Maryland Heights, Lcomp, Inc. 314-291-6200
NH Hudson, Bell Inds. 508-474-8880
NJ Lawrenceville, Riverside Comps. Supp. 609-896-1611
NY Johnson City, Help Elctrns., Inc. 607-729-3528
NY Ronkonkoma, Arrow Elctrns. 516-467-1000
NY Roslyn, I/O Corp. of NY 516-625-1040
NY Whitestone, Power Electro Supp. Co. 212-767-1447
NC Charlotte, Motionex Inc. 704-377-1555
NC Raleigh, Greene-Shaw Co. 919-954-7138
OH Cleveland, I/O Corp. of Cleveland 216-642-7300
OH Dayton, Duellman Elec. 513-461-8000
OH Dayton, Stotts Friedman Co. 513-298-5555
PA Pittsburgh, Circuit Breakers, Inc. 412-366-9542
OH Shandon, Cartessa Corp. 513-738-4477
OH Valley View, Newark Elctrns. 216-447-8860
OR Portland, Taylor Elec. 503-233-5321
PA Conshohocken, I/O Corp. of Phila. 215-825-4610
PA Erie, REM Elctrns. 814-453-5626
PA West Chester, West Chester Elec. & Electrn. 215-696-7500
TN Chattanooga, Techni-Tronics, Inc. 615-332-2119
TX Dallas, Geeco Sls. Co. 214-341-2626
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elctrns. 713-782-4800
VA Ashland, Hanover Controls & Supp. Corp. 804-550-2449
VA Charlottesville, Va. Elctrn. Comps. 804-296-4184
WA Seattle, H. C. Campbell Co. 206-433-1900
WI Milwaukee, Hunt Co. 414-383-1781

HEITZ, KARL, INC., P.O. Box 427, Woodside, NY 11377, Tel: 718-565-0004, FAX: 718-565-2582; Empl.: 15

HELICAL PRODS. CO., INC., Box 1069, Santa Maria, CA 93456-1069, Tel: 805-928-3851, FAX: 805-928-2369; FSC No.: 13201; Empl.: 85; *Sls. Mgr.:* John Ricker

HELM INSTRUMENT CO., INC., 1387 Dussel Drive, Maumee, OH 43537, Tel: 419-893-4356, FAX: 419-893-1371; Empl.: 55; *Sls. Mgr.:* M. Wilhelm; *Dist. Mgr.:* N. Phillips

HELWIG CARBON PRODUCTS, INC., 8900 W. Tower Ave., Milwaukee, WI 53224, Tel: 414-354-2411, FAX: 414-354-2421; FSC No.: SIC 3624; Empl.: 280; *Sls. Mgr.:* John E. Koenitzer

HERBERT PRODS. INC., 180 Linden Ave., Westbury, NY 11590-0384, Tel: 516-334-6500, TWX: 510-222-5963, FAX: 516-334-6538; Empl.: 94; *Sls. Mgr.:* B. J. Simmons

HERGA INC. HERGA ELECTRIC LIMITED, 602 Brandywine Parkway, West Chester, PA 19380, Tel: 215-430-1970, FAX: 215-430-7785; Empl.: 5

HERITAGE METAL FINISHING INC., 800 S. Market St. P.O. Box 446, Elizabethtown, PA 17022, Tel: 717-367-1561, FAX: 717-367-2474; Empl.: 43; *Sls. Mgr.:* Terry L. Rinesmith ..... **D•2235**

Local Sales Offices & Reps

PA Elizabethtown, Heritage Metal Finishing Inc. 717-367-1561

HERMETIC SEAL CORP., 4232 Temple City Blvd., Rosemead, CA 91770, Tel: 213-283-0411, TWX: 910-587-3352, FAX: 818-443-6610; FSC No.: 04820; Empl.: 200

HERMETIC SWITCH, Box 1325, Hwy. 92, Chickasha, OK 73018, Tel: 405-224-4046, TELEX: 796125 Hermetic CKSA, FAX: 405-224-9423; FSC No.: 65623; Empl.: 150; *Sls. Mgr.:* R. Helms, Kim Baker .... **B•1708, 1904-1905**

Local Sales Offices & Reps

CA Arcadia, V. Gott & Assocs. 818-445-9729
CA San Diego, V. Gott & Assocs. 619-489-0893
GA Atlanta, Electro Technlg. Prods. 404-262-1522
IL Lemont, Trend-Tronics, Inc. 708-972-1166
KS Lenexa, Midtec Assocs. 913-541-0505
MA Canton, New England Elctrn. Sls. 617-828-4835
MN Minneapolis, Peterson Sls. & Assocs. 612-835-5281
MO St. Louis, Midtec Assocs. 314-275-8666
NY Oceanside, Current Inds. 516-678-3895
OR Beaverton, LD Elctrns. 503-684-8221
PA Furlong, Avenir 215-348-8290
TX Austin, R. F. Kimball Co. 512-443-5284
TX Houston, R. F. Kimball Co. 713-890-8810
TX Richardson, R. F. Kimball Co. 214-231-3447
WA Snohomish, LD Elctrns. 206-568-0511
WA Spokane, LD Elctrns. 509-922-4883

Local Distributors

TX Ft.Worth, Allied Elctrns. Inc. 817-595-3500

HERSEY MEASUREMENT CO., A Miller Industries Co., P.O. Box 4585, Spartanburg, SC 29305, Tel: 803-574-8960, 1-800-845-2102, FAX: 803-578-7308; Empl.: 80; *Sls. Mgr.:* Don McLellan

HERSTAL AUTOMATION LTD., 3171 W. Twelve Mile, Berkley, MI 48072, Tel: 313-548-2001, FAX: 313-548-2010; Empl.: 14; *Sls. Mgr.:* Randall M. Elliott

HERTNER DIV.:EXIDE CORP., 12690 Elmwood Ave., Cleveland, OH 44111, Tel: 216-252-4242, FAX: 216-941-4330; FSC No.: 28398; Empl.: 100; *Sls. Mgr.:* R.C. Wright

HERTZ FILTER, 3 Aerial Way, Syosset, NY 11791, Tel: 516-822-4770; Empl.: 22

HEURISTICS INCORPORATED, 9845 Horn Rd., Ste. 170, Sacramento, CA 95827, Tel: 916-369-6606, TELEX: 4940010, FAX: 916-369-6175; Empl.: 70; *Sls. Mgr.:* Mike McMann, Genl. Mgr.

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Local Sales Offices & Reps

AL	Birmingham	205-988-0547
AL	Huntsville	205-830-2000
AK	Anchorage	907-563-8855
AZ	Phoenix	602-273-8000
AZ	Tucson	602-573-7400
AR	Little Rock, Hewlett-Packard Co.	501-225-7178
CA	Calabasas	818-880-3400
CA	Carson	213-834-6312
CA	Foster City	415-378-8400
CA	Fresno	209-252-9652
CA	Fullerton	714-999-6700
CA	Goleta	805-685-6100
CA	Irvine	714-472-3000
CA	Los Angeles	213-337-8000
CA	Mountain View	415-694-2000
CA	N. Hollywood	818-509-2300
CA	Pleasanton	415-460-0282
CA	Sacramento	916-929-7222
CA	San Diego	619-279-3200
CA	San Francisco	415-882-6800
CA	Santa Clara	408-988-7000
CA	Santa Rosa	707-578-8888
CA	Ventura	805-658-6898
CO	Boulder	303-938-3065
CO	Englewood	303-649-5000
CT	Darien	203-656-0040
CT	Glastonbury	203-633-8100
FL	Ft. Lauderdale	305-938-9800
FL	Jacksonville	904-296-0252
FL	Melbourne	407-729-0704
FL	Orlando	407-859-2900
FL	Pensacola	904-476-8422
FL	Tampa	813-884-3282
GA	Atlanta	404-955-1500
GA	Norcross	404-448-1894
HI	Honolulu	808-526-1555
ID	Boise	208-323-2700
IL	Bloomington	309-662-9411
IL	Chicago	312-930-0010
IL	Naperville	708-505-8800
IL	Rolling Meadows	708-255-9800
IN	Carmel	317-844-4100
IN	Ft. Wayne	219-482-4283
IA	Cedar Rapids	319-393-0606
IA	West Des Moines	515-224-1435
KS	Wichita	316-636-4040
KY	Louisville	502-426-0100
LA	St. Rose	504-467-4100
MD	Baltimore	301-644-5800
MD	Rockville	301-948-6370
MA	Andover	508-682-1500
MA	Burlington	617-270-7000
MI	Flint	313-733-6556
MI	Grand Rapids	616-957-1970
MI	Novi	313-349-9200
MI	Troy	313-362-5180
MN	St. Paul	612-644-1100
MO	Kansas City	816-737-0071
MO	St. Louis	314-542-1500
MT	Billings	406-259-5615
NE	Omaha	402-493-0300
NV	Las Vegas	702-792-3900
NJ	Paramus	201-599-5000
NJ	Piscataway	201-562-6100
NM	Albuquerque	505-823-6100
NM	Los Alamos	505-662-6700
NY	Albany	518-458-1550
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NY	Fairport	716-223-9950
NY	Liverpool	315-451-1820
NY	Manhattan	212-971-0800
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NY	Purchase	914-935-6300
NY	Wappinger Falls	914-298-9125
NC	Cary	919-467-6600
NC	Charlotte	704-527-8780
NC	Greensboro	919-665-1800
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OH	Cincinnati	513-891-9870
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OH	Strongsville	216-243-7300
OH	Toledo	419-242-2200
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OK	Oklahoma City	405-946-9499
OK	Tulsa	918-481-6700
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PA	Harrisburg	717-657-5900
PA	Pittsburgh	412-782-0400
PA	Valley Forge	215-666-9000
SC	Columbia	803-732-0400
SC	Greenville	803-232-8002
TN	Knoxville	615-966-4747
TN	Memphis	901-763-4747
TN	Nashville	615-255-1271
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TX	Corpus Christi	512-289-8271
TX	El Paso	915-833-4400
TX	Houston	713-776-6400
TX	Irvine	214-869-3377
TX	McAllen	512-630-3030
TX	Richardson	214-231-6101
TX	San Antonio	512-494-9336
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VA	Chesapeake	804-424-7105
VA	Falls Church	703-204-2100
VA	Glen Allen	804-747-7750
VA	Roanoke	703-774-3444
WA	Bellevue	206-643-4000
WA	Spokane	509-922-7000
WV	Charleston	304-925-0492
WI	Brookfield	414-792-8800
Can	Burlington, Ont.	416-335-8644
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Can	Dartmouth, Nova Scotia	902-468-4725
Can	Edmonton, Alberta	403-486-6666
Can	Kirkland, Que.	514-697-4232
Can	London, Ont.	519-686-9181
Can	Markham	410-479-1770
Can	Mississauga, Ont.	416-678-9430
Can	Ottawa, Ont.	613-820-6483
Can	Quebec City, Que.	418-648-0726
Can	Richmond, B.C.	604-270-2277
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HEYCO

FAX: 908-245-3238

HEYCO MOLDED PRODUCTS, INC., Box 160, Kenilworth, NJ 07033, Tel: 908-245-0033, 800-526-4182; FSC No.: 28520; Empl.: 135 ..... **C•1758**

Local Distributors

CA	Garden Grove, HW Eckhardt	800-221-8761
CA	Hayward, Arow Fasteners	800-227-2901
CA	Riverside, Elctrns. Supp.	714-787-9220
CA	San Jose, Pro Fasteners	408-943-9177
IL	Shaumberg, Engrd. Fasteners	312-980-4082
IN	Elkhart, La Vanture Prods. Co.	219-264-0658
MD	Baltimore, Jandorf Elec. & Mfg.	301-358-5550
MA	Newton, In-Stock Prods.	617-964-6200
MN	St. Paul, Arden Fasteners	612-483-6681
MO	St. Louis, Engrd. Fastener Co.	314-434-2888
NY	Amityville, Yorkville Inds. Inc.	516-225-2100
OK	Oklahoma City, Wesco	405-232-5521
TN	Nashville, Arden Fasteners	615-889-7043
TX	Houston, Rainbow	713-957-0500
WI	Waukesha, Cable Comps.	800-558-4388

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HH CONTROLS CO., INC., 16 Frost St., Arlington, MA 02174, Tel: 617-646-2626; Empl.: 13

HIBBING ELECTRONICS CORP., 3125 E. 14th St., Hibbing, MN 55746, Tel: 218-263-8971, FAX: 218-263-8970; Empl.: 440; *Sls. Mgr.:* Michael Walsh

HICKOK ELECTRICAL INSTRUMENT COMPANY, 10514 Dupont Ave., Cleveland, OH 44108, Tel: 216-541-8060, FAX: 216-761-9879; FSC No.: 28569; Empl.: 230; *Sls. Mgr.:* Bob Fiorille

HICO HORIZONS INTL. CO., See Maxon Precision Motors

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HIGH ENERGY, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365, Tel: 215-593-2800, TELEX: 759888, FAX: 215-593-2985; FSC No.: 21052; Empl.: 50; *Sls. Mgr.:* Joseph F. Quinn

HIGHLAND TECHNOLOGY, INC., 320 Judah Street, San Francisco, CA 94122, Tel: 415-753-5814, FAX: 415-753-3301; Empl.: 8; *Sls. Mgr.:* Hugh Callahan

HIGH REL BURN-IN, Riverside Assoc. Inc., 1710 Ringwood Ave., San Jose, CA 95131, Tel: 408-437-5900, FAX: 408-437-1418; FSC No.: 4Y548; Empl.: 30; *Sls. Mgr.:* Judy King

HIGH TECHNOLOGY SENSORS, INC., 262 E. Hornbeam Dr., Longwood, FL 32779, Tel: 407-884-7722; Empl.: 7; *Sls. Mgr.:* R. M. Mindock

HIGH VOLTAGE SYSTEMS, INC., P.O. Box 649, Chappaqua, NY 10514, Tel: 914-238-9057, FAX: 914-238-9057; Empl.: 15; *Sls. Mgr.:* Vincent A. Gianguzzi

HVT

FAX: 914-968-0347

HIGH VOLTAGE TECHNOLOGY INC., 71 Alexander St., Yonkers, NY 10701, Tel: 914-423-6636; Empl.: 12; *Sls. Mgr.:* Edith Schmelzer ..... **D•1788-1791**

Local Sales Offices & Reps

CA	El Cajon, Atronix Technlg. Inc.	619-444-1501
CA	Solvang, Atronix Technlg. Inc.	805-686-4366
NJ	Hillside, Irwin Brill	201-677-0653
NM	Albuquerque, IMEC	505-883-9010

Local Distributors

Intl	Yokohama, Japan, Hivic Inc.	044-64-3294
Can	Ontario, QPL Elctrns.	416-674-8858

HILEVEL TECHNOLOGY, 31 Technology Drive, Irvine, CA 92718, Tel: 714-727-2100, TELEX: 655316, FAX: 714-727-2101; Empl.: 82; *Sls. Mgr.:* Dan Riordan

HILTON INDUSTRIES, INC., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232, Tel: 813-371-2600, FAX: 813-371-7750; Empl.: 137; *Sls. Mgr.:* Larry Copenhaver; *Dist. Mgr.:* Larry Copenhaver

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Local Sales Offices & Reps

AL	Birmingham, Spader & Assocs.	205-979-5500
AZ	Litchfield Pk., S.W. Elctrl. Sls.	602-935-7292
CA	San Diego, RDX Corp.	619-581-0077
CA	San Dimas, RDX Corp.	714-599-0985
CA	Sunnyvale, RDX Corp.	408-734-4500
CO	Parker, Equal Elec. Inc.	303-841-8982
CT	Branford, Abbott Allison Co.	203-481-0405
FL	Daytona Bch. Shores, W. Rihm Assocs.	904-761-7130
GA	Atlanta, Productive Technlg.	404-939-7027
HI	Honolulu, B. F. Wittenberg	808-696-5538
IL	Hawthorne Woods, Ryan & Assocs.	708-438-2905
MO	St. Louis, Fitzgerald Sls. Co.	314-862-1660
MN	Minnetonka, Lee-Noonan Co.	612-938-1112
NJ	Union, Friedman Assocs., Inc.	201-964-6200
NM	Albuquerque, Brytec Sls. Inc.	505-884-1123
NY	Le Roy, Hasgo Power Equip.	716-768-8500
OH	Vermilion, Robert S. Howley	216-967-8787
PA	Downingtown, Kenn Ebert-Hipotronics	215-269-5898
UT	Salt Lake City, Riter Engrg. Co.	801-973-9063
WA	Redmond, Gore Elec. Co.	206-883-4505
PR	Santurce, Mario R. Franceschini Inc.	809-725-7080
Can	Burnaby, B.C., C. D. Nova	604-430-5612
Can	Halifax, N.S., D. C. Keddy Ltd.	902-453-1711
Can	Quebec, J46 1L9, Tremcour Elctrn.,Inc.	514-522-7757
Can	Weston, Ont., U-Tek Svcs. & Supp.	416-747-1879

HI-Q CRYSTALS, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-4544, TWX: 910-743-0029, FAX: 913-764-6400; Empl.: 20; *Sls. Mgr.:* Abdul Ghafoor ..... **A•1372**

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CT	Bridgeport, Park Distrs.	203-366-7200
IL	Bensenville, Magnuson Elctrns.	312-595-7575
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MA	Canton, EPC Elctrns., Inc.	617-821-2111
NJ	Union, Meridian Supp. Co.	201-687-6220
NY	Bohemia, Key Comps., Inc.	516-567-7500
NY	Mamaroneck, Rye Inds., Inc.	914-698-0080
OH	Highland Hgts., Major Electronix, Inc.	216-461-2100
SC	Spartanburg, Harley's Whlsle. Elctrns.	803-585-4860
TX	Richardson, Centurion Mktg.	214-783-6762

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Local Sales Offices & Reps

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FL	St. Petersburg, MacKay, Smith & Assocs.	813-530-1873
GA	Atlanta, MacKay, Smith & Assocs.	404-496-9913
KS	Shawnee Mission, Florence & Meyer	913-722-5210
MO	St. Louis, Florence & Meyer	913-722-5210
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
NC	Raleigh, MacKay, Smith & Assocs.	919-847-2277
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TX	Irving, AID Elctrns.	214-259-4761

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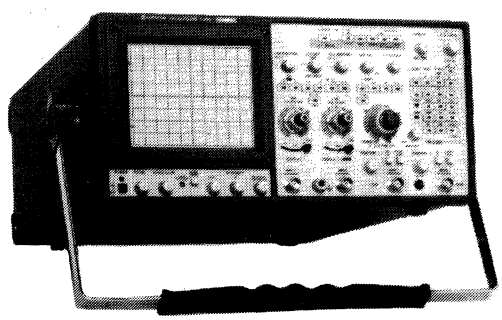
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CT	Wallingford, Technlg. Sls., Inc.	203-269-8853
FL	Orlando, Technlg. Mktg. Assoc.	407-857-3760
GA	Atlanta, Technlg. Mktg. Assoc.	404-446-3565
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MN	Bloomington, Tek Rep Inc.	612-832-0277
NJ	Teaneck, Strategic Sls., Inc.	201-833-0099
NM	Albuquerque, System Sls. of AZ	505-889-2901
NY	Fairport, Technlg. Sls., Inc.	716-223-7500
NC	Raleigh, Robert Elctrn. Sls.	919-878-4465
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OK	Tulsa, West & Assocs.	918-665-3465
OR	Portland, Crown Elctrns.	503-620-8320
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UT	Murray, Parker Webster	801-266-9939
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WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Mississuaga, Ont., Longman Sls.	416-670-8100
	Local Distributors	
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AZ	Phoenix, Sterling	602-268-2121
CA	Angora Hills, Western Micro	818-707-0377
CA	Chatsworth, Marshall	818-407-4100
CA	Irvine, ITT	714-727-4001
CA	Irvine, Marshall	714-458-5301
CA	Irvine, Western Micro	714-637-0200
CA	Sacramento, IEC	916-424-5297
CA	San Diego, Marshall	619-578-9600
CA	San Jose, IEC	408-435-1000
CA	San Jose, ITT	408-453-1404
CA	San Jose, Marshall	408-942-4600
CA	Saratoga, Western Micro	408-725-1660
CO	Denver, IEC	303-292-6121
CO	Denver, Marshall	303-451-8383
CO	Englewood, Sterling	303-792-3939
CT	Milford, Milgray	203-878-5538
CT	Wallingford, Cronin	203-265-3134
CT	Wallingford, Marshall	203-265-3822
FL	Deerfield Beach, Vantage	305-429-1001
FL	Ft. Lauderdale, Marshall	305-977-4880
FL	Ft. Lauderdale, Reptron	305-735-1112
FL	Orlando, Marshall	407-767-8585
FL	Orlando, Milgray	407-647-5747
FL	Tampa, Reptron	813-855-4656
GA	Atlanta, Marshall	404-923-5750
GA	Atlanta, Milgray	404-446-9777
GA	Norcross, Reptron	404-446-1300
IL	Arlington Hgts., Milgray	312-253-1212
IL	Chicago, Marshall	312-490-0155
IL	Hoffman Estates, IEC	312-843-2040
IL	Schaumburg, Reptron	312-882-1700
IN	Indianapolis, Marshall	317-297-0483
KS	Kansas City, Marshall	913-492-3121
KS	Kansas City, Milgray	913-236-8800
KS	Kansas City, Sterling	913-492-5406
MD	Baltimore, Resco	301-529-0500
MD	Columbia, Milgray	301-995-6169
MD	Columbia, Vantage	301-720-5100
MD	Silver Springs, Marshall	301-622-1118
MA	Boston, Western Micro	508-273-2800
MA	Needham, Cronin	617-449-5000
MA	New England, Milgray	508-657-5900
MA	Wilmington, Marshall	508-658-0810
MI	Livonia, Marshall	313-525-5850
MI	Livonia, Reptron	313-525-2700
MN	Minneapolis, Marshall	612-559-2211
MN	Minneapolis, Sterling	612-831-2666
MN	Minnetonka, Reptron	612-938-0000
MO	St. Louis, Marshall	314-291-4650
NJ	Clifton, Vantage	201-777-4100
NJ	Mt. Laurel, Marshall	609-234-9100
NJ	N. New Jersey, Marshall	201-882-0320
NJ	Parsippany, Milgray	201-335-1766
NJ	S. Plainfield, Sterling	201-769-7000
NM	Albuquerque, Sterling	505-884-1900
NY	Binghamton, Marshall	607-798-1611
NY	Farmingdale, Milgray	516-420-9800
NY	Long Island, Marshall	516-273-2424
NY	Rochester, Marshall	716-235-7620
NY	Rochester, Milgray	716-235-0830
NY	Smithtown, Vantage	516-543-2000
NC	Raleigh, Marshall	919-878-9882
OH	Dayton, Marshall	513-898-4480
OH	Solon, Marshall	216-248-1788
OH	Worthington, Reptron	614-436-6675
OK	Tulsa, Sterling	918-663-2410
OR	Beaverton, IEC	503-641-1690
OR	Beaverton, Western Micro	503-629-2087
OR	Portland, Marshall	503-644-5050
TX	Austin, Marshall	512-837-1991
TX	Austin, Sterling	512-836-1341
TX	Dallas, Marshall	214-233-5200
TX	Dallas, Sterling	214-243-1600
TX	Houston, Marshall	713-895-9200
TX	Houston, Sterling	713-627-9800
UT	No. Salt Lake City, IEC	801-298-1869
UT	Salt Lake City, Marshall	801-485-1551
UT	Salt Lake City, Milgray	801-272-4999
VA	Richmond, Sterling	804-226-2190
VA	Washington/ Baltimore, Sterling	703-742-8400
WA	Bellevue, IEC	303-292-5537
WA	Redmond, Western Micro	206-881-6737
WA	Seattle, Marshall	206-747-9100
WI	Milwaukee, Marsh	414-475-6000
WI	Waukesha, Marshall	414-797-8400
Can	Alberta, ITT	403-251-5888
Can	Alberta, ITT	403-451-4001
Can	British Columbia, ITT	604-192-8866
Can	British Columbia, Space Elctrns.	604-294-1167
Can	Manitoba, ITT	204-786-8401
Can	New Brunswick, ITT	506-857-8011
Can	Ontario, ITT	613-226-7406
Can	Ontario, ITT	416-736-1148
Can	Ontario, Space Elctrns.	416-638-4771
Can	Ontario, Space Elctrns.	613-820-8313
Can	Prince Edward Island, ITT	902-465-2350
Can	Quebec, ITT	514-335-7697
Can	Quebec, Space Elctrns.	514-697-8676
Can	Saskatchewan, ITT	306-933-2888

HITACHI AMERICA, LTD., 220 White Plains Rd., Tarrytown, NY 10591, Tel: 914-631-0600, TELEX: 234553, FAX: 914-631-0672; *Sls. Mgr.:* William Porter; *Dist. Mgr.:* John McDonnell

HITACHI DENSHI AMERICA LTD., Test & Meas. Div., 150 Crossways Pk. Dr., Woodbury, NY 11797, Tel: 516-921-7200, FAX: 516-921-0993; Empl.: 110; *Sls. Mgr.:* John Gray

HITECH EQUIPMENT CORP., 9400 Activity Rd., San Diego, CA 92126, Tel: 619-566-1892, FAX: 619-530-1458; Empl.: 12

HI-TECH, INC., 3600 16th St., Zion, IL 60099, Tel: 708-746-2447, FAX: 708-746-4945; Empl.: 35; *Sls. Mgr.:* J. Gordon Johnson

HITEMP TECHNOLOGIES, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0740, FAX: 408-922-0534; Empl.: 15; *Sls. Mgr.:* Roger Meade

HITRAN

FAX: 908-782-9733

HITRAN CORPORATION, 362 Highway 31, Flemington, NJ 08822-9943, Tel: 908-782-5525; FSC No.: 27672; Empl.: 120; *Sls. Mgr.:* James Hindle ..... **A•2235; D•1795, 2202-2203**

	Local Sales Offices & Reps	
AL	Birmingham, Robertson Sls.	205-823-4187
AZ	Scottsdale, Electro Mktg.	602-991-0110,
CO	Denver, Calvert Controls	303-428-4852
CT	Guilford, Motion Controls Assocs.	203-457-1874,
CT	Ridgefield, Manning & Assocs., Inc.	203-438-5027
ID	Boise, Calvert Controls	208-343-3964
IL	Addison, Hedge Assocs., Inc.	312-543-0888
LA	Metairie, RAPCO Assocs., Inc.	504-887-9500,
MA	Hopedale, Motion Controls Assocs.	508-478-0736
NY	Syracuse, Lachut Elctrl. Sls.	315-458-6486,
NC	Charlotte, Servicon Sls. Corp.	704-588-1035
OR	Eugene, Calvert Controls	503-683-2018
OR	Portland, Calvert Controls	503-236-1358
PA	Fort Washington, Hostvedt-Pavoni, Inc.	215-643-5757
PA	Pittsburgh, Greye Glass Assocs.	412-366-6664
UT	Salt Lake City, Calvert Controls	801-531-8129
WA	Seattle, Calvert Controls	206-251-6135
WA	Spokane, Calvert Controls	509-244-3601
WA	Tacoma, Calvert Controls, Inc.	206-383-1130
WA	Tri-Cities, Calvert Controls	509-545-4506
WV	Sissonville, Interstate Ind. Sls. Corp.	304-988-3687
WI	Brookfield, Kirchmayer-Seidel	414-781-5469
	Local Distributors	
NY	Jamaica, Queens Indl. Elec. Corp.	718-526-7198
RI	Providence, WALCO Elec. Co.	401-467-6500,

HMW ENTERPRISES, INC., 604 Salem Road, Etters, PA 17319, Tel: 717-938-4691, FAX: 717-938-4095; FSC No.: 06A150; Empl.: 40; *Sls. Mgr.:* Gerhard Schmutz

HOBART TAFA TECHNOLOGIES, Hobart Bros. Co., 146 Pembroke Rd., Concord, NH 03301, Tel: 603-224-9585, TELEX: 94-3424, FAX: 603-225-4342; Empl.: 60; *Sls. Mgr.:* Daniel Tuszynski; *Dist. Mgr.:* Daniel Tuszynski

HOBSON BROS., 4940 W. Lawrence Ave., Chicago, IL 60630-3884, Tel: 312-283-3600, FAX: 312-283-3606; Empl.: 75; *Sls. Mgr.:* Betty Maager

HODGE MANUFACTURING CO., INC., 55 Fisk Ave., Springfield, MA 01107, Tel: 413-781-6800, FAX: 413-733-6573; *Sls. Mgr.:* Edwin L. Kossoy

HOFFMAN, P.R., CO., MATERIALS PROC, 321 Cherry St., Carlisle, PA 17013, Tel: 717-243-2011, FAX: 717-243-1672; Empl.: 125; *Sls. Mgr.:* Galen Martin

HOFFMAN ENGINEERING, 900 Ehlen Dr., Anoka, MN 55303, Tel: 612-421-2240, FAX: 612-421-1556; *Sls. Mgr.:* Brad Dunn; *Dist. Mgr.:* Paul Premo

HOFFMAN ENGINEERING CORP., 20 Acosta St., Stamford, CT 06902, Tel: 203-325-8933, FAX: 203-327-4812; FSC No.: 06097; Empl.: 49; *Sls. Mgr.:* Jack DeSoye

HOKE INCORPORATED, 1 Tenakill Pk., Cresskill, NJ 07626, Tel: 201-568-9100, TELEX: 135428, FAX: 1-201-568-5913; *Sls. Mgr.:* Ray Pohlke; *Dist. Mgr.:* Ray Pohlke

HOKURIKU USA LTD., 8145 River Dr., Morton Grove, IL 60053, Tel: 708-470-8440, FAX: 708-967-1188; Empl.: 12; *Sls. Mgr.:* Ira Uslander

HOLADAY INDUSTRIES, INC., 14825 Martin Drive, Eden Prairie, MN 55344, Tel: 612-934-4920, FAX: 612-934-3604; Empl.: 29; *Sls. Mgr.:* David Baron

HOLD-HEET PRODUCTS CORP., 5011 N. Ravenswood Ave., Chicago, IL 60640, Tel: 312-728-4454, 312-728-4455, FAX: 312-728-2016; Empl.: 15; *Sls. Mgr.:* Dan Mundt; *Dist. Mgr.:* Dan Mundt ..... **B•1501**

HOLLEX, INC., See Cabletest Products Co.

HOLLINGSEAD INTERNATIONAL, 13701 Excelsior Drive, Santa Fe Springs, CA 90670, Tel: 213-921-3438, TELEX: 691-462, FAX: 213-921-6313; *Sls. Mgr.:* Doug Wagner

HOLLIS AUTOMATION, Esterline Corporation, 15 Charron Ave., Nashua, NH 03063, Tel: 603-889-1121, TELEX: RCA 294005; Empl.: 130; *Sls. Mgr.:* John L. Chugg; *Dist. Mgr.:* Jerry Vermette

HOLT INC., 9351 Jeronimo Rd., Irvine, CA 92718, Tel: 714-859-8800, TELEX: 182704, FAX: 714-859-9643; FSC No.: 44270; Empl.: 110; *Sls. Mgr.:* Roger Smith

HOLT INSTRUMENT, C.P.D. Engineering, Inc., 126 Mott St., PO Box 230, Oconto, WI 54153, Tel: 414-834-2222, FAX: 414-834-3178; FSC No.: 09435; Empl.: 10; *Sls. Mgr.:* C. P. De Witt

	Local Sales Offices & Reps	
AZ	Phoenix, Barnhill Assocs.	602-955-2955
CA	Torrance, Cutlass Elctrns., Inc.	213-324-7360
CO	Denver, Barnhill Assocs.	303-792-9500
NM	Albuquerque, Barnhill Assocs.	505-299-7658
OK	Tulsa, Barnhill Assocs.	918-492-5036
TX	Houston, Barnhill Assocs.	713-266-2666
UT	Salt Lake City, Barnhill Assocs.	801-226-1239

HOLUB INDS., See Blackburn, Div. of F L Industries

HOMALITE™

FAX: 302-652-4578

HOMALITE, Whitco, Inc., 11 Brookside Dr., Wilmington, DE 19804, Tel: 302-652-3686, TWX: 510-600-0874; Empl.: 35; *Sls. Mgr.:* Susan Stepchuck ..... **B•1085**

HONDA CONNECTORS, See Mhotronics, Inc.

HONEYWELL INC., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-5186, TWX: 910-576-2692; Empl.: 15,000

HONEYWELL INC., Commercial Bldgs. Grp., MN 27-4231, Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-2294; Empl.: 6000; *Sls. Mgr.:* Mannie Jackson

HONEYWELL INFORMATION SYSTEMS, 200 Smith St., MS 440, Waltham, MA 02154, Tel: 617-895-6000

HONEYWELL MICROSWITCH DIV., 830 E. Arapaho Dr., Richardson, TX 75081, Tel: 214-470-4271, TELEX: 73-0890, FAX: 214-470-4417; Empl.: 300; *Sls. Mgr.:* Doug Rasmussen; *Dist. Mgr.:* Dave Kimbrough

HOOSIER MAGNETICS, INC., 6545 W. Central Ave. Rm.203, Toledo, OH 43617, Tel: 419-841-7173, FAX: 419-841-7359; FSC No.: 3160; Empl.: 90

HOPKINS ENGRG., 12900 Foothill Blvd., San Fernando, CA 91342, Tel: 818-361-8691, TELEX: 910380-5379, FAX: 818-361-7409; FSC No.: 02777; Empl.: 100

HOPPECKE BATTERY SYSTEMS, INC., 292 Main St., Bulter, NJ 07405, Tel: 201-492-0045, TELEX: 5106002498, FAX: 201-492-2714; *Sls. Mgr.:* Arthur M. Silverman; *Dist. Mgr.:* Arthur M. Silverman



HOPPER ELECTRONICS, 1943 West North Lane 9, Phoenix, AZ 85021, Tel: 602-870-3093; Empl.: 10 ..... **D•1175**

HOTPACK CORP., 10940 Dutton Rd., Philadelphia, PA 19154, Tel: 215-824-1700, 800-523-3608, TWX: 710-670-1694, FAX: 215-637-0519; FSC No.: 66; Empl.: 100; *Sls. Mgr.:* Hugh McKenna

Hotpack is a manufacturer and is sold direct. To contact the salesman in your area call 800-523-3608 or 215-824-1700.

HOUSE OF BATTERIES, 776 W. 19 St., Costa Mesa, CA 92627, Tel: 714-642-8222, 800-432-3385, FAX: 714-548-6598; Empl.: 15; *Sls. Mgr.:* Pat Hoscoe

HOUSTON ATLAS, a Baker Hughes Company, 9441 Baythorne Drive, Houston, TX 77041, Tel: 713-462-6116, TELEX: 75-0197, FAX: 713-462-1831; Empl.: 45; *Sls. Mgr.:* Judy Hood

HOUSTON INSTRUMENT, AMETEK, Inc., 8500 Cameron Rd., Austin, TX 78753, Tel: 512-835-0900, TWX: 910-874-2022; Empl.: 450; *Dist. Mgr.:* Rod Schaffner

HOWARD INDUSTRIES, INC., Box 287, One North Dixie Hwy., Milford, IL 60953, Tel: 815-889-4105, FAX: 815-889-4313; Empl.: 350; *Sls. Mgr.:* Dan Sutter; *Dist. Mgr.:* Barb Davis

HOWELL INSTRUMENTS, 3479 W. Vickery Blvd., Ft. Worth, TX 76107, Tel: 817-336-7411, TELEX: 75-8233; FSC No.: 98869; Empl.: 180; *Sls. Mgr.:* Mike Lathem

HP DIRECT, Hewlett-Packard, 1320 Kifer Rd., Sunnyvale, CA 94086, Tel: 800-538-8787; Empl.: 80,000

HUBBELL INDUSTRIAL CONTROLS INC., 50 Edwards St., Madison, OH 44057, Tel: 216-428-1161, ESYLNK: 980-439, FAX: 216-428-7635

HUDSON TOOL & DIE CO., 18 Malvern St., Newark, NJ 07105, Tel: 201-589-1800, TWX: 710-995-4445, FAX: 201-589-8570; FSC No.: 02875; Empl.: 300

HUGHES AIRCRAFT CO., Connecting Devices Div., 17150 Von Karman Ave., Irvine, CA 92714, Tel: 714-660-5701, FAX: 714-660-5825; FSC No.: 53669; *Sls. Mgr.:* Terry Jarnigan

HUGHES AIRCRAFT CO., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999, Tel: 213-517-6000, TELEX: 67-7064, TWX: 910-347-7321, FAX: 213-517-6714; Empl.: 1249; *Sls. Mgr.:* Jerry H. Herman

HUGHES AIRCRAFT CO., Industrial Products Division, 2051 Palomar Airport Rd., Carlsbad, CA 92009, Tel: 619-931-3000, FAX: 619-931-3334

HUGHES ELECTRONICS PRODUCTS CORP., 34467 Industrial Rd., Livonia, MI 48150, Tel: 313-427-8310, FAX: 313-427-2282; Empl.: 20; *Sls. Mgr.:* Richard L. Smith

HUGHES MICROELECTRONIC CIRCUITS DIVISION, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903, Tel: 714-759-2952, TWX: &, FAX: 714-759-2280

HUGHES SEMICONDUCTOR PRODUCTS CENTER, 500 Superior Ave., Newport Beach, CA 92663, Tel: 714-759-2665, FAX: 714-759-2913; FSC No.: 62458; *Sls. Mgr.:* Steven Rubin

HUGHEY & PHILLIPS, INC., 2162 Union Pl., Simi Valley, CA 93065, Tel: 805-581-5591, FAX: 805-581-5032; FSC No.: 94295; Empl.: 30; *Sls. Mgr.:* Peter H. Johnson; *Dist. Mgr.:* Peter H. Johnson

HUGIN INDUSTRIES INC., 745 Distel Dr., Los Altos, CA 94022, Tel: 415-961-2950, FAX: 415-961-6431; Empl.: 6; *Sls. Mgr.:* Peter Hugin

HULL CORP., 3535 Davisville Rd., Hatboro, PA 19040, Tel: 215-672-7800, FAX: 215-672-7807; Empl.: 200; *Sls. Mgr.:* C. T. Lind; *Dist. Mgr.:* J. T. MacInnes

HUMISEAL DIV., CHASE Corporation, 26-60 BQE West, Woodside, NY 11377, Tel: 718-932-0800, TWX: 710-582-2141, FAX: 718-932-4345; FSC No.: 99109;46058; Empl.: 150; *Sls. Mgr.:* William G. Lott

HUMPHREY, INC., 9212 Balboa Ave., San Diego, CA 92123, Tel: 619-565-6631, TWX: 910-335-2001, FAX: 619-565-6873; Empl.: 278

HUNTINGTON ELECTRIC INC., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, Tel: 219-356-0778, FAX: 219-356-7891; *Sls. Mgr.:* Michael Khorshid

HUNTSVILLE MICROSYSTEMS, INC., 3322 South Memorial Pkwy., Huntsville, AL 35801, Tel: 205-881-6005, TWX: 510-600-8258, FAX: 205-882-6701; Empl.: 30; *Sls. Mgr.:* Kay Keller

HURRICANE ELECTRONICS LAB, P.O. Box 1280, Hurricane, UT 84737, Tel: 801-635-2003, FAX: 801-635-2495; FSC No.: 64109; Empl.: 35; *Sls. Mgr.:* C. R. Reeve

HURST

FAX: 812-386-7504

HURST MANUFACTURING DIV., Box 326, Princeton, IN 47670, Tel: 812-385-2564; Empl.: 200; *Sls. Mgr.:* Don Morrow ..... **B•1272-1275**

Local Sales Offices & Reps

AZ	Phoenix, Sierra Ind. Eng.	602-272-0084
CA	Fullerton, Emerson Motor Div.	714-992-4330
CA	Los Angeles, Sierra Ind'l. Engrg. Co.	213-624-3123
IL	Chicago, Golten Assocs.	708-512-0093
IN	Indianapolis, Emerson Motor Div.	317-842-1342
MD	Glen Arm, Hodgins Assoc.	301-592-7047
MA	Lexington, Hathaway Elctrns.	617-861-7010
MI	Grand Rapids, Emerson Motor Div.	616-942-9500
MN	Wayzata, Cardinal Sls. Co.	612-475-0042
NJ	Sussex, Carbone Assocs.	201-875-1882
NM	Phoenix, Sierra Ind. Eng.	602-272-0084
NY	Rochester, Agma Sls. Assocs.	716-381-5840
NY	Syracuse, Agma Sls. Assocs.	716-381-5840
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
OH	Canton, Emerson Elec. Co.	216-492-4119
OK	Edmond, Emerson Motor Div.	405-340-8228
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
TX	Arlington, Emerson Motor Div.	213-380-2670
WA	Seattle, Northmar	206-524-5170
WI	Milwaukee, Badgerep Inc.	414-241-9200
EXP	NY, Freeport, Minthorne Int'l.	516-546-4700
Can	Burlington, Ont., White Radio Ltd.	416-632-6894

HUTRONIX, INC., 2400 S. 34th Place, Tucson, AZ 85726, Tel: 602-790-5348, FAX: 602-790-8836; FSC No.: 70206; Empl.: 119

HV COMPONENT ASSOCIATES INC., P O Box 2484, Farmingdale, NJ 07727, Tel: 908-938-4499, FAX: 908-938-4451; Empl.: 20; *Sls. Mgr.:* Dennis R. Dean

HYBRICON CORPORATION, 12 Willow Road, Ayer, MA 01432, Tel: 508-772-5422, TWX: 710-347-0654, FAX: 508-772-2963; Empl.: 74; *Sls. Mgr.:* Janis K. Parker

HYBRID DESIGNS, INC., 666 W. Baker, Costa Mesa, CA 92626, Tel: 714-557-9933, FAX: 714-557-0322; FSC No.: 16450; Empl.: 65; *Sls. Mgr.:* Bob Soberman

HYBRID ELECTRONICS CORP., 6 DeAngelo Dr., Bedford, MA 01730, Tel: 617-275-5350, FAX: 617-275-3470; Empl.: 12; *Sls. Mgr.:* John Pantazis

HYBRIDS INTERNATIONAL LTD., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-6400, FAX: 913-764-6409; Empl.: 45; *Sls. Mgr.:* Abdul Ghafoor; *Dist. Mgr.:* John Finley ..... **A•1372-1373, 1727**

Hybridyne Inc.

FAX: 602-791-3899

HYBRIDYNE, INC., 2155 N. Forbes Blvd., Tucson, AZ 85745, Tel: 602-629-0001; Empl.: 90; *Sls. Mgr.:* Richard Brady ..... **A•1729**

Local Sales Offices & Reps

AZ	Phoenix, Wadsworth/Pacific	602-994-4840
CA	Santa Ana, Silicon Coast Assocs., Inc.	714-544-1131
CO	Ft. Collins, Rep Sales	303-226-1504
IL	Downers Grove, Rockford Controls Co.	708-960-2046
MA	Needham Hgts., Vanguard Elctrns.	617-449-5578
MN	Burnsville, Xerotex Technlgs. Corp.	612-894-5007
NJ	Cherry Hill, Metz-Benham-Assocs., Inc.	603-424-0404
NY	Hartsdale, Spectrum Sls. Inc.	914-472-8600
PA	Wynnewood, Metz-Benham-Assocs., Inc.	215-896-7300
TX	Austin, Design Mktg. & Assoc.	512-263-9151
TX	Dallas, Design Mktg. & Assoc.	214-480-8151
TX	Houston, Design Mktg. & Assoc.	713-550-3318

HY-CAL ENGINEERING, 9650 Telstar Ave., El Monte, CA 91731, Tel: 818-444-4000, FAX: 818-444-1314; FSC No.: 12199; Empl.: 145; *Sls. Mgr.:* D. Z. Chapman

HYCOMP, INC., 165 Cedar Hill St., Marlborough, MA 01752, Tel: 508-485-6300, TWX: 710-347-0385, FAX: 508-481-1547; FSC No.: 34707; Empl.: 65; *Sls. Mgr.:* David Petros

HYDRO-GEN PRODUCTS INC., P.O. Box 1517, Fort Collins, CO 80522-1517, Tel: 800-779-0126, FAX: 303-498-0528; Empl.: 25; *Sls. Mgr.:* Derek Bobo; *Dist. Mgr.:* Derek Bobo

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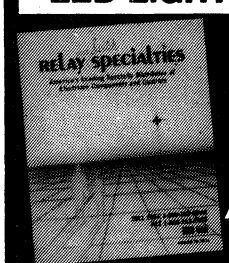
HY MEG CORP., 854 Westgate, Addison, IL 60005, Tel: 708-543-9250, FAX: 708-543-9260; Empl.: 24; *Sls. Mgr.:* Vincent Cupidro ..... **A•1916-1918**

Local Sales Offices & Reps

CA	La Habra, Cygnus	213-691-2993
CA	Mountain View, Westech	415-961-1422
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CO Englewood, Kimball Elctrns. 303-799-0317
CO Englewood, NEP Elctrns. 303-799-9898
CO Littleton, Indelco 303-795-3431
CT Wallingford, GRS Midan 203-265-2077
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Melbourne, G.R.S./Rome Elctrns. 407-242-8151
FL Melbourne, Pridmore Corp. 407-727-2491
FL Orlando, Hammond Elctrns. 407-841-1010
GA Norcross, Hammond Elctrns. 404-449-1996
ID Boise, Kimball Elctrns. 208-342-3559
ID Pocatello, Kimball Elctrns. 208-232-2201
IL Hoffman Estates, Integrated Elctrns. Corp. 708-843-2040
IL Northbrook, Classic Comps. Supp. Co. 708-272-9650
IL Wood Dale, NEP Elctrns. 708-595-8500
IN Carmel, Altex 317-848-1323
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
KS Wichita, RSC Elctrns. 316-267-5213
LA Shraveport, Carlton Bates 318-636-9975
MD Baltimore, Resco/Baltimore 301-931-8200
MD Beltsville, Resco/Washington 301-937-9100
MD Columbia, G.R.S. Elctrns. Co. Inc. 301-995-6744
MA Billerica, A.W. Mayer Elctrns. Co. 617-229-2255
MA Woburn, Lorcor 617-935-5024
MI Farmington Hills, Advent Elctrns., Inc. 313-477-1650
MI Grand Rapids, Calder Elctrns. 616-698-7400
MN Eitzen, Capacitor Assocs. 507-495-3306
MN Fridley, Voyager Elctrns. 612-571-7766
MN Minneapolis, Bergquist Co. 612-835-2322
MO Kansas City, Walters Indl. Supp. 816-531-7015
MO Raytown, Finnigan Elctrns, Inc. 314-362-3388
MO Springfield, Carlton Bates 417-862-1699
MO St. Charles, Finnigan Elctrns. 314-946-6201
NJ Camden, G.R.S. Elctrns. Co., Inc. 609-964-8560
NJ Roselle, Lectron Ind. 201-245-5859
NY Buffalo, Summit Distrs. Inc. 716-887-2829
NY Johnson City, Help Elctrns. 607-729-3528
NY Rome, Rome Elctrns. 315-337-5400
NC Greensboro, Hammond Elctrns. 919-275-6391
OH Akron, AESCO Elctrns. 216-762-8818
OH Columbus, AESCO Elctrns. 614-882-6762
OK Oklahoma City, Carlton Bates 405-681-4446
OK Tulsa, Altair Elctrns. 918-252-5781
OK Tulsa, Carlton Bates 918-250-1626
OR Beaverton, Integrated Elctrns. Corp. 503-641-1690
PA Exton, VSH Elctrns. 215-363-2250
PA No. Versailles, CMD 412-678-6020
PA Philadelphia, Shap Elctrns. Co., Inc. 215-969-3300
PA Reading, G.R.S. Elctrns. Co., Inc. 215-375-4477
RI Pawtucket, Major/Edwards Elctrn., Supp. Inc. 401-725-7400
TN Memphis, Carlton Bates 901-365-3539
TN Nashville, Carlton Bates 615-885-3232
TN Richardson, RSC Elctrns. 214-644-3444
TX Austin, Altair Elctrns. 512-837-4970
TX Austin, Carlton-Bates Co. 512-837-9098
TX Ft. Worth, Carlton-Bates Co. 817-293-5558
TX Houston, Altair Elctrns. 713-462-3029
TX Richardson, Altair Elctrns. 214-231-5166
TX Texarkana, Carlton Bates 214-792-6923
UT Salt Lake City, Kimball Elctrns. 801-328-2075
UT W. Valley City, Integrated Elctrns., Corp. 801-977-9750
WA Bellevue, Integrated Elctrns., Corp. 206-455-2727
WA Bothell, Projections Unltd. 206-485-2147
WI Milwaukee, Badger Capacitor Sls. 414-281-1330
WI New Berlin, Classic Comps. Supp. Co. 414-786-5300
WI New Berlin, NEP Elctrns. 414-785-9100
WI Sullivan, Bergquist Co. 414-593-2025

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FAX: 708-537-1881

ILLINOIS LOCK CO., The Eastern Co., 301 W. Hintz Rd., Wheeling, IL 60090, Tel: 708-537-1800; Empl.: 120; *Sls. Mgr.:* Rick Brabeck ..... **B•1710-1711**

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IMAGE SYSTEMS CORP., 11543 K-Tel Dr., Hopkins, MN 55343, Tel: 612-935-1171, FAX: 612-935-1386; Empl.: 12; *Sls. Mgr.:* Marta Scheff Volbrecht

IMAGING & SENSING TECHNOLOGY CORP., Westinghouse Circle, Horseheads, NY 14845, Tel: 607-796-3372, TWX: 510-252-1588, FAX: 607-796-3279; Empl.: 360

IMAGING TECHNOLOGY INC., 600 W. Cummings Pk, Woburn, MA 01801-6343, Tel: 617-938-8444, TELEX: 948263, FAX: 617-938-1757; Empl.: 110; *Sls. Mgr.:* John Hughes

I.M.C., (International Microtronics Corp.), 4016 E. Tennessee St., Tuscon, AZ 85714, Tel: 602-748-7900, FAX: 602-790-2808; FSC No.: 5371; Empl.: 22; *Sls. Mgr.:* O. Fest; *Dist. Mgr.:* O. Fest

IMC MAGNETICS CORP., Arizona Div., 1900 E. Fifth St., Tempe, AZ 85281, Tel: 602-968-4441, TWX: 910-951-0001, FAX: 602-968-5026; *Sls. Mgr.:* Joseph Gute

IMC MAGNETICS CORP., Exec. Off., 100 Jericho Quadrangle, Ste. 221, Jericho, NY 11753, Tel: 516-938-0800, FAX: 516-938-0752; Empl.: 1,300; *Sls. Mgr.:* Rudy Pascarelli

IMC MAGNETICS CORP., Eastern Div., 570 Main St., Westbury, NY 11590, Tel: 516-334-7070, TWX: 510-222-4469, FAX: 516-334-7723

IMC MAGNETICS CORP., Florida Division, 14025 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-822-2558, FAX: 305-825-3850

IM/D CORP., 540 Commercial St., Manchester, NH 03101, Tel: 603-669-5224, FAX: 603-669-1571; Empl.: 20; *Sls. Mgr.:* Frank N. Haigh

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CA American Canyon, Jacobson & Assocs. 707-552-4412

I.M.S. EQUIPMENT, INC., See Worldnet Marketing, Inc.

IMTRONICS INDUSTRIES, 11930 31st Ct. N, St. Petersburg, FL 33716, Tel: 813-572-9010, FAX: 813-572-9012; Empl.: 10; *Sls. Mgr.:* Steven B. Cohen

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INA BEARING CO., INC., 308 Springhill Farm Rd., Fort Mill, SC 29715, Tel: 803-548-8500, FAX: 803-548-8599; *Sls. Mgr.:* Richard Angell, VP Sls./Mktg.; *Dist. Mgr.:* Earl Dukes, VP

INCONIX CORP, See Hancock Electronics Corp.

INCOTHERM LIMITED, Holmer Road, Hereford HR4 9SL, Tel: (44) 432 355880, FAX: (44)432 352711; Empl.: 10; *Sls. Mgr.:* C. Paul Furniss

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FAX: 408-433-9330

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CA Dana Point, PCA MKtg. & Sls. Engrg. 714-493-9822,FAX:714-240-1894
CA San Diego, K-Tronics 619-549-7155, FAX:619-578-0063
CA Santa Clara, Pinnacle Sls. 408-249-7400, FAX:408-249-5129
CO Westminster, Straube Assocs. Mountain States, Inc. 303-426-0890,FAX:303-426-0896
CT Glastonbury, Liberty Electro Mktg. 203-657-8023
GA Norcross, Mountain Electro Mktg. 404-448-5594, FAX:404-448-8230
IL Deerfield, Brock & Cushman 708-405-9777, FAX:708-405-9778
IN Granger, Gregory Sls. Co. ..... 219-272-9626, FAX:PRESS 5 & *
MA Topsfield, Liberty Electro Mktg. 508-887-6655, FAX:508-887-2329
MI Brighton, A.P. Assocs. 313-229-6550, FAX:313-229-9356
MN Edina, GP Sales, Inc. 612-831-2362, FAX:612-831-2619
MO Florissant, Delltron 314-839-0033, FAX:314-839-4290
NJ Dyno-Rep, Inc. ..... „201-874-5254
NJ Cherry Hill, Vantage Sls. Co. 609-424-6777, FAX:609-424-8909
NY Glen Cove, Dyno-Rep 516-676-1598, FAX:516-676-4355
OH Delaware, Bill Romine Co. 614-363-1600, FAX:614-363-1085
OK Tulsa, Comptech 918-622-7744, FAX:918-660-0340
TX Austin, Comptech 512-343-0300, FAX:512-345-2530
TX Houston, Comptech 713-492-0005, FAX:713-492-6116
TX Irving, Comptech 214-751-1181, FAX:214-550-8113
UT Salt Lake City, Straube Assocs. Mountain States, Inc. 801-263-2640,FAX:801-261-5846
VA Front Royal, Eltron Sls. Inc. 703-635-7201, FAX:703-635-1933
Can Pointe Claire, Que., Interep Technlgs. Ltd. 514-694-6544,FAX:514-694-2778

Local Distributors

AZ Phoenix, Force Electronics 609-437-1060, FAX:609-437-2369
AZ Tempe, Harper S.I.D. 1-800-442-7737
CA Compton, Harper S.I.D. (H.Q.) 213-979-5090, FAX:213-632-1034
CA El Segundo, Force Electronics 213-772-1324, FAX:213-536-0139
CA San Diego, Harper SID 619-578-2500, FAX:619-566-2923
CA San Jose, Compass Comps. 408-432-7575, FAX:408-432-8013
CA San Jose, Daine Prods. 408-265-7220, FAX:408-265-1038
CA San Jose, Harper SID 408-943-9490, FAX:408-943-1663
CA Santa Clara, DC Elctrns. 408-980-1199, FAX:408-980-9573
CT Southbury, Heiland Electronics 203-262-1700, FAX:203-264-0770
GA Norcross, Applied Power 404-263-0421, FAX:404-242-8316

IL Palatine, OHM Electronics 708-359-5500, FAX:708-359-9686
MA Ashland, Quality Components 508-881-6504, FAX:508-881-1704
MA Ashland, Quality Comps., Inc. 508-881-6504, FAX:508-881-1704
MA Westborough, In-Stock Prods. 508-870-5750, FAX:508-870-0573
MA Wilmington, Heiland Electronics 508-657-4870, FAX:508-658-0278
MA Winchester, Webb Distbn., Inc. 617-729-5800, FAX:617-729-6839
MN Fridley, Voyager Elctrns. 612-571-7766,F, 612-571-9519
MO St. Louis, Beckwith Elec. 314-343-6463, FAX:314-343-7026
NJ West Berlin, GCI Corp. 609-768-6767, FAX:609-768-3649
NY Ronkonkoma, Conco Elctrns. 516-467-8200, FAX:516-467-3165
OH Cincinnati, Hughes-Peters 513-351-3000
OH Columbus, Hughes-Peter Inc. 614-294-5351, FAX:614-294-7115
OK Tulsa, Carlton-Bates 918-250-1626, FAX:918-250-1178
PA Norristown, Century Elctrns. Comp. 215-631-5400, FAX:215-631-5406
TX Farmers Branch, Force Electronics 214-247-9955, FAX:214-247-0619
TX Houston, Force Electronics 713-561-8644
TX Irving, Harper SID 214-621-0500, FAX:214-929-1015
UT Salt Lake City, Standard Supply 801-486-3371, FAX:801-466-2362
VA Charlottesville, Virginia Elctrn. Comp. 804-296-4184,FAX:804-971-8411
WA Redmond, Priebe Elctrns. 206-881-2363, FAX:206-881-0508
Can St. Laurent, Que., ZEI Electronics 514-342-6211, FAX:514-342-4073

INDEPENDENT CABLE, INC., 43 Broad St., Hudson, MA 01749, Tel: 508-562-9913, TELEX: 508-562-9917; Empl.: 120; *Sls. Mgr.:* R. David Gates

INDIANA MICROELECTRONICS CENTER CORP. FOR SCIENCE & TECHNOLOGy, 118 East Ludwig Rd., Fort Wayne, IN 46825, Tel: 219-482-8200, FAX: 219-482-8800; Empl.: 6

INDUCTOR SUPPLY, 1849 W. Sequoia Ave., Orange, CA 92668-1017, Tel: 714-978-2277, 800-854-1881, 800-472-8421, FAX: 714-978-2411; Empl.: 25; *Sls. Mgr.:* Neal McDonald

Industrial Computer Designs

FAX: 818-889-1490

INDUSTRIAL COMPUTER DESIGNS, INC., 31355 Agoura Road, Westlake Village, CA 91361, Tel: 818-889-3179, 800-423-3179; Empl.: 35; *Sls. Mgr.:* Jerry Becker ..... **D•1179**

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CA Corte Madera, Perx, Inc. 415-927-0155
CA San Diego, Indl. Computer Source 619-279-0084
CA Santa Cruz, Digital Distrs. 408-423-1556
OR Portland, D.Treichel & Co. 503-239-5403

INDUSTRIAL COMPUTER SOURCE, 4837 Mercury Street, San Diego, CA 92111, Tel: 619-279-0084, FAX: 619-541-1138; FSC No.: 7042; Empl.: 55; *Sls. Mgr.:* Nate Bailey

INDUSTRIAL CONTROL CO., 3100 Suntree Blvd., Rockledge, FL 32955, Tel: 407-259-7105; FSC No.: 90081; Empl.: 15; *Sls. Mgr.:* I. Nobilio

INDUSTRIAL CPU SYSTEMS, INTL., 111 W. Dyer Rd., Ste. D, Santa Ana, CA 92707, Tel: 714-957-2815, FAX: 714-957-3128; Empl.: 8; *Sls. Mgr.:* Dick McCormick

INDUSTRIAL DEVICES CORPORATION, 64 Digital Drive, Novato, CA 94949-5728, Tel: 415-883-3535, 800-747-0064, FAX: 415-883-2094; Empl.: 42; *Sls. Mgr.:* Louis G. Walton

INDUSTRIAL DEVICES, INC., 260 Railroad Ave., Hackensack, NJ 07601, Tel: 201-489-8989, FAX: 201-489-6911; FSC No.: 91802; Empl.: 275; *Sls. Mgr.:* Paul Flynn ..... **B•1166-1167**

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AL Huntsville, Hughes Assocs., Inc. 205-533-9108
CA San Diego, Universal Comps. Co. 619-232-5163
AZ Tempe, WestRep 602-820-9932
CA Santa Clara, WestRep 408-988-8833
CA Torrance, Universal Comps. 213-783-0220
CO Littleton, Harthun Assocs., Inc. 303-792-5545
FL Tamarac, Hughes Assocs. Inc. 305-720-1674
IN Indianapolis, Needler Sls. Co., Inc. 317-255-8056
IA Cedar Rapids, KKB, Inc. 313-373-1730
MD Columbia, PSA, Inc. 215-245-0513
MA Westborough, Anchor Engrg. 617-870-0573
MI E. Detroit, Fred Harris & Assocs. 313-776-5430
MN Minneapolis, Elec. Comp. Sls. 612-933-2594
MS Corinth, Hughes Assocs., Inc. 601-287-2915
MO Blue Springs, KKB, Inc. 816-229-0001
MO St. Louis, KKB, Inc. 314-647-2000
NY Glen Cove, Dyno-Rep 516-676-1598
NY Rochester, Apex Assocs. 716-254-6050
NC Cary, Hughes Assocs., Inc. 919-467-7029
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
OR Hillsboro, Temco Northwest 503-649-8375
PA Hickory, J. C. Hofstetter Co. 412-356-2305
PA Trevose, PSA, Inc. 215-245-0513
TN Knoxville, Hughes Assocs., Inc. 615-558-0283
TX Austin, R. F. Kimball Co. 512-443-5284
TX Houston, R. F. Kimball Co. 713-580-5754
TX Richardson, R. F. Kimball Co. 214-231-3447
VA Oakton, PSA, Inc. 301-953-4884
WA Bothell, Temco Northwest 206-821-5434
WA Hillsboro, Temco Northwest 503-645-2030
WI Brookfield, Rendell Sls. Co. 312-782-3954

Local Distributors

AL Huntsville, Allied Elctrns. 205-721-3500
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2885
CA Fremont, Allied Elctrns. 415-487-5250
CA Gardena, Calif. Switch & Signal 213-770-2330
CA Los Angeles, Elec. Switches 213-664-1141
CA Milpitas, Zack Elctrns. 408-942-5432
CA S. San Francisco, Steven Engrg. 415-588-9200
CA Sacramento, Zack Elctrns. 916-446-3131
CA San Diego, Shanks & Wright 619-239-0176
CA San Diego, Sigma Elctrns. 714-565-2000
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Quement Elctrns. 408-998-5900
CA San Jose, Rose Elctrn. Distrbg. Co. 408-943-0255
CA Santa Ana, Sunray Lighting, Inc. 714-556-3630
CA Tustin, Allied Elctrns. 714-669-4190
CO Arvada, Denver Beta 303-431-7161
CO Denver, Allied Elctrns. 303-790-1662
CO Denver, Con. Parts 303-623-5313
CT Bridgeport, Park Distrs. 203-366-7200
CT Wallingford, Sager Electrical Supp. 203-265-4600
FL Pompano Bch., Allied Elctrns. 305-978-3008
FL Tampa, Specialty Distrbg. Co. 813-870-3315
FL W. Palm Beach, Atlantic Elctrns. 407-686-8553
GA Atlanta, Wholesale Indl. Elec. 800-282-1857
GA Norcross, Whitehead Elctrns. 404-923-6667
ID Boise, Radar/Elec. 208-336-2322
IL Crystal Lake, Sub-Sem 312-782-3954
IL Elgin, Allied Elctrns. 312-697-8200
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IL Villa Park, Melvin Elctrns. 312-279-5015
IL Wheeling, Hawk Elctrns. 800-843-4295
IL Wood Dale, Electro-Kinetics 312-595-6700
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IN Fort Wayne, Bell Inds. 219-423-3422
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IN Indianapolis, MAR Elctrns., Inc. 317-633-6699
IN South Bend, Genesis Elctrns. 219-287-2911
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KY Bowling Green, Crescent Elctrns. 502-842-2444
LA Lafayette, Ralph's 318-234-4507
MD Baltimore, PEI/Genesis 301-931-8280
MD Columbia, Sager Elctrns. 301-995-6580
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Hingham, Sager Elec. Supp. 617-749-6700
MA Norwood, Gerber Elctrns. 617-329-2400
MA Worcester, Coghlin Elect. 617-756-8311
MI Flint, Shand Elctrns. 313-743-8940
MI Livonia, RS Elctrns. 313-525-1155
MI Livonia, Shand Elctrns. 517-799-2527
MI Saginaw, Shand Elctrns. 313-591-3980
MN Minneapolis, Bergquist Co. 612-835-2322
MN Minneapolis, Elctrn. Center 612-371-5200
MN Minneapolis, Stark Elctrns. 612-332-1325
MS Columbus, Bluff City Elctrns. 601-328-6212
MO Kansas City, Chelsea Inds. 816-842-8556
MO Maryland Hgts., Chelsea Inds. 314-997-7709
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NE Lincoln, Scott Elctrn. Supp. 402-466-8221
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NY Hempstead, Elctrn. Equip. 800-645-1605
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Elctrns. 716-334-8110
NC Raleigh, Sager 919-850-9550
NC Raleigh, Southeastern Radio Supp. 919-828-2311
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OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Warren, REM Elctrns. 216-373-1300
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PA Erie, REM Elctrns. 814-453-5626
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PA Mars, Sager Elctrns. 412-772-2233
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TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
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UT Salt Lake City, Standard Supp. 801-486-3371
VA Glen Allen, Hermitage Distrs. 804-798-3830
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WA Seattle, Allied Elctrns. 206-547-2827
WA Seattle, Radar Elec. 206-282-2511
WA Spokane, Radar Elec. 509-747-3053
WI Milwaukee, Marsh Elctrns. 414-475-6000

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FAX: 703-731-0847

INDUSTRIAL DRIVES, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, Tel: 703-639-2495; FSC No.: 11384; Empl.: 343; *Sls. Mgr.:* Robert White, Jr. ..... **B•1276-1277**

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CA Laguna Hills, Industrial Drives 714-581-3626
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CO Longmont, Piper Sls. Co. 303-443-5337
CT Madison, Tedicko, Inc. 203-644-4330
FL Sarasota, Indl. Apparatus Co. 813-377-2482
GA Atlanta, Industrial Apparatus Co. 404-875-8086
IL Arlington Hgts., Industrial Drives 708-981-1433
IN Indianapolis, J.N. Fauver Co. 317-872-3060
MD Annapolis, Homersmith, Inc. 301-269-6493
MA Topsfield, Whitehead Assocs. 508-887-8050
MI Madison Hgts., J.N. Fauver Co. 313-585-5252
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MO St. Charles, Drives Plus, Inc. 314-441-7765
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UT Salt Lake City, Piper Sls. 801-466-9336
VA Radford, The Hatfield Co. 703-639-5471
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MI Kentwood, J. N. Fauver Co. 616-957-5177
MI Madison Heights, J. N. Fauver Co. 313-585-5252
MI Saginaw, J. N. Fauver Co. 517-753-0474
MO St. Charles, Direct Elec. Co. 314-949-1164
NY Elmira, Wehle Elec. Co., Inc. 607-733-6646, 800-272-6900
OH Cincinatti, J. N. Fauver Co. 513-247-9900
OH Dayton, J. N. Fauver Co. 513-236-3554
OH Hilliard, J. N. Fauver Co. 614-777-2225
OH Northwood, J. N. Fauver Co. 419-666-3404
OH Stow, J. N. Fauver Co. 216-923-8855
TX Dallas, Cates Drives & Controls 214-960-1961
Can Oldcastle (Windsor), Ont., J. N. Fauver Co. 519-737-6925

INDUSTRIAL ELECTRONICS CORP., 24175 Gibson Drive, Warren, MI 48089, Tel: 313-759-4450, FAX: 313-759-1589; Empl.: 30; *Sls. Mgr.:* Allen A. Russell

INDUSTRIAL INDEXING SYSTEMS, INC., 626 Fishers Run, Victor, NY 14564, Tel: 716-924-9181, FAX: 716-924-2169; Empl.: 40; *Sls. Mgr.:* Andrew Kohn

INDUSTRIAL SERVICE TECHNOLOGY, 3286 Kentland Ct. SE, Grand Rapids, MI 49548, Tel: 616-247-1033; Empl.: 13; *Sls. Mgr.:* Julie A. Corby

Powertron

FAX: 516-883-7155

INDUSTRIAL TEST EQUIPMENT CO., Inc., 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700; FSC No.: 99074; *Sls. Mgr.:* Jay Monroe ..... **D•1266, 2204-2207**

INDUSTRIAL TIMER CO., 30 Industrial Park Rd., P.O. Box 307, Centerbrook, CT 06705, Tel: 203-767-7130, FAX: 203-767-9137; Empl.: 55; *Sls. Mgr.:* Ann Fraser Carroll

INERTIAL MOTORS, 280 N. Broad St., Doylestown, PA 18901, Tel: 215-345-1010, TELEX: 83-1633, FAX: 215-345-0111; Empl.: 14; *Sls. Mgr.:* Joanne Dorr

INFICON LEYBOLD-HERAEUS, INC., See Leybold Inficon, Inc.

INFINETICS INC., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802, Tel: 302-658-2471, FAX: 302-658-2475; *Sls. Mgr.:* M. Schwartz

INFODEX
DISPLAY SYSTEMS TECHNOLOGIES

FAX: 203-879-4944(x230)

INFODEX, INC., 10 Venus Dr., Wolcott, CT 06716, Tel: 203-879-4944; FSC No.: 09087; Empl.: 42; *Sls. Mgr.:* Robert Vance ..... **B•1016-1017, 1090**

Local Sales Offices & Reps

MA Medfield, Nortech Engrg. Sls. 508-359-6063

INFO-LITE CORP., See Dio-Rey and Crosspoint

INFOMETRIX, 2200 Sixth Ave. No. 833, Seattle, WA 98121, Tel: 206-441-4696, FAX: 206-441-0841; Empl.: 10; *Sls. Mgr.:* Paul Bailey

INFOPRINT, INC., Micro Electronic Business, Inc., 4315 N. Elston Ave., Chicago, IL 60641, Tel: 312-539-6045, FAX: 312-539-6645 ..... **D•1097**

INFORMATION CONTROL CORP., 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234, FAX: 203-368-3747; Empl.: 50

INFORMATION TRANSFER INC., Box 357, Bloomfield, NY 14469, Tel: 716-657-7074, FAX: 716-657-7432; FSC No.: 55137; Empl.: 50; *Sls. Mgr.:* John Dillman ..... **D•1180-1181**

Local Sales Offices & Reps

AZ Chandler, VIC Myers Assocs. 602-345-6449
CA Montrose, Luscombe Engrg. 818-249-9000
CA San Diego, Luscombe Engrg. 619-292-4337
CO Denver, VIC Myers Assocs. 303-730-7313
CA Sunnyvale, Westech 408-735-8647
FL Winter Park, Wade H. Boggs, Inc. 407-647-2226
NM Albuquerque, VIC Myers Assocs. 505-884-6878
TX El Paso, VIC Myers Assocs. 505-884-6878
WA Bellevue, Tasco 206-453-1414

INFRANOR, 45E Great Hill Road, Naugatuck, CT 06770, Tel: 203-729-8258, 800-BE-SERVO, FAX: 203-729-6969; Empl.: 11 ..... **B•1279**

Local Sales Offices & Reps

IL Arlington Hgts., Infranor Inc. 312-870-0818
OH Columbiana, Infranor Inc. 216-482-9286

INFRARED INDUSTRIES, INC., 12151 Research Parkway, Orlando, FL 32826, Tel: 407-282-7700, FAX: 407-273-9046; Empl.: 50

ING. F. P. KOGL, Weissenwolffstr.14, 4221 Steyregg, Steyregg, Austria, Tel: 732-640-591-0, FAX: 732-640-592-5; Empl.: 8; *Sls. Mgr.:* Ing. Franz Peter Kogl; *Dist. Mgr.:* Mrs. Michaela Eibl

INJECTORALL ELECTRONICS (WOMAN OWNED), 110 Keyland Court, Bohemia, NY 11716, Tel: 516-563-3388, FAX: 516-563-3389 ..... **C•1147**

Local Distributors

AL Birmingham, ACK Radio Supp. 205-322-0588
AZ Tucson, Electronic City 602-622-1173
CA San Luis Obispo, Midstate Elctrns. Supp. 805-543-2770
CA San Rafael, Elctrns. Plus 415-457-0466
CA Sunnyvale, Halted Specialties 408-732-1573
IL Lombard, NyTron Elctrns. 312-691-8900
IN Evansville, Tri-State Supp. Co. 812-423-4257
IA Cedar Rapids, Iowa Radio Supp. Co. .. 800-332-5296
KY Louisville, P.I. Burkes 502-589-3960
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Needham, Y.D.I. 617-449-1005
MI Canton, The Elctrn. Connection 313-595-6655
NY Lindenhurst, RNJ Elctrns. 516-226-2700
NY Long Island City, Typeco 718-706-6666
NY Richmond Hill, Anchor 212-846-2420
NC Charlotte, Slayton Elctrns. 704-375-6600
OK Oklahoma City, Radio Supp., Inc. 405-332-6127
OR Beaverton, Norvac 503-644-1025
SC Charleston, Wholesale Indl. Elctrns. ... 803-722-2634
TX Fort Worth, Sweico 817-335-6521
VA Roanoke, H. C. Baker 703-344-9209

INLAND MOTOR
KOLLMORGEN CORPORATION

FAX: 602-458-2161

INLAND MOTOR, Kollmorgen Corp., 4020 E. Inland Rd., Sierra Vista, AZ 85635, Tel: 602-459-1150, TWX: 910-973-9869; FSC No.: 11384; Empl.: 580 ... **B•1280-1282**

Local Sales Offices & Reps

FL Deerfield Beach, Technlg. Mktg. Assocs. 305-427-1090
IA Grimes, Drives Plus 515-986-3991
PA Media, Homersmith, Inc. 215-543-2434
FL Orlando, Technlg. Mktg. Assocs. 407-857-3760
AZ Sierra Vista, Inland Motor 602-459-1150
MD Annapolis, Homersmith, Inc. 301-269-6493
MI Farmington Hills, Carter, McCormic & Peirce, Inc. 313-477-7700
FL Largo, Technlg. Mktg. Assocs. 813-531-4405
KS Kansas City, Drives Plus 913-268-5410
MN New Brighton, Motion Technlgs., Inc. .. 612-631-3069
NJ Williamstown, Homersmith, Inc. 609-629-0606
MO St. Charles, Drives Plus 313-441-7765
OH Medina, Cygnus Inc. 216-725-1663
PA Downingtown, Homersmith, Inc. 215-269-3637
TX Richardson, Barger Engrg., Inc. 214-349-6171

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AL Huntsville, Technology Mktg. Assocs. 205-882-6162
AZ Tempe, Thor Engrg. 602-438-8494
CA Alhambra, Thorson Co. of Southern CA 818-281-2280
CA Goleta, Thorson Co. of Southern CA .. 805-964-8751
CA La Jolla, Thorson Co. of San Diego ... 619-292-8525
CA Mtn. View, Thorson West 415-964-9300
CA Signal Hill, Thorson Co. of Southern CA 213-595-0361
CO Englewood, Thorson Rocky Mt., Inc. .. 303-799-3435
GA Norcross, Technlg. Mktg. Assocs. 404-446-3565
IA Cedar Rapids, Carlson Elctrn. Sls. 319-378-1450
IL Elk Grove Vl., Carlson Elctrn. Sls. 708-956-8240
IN Indianapolis, Precision Elctrns. 317-842-3740
MA Needham Hgts., Vanguard Elctrns. Corp. 617-449-5578
NJ Wayne, SHL Assocs., Inc. 201-790-1714
NY E. Rochester, A & D Dvcs. 716-385-2778
NC Jamestown, Homersmith, Inc. 919-337-3370
OR Beaverton, Thorson Co. Northwest ... 503-644-5900
UT Salt Lake City, Thorson Rocky Mt., Inc. 801-973-7969
WA Bellevue, Thorson Co. Northwest 206-455-9180
WI Milwaukee, Carlson Elctrn. Sls. 414-476-2790

INMARK CORP., 4 Byington Pl., Norwalk, CT 06854, Tel: 203-866-8474, FAX: 203-866-0918; *Sls. Mgr.:* Roger Hibbert

INMOS CORP., P.O. Box 16000, Colorado Springs, CO 80935, Tel: 719-630-4000 (ext 4357), FAX: 719-630-4325; Empl.: 120; *Sls. Mgr.:* Richard Riker; *Dist. Mgr.:* David Bowers

INNOVATEK MICROSYSTEMS, INC., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720, Tel: 914-373-9003; Empl.: 8; *Sls. Mgr.:* Paul F. Fitts

INNOVATIVE ELECTRONICS, INC., Dynatech Corporation, 10110 USA Today Way, Miramar, FL 33025, Tel: 305-432-0300, FAX: 305-432-0705; Empl.: 40; *Sls. Mgr.:* Marshall Roper

INNOVUS, 1756 Junction Ave., Ste. E, San Jose, CA 95112, Tel: 408-436-7790, FAX: 408-436-8185; Empl.: 15

INRECO, See Ransco Industries

INRESCO, INC., 2411 Atlantic Avenue, Manasquan, NJ 08736, Tel: 908-223-6330, FAX: 908-223-2571; Empl.: 16

INSERVO, INC., 128 Commerce Drive, Box 110, LaGrange, OH 44050, Tel: 1-216-355-5102, FAX: 1-216-355-5342; Empl.: 70; *Sls. Mgr.:* Sandra Affolter

INSTANT BOARD CIRCUITS GRP., 20 A Pamaron Way, Novato, CA 94949, Tel: 415-883-1717, FAX: 415-883-2626; Empl.: 13

INSTRULAB, P.O. B. 98, Dayton, OH 45404, Tel: 513-223-2241; Empl.: 22; *Sls. Mgr.:* Fred Pummill

INSTRUM, MDH Industries, Inc., 426 W. Duarte Rd., Monrovia, CA 91016, Tel: 818-303-4210, TELEX: 182910, FAX: 818-357-8863; *Sls. Mgr.:* Craig Rahn

ICS

FAX: 708-543-6244

INSTRUMENTATION & CONTROL SYS., ICS.Inc., 520 Interstate Rd, Addison, IL 60101, Tel: 708-543-6200, TELEX: 271503 ICS UR; Empl.: 30; *Sls. Mgr.:* Harold Miller ..... **B•1504-1505; D•2208-2209**

Local Distributors

FL Largo, Allied Elctrns. 813-541-4660
IL Chicago, Leeds Electro Comps. 312-625-3800
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Allied Elctrns. 317-875-0448
MA Norwood, Allied Elctrns. 617-255-0361
MN Eden Prairie, Allied Elctrns. 612-829-7554
NJ Audubon, Universal Elctrn. Supp. ... 1-800-327-3529
NJ Mt. Laurel, Allied Elctrns. 609-234-7769
NY Fairport, Allied Elctrns. 716-425-3850
OH Solon, Allied Elctrns. 216-248-4200

PA Pittsburgh, Allied Elctrns. 412-367-4124
WI Green Bay, Power/Mation 414-496-0944

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Timer Representatives
CA Arcadia, HMC, Inc. 818-447-0958

UPS Representatives
TX Houston, Gettys-Eads-Adair 713-827-7155
AL Huntsville, Allied Elctrns. 205-721-3500
CA Canoga Park, C & A Elctrns. 818-340-6022
CA Fremont, Allied Elctrns. 415-770-0590
CA Tustin, Allied Elctrns. 213-860-0090
CO Englewood, Allied Elctrns. 303-790-1664
FL Pompano Bch., Allied Elctrns. 305-978-3008
GA Duluth, Allied Elctrns. 404-497-9544
GA Roswell, Henderson Ind. Equip. 404-552-0185
IL Berwyn, B-B & W, Inc. 312-749-1710
IL Rockford, Power/Mation 515-397-0510
IL Rosemont, Advent Elctrns. 312-297-6200
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IL Wood Dale, Allied Elctrns. 708-860-0007
MD Columbia, Allied Elctrns. 301-381-1560
MI Farmington Hills, Advent Elctrns. 313-447-1650
MN St. Paul, Powermation 612-645-0781
NY Hauppauge, N & L Instrs. 516-234-9797
NY Mineola, Allied Elctrns. 516-248-2360
NC Raleigh, Allied Elctrns. 800-638-1381
OH Chagrin Falls, Comm-Omni 216-543-1328
OH Warren, REM Elctrn. Supp. Co., Inc. ... 216-373-1300
TX Brownsville, Garden Indl. Grp. 512-546-1612
TX Dallas, Wofford Elctrns. 214-320-0294
TX Ft. Worth, Allied Elctrns. 817-336-5401, 214-265-9341
TX Ft. Worth, Allied Export Svcs. 817-336-5401
WA Seattle, Allied Elctrns. 206-547-2827
WI Fond du Lac, Fedco Elctrns. 414-922-6490
WI Waukesha, Powermation 414-542-2868

INSTRUMENTATION MEAS. LAB., See Lockheed Electronics Co., Inc.

INSTRUMENTATION SERVICES, INC., 957 Winnetka Ave. N., Minneapolis, MN 55427, Tel: 612-544-8916, FAX: 612-544-4887; Empl.: 30; *Sls. Mgr.:* G. Ryan

INSTRUMENT DESIGN ENGINEERING ASSOCS., INC., See IDEA, Inc.

INSTRUMENTED SENSOR TECHNOLOGY, INC., 1305 S. Cedar St., Lansing, MI 48910, Tel: 517-371-1980, TELEX: 517-371-1244; Empl.: 10

INSTRUMENT ENCLOSURES, 9767 Glenoaks Blvd., Sun Valley, CA 91352, Tel: 818-768-4622, FAX: 818-767-4988; FSC No.: 62012; Empl.: 35; *Sls. Mgr.:* Guy Crutchfield

INSTRUMENT RESEARCH CO., Box 40207, Santa Barbara, CA 93103, Tel: 805-962-8336; Empl.: 6

INSTRUMENT RESISTOR CO., See INRESCO/Instr. Resistor

INSTRUMENTS, INC., 7263 Engineer Rd., Ste. G, San Diego, CA 92111, Tel: 619-571-1111, FAX: 619-571-0188; FSC No.: 34563; Empl.: 28; *Sls. Mgr.:* Ken Kalbfell

INSTRUMENTS & CONTROLS DIV., See Technology Systems Div., KRUG Intl.

FAX: 516-467-8558

INSTRUMENTS FOR INDUSTRY, INC., 731 Union Parkway, Ronkonkoma, NY 11779, Tel: 516-467-8400; Empl.: 25 ..... **D•1012**

Local Sales Offices & Reps
AL Eva, Barr Elctrn. Instrs. 205-796-7533
AZ Mesa, DJM Elctrns. 602-820-4030
CA Valencia, DJM Elctrns. 805-254-2677
CO Englewood, R.A. Mayes Co. 303-761-9447
FL Barr Elctrns. 407-723-4109
IA Hiawatha, EIR Co. 319-395-4500
KS Lenexa, KJS Mktg. 913-962-1795
MD Beltsville, Applied Engrg. 301-595-5393
MO Leasburg, KJS Mktg. 314-245-6579
NH Hudson, EMC Sls., Inc. 603-672-4455
NJ N. Plainfield, Brady Co. 201-755-7900
NM Albuquerque, Mesa Tech. Corp. 505-883-8833
NC Winston-Salem, Scientific Dvcs. S.E. .. 919-859-0868
PA Sewickley, Teplitz/Byrne Assocs. 412-741-3628
TX Richardson, Scientific Dvcs. 214-231-8106
WA Seattle, Del Black Assocs. 206-788-6131
Can Nepean, Ont., Multilek, Inc. 613-226-2365

INSTRUMENT SOCIETY OF AMERICA, P.O. Box 12277, Research Triangle Park, NC 27709, Tel: 919-549-8411, TELEX: 802-540, FAX: 919-549-8288; Empl.: 102

Instrument Specialties Co., Inc.

FAX: 717-424-6213

INSTRUMENT SPECIALTIES CO. HEADQUARTERS, P.O. Box A, Delaware Water Gap, PA 18327-0136, Tel: 717-424-8510, TWX: 510-671-4526; Empl.: 300; *Sls. Mgr.:* John Blazejewski ..... **B•1018; C•1691-1697**

Local Sales Offices & Reps
AZ Phoenix, O'Donnell Assocs. 602-944-9542
CA San Jose, O'Donnell Assocs. 408-456-2950
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Englewood, D. M. Harthun Assocs., Inc. 303-792-5050
FL Boca Raton, Kinetic Sls., Inc. 407-368-7373
ID Boise, Temco Northwest 208-345-2051
KS Wichita, Thunderbird Tech. Sls. 316-636-5018
MN St. Paul, Arkco Sls. 612-777-7454
MO Maryland Heights, Thunderbird Tech. Sls. 314-298-8940
NM Albuquerque, O'Donnell Assocs. S.W. 505-889-4522
OR Hillsboro, Temco Northwest 503-645-2030
TX Dallas, J. M. Spell 214-620-0040
WA Bothell, Temco Northwest 503-645-2030
WA Spokane, Temco Northwest 509-927-9392
Can Pickering, Ont., A. C. Simmonds & Sons, Ltd. 416-839-8041

INSTRUMENT SPECIALTIES CO., Western Div., 505 Porter Way, Placentia, CA 92670, Tel: 714-579-7100, FAX: 714-579-7105; Empl.: 25; *Sls. Mgr.:* William Oliver; *Dist. Mgr.:* Phil Strong

INSULATON COMPONENTS ASSOCIATES, INC., P.O. Box 4849, Downey, CA 90241, Tel: 213-861-7268, FAX: 213-861-7265

INSULCAST, Permagile Inds. Inc., 101 Commercial St., Plainview, NY 11803, Tel: 516-349-1100, TELEX: 221720 PERM UR, FAX: 516-349-1156; FSC No.: 13549; *Sls. Mgr.:* William P. Flaim, Natl. Sls. Mgr.

INTAQ®

FAX: 206-284-3705

INTAQ KEY PANELS, GM Nameplate, Inc., 2040 15th Ave. W., Seattle, WA 98119, Tel: 206-284-5475; FSC No.: 9905; Empl.: 350; *Sls. Mgr.:* Alan Burk ..... **B•1815**

Local Sales Offices & Reps
AZ Tempe, Elctrn. Dev./Sls. 602-438-1547
AL Huntsville, JWL Assocs. 205-883-1712
CA San Diego, Omni 619-268-9606
CA San Jose, G M California 408-435-1666
CA Irvine, Balzer-Wolf Assoc. 714-261-6877
CO Englewood, Deltron 303-741-2122
FL St. Petersburg, Gulfport & Tech. Sls. .. 813-573-3910
HI Honolulu, Menehune Unlimited 808-737-3472
ID Eagle, GM/West 208-939-7202
IL Elgin, BK/Custom Engrd. Pts. 708-741-8556
IN Zionsville, WK/Custom Engrd. Pts. 317-873-5626
MI Southfield, E&A Inds., Inc. 313-647-0330
MN Burnsville, Electromec Sls., Inc. 612-894-8200
MO St. Louis, Halpin D. Burke & Son 314-968-2727
NH Mt. Vernon, GM/Northeast 603-673-9737
NJ Pitman, Colrud Corp. 609-589-5866
NJ West Caldwell, Grimm, Siegel & Assoc. 201-575-9300
NC Charlotte, JWL Assocs. 704-541-5750
OH Akron, Augnat Assocs. 216-239-2499
OR Portland, GM-Portland 503-223-9879
PA Pittsburgh, Allied Entprs. 412-788-2992
TX Irving, EDS Southwest 214-929-8140
VA Reston, Colrud Corp. 703-904-0240
WA Seattle, GM Nameplate Seattle 206-284-2200
Can Richmond,B.C., Enerlev Sls. Ltd. 604-273-0882
Can Scarborough, Ont., Banks Elctrns. Ltd. 416-292-5152

INTEC CONTROLS CORP., 55 West St., Walpole, MA 02081, Tel: 508-660-1221, FAX: 508-660-2374; Empl.: 25; *Sls. Mgr.:* Bruce Manthey; *Dist. Mgr.:* Bruce Manthey

INTEGRATED CIRCUITS INC. (ICI), See Interpoint

INTEGRATED DEVICE TECHNOLOGY, INC., 3236 Scott Blvd., Santa Clara, CA 95054-3090, Tel: 408-727-6116, TWX: 910-338-2070, FAX: 408-492-8674; FSC No.: 61772; Empl.: 2090; *Sls. Mgr.:* Joe Zabkar (VP); *Dist. Mgr.:* Bill Franciscovich

INTEGRATED ENGINEERING SOFTWARE, 347-435 Ellice Ave., Winnipeg, Man., Canada R3B 1Y6, Tel: 204-942-5636, FAX: 204-944-8010; Empl.: 10; *Sls. Mgr.:* Bennetta Benson

INTEGRATED MICROWAVE

FAX: 619-755-8679

INTEGRATED MICROWAVE, 3422 Tripp Ct., San Diego, CA 92121-1009, Tel: 619-259-2600; FSC No.: 60656; Empl.: 75; *Sls. Mgr.:* Jeff Beard ... **A•1678-1679**

Local Sales Offices & Reps
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CA Van Nuys, Cain Technology 818-904-9392
FL Satellite Beach, BWS Microwave Mktg. 407-773-6170
MD Burtonsville, Mid-Atlantic Microwave Sales 301-725-3955
MA Chelmsford, Matrix Sales 508-459-4000
NJ Paramus, El-Tech Sales 916-463-2664
NY E. Syracuse, Em-Tech Assocs. 315-437-6410
PA Ft. Washington, Beta Sales 215-643-6650

INTEGRATED POWER DESIGNS, INC., 9c Princess Rd., Lawrenceville, NJ 08648, Tel: 609-896-2122, FAX: 609-895-1738; Empl.: 18; *Sls. Mgr.:* Steven Thompson

INTEGRATED TECHNOLOGIES SOLUTIONS INC., 402 Chestnut Lane, East Meadow, NY 11554, Tel: 516-481-0857, FAX: 516-292-3115; Empl.: 8; *Sls. Mgr.:* M. Lieber ..... **D•1267**

Local Sales Offices & Reps
CA Chino, Deltatec Intl. Inc. 714-551-8546

INTEGRITY TECHNOLOGY CORP., 1400 Coleman Ave., Ste. E15, Santa Clara, CA 95050, Tel: 408-262-8640, TELEX: 697-2396, ESYLNK: MCI Mail:209837, FAX: 408-262-1680; Empl.: 247; *Sls. Mgr.:* Larry Young

Local Sales Offices & Reps
CA Santa Clara, Integrity Techng. Co. 408-262-8640
CO Littleton, GLX, Inc. 303-771-3230
FL Clearwater, H.E. Johnson & Assocs. .. 813-447-7529
MA Agawam, Hi-Q Mktg. 413-789-4683
NY Wading River, Niktronics 516-929-4671

INTEK, INC., 751 Intek Way, Westerville, OH 43081, Tel: 614-895-0301, FAX: 614-895-0319; FSC No.: 6680; *Sls. Mgr.:* Robert Curry

INTELCO, 8 Craig Road, Acton, MA 01720, Tel: 508-264-4485, TELEX: 62923380, FAX: 508-264-9677; Empl.: 35

INTELLIGENCE POWER TECHNOLOGY, 829 Flynn Rd., Camarillo, CA 93012, Tel: 805-484-4441, FAX: 805-987-0271; Empl.: 22; *Sls. Mgr.:* K. Iwan

INTELLIGENT INSTRUMENTATION/BURR-BROWN, 1141 W. Grant Road,MS 131, Tucson, AZ 85705, Tel: 602-624-2434, FAX: 602-623-8965; *Sls. Mgr.:* Bill McGovern ..... **D•1637-1639**

INTELLIGENT INTERFACES, INC., P.O. Box 1486, Stone Mountain, GA 30086, Tel: 404-381-9891, 1-800-842-0888; FSC No.: OA4H9; Empl.: 3; *Sls. Mgr.:* Robert E. Jarvis

INTELLUTION, INC., 315 Norwood Park South, Norwood, MA 02062, Tel: 617-769-8878, TELEX: 940-103, FAX: 617-769-1990; *Sls. Mgr.:* Jeff Cassis; *Dist. Mgr.:* Jeff Cassis

INTEPRO SYSTEMS INC., Six Fortune Dr., Billerica, MA 01821, Tel: 508-663-7555, FAX: 508-663-7558; Empl.: 50; *Sls. Mgr.:* Mike O'Connor; *Dist. Mgr.:* Mike O'Connor

INTERACTION SYSTEMS INC., 86 Coolidge Ave., Watertown, MA 02172, Tel: 617-923-6001, FAX: 617-923-2112 ..... **D•1098**

INTERACTIVE CIRCUITS SYSTEMS LTD., 5430 Canotek Rd., Gloucester,Ont., Canada K1J 9G2, Tel: 613-749-9241, 1-800-267-9794, FAX: 613-749-9461; Empl.: 20

INTERACTIVE COMPUTER PRODUCTS, INC., 23482 Peralta, unit C, Laguna Hills, CA 92653, Tel: 714-770-5332; Empl.: 20; *Sls. Mgr.:* Pat Cooper

INTERCONNECT DEVICES, INC., 5101 Richland Ave., Kansas City, KS 66106, Tel: 913-342-5544, TELEX: 286767 IDIKC UR, FAX: 913-342-7043; Empl.: 150; *Sls. Mgr.:* Donna McKinney, Cathy Snead; *Dist. Mgr.:* Carol Narr

Distributor

FAX: 714-447-3976

INTERCONNECT SPECIALTIES, INC., Tel: 800-752-4777, 714-773-0411, TELEX: 910 321 0310

.....613, 620, 633, 714, 718, 724, 752, 791, 813, 816

INTERELECTRONICS CORP., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920, Tel: 914-EL8-8000; Empl.: 82; *Sls. Mgr.:* M. H. Pintell; *Dist. Mgr.:* G. Sherwood ..... **D•1797**

INTERFACE, INC., 7401 E. Butherus Dr., Scottsdale, AZ 85260, Tel: 602-948-5555, TELEX: 825-882, FAX: 602-948-1924; FSC No.: 32311; Empl.: 85; *Sls. Mgr.:* Irv Wilson

FAX: 617-986-8932

INTERFACE ENGINEERING INC., 300 Centre St., Holbrook, MA 02343, Tel: 617-986-2600, TELEX: 249-545; FSC No.: 14352; Empl.: 25; *Sls. Mgr.:* Thomas Scanlon ..... **D•1182-1183**

Local Sales Offices & Reps

NY	Great Neck, Industron Assoc.	516-487-2620
VA	Herndon, Gans & Pugh Assocs., Inc.	703-709-0305

Local Distributors

VA	Arlington, Gans & Pugh Assocs., Inc.	

INTERFACE PRODUCTS, INC., 4630 North Ave., Oceanside, CA 92056, Tel: 619-945-0230, FAX: 619-945-0239; FSC No.: 55300; Empl.: 75; *Sls. Mgr.:* William Lang

INTERFACE TECHNOLOGY, Dynatech Corp., 2100 E. Alosta Ave., Glendora, CA 91740, Tel: 818-914-2741, TELEX: 4945489, FAX: 818-335-8346

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FAX: 415-340-1670

INTERFAN, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-1203; Empl.: 12; *Sls. Mgr.:* F. L. Nelson ..... **C•1626-1629**

Local Sales Offices & Reps

AZ	Glendale, Knight Co.	602-433-2166
CA	Anaheim, Impact Elctrns., Inc.	714-533-1351,
CA	Burbank, Darco	818-504-2425
CA	Burlingame, William J. Purdy Co.	415-347-7701
CO	Englewood, William J. Purdy Co., Assocs.	303-790-2211
FL	Lighthouse Pt., Jack Krutek & Assocs.	305-783-2501
IL	Mt. Prospect, The Dombrow Co.	708-253-3326
IN	Indianapolis, John Sukup, Inc.	317-253-5501
MD	Monkton, Imagitron Sls. Co.	301-374-5600
MI	Royal Oak, Hilltronics Inc.	313-435-0920
MN	St. Paul, Proud Inds., Inc.	612-646-9428
MO	Bridgeton, AEM, Inc.	314-298-9900
NY	Hempstead, Kahgan Brody Assocs.	516-538-2300
NY	E. Syracuse, R.M. Scanlon & Assocs.	315-463-7682
OH	Cleveland, Marlow Assocs. Inc.	216-831-8232
OR	Beaverton, Pacific Mktg. Specialists	503-641-9373
PA	Pittsburgh, Marlow Assocs. Inc.	412-343-5050
TX	Bedford, El-Tec Sls., Inc.	817-268-2896
WA	Redmond, Pacific Mktg. Specialists	206-882-3144
Can	Lachine, Que., Bytewide Mktg.	514-636-4121

INTERGRAPH CORP., Advanced Processor Division, 2400 Geng Rd., Palo Alto, CA 94303, Tel: 415-494-8800, FAX: 415-856-9224; *Sls. Mgr.:* James Pierce; *Dist. Mgr.:* James Pierce, Sls. Rep. Mgr.

INTERLOGIC INDUSTRIES, 85 Marcus Dr., Melville, NY 11747-4294, Tel: 516-420-8111, FAX: 516-420-8007; Empl.: 46; *Sls. Mgr.:* Bert Freifeld

INTERLOOP, 706 Charcot Ave., San Jose, CA 95131, Tel: 408-922-0520, FAX: 408-922-0545; Empl.: 3

INTER-MARKET, 1946 Lehigh Ave., Glenview, IL 60025, Tel: 708-729-5330, FAX: 708-729-4849; FSC No.: 34165; Empl.: 10; *Sls. Mgr.:* Phil Gardanier

INTERMATIC, Intermatic Plaza, Spring Grove, IL 60081, Tel: 815-675-2321, TELEX: 25-265, FAX: 815-675-2112; Empl.: 1000

INTERMETRICS MICROSYSTEMS SOFTWARE, INC., 733 Concord Ave., Cambridge, MA 02138, Tel: 617-661-1840, 800-356-3594, FAX: 617-661-0072; Empl.: 600ò; *Sls. Mgr.:* Burr Tupper

INTER METRO INDUSTRIES CORP., North Washington St., Wilkes-Barre, PA 18705, Tel: 717-825-2741, TELEX: 831-833, FAX: 717-823-0250

INTERNATIONAL COMPONENTS CORP., 105 Maxess Rd., Melville, NY 11747, Tel: 516-293-1500, TELEX: 221576, FAX: 516-293-4983; Empl.: 100; *Sls. Mgr.:* Ken Reed ..... **D•1037-1039**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AR	Mabelville, Erickson Sls.	501-455-0618
CA	Burbank, Darco	818-504-2425
CO	Littleton, Romulus Elctrns.	303-770-4888
FL	Tamarac, Hughes Assocs.	305-720-1674
GA	Atlanta, Hughes Assocs.	404-662-1587
IL	Arlington Heights, MJ Petersen	708-577-8200
IA	Cedar Rapids, Delltron Co.	319-393-0075
LA	Chalmette, Erickson Sls. Inc.	504-271-1976
MA	Framingham, Stone Comp. Sls.	508-875-3226
MA	Long Meadow, Stone Comp. Sls.	413-567-1019
MS	Corinth, Hughes Assocs.	601-287-2915
MO	Florissant, Delltron Co.	314-839-0033
MO	Kansas City, Delltron Co.	816-436-6445
NJ	Pennsuakem, ArJay Tech.	609-662-0285
NY	Melville, ICC	516-293-1500
NC	Charlotte, Hughes Assocs.	919-467-7029
OH	Cincinnati, Bob Gilbert Assocs.	513-574-1932
OR	Portland, Adapt E2	503-297-2151
TN	Knoxville, Hughes Assocs.	615-558-0283
TX	Dallas, Erickson Sls. Inc.	214-739-5833
WA	Bellevue, Adapt E2	206-637-0302
PR	Hato Rey, Casanova Indl. Sls. Corp.	809-753-8674

Local Distributors

CA	Canoga Park, Myco Vickers	213-340-2025
CA	Redwood City, Hi-Cor	415-365-5087
CA	San Diego, Tauber Elctrns. Corp.	619-274-7242
CA	Sunnyvale, Penstock Microwave Dist.	408-727-1200
CT	Bridgeport, Park Distr.	203-366-7200
CT	East Haven, JV Elctrns.	203-469-2321
FL	Ft. Lauderdale, Bros. Elctrns.	305-561-6700
FL	Ft. Lauderdale, National Resistor Co.	305-772-4500
GA	Norcross, Applied Power, Inc.	404-263-0421
IL	Bensenville, Voyager Elctrns. Corp.	312-860-1300
IL	Wheeling, Hawk Elctrns., Inc.	708-459-4030
IN	Indianapolis, RM Elctrns.	317-291-7110
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Chelmsford, Shelly Ragon	508-250-9666
MA	Sharon, Adcour Passive Comps.	617-784-8123
MI	Grand Rapids, R M Elctrns.	616-531-9300
MI	Southfield, R M Elctrns.	313-262-1582
MN	Eden Prarie, Cassidy Elctrns.	612-944-0100
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
MN	Minneapolis, Cassidy Elctrns.	612-835-7746
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	St. Louis, Beckwith Elctrns.	314-343-6463
NJ	Bellmaur, Mid-Atlantic Elctrns.	609-931-5303
NJ	Clifton, Vantage Comps.	201-667-1840
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	Sparta, Instruments & Equip.	201-729-4293
NY	Commack, Vantage Comps. Corp.	516-543-2000
PA	Philadelphia, MurTronics	215-632-4330
TN	Hixson, Techni-Tronics	615-842-0514
TX	Dallas, Wholesale Elctrns.	214-969-9400
TX	Fort Worth, Allied Elctrns.	817-336-7414
TX	Ft. Worth, C & W Supp. Co.	817-831-0395
WA	Seattle, Vesco	206-575-3607

INTERNATIONAL CONFIGURATIONS, INC., P. O. Box 3374, Enfield, CT 06082, Tel: 203-749-6380, TELEX: 643067, FAX: 203-749-2985; FSC No.: 62484; Empl.: 4; *Sls. Mgr.:* Ov. L. Baldwin

INTERNATIONAL CONVERTER CORP., 770-101 Wooten Road, Colorado Springs, CO 80915, Tel: 719-570-6900, FAX: 719-570-6180; Empl.: 9; *Sls. Mgr.:* Matt Breneman

INTERNATIONAL CRYSTAL MFG., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126, Tel: 504-236-3741, 1-800-426-9825, FAX: 405-235-1904,1-800-322-9426; Empl.: 120; *Sls. Mgr.:* Sheri Smith; *Dist. Mgr.:* Sheri Smith, Sls. Mgr.

INTERNATIONAL DATA AQUISTION & CONTROL, INC., Box 397, Rte. 101 The Meeting Place, Amherst, NH 03031, Tel: 603-673-0765, FAX: 603-673-0767; Empl.: 7; *Sls. Mgr.:* Gene Calvano; *Dist. Mgr.:* Gerry Klein

INTERNATIONAL DIGITAL ELECTRONICS, 160 W. Santa Clara St., Ste. 800, San Jose, CA 95113, Tel: 408-283-1010 (ext 107), FAX: 408-283-0344; Empl.: 2; *Sls. Mgr.:* Masanori Kotani

INTERNATIONAL DIODE, 229 Cleveland Ave., Harrison, NJ 07029, Tel: 201-482-6518, FAX: 201-482-4958; Empl.: 9; *Sls. Mgr.:* Lee Toong

INTERNATIONAL ELECTRO MAGNETICS, INC., 350 N. Eric Dr., Palatine, IL 60067, Tel: 708-358-4622, TELEX: 4932869 IEM UI; Empl.: 6; *Sls. Mgr.:* T. Pretto ..... **D•1036**

INTERNATIONAL EYELETS, INC., 5674 El Camino Real No. L, Carlsbad, CA 92008-9812, Tel: 619-931-1446, 1-800-333-9353, FAX: 619-931-8667; FSC No.: 5325; Empl.: 5; *Sls. Mgr.:* Sally Dalrymple

INTERNATIONAL INSTRUMENTATION, INC., 2282 Townsgate Rd., Westlake Vlg., CA 91361, Tel: 805-495-7673, FAX: 805-379-0701; Empl.: 32; *Dist. Mgr.:* John Mesenbring

INTERNATIONAL INSTRUMENTS, A PRIME TECHNOLOGY COMPANY, Twin Lakes Rd, P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; Empl.: 150; *Dist. Mgr.:* Keith MacDowall ..... **D•1350-1351**

Local Sales Offices & Reps

CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	N. Branford, II Consult Factory	203-481-5721
FL	Lakeland, Munday Sls., Co.	813-858-5606
KS	Olathe, Tech. Sls. Assoc.	913-829-2800
MO	Ferguson, Tech. Sls. Assocs.	314-725-5361
OH	Westlake, Advanced Tech. Assocs.	216-835-5050
PA	Malvern, Stitzer Assocs.	215-644-5500

Local Distributors

CA	Los Angeles, E.I.L. Instrs., Inc.	213-685-7020
CA	Palo Alto, Metermaster	415-960-8500
CA	San Diego, Metermaster	619-560-4841
CA	Sunnyvale, E.I.L. Instrs.	408-245-4320
CO	Denver, E.I.L. Instrs., Inc.	303-534-4160
CO	Denver, Metermaster Instr. Corp.	303-722-5766
CT	Middletown, E.I.L. Instrs., Inc.	203-346-6646
FL	Palm Bay, E.I.L. Instrs., Inc.	407-725-8300
GA	Kennesaw, CMI Metermaster	404-425-8902
IL	Bridgeview, E.I.L. Instrs., Inc.	312-430-2292
IL	Glendale Heights, CMI Metermaster	312-351-4554
IN	Indianapolis, E.I.L. Instrs., Inc.	317-545-1373
KY	Louisville, E.I.L. Instrs., Inc.	502-454-3420
LA	New Orleans, Industrial Instr. Works	504-733-8355
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Southbridge, CMI-Metermaster	508-765-1676
MI	Ferndale, Ram Meter Inc.	313-398-6767
MN	Minneapolis, Process Meas. Co.	612-544-4035
NJ	Pensauken, E.I.L. Instrs., Inc.	609-488-0474
NY	Clarence, E.I.L. Instrs.	716-634-8500
NY	Hauppauge, E.I.L. Instrs., Inc.	516-231-6333
NY	Long Island City, Metermod Instr. Corp.	718-726-4850

NY Rochester, E.I.L. Instrs. 716-586-8251
NC Charlotte, E.I.L. Instrs. 704-376-2237
OH Cleveland, Process Measurement Corp. 216-587-3600
OH Dayton, E.I.L. Instrs., Inc. 513-435-2134
PA Pittsburgh, E.I.L. Instrs. 412-823-2255
TX Dallas, E.I.L. Instrs., Inc. 214-357-0297
TX Garland, CMI Metermaster 214-271-5671
TX Houston, CMI Metermaster 713-644-1631
TX Houston, E.I.L. Instrs., Inc. 713-271-3100
VA Norfolk, E.I.L. Instrs., Inc. 804-855-9553
VA Springfield, E.I.L. Instrs., Inc. 703-569-2611
WA Redmond, E.I.L. Instrs., Inc. 206-882-3222
Can Longueuil, Que., E.I.L. Instrs. 514-651-4844
Can Mississauga, Toronto, E.I.L. Instrs. 416-624-6660
Can Toronto, Ont., Versatile Measuring Instrs. 416-239-8161
AZ Tempe, CMI Metermaster 603-431-0880

INTERNATIONAL LIGHT, 17 Graf Rd., Newburyport, MA 01950-4092, Tel: 508-465-5923, TELEX: 94-7135, FAX: 508-462-0759; Empl.: 19; *Sls. Mgr.:* Bob Angelo; *Dist. Mgr.:* Bob Angelo

INTERNATIONAL MACHINE & TOOL CORP., 115 Maple St., Warwick, RI 02888, Tel: 401-467-6905, FAX: 401-467-5885; Empl.: 35; *Sls. Mgr.:* Peter S. Piscopio

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INTERNATIONAL MANUFACTURING SERVICES, 50 Schoolhouse La., Portsmouth, RI 02871-2418, Tel: 401-683-9700; FSC No.: 45177; Empl.: 25; *Sls. Mgr.:* Scott H. Marston ..... **A•1922**

Local Sales Offices & Reps

MA Attleboro, Antex-Overseas Sls. 617-222-5221
PA Downingtown, Grasso Tech. Sls. 215-458-8967

INTERNATIONAL MICROELECTRONICS, P.O. Box 170415, Arlington, TX 76003, Tel: 817-561-2244, FAX: 817-561-5824

INTERNATIONAL MICROSYSTEMS, 521 Valley Way, Milpitas, CA 95035, Tel: 408-942-1001, FAX: 408-942-1051; Empl.: 10; *Sls. Mgr.:* Peter Schade

INTERNATIONAL MICROTRONICS, 4016 E. Tennessee St., Tucson, AZ 85714, Tel: 602-748-7900, FAX: 602-790-2808; Empl.: 16; *Sls. Mgr.:* Otto H. Fest, Jr. ..... **D•1352-1357**

Local Distributors

CA Santa Ana, Tech-Ser, Inc. 408-496-1004
CA Torrance, Tech-Ser, Inc. 213-370-7200
CO Aurora, R&R Instrmn. 303-340-8728
IL Chicago, Data Elctrns. 312-283-0300
MA Waltham, Calibron/Burton Instr. 617-894-6440
MO Manchester, Universal Precision Instr. 314-394-4693
NY Rochester, Masline Elctrns. 716-546-5373
OR Portland, Hydraulic Instrmn. Svcs. 503-643-5648
TX Dallas, Textrol Inc. 214-637-6262
WA Redmond, Hydraulic Instrmn. Svcs. 206-867-5437

INTERNATIONAL POLARIZER, INC., 320 Elm Street, Marlborough, MA 01752, Tel: 508-481-7495, TELEX: 601 6454, FAX: 508-481-0222; Empl.: 8; *Sls. Mgr.:* Donald Rickert

INTERNATIONAL POWER DC POWER SUPPLIES, INC., 355 N. Lantana, Ste. 710, Camarillo, CA 93010, Tel: 805-987-7900, FAX: 805-388-2686; Empl.: 25; *Sls. Mgr.:* Jose M. Covarrubias; *Dist. Mgr.:* Jose M. Covarrubias ..... **D•1779-1781**

Local Sales Offices & Reps

AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA El Cajon, Atronix/Marble 619-444-1501
CA Gilroy, Mouser Elctrns. 800-346-6873
CA Mission Viejo, Atronix/Marble 714-858-9009
CA San Diego, Zerimar Sales 619-436-3379
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CA So. CA, Elkins & Assocs. 818-597-1075
CA Solvang, Atronix/Marble 805-686-4366
FL Land O Lakes, A.J. Power Source 813-996-2583
GA Atlanta, AJ's Power Source 404-441-7927
IL Wheeling, Ed Joyner & Co. 708-520-1200
IN Evansville, Evansville Supply 812-424-7541
IA Cedar Rapids, Advanced Tech. Sls. 319-393-8280
KS Olathe, Advanced Tech. Sls. 913-782-8702
ME Portland, The MacInnis Co. 800-544-1014
MD Randallstown, Beacon North, Inc. 703-478-2480
MA Boston, The MacInnis Co. 617-762-8090
MI Livonia, Electro-Mktg. 313-421-7590
MI Muskegon, Electro-Mktg. 616-798-1912
MN Minneapolis, Clay Rep Co. 612-861-2191
MO Bridgeton, Advanced Tech. Sls. 314-291-5003
MO St. Louis, Advanced Tech. Sls. 314-878-2921
NV Las Vegas, Sandy's Elctrn. Supp. 702-383-8353
NH Manchester, The MacInnis Co. 800-544-1014
NH Windham, The MacInnis Co. 800-544-1014
NJ E. Rutherford, A-A Elec., Inc. 201-777-5477
NJ Ft. Lee, Neptune Elctrns. Co. 201-461-2789
NJ Randolph, Mouser Elctrns. 800-346-6873
NM Mouser Elctrns. 800-346-6873
NY E. Syracuse, Advanced Comps. Corp. 315-437-6700
NY Glen Head, Livera-Polk Assocs. 516-759-9300
NY Penn Yan, Advacom Technlg., Inc. 315-536-2221
NY Plainview, Neptune Elctrns. Co. 516-349-1600
NY Troy, Trojan Elctrn. Supp. 518-274-4481
NC Raleigh, Overton Assocs. 919-781-7004
OH Cleveland, Major Elctrns. Corp. 216-461-2100
OH Dayton, Electro-Mktg. 513-890-8322
OH N. Royalton, Electro-Mktg. 216-582-0075
OK AID Elctrns., Inc. 800-669-4761
OK Oklahoma City, RSC Elctrns. 405-631-7729
OR Clackamas, Platt Elec. Supp. 503-655-3504
OR Hillsboro, Turn-A-Round Sls. 503-640-4641
OR Medford, Platt Elec. Supp. 503-772-1414
OR Portland, 04 Controls 503-659-7891
OR Portland Metro, Platt Elec. Supp. 503-224-1919
OR Tualatin, Platt Elec. Supp. 503-684-2087
PA McKean, Advacom, Inc. 814-476-7774
PA N. Versailles, CMD Elctrns. 412-678-6020
PA Pittsburgh, Electro-Mktg. 412-823-5400
RI Mouser Elctrns. 800-346-6873
RI Providence, The MacInnis Co. 800-544-1014
SC Mouser Elctrns. 800-346-6873
SC Seneca, Overton Assocs. 803-638-7101
SD Mouser Elctrns. 800-346-6873
TN Mouser Elctrns. 800-346-6873
TN New Tazewell, Overton Assocs. 615-626-6009
TX Austin, AID Elctrns., Inc. 800-669-4761
TX Austin, RSC Elctrns. 512-834-1415
TX Austin, Wofford Elctrns. 512-339-1131
TX Dallas, Wofford Elctrns. 214-320-0294
TX Houston, AID Elctrns., Inc. 800-669-4761
TX Houston, Wofford Elctrns. 713-847-3583
TX Irving, AID Elctrns., Inc. 800-669-4761
TX Mansfield, Mouser Elctrns. 800-346-6873
TX Richardson, RSC Elctrns. 214-644-3444
UT Ogden, Taylor Mktg. 801-546-9570
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VT Mouser Elctrns. 800-346-6873
VT Burlington, The MacInnis Co. 800-544-1014
VA Sterling, Beacon North, Inc. 703-478-2480
VA Sterling, ICE Comps. 703-478-2677
WA Longview, Platt Elec. Supp. 206-423-4800
WA Seattle, H.D. Campbell 206-433-1900
WA Seattle, PLatt Elec. Supp. 206-624-4083
WA Vancouver, Platt Elec. Supp. 206-699-4833
WV Mouser Elctrns. 800-346-6873
WI Cedarburg, A-A Elec., Inc. 414-377-8000
WI Green Bay, A-A Elec., Inc. 414-499-6000
WI N. Wisconsin, Clay Rep Co. 612-861-2191
WI S. Wisconsin, Ed Joyner and Co. 708-520-1200
WY Mouser Elctrns. 800-346-6873
Can Surrey, B.C., Enerlec Sls. 604-273-0882
Can Surrey, B.C., Enerlec Sls., Ltd. 604-888-1667

Local Distributors

CA Canoga Pk., Sandy's Elctrn. Supp. 818-346-0510
CA Costa Mesa, Marvac Dow Elctrns. 714-650-2001
CA Fullerton, Orvac Elctrns. 714-871-1020
CA Gilroy, Mouser Elctrns. 800-346-6873
CA Long Beach, Mag-Trol 213-435-3451
CA N. Hollywood, Sandy's Elctrn. Supp. 818-765-8585
CA Pasadena, Marvac Dow Elctrns. 818-793-1195
CA San Jose, Sierra West 408-945-1050
CA San Jose, Spectra Elctrns. 408-452-1590
CA Santa Clara, Manco 408-496-6611
CA Santee, Mouser Elctrns. 800-346-6873
CA Simi Valley, Pace Elctrns., Inc. 805-522-7394
CA Thousand Oaks, Pace Elctrns. 805-497-7515
CA Vista, Pacific Phoinix, Inc. 619-598-3955
CO Mouser Elctrns. 800-346-6873
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
DE Mouser Elctrns. 800-346-6873
FL Lakeland, A-A Electric, Inc. 813-665-6941
FL Oldsmar, Applied Power, Inc. 813-854-4004
GA Atlanta, A-A Electric, Inc. 404-449-8670
GA Norcross, A-A Elec., Inc. 404-449-8670
GA Norcross, Applied Power, Inc. 404-263-0421
HI Mouser Elctrns. 800-346-6873
ID Mouser Elctrns. 800-346-6873
ID Boise, Platt Elec. Supp. 208-376-5643
ID Idaho Falls, Platt Elec. Supp. 208-524-6171
ID Pocatello, Platt Elec. Supp. 208-233-2002
ID Twin Falls, Platt Elec. Supp. 208-734-5413
IL Champaign, Klaus Radio 217-356-1896
IL Geneva, Melvin Elctrns. 708-232-7300
IL Mt. Prospect, Feed Control 708-253-3898
IL Peoria, Klaus Radio 309-691-4840
IN Evansville, Evansville Supp. Co. 812-424-7541
IA Mouser Elctrns. 800-346-6873
KS Olathe, Tradewise 913-782-8702
KS Wichita, RSC Elctrns. 316-267-5213
KY Mouser Elctrns. 800-346-6873
LA Mouser Elctrns. 800-346-6873
ME Mouser Elctrns. 800-346-6873
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MA Wilmington, North Star Elctrns. 508-657-5155
MI Brighton, Applied Power, Inc. 313-227-3604
MN Eden Praire, Braas Co. 612-937-8902
MN N. St. Paul, Edison Controls 612-770-5122
MS Mouser Elctrns. 800-346-6873
MO Kansas City, Richland Automation 816-241-2000
MT Mouser Elctrns. 800-346-6873
NE Omaha, Automation Elec. 402-331-2255
NV Elko, Platt Elec. Supp. 702-753-7553
NV Las Vegas, Sandy's Elctrn. Supp. 702-383-8353
NH Manchester, Cronin Elctrns., Inc. 603-624-0105
NH Windham, Orion Inds., Inc. 603-437-4446
NJ E. Rutherford, A-A Electric, Inc. 201-777-5477
NJ Randolph, Mouser Elctrns. 800-346-6873
NY Canandaigua, Advacom Technlgy., Inc. 716-396-9050
NY Glen Head, Livera Polk Assocs. 516-759-9300
NY Penn Yan, Advacom Technlg., Inc. 315-536-2221
NY Troy, Trojan Elctrn. Supp. 518-274-4481
NC Mouser Elctrns. 800-346-6873
ND Mouser Elctrns. 800-346-6873
OH Cleveland, Major Elctrns. Corp. 216-461-2100
OR Beaverton, Platt Elec. Supp. 503-641-6121
OR Clackamas, Platt Elec. Supp. 503-655-3504
OR Eugene, Platt Elec. Supp. 503-485-7528
OR Medford, Platt Elec. Supp. 503-772-1414
OR Portland, 04 Controls 503-659-7891
OR Portland Metro, Platt Elec. Supp. 503-224-1919
OR Salem, Platt Elec. Supp. 503-581-7012
OR Tualatin, Platt Elec. Supp. 503-684-2087
PA McKean, Advacom, Inc. 814-476-7774
PA N. Versailles, CMD Elctrns. 412-678-6020
TX Mansfield, Mouser Elctrns. 800-346-6873
UT Salt Lake City, Platt Elec. Supp. 801-974-5733
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Sterling, ICE Comps., Inc. 703-478-2677
WA Bellevue, Platt Elec. Supp. 206-885-4124
WA Longview, Platt Elec. Supp. 206-423-4800
WA Seattle, H.D. Campbell 206-433-1900
WA Seattle, Platt Elec. Supp. 206-624-4083
WA Vancouver, Platt Elec. Supp. 206-699-4833
WA Yakima, Platt Elec. Supp. 509-452-6444
WI Cedarburg, A-A Electric, Inc. 414-377-8000
WI Green Bay, A-A Electric, Inc. 414-499-6000

IPD

FAX: 617-782-7416

INTERNATIONAL POWER DEVICES INC., 155 N. Beacon St., Brighton, MA 02135, Tel: 617-782-3331; Empl.: 96; *Sls. Mgr.:* Aileen Liu, G/M; *Dist. Mgr.:* Russell Mitnik ..... **D•1799-1805**

Local Sales Offices & Reps

AL Huntsville, Macro Mktg. 205-883-9630
AZ Chandler, ELEC-COM 602-893-2930
CA Los Angeles, Power Partners 213-215-0800
CA San Diego, Power Partners 619-560-0099
CA San Ramon, Tech. Consits. 415-830-0829
CA Santa Barbara, Power Partners 805-966-3309
CO Franktown, MRC 303-660-8750
CO Littleton, MRC 303-794-4684
FL Maitland, Hawkins Fredrickson Assocs. 407-831-2474
FL Pompanó Beach, Hawkins Frederickson Assoc. 305-979-0330
FL Tampa, Hawkins Frederickson Assoc. 813-651-1063
GA Norcross, Macro Mktg. 404-662-5580
IL Chicago, M. Gottlieb Assocs. 312-775-8620
IA Cedar Rapids, Lorenz Sls. 319-377-4666
MA Arlington, Interstate Sls. Assoc. 617-646-3914
MA Bolton, Future Electronics, Corp. 508-366-2400
MA Chelmsford, Interstate Sls. Assoc. 508-256-2287
MI Ann Arbor, Augnat Assocs. 313-668-3134
MN Minneapolis, Robert W. Marshall Corp. 612-929-0457

MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
NJ Glen Gardner, Daner-Hayes 800-225-8760
NJ Haddonfield, Sunday O'Brien 609-429-4013
NY Massapequa, Daner-Hayes 800-225-8760
NY Rochester, Indl. Tech. Sls. 716-872-1628
NY Smithtown, T & K Sls. 516-724-3456
NC Raleigh, C-Tech Sls. 919-782-8100
OH Akron, Augnat Assocs. 216-273-1211
OH Dayton, Augnat Assocs. 513-298-1507
OR Beaverton, Future Elctrns., Corp. 503-645-9545
OR Beaverton, Pacific Mktg. Specialists Inc. 503-641-9373
TX Dallas, Seaton Corp. 214-980-9860
TX Houston, Seaton Corp. 713-731-2649
VA Richmond, Glasscock Assocs. 804-798-2125
Can Kanata, Ont., Canadian Mktg. Techlgs. 613-591-9555
Can Mississauga, Ont., Canadian Mktg. Technlgs. 416-612-0900
Can Pointe Claire, Que., Canadian Mktg. Technlgs. 514-694-6088

Local Distributors

AL Huntsville, Future Elctrns., Corp. 205-830-2322
AZ Phoenix, Bell Inds. 602-966-7800
AZ Phoenix, Future Elctrns., Corp. 602-968-7140
CA Agoura Hills, Bell Industries 818-879-6501
CA Anaheim, Computech Elctrns. 714-939-9113
CA Chatsworth, Future Elctrns., Corp. 818-772-6240
CA Huntsville, Future Elctrns. 205-830-2322
CA Irvine, Future Elctrns., Corp. 714-250-4141
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, Computech Elctrns. 408-945-9100
CA Sacramento, Bell Inds. 916-652-0414
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Future Elctrns., Corp. 619-278-5020
CA San Jose, Future Elctrns., Corp. 408-434-1122
CA Sunnyvale, Bell Inds. 408-734-8570
CO Denver, Bell Inds. 303-424-1985
CO Denver, Future Elctrns., Corp. 303-421-0123
CT Bethel, Future Elctrns., Corp. 203-743-9594
FL Altamonte Springs, Bell Inds. 407-339-0078
FL Altamonte Springs, Future Elctrns., Corp. 407-767-8414
FL Clearwater, Future Elctrncs. 813-530-1222
FL Clearwater, Future Elctrns., Corp. 813-530-1222
FL Oldsmar, Applied Power 813-854-4004
GA Atlanta, Future Elctrns., Corp. 404-441-7676
GA Norcross, Applied Power, Inc. 404-263-0421
GA Norcross, Bell Inds. 404-662-0923
IL Chicago, Future Electronics 708-882-1255
IL Elk Grove Village, Bell Inds. 708-640-1910
IN Fort Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Bell Inds. 317-875-8200
IA Cedar Rapids, Bell Inds. 319-365-4877
MD Columbia, Future Elctrns., Corp. 301-290-0600
MD Gaithersburg, Axis Elctrns. 301-840-9640
MD Jessup, Bell Inds. 301-953-2566
MA Andover, Bell Inds. 508-474-8880
MA Bolton, Future Electronics 508-779-3000
MI Brighton, Applied Power, Inc. 313-227-3604
MI Detroit, Future Elctrns., Corp. 313-261-5270
MI Livonia, L.W.C. Distributors 313-464-7700
MI Wixom, Bell Inds. 313-347-6633
MN Eden Prairie, Future Elctrns., Corp. 612-944-2200
MO St. Louis, Future Elctrns., Corp. 314-469-6805
NH Londonderry, Orion Inds. 603-437-3260
NJ Fairfield, Future Elctrns., Corp. 201-227-4346
NJ Lodi, TRC Elctrns. 201-779-8282
NM Albuquerque, Bell Inds. 505-292-2700
NY Long Island, Future Elctrns., Corp. 516-234-4000
NY Rochester, Future Elctrns., Corp. 716-272-1120
NY Syracuse, Future Elctrns., Corp. 315-451-2371
NC Charlotte, Future Elctrns., Corp. 704-529-5500
NC Raleigh, Future Elctrns., Corp. 919-790-7111
OH Dayton, Bell Inds. 513-435-8660
OR Beaverton, Future Elctrns., Corp. 503-645-9454
OR Lake Oswego, Bell Inds. 503-635-6500
PA Allentown, TRC Elctrns. 215-391-8977
PA Philadelphia, Future Elctrns., Corp. 609-778-7600
TX Dallas, Bell Inds. 214-690-0466
TX Dallas, Future Elctrns., Corp. 214-437-2437
TX Dallas, Seaton Elctrns. 214-980-9860
TX Houston, Future Elctrns., Corp. 713-556-8696
TX Houston, Seaton Elctrns. 713-731-2649
UT Midvale, Bell Inds. 801-255-9611
UT Salt Lake City, Future Elctrns., Corp. 801-972-8489
WA Redmond, Future Elctrns., Corp. 206-881-8199
WI Waukesha, Bell Inds. 414-547-8879
WI Waukesha, Future Elctrns., Corp. 414-786-1884
Can Calgary, Alb., Future Elctrns., Corp. 403-250-5550
Can Edmonton, Alb., Future Elctrns., Corp. 403-438-2858
Can Mississauga, Future Electronics 416-612-9200
Can Montreal, Que., Future Elctrns. Corp. 514-694-7710
Can Ottawa, Ont., Future Elctrns., Corp. 613-820-8313
Can Quebec City, Que., Future Elctrns., Corp. 418-682-8092
Can Vancouver, B.C., Future Elctrns., Corp. 604-294-1166
OR Beaverton, Future Elctrns., Corp. 503-645-9545

INTERNATIONAL POWER MACHINES, 2975 Miller Park North, Garland, TX 75042, Tel: 800-527-1208, TELEX: 163592 IPM POWER DAL, FAX: 214-494-2690; *Sls. Mgr.:* Barry Papermaster, VP Mktg. & Sls.

International Power Sources, Inc.

FAX: 508-879-8669

INTERNATIONAL POWER SOURCES, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7434 ..... **D•1807-1809**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
AZ Scottsdale, Power Up Elctrns. 602-955-1105
CA Laguna Hills, Electro Venture South 714-581-9244
CA Los Altos Hills, H B Mktg. 415-941-4080
FL Palm Beach Gardens, Graham Assocs., Inc. 407-622-4049
IL Arlington Hgts., Phoenix Elctrn. Sls. 708-394-4422
KS Olathe, Tech. Sls. Assocs. 913-829-2800
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MA Franklin, OEM Mktg. & Sls. 508-528-4983
MN Edina, Engineering Prods. Assoc., Inc. 612-835-9022
MO St. Louis, Tech. Sls. Assocs. 314-521-2044
NH Salem, OEM Mktg. & Sls. 603-893-0009
NY Jericho, J-Square Mktg. 516-935-3200
NC Winston-Salem, Murcota 919-722-9445
OH Cincinnati, KCH Co. 513-931-1686
PA Montgomeryville, Eastern Sci. Mktg. 215-368-4570
TX Richardson, Jim D. Gray & Assocs. 214-699-9976
UT Ogden, Taylor Mktg. 801-456-9570
WI Brookfield, McMahon Sls., Inc. 414-782-3335

Local Distributors

CA Redwood City, HdB Elctrns. 415-368-1388
GA Norcross, Applied Power, Inc. 404-263-0421
MI Brighton, Applied Power, Inc. 313-227-3604
NH Londonderry, Orion Inds., Inc. 603-437-4446
TX Stafford, Southwest Elctrns. 713-240-4000

International IOR Rectifier

FAX: 213-772-9028

INTERNATIONAL RECTIFIER CORP., 233 Kansas St., El Segundo, CA 90245, Tel: 213-772-2000; Empl.: 2400; *Sls. Mgr.:* Don Prescott; *Dist. Mgr.:* Shawn Fogarty ..... **B•1507**

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Phoenix, Sun State Tech. Sls. 602-220-0595
CA Chatsworth, First Rep 818-718-6155
CA Mtn. View, Brooks Tech. Grp. 415-960-3880
CA San Diego, Harvey King, Inc. 619-587-9300
CA Tarzana, Power Comp. Sls. 818-881-9111
CO Englewood, Thorson Rocky Mountain, Inc. 303-799-3435
CT Fairfield, N.R.G. Ltd., Inc. 203-384-1112
FL Altamonte Springs, Lawrence Assocs., Inc. 407-339-3855
FL Kissimmee, Intl. Rectifier 407-933-2383
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL Palatine, International Rectifier 312-397-0002
IL Rolling Meadows, Phase II Mktg., Inc. 708-806-1330
KY Carmel, Tech. Mktg. Corp. 317-844-8462
IN Ft. Wayne, Tech. Mktg. Corp. 219-432-5553
IA Cedar Rapids, Hitec Central, Inc. 319-396-3228
KY Louisville, Technlg. Mktg. Corp. 502-893-1377
MO Independence, Hitec Central, Inc. 816-796-6684
MA Burlington, AD/Nova Sls., Inc. 617-270-9600
MI Farmington Hills, Luebbe Sls. 313-489-8828
MN Edina, Mel Foster Tech. Sls. 612-941-9790
MO Bridgeton, Hitec Central, Inc. 314-291-5920
NJ Pallisades Park, International Rectifier 201-943-4554
NJ W. Caldwell, Tech. Mktg. Grp. 201-226-3300
NM Albuquerque, Reptronix Ltd. 505-292-1718
NY E. Syracuse, Nycom, Inc. 315-437-8343
NY Fishkill, Intl. Rectifier 914-896-4262
NY Melville, Tech. Mktg. Grp. 516-351-8833
NC Cary, Montgomery Mktg., Inc. 919-467-6319
NC Greensboro, Intl. Rectifier 919-299-4762
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Dayton, Luebbe Sls. Co. 513-294-0426
OH Northfield, Intl. Rectifier 216-467-0852
OH Westlake, Luebbe Sls. Co. 216-899-0071
OR Beaverton, Electra Tech. Sls., Inc. 503-643-5074
PA Broomal, L. D. Lowery, Inc. 215-356-5300
PA Pittsburgh, Luebbe Sls. Co. 412-364-0490
TX Austin, BP Sls. 512-346-9186
TX Houston, BP Sls. 713-782-4144
TX Richardson, BP Sls. 214-234-8438
UT Salt Lake City, Thorson Rocky Mtn., Inc. 801-973-7679
WA Kirkland, Electra Tech. Sls., Inc. 206-821-7442
WI Brookfield, International Rectifier 414-784-2480
WI Wauwatosa, Phase II Mktg., Inc. 414-771-9986

INTERNATIONAL RESISTIVE COMPANY, P.O. Box 1860, Boone, NC 28607, Tel: 704-264-8861, TELEX: 46-9902, FAX: 704-264-8865; Empl.: 1700; *Dist. Mgr.:* Larry J. Johnston

INTERNATIONAL RESOURCE SVCS., 7792 N.W. 72nd Ave., Miami, FL 33166, Tel: 305-884-2924, FAX: 305-885-3127; Empl.: 5; *Sls. Mgr.:* Richard L. Winn



FAX: 402-694-6180

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk., Box 345, Aurora, NE 68818, Tel: 402-694-6111; Empl.: 45; *Sls. Mgr.:* Wayne Roblee ..... **A•1730-1731**

Local Sales Offices & Reps

CA Mission Viejo, EAB Assocs. Inc 714-859-7701
MD Baldwin, Quarterback Sls. Inc. 301-764-9400
MA Scituate, Olsen Tech Sls. Inc. 617-545-5101
MN Minneapolis, Stoss Assocs., Inc. 612-925-2757
MO Jefferson City, Williams Assocs. Co. 314-893-2459
NE Omaha, IONEB 402-895-4431
NJ Collingswood, Resource Partnerships, Inc. 609-869-3170
NY Liverpool, Syronics, Inc. 315-451-0968
NC Raleigh, Raycom, Inc. 912-266-9827
OH Cincinnati, Applied Data Mgt. 513-579-8108
TN McMinnville, B & D Mktg. 615-473-7155
WA Bothell, Evergreen Mktg. Grp. 206-485-8063

INTERNATIONAL SENSOR TECHNOLOGY, 17771 Fitch St., Irvine, CA 92714, Tel: 714-863-9999, FAX: 714-474-7417; *Sls. Mgr.:* Jack McCann

INTERNATIONAL TECHNOLOGIES, INC., 68 Albany Rd., Warwick, RI 02888, Tel: 401-781-5595, FAX: 401-467-5885; Empl.: 15; *Sls. Mgr.:* R.W. Elsdoerfer

INTERNATIONAL TELECOMMUNICATIONS COMPONENTS, INC., 94 B East Jefryn Blvd., Deer Park, NY 11729, Tel: 516-243-1444, FAX: 516-595-9160; FSC No.: 0E6J8; Empl.: 15; *Sls. Mgr.:* Rick Walter

INTERNATIONAL TRANSDUCER CORP., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111, Tel: 805-683-2575, TELEX: 658 495, FAX: 805-967-8199; FSC No.: ID 532; Empl.: 65; *Sls. Mgr.:* Christine M. Bashforth

INTEROPTICS

FAX: 415-340-1670

INTEROPTICS, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-7727, TELEX: 677-1439 (PURDY UW); Empl.: 35 ..... **B•1217**

Local Sales Offices & Reps

AZ Mesa, McDonald-Kerr Tech. Assoc. 602-833-7734
CA Poway, William Steffens Assoc. 619-487-1115
CA Sunnyvale, Pass Assocs. 408-735-9040
FL Boca Raton, Beacon Elctrns. 407-997-5740
FL Clearwater, Beacon Elctrns 813-796-2378

FL	Longwood, Beacon Elctrns.	407-332-1940
MA	Mendon, DMA Mktg.	508-473-9456
MN	Edina, Dytec Instrs., Inc.	612-831-7169
NJ	Passaic, Lightcomm Sls. Assocs.	201-778-6540
NY	New York, Lightcomm Sls. Assocs.	212-254-3211
NC	Fayetteville, Zim-Tek	919-488-4101
OH	Cleveland, Marlow Assocs.	216-831-8232
TX	Dallas, Allied Comps., Inc.	214-238-0408
OR	Beaverton, Pacific Mktg. Specialists	503-641-9373
TX	Austin, Allied Comps., Inc.	512-331-4494
TX	Hurst, Allied Comps., Inc.	817-589-0456
VA	Richmond, EME IV, Inc.	804-360-5049
VA	Williamsburg, EME IV, Inc.	804-253-0171
WA	Redmond, Pacific Mktg. Specialists	206-882-3144

interpoint

FAX: 206-882-1990

INTERPOINT CORPORATION, 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98073-9705, Tel: 206-882-3100; FSC No.: 50821; Empl.: 450; *Sls. Mgr.:* D.T. Baughman, VP of Sls. .... **A•1732-1733; D•1810-1820**

Local Sales Offices & Reps

AL	Huntsville, Novus Grp.	205-534-0044
AZ	Tempe, Gassner & Clark	602-968-9037
TX	Irving, Kite Elctrn. Sls.	214-986-0321
CA	San Diego, Varigon San Diego	619-576-0100
CA	Woodland Hills, Varigon Inc.	818-594-5080
CO	Parker, Tech. Mktg. Assocs.	303-841-3435
FL	Lighthouse Point, Krutek & Assocs.	305-783-2501
GA	Norcross, Novus Grp.	404-263-0320
IN	Ft. Wayne, Corrao Marsh Inc.	219-482-2725
IN	Greenfield, Corrao Marsh Inc.	317-462-6568
CA	Mountain View, Weseloh-Swanson	415-961-0565
FL	Maitland, Jack Krutek & Assoc.	407-628-4837
MD	Owings Mills, Neal Deoul Assocs.	301-363-4311
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MN	Minneapolis, Intertec	612-921-8443
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Marriotsville, Neal Deoul Assoc.	301-795-5775
NJ	Flanders, K & R Engrg. Sls.	201-584-5235, 800-631-9362
NY	E. Syracuse, Advanced Comps. Corp.	315-699-2671
NC	Cary, Novus Grp.	919-460-7771
OH	Mayfield Village, Arthur H. Baier Co.	216-461-6161
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Houston, Kite Electrn. Sls.	713-738-5258
Can	Calgary, Alb., Cana Rep. Grp. Inc.	403-243-5148
Can	Montreal, Que., Cana Rep Grp. Inc.	514-276-4477
Can	Surrey, BC, Cana Rep Grp. Inc.	604-589-8595
Can	Willowdale, Ont., Cana Rep. Grp. Inc.	416-250-6683

Local Distributors

IA	Cedar Rapids, Midwest Tech. Sls.	319-393-5115
KS	Goddard, Midwest Tech. Sls.	316-794-8565
MO	Earth City, Midwest Tech. Sls.	314-298-8787
UT	Salt Lake City, Technology Mktg. Assoc.	801-943-5609

INTERSWITCH, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-8217, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (Purdy UW); Empl.: 32; *Sls. Mgr.:* Clarence Bruce ..... **B•1817**

Local Sales Offices & Reps

CA	Burlingame, Interswitch	415-347-8217
CA	Burbank, Darco	818-504-2425
CA	Burlingame, William J. Purdy Co.	415-347-7701
CO	Englewood, William J. Purdy Co.	303-790-2211
IL	Addison, Hedge Assocs., Inc.	708-543-0888
IN	Indianapolis, John Sukup Inc.	317-253-5501
MA	Framingham, Gallagher Assocs., Inc.	508-626-2346
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, Hei-Lite Sls., Inc.	612-550-0506
NY	Victor, Net Sls., Inc.	716-924-1844
OH	Cleveland, Marlow Assocs.	216-861-8232
OH	Dayton, Marlow Assocs.	513-274-9666
OR	Beaverton, Pacific Mktg.	503-641-9373
PA	Ambler, W.R. Hartmaier Assocs.	215-643-6691
TX	Dallas, Elcom Mktg.	214-241-2166
TX	Houston, Elcom Mktg.	713-350-8064
WA	Redmond, Pacific Mktg.	206-882-3144
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	Fremont, Allied Elctrns.	415-770-0590
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Sunnyvale, Penstock	408-730-0300
CA	Tustin, Allied Elctrns.	714-669-4190
CO	Denver, Integrated Elctrns.	303-292-6121
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
GA	Norcross, Allied Elctrns.	404-446-8595
IL	Chicago, Federal Screw Prods.	312-478-5744
IL	Elgin, Allied Elctrns.	312-697-8200
MD	Columbia, Powell Elctrns.	301-621-8080
MA	Lynn, Land Elctrn. Co.	617-592-2220
MA	Westborough, Powell Elctrns.	617-366-6100
MA	Wilmington, Allied Elctrns.	617-942-0150
MN	Minneapolis, Bergquist	612-835-2322
NJ	Englewood, Powell Elctrns.	201-894-0800
NJ	Mt. Laurel, Allied Elctrns.	609-234-7769
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Rochester, Allied Elctrns.	716-244-9440
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Allied Elctrns.	919-876-5845
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Pittsburgh, Allied Elctrns.	412-367-4124
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Irving, Powell	214-550-0547
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Seattle, Allied Elctrns.	206-547-2827
WI	Milwaukee, Taylor Elec. Co.	414-241-4321
Can	Don Mills, Ont., Saynor Varah	416-445-0723

INTER-TECHNICAL GROUP INC., WIMA Div., 2269 Saw Mill River Rd., Ste. 400, P.O. Box 217, Elmsford, NY 10523, Tel: 914-347-2474, FAX: 914-347-7230; Empl.: 17; *Sls. Mgr.:* Gary M. Fey; *Dist. Mgr.:* Andrew E. Dvorscak ..... **A•1071-1073**

Local Sales Offices & Reps

AL	Huntsville, J. R. Assocs.	205-830-2130
AZ	Phoenix, Saguaro Sls.	602-861-1856
CA	Campbell, Shur Sls.	408-374-5577
CO	Arvada, ArrowHead/CSI Sls. Corp.	303-423-5556
FL	Clearwater, Electrocraft, Inc.	813-573-2277
GA	Conyers, J.R. Assocs.	404-760-1815
MA	Millis, Selmark Assocs., Inc.	508-376-2914
MI	Detroit, Qualitron	313-534-1511
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NY	Rochester, BKT Assocs., Inc.	716-461-9880
NY	Smithtown, T & K Sls.	516-724-3456
NC	Greensboro, Arthur, Harris and Assoc., Inc.	919-275-3030
OR	Beaverton, Harry Levinson Co.	503-690-1312
OH	Columbus, Tom Mulligan Co.	614-457-2242
TN	Chattanooga, J. R. Assocs.	615-977-0711
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls, Inc.	214-234-0255
UT	Midvale, ArrowHead/CSI Sls. Corp.	303-423-5556
VA	Richmond, Glasscock Assocs.	804-740-0063
WA	Seattle, Harry Levinson Co.	206-382-1300

Local Distributors

CA	San Jose, Shelly-Ragon, Inc.	408-432-0600
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
CT	Bridgeport, Park Distrs. Inc.	203-366-7200
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Melbourne, Pridmore Corp.	407-727-2491
CO	Englewood, Indelco, Inc.	303-694-9444
IL	Rosemont, Advent Elctrns., Inc.	312-297-6200
IN	Indianapolis, Advent Elctrns., Inc.	317-872-4910
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
MA	Ashland, March Elctrns.	508-881-6715
MN	New Brighton, Chris Elctrns. Distr.	612-631-2647
NJ	East Brunswick, Brothers Elctrns., Inc.	201-238-2200
NM	Albuquerque, Betatron Elctrns.	505-821-1122
NY	Bohemia, March Elctrns.	516-563-6000
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
OH	Englewood, Argent Inds., Inc.	513-836-8633
PA	Exton, VSH Elctrns.	215-363-2250
PA	North Versailles, CMD Elctrns., Inc.	412-678-6020
TX	McKinney, Prime Distrbg. Co.	214-231-0170
WA	Seattle, Kam Elctrns. Div.	206-382-1300

INTRA-COMPUTER, 87-46 Van Wyck Expwy., Jamacia, NY 11418, Tel: 718-297-5500, FAX: 718-297-5518; Empl.: 9; *Sls. Mgr.:* Art Yaglian

INTRONICS, INC., 150 Dan Rd., Canton, MA 02021, Tel: 617-828-4992, FAX: 617-828-5050; Empl.: 75

ION PHYSICS CO., 11 Industrial Way, Atkinson, NH 03811, Tel: 603-893-6687, FAX: 603-893-6729

IPAC GRP., 3047 Indl. Blvd., Bethel Pk, PA 15102, Tel: 412-831-9200, TWX: 510-697-3935, FAX: 412-831-9580; Empl.: 50; *Sls. Mgr.:* Joseph Gill

IPM, INC., Elnik Systems, 3 Edison Place, Fairfield, NJ 07004, Tel: 201-882-8033, FAX: 201-882-8037; Empl.: 8; *Sls. Mgr.:* Claus J. Joens

IRONICS INCORPORATED, 798 Cascadilla St., Ithaca, NY 14850, Tel: 607-277-4060, TELEX: 705-742; *Sls. Mgr.:* R. Chris Martens

IR SCIENTIFIC, Box 110, Carlisle, MA 01741, Tel: 508-667-7110; Empl.: 10

ISC CARDION ELECTRONICS, INC., Long Island Expwy., Woodbury, NY 11797, Tel: 516-921-7300, TELEX: 221683 CARD, TWX: 510-221-2179, FAX: 516-921-7330; FSC No.: 12909; Empl.: 450; *Sls. Mgr.:* F. J. Gareffa

ISC DATACOM, ISC Defense & Space, 1288 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-747-0300, FAX: 408-747-1873; FSC No.: 74444; Empl.: 35; *Sls. Mgr.:* C. Frank

ISC MAGNETICS DIV., See Aeroflex Labs., Inc., Magnetic Prods. Div.

ISKRA ELECTRONICS, INC., 155 Dupont St., Plainview, NY 11803, Tel: 516-349-0222, TELEX: 221527, FAX: 516-349-7642; *Sls. Mgr.:* Debbie Gremito ..... **A•1075, 1923, 2095**

Local Sales Offices & Reps

IL	Cary, Bob Burns & Assocs.	708-516-3322
NM	Albuquerque, FP Sls.	505-345-5553
IN	Indianapolis, Insul Reps.	317-251-1994
LA	Hammond, Design Mktg. of LA, Inc.	504-542-1115
AZ	Tempe, F P Sls.	602-894-5303
NJ	Medford, CEF Assocs.	609-953-8945
GA	Alpharetta, R A Sls.	404-442-6749
NY	North Port, R. P. Luce & Co.	516-754-5064
NC	New Bern, R A Sls.	919-244-2672
OH	Mentor, Sales Plus	216-942-7811
SC	Easley, R A Sls.	803-859-1859
TN	Knoxville, Insul Reps	615-691-7586
UT	Salt Lake City, Sage Assoc.	801-467-5451

Local Distributors

MA	Billerica, Baldwin Comps. Ctr.	508-667-6710
NJ	Westwood, Seacor	201-666-5600
NY	Ronkonkoma, Baldwin Comps.	516-588-5700



FAX: 516-937-3840

ISL PRODUCTS INT'L, LTD., 235 Robbins La., Ste. 270, Syosset, NY 11791-6093, Tel: 516-937-3475, TELEX: 503242; Empl.: 10; *Sls. Mgr.:* Ken Kawaller ..... **A•1734, 2042, 2237; C•1399, 1759**

Local Sales Offices & Reps

IN	Indianapolis, C.C. Electro Sales	317-255-1508
MN	St. Paul, Countryman Assoc.	612-645-9151

ISOCOM INC., 274 E. Hamilton Ave., Ste.E, Campbell, CA 95008, Tel: 408-370-2212, FAX: 408-370-2309; *Sls. Mgr.:* Stephen Parry; *Dist. Mgr.:* Glenda Rees

ISOLATION PRODUCTS, INC., 157 San Lazaro Ave., Sunnyvale, CA 94086, Tel: 408-730-4672; Empl.: 5

ISOREG CORP., 410 Great Rd., P.O. Box 486, Littleton, MA 01460, Tel: 508-486-9483, FAX: 508-486-3539; FSC No.: 7Y052; Empl.: 75; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss



FAX: 508-676-0885

ISOTEK CORPORATION, 566 Wilbur Ave., Swansea, MA 02777, Tel: 508-673-2900; Empl.: 3; *Sls. Mgr.:* Steve Mathewson ..... **A•1925-1927**



FAX: 804-977-1849

ISOTEMP RESEARCH, INC., P.O. Box 3389, Charlottesville, VA 22903, Tel: 804-295-3101; FSC No.: 031785; Empl.: 58 ..... **A•1376-1377**

Local Sales Offices & Reps

CA	Fremont, Wm. Parks & Assocs.	415-796-0875
CA	San Diego, Qualtronics	619-695-0118
IL	Woodridge, Trend-Tronics	312-985-0626
NC	Raleigh, Godwin Assocs.	919-847-3006

ISOTRONICS, INC., Industrial Park, New Bedford, MA 02745, Tel: 508-998-2000, TWX: 710-344-1961; *Sls. Mgr.:* Jeffrey Lang

ITEK ENCODER, See BEI Motion System/ITEK Encoder Div.

ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, TWX: 510-255-9307, FAX: 607-272-4550; Empl.: 100; *Sls. Mgr.:* E. W. Seymour

ITL CIRCUITS, 90 Don Park Road, Markham, Ontario, Canada L3R 1C4, Tel: 416-475-6658, 416-492-9307, FAX: 416-475-5097; FSC No.: FSCM 38747; Empl.: 95; *Sls. Mgr.:* Derk Wissink

ITRONIC-FUCHS CORP., P.O. Box 543, Buford, GA 30518, Tel: 404-945-3844, FAX: 404-945-7766; Empl.: 2; *Sls. Mgr.:* Michael Wegner; *Dist. Mgr.:* Michael Wegner

ITT CANNON, 666 E. Dyer Road, Santa Ana, CA 92705-5684, Tel: 714-557-4700, TELEX: 75-3917, TWX: 910-997-0523; FSC No.: 71468;Multiple; Empl.: 1500; *Sls. Mgr.:* Richard Torson; *Dist. Mgr.:* Richard Torson

ITT

FAX: 714-727-2109

ITT COMPONENTS, ITT Corporation, 5 Jenner St., Irvine, CA 92718, Tel: 714-727-3001, TELEX: 681-389, TWX: 910-595-1744; FSC No.: 61725; Empl.: 20; *Dist. Mgr.:* M. Pommier ..... **A•2096-2097; B•1508-1515**

Local Sales Offices & Reps

AL	Huntsville, JWL	205-883-1712
AZ	Phoenix, Hartland	602-492-0012
CA	Burbank, Darco	818-504-2425
CA	San Diego, Varigon	619-576-0100
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Englewood, Romulus Elctrns.	303-770-4888
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Pompano Bch., Bolton Assocs.	305-975-7245
FL	St. Petersburg, Bolton	813-864-2294
GA	Atlanta, JWL	404-320-7643
IL	Inverness, Heartland Tech. Sls.	708-358-6622
IN	Ft. Wayne, M/S Sls.	219-436-3023
IN	Indianapolis, M/S	317-881-0110
KS	Wichita, Thunderbird Tech. Sls.	316-684-3941
MD	Lutherville, DGR	301-583-1360
MA	Sudbury, KSA of New England	508-443-5881
MI	Brighton, Elctrn. Sources Inc.	313-227-3598
MN	Minnetonka, Neotech	612-935-7930
MO	Maryland Hgts., Thunderbird Tech. Sls.	314-298-8940
NJ	Mt. Laurel, Wyck Mktg.	609-727-1070
NM	Albuquerque, Syntech	505-266-7951
NY	Manhasset, Win Cor Elctrns.	516-627-9474
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OH	Cleveland, Omega Sls.	216-360-9400
OK	Tulsa, Milco	918-582-9411
TX	Plano, Milco Mktg.	214-578-1996
WA	Redmond, EMG	206-882-0962
WA	Vancouver, EMG	206-254-4572
WI	Brookfield, Heartland	414-792-0920

Local Distributors

AL	Huntsville, Time	205-721-1133
AL	Mobile, Control Design Supp.	205-666-6693
AZ	Tempe, Control Design Supp.	602-829-7981
AZ	Tempe, Richey Impact Elctrns.	800-421-7258
AZ	Tempe, Time	602-967-2000
AR	Maumelle, Control Design Supp.	501-851-3137
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Chatsworth, Time	818-998-7200
CA	Garden Grove, Richey Impact Elctrns.	714-895-0060
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Irvine, ITT Multi Comps.	714-727-4001
CA	Oakland, Brill	415-834-5888
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Diego, Richey Impact Elctrns.	619-271-4511
CA	San Diego, Time	619-586-0129
CA	San Jose, Integrated Elctrns.	408-263-1100
CA	San Jose, ITT Multicomps.	408-279-0685
CA	San Jose, Richey Impact Elctrns.	408-432-7100
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Sunnyvale, Time	408-734-9888
CA	Torrance, Time	213-320-0880
CA	Tustin, Time	714-669-0100
CO	Denver, Control Design Supp.	303-296-1822
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, NEP Elctrns.	303-799-9898
CO	Englewood, Time	303-721-8882
CO	Westminster, ITT Multicomponents	303-451-8740
CT	Cheshire, Time	203-271-3200
CT	East Haven, J.V. Elctrns.	203-469-2321
CT	New Haven, Greene Shaw Co.	203-397-0710
CT	Wallingford, Control Design Supp.	203-269-9955
FL	Almonte Spgs., Control Design Supp.	305-788-3220
FL	Davie, ARCO Distrs.	305-473-2550
FL	Ft. Lauderdale, Time	305-484-1778
FL	Melbourne, Greene Shaw	407-951-3636
FL	Orlando, Time	407-841-6565
FL	Pompano Bch., Control Design Supp.	305-782-1311
GA	Norcross, Time	404-368-0969
GA	Stone Mountain, Control Design Supp.	404-979-3500
IL	Chicago, Leeds Electro Comps.	312-825-3800
IL	Chicago, NEP Elctrns.	708-595-8500
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
IL	Schaumberg, Time	708-303-3000
IL	Schaumburg, Control Design Supp.	708-307-8900
IN	Indianapolis, Control Design Supp.	317-788-4559
IN	Indianapolis, CSE	317-879-9119
IN	Indianapolis, Mar Elctrns.	317-633-6699
IA	Marion, Control Design Supp.	319-373-2923
KS	Kansas City, Control Design Supp.	913-362-4248
MD	Beltsville, RESCO-Washington	301-937-9100
MD	Columbia, Time	301-964-3090
MD	Jessup, TREEKO Sls.	301-470-3300
MD	White Marsh, Resco	301-529-0500
MA	Canton, Richey Impact Elctrns.	617-821-1500
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Peabody, Time	508-532-9900
MA	Woburn, Control Design Supp.	617-932-9404
MI	Farmington Hills, Control Design Supp.	313-473-0220
MI	Livonia, Key Elctrns.	313-489-5455
MN	Edina, Time	612-943-2433
MN	Minneapolis, Control Design Supp.	612-721-1628
MN	St. Paul, Shelley-Ragon	612-642-2828
MO	Kansas City, Control Design Supp.	913-362-4248
MO	Manchester, Time	314-391-6444
MO	St. Louis, Control Design Supp.	314-426-3150
NV	Las Vegas, Kiesub Elctrns.	702-733-3888
NJ	Marlton, Time	609-596-6700
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	W. Berlin, GCI	609-768-6767
NJ	Wayne, Time	201-785-8250
NM	Albuquerque, Betatron Elctrns.	505-344-2381
NM	Albuquerque, Harrison/Intl.	505-291-9951
NY	E. Syracuse, Time	315-432-0355
NY	Hauppauge, Time	516-273-0100
NY	Rochester, Masline	716-546-5373
NC	Charlotte, Control Design Supp.	704-588-4410
NC	Raleigh, Greene-Shaw	919-954-7138
NC	Raleigh, Resco	919-781-5700
NC	Raleigh, Time	919-847-9650
OH	Cincinnati, Schuster	513-489-1400
OH	Cleveland, Schuster	216-425-8134
OH	Columbus, Time	614-794-3301
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Portland, Time	503-684-3780
PA	Malverne, Control Design Supp.	215-296-0150
TX	Austin, Time	512-346-7346
TX	Carrollton, LCD	214-245-0600
TX	El Paso, Harrison/Intl.	915-598-3406
TX	Houston, Control Design Supp.	713-868-4018
TX	Houston, Harrison Elctrns.	713-879-2727
TX	Richardson, Time	214-644-4644
UT	Nephi, Control Design Supp.	801-623-2908
UT	W. Salt Lake, Integrated	801-298-1869
UT	W. Valley, Time	801-973-8494
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Kent, Control Design Supp.	206-251-6323
WA	Redmond, Time	206-882-1600
WA	Seattle, Radar	206-282-2511
WA	Seattle, Richey Impact Elctrns.	206-575-1910
WI	New Berlin, Control Design Supp.	414-784-1015
WI	New Berlin, NEP Elctrns.	414-785-9100

ITT CONOFLOW, ITT Fluid Technology Corp., Route 78, St. George, SC 29477, Tel: 803-563-9281, TELEX: 4945706, FAX: 803-563-2131; *Sls. Mgr.:* Thomas Floro

ITT GILFILLAN, ITT Defense Inc., 7821 Orion Ave., P.O. Box 7713, Van Nuys, CA 91409, Tel: 818-988-2600, TELEX: 651421, TWX: 910-495-1787; FSC No.: 24930; Empl.: 1250; *Sls. Mgr.:* Nick Riley, VP

ITT HIGBIE BAYLOCK, 3000 University Drive, Auburn Hills, MI 48321-7016, Tel: 313-340-3000, FAX: 313-340-3707; Empl.: 1500; *Sls. Mgr.:* R.M. Davie VP Sls.

ITT POWERSYSTEMS CORP., Box 688, Galion, OH 44833-0688, Tel: 419-468-5200, TELEX: 4972923, FAX: 419-468-3235; Empl.: 450; *Sls. Mgr.:* C. Searles; *Dist. Mgr.:* G. Ardolino

ITT SCHADOW, 8081 Wallace Rd., Eden Prairie, MN 55344, Tel: 612-934-4400, TELEX: 29-0556, TWX: 910-576-2469, FAX: 612-934-9121; Empl.: 115; *Sls. Mgr.:* Darrell Wilk; *Dist. Mgr.:* Scott Mork

ITT SEALECTRO, INC., 585 East Main St., New Britian, CT 06051, Tel: 203-223-2700, TELEX: 71-425-501, FAX: 203-225-2781; FSC No.: 98291; Empl.: 350; *Sls. Mgr.:* Ray Champi; *Dist. Mgr.:* Karen Muratori

ITW FASTEX DISTRIBUTOR BUSINESS, 226 Gerry Dr., Wood Dale, IL 60191-1150, Tel: 708-350-8200, FAX: 708-595-2141; *Sls. Mgr.:* S. Blank,B. Casey, R. Grega, B. Vanbebber

ITW Paktron

FAX: 804-239-4730

ITW PAKTRON, Div. of Illinois Tool Works, P.O. Box 4539, 1205 McConville Rd., Lynchburg, VA 24502, Tel: 804-239-6941; FSC No.: 19396; *Sls. Mgr.:* Richard Slocum ..... **A•1076-1077**

Local Sales Offices & Reps

AL	Huntsville, ACM, Inc.	205-881-5493
AZ	Paradise Valley, Astrocom Mktg.	602-991-6646
CA	Playa-del-Ray, Corcoran Assoc.	213-823-4589
CA	Santa Clara, Synelect Mktg.	408-244-9900
CO	Parker, High Plains Mktg.	303-841-6464
FL	Cassel Berry, Dyne-A-Mark	407-831-2822
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
GA	Norcross, ACM, Inc.	404-448-7025
IL	Rolling Meadows, Weisser Assoc.	312-392-5556
IN	Indianapolis, Central Regional Off.	317-257-3704
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	West Des Moines, SPS Assocs., Ltd.	515-225-0607
KS	Olathe, SPS Assocs., Ltd.	913-764-4460
MD	Annapolis, Parogem Inc.	301-269-1898
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Oak Pk., A. Blumenberg Assocs. Inc.	313-968-3230
MN	Hopkins, Forsythe Assoc.	612-933-8267
MO	Earth City, SPS Assocs., Ltd.	314-291-0520
NE	Panama, SPS Assocs.	402-788-2536
NY	E. Rochester, L-Mar Assocs., Inc.	716-681-9100
NY	Poughkeepsie, L-Mar Assoc. Inc.	914-462-8025
NC	Raleigh, C-Tech	919-782-8100
OH	Solon, J R Thornberry Co. Inc.	216-248-4995
TX	Austin, Electra Reps, Inc.	512-339-1163
TX	Dallas, Electra Reps, Inc.	214-248-3852
VA	Lynchburg, Paktron Div.	804-239-6941
WA	Bellevue, Caruso & Co.	206-455-8811

WI Hartland, Selective Sls. Inc. 414-367-1133
Can Markham, Ont., Avotronics 416-475-2024
Can Pointe Claire, Que., Avotronics 514-697-2135

Local Distributors

AZ Phoenix, Future Elctrns. 602-272-7951
CA Chatsworth, Future Elctrns. 818-772-6240
CA Irvine, Future Elctrns. 714-250-4141
CA San Diego, Future Elctrns. 619-278-5020
CA San Jose, Future Elctrns. 408-434-1122
CA Van Nuys, E.W. Elctrns. 818-782-9020
CO Westminster, Future Elctrns., Inc. 303-650-0123
CT Bethel, Future Elctrns. 203-743-9594
FL Altamonte Springs, Future Elctrns., Inc. 305-767-8414
FL Clearwater, Future Elctrns., Inc. 813-578-2770
FL Ft. Lauderdale, N R C Elctrns. 305-772-4500
GA Augusta, Dixie Elctrns., Inc. 404-722-2055
GA Norcross, Future Elctrns., Inc. 404-441-7676
IL Elk Grove Village, Bell Inds. 312-640-1910
IL Schaumburg, Future Elctrns. 312-882-1255
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Custom Svcs. Elec. 317-879-9119
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MD Columbia, Future Elctrns. 301-290-0600
MD Jessup, Treeko Sls. 301-470-3300
MD Spencerville, U.S. Elctrns. 301-384-3300
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MA Westboro, Future Elctrns. 617-366-2400
MI Livonia, Future Elctrns. 313-261-5270
MN Eden Prairie, Future Elctrns. 612-944-2200
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NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Hauppauge, Future Elctrns. Inc. 516-234-4000
NY Liverpool, Future Elctrns. 315-451-2371
NY Rochester, Future Elctrns. 716-272-1120
NY Rochester, Simcona Elctrns. 716-328-3230
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NC Charlotte, Future Elctrns. 704-529-5500
NC Greensboro, Golden Elctrns. 919-294-4653
NC Winston-Salem, Dixie Elctrns. 919-724-5961
OH Columbus, Elctrn. Mktg. Corp. 614-299-4161
OH Dayton, Elctrn. Mktg. Corp. 513-439-4711
OH Highland Heights, Elctrn. Mktg. Corp. 216-442-3441
OK Tulsa, Altair Co. 918-252-5781
OR Beaverton, Future Elctrns. 503-646-9454
PA McKean, Advacom, Inc. 814-476-7774
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SC Greenville, Dixie Elctrns., Inc. 803-297-1435
SC N. Charleston, Dixie Elctrns. 803-552-2671
TN Gray, Dixie Elctrns., Inc. 615-477-3838
TN Knoxville, Dixie Elctrns., Inc. 615-938-4131
TX Austin, Altair Co. 512-837-4970
TX Houston, Altair Co. 713-462-3029
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TX Richardson, Future Elctrns., Inc. 214-437-2437
UT Salt Lake City, Future Elctrns. Inc. 801-972-8489
WA Redmond, Future Elctrns., Inc. 206-881-8199
WI Mequon, Taylor Elec. 414-241-4321
WI Racine, Badger Elctrns. Co. Inc. 414-637-1256
WI Waukesha, Bell Inds. 414-547-8879
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Can St. Foy, Que., Future Elctrns. 418-682-8092
Can Vancouver, B.C., Future Elctrns. 604-294-1166
Can Winnipeg, Manitoba, Future Elctrns. 204-786-7711

ITW Switches

FAX: 312-545-4450

ITW SWITCHES, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040, TELEX: 275226; Empl.: 500; *Dist. Mgr.:* P. Smentek ..... **B•1712-1721**

Local Sales Offices & Reps

AL Huntsville, Electro Mech 205-880-0592
AZ Glendale, The Knight Co. 602-433-2166
CA Los Angeles, The Knight Co. 213-670-2833
CA Santa Clara, Westrep 408-988-8833
CO Parker, High Plains Mktg. 303-841-6464
CT Clinton, Selmark Assoc. 203-573-9088
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GA Atlanta, Electro Mech. 404-447-6478
IL Downer's Cove, Golten Assoc. 708-512-0093
IA Cedar Rapids, R. F. Welch Co. 319-362-6824
KS Kansas City, BC Elctrns. 913-342-1211
MD Baltimore, MicroComp 301-644-5700
MA Millis, Selmark Assoc. 508-376-2914
MI Grand Rapids, Urban & Assoc. 616-245-0511
MN Minneapolis, Comstrand 612-788-9234
MO St. Louis, BC Elctrns. 314-521-6683
NJ Red Bank, Varrelman-Gorman Co. 201-219-0088
NY E. Syracuse, Fountain, Young & Co. 315-437-7733
NC Raleigh, Electro Mech 919-790-9300
OH Medina, Rockford Controls 216-725-3705
PA Oreland, Precision Mktg. 215-233-9233
TX Dallas, Electra Reps. 214-248-3852

IVEK CORP., Fairbanks Rd., N. Springfield, VT 05150, Tel: 802-886-2238, FAX: 802-886-8274; Empl.: 15; *Sls. Mgr.:* Mark Tanny; *Dist. Mgr.:* Frank Nobile

IVO

FAX: 908-542-2938

IVO INDUSTRIES, INC., 201 Industrial Way W., Eatontown, NJ 07724, Tel: 908-542-5151, 800-932-0489; Empl.: 10; *Sls. Mgr.:* Daniel Vannote ..... **B•1091, 1722-1723, 1906-1907**

IXYS CORP., 2355 Zanker Rd., San Jose, CA 95131-1109, Tel: 408-435-1900, TELEX: 384928IXYSSNJ UD, FAX: 408-435-0670; FSC No.: 408-435-1033; Empl.: 100; *Sls. Mgr.:* Kent Paris

JAE
JAE Electronics, Inc.

FAX: 714-753-2699

JAE ELECTRONICS INC., 142 Technology Drive, Irvine, CA 92718, Tel: 714-753-2600; Empl.: 3400 (Worldwide); *Sls. Mgr.:* David Shaff, Dir. Field Sls.; *Dist. Mgr.:* Paul Parkinson ..... **B•1724-1725; C•1400-1403**

Local Sales Offices & Reps

AL Huntsville, Glen White Assocs. 205-882-6751
CA Newport Beach, Camda, Inc. 714-553-9228
CA San Diego, Camda, Inc. 619-726-9844
CA Santa Clara, Pinnacle Sls. 408-249-7400
CA Studio City, Camda, Inc. 818-762-9261
CO Littleton, Con-Tek Mktg. 303-973-8490
FL Clearwater, Glen White Assocs. 813-938-7557
FL Deerfield Beach, Glen White Assocs. 305-570-8545
FL Ft. Lauderdale, JAE Elctrns. 305-563-3484, 800-248-0737
FL Satellite Bch., Glen White Assocs. 407-773-3514
GA Norcross, Glen White Assocs. 404-441-1447
IN Ft. Wayne, Frank J. Campisano Co. 219-486-6443
IN Indianapolis, Campisano Co. 319-577-0319
MD Baltimore, Glen White Assocs. 301-321-7235
MA Harvard, Cycle Sls. 508-456-6868
NJ Matawan, Shepard & Assocs. 908- 254-5757
NY Pittsford, Franklin Sls. Corp. 716-248-8251
NC Charlotte, Glen White Assocs. 704-875-3777
NC Raleigh, Glen White Assocs. 919-848-1931
OH Cincinnati, Frank J. Campisano Co. 513-574-7111
OH Columbus, Frank J. Campisano Co. 614-876-5404
OH Mentor, Frank J. Campisano 216-975-9300
TX Plano, Jae Elctrns. 214-881-1183
TX Plano, RAM 214-424-4455
OR Portland, Venture Elctrns. 503-624-0617
PA Coraopolis, Frank J. Campisano Co. 412-264-5151
RI Cranston, Jae Elctrns. 401-946-0210
PA West Chester, TCA Inc. 215-692-6853
TX Austin, RAM 512-250-5082
TN Gray, Glen White Assocs. 615-477-8850
TX Houston, RAM 713-580-7394
TX Houston, RAM 713-955-0768
VA Lynchburg, Glen White Assocs. 804-385-6110
WA Bellevue, Venture Elctrns. 206-454-4594

Local Distributors

AZ Scottsdale, Cypress Elctrns. 602-949-0802
CA Buena Pk, Cypress Elctrns. 213-404-0445, 714-521-5230
CA San Diego, Cypress Elctrns. 619-535-0011
CA Santa Clara, Compass Elctrns. 408-432-7575
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Englewood, Cypress Elctrns. 303-792-5829
GA Atlanta, Satori 404-242-0606
MA Middleboro, Glynn Elctrns. 508-947-4262
MN Eden Prairie, Cypress Elctrns. 612-934-2104
NH Manchester, Glynn Elctrns. 603-622-8131
NY Deer Pk., Ramtronix Inc. 516-242-4700
OH Akron, Aesco Elctrns. 216-762-8818
OH Columbus, Aesco Elctrns. 614-882-6762
OR Beaverton, Cypress Elctrns. 503-223-8900
PA Bristol, AIM Elctrns. 215-785-3500
TX Dallas, Satori 214-518-1946
TX Dallas, Cypress Elctrns. 214-225-0065
WA Bothell, Cypress Elctrns. 206-483-1144

JAICO PRODUCTS, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622, Tel: 312-421-1090, FAX: 312-421-1165; Empl.: 35; *Sls. Mgr.:* John S. Jaidinger

JAMES ELECTRONICS, 4050 N. Rockwell, Chicago, IL 60618, Tel: 312-463-6500, FAX: 312-465-1504; Empl.: 220; *Sls. Mgr.:* Vincent Kennedy

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AN ESOP CORP.

FAX: 818-842-3396

JANCO CORP., Box 3038-Glenoaks Sta., Burbank, CA 91508, Tel: 818-846-1800, TWX: 910-498-2701; FSC No.: 91812; Empl.: 185; *Sls. Mgr.:* Maurice Goldwater ..... **B•1726-1727**

Local Sales Offices & Reps

AZ Mesa, Sys. Sls. of AZ. Inc. 602-464-9989
CA San Diego & So. California, Gabriel & Assoc. 714-666-0660
CA San Jose, Ruppert Sls. & Engrg. 408-998-8717
CO Aurora, Key Specs. 303-690-6106
FL Orlando, MacKay, Smith & Assocs. 305-423-4353
GA Atlanta, MacKay, Smith & Assocs. 404-449-7444
IL Addison, Vikeland Sls. 708-832-8425
IN Greenwood, Aktron Corp. 317-888-2260
KS Wichita, Dy-Tronix Inc. 316-838-2645
MD Ellicott, Tech. Sls. Inc. 800-225-4335
MA Swansea, Eastrep Co. 617-672-0788
MN St. Paul, Cahill, Schmitz & Cahill 612-646-7217
MO Bridgeton, Dy-Tronix Inc. 314-291-4777
NJ Cherry Hill, Quality Comps. 609-428-6266
NY Fairport, TAC Sls. Inc. 716-377-2250
NC Charlotte, MacKay, Smith & Assocs. 704-372-1188
OH Columbus, Tom Mulligan Company 614-457-2242
TX Irving, Trice Mktg. Corp. 214-255-1877
WA Seattle, Norwest 206-827-9562

Local Distributors

CA Burbank, Merit Comp. Supp. 818-842-7607
CA Westlake Village, Tech-Cable Prods. 818-991-4697

JAN

FAX: 718-784-0796

JAN HARDWARE MFG. CO., P.O. Box 1199, Melville, NY 11747, Tel: 718-361-0800; FSC No.: 99813; Empl.: 35; *Sls. Mgr.:* Irwin E. Wasserman ..... **C•1585-1590**

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Local Sales Offices & Reps

CA	San Diego, James E. Fitch & Assocs.	213-946-8062
CA	Santa Fe Springs, James E. Fitch & Assoc.	213-945-2624
MD	Gaithersburg, Naudain Assocs. South.	301-258-5040
MA	Brookline, Harman Assoc., Inc.	617-232-6687
MA	Lee, Harman Assoc., Inc.	413-243-1158
NJ	Marlton, Naudain Assoc.	609-983-5300
TX	Richardson, AGM Sls. Co.	214-644-1475

JEMA

FAX: 708-251-3738

JAPAN ELECTRONIC MANUFACTURERS AGENCY, INC., 1000 Skokie Blvd., Wilmette, IL 60091, Tel: 708-251-3600; Empl.: 10; *Sls. Mgr.:* James Schafen; *Dist. Mgr.:* Chris Gantz **D•1022-1023, 1040-1041, 1268-1269**

JAPANESE PRODUCTS CORP., 7 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-8880, TELEX: 516929 ANS BACK ENFD, FAX: 914-592-7001; Empl.: 8; *Sls. Mgr.:* Don Cassalia

JARO COMPONENTS, INC., 1225 Broken Sound Pkwy., Boca Raton, FL 33431, Tel: 305-771-7000, FAX: 305-772-8899; Empl.: 30; *Sls. Mgr.:* Floyd Burwell; *Dist. Mgr.:* Floyd Burwell

J.A.W. INDUSTRIES, INC., 1750-A Costner Dr., Warrington, PA 18976, Tel: 215-343-8990, FAX: 215-343-8942; Empl.: 20; *Sls. Mgr.:* J. McLaughlin; *Dist. Mgr.:* J. McLaughlin

JAYCO PLASTICS OF CALIFORNIA, INC., 507 W. Blueridge Ave., Orange, CA 92665, Tel: 714-974-1701, TELEX: 678401, FAX: 714-998-4954; Empl.: 33 **B•1818-1819**

Local Sales Offices & Reps

AZ	Tempe, ETS	602-921-7122
CA	Los Angeles, Satori Elec.	213-214-1791
CA	San Diego, Coastal Elctrn. Sls.	619-459-4148
CA	Sunnyvale, Pass Assocs.	408-735-9040
CO	Boulder, Stratford Grp.	303-530-3194
GA	Atlanta, Satori Elec.	404-242-0606
IL	Berkeley, ESA	708-544-0120
NM	Albuquerque, ETS	800-424-2540
NY	New York, Breen Assocs.	201-696-8683
NC	Raleigh, Pinnacle Mktg.	919-878-4658
OR	Portland, D.A. Sullivan Co.	503-292-2448
TX	Dallas, Satori Elec.	214-518-1946

JAYCOR, P.O. Box 85154, San Diego, CA 92186, Tel: 619-453-6580, FAX: 619-535-9763; FSC No.: 3M687; Empl.: 800; *Sls. Mgr.:* Steven Lutjens

JB ELECTRONIC TRANSFORMERS, 2300 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080, FAX: 312-342-9098; FSC No.: 11700; Empl.: 150

jbm

FAX: 603-623-0446

JBM ELECTRONICS, INC., 1 Commerce Drive, Bedford, NH 03110-6802, Tel: 603-623-0222; FSC No.: 62694; Empl.: Approx. 50; *Sls. Mgr.:* Susan Bennett **A•1572-1577, 2238-2239**

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
AZ	Tucson, Clemick & Assocs.	602-749-4003
CA	San Diego, Quattro Sls.	619-581-3093
CA	Santa Clara, Westrep	408-988-8833, FAX:408-988-3186
FL	Miramar, Dan-Tech Sls.	305-963-6142
GA	Chamblee, BCI, Inc.	404-455-0405
IL	Arlington Hgts., Davix Intl. Ltd.	414-255-1600, FAX:414-255-1863
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Needham Hgts., Kanan Technlgs.	617-449-7400
MN	St. Paul, Proud Assocs.	612-646-9428
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NY	Roslyn Hgts., November Elctrn. Sls.	516-621-6378
NC	Charlotte, Quantum Mktg.	704-523-8822
NC	Raleigh, Quantum Mktg.	919-846-5728
PA	Glenside, Koebert Assocs.	215-887-2310
TX	Austin, Texoma Sls.	512-441-1771
TX	Freeport, Texoma Sls.	409-233-3192
TX	Houston, Texoma Sls.	713-462-1432
TX	Richardson, Texoma Sls.	214-238-8127
WV	Inwood, Koebert Assocs.	304-229-8401
Can	Mississauga, Ont., Indigo Electronics	416-670-0284

J-B-T INSTRUMENTS, INC., Box 1818, New Haven, CT 06508-1818, Tel: 203-776-1111, FAX: 203-624-8142; Empl.: 25; *Sls. Mgr.:* Lillian Sharron

JC SYSTEMS, INC., 11175 Flintkote Ave., San Diego, CA 92121, Tel: 619-453-9980, FAX: 619-453-2115; Empl.: 20; *Sls. Mgr.:* Ralph Aniunas

JDK CONTROLS, INC., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, Tel: 805-499-7779, FAX: 805-499-0990; Empl.: 40; *Sls. Mgr.:* Reece Kendall **A•2043**

Local Sales Offices & Reps

NJ	Matawan, Tim Reilly Assocs.	908-566-4555

JEFFERS ELECTRONICS, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621, Tel: 602-281-4925, TELEX: 165036, FAX: 602-281-2930; FSC No.: 59474; Empl.: 400; *Sls. Mgr.:* Ken Shobert; *Dist. Mgr.:* Steve Morris

W. S. JENKS & SON, 1933 Montana Ave. NE, Washington, DC 20002, Tel: 202-529-6020, 800-673-8199, FAX: 202-832-3411

JENNINGS
HIGH VOLTAGE COMPONENTS

FAX: 408-286-1789

JENNINGS, 970 McLaughlin Ave., San Jose, CA 95122-2696, Tel: 408-292-4025, TELEX: 34-6311, TWX: 910-338-0159; FSC No.: 73905; Empl.: 350; *Sls. Mgr.:* E. V. Valehrach **A•1079; B•1516-1519; D•1274**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
AZ	Phoenix, Crown Systems	602-274-3180
CA	Encino, King-Way Assocs.	818-788-4124
CA	San Jose, H. W. Assocs.	408-996-9940
CO	Denver, Lindberg Co.	303-758-9033
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Arlington Hgts., Berndt Assocs.	312-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Haverhill, L.K. Assocs.	617-373-1313
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Flanders, K&R Engrg. Sls.	201-584-5235
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Kingston, Leonard D. Allen, Inc.	914-338-7588
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Centerville, Bear Mktg., Inc.	513-436-2061
OH	Richfield, Bear Mktg., Inc.	216-659-3131
PA	Huntingdon Valley, Omega Elctrns.	215-947-4135
PA	Pittsburgh, Bear Mktg., Inc.	412-531-2002
TX	Houston, Barry Sales	713-784-5860
TX	Richardson, Barry Sales	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-277-2643
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

CA	Carlsbad, Surcom Assocs.	619-438-4420
IL	La Fox, Richardson Elctrns., Ltd.	312-456-0600
TN	Bristol, Kintronics	615-878-3141

JENSEN TOOLS, INC., Axia, Inc., 7815 S. 46th St., Phoenix, AZ 85044, Tel: 602-968-6241, FAX: 800-366-9662; Empl.: 250; *Sls. Mgr.:* Bill Frost

JEROME INDUSTRIES CORP., 730 E. Division St., Elizabeth, NJ 07201, Tel: 908-353-5700, FAX: 908-353-1021; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo **A•2241; D•1822-1825**

JERSEY SPECIALTY CO., See JSC Wire & Cable

JETA
POWER SYSTEMS, INC

FAX: 213-426-2417

JETA POWER SYSTEMS, INC., 2675 Junipero, Signal Hill, CA 90806, Tel: 213-427-0095; Empl.: 110; *Sls. Mgr.:* Derek Steel **D•1826-1827**

Local Sales Offices & Reps

AL	Huntsville, R.O. Whitesell & Assoc.	205-883-5110
AZ	Phoenix, ISBS	602-971-6250
CA	Los Alamitos, Power Specialists, Inc.	213-594-9418
CO	Arvada, Arrowhead/CSI Sls., Inc.	303-423-5597
CT	Vernon, George Urban & Assocs.	203-647-3991
FL	Boca Raton, S. Atlantic Comp. Sls.	407-391-1034
FL	Orlando, S. Atlantic Comp. Sls.	407-857-3650
FL	Winterhaven, S. Atlantic Comp. Sls.	813-324-0953
GA	Atlanta, R. O. Whitesell & Assocs.	404-449-9190
IL	Elmhurst, UTRONIX	708-834-1100
IN	Indianapolis, R. O. Whitesell	317-359-9283
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Dover, George Urban & Assocs.	617-329-4068
MN	Edina, Engrg. Prods. Assocs.	612-835-9022
NH	Londonderry, George Urban Assoc.	603-437-3622
NY	Fairport, Hi-Tec Sls.	716-223-5922
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Fuguay-Varina, R.O. Whitesell & Assoc.	919-552-1122
NC	Greensboro, R.O. Whitesell & Assocs.	919-273-1945
OH	Cincinnati, R.O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
PA	Allentown, TRC Elctrns.	215-391-8977
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TN	Knoxville, R.O. Whitesell & Assocs.	205-883-5150
TX	Dallas, Sunbelt Comps.	214-248-8000
UT	Midvale, Arrowhead/CSI Sls.	801-561-5688
WA	Vancouver, Northwest Comp. Sls.	206-695-1331
WA	Kirkland, N.W. Comp. Sls.	206-828-2104
Can	Montreal, Empro Sls.	514-341-6420

JETTRON PRODUCTS INC., P.O. Box 337, E. Hanover, NJ 07936, Tel: 201-887-0571, FAX: 201-887-4182; FSC No.: 04435; Empl.: 30; *Sls. Mgr.:* Ben Latawiec **C•1404-1405**

Local Sales Offices & Reps

CA	El Cajon, A-Tronics	619-444-1501
NY	New York, Eltron Export Co.	212-944-7635

JEWELL ELECTRICAL INSTRUMENTS, 850 Perimeter Rd., Manchester, NH 03103, Tel: 603-669-6400, FAX: 603-669-5962; Empl.: 175; *Sls. Mgr.:* Andrew Roeper; *Dist. Mgr.:* Andrew Roeper

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JF MICROSYSTEMS, 3641 Frontier Road, Pasco, WA 99301-9619, Tel: 509-297-4294, 800-532-2737; Empl.: 2; *Sls. Mgr.:* Jim Follansbee

JFW INDUSTRIES, INC., 5134 Commerce Sq. Dr., Indianapolis, IN 46237, Tel: 317-887-1340, FAX: 317-881-6790; FSC No.: 61162; Empl.: 87; *Sls. Mgr.:* Carrie Glover

JH

FAX: 213-328-0057

JH AMERICA, INC., JI-HAW Group, 20809 Higgins Court, Torrance, CA 90501, Tel: 213-328-0051 **C•1406-1407, 1760-1763**

Local Sales Offices & Reps

CA	Sunnyvale, Logan Sls.	408-732-6020
CA	Ventura, R D Sls.	805-650-0112
MN	St. Paul, Johnson Co.	612-641-1878
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742

Local Distributors

AZ	Tempe, Comtel Corp.	602-829-9471
CA	Anaheim, Deco Elctrns.	714-630-8252
CA	San Diego, Deco Elctrns.	619-693-1595
FL	Orlando, Computel	407-682-3957
NJ	Kennilworth, Computel	201-241-5400
NC	Charlotte, Computel	704-376-4414

JKL COMPONENTS CORPORATION

FAX: 818-897-3056

JKL COMPONENTS CORPORATION, 13343 Paxton St., Pacoima, CA 91331-2376, Tel: 818-896-0019; FSC No.: 55335; Empl.: 35; *Sls. Mgr.:* Ernie Soares; *Dist. Mgr.:* Bob Brandt ..... **B•1169**

Local Sales Offices & Reps

AL	Huntsville, Taylor-Stone Inc.	205-830-9322
CA	San Diego, Lawsco	619-755-0200
IL	Cary, Bob Burns & Assocs.	708-516-3322
NY	Henrietta, CMJ, Inc.	716-334-3277
IN	Indianapolis, Apex-Tec, Inc.	317-842-5559
MI	Farmington Hills, Clark Sls.	313-553-0610
MN	Bloomington, Murnco	612-854-4161
OH	Cincinnati, Clark Sls. Co.	513-922-7555
OH	Painsville, Clark Sls. Co.	216-247-7848
PA	Philadelphia, Check Assoc.	215-487-3007
TX	Irving, Kite Elec. Sls.	214-986-0321

Local Distributors

AL	Huntsville, Powell Elec.	205-539-2731
CA	San Diego, Richie/Impact Sls.	619-271-4511
AZ	Phoenix, Capital Elctrns.	602-252-5897
CA	Garden Grove, Richey Western	714-895-0060
CA	Gardena, Cal. Switch & Signal	213-770-2330
CA	San Diego, Richie/Impact Sls.	619-271-4511
CA	Santa Clara, Richey/Western Elec.	408-727-7411
CA	Sunnyvale, Target Elec.	415-961-1170
CT	Wallingford, Sager Elec.	203-265-4600
FL	Ft. Lauderdale, Powell Elec.	305-484-8377
GA	Norcross, Specialty Distrbg. Co.	404-446-3190
IL	Wheeling, Hawk Elec.	312-459-4030
IN	Indianapolis, Meunier Elctrns.	317-635-3511
KS	Lenexa, Amer. Elec. & Cable	913-469-0099
MD	Kensington, Marine Air Supp.	301-949-1353
MD	Rockville, M S Elctrns.	301-340-6400
MA	Hingham, Sager Elec.	617-749-6700
MA	Westborough, Powell Elec.	617-366-6100
MI	Livonia, LWC Distrs.	313-464-7700
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Richland, ATR Ent.	314-765-5219
MN	Fridley, Voyager Elec.	612-571-7766
NJ	Clifton, Vantage Comps.	201-777-4100
NM	Albuquerque, Walker Elec. Supply	505-883-2992
NY	Apalachin, Rogan Elec.	607-625-2949
NY	Bohemia, Genelco	516-589-0909
NH	Salem, Sager Elec.	603-898-1348
NC	Greensboro, Hammond	919-275-6391
OH	Cincinnati, Schuster Elec.	216-425-8134
OK	Oklahoma City, Radio Supp. Inc.	405-232-6127
PA	Bristol, Aim Elec.	215-785-3500
PA	Philadelphia, Powell Elec.	215-365-1900
TN	Chattanooga, Specialty Distr. Co.	615-624-1040
OH	Yellow Springs, Electro-Shield	513-767-1054
TX	Ft. Worth, T & S. Supp.	817-248-4781
WA	Greenacres, Mica Co.	509-928-1720
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Oshkosh, Electronic Inds.	414-235-8930
Can	Quebec, Future Elec.	514-694-7710

JMJ TECHNICAL PRODS., 50 Wheeler Point Rd, Newark, NJ 07105, Tel: 201-589-4257, FAX: 201-762-9334; Empl.: 8; *Sls. Mgr.:* Kevin Kolenut ..... **C•1591**

JMK INCORPORATED

FAX: 603-886-4115

JMK, INC., 15 Caldwell Dr., Amherst, NH 03031, Tel: 603-886-4100; Empl.: 200; *Sls. Mgr.:* J. Kennedy ..... **A•1626-1627**

Local Sales Offices & Reps

CA	Santa Clara, Cummings & Assocs.	408-247-8656
MN	St. Paul, Arkco Sls.	612-777-7454

JMR ELECTRONICS, 1525 Blondell Ave., Bronx, NY 10461, Tel: 212-597-6050; FAX: 212-597-6137; Empl.: 50

JM TRANSFORMER CO., INC., 112 Florida St, Farmingdale, NY 11735, Tel: 516-293-0475, FAX: 516-293-3923; Empl.: 18; *Sls. Mgr.:* J. Millman ..... **A•2242-2247**

JOBMASTER CORP., 9010 Liberty Rd., Randallstown, MD 21133-0207, Tel: 410-655-1400, FAX: 410-521-5461; Empl.: 16 ..... **A•1285**

JOHANSON DIELECTRICS, INC., 2220 Screenland Dr., Burbank, CA 91505, Tel: 818-848-4465, TWX: 910-498-2735, FAX: 818-841-7261; Empl.: 300 ..... **A•1081**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Tempe, Reptronix, Inc.	602-345-4580
AZ	Tucson, Compass Mktg. & Sls.	602-293-1220
CA	Costa Mesa, Richland Tech. Sls.	714-722-9881
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
CT	Waterbury, Compak Inc.	203-753-6431
FL	Ft. Lauderdale, VG Sales Co.	305-938-4333
FL	Altamonte Springs, VG Sales Co.	407-831-8688
FL	Largo, VG Sales Co.	813-536-7787
IL	Lisle, WG Controls	708-963-5954
IN	Indianapolis, M & L Elctrns.	317-359-4742
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Columbia, PSA South	301-730-0359
MA	Hudson, Compak Inc.	508-568-0331
CT	Wethersfield, Compac Sls.	203-563-4784
MI	Ypsilanti, Techrep, Inc.	313-572-1950
MN	St. Paul, Cahill, Schmitz & Cahill, Inc.	612-646-7217
MO	St. Louis, Midtec Assocs.	314-275-8666
NM	Albuquerque, Reptronix, Inc.	505-292-1718
NY	East Rochester, L-Mar Assocs.	716-381-9100
NY	Huntington, Compar New York Inc.	516-423-5660
NC	Winston-Salem, Murcota	919-722-9445
OH	Westlake, Baehr Greenleaf Assocs.	216-892-1770
PA	Trevose, PSA, Inc.	215-245-0513
PA	Warrendale, Baehr-Greenleaf Assocs.	412-934-3088
TX	Dallas, C & J Assocs.	214-539-0140
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Oakton, PSA South	703-281-1806
WA	Seattle, Northmar, Inc.	206-524-5170

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
CA	Los Alamitos, SEMI DICE	213-594-4631
CA	San Diego, Bell Industries	619-268-1277
CA	Santa Clara, SEMI DICE	408-980-9777
CA	Yorba Linda, Corona Elctrns.	714-283-8185
CO	Denver, Newark Elctrns.	303-757-8531
CT	Bloomfield, Newark Elctrns.	203-243-1731
FL	Orlando, Newark Elctrns.	407-896-8350
IL	Chicago, Newark	312-784-5100
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Columbia, Jaco Elctrns.	301-995-6620
MA	South Easton, Semi Dice	508-238-8344
MA	Tewksbury, Jaco Elctrns.	508-640-0010
MI	Jackson, Newark Elctrns.	601-956-8300
MN	Minneapolis, Newark Elctrns.	612-331-6350
NJ	Fairfield, Micross Comps.	201-227-8007
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
OR	Lake Oswego, Bell Industries	503-635-6500
TX	Allen, Prime Distribution	214-542-7915
WI	Waukesha, Bell Industries	414-547-8879

JOHANSON MANUFACTURING CORPORATION, 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, FAX: 201-334-2954; FSC No.: 91293; Empl.: 200 ..... **A•1080**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Tempe, Reptronix, Ltd.	602-345-4580
CA	Escondido, Knight Co.	619-743-5136
CA	Los Angeles, Knight Co.	213-670-2833
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assoc., Mt. States	303-426-0890
CT	Wetherfield, Compak, Inc.	203-563-4784
FL	Ft. Lauderdale, Vg Sls.	305-938-4333
FL	Largo, Vg Sls.	813-536-7787
FL	Pompano Beach, Vg Sls.	305-971-0900
IL	Lisle, W.G. Controls	708-963-5954
IN	Kokomo, Schillinger Assocs.	317-455-2708
IA	Hiawatha, ARD Sales Co.	319-393-6392
MA	Hudson, Compak, Inc.	617-568-0331
MN	St. Paul, Cahill, Schmirz & Cahill, Inc.	612-646-7217
MO	St. Louis, Midtec Assocs.	314-275-8666
NM	Albuquerque, Reptronix Inc.	505-292-1718
NY	Boonton, Johanson Mfg. Corp.	201-334-2676
NY	Mount Vernon, Friedman-Smith Elctrn. Sls.	914-664-4866
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Columbus, Baehr, Greenleaf & Assocs.	614-847-0220
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assoc.	216-842-1770
PA	Evans City, Baehr, Greenleaf & Assocs.	412-776-2151
PA	Trevose, P.S.A.	215-245-0513
TX	Austin, W. Pat Fralia & Assocs.	512-835-7911
TX	Euless, W. Pat Fralia & Assocs.	817-267-3577
TX	Houston, W. Pat Fralia & Assocs.	713-772-1572
UT	Salt Lake City, Straube Assocs., Mt. States	801-263-2640
VA	Oakton, PSA South	703-281-1806
WA	Seattle, Northmar	206-524-5170

Local Distributors

AZ	Tempe, Penstock	800-255-6788
CA	Beverly Hills, Penstock	818-841-8881
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Penstock	619-225-8600
CA	San Jose, All American Semiconductor	408-287-0190
CA	San Pedro, ASAP Elctrns./West	213-519-8377
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Penstock	408-730-0300
CA	Thousand Oaks, Bell Inds.	213-826-6778
CA	Westlake Vl., JACO/Distel, Inc.	805-495-9998
CO	Denver, Penstock	303-973-3010
CO	Wheatridge, Bell Inds.	303-424-1985
FL	Deerfield Bch., Bell Inds.	305-421-1997
FL	Ft. Lauderdale, All American	305-572-7999
FL	Tampa, JACO	813-628-4665
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove Vl., Bell Inds.	312-640-1910
IL	Palatine, Penstock	708-934-3700
IN	Indianapolis, Bell Inds.	317-634-8202
IN	Indianapolis, Penstock	317-784-3870
MD	Baltimore, Radio Elec. Svc.	301-529-0500
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MA	Seekonk, M-Squared	617-761-5490
MA	Wakefield, All American	617-246-2300
MA	Wilmington, RC/Jaco Elctrns.	617-273-1860
NJ	Fairfield, Penstock	201-808-1414
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
NY	Syracuse, Newark Elctrns.	315-437-6611
OH	Dayton, Bell Inds.	513-435-8660
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Ft. Worth, PATCO Supplies	817-429-8596
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Bell Inds.	206-747-1515

JOHNSON, E. F., CO., P.O. Box 59089, Minneapolis, MN 55459-0089, Tel: 612-943-5500, FAX: 507-835-6485; Empl.: 1400; *Sls. Mgr.:* Arnie Nicklin

JOHNSON CONTROLS BATTERY GROUP, INC., 900 East Keefe Ave., Milwaukee, WI 53212, Tel: 414-961-6500, FAX: 414-961-6506; Empl.: 250; *Sls. Mgr.:* Daniel E. Ellis, Dir. Sls. & Mktg.

JOHNSON YOKOGAWA CORP., 4 Dart Road, Newnan, GA 30265, Tel: 404-254-0400, FAX: 404-254-0928; Empl.: 700; *Sls. Mgr.:* Chuck Micallef

JOLO INDUSTRIES, INC., 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, FAX: 714-554-0306; FSC No.: 30035; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr. ..... **C•1408-1409**

Local Sales Offices & Reps

AZ	Scottsdale, JK & Assocs.	602-990-8804
CA	Los Angeles, Quattro Sls. Assocs.	213-372-4221
CA	Mountain View, Leddy Assocs.	415-969-6313
CA	Orange County, Quattro Sls. Assocs.	800-735-4510
CA	San Diego, Quattro Sls. Assocs.	619-581-3093
CA	San Fernando Valley, Quattro Sls. Assocs.	805-523-2978
FL	Longwood, Mathias Assocs., Inc.	407-682-1700
IL	Chicago, McNulty & Assocs.	312-980-9868
MA	Reading, Lincoln Tech. Sls.	617-944-9594
MI	Sterling Heights, Geotronix, Inc.	313-254-0520
OH	Cleveland, Geotronix Mktg. Assocs.	216-659-6100
OH	Trotwood, Geotronix, Inc.	513-854-5939
OR	Beaverton, Evergreen Mktg. Grp.	503-643-8020
PA	Allison Park, Geotronix, Inc.	412-487-1770
TX	Austin, Barry Sls., Inc.	512-837-3616
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255
WA	Seattle, Evergreen Mktg. Grp. Inc.	206-485-8063
Can	Nepean, Ont., Tech-Trad, Inc.	613-727-1272

Local Distributors

FL	Miami, Elec. Equip.	305-526-6060
OH	Richfield, Alpha Distr. Corp.	216-659-7100

JONARD INDUSTRIES CORP., 134 Marbledale Rd, Tuckahoe, NY 10707, Tel: 914-793-0700, TELEX: 996570, TWX: 710-562-0107, FAX: 914-793-4527; Empl.: 65; *Sls. Mgr.:* C. McClory

JONATHAN MANUFACTURING CORP., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, FAX: 714-879-1212; Empl.: 375; *Sls. Mgr.:* Todd Leverich

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266, FAX: 805-642-5978; Empl.: 4

JOSLYN ELECTRONIC SYSTEMS, P.O. Box 817, Goleta, CA 93116, Tel: 800-752-8068, 805-968-3551, TELEX: 181824, FAX: 805-968-2335; FSC No.: 23663; Empl.: 240; *Sls. Mgr.:* M. Young

JOULE POWER, INC., Joyce Industrial Pk., Summer Rd., Boxborough, MA 01719, Tel: 508-263-9071 ..... **D•1829**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Scottsdale, Sun Tech Mktg. 602-483-1082
CA San Jose, Silicon Valley Sls. 408-432-1967
FL Altamonte Springs, Over & Over 407-332-1222
GA Norcross, Over & Over 404-449-6205
IL Schaumberg, Victory Sls. 708-490-0300
MA Burlington, Tech Rep. Inc. 617-272-5965
NJ Fairfield, Metrologic Corp. 201-575-5585
NC Raleigh, Over & Over 919-876-7338
OH Chargin Falls, Larry Bennett & Assocs. 216-247-2174
PA Wayne, John Lyons Mktg. 215-687-2277
TX Plano, Aticus 214-964-0663
UT Ogden, Doug Taylor & Assocs. 801-546-9570
VA Alexandria, Tech Reps. Inc. 703-370-2600
WA Edmonds, Power Sources Unlimited .. 206-743-6641
Can Montreal, Que., Solid State Engrg. 514-481-3313

JOVIL MANUFACTURING CO., INC., Precision Rd., Danbury, CT 06810, Tel: 203-792-6700, TELEX: 969634, FAX: 203-790-8645; Empl.: 25; *Sls. Mgr.:* Keith Fredlund

JRW INDUSTRIES, INC., 2312 N Second St., Harrisburg, PA 17110, Tel: 717-236-1418, FAX: 717-236-1895; Empl.: 4; *Sls. Mgr.:* Kevin J. Williams, Sls. Mgr.

JSC WIRE & CABLE, Box 248, Burgess Pl., Wayne, NJ 07474, Tel: 201-694-6200, 1-800-572-9473, FAX: 201-694-8297; Empl.: 40; *Sls. Mgr.:* Richard Wojtovitz

J.S.T. CORP., 1200 Business Ctr. Dr., Ste. 400, Mt. Prospect, IL 60056, Tel: 1-800-292-4243, FAX: 708-803-4918; *Sls. Mgr.:* Ron Lesky; *Dist. Mgr.:* Ron Lesky ..... **C•1411-1421**

Local Sales Offices & Reps

AL Huntsville, Over & Over, Inc. 205-837-7105, FAX:205-837-7305
AZ Scottsdale, Whyle & Assocs. 602-391-0226, FAX:602-391-9498
CA Arcadia, Van Gott & Assocs. 818-445-9728, FAX:818-445-5019
CA Auburn, Ad. Tech. Mktg. 916-888-0788, FAX:916-888-0787
CA Escondido, Van Gott & Assocs. 619-489-0893, FAX:619-489-8167
CA Santa Clara, GMB Tech Sls. 408-496-6181, FAX:408-496-0634
CO Arvada, Arrowhead Sls. Corp. 303-423-5556, FAX:303-423-5598
FL Altamonte Spgs., Over & Over, Inc. 407-322-1222, FAX:407-332-4433
FL Coral Springs, Over & Over, Inc. 305-753-7050, FAX:305-753-0337

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GA Norcross, Over & Over, Inc. 404-449-6205, FAX:404-449-6177
IL Itasca, Circuit Sls. 708-773-0200, FAX:708-773-2721
IN Ft. Wayne, Corrao/Marsh 219-482-2725, FAX:219-484-7491
IN Greenfield, Corrao/Marsh, Inc. 317-462-4446, FAX:317-462-6568
MD Ellicott, AM-Tech Assocs. 301-461-5599, FAX:301-461-5659
MA Norwell, M.J. Sls., Inc. 617-982-8776, FAX:617-878-6707
MA Randolph, The T.M.R. Grp. 617-961-4486, FAX:617-986-4640
MI St. Joseph, Six Sigma 616-429-7788, FAX:616-429-7788
MI Sylvan Lake, Six Sigma 313-332-4900, FAX:313-332-4903
MN St. Paul, Countryman Assoc. Co. 612-645-9151, FAX:612-641-6153
MS Horn Lake, Edward Alan Co. 601-342-4989
MO Florissant, Palatine Engrg. & Sls. Inc. 314-839-0800,FAX:314-839-6023
MO Kansas City, Palatine Engrg. & Sls; Inc. 816-531-7221,FAX:816-531-7443
NJ Madsion, Venture Quest, Inc. 201-377-4922, FAX:201-377-0453
NY Clay, MJ Sls., Inc. 315-699-9596, FAX:315-699-7851
NY W. Babylon, Venture Quest, Inc. 516-491-3120, FAX:516-491-0907
NC Charlotte, Over & Over, Inc. 704-542-9111, FAX:704-542-9937
NC Raleigh, Over & Over 919-876-7338, FAX:919-876-8098
OH Highland Hgts., KT/DEPCO 216-442-6200, FAX:216-461-2101
OH Mentor, Qualtek Elctrns. Corp. 216-951-3300, FAX:216-951-7252
OR Hillsboro, Turn-A-Round Sls. 503-640-4641, FAX:503-640-4640
PA Fort Washington, SMC Inc. 215-628-3394, FAX:215-628-3395
PA Pittsburg, KT/Depco 412-367-1011, FAX:412-367-2153
TX Arlington, T-Tec Sls. 817-429-9151, FAX:817-457-6704
TX Arlington, T-Tec Sls. 817-461-0522, FAX:817-277-8502
TX El Paso, T-Tec Sls. 915-598-1898, FAX:915-598-2485
TX Gilmer, T-Tec Sls. 918-747-8316, FAX:903-734-5316
TX Katy, T-Tec Sales 713-347-2926, FAX:713-347-2088
WA Kirkland, Turn-A-Round Sls. 206-822-4634, FAX:206-828-0633
WI Brookfield, Circuit Sls. 414-784-7773, FAX:414-784-4528
Can Markham, Ont., Avotronics, Ltd. 416-475-2024, FAX:416-475-2019
Can Vancouver, BC, Fairwest Sls. 604-685-1473, FAX:604-681-7712

Local Distributors

AL Birmingham, KSM Elctrns. 205-879-8377, FAX:205-879-8406
AZ Tempe, Elctrn. Hardware 602-967-1691, FAX:602-967-1694
AZ Tucson, SWS Elctrns; Inc. 602-628-1613, FAX:602-628-1921
CA Fremont, Vic/Tal Sls. 415-651-6420, FAX:415-651-8795
CA Fullerton, I.S.I. 714-773-0411,FAX:714-447-3976
CA Huntington Bch., On-Line Elctrns. 714-847-5111, FAX:714-847-4485
CA Irvine, Kensington Elctrns. 714-588-0575, FAX:714-588-0176
CA N. Hollywood, Elctrn. Hardware 818-982-6100, FAX:818-764-1889
CA Norwalk, Myco Elctrns. Supp. 213-404-2053, FAX:213-926-8536
CA San Carlos, Logan Elctrns. 415-594-0700, FAX:415-594-1687
CA San Diego, Mock III 619-693-8230, FAX:619-693-3355
CA San Jose, Spectra Elctrns. 408-452-1590, FAX:408-452-1683
CA Santa Clara, Elctrn. Hardware 408-988-1000, FAX:408-988-4189
CA Santa Clara, Trinty Elctrns. 408-980-9011, FAX:408-980-9014
CA Vista, Elctrn. Hardware 619-231-1307, FAX:619-598-6958
CO Englewood, Indelco 303-795-3431, FAX:303-795-8298
CT Wallingford, Midstate Elctrns. 203-265-9900, FAX:203-269-2374
FL Ft. Lauderdale, KSM Elctrns. 305-971-5900, FAX:305-977-0489
GA Athens, Dixie Elctrns. 404-613-7755, FAX:404-613-7856
GA Atlanta, KSM Elctrns. 404-458-2013, FAX:404-451-0891
GA Augusta, Dixie Elctrns. 404-722-2055, FAX:404-722-0388
IL Addison, Belford Elctrns. 708-691-1100, FAX:708-691-1118
IL Bensenville, Voyager I 708-860-1300, FAX:708-860-1573
IL Glendale Hgts., KSM Elctrns. 708-529-1700, FAX:708-529-3668
IL Palatine, OHM Elctrns. 708-359-5500, FAX:708-359-9686
IN Carmel, Altex Elctrns. 317-848-1323, FAX:317-844-6593
IN Elkhart, Babsco, Inc. 219-293-0631, FAX:219-293-7207
IN Indianapolis, Mar Elctrns. 317-633-6699, FAX:317-633-6687
MD Gaithersburg, Axis Elctrns., Inc. 301-840-9640, FAX:301-840-9299
MA Burlington, QPL Elctrns. Distrs. 617-229-2424, FAX:617-273-5075
MA Franklin, JEM Elctrns. 508-520-3105, FAX:508-520-3109
MI Grand Rapids, S.F. Elctrns. 616-459-0216, FAX:616-459-5601
MI Southfield, Michigan Lectrols Corp. 313-353-1350, FAX:313-353-1433
MI Wyoming, E.C. Elctrns. 616-530-0576, FAX:616-530-8598
MN Fridley, Voyager II 612-571-7766, FAX:612-571-9519
MN New Brighton, Chris Elctrns. 612-631-2647, FAX:612-631-3071
MN Roseville, TLC Distbn. 612-483-2226, FAX:612-481-0287
NE Lincoln, Scott Elctrns. 402-466-8221, FAX:402-466-4187
NE Omaha, Scott Elctrns. 402-734-6750, FAX:402-734-1442
NJ Cherry Hill, Jeta Corp. 609-663-7272, FAX:609-663-1698
NJ Moorestown, Marlac Elctrns. 609-234-4200, FAX:609-234-0672
NJ Woodbridge, Calmm Elctrns. 201-750-4497, FAX:201-750-4212
NM Albuquerque, TMA, Inc. 505-345-8921, FAX:505-344-1113
NY Bohemia, Key Comps., Inc. 516-567-7500, FAX:516-567-2920
NY Hauppauge, Addem Distbg. Div. 516-273-6777, FAX:516-273-7086
NC Charlotte, Dixie Elctrns. 704-377-5413, FAX:704-377-2561
NC Winston-Salem, Dixie Elctrns. 919-724-5961, FAX:919-723-7024
OH South Euclid, Circuit Elec. 216-382-0330, FAX:216-382-4411
OR Aloha, Elctrn. Concepts 503-642-9715, FAX:503-591-8383
OR Beaverton, Micro Power Elctrns. 503-626-7086, FAX:503-643-1556
PA Bristol, Aim Elctrns. 215-785-3500, FAX:215-785-3510
SC Columbia, Dixie Elctrns. 803-779-5332, FAX:803-765-9276
SC Greenville, Dixie Elctrns. 803-297-1430, FAX:803-297-1439
SC N. Charleston, Dixie Elctrns. 803-552-2671, FAX:803-552-2676
TN Gray, Dixie Elctrns. 615-477-2131, FAX:615-477-4407
TN Oak Ridge, Dixie Elctrns. 615-481-3393, FAX:615-481-3397
TN Soddy Daisy, Techni-Tronics 615-332-2119, FAX:615-332-1061
TX Austin, Wofford Elctrns. 512-339-1131, FAX:512-835-7351
TX Dallas, Wofford Elctrns. 214-320-0294:FAX:214-320-2017
TX El Paso, Schick Entprs. 915-772-3283:FAX:915-772-3034
TX Friendswood, Schick Enterprises 713-388-1714
TX Houston, Wofford Elctrns. 713-847-3583, FAX:713-847-4035
TX N. Richland Hills, Swieco Elctrns (Dixie) 817-281-1811,FAX:817-281-1783
WA Redmond, Priebe Elctrns. 206-881-2363, FAX:206-881-0508
Can Burlington, Ont., Alternate Source Comps., Ltd. 416-335-6385,FAX:416-332-1385
Can Concord, Ont., Zierick Canada Corp. ... 416-669-1429, FAX:416-669-5626

Can Markham, Ont., ARMA Elctrns. Sls., Inc. 416-475-1858,FAX:416-475-2019
Can Vancouver, B.C., Brockton Elctrns. Ltd. 604-291-6665,FAX:604-291-6664

JUDCO MFG. INC., P.O. Box 487-E84, 1429 240th St, Harbor City, CA 90710, Tel: 213-534-0959; *Sls. Mgr.:* Kevin Johnson

JUDD WIRE INC., 57 Turnpike Rd., Turners Falls, MA 01376, Tel: 413-863-4357, FAX: 413-863-2305; FSC No.: 3357; Empl.: 148; *Sls. Mgr.:* Jim Paradise ..... **B•1020-1021; C•1764**

Local Sales Offices & Reps

AL	Huntsville, R & G Assocs.	205-880-8020
AZ	Phoenix, O'Donnell Associates	602-944-9542
CA	Los Altos, Ewing Foley	415-941-4525
CA	Torrance, O'Donnell Assocs.	213-539-9664
CO	Boulder, Stratford Grp.	303-530-3194
FL	Coral Springs, J.P. Jasco & Assocs.	813-371-3814
IL	Arlington Heights, Rozner Sls. Co.	312-577-0067
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Marlborough, O.K. Engrg.	617-481-6400
MN	Bloomington, EMT Engineering	612-888-1020
MO	Hazelwood, Spectrum Sls.	314-731-5151
NJ	Haddonfield, M & S Mesa Inc.	609-429-9531
NM	Albuquerque, O'Donnell Assocs.	505-883-1030
NY	Fairport, Senntec Sls.	716-425-3954
OH	Worthington, Simcox Assocs.	614-885-8776
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
TX	Dallas, Stevens Sls. Co.	214-702-0132
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
CA	Concord, Control Master	415-939-3600
CA	Fountain Valley, Innovative Sys.	714-968-6383
CA	Irvine, Republic Elctrns.	714-855-2222
CA	Menlo Park, Bay Associates	415-321-2990
CA	San Leandro, Anixter	415-352-3100
CA	Torrance, Blake Wire & Cable	213-533-8141
CA	Valencia, Wirenetics Co.	805-257-2400
CO	Colorado Springs, SCI	303-598-6888
CT	East Hartford, E. J. Stephens Co.	203-282-9400
CT	Manchester, I.M.S.	203-649-4415
FL	Altamonte Springs, Royce Elctrns.	305-869-4700
FL	Ft. Lauderdale, Anixter	305-485-4455
FL	Ft. Lauderdale, Pacer Elctrns.	305-462-0902
IL	Brookfield, Conductors Unltd.	312-485-7855
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Bloomington, K. L. Tannehill	612-881-6700
NH	Amherst, North Country Wire & Cable	603-889-0063
NJ	Dover, Electro Spec.	201-361-6300
NY	Farmingdale, Weico Elctrns.	516-293-0050
MA	Lowell, Anixter	508-459-6400
NY	Rochester, Simcona Elctrn.	716-328-3230
FL	Tampa, Conductors Unlimited	813-248-1620
NC	Raleigh, Wholesale Electric	919-878-9400
OH	Dayton, Astro Inds.	513-429-5900
PA	Montgomeryville, Pyttronic Ind.	215-242-6700
TX	Dallas, Interstate Wire	214-553-1311
WA	Tukwila, Carlyle Inc.	206-251-0700
WI	New Berlin, Indl. Elec. Wire & Cable	414-782-2323

JUDD WIRE INC., 870 Los Vallecitos Blvd., San Marcos, CA 92069, Tel: 619-744-7720, FAX: 619-744-6089; FSC No.: 3357 ..... **B•1020-1021; C•1764**

Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JULIE RESEARCH

FAX: 212-691-3320

JULIE RESEARCH LABS., 508 West 26 Street, New York, NY 10001, Tel: 212-633-6625, TWX: 710-581-5138; FSC No.: 07062; Empl.: 35; *Sls. Mgr.:* Pamela Spencer; *Dist. Mgr.:* Pamela Spencer ..... **A•1929; D•1270-1273**

Local Sales Offices & Reps

CA	Fresno, Lion Elctrn. Labs	209-233-9096

JUMO PROCESS CONTROL, INC., 735 Fox Chase, Coatsville, PA 19320, Tel: 215-380-8002, FAX: 215-380-8009; *Sls. Mgr.:* Gunnar Oberg

KAHLE ENGINEERING, 50 S. Center St. Bldg. No. 1, Orange, NJ 07050, Tel: 201-678-2020, FAX: 201-678-0328; Empl.: 50; *Sls. Mgr.:* Daniel Fowler

KSI

FAX: 508-922-8374

KAISER SYSTEMS, INC., 126 Sohier Road, Beverly, MA 01915, Tel: 508-922-9300; FSC No.: IFD78; Empl.: 100; *Sls. Mgr.:* Steve Swech ..... **D•1830-1835**

KALAMAZOO TECHNICAL FURNITURE, See TECLAB

KALGLO ELCTRNS. CO., INC., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017-9359, Tel: 215-837-0700, TWX: 510-651-2101, FAX: 215-837-7978; FSC No.: 64521; *Sls. Mgr.:* James H. Beidelman

KALMUS & ASSOCS., INC., 2424 S. 25th Ave., Broadview, IL 60153, Tel: 708-343-7004, FAX: 708-343-7016; Empl.: 250; *Sls. Mgr.:* Kent Prather

KAMAN INSTRUMENTATION, 1500 Garden of the Gods, P.O. Box 7463, Colo Springs, CO 80907, Tel: 1-719-599-1892, FAX: 719-599-1823; FSC No.: 21732; Empl.: 200

KAM COMPONENTS, INC., P. O. Box 192-EEM, Nesconset, NY 11767, Tel: 516-585-0666, FAX: 516-585-1580; Empl.: 29; *Sls. Mgr.:* Cheryl Day

K&L MICROWAVE, INC., 408 Coles Circle, Salisbury, MD 21801, Tel: 301-749-2424, FAX: 301-749-5725; FSC No.: 50140; Empl.: 550; *Sls. Mgr.:* Jim Price

K & L OSCILLATEK, A DOVER TECHNOLOGY CO., See Oscillatek, A Dover Technology Co.

K & M ELECTRONICS, 11 Interstate Dr., W. Springfield, MA 01089, Tel: 413-781-1350, FAX: 413-737-0608; FSC No.: 66613; Empl.: 700; *Sls. Mgr.:* James Chase

KAPPA® TECHNOLOGIES INC.

FAX: 908-388-4786

KAPPA TECHNOLOGIES, INC., 1443 Pinewood St., Rahway, NJ 07065, Tel: 908-396-9400, 1-800-223-0603; FSC No.: 20933; Empl.: 175; *Sls. Mgr.:* M. Pearl ..... **A•1578-1588, 1680-1681, 2248-2249; D•1836**

Local Sales Offices & Reps

AZ	Scottsdale, Interstate Marketing	602-244-9050
CA	Woodland Hills, Interstate Marketing	818-883-7606
CO	Wheatridge, Wescom Mktg. Inc.	303-422-8957
MD	Middletown, S.T./Woolard Co., Inc.	301-371-4500
MN	Osseo, Gaffney Sls. Co.	612-425-5484
NJ	Ft. Lee, Neptune Elctrns. Co.	201-461-2789
NY	Cazenovia, S.T./Woolard Co., Inc.	315-655-8145
NY	Plainview, Neptune Elctrns. Co.	516-349-1600
PA	Ft. Washington, SMC, Inc.	215-628-3394
TX	Austin, Gardin-Moore Sls.	512-794-2900
TX	Dallas, Gardin-Moore Sls.	214-985-1193
TX	Houston, Gardin-Moores Sls.	713-496-7651
UT	Salt Lake City, Wescom Mktg. Inc.	801-269-0419
SC	Pickens, S.T./Woolard Co., Inc.	803-878-3830

Local Distributors

CA	Laguna Hills, Jaco/Distel, Inc.	714-837-8966
CA	San Jose, Jaco/Distel, Inc.	408-432-9290
CA	Sherman Oaks, Delay Line Distrs. Inc.	213-283-2058
CA	Westlake, Jaco/Distel, Inc.	805-495-9998
CT	Meriden, Jaco Elctrns., Inc.	203-235-1422
FL	Boca Raton, Jaco/QC	407-241-7950
GA	Norcross, Jaco/QC	404-449-9508
MD	Columbia, Jaco Elctrns., Inc.	301-995-6620
MA	Tewksbury, Jaco Elctrns., Inc.	508-640-0010
NY	Hauppauge, Jaco/Elctrns., Inc.	516-273-5500
NC	Raleigh, Jaco/QC	919-876-7767
OK	Tulsa, Jaco/QC	918-664-8812
TX	Addison, Jaco/QC	214-733-4300
TX	Austin, Jaco/QC	512-835-0220
TX	Sugar Land, Jaco/QC	713-240-2255
WA	Redmond, Jaco/Distel, Inc.	206-881-9700

KATRONIC ELEKTRONIC GES.M.B.H., OrtenburgerstraBe 28, Austria, Tel: 04762-5340, FAX: 534075; Empl.: 74; *Sls. Mgr.:* Herbert Sandner

KAUT & BUX MANUFACTURING CO., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060, Tel: 708-949-8505, TELEX: 6871289 KBM UN/, FAX: 1-708-949-4250; *Sls. Mgr.:* Heinz Kutschera

KAVLICO CORP., 14501 Los Angeles Ave., Moorpark, CA 93021, Tel: 805-523-2000, TELEX: 65-1481, FAX: 805-523-7125; Empl.: 500; *Dist. Mgr.:* Drew Distin

KAYCEE INDUSTRIES LTD., 32 Ramjibhai Kamani Rd., B.E., Bombay-38, INDIA, Tel: 2615567-68, 2613521-22-23, FAX: (91-22) 2616106; Empl.: 400

KAY ELEMETRICS CORP., 12 Maple Ave., P.O. Box 2025, Pine Brook, NJ 07058-2025, Tel: 201-227-2000, TWX: 710-734-4347; FSC No.: 80138; Empl.: 50; *Sls. Mgr.:* Stephen P. Crump ..... **A•1750**

KAY-RAY/SENSALL, INC., 1400 Business Center Drive, Mt. Prospect, IL 60056, Tel: 708-803-5100; Empl.: 170

KAY-TOWNES, Div. of Alco Industries, Inc., P.O. Box 593, Rome, GA 30161, Tel: 404-291-9871, FAX: 404-235-6851; Empl.: 60; *Sls. Mgr.:* James Joiner; *Dist. Mgr.:* Pauline Petty

KB ELECTRONICS, 73 Wortman Ave., Brooklyn, NY 11207, Tel: 718-257-3300, TWX: 710-584-2308, FAX: 718-257-4740; Empl.: 140; *Sls. Mgr.:* A Bueller

KCK AMERICA INC., Mitsubishi Materials Corporation, 930 Remington Rd., Schaumburg, IL 60173-4516, Tel: 708-884-8688, FAX: 708-884-9327; Empl.: 500; *Sls. Mgr.:* K. G. Such, V.P.

KD COMPONENTS, INC., 2710 S. Main St, Santa Ana, CA 92707, Tel: 714-545-7108, TWX: 910-595-2678, FAX: 714-549-7966; FSC No.: 58421; Empl.: 32; *Sls. Mgr.:* Wayne Devine

KDI/TRIANGLE ELECTRONICS, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-5700, TWX: 710-986-8220; FSC No.: 64537; Empl.: 385

KDS AMERICA, Daishinku Corp., 10901 Granada Ln., Overland Pk., KS 66211, Tel: 913-491-6825, FAX: 913-491-6812; Empl.: 12; *Sls. Mgr.:* Tom Lawrence-East. Reg.; *Dist. Mgr.:* Sara Peterson ..... **A•1379**

Local Sales Offices & Reps

AL	Huntsville, ACM	205-881-5493
AZ	Carefree, Integrated Rep Co., Inc.	602-488-1740
CA	Fountain Valley, Dyna Rep.	619-693-1111
CA	San Diego, Bestronics	714-545-3255
CA	San Jose, QCI Assocs.	408-432-1070
CA	Simi Valley, Dyna Rep.	805-527-0072
CO	Wheatridge, Wescom Mktg., Inc.	303-422-8957
FL	Boynton, D-Assocs.	305-492-8634
FL	Sanford, D-Assocs.	407-321-9594
FL	Tampa, D-Assocs.	407-321-9594
GA	Norcross, ACM	404-448-7025
IL	Itasca, Circuit Sls.	708-773-0200
IN	Fishers, Rathsburg Assoc.	317-577-4500
IA	Cedar Rapids, Barnes Wes Tech. Assoc.	319-393-9790
MA	Scituate, CTC Assocs.	617-848-2077
MI	Farmington Hills, Rathsburg Assocs.	313-489-1500
MN	Chanhassen, Barnes Sls. Assocs.	612-934-2907
NY	Buffalo, Quality Comps.	716-837-5430
NY	Manlius, Quality Comps.	315-682-8885
NY	Smithtown, PAF Assocs.	516-360-0940
NC	Charlotte, Prime Comps., Inc.	704-522-1150
NC	Raleigh, Prime Comps. Inc.	919-850-9866
OH	North Royalton, Rathsburg Assocs.	216-582-9550
OH	Reynoldsburg, Rathsburg Assocs.	614-866-2490
OR	Beaverton, Western Tech. Sls.	503-644-8860
PA	Norristown, DER, Inc.	215-272-4502
TX	Austin, SW Mktg. Assoc., Inc.	512-255-8010
TX	Dallas, SW Mktg. Assoc., Inc.	214-341-8631
TX	Houston, SW Mktg. Assoc.,Inc.	713-537-8166
UT	Salt Lake City, Wescom Mktg., Inc.	801-269-0419
WA	Bellevue, Western Tech. Sls.	206-641-3900
WA	Spokane, Western Tech. Sls.	509-922-7600
WI	Brookfield, Circuit Sls.	414-784-7773
Can	Burnaby, B.C., Vitel Elctrns.	514-636-5951
Can	Kanata, Ont., Vitel Elctrns.	613-592-0090
Can	Lachine, Que., Vitel Elctrns.	514-636-5951
Can	Mississauga, Ont., Vitel Elctrns.	416-676-9720

Local Distributors

AL	Huntsville, Future Electronics	205-830-2322
AL	Huntsville, Reptron	205-722-9500
AZ	Phoenix, Future Electronics	602-968-2140
CA	Chatsworth, Future Elctrns.	818-772-6240
CA	Garden Grove, Natl Elctrns.	714-892-7749
CA	Irvine, Future Elctrns.	714-250-4141
CA	Irvine, ITT Multicomps.	714-727-3001
CA	San Diego, Future Elctrns.	619-278-5020

CA San Jose, Compass Comps. 408-432-7575
CA San Jose, Eric Elctrns. 408-432-1111
CA San Jose, Future Elctrns. 408-434-1122
CA San Jose, PSC Elctrns. 408-737-1333
CA Saratoga, Western Micro 408-725-1660
CO Englewood, NEP Elctrns. 303-799-9898
CO Westminster, Future Electrns. 303-650-0123
CO Westminster, ITT Multicomponents ... 303-451-8740
CT Bethel, Future Elctrns. 203-743-9594
FL Altamonte Springs, Future Elctrns. 305-767-8414
FL Clearwater, Future Elctrns. 813-578-2770
FL Ft. Lauderdale, Reptron 305-735-1112
FL Tampa, Reptron 813-854-2351
GA Norcross, Future Elctrns. 404-441-7676
GA Norcross, Reptron 404-446-1300
IL Schaumburg, Future Elctrns. 312-882-1255
IL Schaumburg, Reptron 708-882-1700
IL Wood Dale, NEP Elctrns. 708-595-8500
MD Columbia, Future Elctrns. 301-995-1222
MA Burlington, Western Micro Technology 617-273-2800
MA Hopkinton, Interface Electronics 508-436-6858
MA Westboro, Future Elctronics 617-366-7400
MI Livonia, Future Elctrns. 313-261-5270
MI Livonia, Reptron 313-525-2700
MN Eden Prairie, Future Elctrns. 612-944-2200
MN Minnetonka, Reptron 612-938-0000
MO St. Louis, Future Elctrns. 314-469-6805
NJ Fairfield, Future Elctrns. 201-227-4346
NJ Mount Laurel Future Elctrns. 609-778-7600
NY Liverpool, Future Elctrns. 315-451-2371
NY Long Island, Future Elctrns. 516-234-4000
NY Rochester, Future Electrns. 716-272-1120
NC Charlotte, Future Elctrns. 704-529-5500
NC Raleigh, Reptron 919-870-5189
OH Solon, Reptron 216-349-1415
OH Worthington, Reptron 813-436-6675
OR Beaverton, Future Electrns. 503-645-9454
OR Beaverton, Western Microtechnology 503-629-2082
TX Austin, Omni Pro 512-794-9200
TX Dallas, Omni Pro 214-233-0500
TX Richardson, Future Elctrns. 214-437-2437
UT Salt Lake City, Future Elctrns. 801-972-8489
UT Salt Lake City, Western Microtechnology 801-575-7150
WA Redmond, Future Elctrns. 206-881-8199
WA Redmond, Western Microtechnology .. 206-881-6737
WI Waukesha, Future Elctrns. 414-786-1884
Can Pointe Claire, Future Elctrns. 514-694-7710

KEDMAN CO., Box 25667, Salt Lake City, UT 84125, Tel: 801-973-9112, FAX: 801-972-2756; Empl.: 100

KEITHLEY INSTRUMENTS

FAX: 216-248-6168

KEITHLEY INSTRS., 28775 Aurora Rd., Cleveland, OH 44139, Tel: 800-552-1115; Empl.: 750; *Sls. Mgr.:* Mike Sciulli ..... **D•1275-1277**

Local Sales Offices & Reps

AL Huntsville, W. A. Brown Instrs. 205-830-9224
AZ Tempe, Aztec Entprs. 602-431-8401
CA Carson, Tritek Solutions, Inc. 213-515-1590
PA Huntington Valley, Scientific Reps. 215-322-6500
CO Denver, Aztec Entrprs. 303-779-5285
FL Orlando, W. A. Brown Instrs. 407-648-9660
IL Buffalo Grove, Torkelson 708-520-0710
IN Indianapolis, Torkelson 317-244-7867
IA Cedar Rapids, Torkelson 319-373-0200
MA Reading, Keithley 800-552-1115
MI Detroit, EQS Sys. 313-455-7920
MN Minneapolis, Torkelson 612-835-2414
MO Florissant, Keithley 800-552-1115
NJ Paramus, Keithley 800-552-1115
NM Albuquerque, Aztec Entrprs. 505-262-1688
NY Melville, Keithley 800-552-1115
NY Syracuse, Labtronics 315-455-7314
NC Cary, W.A. Brown Instrs., Inc. 919-460-1120
OH Chesterland, EQS Sys. 216-729-2222
OR Wilsonville, Syntek 503-682-2750
TX Austin, Testech 512-338-9246
TX Houston, Testech 713-893-9661
TX Richardson, Testech 214-644-5010
VA Fairfax, Scientific Assocs. 703-385-0600
WA Bellevue, Syntek 206-462-7700
WI Waukesha, Torkelson Assocs., Inc. 414-784-7736

KEITHLEY METRABYTE, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3000, TELEX: 503989, FAX: 508-880-0179; FSC No.: 1 FG 11; Empl.: 140; *Sls. Mgr.:* Gary Gross; *Dist. Mgr.:* Gary Gross ..... **D•1184**

Local Sales Offices & Reps

AL Huntsville, Magaro Assocs. 205-882-0827
AZ Tempe, Aztec Entprs. 602-431-8401
CA Orange, X. B. X. Sls. 714-998-8200
CA San Jose, Nelson Elctrn. 408-437-9300
CO Denver, Aztec Entprs. 303-779-5285
FL Orlando, Magaro & Assocs. 407-859-6546
GA Atlanta, Magaro Assocs. 404-451-8862
IL Arlington Hts., Berndt Assocs. 708-632-0900
IN Carmel, Berndt Assocs. 317-844-0114
MN Minneapolis, Berndt Assocs. 612-546-2021
MO Manchester, Vertec Assoc., Inc. 314-394-6242
NJ Elmwood Park, L & M Assocs. 201-797-0441
NM Albuquerque, Aztec Entprs. 505-262-1688
NY Canandaigua, West Technlgs., Inc. 716-394-6355
NC Greensboro, Magaro Assocs. 919-282-4424
OH Chesterland, EQS Sys. 216-729-2222
OR Beaverton, Northwest Test & Meas. ... 503-645-9000
PA Huntington Valley, Sci-Rep, Inc. 215-322-6500
RI Narragansett, Pat Assocs. 401-783-9598
TX Richardson, Testech, Inc. 214-644-5010
UT Salt Lake City, Aztec Entprs. 801-467-4675
VA Fairfax, Sci-Rep, Inc. 703-385-0600
WA Bellevue, Northwest Test & Meas. 206-881-8857
WI Milwaukee, Berndt Assocs. 414-545-8400

KEL AM, See Teltec, Inc.

KELLER-PSI, 503 No. 15A Vista Bella, Oceanside, CA 92056, Tel: 619-967-6066, TELEX: 380-948, ESYLNK: 62744770, FAX: 619-967-0563; Empl.: 8; *Sls. Mgr.:* Dick Grove; *Dist. Mgr.:* Dick Grove

KEL CONNECTORS, INC., KEL Corp., 1250 Oakmead Pkwy., No. 105, Sunnyvale, CA 94086, Tel: 408-720-9044, FAX: 408-720-1989; *Sls. Mgr.:* Jim Eilers

Local Distributors

CA San Carlos, LoDan West 415-592-4600
FL Largo, LoDan Elctrns. 813-586-2851
IL Arlington Heights, LoDan Elctrns. 708-398-5311
MN Eitzen, Capacitor Assocs. 507-495-3306

KELLY AMERICAN, INC., 640 Federal Rd., Brookfield, CT 06804, Tel: 203-775-2590, TELEX: 4750159ELECABUL, FAX: 203-775-9048; *Sls. Mgr.:* Robert Buckley

KELMET, INC., 569 W. Covina Blvd., San Dimas, CA 91773, Tel: 714-599-0954, FAX: 714-599-2835; Empl.: 6; *Sls. Mgr.:* Paul Hodge

KELTEC FLORIDA, INC., MICROWAVE PRO, P.O. Box 2917, Ft. Walton Bch., FL 32549-2917, Tel: 904-244-0043, FAX: 904-243-0103; FSC No.: 09062; Empl.: 350; *Sls. Mgr.:* I. Rampurawala

KELTECH INC., 7508 Hitech Rd., Roanoke, VA 24019, Tel: 703-362-8466, FAX: 703-362-3957; Empl.: 35; *Sls. Mgr.:* William Sinclair, Gen. Mgr.

KELTRON CORPORATION

FAX: 617-899-9602

KELTRON CORP. High Voltage Power Supply Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, TELEX: 948197; Empl.: 170; *Sls. Mgr.:* T. Chadurjian ..... **D•1099**

KELTRON CORP., Miniprinter/Security Systems Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, TELEX: 948197, FAX: 617-899-9602; FSC No.: 18662; Empl.: 250; *Sls. Mgr.:* Steven P. Sargent ..... **D•1099**

Local Sales Offices & Reps

CA Canoga Pk., Dolphin Tech Entprs. 818-710-1966
IL Palatine, Key Entprs. 708-991-2144
MD Baltimore, Advanced Tech. Sls., Inc. ... 301-323-3140
NY Amsterdam, Traxonics 518-843-1445
PA Oreland, Precision Mktg. Grp. 215-233-9233
WI South Milwauke, Key Entprs. 414-762-2323

Local Distributors

AL Decatur, Mgt. Security, Inc. 205-355-3030
CA San Francisco, SF Fire & Burg. 415-861-0994
DC District of Columbia, Ellenco Inc. 301-927-4370
FL Miami, Glanz Technlg., Inc. 305-893-1269
GA Albany, Tri-L Sys. 912-888-1266
IL Chicago, Natl. Guardian Alarm 312-775-8600
MA Georgetown, B & B Engrg. 508-352-6402
MI Bloomfield Hills, W.E. Healy & Assocs. 313-335-9245
NC Raleigh, National Security 919-821-1150
OK Tulsa, Pendergraph, Inc. 918-835-8403
TX Amarillo, Firehawk Safety Sys. 806-374-9613
WI Brookfield, John Guetzke & Assocs., Inc. 414-784-5929

KELVIN INDUSTRIES, INC., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, Tel: 818-990-1192, FAX: 818-995-6460; FSC No.: 19587; Empl.: 180; *Sls. Mgr.:* R. A. Featherston

KEMET®

FAX: 803-963-6521

KEMET ELECTRONICS CORPORATION, Box 5928, Greenville, SC 29606, Tel: 803-963-6621, TELEX: 57-0496, TWX: 810-287-2536; FSC No.: 31433; Empl.: 6,200; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Dan Manly ..... **A•1082-1083**

Refer to Kemet, Union Carbide Corp., Elctrns. Div. for sales office information and for distributor listings.

Local Sales Offices & Reps

AL Huntsville 205-830-1090
AZ Tempe 602-831-2151
CA Encino 818-609-7561
CA Newport Beach 714-640-9320
CA Santa Clara 408-986-0424
CO Englewood 303-220-0759
FL Ft. Lauderdale 407-394-2326
FL Orlando 407-855-8886
GA Norcross 404-441-7701
IL
IL Schaumburg 708-517-1030
IN Carmel 317-844-7756
MD Columbia 301-992-5600
MA Wakefield 617-245-4646
MI Farmington Hills 313-489-5850
MN Edina 612-929-4642
NY Elmsford 914-347-4390
NY Liverpool 315-451-0720
NC Raleigh 919-872-2877
OH Columbus 614-885-3330
OK Tulsa 918-664-8592
PA Exton 215-363-8310
SC Greenville 803-242-5789
TX Austin 512-458-3181
TX Irving 214-556-0009
WA Kirkland 206-828-4853

Local Distributors

CA Agoura Hills, Time Elctrns. 818-707-2890
CA Compton, Harper SID 213-979-5090
CA Culver City, Hamilton/Avnet Elctrns. .. 213-558-2100
CA Los Angeles, Bell Inds. 213-826-6778
CA Sunnyvale, Capsco Sls., Inc. 408-734-3020
CO Denver, Integrated Elctrns. 303-292-5537
DE Wilmington, J.V. Elctrns. 508-657-6523
GA Gaithersburg, Pioneer Technlgs. 301-921-0660
IL Chicago, Newark Elctrns. 312-784-5100
NJ Old Bridge, Arm Bar Inds. 201-679-3377
NM Albuquerque, Alliance Elctrns. 505-292-3360
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Central Islip, Semicap Elctrns. 516-582-4400
NY Hauppauge, L.I., Jaco Elctrns. 516-273-5500
NY Westbury, Schweber Elctrns. 516-876-4000
NC Greensboro, Golden Elctrns. 919-294-4653
NC Greensboro, Hammond Elctrns. 919-275-6391
OH Cleveland, Pioneer Elctrns. 216-587-3600
TX Fort Worth, TTI Elctrns. 817-831-8300
Can Vancouver, B.C., Deskin Sls. 604-324-8343

KEMLON PRODUCTS & DEVELOPMENT COMPANY, 6310 Sidney, Houston, TX 77021, Tel: 713-747-5020, FAX: 713-747-0049; Empl.: 165; *Sls. Mgr.:* Bob Horton

KEMTRON CIRCUITS & ELCTRNS. CORP., 110 S. Long Bch. Rd., Rockville Centre, NY 11570, Tel: 516-766-2772; Empl.: 7; *Sls. Mgr.:* Walter Carlock

KENMAR MANUFACTURING SERVICES, Kenmar Business Groups, Inc., 3020 Barrow Drive, Raleigh, NC 27604, Tel: 919-876-6049, FAX: 919-876-6292; Empl.: 35

M.S. KENNEDY CORP., 8170 Thompson Rd., Cicero, NY 13039, Tel: 315-699-9201, FAX: 315-699-8023; FSC No.: 51651; Empl.: 60; *Sls. Mgr.:* Greg Overend

KENTRON, INC., P.O. Box 142, Cedarburg, WI 53012-0142, Tel: 414-377-3733, FAX: 414-377-3733; *Sls. Mgr.:* Kenneth L. Krolski

KEN-TRON MFG., INC., 610 Industrial Dr., Owensboro, KY 42301, Tel: 502-684-0431, TELEX: 20-4305, FAX: 502-684-0435; Empl.: 100; *Sls. Mgr.:* R. Thompson

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Local Sales Offices & Reps

AL	Huntsville, W. A. Brown, Inc.	205-830-9224
AZ	Phoenix, Aztec Entprs.	602-431-8401
CA	Carson, TRITEK	213-515-1590
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CA	Sunnyvale, N-S Westronics	408-745-1102
CO	Denver, Aztec Entprs.	303-779-5285
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Waterbury, R. Perron Co.	203-756-9684
DC	Washington, Eastern Instrmn. Corp.	301-384-8500
FL	Ft. Lauderdale, W. A. Brown Instrs., Inc.	305-581-6444
FL	Melbourne, W. A. Brown Instrs., Inc.	407-723-0766
FL	Orlando, W. A. Brown Instrs., Inc.	407-648-9660
GA	Atlanta, W. A. Brown Instrs., Inc.	404-449-7160
KS	Kansas City, ATECH, Div. of ATA, Inc.	913-268-9644
MD	Baltimore, Eastern Instrmn. Corp.	301-792-7039
MA	Boston, R. Perron Co.	617-449-6162
MI	Plymouth, EQS	313-445-7924
MN	Plymouth, Kepco Inc.	612-559-1128
MO	St. Louis, ATECH, Div. of ATA, Inc.	314-949-9075
NM	Albuquerque, Aztec Entrps.	505-262-1688
NY	Liverpool, NTS Assocs., Inc.	315-451-1091
NC	Cary, W. A. Brown Instrs., Inc.	919-460-1120
OH	Chesterland, EQS	216-729-2222
OK	Tulsa, Airep Elctrns.	918-592-7711
OR	Beaverton, H. Levinson Co.	503-690-1312
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
TX	Houston, Airep Elctrns.	713-952-5395
UT	Ogden, Aztec Entprs., Inc.	801-467-4675
WA	Seattle, H. Levinson Co.	206-382-1300
WI	Milwaukee, Star Engineering	414-645-3680
Can	Downsview, Ont., Rayonics	416-736-1600
Can	Ottowa, Ont., Rayonics	613-521-8251
Can	St. Laurent, Que., Rayonics	514-335-0105

KEPRO CIRCUIT SYSTEMS, 630 Axminister Dr., Fenton, MO 63026-2992, Tel: 314-343-1630, FAX: 314-343-0668; FSC No.: 5999; Empl.: 17; *Sls. Mgr.:* Jeff R. Keil; *Dist. Mgr.:* Jeff R. Keil

KEPTEL/ARMIGER, 56 Park Rd., Tinton Falls, NJ 07724, Tel: 800-526-3697, 201-389-8800; Empl.: 300; *Sls. Mgr.:* Kathy Plesnarski; *Dist. Mgr.:* Larry Bucknell

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KESTER

FAX: 708-390-9338

KESTER SOLDER DIV., Litton Sys., Inc., 515 E. Touhy Ave, Des Plaines, IL 60018, Tel: 708-297-1600; Empl.: 350; *Sls. Mgr.:* Nick Bohun; *Dist. Mgr.:* Carl Voelkel ..... **C•1701**

Local Sales Offices & Reps

CA	Anaheim	714-871-0280
NJ	Newark	201-589-0246

KETEMA
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FAX: 714-630-4131

KETEMA/RODAN DIVISION, 2900 Blue Star St., Anaheim, CA 92806, Tel: 714-630-0081, TWX: 910-591-1684; FSC No.: 15454;DESC-EQP-75-1387; Empl.: 170; *Sls. Mgr.:* Jack H. Moore ..... **B•1846-1848**

Local Sales Offices & Reps

AL	Huntsville, Alpha Mktg.	205-533-0766
AZ	Phoenix, TC Elctrn. Sls., Inc.	602-994-5153
AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Chatsworth, Wes-K/Raltech	818-700-0933
CO	Westminster, Straube Assocs.	303-426-0890
IL	Inverness, Heartland Tech. Mktg.	708-358-6622
IN	Ft. Wayne, Menze Sls. Co.	219-747-5616
KS	Parker, S. W. Assocs., Inc.	913-898-6552
MA	Framingham, Marathon Sls. Ltd.	508-875-3566
MN	Mendota Hgts., G-II Sls.	612-454-3086
MO	St. Louis, Abrams & Assocs.	314-569-0447
NJ	Bellmawr, TAI Corp.	609-933-2600
NY	Melville, Comtronic Assocs.	516-249-0505
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
NC	Charlotte, Arthur, Harris Assocs.	704-542-9338
WI	Brookfield, Heartland Tech. Mktg.	414-792-0920
TX	Houston, R-Squared Elctrns.	713-820-3210
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Vancouver, R. Over Sls.	206-695-6179

Local Distributors

AZ	Tempe, Elctrn. Supp.	602-276-1199
CA	Los Alamitos, Permag Pacific Corp.	213-594-6515
CA	Riverside, Elctrn. Supp.	714-543-9214
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	Sunnyvale, Permag Sierra	408-738-1080
CO	Denver, Permag Corp.	303-693-6612
GA	Norcross, Permag S.E. Div.	404-448-4998
IL	Elk Grove Vl., Permag Cen. Div.	312-956-1140
MA	Billerica, Permag N.E. Div.	617-663-7500
MN	Eden Prairie, Permag Minnesota Div.	612-934-4635
NY	Hauppauge, Fairmont Elctrns.	516-231-3313
NY	Hicksville, Permag Atlantic Div.	516-822-3311
OH	Toledo, Permag Magnetics Div.	419-385-4621
TX	Richardson, Permag S.W. Div.	214-699-1121
WA	Bellevue, Permag N.W. Div.	206-882-2507
Can	Mississauga, Ont., R-Theta, Inc.	416-890-0221

KEWAUNEE SCIENTIFIC CORP., Technical Workstation Div., 901 FM 20, P.O. Box 930, Lockhart, TX 78644, Tel: 512-398-5292, TELEX: 752706, FAX: 512-398-5104; Empl.: 165 (This Location) 800 (Company Wide); *Sls. Mgr.:* Frank Johnson, Dir. Sls./Mktg.

Keystone
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KEYSTONE CARBON, Thermistor Div., 1935 State Street, St. Marys, PA 15857, Tel: 814-781-1591; FSC No.: 75-263; Empl.: 1200; *Sls. Mgr.:* John A. Brock; *Dist. Mgr.:* John A. Brock ..... **B•1849-1851**

Local Sales Offices & Reps

CA	Redwood City, Hickey Inds. Sls.	415-594-9978
CA	San Diego, ProSales	619-571-1133
CT	Wethersfield, L.J. Labant	203-529-0048
GA	Marietta, J.J. Arnold	404-427-1062
IL	Palatine, David J. Brock	708-359-0955
IN	Fort Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-876-9000
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127
KS	Shawnee, Benson Engrg.	913-491-4446
MI	Birmingham, Mi, Gregory J. Lukas	313-642-9115
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, Dave Marrone	612-566-6573
NY	Rochester, Foster & Wager	716-385-7744
OH	Cincinnati, R.O. Whitesell & Assocs.	513-528-5644
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
NC	Cary, J. E. Shea	919-481-2475
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TX	Dallas, Benson Engrg.	214-352-7541
TX	Houston, Benson Engrg.	713-333-3112
EXP	Great Neck NY, Minthorne Int'l.	516-487-0700

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AZ	Phoenix, Allied Elctrns.	602-437-9080
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Torrance, Allied Elctrns.	213-373-8828
CO	Denver, Newark Elctrns.	303-373-4540
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Ft. Lauderdale, Newark Elctrns.	305-587-2372
GA	Norcross, Allied Elctrns.	404-446-8595
HI	Aiea, Newark Elctrns.	808-487-8951
ID	Boise, Newark Elctrns.	208-342-4311
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Indianapolis, Allied Elctrns.	317-875-0448
IA	Bettendorf, Newark Elctrns.	319-359-3711
KS	Lenexa, Allied Elctrns.	913-599-6227
KY	Louisville, Allied Elctrns.	502-452-2293
LA	Metairie, Allied Elctrns.	504-885-1195
MD	Columbia, Newark Elctrns.	301-964-4482
MA	Billerica, Allied Elctrns.	508-667-7921
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Thief River Falls, Digi-Key Corp.	800-344-4539
MS	Jackson, Newark Elctrns.	601-956-3834
MO	Earth City, Allied Elctrns.	314-291-7031
NE	Omaha, Newark Elctrns.	402-392-1221
NH	Nashua, Allied Elctrns.	603-883-3006
NJ	Frenchtown, Sintec	201-996-4093
NM	Albuquerque, Newark Elctrns.	505-883-6181
NY	Fairport, Allied Elctrns.	716-425-3850
NC	Charlotte, Newark Elctrns.	704-535-5650
OH	Solon, Allied Elctrns.	216-248-4200
OK	Tulsa, Newark Elctrns.	918-832-7004
OR	Portland, Allied Elctrns.	503-245-4225
PA	Pittsburgh, Newark Elctrns.	412-343-9090
RI	Cranston, Newark Electrns.	401-943-3340
SC	Greenville, Newark Elctrns.	803-288-9610
TN	Memphis, Allied Elctrns.	901-367-2895
TX	Fort Worth, Allied Elctrns.	817-336-5401
UT	Salt Lake City, Newark Electrns.	801-484-8611
VA	Virginia Beach, Allied Elctrns.	804-363-8662
WA	Seattle, Allied Elctrns.	206-547-2827
WV	Charleston, Newark Elctrns.	304-345-6505
WI	New Berlin, Allied Elctrns.	414-796-1280
Can	Mississauga, Ont., Newark Elctrns.	416-675-8351

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KEYTEK INSTRUMENT CORP., 260 Fordham Rd., Wilmington, MA 01887, Tel: 508-658-0880, TELEX: 951389 KEYTEK BURL, FAX: 508-657-4803; *Sls. Mgr.:* Michael Hopkins

KEYTEK KEYBOARDS CANADA INC., 16 Mary St., Units 3 & 4, Aurora, Ontario, Canada L4G 3W8, Tel: 416-727-9491, FAX: 416-727-7118; Empl.: 20

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FAX: 818-798-1466

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Local Sales Offices & Reps

NJ	Wayne, BIZ Intl.	201-694-2417
TX	Hurst, McGarrah & Assocs.	817-268-3557

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AZ	Chandler, Vic Myers Assocs.	602-345-6449
CA	Santa Clara, Alltronics	408-982-9222
CA	Torrance, Amasco South	213-781-9494
CO	Littleton, Vic Myers Assocs.	303-730-7313
FL	Cape Canaveral, Teqspec	407-783-3444
FL	Palm Harbor, Teqspec	813-942-6006
HI	Honolulu, Honolulu Elctrns.	808-949-5564
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Billerica, Eastronix	508-670-2400
MI	Bloomfield Hills, MacKellar Assoc. Inc.	313-335-4440
MN	Minneapolis, Sector Engrg. Sls.	612-378-2123
MO	St. Louis, Midtech Assocs.	314-275-8666
NJ	Ridgefield Park, Scientific Dvcs. East	201-440-1400
NM	Albuquerque, Vic Myers Assocs., Inc.	505-884-6878
NY	Rochester, Eastern Sys.	716-292-1460
OH	Columbus, MacKellar Assoc. Inc.	614-848-3552
OK	Tulsa, Scientific Dvcs.-S.W.	918-457-4888
OR	Wilsonville, Syntek, Inc.	503-682-2750
PA	Horsham, PA Scientific Dvcs.	215-956-0700
TX	Houston, Scientific Dvcs. SW	713-645-4100
TX	Richardson, Scientific Dvcs. SW	214-231-8106, 800-256-6633
UT	Salt Lake City, Vic Myers Assoc. Inc.	801-581-1760
WA	Bellevue, Syntek, Inc.	206-462-7700
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
PR	San Juan, David S. Ternent	809-762-2688
Can	Burnaby, BC, Interfax Sys., Inc.	604-430-1410
Can	Nepean, Ont., Interfax Sys., Inc.	613-726-8888
Can	Rexdale, Ont., Interfax Sys., Inc.	416-674-8970
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Local Sales Offices & Reps

CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	La Habra, Cygnus Sls. Engrg. Corp.	213-691-2993
FL	Orlando, Comp. Design Mktg.	407-240-3903
GA	Atlanta, Electro Tech	404-262-1522
IL	Elgin, Gassner & Clark, Inc.	312-695-9540
IA	Cedar Rapids, Seltec Sls. Corp.	319-364-7660
KS	Overland Pk., Spectrum Sls.	913-648-6811
NH	Nashua, Bell Controls	603-882-6984
NM	Albuquerque, Cleveland Entprs., Inc.	505-265-7893
NY	Great Neck, Trionic Assocs.	516-466-2300
NY	Rochester, Lamb Comp., Inc.	716-323-1250
NC	Winston-Salem, DGW, Inc.	919-768-7166
OH	Cleveland, Electronic Components, Inc.	216-331-5330
OH	Columbus, Electronic Comp., Inc.	614-231-2318
OH	Miamisburgh, Electronic Comps., Inc.	513-866-3340
OR	Tigard, Components West, Inc.	503-684-1671
TX	Dallas, Caton Sls. Co.	214-243-4718
WA	Redmond, Components West, Inc.	206-885-5880
Can	Brit. Columbia, Macom Agencies, Ltd.	604-271-2661

KINEMETRICS/SYSTEMS, Kinemetrics, Inc., 222 Vista Ave., Pasadena, CA 91107, Tel: 818-795-2220, TELEX: 67-5402, FAX: 818-795-0868; Empl.: 65; *Sls. Mgr.:* Mel Lund

KINEMETRICS/TRUETIME, 3243 Santa Rose Ave, Santa Rosa, CA 95407, Tel: 707-528-1230, TELEX: 176687(TRUETIME SARO), FAX: 707-527-6640; Empl.: 45; *Sls. Mgr.:* R. J. Dielman

KINETICSYSTEMS, 11 Maryknoll Dr., Lockport, IL 60441, Tel: 815-838-0005, TWX: 910-638-2831, FAX: 815-838-4424; Empl.: 135; *Sls. Mgr.:* Norman R. Ellison, Dir. Domestic Sls.

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KINGBRIGHT USA CORP., Kingbright Elec. Co., Ltd., 200 S. Garfield Ave., No. 204, Alhambra, CA 91801, Tel: 818-281-9788, 818-281-9807; Empl.: 3 ..... **B•1170-1172**

Local Sales Offices & Reps

AL	Madison, Contact Manufacturer	818-281-9788
AZ	Phoenix, C.T. Carlberg Assocs.	602-468-0750
CO	Denver, Parker-Webster	303-841-4888
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Rolling Hills, Eagle Tech. Sls.	708-991-0700
IA	Cedar Rapids, Contact Manufacturer	818-281-9788
MD	Gaithersburg, Contact Manufacturer	818-281-9788
MO	Florissant, Contact Manufacturer	818-281-9788
MO	St. Louis, Rush & West Assocs.	314-965-3322
NY	Tuckahoe, Disty-Brown Sls.	800-933-4789
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
PA	Ft. Washington, Contact Manufacturer	818-281-9788
VA	Front Royal, Contact Manufacturer	818-281-9788
WI	Colgate, Contact Manufacturer	818-281-9788

Local Distributors

AZ	Phoenix, C.T. Carlsberg & Assocs. Inc.	800-888-1408
CA	Chatsworth, Passive Comps. Inc.	818-700-8838
CA	Los Angeles, Electric Switches Inc.	800-252-4640
CA	Milpitas, Sierra West	408-945-1050
CA	Mission Viejo, Opto Plus, Inc.	714-380-8654
CA	San Diego, Southland Comps. Inc.	619-673-3800
CA	Santa Maria, Garrett/IEU Inc.	805-922-6383
CA	Simi Valley, Tri-Electro Sls., Inc.	805-527-3317
CO	Englewood, Computech Mktg.	303-773-3981
CT	Norwalk, Cobra Comps., Inc.	203-847-6442
CT	Sudbury, KSA of New England	508-443-5881
FL	Boca Raton, N.R.C. Elctrns., Inc.	407-241-8600
FL	Clearwater, Atlantic Elctrns., Inc.	813-531-5900
FL	Clearwater, Source Research Inc.	813-443-7001
FL	Pembroke Pines, Munday Sls., Inc.	306-961-9420
IL	Cleveland, RK Comp. Sls. Inc.	216-642-9312
IL	Rolling Meadows, Eagle Tech. Sls., Inc.	708-991-0700
MD	Baltimore, Astrex	800-257-7717
MA	W. Springfield, Astrex	800-445-9763
MO	St. Louis, Ric-Tronics, Inc.	314-997-4707
MO	St. Louis, Rush & West	314-965-3322
NJ	Pennsauken, Astrex	800-257-7713
NJ	Tenafly, Michelle Assocs.	201-894-8964
NY	East Syracuse, ADR Technigs., Inc.	315-437-7087
NY	Endwell, Astrex	800-252-8711
NY	Endwell, Elctrns., Inc.	607-754-3823
NY	Tuckahoe, Disty-Brown Sls. Co.	914-933-4789
NC	Raleigh, Benchmark Tech. Sls., Inc.	919-850-0633
TX	Austin, Wofford Elctrns., Inc.	512-339-1131
TX	Carrollton, LCD Elctrns., Inc.	800-245-0342
TX	Dallas, Orion Assocs.	214-241-3505
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
WA	Bellevue, Luscombe Engrg.	206-223-1541
EXP	Los Angeles, Kingbright USA Corp.	818-281-9788

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KIPP & ZONEN, Enraf-Nonius, 390 Central Ave., Bohemia, NY 11716, Tel: 516-589-2885, 800-645-1025, FAX: 516-589-2068; Empl.: 25; *Sls. Mgr.:* Wm. Novack; *Dist. Mgr.:* Joe Carlin

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KISTLER INSTRUMENTS CORP., 75 John Glenn Dr., Amherst, NY 14221-2171, Tel: 716-691-5100, FAX: 716-691-5226; Empl.: 67; *Sls. Mgr.:* Mike Murphy

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KLC/KARL LAMBRECHT CORP., 4204 N. Lincoln Ave., Chicago, IL 60618, Tel: 312-472-5442, FAX: 312-472-2724; Empl.: 29; *Sls. Mgr.:* Raymond Lambrecht

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KNIGHTFIRE TECHNOLOGY, 2139 University Dr., Ste.211, Coral Springs, FL 33071, Tel: 305-344-3682, FAX: 305-752-4353; FSC No.: FSC 6130; Empl.: 4; *Sls. Mgr.:* Sue Pantelakis

KNOWLEDGEWARE, INC., 3340 Peachtree Rd., N.E., Atlanta, GA 30326, Tel: 404-231-8575, TELEX: 544080; FSC No.: 7030-0003; Empl.: 350; *Sls. Mgr.:* Donald P. Addington

KNOWLES ELECTRONICS, INC., 1151 Maplewood Dr., Itasca, IL 60143, Tel: 708-250-5100, TELEX: 433-0330, FAX: 708-250-0575; *Sls. Mgr.:* W. Jeff Taylor

KNURR USA INC., Knurr A.G., 1890 N. Voyager Ave., Simi Valley, CA 93063, Tel: 805-526-7733, FAX: 805-584-8371; Empl.: 20; *Sls. Mgr.:* Georg Wolf (acting)



FAX: 814-362-8883

KOA SPEER ELECTRONICS, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, Tel: 814-362-5536, TELEX: 91-4404; FSC No.: 09021; Empl.: 3000; *Sls. Mgr.:* L. G. Holzwarth; *Dist. Mgr.:* L. Rice .... **A•1002, 1085, 1834, 1930-1934**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
Can	Mississauga, Ont., Indigo Elctrns.	416-670-0284
Can	Montreal, Que., Indigo Elctrns.	514-696-6104
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Caltron Comps.	408-980-0181
CO	Boulder, R. G. Entprs.	303-447-9211
CT	Plainville, Northeast Representatives	203-747-2423
FL	Altamonte Springs, APM Assocs.	407-869-6831
FL	Ft. Lauderdale, APM Assocs.	305-978-9941
FL	Tampa, APM Assocs.	813-886-2457
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Arlington Hgts., C. L. Greenslade Sls.	708-593-3450
IN	Fort Wayne, John F. Kilfoil	219-483-6208
KS	Overland Pk., Spectrum Sls.	913-648-6811
LA	Covington, Cartwright & Bean	504-892-1780
MA	Hingham, Northeast Representatives	617-749-8700
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Edina, Grayden & Flemmer	612-941-1120
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Mont Vernon, Northeast Representatives	603-880-8199
NJ	Cherry Hill, Metz-Benham Assoc.	609-424-0404
NM	Albuquerque, SynTech	505-266-7951
NY	East Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Endwell, Tri-Tech Elctrns.	607-754-1094
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Fishkill, Tri-Tech Elctrns.	914-897-5611
NY	Great Neck, MOS Assocs.	516-487-3966
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, John F. Kilfoil	513-791-6150
OR	Tigard, Earl & Brown Co.	503-639-2100
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Lewisville, Jim Hughes	214-221-1536
WA	Redmond, Earl & Brown Co.	206-885-5064
PR	San German, Digit-Tech Sls.	809-892-4260
Can	Calgary, Alb., A. Deskin Sls.	403-270-4440
Can	Edmonton, Alb., A. Deskin Sls.	403-466-2106
Can	Kanata, Ont., Indigo Elctrns.	613-831-3107
Can	Transcona, Manit., A. Deskin Sls.	204-224-1321
Can	Vancouver, B.C., A. Deskin Sls.	604-324-8343

Local Distributors

AL	Huntsville, Reptron	205-722-9500
AZ	Ftn. Hill, RCD Inds.	602-483-6412
CA	Santa Ana, TTI	714-641-9393
AZ	Tempe, Shelley- Ragon	602-894-2058
AZ	Tempe, T.T.I.	602-431-1191
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Campbell, Lartronics	408-379-6454
CA	Chatsworth, MIL-Comm Distrs.	818-998-3111
CA	Chatsworth, Shelley-Ragon	818-998-3333
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Fountain Valley, Comps. Ctr.	714-979-0433
CA	Garden Grove, Natl. Elctrns.	714-892-7749
CA	Huntington Beach, SMD, Inc.	714-841-4556
CA	Irvine, KELEX	714-863-1230
CA	Milpitas, T.T.I.	408-946-5577
CA	Mission Hills, T.T.I.	818-891-8885
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Diego, T.T.I.	619-748-2025
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Jaco	408-432-9290
CA	San Jose, Shelley Ragon	408-432-0600
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Sunnyvale, SAI	408-745-0800
CA	Tustin, Capstone Elctrns.	714-730-0349
CA	Tustin, Jaco Elctrns.	714-258-9003
CA	Westlake Village, Jaco	805-495-9998
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Boulder, R. G. Entprs.	303-447-9211
CO	Denver, T.T.I.	303-429-6806
CO	Englewood, Shelly-Ragon Elec. Parts	303-762-0670
CT	Wallingford, Midstate Elctrns.	203-265-9900
CT	Wallingford, T.T.I.	203-284-7474
CT	Wallingford, Utronics	203-265-2724
FL	Boca Raton, Jaco Elctrns.	407-241-7943
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Orlando, TTI	407-859-1000
FL	Tampa, Reptron	813-855-4656
FL	Tampa, Reptron Elec.	813-854-2351
FL	Tampa, Shelley-Ragon	813-623-6560
FL	W. Palm Beach, Atlantic Elctrns.	407-686-8553
GA	Norcross, Reptron	404-446-1300
GA	Norcross, T.T.I.	404-662-0911
IL	Bensenville, Goold Elctrns.	708-860-7171
IL	Glendale Heights, Shelley-Ragon	708-529-9977
IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IL	Rosemont, Advent Elctrns.	708-298-4210
IL	Schaumburg, Reptron Elctrns.	708-882-1700
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Baltimore, Radio Elec. Svc. Co.	301-931-8200
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MD	Columbia, Jaco Comps.	301-995-6620
MD	Columbia, T.T.I.	301-995-1331
MA	Billerica, Baldwin Comp. Ctr.	617-667-6710
MA	Chelmsford, Shelly-Ragon	508-250-9666
MA	Norwood, EMTEL Electronics	617-769-9500
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, North Star Elect.	508-657-5155
MA	Wilmington, T.T.I.	508-658-4700
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Hibbing, Minn Tech Elctrns.	218-262-5228
MN	Minnetonka, Reptron	612-938-0000
MN	Minnetonka, T.T.I.	612-933-8555
MN	St. Paul, Shelley-Ragon Elctrns.	612-642-2828
MO	Independence, Shelley-Ragon Elctrns.	816-254-3410
MO	St. Louis, Franklin Elctrns.	314-429-3111
NE	Lincoln, Scott Elctrns.	402-466-8221
NV	Las Vegas, Kiesub Corp.	702-733-3888
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Mount Laurel, TTI Inc.	609-234-6400
NJ	Mt. Laurel, Capstone Elctrns.	609-727-7800
NJ	Rockaway, Nasco	201-625-7777
NM	Albuquerque, Betatron	505-821-1122
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Buffalo, Summit Distrs.	716-887-2845
NY	Hauppauge, Jaco	516-273-5500
NY	Melville, S.A.I.	516-293-2710
NC	Raleigh, Reptron	919-832-3117
NY	Rochester, Summit Distrs.	716-334-8110
NY	Ronkonkoma, Baldwin Comp. Ctr.	516-588-5700
NY	Ronkonkoma, Prime Comps.	516-737-1730
NY	Ronkonkoma, T.T.I.	516-737-2000
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Raleigh, Jaco	919-876-7767
NC	Raleigh, Resco-Raleigh	919-781-5700
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Cleveland, Roberts Elect. Corp.	216-238-1711
OH	Columbus, T.T.I.	614-848-5770
OH	Independence, TTI	216-328-9755
OH	Solon, Reptron	216-349-1415
OH	Worthington, Reptron	614-436-6675
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Murphy Elctrns.	503-642-2001
NC	Raleigh, Capstone Elctrns.	919-954-0600
PA	Erie, Rem Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Philadelphia, Shap	215-969-3300
PA	Trevose, Sager Electronics	215-464-4336
RI	Pawtucket, Major Edwards	401-725-7400
TX	Addison, Jaco/QC Elctrns.	214-733-4300
TX	Carrollton, Capstone Elctrns.	214-380-9049
TX	Fort Worth, TTI	817-847-6666
TX	Ft. Worth, Carlton Bates	817-831-0395
TX	Ft. Worth, T.T.I.	817-831-8300
TX	Ft. Worth, T.T.I. Inc.	817-595-3100
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Jaco	214-235-9575
WA	Redmond, JACO Electronics	206-881-9700
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, T.T.I.	206-882-0291
WI	Oconomowac, G W Elctrns.	414-567-9445
Can	Calgary, Alb., A. Deskin Sls.	403-270-4440
Can	Edmonton, Alb., A. Deskin Sls.	403-468-3019
Can	Markham, Ontario, Semad	416-475-3922
Can	Transcona, Manit., A. Deskin Sls.	204-224-1321
Can	Vancouver, B.C., A. Deskin Sls.	604-324-8343

KOEP PRECISION STANDARDS, INC., 121 Helen Street, 2nd Fl, South Plainfield, NJ 07080, Tel: 201-757-2220/2277, FAX: 201-757-2332; FSC No.: 57114; Empl.: 4; *Dist. Mgr.:* N/A

KOLIN INDS., Box 300, Pound Ridge, NY 10576, Tel: 914-764-5775, FAX: 914-764-5386; Empl.: 30; *Sls. Mgr.:* J. Kolinsky

KONTES, Kimble Div. of Owens/IL, 1001 Spruce St, Vineland, NJ 08360, Tel: 800-223-7150, TWX: 510-687-8967

KONTRON ELEKTRONIK-US KONTRON ELEKTRONIK GMBH-SUB. BM, 66 Cherry Hill Dr., Beverly, MA 01915, Tel: 508-927-6575, FAX: 508-927-6511; Empl.: 30

KOOLTRONIC, INC., Hamilton Ave., Hopewell, NJ 08525, Tel: 609-466-3400, TELEX: 843345, FAX: 609-466-1114; Empl.: 200; *Sls. Mgr.:* John J. Drages

KOOLTRONIC, INC., 1700 Morse Avenue, Ventura, CA 93003, Tel: 805-642-8521, FAX: 805-658-2901; Empl.: 200

KRAFT DYNATRONIX, INC., 105 Power St., Amery, WI 54001, Tel: 715-268-8118, 800-826-7172, FAX: 715-268-8183; Empl.: 26; *Sls. Mgr.:* R. W. Kappler; *Dist. Mgr.:* R. W. Kappler, Natl. Sls. Mgr.

KRECKMAN, HERB, CO., 27 Spruce Cabin Road, Cresco, PA 18326, Tel: 717-595-2212, FAX: 717-595-2024; Empl.: 4

KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 908-636-1900, FAX: 908-636-1982; FSC No.: 55259; Empl.: 20; *Sls. Mgr.:* none ..... **A•1682-1683**

Local Sales Offices & Reps

CO	Englewood, Tech. Mktg. Co.	303-770-8994
OH	Kettering, Frank Bold & Assocs.	513-298-6145
TX	Richardson, Jim Wisdom & Assocs., Inc.	214-470-9093

KRENZ ELECTRONIC, INC., 1020 Calle Cordillera Ste.107, San Clemente, CA 92672, Tel: 714-361-2433, FAX: 714-361-2434; Empl.: 75; *Sls. Mgr.:* Alex Schlag, VP

KRISTEL CORPORATION, 833 Industrial Dr., West Chicago, IL 60185, Tel: 708-293-0850, FAX: 708-293-1255; Empl.: 35; *Sls. Mgr.:* Kevin Michael



FAX: 603-624-0634

KRL/BANTRY COMPONENTS, INC., 160 Bouchard St., Manchester, NH 03103, Tel: 603-668-3210; FSC No.: 18235; Empl.: 100; *Sls. Mgr.:* Bert A. Spiller ..... **A•1935-1940**

Local Sales Offices & Reps

TX	Grand Prairie, Claybrook & Assocs.	214-262-1188
CA	Mtn. View, Francisco & Assocs.	415-962-1717
CA	Sepulveda, Gil & Assocs.	818-894-1262
FL	Boca Raton, Sls. Specialists	813-754-1329
IN	Indianapolis, CC Electro Sls.	800-423-7799
NH	Amherst, D. A. Crowley & Assocs.	603-673-7050
NY	Port Washington, Ashtec	516-767-0336
NY	Rochester, H. C. Johnson Agencies	716-586-0777
OH	Akron, Augnat Assocs.	216-273-1211
TX	Dallas, Claybrook & Assocs.	214-690-9881
PA	Wyndmoor, Precision Mktg. Grp.	215-233-9233
TX	Houston, Milco Mktg.	713-723-5003
TX	Richardson, Milco Mktg.	214-738-2716
UT	Salt Lake City, Sage Assocs.	801-467-5451
WA	Seattle, The Harry Levinson Co.	206-382-1300

Local Distributors

MA	Billerica, Baldwin Comps.	617-667-6710
NY	Ronkonkoma, Baldwin Comps. Center	516-588-5700,800-645-5608
PA	Harrisburg, Ad-Tech	717-939-8337

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 508-580-1660, FAX: 617-583-8989; Empl.: 35 ..... **A•1684; D•1279**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs.	205-837-0692
AZ	Phoenix, Odyssey 1	602-246-8846
CA	Huntington Bch., Sci-Dev West	714-840-3501
CA	San Jose, Scientific Devs. West	408-554-0455

CO Englewood, Odyssey 1 303-773-8176
FL Ft. Lauderdale, Gentry Assocs. 305-791-8405
FL Orlando, Gentry Assocs. 305-859-7450
FL Tampa, Gentry Assocs. 813-886-0720
GA Atlanta, Gentry Assocs. 404-998-2828
IL Chicago, Berndt Assocs. 312-283-0713
IN Carmel, Berndt Assocs. 317-844-0114
KS Overland Park, Ramsey Assocs. 913-649-6996
LA Gretna, Gentry Assocs. 504-367-3975
MD Baltimore, Sci-Rep 703-385-0600
MI Detroit, EQS Sys. 313-961-3042
MN Minneapolis, Berndt Assocs. 612-546-2021
MO St. Louis, Ramsey Assocs. 314-878-5042
NJ Englewood, Sci. Devices E. 201-871-3916
NM Albuquerque, Odyssey 1 505-265-6645
NY Syracuse, Labtronics 315-455-7314
OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
WA Bellevue, Sci. Dvcs., N.W. 206-747-5189
PA Pittsburgh, EQS Sys. 216-729-2222
PA Spring House, Scientific Devices East 215-643-3335
SC Columbia, Gentry Assocs. 803-772-6786
TN Knoxville, Gentry Assocs. 615-584-0281
TX Houston, Barnhill Assocs. 713-444-1733
VA Fairfax, Sci-Rep 703-385-0600
WA Bellevue, Sci. Dvcs. N. W. 206-747-5169
WI Milwaukee, Berndt Assocs. 414-545-8400

KRYSTINEL CORP., 126 Pennsylvania Ave., Paterson, NJ 07509, Tel: 201-345-8900, TWX: 710-988-5931, FAX: 201-345-1172; Empl.: 200; *Sls. Mgr.:* William Perkins ,Mgr.Customer Service

KSI, See Kaiser Systems, Inc.

K-SYSTEMS OF TEXAS, INC., 11501 Rojas Dr. Ste. P, El Paso, TX 79936, Tel: 915-598-9769, TELEX: WUI 6502763972, FAX: 915-593-2080; Empl.: 4; *Sls. Mgr.:* J.C. Kates

K-TRONICS, See U. S. Elco Inc. (Under Elco)

K-TWO INDUSTRIES, 4331 Miranda Ave., Palo Alto, CA 94306, Tel: 408-720-9316; Empl.: 5

KULITE SEMICONDUCTOR PRODS., INC., One Willow Tree Rd., Leonia, NJ 07605, Tel: 201-461-0900, TELEX: 685-3296, FAX: 201-461-0990; Empl.: 350

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(415) 835-1500 1026 6th Avenue, Oakland, CA 94606

Local Sales Offices & Reps
AL Huntsville, Jim Springer, Inc. 205-883-4163
AZ Scottsdale, Dave Menegey Assocs. ... 602-994-9519
CA Hollywood, B. J. Wolfe Entprs. 213-877-5518
CA Walnut Creek, Dale-Dahl Assocs. 415-933-9595
CO Boulder, Measurement Cnslts. 303-449-7506
FL Bonita Springs, United Sls. Assocs. ... 813-947-4115
IL Carpentersville, Precision Meas. Prods., Inc. 312-426-4446
MA Brockton, JHL Assocs. 508-580-1703
MI Madison Heights, WKM Assocs. 313-588-2300
MN Minneapolis, Trask Engrg. 612-537-2434
MO St. Louis, Ozark Elctrn. Mktg. 314-423-7200
NJ Glen Gardner, United Sls. Assocs. 813-947-4115
NM Albuquerque, Amonette Entprs. 505-344-4143
NY Fairport, D.H. Brennan 716-223-7935
OH Cleveland, WKM Assocs. 216-524-5930
OH Dayton, WKM Assocs 513-434-7500
PA Doylestown, United Sls. Assocs. 813-947-4115
PA Pittsburgh, WKM Assocs. 412-892-2953
TX Dallas, Seaton Corp. 214-980-9860
UT Centerville, MC 2 801-298-3388
WA Seattle, Brett Assocs. 206-431-8090

KULKA (DIALIGHT CO.), See H.H. Smith, NT-T Inc.

KURZ INSTRUMENTS INC., 2411 Garden Rd., Monterey, CA 93940, Tel: 800-424-7356, TELEX: 172275; FSC No.: 94-24-11681; Empl.: 72; *Sls. Mgr.:* Tom Setliff

K-W MANUFACTURING CO., INC., P. O. Box 508, Prague, OK 74864, Tel: 405-567-2285, TELEX: 4932625, FAX: 405-567-4153; Empl.: 60; *Sls. Mgr.:* Freda Pickard

KYCON CABLE & CONNECTOR, INC., 1772 Little Orchard St., San Jose, CA 95125, Tel: 408-295-1110, FAX: 408-295-8054; Empl.: 9; *Sls. Mgr.:* Wendy Wuerth; *Dist. Mgr.:* Wendy Wuerth ..... **C•1422-1423, 1765**

Local Sales Offices & Reps
AZ Tempe, ACS of Arizona 602-731-9711
CA Aliso Viejo, Pro Assocs. 914-588-2700
CA San Jose, Kycon Cable & Connector, Inc. 408-295-1110
CA San Jose, Kycon Sls. Off. 408-295-1110
FL Clearwater, Dan-Tech Sls. 813-791-4551
FL Miramar, Dan-Tech Sls. 305-963-6142
GA Norcross, Pinnacle Mktg. 404-621-0212
KY Lexington, Protocol Sls. 606-272-4203
MA Sudbury, KSA of New England 508-443-5881
MO Chesterfield, Weisler and Assocs. 314-537-0010
NJ Oakland, Relay Specialties 800-526-5376
NC Raleigh, Pinnacle Mktg. 919-848-0404
OH Twinsburg, Protocol Sls. 216-425-2569
OR Beaverton, Quest Mktg. 503-641-7377
TX Dallas, Weisler and Assocs. 214-437-2386
WA Bellvue, Quest Mktg. 206-747-9424

Local Distributors
MA Ashland, Quality 508-881-6500
NC Raleigh, Resco Raleigh 919-781-5700

KYOCERA AMERICA, INC., 8611 Balboa Avenue, San Diego, CA 92123, Tel: 619-576-2766, TELEX: 47Z3069; Empl.: 1,150; *Sls. Mgr.:* Rick Sigliano

KYOCERA NORTHWEST, Electronic Components Group, 5701 E. Fourth Plain Blvd., Vancouver, WA 98661, Tel: 206-696-2840, FAX: 206-695-5836; FSC No.: 0FDX0; Empl.: 450; *Sls. Mgr.:* Koji Kanatani; *Dist. Mgr.:* Phil Elliott, Dist. Sales

LAB-LINE INSTRUMENTS, 15th & Bloomingdale, Melrose Park, IL 60160, Tel: 708-450-2600, TELEX: 6781028, FAX: 708-450-0943; Empl.: 225

LABORATORY TECHNOLOGIES CORP., 400 Research Dr., Wilmington, MA 01887, Tel: 508-657-5400, TELEX: 989695, FAX: 508-658-9972; Empl.: 31; *Sls. Mgr.:* Neil Parmenter

LABTRONICS INC., 75 Rickson Ave., Guelph, Ont., Canada N1G 3B6, Tel: 519-767-1061

LAFRANCE CORP., Entprs & Exec Aves, Philadelphia, PA 19153-3893, Tel: 215-365-8000, TELEX: 506-082, FAX: 215-365-4420; Empl.: 502; *Sls. Mgr.:* J. Singer

LAFRANCE CORP., PACTEC DIV., See PacTec Div., LaFrance Corp.

LAKE SHORE CRYOTRONICS, INC., 64 E. Walnut St., Westerville, OH 43081, Tel: 614-891-2243, TELEX: 24-5415, FAX: 614-891-1392; *Sls. Mgr.:* David L. Calvelage

LA MARCHE MFG., 106 Bradrock Dr., Des Plaines, IL 60018, Tel: 708-299-1188, TELEX: 28-2526; FSC No.: ;15736; Empl.: 225

LABORATORY TECHNOLOGIES CORP., 400 Research Drive., Wilmington, MA 01887, Tel: 508-657-5400, TELEX: 989695, FAX: 508-658-9972; Empl.: 30

LAMBDA ELECTRONICS INC., 515 Broad Hollow Rd., Melville, NY 11747-3700, Tel: 516-694-4200, FAX: 516-293-0519; Empl.: 1200; *Sls. Mgr.:* John Valenti

LAMBERT ENGINEERING INC., 601 N.W. Harmon Blvd., Bend, OR 97701, Tel: 503-388-2623, FAX: 503-388-1794; Empl.: 9

LAMB INDUSTRIES, INC., 6585 S.W. Raleighwood Ln., Portland, OR 97225, Tel: 503-297-8878, 800-824-9374, TELEX: 263373LAMBUR, FAX: 503-297-8879; Empl.: 5; *Sls. Mgr.:* Gary Rhode; *Dist. Mgr.:* Joanne McIntyre ..... **B•1728-1729**

Local Sales Offices & Reps
CA Canoga Park, Acorp Inds. 818-700-2991
CA San Diego, Deco Elctrns. 619-693-1595
CA San Diego, Sigma Elctrns. 619-565-2000
IA Des Moines, Mid State Distrbg. 515-244-7231
MN Fridley, Voyager Elctrns. 612-571-7766
MO St. Louis, Wes Garde 314-567-7776
NE Omaha, Mid State Distrbg. 402-592-5965
WA Redmond, Priebe Elctrns. 206-881-2363

Local Distributors
CA San Carlos, Logan Elctrns. 415-594-0700
CA Sunnyvale, Target Elctrns. 408-733-0384
CA Van Nuys, EW Elctrns. 714-857-4422
CA Van Nuys, Wes-Garde 213-873-4802
CT Hartford, Wes-Garde 203-527-7705
FL Lakeland, Wes-Garde 813-644-7564
IL Carrol Stream, Wes-Garde 312-653-1460
MN Minneapolis, Tor/Tec Corp. 612-866-3662
NY Freeport, KRP Elctrns. 516-623-3346
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OR Portland, Radar Elctrns. 503-232-3404
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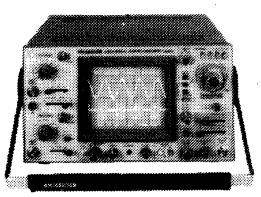
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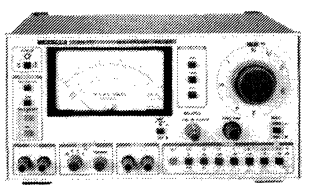
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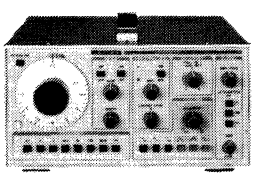
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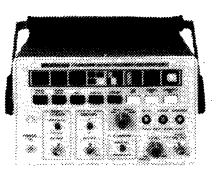
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LEYBOLD INFICON INC., 6500 Fly Rd, E. Syracuse, NY 13057, Tel: 315-434-1100, TWX: 710-541-0594, FAX: 315-437-3803; Empl.: 200; *Sls. Mgr.:* Mark Wilson

LFE INSTRUMENTS, 55 Green St., Clinton, MA 01510-3099, Tel: 508-835-1000, TELEX: 200157, FAX: 508-835-1068; Empl.: 250; *Sls. Mgr.:* D. Snyder; *Dist. Mgr.:* D. Hammer (East)D. Flanagan (West)

LF ENGINEERING COMPANY INC., 17 Jeffry Road, East Haven, CT 06512, Tel: 203-467-3590

LG SYSTEMS CORP., Lockwood Greene Engineers, Inc., P.O. Box 491, 1500 International Drive, Spartanburg, SC 29304, Tel: 803-578-2143, TELEX: 805288, TWX: 809436, FAX: 803-599-0436; Empl.: 1720; *Sls. Mgr.:* Jim Jones

FAX: 714-669-2562

LH RESEARCH, INC., 14402 Franklin Ave., Tustin, CA 92680, Tel: 1-800-547-2537; Empl.: 900; *Sls. Mgr.:* Martin Hudis ..... **D•1874-1875**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Irvine, LH Resch., Inc.	714-770-6102
CA	Los Gatos, Luscombe Engrg.	408-370-2020
CA	Montrose, Luscombe Engrg.	818-249-9000
CA	Tustin, LH Resch., Inc.	800-LH-SALES
CO	Arvada, LH Research, Inc.	303-424-5119
CT	North Haven, Kitchen & Kutchin	203-239-0212
DC	Washington, D.C., Marktron	301-251-8990
FL	Melbourne, Synergistic	407-242-9661
GA	Atlanta, Beacon Elctrns.	404-256-9640
IA	Cedar Rapids, Adv. Tech. Sls.	319-393-8280
KS	Olathe, Adv. Tech. Sls.	913-782-8702
MD	Hunt Valley, Marktron	301-628-1111
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Minneapolis, Professional Sls.	612-944-8545
NM	Albuquerque, Luscombe Engrg.	505-888-0333
NY	Melville, Comtronic Assoc.	516-249-0505
NY	Pittsford, Elcom Sls., Inc.	716-385-1400, 315-685-8967
OK	Tulsa, Milco Mktg., Inc.	918-664-2188
OR	Beaverton, Core II Mktg.	503-649-0871
TX	Plano, Milco Mktg., Inc..	214-578-7026,512-335-3203
WA	Seattle, V.M.I.	206-882-2999

LIBERTY CONTROLS INC.

FAX: 815-725-6571

LIBERTY CONTROLS, 500 Brookforest Ave., Shorewood, IL 60435, Tel: 815-725-2241; Empl.: 60; *Sls. Mgr.:* Gary Davies ..... **B•1627**

Local Sales Offices & Reps

CA	Arcadia, H.M.C. Inc.	818-447-0958
CA	Hayward, Featherstone Sls. Co.	415-785-1926
CO	Arvada, Gemini Elctrns.	303-428-5600
CT	Cheshire, The MacInnis Co.	203-272-3797
IL	Lisle, WG Controls, Inc.	708-963-5954
KS	Olathe, Advanced Tech. Sls.	913-782-8702
MA	Norwood, The MacInnis Co.	617-762-8090
MI	Detroit, R. P. Urban & Assocs.	313-535-2355
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	Englewood Cliffs, Mason-Esco Inc.	201-569-8868
NY	Hauppauge, Mason-Esco Inc.	516-273-3500
NY	Rochester, BRS Sls. Assocs.	716-586-1522
OH	Dayton, J. C. Hoffsteller Co.	513-296-1010
OH	Medina, J. C. Hoffstetter Co.	216-241-4880
OR	Portland, SPS Elctrns., Inc.	503-297-6919
TX	Dallas, Reese & Assocs.	214-351-0703
UT	Slat Lake City, Gemini Elctrns.	801-278-0201
WA	Redmond, SPS Elctrns., Inc.	206-323-4140

LIBERTY INTERNATIONAL CORP., 1606 Lockness Place, Torrance, CA 90501, Tel: 213-539-6452, FAX: 213-539-8450; Empl.: 5; *Sls. Mgr.:* Gary Lee; *Dist. Mgr.:* Maria A. Lauro

LIBERTY POLYGLAS, INC., 1575 Lebanon School Rd, West Mifflin, PA 15122, Tel: 412-466-8611, FAX: 412-466-8640; FSC No.: 2E281; Empl.: 50; *Sls. Mgr.:* L.P. Connors

LIBRASCOPE CORP., 833 Sonora Ave., Glendale, CA 91201, Tel: 818-244-6541, TELEX: 674912, FAX: 818-502-8145; Empl.: 1350

LIGHT CONTROL SYSTEMS INC., M/A COM Inc., 2 Bridgeview Circle, Tyngsboro, MA 01879, Tel: 508-649-9870, FAX: 508-649-9636; Empl.: 35; *Sls. Mgr.:* Karen A. Gentis

LIGHTNING PROTECTION CORP., Box 6086, Santa Barbara, CA 93160, Tel: 805-967-5089/4577, FAX: 805-967-4320; FSC No.: 56618; Empl.: 25; *Sls. Mgr.:* Chester J. Kawiecki

LIGHTWAVE COMMUNICATIONS, INC., 650 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-3591, FAX: 203-431-3001; FSC No.: 6020; *Sls. Mgr.:* Philip Franceschimi; *Dist. Mgr.:* Philip Franceschimi

LILLY-RAM INDUSTRIES, 210 E. Alondra Blvd., Gardena, CA 90248, Tel: 213-321-0710; Empl.: 100; *Sls. Mgr.:* Jerome J. Pajor; *Dist. Mgr.:* Jerome J. Pajor

LINCOLN INSTRUMENTS, 2720 Kimball Ave., Pomona, CA 91767, Tel: 714-626-3399, FAX: 714-625-6654; Empl.: 13; *Sls. Mgr.:* Barbara J. Burchette

LINCOLN LASER CO., 234 East Mohave, Phoenix, AZ 85004, Tel: 602-257-0407, FAX: 602-257-0728; Empl.: 100; *Sls. Mgr.:* Robert S. Nehrbas, Jr.

LINDGREN RF ENCLOSURES, INC., 400 High Grove Blvd., Glendale Hgts., IL 60139, Tel: 708-307-7200, TELEX: 297296LIND UR, FAX: 708-307-7571; FSC No.: 18234; Empl.: 125; *Sls. Mgr.:* John T. Guennewig

LINEAR INSTRUMENTS, Spectra Physics Analytical, 2325 Robb Dr., Reno, NV 89523, Tel: 702-746-2200, FAX: 702-746-2212; Empl.: 90

LINEAR MOTIONS CO., 17025 Dubesor St., Valinda, CA 91744, Tel: 818-918-7806; FSC No.: 5945; Empl.: 6; *Sls. Mgr.:* L. Wolby ..... **B•1628**

LINEAR TECHNOLOGY CORP., 1630 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-432-1900, FAX: 408-434-0507; FSC No.: 64155; Empl.: 425; *Sls. Mgr.:* Bill Ehrsam; *Dist. Mgr.:* David Robbie

LINE ELECTRIC PRODUCTS, P.O. Box 327, Hartford, CT 06141, Tel: 203-659-3573, 1-800-331-1137, FAX: 203-659-3576; FSC No.: 07065; Empl.: 35; *Sls. Mgr.:* Teo Babun; *Dist. Mgr.:* Bill Harris ..... **B•1537**

Local Sales Offices & Reps

CT	W. Hartford, Component Concept	203-523-4066
GA	Norcross, Electramark, Inc.	404-446-7915
Can	Brossard, Que., DB Lectro, Inc.	514-672-7029

Local Distributors

AL	Birmingham, MG Elctrns.	205-328-4525
CA	Covina, Selecta Switch	818-967-4119
CA	Hayward, Electro Comps.	415-783-5800
CA	Los Angeles, Master Distrs.	213-452-1229
CA	San Diego, Shanks & Wright	714-239-0176
CT	E. Hartford, R & S Elctrn. Distrs.	203-528-9901
CT	Fairfield, Indl. Elec.	203-255-9547
FL	Hialeah, Atlas Elec. Supp.	305-885-8941
FL	Miami, Miramar Elec. Sys.	305-871-4072
GA	Rome, Battey Machine	404-291-4141
IL	Elk Grove Village, Elk Grove Elec.	312-956-6350
IN	Marion, Myers Radio Supp.	317-664-7394
KY	Louisville, Cameron & Barkley	919-758-2507
MA	Allston, Hilco Elec. Supp.	617-783-2600
MA	Lynn, Land Elctrns. Supp., Inc.	617-592-2220
NY	Nanuet, BJ Inds.	914-623-2660
NC	Forest City, Lucky One	704-245-8053
NJ	Jersey City, Cuny & Gerber	201-653-0222
NJ	Linden, Turtle & Hughes	201-574-3600
NJ	Piscataway, Fromm Elec.	209-981-0400
NJ	Secaucus, Franklin & Smith	201-864-0555
NM	Hobbs, K & S Elec. Co.	505-393-3114
NY	Baldwinsville, Scibetta Distrs.	315-622-3993
NY	Bronx, Smith Elctrns.	212-292-4670
NY	New York, Blan Elctrns.	212-233-6288
OH	Cincinnati, Cincinnati Controls	513-530-0049
OH	Cleveland, Specialized Comp. Sls. Co., Inc.	216-464-0405
OH	Dayton, John A. Becker Co.	513-226-1341
PA	Philadelphia, F & C Sls. Co.	215-228-5656
TX	San Angelo, Gunter Wholesale Co.	915-655-9181

LINEMASTER SWITCH, 29 Plaine Hill Rd.,P.O Box 238, Woodstock, CT 06281-0238, Tel: 203-974-1000, FAX: 203-974-0691; FSC No.: 979180; Empl.: 190

LINSEIS, INC., P.O. Box 666, Princeton Junction, NJ 08550, Tel: 609-799-6282, 800-RECORDER, FAX: 609-799-7739; *Sls. Mgr.:* Michael Bissell ..... **D•1420**

LISK, G. W., CO., 2 South St., Clifton Springs, NY 14432, Tel: 315-462-2611, TELEX: 71-6854113, FAX: 315-462-7661; Empl.: 300; *Sls. Mgr.:* D.J. Riggs; *Dist. Mgr.:* D.J. Riggs

LITEON

FAX: 408-942-1527

LITE-ON INC., 720 S. Hillview Dr., Milpitas, CA 95035, Tel: 408-946-4873; Empl.: 1100; *Sls. Mgr.:* Michael Barnes; *Dist. Mgr.:* Mark King ..... **A•2098-2099; B•1092-1095**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrn. Assoc.	205-881-5031
AZ	Mesa, System Sls. of AZ.	602-464-9989
CA	Agoura, Quadrep Southern	818-597-0222
CA	Irvine, Quadrep Southern	714-727-4222
CA	San Diego, Quadrep Southern	619-560-8330
CA	San Jose, Quadrep, Inc.	408-432-3300
CO	Lakewood, Candal, Inc.	303-935-7128
CT	Middletown, Gerber Sls.	203-347-3000
FL	Altamonte Spgs., Semtronics Assoc. Inc.	407-831-8233
FL	Clearwater, Semtronics Assoc. Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronics Assoc. Inc.	305-731-2484
GA	Atlanta, Beacon Elctrn. Assoc.	404-256-9640
IL	Itasca, Circuit Sls. Inc.	312-773-0200
IN	Fort Wayne, Corrao Marsh, Inc.	219-482-2725
IN	Greenfield, Corrao Marsh, Inc.	317-462-4446
IA	Cedar Rapids, Hitec Central, Inc.	319-396-3228
MD	Glen Burnie, Third Wave Solutions	301-290-5990
MA	Burlington, Gerber Sls.	617-229-1150
MI	Brighton, AP Assocs.	313-229-6550
MN	Minneapolis, Comstrand	612-788-9234
MO	Bridgeton, Hi-Tec Central	314-731-7243
NJ	Morristown, Andrews & Andrews	201-569-8800
NJ	Totowa, R.O.I. Sls. Co.	201-812-9606
NM	Albuquerque, System Sls. of Az.	505-889-2901
NC	Raleigh, Beacon Elctrn. Assoc.	919-787-0330
OH	Dublin, Sales Plus	614-889-8362
OH	Mentor, Sales Plus	216-942-7811
OR	Portland, Q.R./Crown, Inc.	503-620-8320
PA	Willow Grove, Tech Sales Assoc.	215-784-0170
TN	Knoxville, Beacon Elctrn. Assoc.	615-689-2141
TX	Houston, RAM Elctrn. Sls., Inc.	713-855-0768
TX	Plano, RAM Elctrn. Sls., Inc.	214-424-4455

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UT	Ogden, Taylor Mktg.	801-546-9570
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WI	Brookfield, Circuit Sls.	414-784-7773
Can	Brampton, Ontario, Designtronics	416-793-5155
Can	Pointe Claire, Quebec, Designtronics	514-695-3124
Can	Richmond, B.C., Blakewood Assocs.	604-273-9910

LITTELFUSE, INC., 800 E. Northwest Hwy., Des Plaines, IL 60016, Tel: 708-824-1188, 708-824-0400, FAX: 708-824-3024; Empl.: 1700; *Sls. Mgr.:* David Hanley; *Dist. Mgr.:* Michael Budde ..... **B•1372-1373**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Tucson, Clemick & Assocs.	602-749-4003
AR	Little Rock, Erickson Sls., Inc.	501-455-0618
CA	Burlingame, Wm. J. Purdy Co.	415-347-7701
CA	Irvine, Gravley & Assocs.	714-852-9994
CO	Denver, The Lindberg Co.	303-758-9033
CO	Englewood, Purdy Co. Assoc.	303-790-2211
CT	Branford, Coakley, Boyd & Abbett Inc.	203-481-2218

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FL	Pompano Beach, Hawkins-Frederickson Assoc. Inc.	305-979-0330
GA	Norcross, Cartwright & Bean Inc.	404-368-0160
IL	Mt. Prospect, The Dombrow Co.	708-253-3631
IN	Indianapolis, L. M. DeVoe Co.	317-842-3245
IA	Cedar Rapids, T.L. Dowell Assoc.	319-364-3880
KS	Overland Park, T. L. Dowell & Assocs.	913-599-1100
LA	Chalmette, Erickson Sls. Inc.	504-271-1976
MD	Silver Spring, Mid-Atlantic Sls. Co.	301-593-7749
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MA	W. Bridgewater, Coakley,Boyd & Abbott, Inc.	508-559-6700
MI	Farmington Hills, R. C. Merchant Co.	313-476-4600
MI	St. Joseph, R. C. Merchant	616-983-7378
MN	Edina, M. Foster Tech. Sls., Inc.	612-941-9790
MO	St. Louis, T. L. Dowell & Assocs.	314-849-4234
NJ	Englewood, MOS Mktg. Assoc.	201-569-2071
NM	Albuquerque, The Lindberg Co.	505-881-1006
NY	Binghamton, R.W. Mitscher Co., Inc.	607-724-6561
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	New York, MOS Mktg. Assoc.	516-487-3966
NY	Pittsford, R. W. Mitscher Co., Inc.	716-586-4012
NY	Rochester, R. W. Mitscher Co., Inc.	716-227-0839
NY	Utica, R.W. Mitscher Co., Inc.	315-724-3947
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean,Inc.	919-876-4130
OH	Centerville, Bear Mktg., Inc.	513-436-2061
OH	Richfield, Bear Mktg., Inc.	216-659-3131
OR	Portland, J. E. Belusko Co.	503-222-4279
PA	Harrisburg, Beil & Whitaker, Inc.	717-564-6900
PA	Narberth, Bresson Assocs., Inc.	215-664-6460
PA	Pittsburgh, Bear Mktg., Inc.	412-531-2002
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, Elcom Mktg., Inc.	214-241-2166
TX	Dallas, Erickson Sls., Inc.	214-739-5833
VA	Charlottesville, Mid-Atlantic Sls. Co.	804-973-8099
Can	Pickering, Ont., A. C. Simmonds	416-839-8041

LITTON ELECTRON DEVICES, 960 Industrial Rd., San Carlos, CA 94070, Tel: 415-591-8411, TWX: 910-376-4900, FAX: 415-591-5623; Empl.: 800

LITTON ELECTRON DEVICES, Litton Systems, Inc., 1215 South 52nd St., Tempe, AZ 85281, Tel: 602-968-4471, TELEX: 910-950-0149, FAX: 602-966-9055; FSC No.: 55311; Empl.: 708; *Sls. Mgr.:* C. M. Wood, Byron Harding, Mktg. Mgrs.; *Dist. Mgr.:* C. M. Wood, Byron Harding,Mktg. Mgrs.

LITTON ENCODER DIV., 20745 Nordhoff St., Chatsworth, CA 91311, Tel: 818-341-6161, TWX: 910-494-1229, FAX: 818-882-4553; FSC No.: 17080; Empl.: 150

LITTON LASER SYSTEMS, CLS OPERATIONS, 5 Jeffrey Drive, South Windsor, CT 06074, Tel: 203-289-3551

Litton
Poly-Scientific

FAX: 703-953-1841

LITTON POLY-SCIENTIFIC, Div. of Litton Industries, 1213 N. Main St., Blacksburg, VA 24060-3100, Tel: 800-336-5917, 703-953-4751, TWX: 710-875-3694; Empl.: 800 ..... **B•1218-1223, 1283-1292**

Local Sales Offices & Reps

AZ	Phoenix, Dick Palmer	602-242-0910
CA	Huntington Beach, Mike Baggetta	714-968-0434
CA	Woodland Hills, Bob Billington	818-347-0603
FL	Fern Park, Blair Engrg.	305-834-1244
MA	Sturbridge, Russ Persson	203-871-8900
MI	Stockbridge, Erhart Engrg.	517-851-8770
MN	Prior Lake, Midwest Meridian	612-447-8222
KS	Olathe, Technical Sls. Assoc.	913-829-2800
NY	Mineola, Kahn Assocs.	516-742-1900
TX	Dallas, Blair Engrg.	214-241-5655
OH	Medina, Stress Analysis Svcs.	216-725-7733
TX	Garland, Carey, McMahill & Associates	214-681-1414
WA	Bellevue, Thorsen Co.	206-455-9180

LITTON POTENTIOMETER DIV., 750 So. Fulton Ave., Mt. Vernon, NY 10551, Tel: 914-664-7733, TWX: 710-562-0129, FAX: 914-664-2466; FSC No.: 04454;Multiple; Empl.: 300; *Sls. Mgr.:* Sales Director

LITTON SOLID STATE, Litton Systems, Inc., 1504 Mc Carthy Blvd., Milpitas, CA 95035, Tel: 408-433-0933, FAX: 408-954-9652

LIXI, INC., 1438 Brook Dr., Downers Grove, IL 60515, Tel: 708-620-4646, FAX: 708-620-7776; Empl.: 17; *Sls. Mgr.:* Tom Nguyen; *Dist. Mgr.:* Andy Xydakis

LJ TECHNICAL SYSTEMS, 19 Power Drive, Hauppauge, NY 11788, Tel: 516-234-2100, FAX: 516-234-2656; Empl.: 25; *Sls. Mgr.:* Christopher Rowe

LMB HEEGER, INC., 6400 Fleet St., Commerce, CA 90040, Tel: 213-728-5108, FAX: 213-728-4740; *Sls. Mgr.:* Robert Heeger

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LMI CONNECTORS INC., 34 West Service Rd., Champlain, NY 12919, Tel: 518-298-5360; *Sls. Mgr.:* David Asseraf; *Dist. Mgr.:* David Asseraf ..... **C•1442-1445**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Phoenix, Piatt Sls.	602-957-3570
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	San Diego, Van Gott & Assoc.	714-698-7774
CT	Bloomfield, The Newscott	203-243-8514
CT	Killingsworth, Newscott Co.	203-663-2338
FL	Altamonte Springs, Over & Over, Inc.	407-332-1222
FL	Coral Springs, Over & Over, Inc.	305-753-7050
FL	Tampa, Over & Over, Inc.	813-626-9100
GA	Norcross, Over & Over	404-449-6505
IL	Glenview, Prime Dvcs.	708-729-2550
IN	Columbus, Connect 21	502-426-8955
KS	Olathe, G.M. Brown & Assocs.	913-829-3086
KY	Louisville, Connect 21	502-426-8955
MD	Millerville, Components & Assemblies	301-987-0034
MA	Needham Heights, The Newscott Co.	617-444-1923
MN	Eden Prairie, Electro Mark	612-944-5850
MO	Florissant, G.M. Brown & Assocs.	314-839-3600
NJ	Medford, The McCoy Grp.	609-953-0770
NY	Bohemia, JSA	516-244-2584
NY	Champlain, LMI Connectors, Inc.	518-298-5360
NY	Rochester, Lamb Comps.	716-328-6350
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NC	Raleigh, Over & Over, Inc.	919-876-7338
OH	Columbus, McFadden Sls.	614-761-3177
PA	Easton, The McCoy Grp.	215-363-0350
WI	Oak Creek, Prime Dvcs.	414-263-3900
Can	Montreal, Que., Avotronics	514-697-2135
Can	Toronto, Ont., Avotronics	416-475-2019

Local Distributors

AZ	Tempe, Control Design Supp.	602-829-7981
CA	Anaheim, Control Design Supp.	714-821-6173
CA	Fullerton, Interconnect Specs.	714-773-0411
CA	San Carlos, Control Design Supp.	415-592-4806
CA	San Diego, Control Design Supply	619-457-9822
CA	Santa Ana, BDS Elctrns.	714-662-1050
CO	Denver, Control Design Supp.	303-296-1922
CT	Wallingford, Control Design Supp.	203-269-9955
FL	Altamonte, Control Design Supp.	305-788-3220
FL	Pompano Beach, Control Design Supp.	305-782-1311
GA	Stone Mountain, Control Design Supp.	404-979-3500
IL	Chicago, Control Design Supp.	708-307-8944
IL	Chicago, Leeds	312-625-3800
IL	Schaumburg, Control Design Supp.	708-307-8900
IN	Indianapolis, Control Design Supp.	317-788-4559
IA	Marion, Control Design Supp.	319-373-2923
KS	Kansas City, Control Design Supp.	913-362-4248
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Woburn, Control Design Supp.	617-932-9404
MN	Minneapolis, Control Design Supp.	612-721-1628
MO	St. Louis, Control Design Supp.	314-426-3150
NJ	Union, Avanti	201-964-0333
NY	Canandaigua, Advacom	716-396-9050
NY	Whitestone, Power Electro Supp.	718-767-1447
NC	Charlotte, Control Design Supp.	704-588-4410
PA	Malvern, Control Design Supp.	215-296-0150
TX	Arlington, Bell Comp. Sls.	817-461-5303
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Control Design Supp.	214-358-1441
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	Houston, Wofford Elctrns., Inc.	713-847-3583
UT	Nephi, Control Design Supp.	801-623-2977

WA Kent, Control Design Supply 206-251-6323
WI New Berlin, Control Design Supp. 414-784-1015
Can Calgary, AB, Memco 403-258-3399
Can Edmonton, AB, Wholesale Electronics 403-451-2180
Can Montreal, Que., Ferrotronic Components 514-341-3450
Can Montreal, Que., Megastar Electronics 514-329-0042
Can Ottawa, Ont., Z.E.I. 613-526-2911
Can St. Laurent, Que., Z.E.I. 514-342-6211
Can Ste-Foy, Que., Z.E.I. 418-681-1262
Can Surrey, B.C., Memco 604-590-1553
Can Toronto, Ont., Z.E.I. 514-674-7220
Can Victoria, B.C., Pacific Coast Electronics 604-385-5111

LMI CONNECTORS INC., 8415 Dalton Rd., Town of Mount Royal, Canada H4T 1V5, Tel: 514-733-8311, FAX: 514-733-8440

LNR COMMUNICATIONS, INC., 180 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-7111, TELEX: 221620, TWX: 510-227-9871, FAX: 516-273-7119; FSC No.: 51049; Empl.: 200; *Sls. Mgr.:* F. Kelly, Dir. Mktg.

LOCKHEED SANDERS, INC., EMC Dept., 95 Canal St., Nashua, NH 03061-2004, Tel: 603-885-3602, TELEX: 94-3430, TWX: 710-228-1894, FAX: 603-885-5133; FSC No.: 94117; *Sls. Mgr.:* (EMC) R. Bossart

LOCTITE LUMINESCENT SYS., INC., LocTite Corp., Etna Rd., Lebanon, NH 03766, Tel: 603-448-3444, TELEX: 710-366-0607, FAX: 603-448-3452; Empl.: 200

LOCUS, INC., Box 740, State College, PA 16804, Tel: 814-466-6275, FAX: 814-466-3341; *Sls. Mgr.:* Ellwood E. Brem

LOCUS, Kaman, PO Box 740, State College, PA 16804, Tel: 814-466-6275; *Sls. Mgr.:* Ellwood E. Brem

LOCUS COMPUTING CORP., 9800 La Cienega Blvd., Inglewood, CA 90301-4440, Tel: 213-670-6500, FAX: 213-670-2980; Empl.: 275

LOCUS INC., 1842 Hoffman Street, Madison, WI 53704, Tel: 608-244-0500, FAX: 608-244-0528; Empl.: 18

LODESTONE PACIFIC, 4065 E. La Palma Ave. Bldg. G, Anaheim, CA 92807, Tel: 714-630-1343, FAX: 714-630-8480; FSC No.: OJWU1; Empl.: 11; *Sls. Mgr.:* Mark Soukup ..... **A•1210-1211**

Local Sales Offices & Reps
IL Chicago, Charles Atwater Assoc. 708-668-2303
MA Boston, Anchor Engrg. Corp. 508-898-2724
NY Long Island, Kahgan Brody Assoc. 516-538-2300
PA Easton, Kendon Co. 215-253-3100
VA Roanoke, A.B. Kreger Co. 703-989-4738
Intl Frankfurt, Germany, BFI 06074 4098-0
Intl Hong Kong, P. Leo & Co. Ltd. 5-413655
Intl London, England, Cirkit 0992-444111
Intl Milano, Italy, BFI 2-33100535
Intl Paris, France, BFI 145-330137
Intl Roskilete, Denmark, BFI 488-8289900
Intl Sollenton, Sweden, BFI 488 828 9900

LOGICAL DESIGN GROUP, INC., 6301 Chapel Hill Rd., Raleigh, NC 27607, Tel: 919-851-1101, FAX: 919-851-2844; Empl.: 22; *Sls. Mgr.:* Cam McPhee; *Dist. Mgr.:* Barbara Boyette

LOGICAL DEVICES, INC., 1201 N.W. 65th Place, Fort Lauderdale 33309, Tel: 305-974-0967, FAX: 305-491-6956; *Sls. Mgr.:* Bob Sims

LOGIC BEACH INC., 8033 Pasadena Ave., La Mesa, CA 91941, Tel: 619-698-3300, FAX: 619-469-8604; Empl.: 10; *Sls. Mgr.:* David Parks; *Dist. Mgr.:* David Parks

LOGI COMP ELECTRONICS, INC., 1009 W. Boston Post Rd., Mamaroneck, NY 10543, Tel: 914-698-9332, FAX: 914-698-9456; Empl.: 6

LOGICOMP ELCTRNS., INC., See Pres-Air-Trol Corp.

LOGIC TECHNOLOGY, INC., 1090-B L'Avenida, Mtn. View, CA 94043, Tel: 415-967-1007, FAX: 213-641-4691; FSC No.: 51019; *Sls. Mgr.:* Mel Morgan

LOGIMETRICS, 121-03 Dupont St., Plainview, NY 11803, Tel: 516-349-1700, TELEX: 7608152, FAX: 516-349-8552; FSC No.: 33013; Empl.: 75; *Sls. Mgr.:* Eugene Blum

LOGITEK

THE LOGICAL CHOICE OF THE TECHNICAL MIND

FAX: 516-467-4090

LOGITEK, INC., 101 Christopher St., Ronkonkoma, NY 11779, Tel: 516-467-4200, TWX: 510-224-6253; FSC No.: 15420; Empl.: 75; *Sls. Mgr.:* David Fischer ..... **B•1538-1540; D•1877**

Local Sales Offices & Reps
AL Huntsville, R.O. Whitesell & Assocs. ... 205-883-5110
AZ Scottsdale, Logitek 805-527-4700
CA Campbell, Shur Sls., Inc. 408-374-5577
CO Englewood, Advanced Technlg. Mktg. 303-789-2606
CA Simi Valley, Logitek 805-883-7608
CT Hartford, Dynamic Sls. of New England 203-693-6567
FL Longwood, R. O. Whitesell & Assoc. .. 407-682-6662
GA Norcross, R.O. Whitesell & Assocs. ... 404-449-9190
IN Indianapolis, R.O. Whitesell & Assocs. 317-359-9283
KS Wichita, D&O Engrg. Co. 316-686-2808
KY Pewee Valley, R.O. Whitesell & Assocs. 502-241-1441
MA Burlington, Dynamic Sls. of New England 617-272-5676
MN Brooklyn Center, White Sls. Co. 612-566-8694
MO Southfield, R.O. Whitesell & Assocs. .. 313-559-5454
NY Ronkonkoma, JL Sls. 516-737-2801
NC Greensboro, R.O. Whitesell & Assocs. 919-273-1945
OH Dayton, R.O. Whitesell & Assocs. 513-298-9546
OK D&O Engrg. Co. 316-686-2808
NY Mendon, Tech Mark 716-624-3840
PA Pittsburgh, R.O. Whitesell & Assocs. .. 412-963-6161
TN Nashville, R.O. Whitesell & Assocs. ... 615-352-4760
TX Dallas, D&O Engrg. Co. 214-241-3099
VT Burlington, Dynamic Sls. of New England 802-863-6665
VA Charlottesville, Elctrn. Sources, Inc. ... 804-973-7008
WA Kirkland, Skye-Tek 206-828-2115
Can Lachine, Que., Electrodesign Ltd. 514-636-4838

LONG ISLAND TRANSFORMER & INDUCTOR COMPANY, INC., 882 Wallace Ave., Baldwin, NY 11510, Tel: 516-766-5644; Empl.: 5

LONGSHINE TECHNLG. INC., 2013 N. Capitol Ave., San Jose, CA 95132, Tel: 408-942-1746, FAX: 408-942-1745; Empl.: 300

LORAIN PRODUCTS, Reliance Electric, 1122 F St., Lorain, OH 44052, Tel: 216-288-1122, TELEX: 98-0505, TWX: 196131; Empl.: 1200; *Sls. Mgr.:* T. F. McFadden

LORAL DATA SYSTEMS, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, FAX: 813-378-1893; FSC No.: 06141; Empl.: 900; *Sls. Mgr.:* F. V. Bud Hinkel

LORAL DATA SYSTEMS, Data Recorders, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, FAX: 813-378-1893; FSC No.: GS-00K-8301-S0078; Empl.: 750; *Sls. Mgr.:* Steve Hoff

LORAL FAIRCHILD, Imaging Sensors, 1801 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2500, TWX: 910-373-2110, FAX: 408-433-2508; *Sls. Mgr.:* Jim Johnson; *Dist. Mgr.:* Jim Johnson

LORAL MICROWAVE-FSI, Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824, Tel: 508-256-4113/8101, TWX: 710-343-0404, FAX: 508-937-3748; FSC No.: 26629; Empl.: 90; *Sls. Mgr.:* D. Langan

LORAL MICROWAVE NARDA, 435 Moreland Rd., Hauppauge, NY 11788, Tel: 516-231-1700, TWX: 510-221-1867, FAX: 516-231-1711; FSC No.: 99899; Empl.: 400; *Sls. Mgr.:* Robert Nopper

LORAL MICROWAVE-NARDA WEST, 214 Devcon Dr., San Jose, CA 95112-4210, Tel: 408-436-4400, FAX: 408-436-8476; FSC No.: 8F150; Empl.: 200; *Sls. Mgr.:* Leon Becker

LORAL MICROWAVE-WAVECOM, 9036 Winnetka Ave., Northridge, CA 91324, Tel: 818-882-3010, TELEX: 6502408147; FSC No.: 28979; Empl.: 109

LORAL TERRACOM, Sub. of Loral Corp., 9020 Balboa Ave., San Diego, CA 92123, Tel: 619-278-4100, TELEX: TERRACOM A SDG 18-2774, FAX: 619-292-1140; *Sls. Mgr.:* Michael A. Lapadula

LORCH ELECTRONICS:DIV. OF VERNITRON CORP., 2801 - 72nd St., No., St. Petersburg, FL 33710, Tel: 813-347-2181, FAX: 813-347-3881; FSC No.: 29971; Empl.: 50; *Sls. Mgr.:* Carol McCoy ..... **A•1751**

Local Sales Offices & Reps
AZ Phoenix, J.F. Hurlbut 602-952-2079
CA Los Angeles, McDougall/McLauglin Co. 213-477-8556
CO Golden, J. F. Hurlbut Co. 303-279-7796
KY Ft. Mitchell, G. W. Thelen Co., Inc. 606-341-8181
MO St. Louis, Engrg. Svcs. 314-997-1515
NH Amherst, D.A.Crowley & Assocs., Inc. .. 603-673-7050
NJ W. Orange, E-F Tech. Sls. 201-731-7203
NJ W. Orange, E-F Tech. Sls., Inc. 201-731-7203
NY Liverpool, R & D Assocs. 315-457-0100
NY Plainview, E-F Tech. Sls. 516-942-7400
OH Chagrin Falls, G.W. Thelen Co.,Inc. 216-543-1095
PA Glenside, Koebert Assocs., Inc. 215-887-2310
TX Plano, Zeus Engrg. 214-423-2027
WA Seattle, G. M. Gillett & Assocs. 206-284-3344
EXP NY, Great Neck, Ad. Auriema 516-487-0700
Can La Salle, Que., Electrodesign, Ltd. 514-363-0245

LORLIN TEST SYSTEMS, 8 Lakeside Office Pk. 599 North Ave., Wakefield, MA 01867, Tel: 617-245-9044, FAX: 617-246-5822; Empl.: 45; *Sls. Mgr.:* Paul Pedigo

LORTEC POWER SYSTEMS, INC., 145 Keep Court, Elyria, OH 44035-2214, Tel: 216-327-5050, FAX: 216-327-9628; Empl.: 65; *Sls. Mgr.:* Dale Lamirand

LOVE CONTROLS CORP., 1475 S. Wheeling Rd., Wheeling, IL 60090, Tel: 708-541-3232, TELEX: 297115, FAX: 708-541-7366; FSC No.: 8L919; Empl.: 72; *Sls. Mgr.:* James Nolan; *Dist. Mgr.:* Jim Clark

low key

FAX: 508-281-6321

LOW KEY CORPORATION, Strong Group, 105 Maplewood Ave., P.O. Box 1195, Gloucester, MA 01930, Tel: 508-281-0448; Empl.: 25; *Sls. Mgr.:* Brian Hendricks ..... **B•1820-1821**

Local Sales Offices & Reps
AL Huntsville, MacKay Smith Assocs. 205-539-8005
CO Englewood, Elctrn. Comp. Sls. 303-762-9576
CT Weatherfield, Compak 203-563-4784
FL Orlando, MacKay Smith Assocs. 407-423-4353
GA Tucker, MacKay Smith Assocs. 404-496-9913
IL Skokie, Electro Tech Mktg. 312-676-3151
IN Greenfield, France Entprs. 317-462-6098
MD Baltimore, Hagy Assocs. 301-529-3995
MA Westford, Bucher Assoc. 508-692-7503
NJ Lebanon, F.F. Sylvester Assocs. 201-735-2488
NY Coram, F.F. Sylvester Assocs. 516-473-2018
NC Raleigh, MacKay Smith Assocs. 919-847-2277
PA Newtown Sq., Hagy Assocs. 215-459-0504
UT Salt Lake City, Elctrn. Comp. Sls.

LSI LOGIC CORP., 1551 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-8000, TELEX: 172153; *Dist. Mgr.:* John Mucciaro

LTI, INC., 363 St. Paul Blvd., Carol Stream, IL 60188, Tel: 708-668-8886, FAX: 708-668-9480; Empl.: 60; *Sls. Mgr.:* Mike Khetarpal

LTX CORPORATION, LTX Pk. @ University Ave., Westwood, MA 02090, Tel: 617-461-1000, TELEX: 4430108, FAX: 617-326-5895; Empl.: 1,500; *Sls. Mgr.:* Roger Blethen, Sr. V.P. Sls.

LUCAS DEECO CORP., 31047 Genstar Road, Hayward, CA 94544-7831, Tel: 415-471-4700, FAX: 415-489-3500; *Sls. Mgr.:* Bill Lepior, Natl; *Dist. Mgr.:* Brian Frey, Intl.

LUCAS DURALITH CORPORATION, 525 Orange St., Millville, NJ 08332, Tel: 609-825-6900, TWX: 609-825-6345 -; Empl.: 375; *Sls. Mgr.:* Leroy Nopper, V.P. Sls.; *Dist. Mgr.:* Nick Tonkery, Sls. Mgr. ..... **B•1822**

Local Sales Offices & Reps
CA Anaheim, Lucas Duralith-Western Div. 714-776-6700
NH Milford, Lucas Duralith-AKT Div. 603-672-0470
NJ Millville, Lucas Duralith-Eastern Div. .. 609-825-6900

LUCAS EPSCO, INC., 99 South St., Hopkinton, MA 01748-2204, Tel: 508-435-2400, TELEX: 95-1110, FAX: 508-435-2022; FSC No.: 15894; Empl.: 240; *Sls. Mgr.:* John M. Shalhoub

Local Sales Offices & Reps

IA Cedar Rapids, Midwest Tech. Sls., Inc. 319-365-4011
KS Lenexa, Midwest Tech. Sls., Inc. 913-888-5100
MO St. Charles, Midwest Tech. Sls., Inc. ... 314-441-1012
NY Huntington, CDB Entprs. Inc. 516-692-5200
NY Syracuse, I. A. Holtze 315-479-6641
OH Dayton, R. A. Ehlert Assocs., Inc. 513-253-9197
TX Dallas, Kruvand Assoc., Inc. 214-437-3355

LUCAS LEDEX INC., P.O. Box 427, 801 Scholz Dr., Vandalia, OH 45377-0427, Tel: 513-898-3621, TELEX: 6874241/6874243, FAX: 513-898-8624; FSC No.: 81840; Empl.: 450; *Sls. Mgr.:* T. C. Ristoff ..... **B•1629-1631, 1731, 1915**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg., Inc. 205-722-0440
AZ Scottsdale, Arcom Sls., Inc. 602-947-5745
CA San Diego, Interstate Mktg. Assocs. ... 619-693-3220
CA Saratoga, Testco, Inc. 408-253-1900
CA Woodland Hills, Interstate Mktg. Assocs. 818-883-7606
CO Englewood, Integrated Motion Sys. 303-792-5516
CT Bloomfield, SIR-Assocs. 203-243-9343
FL Deerfield, Techn. Mktg. Assocs. 305-427-1090
FL Largo, Techn. Mktg. Assocs. 813-531-4405
FL Orlando, Techn. Mktg. Assocs. 407-857-3760
GA Duluth, DHR Mktg., Inc. 404-564-0529
IL Elk Grove Vl., Control Sls., Inc. 312-595-2110
KS Leawood, Thunderbird Tech. Sls. & Svcs. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. & Svcs. 316-636-5777
MA Westford, SIR Assocs. 508-692-2500
MI Royal Oak, Hilltronics, Inc. 313-435-0920
MN Minneapolis, Josco/Melius, Inc. 612-861-3343
MO Maryland Heights, Thunderbird Tech. Sls. & Svcs. 314-298-8940
NY Clark Mills, KLM-Garner Co. 315-853-6126
NY Oceanside, Bittan Assocs., Inc. 516-678-6222
NY Pittsford, KLM-Garner Co. 716-381-8350
NC Raleigh, DHR Mktg., Inc. 919-829-1970
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
SC Greenville, DHR Mktg., Inc. 803-235-3594
TN Nashville, DHR Mktg., Inc. 615-331-2745
TX Austin, ION Assocs., Inc. 512-794-9007
TX Grand Prairie, ION Assocs., Inc. 214-647-8225
TX Houston, ION Assocs., Inc. 713-537-7717
WA Bellevue, Testco, Inc. 206-454-7422
WA Vancouver, Testco, Inc. 206-693-7262
WI Brookfield, Control Sls., Inc. 414-797-9500

LUCAS SCHAEVITZ, 7905 N. Route 130, Pennsauken, NJ 08110-1489, Tel: 609-662-8000, TWX: 710-892-0714; FSC No.: 93190; Empl.: 201; *Sls. Mgr.:* Mike Finnerty

LUCAS WEINSCHEL, P.O. Box 6001, Gaithersburg, MD 20884-6001, Tel: 301-948-3434, TELEX: 440702, FAX: 301-948-3625; FSC No.: 93459; *Sls. Mgr.:* Curtis W. Crews

LUCAS WESTERN INC., Electro Systems Division, 610 Neptune Ave., Brea, CA 92621, Tel: 714-671-4500, TWX: 910-240-3603, FAX: 714-671-4503; Empl.: 175; *Sls. Mgr.:* Jerry Neumayer

LUCAS ZETA, INC., Lucas Aerospace, Inc., 2811 Orchard Parkway, San Jose, CA 95134, Tel: 408-434-3600, FAX: 408-433-0205; FSC No.: 31260; Empl.: 280; *Sls. Mgr.:* Richard Wood

LUFF RESEARCH, 22 N. Tyson Ave., Floral Park, NY 11001, Tel: 516-358-2880, FAX: 516-358-2757; Empl.: 5; *Sls. Mgr.:* R. Scheer

LUFT INSTRUMENTS, INC., Hillside Rd., P.O. Box 214, Lincoln, MA 01773, Tel: 617-259-9215, FAX: 617-259-9215; Empl.: 12

LUMEX OPTO/COMPONENTS, INC., 292 E. Hellen Rd., Palatine, IL 60067-6955, Tel: 708-359-2790, FAX: 708-359-8904; Empl.: 125; *Sls. Mgr.:* Hank Zabanski; *Dist. Mgr.:* Tanya Bons

LUMITRON, PO Box 267, Summit, NJ 07902-0267, Tel: 201-273-8998, FAX: 201-273-0853; FSC No.: 51702; Empl.: 20; *Sls. Mgr.:* Gil Chassie

LUNAIRE ENVIRONMENTAL, INC., Lunaire Limited, 4 Quality St., Williamsport, PA 17701, Tel: 717-326-1770, FAX: 717-326-7304; Empl.: 130; *Sls. Mgr.:* Stu Lunick

LUNDAHL INSTRUMENTS, INC., Ezra C. Lundahl Inc., 429 South Main, Logan, UT 84321, Tel: 801-753-7300, FAX: 801-753-7490; Empl.: 17; *Sls. Mgr.:* Val Potter

LUTRON ELECTRONICS CO., 205 Suter Rd, Coopersburg, PA 18036, Tel: 215-282-3800, TELEX: 847475, TWX: 510-651-3755; Empl.: 378; *Sls. Mgr.:* John McKiernan; *Dist. Mgr.:* Robert Van Horne

LUTZE, INC., 38 Fairfield Place, West Caldwell, NJ 07006, Tel: 201-227-2371, 800-447-2371, FAX: 201-227-2954; Empl.: 6

LUXO LAMP CORP., P.O. Box 951, Port Chester, NY 10573, Tel: 914-937-4433, FAX: 914-937-7016; Empl.: 150; *Sls. Mgr.:* Robert H. Newton

LXD

FAX: 216-786-8711

LXD, INC., 7650 First Place, Cleveland, OH 44146, Tel: 216-786-8700, TELEX: 98-5442 LXD BCWD; FSC No.: 66706; Empl.: 100; *Sls. Mgr.:* Patrick Bowen; *Dist. Mgr.:* Patrick Bowen ..... **B•1097-1099**

Local Sales Offices & Reps

AL Madison, DTM Inc. 205-837-5062
CA Redwood City, James S. Heaton Co. .. 415-367-9000
CO Littleton, MRC 303-794-4684
IL Northbrook, Howard Benjamin Assoc. 708-272-2900
CT Seymore, Sturdy Corp. 203-888-1480
ID Boise, N.R. Schultz Co. 208-377-8686
IN Fort Wayne, RL Bontempo Assoc. 219-478-1057
IN Indianapolis, R. L. Bontempo Assocs. 317-293-8312
KS Prairie Village, C. Logsdon & Assocs. 913-381-3833
MA Wellesley Hills, Sturdy Corp. 617-235-2330
MN Minneapolis, George Russell & Assocs. 612-854-1166
MO St. Louis, C. Logsdon & Assocs. 314-849-5125
NH Derry, Sturdy Corp. 603-434-8440
NJ Haddonfield, Sunday O'Brien 609-429-4013
NJ Westwood, Jarms Elctrns. 201-666-9390
NC Raleigh, Eastern Elctrns. 919-876-7591
OH Cleveland, Electronics Mktg. Corp. 216-442-3441
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OR Beaverton, N.R. Schultz Co. 503-643-1644
TX Austin, THT Sls. 512-835-2796
TX Dallas, THT Sls. 214-783-1501
WA Bellevue, N.R. Schultz Co. 206-764-1890
Can Concord, Ont., ITT Multicomponents .. 416-736-1144

LYDALL INC., MANNING DIV., P.O. Box 328, Troy, NY 12181, Tel: 518-273-6320, FAX: 518-273-6361; Empl.: 185; *Sls. Mgr.:* Ray Dugan

LYNN ELECTRONICS, 915 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-677-6700, 800-523-6075, TWX: 510-667-1988, FAX: 215-364-2944; FSC No.: 19151; Empl.: 125; *Sls. Mgr.:* H. T. Colas

LYNTRONICS, INC., 569 Acorn St., Unit 5, Deer Park, NY 11729, Tel: 516-243-6397, FAX: 516-243-0232; FSC No.: OBSY 9; Empl.: 12; *Sls. Mgr.:* Gary L. Miller .... **D•1467**

LYN-TRON, INC., 3150 Damon Way, Burbank, CA 91505, Tel: 213-849-6211, 800-423-2734, FAX: 818-840-9581; FSC No.: 05791; Empl.: 85; *Sls. Mgr.:* Kory L. Wardle; *Dist. Mgr.:* Kory L. Wardle

LYON METAL PRODUCTS, INC., Box 671, Aurora, IL 60507, Tel: 708-892-8941, FAX: 1-800-367-6681; Empl.: 600; *Sls. Mgr.:* J. L. Wiebusch

LYTRON INCORPORATED, Dragon Court, Woburn, MA 01801, Tel: 617-933-7300, TELEX: 951-934, FAX: 617-935-4529; Empl.: 75; *Sls. Mgr.:* Edwin Carell

LZRelectronics,inc.

FAX: 301-670-0436

LZR ELECTRONICS, INC., 8051 Cessna Ave., Gaithersburg, MD 20879, Tel: 301-921-4600; Empl.: 35; *Sls. Mgr.:* John Andreoli; *Dist. Mgr.:* Greg Mozingo ..... **B•1823; C•1446-1462, 1766-1769; D•1042-1043, 1878-1889**

Local Sales Offices & Reps

AZ Phoenix, Howe & Howe 602-264-7971
CA Los Alamitos, Power Specialists 213-594-9418
CA San Jose, Bytec Sls. 408-435-8004
CA Simi Valley, Power Specialists 805-581-4785
CO Arvada, Mountain High Mktg. 303-422-2573
CT Guilford, Data Mark, Inc. 203-453-0575
FL Melbourne, Jim Kennedy Assocs. 407-676-6875
AL Huntsville, Dean Assocs., Inc. 205-534-2255
MD Lutherville, DGR 301-583-1360
MA Norwood, JMG, Inc. 617-762-5333
NJ Clifton, ROI Sls. 201-340-1515
NM Albuquerque, Nelco Electronix 505-293-1399
NY Victor, Net Sls.(Upper NY) 716-924-1844
OH Troy, S-Tek 408-435-8004
OH Mason, S-TEK 513-339-5233
PA West Chester, TCA Assocs. 215-692-6853
MN Richfield, Clap Rep Co. 612-861-2191
NJ Totowa, R.O.I. Sls. 201-812-9606
WA Lynnwood, Blair Hirsch Co. 206-774-8151
WI Genoa City, Vine Sales, Inc. 414-279-3871
Can Scarborough, Cantronics Ltd. 416-297-8668

MABUCHI MOTOR AMERICA CORP., 475 Park Ave. South, New York, NY 10016, Tel: 212-686-3622, TELEX: 23-4374, TWX: MABU, FAX: 212-532-4263; Empl.: 10,000 ..... **B•1293**

PANAFAX: 212-532-4263

Local Sales Offices & Reps

MI Detroit, Mabuchi Motor America Corp. 313-370-9090

MACCOR, INC., 2805 W. 40th Street, Tulsa, OK 74107, Tel: 918-446-1874, FAX: 918-445-1496; FSC No.: 6625; *Sls. Mgr.:* Andrew D. MacKay

MACHINE COMPONENTS CORP., 70 Newtown Rd., Plainview, NY 11803, Tel: 516-694-7222, FAX: 516-694-7252; FSC No.: 15531; Empl.: 46; *Sls. Mgr.:* D. L. Dubov

MACOM, INC., 43 Second Ave., Bldg. 8, Burlington, MA 01803, Tel: 617-272-3000, TELEX: 94-9464, TWX: 710-332-6789

M/A-COM CONTROL COMPONENTS DIV., M/A-COM, 21 Continental Blvd., Merrimack, NH 03054-4343, Tel: 603-424-4111, TWX: 710-336-0674, ESYLNK: 62038279, FAX: 603-424-6580; FSC No.: 16179; Empl.: 750

M/A-COM GOVERNMENT PRODUCTS, INC., 10713 Gilroy Rd., Hunt Valley, MD 21030, Tel: 301-771-0077, FAX: 301-771-6025; FSC No.: 29644; *Sls. Mgr.:* Frederick D. Reynolds

M/A-COM LASER DIODE, INC., See Laser Diode, Inc., Div. of Morgan Crucible

M/A COM LTD., Humphrey Rd., Dunstable, Bedfordshire, England LU5 4SX, England, Tel: 44(582)471200, TELEX: 82295; Empl.: 500; *Sls. Mgr.:* D. McGuinness

M/A-COM OMNI SPECTRA, INC., 140 Fourth Avenue, Waltham, MA 02254-9101, Tel: 617-890-4750, FAX: 617-890-2381; FSC No.: 26805; Empl.: 750

M/A-COM PHI, INC., M/A COM, Inc., 1742 Crenshaw Blvd., Torrance, CA 90501, Tel: 213-320-6160, TWX: 910-349-6651, FAX: 213-618-9191; FSC No.: 50998; Empl.: 260; *Sls. Mgr.:* Charlie Hancock

MACROAMP INC., P.O. Box 1512, Ukiah, CA 95482, Tel: 707-462-2222, FAX: 707-462-4103; Empl.: 25

MACRODYNE INC., 4 Chelsea Pl, Box 376, Clifton Pk., NY 12065, Tel: 518-383-3800, FAX: 518-383-0049; Empl.: 16; *Sls. Mgr.:* Clifford J. Jurus

MACROLINK, 1500 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-8800, FAX: 714-777-8807; Empl.: 40; *Sls. Mgr.:* Bill Goodale

MACROMATIC DIVISION, Milwaukee Elctrns. Corp., 7817 W. Clinton Ave., Milwaukee, WI 53223, Tel: 414-358-4000, FAX: 414-358-4001; FSC No.: 98664; Empl.: 100-150; *Sls. Mgr.:* James Scholler

MACRONETICS, See Veeco Instrs. Inc.

MAG-CON, 1626 Terrace Dr., St. Paul, MN 55113, Tel: 612-633-8820, FAX: 612-633-1851; Empl.: 40; *Sls. Mgr.:* Gene Litzau

MAG DEV INC., 17 Downing Three, Pittsfield, MA 01201, Tel: 413-442-6368, FAX: 413-443-9107; Empl.: 10

MAG-HEAD ENGINEERING CO., 686-Mendelssohn Ave., Minneapolis, MN 55427, Tel: 612-545-1321, FAX: 612-545-0335; FSC No.: (Cage) 0DU70; Empl.: 30; *Sls. Mgr.:* Anthony T. Price

MAGNA-POWER ELECTRONICS, INC., 135 Route 10, Whippany, NJ 07981, Tel: 201-428-1197, TELEX: 201-428-2853; FSC No.: 7V550; Empl.: 10 ..... **D•1891**

MAGNATROL VALVE CORP., 67 Fifth Ave., Hawthorne, NJ 07507, Tel: 201-427-4341, FAX: 201-427-7611; *Sls. Mgr.:* R. Kretschmer

MAGNECOMP

FAX: 803-878-0507

MAGNECOMP, INC., P.O. Box 625, Gravley Rd., Pickens, SC 29671, Tel: 803-878-4700; Empl.: 10; *Sls. Mgr.:* T. Sullivan ..... **A•2252**

MAGNECRAFT ELECTRIC CO., 1910 Techny Road, Northbrook, IL 60062-5376, Tel: 708-564-8800, TWX: 910-221-0122, FAX: 312-564-3027; FSC No.: 94696; Empl.: 700; *Sls. Mgr.:* Wiley Greenwood; *Dist. Mgr.:* Wiley Greenwood

MAGNELAB CORPORATION

FAX: 303-447-1588

MAGNELAB, 7315 Red Deer Dr., Boulder, CO 80301-4696, Tel: 303-442-6700; FSC No.: 58439; Empl.: 25; *Sls. Mgr.:* Carl A. Forsberg ..... **A•1209, 2253-2257**

Local Sales Offices & Reps

CA	San Diego, Mesa Sls. & Engrg.	619-278-8021

MAGNETEK, Transducer Products, 650 Easy St., Simi Valley, CA 93065, Tel: 805-581-3985, FAX: 805-583-1526; FSC No.: 65998; Empl.: 37; *Sls. Mgr.:* Dave Snyder

MAGNETEK DEFENSE SYSTEMS, MagneTek, Inc., 901 E. Ball Road, Anaheim, CA 92805, Tel: 714-956-9200, FAX: 714-956-5397; Empl.: 450; *Sls. Mgr.:* Ty Fredericksen

MAGNETEK TRIAD, 1124 E. Franklin St., Huntington, IN 46750, Tel: 219-356-7100, FAX: 219-356-3148; Empl.: 963; *Sls. Mgr.:* Mark Decker ..... **A•2259-2263**

MAGNETIC CIRCUIT ELEMENTS, 1540 Moffett St., Salinas, CA 93905, Tel: 408-757-8752, FAX: 408-757-5478; FSC No.: 09349; Empl.: 30; *Sls. Mgr.:* Lisa Battaglia

Local Sales Offices & Reps

CA	Fremont, R-C Elctrns.	415-656-8490
WA	Bellevue, Advanced Power Comps. ...	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945

MAGNETIC COILS, INC.,, See MCI Transformer Corporation

MAGNETIC COMPONENT ENGINEERING CO., 11379 Playa Street, Culver City, CA 90230, Tel: 213-398-4761, FAX: 213-572-1691; FSC No.: 52634; Empl.: 12; *Sls. Mgr.:* L.D. Montgomerie

Local Sales Offices & Reps

AZ	Phoenix, C.T. Carlberg Assocs.	602-468-0750
CA	Culver City, Magnetic Comp. Engrg. ...	213-398-4761
CA	San Jose, Silicon Valley Sls.	408-432-1967
MN	Minneapolis, A. J. Warner Co., Inc.	612-823-8272
NJ	Englewood, Cooper Assocs.	201-871-4985
NY	Rochester, Irondequoit Inds.	716-544-6257
NM	Albuquerque, C.T. Carlberg Assocs. ...	505-836-1448

mi

FAX: 317-549-0502

MAGNETIC INSTRUMENTATION, 8350 E. 48TH ST., Indianapolis, IN 46226, Tel: 317-545-2102, TELEX: 27-2111; Empl.: 35; *Sls. Mgr.:* Peter Stolpe ..... **D•1290**

MAGNETICO INC.

FAX: 516-758-7408

MAGNETICO INC., 182 Morris Ave., Holtsville, NY 11742, Tel: 516-654-1166; FSC No.: 10581; Empl.: 65 ..... **A•2264-2265**

MAGNETIC RADIATION LABS, 690 Hilltop Drive, Itasca, IL 60143, Tel: 708-285-0800, FAX: 708-285-0807; Empl.: 43; *Sls. Mgr.:* Ken Phillips

MAGNETICS, Spang & Co., Box 391, Butler, PA 16003-0391, Tel: 412-282-8282, TWX: 710-373-3821, FAX: 412-282-6955; Empl.: 750; *Sls. Mgr.:* J. F. Huth

MAGNETIC SHIELD CORPORATION, Perfection Mica Co., 750 North Thomas Dr., Bensenville, IL 60106, Tel: 708-766-7800, TWX: 910-256-4815, FAX: 708-766-2813; FSC No.: 06682; Empl.: 43 ..... **C•1698-1699**

Local Sales Offices & Reps

CA	Foster City, Polach & Bensinger Inc. ..	415-578-8200
CA	Woodland Hills, Cal-Ward Sls. Co.	213-883-2202
FL	Orlando, Ludlum Assoc. Co.	305-894-7761
MD	Baltimore, Bernard White & Co.	301-484-5400
MA	Framingham, Harvard Technlg.	617-899-4568
MI	Livonia, Amtech Reps.	313-474-8300
MN	Minneapolis, Josco-Meluis & Assocs.	612-861-3343
NM	Albuquerque, IMEC	505-883-9010
NJ	Morristown, Kenneth L. Love Assocs.	201-540-0204
NY	Plainview, Robert Smith Assoc.	516-932-3975
OR	Hillsboro, Temco Northwest	503-648-8171
PA	Newton Square, W. Reeves Assocs. ..	215-356-7500
PA	Sewickley, Teplitz-Byrne Assoc.	412-741-3268
SC	Walhalla, Overton Assoc.	803-638-7101
TX	Dallas, Allied Components,Inc.	214-238-0408
WA	Bothell, Temco Northwest	206-821-5434

MAGNETIC TECHNOLOGIES CORP., 770 Linden Avenue, Rochester, NY 14625, Tel: 716-385-9010, FAX: 716-385-5625; Empl.: 65; *Sls. Mgr.:* Gordon H. McNeil

MAGNETOELASTIC DEVICES, Box 625, Pittsfield, MA 01202, Tel: 413-445-5608, FAX: 413-442-3750

MAGNETROL INTERNATIONAL, 5300 Belmont Rd., Downers Grove, IL 60515-4499, Tel: 708-969-4000, FAX: 708-969-9489; *Sls. Mgr.:* Roger T. Piegza, Natl. Sls. Mgr.

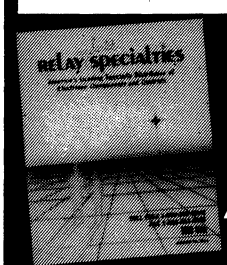
MAGNET SALES & MFG. CO. INC., 11248 Playa Court, Culver City, CA 90230-6127, Tel: 213-391-7213, 800-421-6692, FAX: 213-390-4357; FSC No.: 17853; Empl.: 55; *Sls. Mgr.:* Chris Nanji; *Dist. Mgr.:* Chris Nanji

MAGNOS, 9 Bonazzoli Ave., Unit 17, Hudson, MA 01749, Tel: 508-562-1173, TELEX: 951417MAGN, FAX: 508-562-1175; Empl.: 5 ..... **D•1291**

MAGNUM MICROWAVE CORP., 4575 Cushing Pkwy., Fremont, CA 94538, Tel: 415-657-9898, FAX: 415-490-3351; FSC No.: 59277; Empl.: 105; *Sls. Mgr.:* Harry L. Fowler

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MAGTECH CONTROLS, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, Tel: 619-428-5581, FAX: 619-428-5090; FSC No.: 10112; Empl.: 200; *Sls. Mgr.:* R. Campbell ..... **B•1294**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	818-246-8263
CO	Wheat Ridge, Waugaman Assocs.	303-423-1020
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Largo, Labrant	813-536-8480
GA	Dunwood, Hugh Assoc.	404-396-5848
IL	Northbrook, Howard Benjamin	708-272-2900
MA	Burlington, Kitchen & Kutchin	617-229-2660
MO	St. Louis, Rush & West	314-965-3332
NJ	Cherry Hill, Lanson Assocs.	609-424-4670
NY	Jericho, Metro Tech. Sls.	516-935-3330
NY	Syracuse, T-Squared Elctrns., Inc.	315-463-8592
NY	Victor, T-Squared Elctrns., Inc.	716-924-9101
OH	Dayton, Rixan Assocs.	513-222-0011
TX	Dallas, CMR	817-379-6540
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
VA	Fredericksburg, Vernitron	703-752-4499

MAG-TEK, 20725 S. Annalee Ave., Carson, CA 90746, Tel: 213-631-8602, TWX: 510-600-0621 MAG TEK CRSN, FAX: 213-631-3956; *Dist. Mgr.:* Shelley Schira

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FAX: 804-722-1194

MAIDA DEVELOPMENT CO., 20 Libby St., Hampton, VA 23663, Tel: 804-723-0785; Empl.: 299; *Sls. Mgr.:* Edward T. Maida, Frank Thompson ..... **A•1086-1089, 1942-1944**

Local Sales Offices & Reps

CA	La Habra, Cygnus Sls. Engrg. Corp.	213-691-2993
CA	Redwood City, Hickey Inds. Sls. Corp.	415-594-9978

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IL	Schaumburg, Seas (Silvers Elctrns.)	708-893-7999
MI	Southfield, M. Gottlieb Assocs.	313-358-4151
MN	St. Paul, Johnson Co.	612-641-1878
NH	Amherst, D.A. Crowley & Assocs.	603-673-7050
NY	Rockville Centre, S-I Assocs., Inc.	516-536-4242
NY	Upstate, Inactive Comp. Sls.	315-445-9600
NC	Raleigh, F.B.D. Sls. Corp.	919-832-0202
OH	Cleveland, RK Comps.	216-642-9312
OR	Beaverton, UniComp, Inc.	503-643-1645
SC	Mauldin, Carl Hart	803-288-2323
TX	Plano, Mega Tech Mktg., Inc.	214-423-6342
VA	Danville, F.B.D. Sls.	804-836-1499
VA	Hampton, Maida Dev. Co.	804-723-0785
VA	Manassas(Northern), F.B.D. Sls. Corp.	703-369-7212
WA	Snohomish, UniComp, Inc.	206-568-0511
Can	Dundas, D. J. Hyslop & Co.	416-628-0266

MAINE POLY, INC., P.O. Box 8 Rte. 202, Greene, ME 04236, Tel: 207-946-7440, FAX: 207-946-5492; FSC No.: 46280; Empl.: 130; *Sls. Mgr.:* Jon Chase

MAIN PROTOTYPES LTD., Moldmakers/Injectors, 15 Raglin Pl., Cambridge, Ont., CAN N1R7J2, Tel: 519-622-2291, FAX: 519-622-3208; Empl.: 10; *Sls. Mgr.:* David Main

MAKK-O INDUSTRIES, 761 Nepperhan Ave., Yonkers, NY 10703, Tel: 914-376-0160, 914-376-0161, FAX: 914-376-0162; Empl.: 18; *Sls. Mgr.:* Vincent Passalacqua; *Dist. Mgr.:* Debbie Carroll ..... **C•1596**

Local Sales Offices & Reps

AZ	Prescott, IMEC	602-445-8727
MA	Lee, Francis Biasin	413-243-0970
NJ	Upper Montclair, McCarron Entprs.	201-783-3112
NM	Albuquerque, IMEC	505-294-1124
TX	Dallas, S & B Sls.	214-369-5936

MALCO, DIV. OF MICRODOT, INC., See Microdot, Interconnect Sys. Div.

MALLORY BATTERY, See Duracell Intl.

MALLORY CONTROLS, Emerson Electric Canada, P.O. Box 210, 1079 Parkinson Rd., Woodstock, Ont., Canada N4S 7W8, Tel: 519-539-4891, TELEX: 23 MOY 001, FAX: 519-539-6684; FSC No.: 37942;76055; *Sls. Mgr.:* Joe Labonte; *Dist. Mgr.:* Joe Labonte ..... **A•1091, 2064-2065**

Local Sales Offices & Reps

IL	Chicago, M & S Sls.	708-934-1200, FAX:708-934-9169
MN	St. Paul, Johnson Co.	612-641-1878, FAX:612-641-0146
NY	New York, Hebert Rude Assoc., Inc.	212-721-1001, FAX:212-721-1004
OH	Cleveland, ESI	216-831-9555,FAX:216-831-8647
TX	Dallas, Eltec Sls.	817-268-2896,FAX:817-282-3010

MALLORY CONTROLS, Emerson Electric, 2831 Waterfront Pkwy-E. Drive, Indianapolis, IN 46214, Tel: 317-328-4010, FAX: 317-328-4244; Empl.: 2,000; *Sls. Mgr.:* Lewis Jones

MALLORY/NORTH AMERICAN CAPACITOR CO., 4760 Kentucky Ave., Indianapolis, IN 46241, Tel: 317-856-3731, TELEX: 317-687-6090, FAX: 317-856-2500; Empl.: 450; *Dist. Mgr.:* Tom Green, V.P. Sls. & Mktg.

MANAGE, INC., Fibre Optics Elctrns. Sys. Grp., P.O. Box 175, 40 Nichols Rd., Chicopee, MA 01014, Tel: 413-592-9123, FAX: 413-594-4891; Empl.: 33; *Sls. Mgr.:* David Menard

MANGER ELECTRIC COMPANY, INC., W. Henry St, Stamford, CT 06902, Tel: 203-348-7761, FAX: 203-324-5447; FSC No.: 20262; Empl.: 100; *Sls. Mgr.:* Peter J. Romaniello

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Local Sales Offices & Reps

CA	Hayward, Manhattan Elec. Cable Corp.	800-423-4040
CA	Los Angeles, Manhattan Elec. Cable Corp.	800-423-4040
CA	San Francisco, Manhattan Elec. Cable Corp.	800-423-4040
GA	Atlanta, Manhattan Elec. Cable Corp.	800-356-4796
IL	Niles, Bensdorf & Johnson	708-647-8512
IN	Indianapolis, Wiltrout Sls., Inc.	317-577-7500
MA	Holliston, Manhattan Elec. Cable Corp.	800-255-1429
MN	Maple Grove, North Central Sls.	800-829-2885
NJ	Bridgeton, Manhattan Elec. Cable Corp.	800-225-2293
NJ	Fairfield, Manhattan Elec. Cable Corp.	800-888-0146
OH	Cleveland, Manhattan Elec. Cable Corp.	800-966-9473
TX	Houston, Manhattan Elec. Cable Corp.	800-392-4928
WA	Redmond, Elctrn. Mktg. Grp., Inc.	206-882-0962

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
CA	El Monte, Marshall Elctrns.	818-442-7204
CA	El Toro, Sourcery Wire & Cable	714-380-0466
CA	Long Beach, John B. Rudy Co.	213-636-6934
CA	Oakland, Brill Elctrns.	415-834-5888
CA	San Jose, Compass Comps.	408-432-7575
CA	Santa Clara, Trinity Elctrns.	408-980-9011
CO	Denver, CSID	303-292-9594
CT	Greenwich, Wise Comps.	203-531-4880
FL	Orlando, Hammond Elctrns.	407-849-6060
FL	Pensacola, Elctrn. Supp. Co.	904-432-6916
FL	Tamarac, Pacer Elctrns.	305-749-1910
FL	Tampa, Dow Elctrns.	813-626-5195
LA	Harahan, MG Elctrns.	504-733-0070
MD	Owings Mill, Cameo Elctrns.	800-227-7077
MA	Burlington, QPL	617-229-2424
MA	Hudson, Metro Wire & Cable	508-562-6288
MA	Woburn, Pacer	617-935-8330
MI	Madison Heights, Quad Elctrns.	800-969-9220
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Long Island City, H. L. Dalis	718-361-1100
NY	Mt. Vernon, QAR/All American	914-699-2224
NY	Rochester, Simcona Elctrns.	800-274-6266
NY	Syracuse, Newark Elctrns.	315-437-6611
OH	Cincinnati, Hughes Peters	800-543-4483
OH	Columbus, Hughes Peters	800-282-1262
OH	Strongsville, Calvert Wire & Cable	800-321-1203
OH	Yellow Springs, Electroshield	800-662-1054
PA	Allentown, P. A. Peters	800-322-9583
PA	Harrisburg, Cumberland Elctrns.	800-692-7425
PA	Montgomeryville, Pytronic Inds.	800-562-5780
TN	Memphis, Bluff City Elctrns.	901-345-9500
TX	Austin, Wholesale Elctrn. Supp.	512-478-9568
TX	Houston, Houston Wholesale Elctrns.	713-644-8320
TX	Houston, Kent Elctrns.	713-780-7770
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VT	Bethel, Clifford of Vermont	802-234-9921
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Woodinville, Northwest Wire & Cable	206-486-8342

MANN, HENRY, INC., 3983 Mann Road, Huntingdon Valley, PA 19006, Tel: 215-355-7200, TELEX: 6851160, FAX: 215-355-5134; Empl.: 52; *Dist. Mgr.:* Mickey Hoffer

MANTEX CORP., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48371, Tel: 313-628-8210, FAX: 313-628-1520; Empl.: 100; *Sls. Mgr.:* David Rice

MANUFACTURERS COMPONENTS, INC., 2260 W. 77 St., Hialeah, FL 33016, Tel: 305-556-4481, 800-367-0377, TELEX: 514181, FAX: 305-823-8934; Empl.: 5; *Sls. Mgr.:* Jackie Barker

MANU-TRONICS, INC., 8701-100th St., Lakeview Corporate Pk., Kenosha, WI 53142-9508, Tel: 414-947-7700 , 414-947-7302, FAX: 414-947-7729; Empl.: 300

MARATHON POWER TECHNOLOGIES, P.O. Box 8233, Waco, TX 76714-8233, Tel: 817-776-0650, TWX: 910-894-5203 MARATHON WAC

MARATHON SPECIAL PRODS., Marathon Electric, 13300 Van Camp Rd., Bowling Green, OH 43402, Tel: 419-352-8441, TWX: 810-499-2988, FAX: 419-352-0875; FSC No.: 26405; Empl.: 150; *Sls. Mgr.:* J. Campisi

MARCO MANUFACTURING CO., INC., 2021-43 So. 29th St., Philadelphia, PA 19145, Tel: 215-463-2332, FAX: 215-334-4990; Empl.: 35-40

MARCON AMERICA CORP., 998 Forest Edge Dr., Vernon Hills, IL 60061, Tel: 312-913-9980, FAX: 312-913-1150; Empl.: 14; *Sls. Mgr.:* Tony Olita; *Dist. Mgr.:* Helen A. Stubbs

MARCONI CIRCUIT TECHNOLOGY CORP., 160 Smith St., Farmingdale, NY 11735, Tel: 516-293-8636, FAX: 516-293-0061; Empl.: 500; *Sls. Mgr.:* Kurt Kuhl

MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401, Tel: 201-934-9050, FAX: 201-934-9229; *Sls. Mgr.:* Carl Pepple, Gen. Mgr. ..... **D•1292**

Local Sales Offices & Reps

AZ	Tempe, Scientific Dvcs.West	602-730-9774
CA	Citrus Hights, Larry Allen d/b/a/ L.K. Allen	916-638-7655
CA	Santa Fe Springs, Wallace & Wallace	213-945-2908
CA	Shingle Springs, LK Allen Comms.	916-676-2533
CO	Broomfield, Scientific Dvcs. West	303-469-5145
CO	Littleton, K. C. Marketers, Inc.	303-972-8411
FL	Orlando, Panterra Sls., Inc.	407-855-6130
GA	Alpharetta, Panterra Sls.	404-772-9944
GA	Decatur, Panterra Sls., Inc.	404-325-0165
IL	Schaumburg, K.W. Meyers	708-882-4808
IN	Indianapolis, K. Meyers	317-573-0966
KY	Louisville, Webster Assocs., Inc.	502-937-8189
MD	Burtonsville, Elect. Mktg. Assocs.	301-792-9300
MD	Laurel, Elect. Mktg. Assocs.	301-953-7800
MA	Westford, ICS Assocs.	508-765-5131
MA	Westford, ICS Assocs.	508-692-3545
MI	Houghton Lake, W.E.Price & Co.	517-366-8702
MI	Rochester, Webster Assocs., Inc.	313-375-0420
MN	Minneapolis, K.W. Meyers	612-822-9253
MO	Maryland Hgts., Comms. Equip. Specialties	314-291-7841
NJ	Allendale, Allan Mowat	201-934-9050
NM	Albuquerque, Scientific Dvcs.	505-883-3668
NY	Rochester, TAE-REP	716-586-8710
NY	Whitney Point, Tae-Rep	607-692-3705
NC	Pineville, Communications Mktg. SE, Inc.	704-542-0374
OH	St. Mary's, Thomas Shelby Co.	419-394-3377
OR	Oregon City, Proctor Sls. & Mktg.	503-657-7583
TX	Austin, Eng. Equip. Sls.	512-467-9655
TX	Dallas, EES	214-644-8881
TX	Richardson, Engrg. Equip. Sls.	512-467-9655
VT	Graniteville, ICS Assocs.	802-476-4223
WI	Burtonsville, K.W. Meyers Co.	708-882-4808

MAREL INSTR. CO., 907 South East 13th Pl, Cape Coral, FL 33990, Tel: 813-574-8788; Empl.: 14; *Sls. Mgr.:* T. Swift

MARKAT DIV., Wild Oats Corp., 1432 Fox Hollow Way, N. Myrtle Bch., SC 29582, Tel: 803-249-5191, FAX: 803-249-5191; Empl.: 211; *Sls. Mgr.:* K. L. Campbell; *Dist. Mgr.:* W. B. Heather

Markel
CORPORATION

FAX: 215-270-3138

MARKEL CORP., P.O. Box 752, Norristown, PA 19404, Tel: 215-272-8960, TWX: 510-660-0929; FSC No.: 03890; Empl.: 228; *Sls. Mgr.:* Allan R. Soldwisch; *Dist. Mgr.:* L. J. Clemente ..... **C•1677**

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn	602-257-9015
AL	Montgomery, MYA, Inc.	205-284-1948
CA	L.A., Natl. Wire & Cable	213-225-5611
CO	Evergreen, Mid/West Co.	303-374-4829
CT	Hamden, Datcom	203-288-7005
FL	Deerfield Bch., Jack Krutek & Assoc.	305-427-4202
IL	Schiller Pk., Wm. R. Bolles	312-678-7888
MD	Glen Burnie, F. Lott	301-744-4611
MA	Waltham, Datcom	617-891-4600
MI	Canton, L. George & Assoc.	313-454-0580
MN	Minneapolis, Technical Comps. Grp.	612-536-9512
MO	Florissant, Mid/West Co.	314-837-3361
NJ	Colonia, Heft & Ficarra	201-381-5193
NY	Lynbrook, Heft & Ficarra	516-599-3351
NY	Rochester, Apex	716-272-7040
OH	Chagrin Falls, Electrolock	216-543-6626
PA	Flourtown, CGM Inc.	215-233-0333
SC	Greenville, Electrolock Inc.	803-297-9830
TN	Murfreesboro, Alpha Mktg.	615-896-6102
TX	Richardson, C.J. Garvey	214-234-3371
WI	Mequon, Wm. R. Bolles	414-241-3320
EXP	Plymouth Meeting, Pa., Ballogh & Thrall	215-825-5710
Can	Rexdale,Ont, True North Technology	416-744-2233

Local Distributors

CA	Los Angeles, Natl. Wire & Cable	213-225-5611
CA	San Bernadino, Indl. Dielectrics West	714-381-4734
CO	Denver, Brownell Elctrns.	303-333-3541
NY	Endwell, Pryme-Line	607-748-5200
CT	Hartford, Wes-Garde	203-527-7705
FL	Davie, Arco Distrs.	305-473-2550
FL	Lakeland, Switch Controls	800-282-7619
GA	Atlanta, Accu-Tech Cable	404-455-6422
IL	Chicago, Fay Electric Wire	708-267-9222
IL	West Chicago, J.J. Glenn	708-293-7800
IN	Indianapolis, Marian Rubber	317-638-6525
KS	Wichita, Midwest Aircraft Supp.	316-267-3318
LA	New Orleans, Radio Parts	504-581-5959
MD	Rockville, Read Plastics	301-881-7900
MI	St. Clair Shores, Spemco	313-771-2700
MN	Bloomington, K.L. Tannenill	612-881-6700
MO	St. Louis, Midwest Switch	314-567-7164
NY	Rochester, Simcona Elctrns.	716-328-3230
OH	Chagrin Falls, Electrolock	216-543-6626
OR	Wilsonville, O.T.S. Wire	503-682-7050
SC	Greenville, Electrolock, Inc.	803-297-9830
AR	Little Rock, Hisco	501-568-3105
CT	Manchester, IMS Inc.	203-288-7005
VA	Roanoke, Control Distbn.	703-774-4586
Can	Mississauga, Ont., Marflex-Barrett Ltd.	416-828-0220

MARKEM CORP., 150 Congress St, Keene, NH 03431, Tel: 603-352-1130, TELEX: 710-366-1800, FAX: 603-357-5871; FSC No.: 38360; Empl.: 1400; *Sls. Mgr.:* Rich Howsen

MARKENRICH CORP., 1812 Flower Avenue, Duarte, CA 91010, Tel: 818-359-9190, TELEX: 298727, FAX: 818-359-5223; FSC No.: 63837; Empl.: 8

MARK EYELET INC., AMP, Inc., 63 Wakelee Rd., Wolcott, CT 06716, Tel: 203-756-8847, TELEX: 69-6191, FAX: 203-755-9410; Empl.: 90; *Dist. Mgr.:* Andrew Babiak

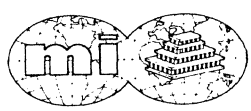
Local Distributors

CA	San Francisco, Marshall	408-942-4600
CA	SAn Jose, Compass Comps.	408-432-7575
CT	Wallingford, Cronin	203-265-3134
FL	Orlando, Hammond Elctrns., Inc.	407-841-1010
FL	Orlando, Marshall	407-767-8585
IL	Chicago, Newark	312-784-5100
MA	Needham, Cronin	617-449-5000
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
NY	Rochester, Masline Elctrns.,Inc.	716-546-5373
PA	Philadelphia, Powell Elctrns.	215-365-1900
WI	Milwaukee, Marsh Elctrns.	414-475-6000

MARK POLARIZED CORP., 25 Davids Dr., Hauppauge, NY 11788, Tel: 516-273-1122, FAX: 516-436-7257; FSC No.: 5895; Empl.: 10; *Sls. Mgr.:* Ronald M. Miller

MARKTECH INTERNATIONAL CORP., 5 Hemlock St., Latham, NY 12110, Tel: 518-786-6591, FAX: 518-786-6599; Empl.: 42; *Sls. Mgr.:* Lou Verenini

MARLEE SWITCH CO., 933-D N. Central Ave., Upland, CA 91786, Tel: 714-982-8988, FAX: 714-982-8989; Empl.: 10; *Sls. Mgr.:* LeRoy Tichy



FAX: 214-341-5212

MARLOW INDUSTRIES, INC., 10451 Vista Park Rd., Dallas, TX 75238-1645, Tel: 214-340-4900, TWX: 910-860-5161; FSC No.: 55686; Empl.: 160; *Sls. Mgr.:* John Nelson; *Dist. Mgr.:* David Marlow ..... **C•1630-1631**

MARQUARDT SWITCHES INC., 2711 Rte. 20 East, Cazenovia, NY 13035, Tel: 315-655-8050, TELEX: 703-287-UD, FAX: 315-655-8042; *Sls. Mgr.:* R. A. Philipchik, V.P. Mktg.; *Dist. Mgr.:* P. D'Addario

MARSH-MCBIRNEY, INC., 4539 Metropolitan Court, Frederick, MD 21701, Tel: 800-368-2723, 301-874-5599, TWX: 710-828-0083, FAX: 301-874-2172; Empl.: 90; *Sls. Mgr.:* K. Steiding

MARSH PRODUCTS, INC., Spectrum Companies, Intl., 336 McKee St., Batavia, IL 60510, Tel: 708-879-8008, FAX: 708-879-8072

MARTEL ELECTRONICS, 8a Industrial Way P.O. Box 897, Salem, NH 03079, Tel: 603-893-0886, FAX: 603-898-6820; *Sls. Mgr.:* David DeVries

MARTIN SOUND PRODS. INC., 28 Alpha Park, Cleveland, OH 44143-2297, Tel: 216-442-2286, FAX: 216-442-7713; Empl.: 4; *Sls. Mgr.:* Christopher Martin; *Dist. Mgr.:* Christopher Martin

MARWAY
PRODUCTS INC.

FAX: 714-973-2931

MARWAY PRODS. INC., 311 N. Clara St., Santa Ana, CA 92703, Tel: 714-973-1800; FSC No.: 60955; Empl.: 23; *Sls. Mgr.:* Tom Goreth ..... **D•2212-2213**

Local Sales Offices & Reps

AZ	Glendale, Sunbird Inds, Inc.	602-439-0134
CA	Milpitas, Ward Elctrn. Packaging Sls.	408-945-0420
CA	Santa Ana, Marway Prods., Inc.	714-973-1800
CO	Monument, Sunbird Inds., Inc.	719-481-2900
CT	Meriden, PCS-Power Conversion Sys.	203-235-4886
FL	Land O' Lakes, AJ's Power Source, Inc.	813-996-2583
MD	Landover, Sel-Tronics, Inc.	301-341-2700
MA	Hopkinton, Eastern Sys. Inc.	508-435-2151, 508-435-2517
NH	Londonderry, PCS- Power Conversion Sys.	603-434-2371
TX	Richardson, Interactive Comp. Sls.	214-669-2277
WA	Bellvue, Underwood Hanify	206-643-1793

MASTECH, INC., Lorlin Test Systems, Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, TELEX: 7104565030; Empl.: 57; *Sls. Mgr.:* L. Sanders Corbit

MASTER APPLIANCE CORP., 2420 18th St., Box 68, Racine, WI 53403, Tel: 414-633-7791, TELEX: 269-505; FSC No.: 83284; Empl.: 54; *Sls. Mgr.:* Don Royer, Natl. Sls. Mgr.; *Dist. Mgr.:* F.W. Krescanko, Int'l. Sls. Mgr.

MASTER BOND, 154 Hobart St., Hackensack, NJ 07601, Tel: 201-343-8983, FAX: 201-343-2132; FSC No.: 59504; Empl.: 16; *Sls. Mgr.:* James Brenner

Distributor

MASTER DISTRIBUTORS, P.O. Box 25662, Los Angeles, CA 90025, Tel: 213-452-1229 ..... **A•1247, 1632, 1739, 1948, 2166, 2308, 2420; B•1152, 1210, 1313, 1350, 1384, 1390, 1466, 1506, 1526, 1557, 1577, 1632, 1730, 1770, 1792, 1852, 1890; C•1052, 1348, 1410, 1478, 1536, 1660, 1818** 608, 610, 611, 612, 618, 631, 632, 635, 641, 649, 651, 652, 661, 665, 667, 668, 669, 672, 689, 692, 695, 699, 700, 701, 710, 717, 720, 722, 723, 727, 731, 737, 738, 753, 755, 763, 772, 784, 789, 792, 803, 807, 808, 810, 812, 817

MEC

FAX: 213-399-8600

MASTER ELECTRONIC CONTROLS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 213-452-1336, TELEX: 182041 MASTER SNM; Empl.: 74; *Sls. Mgr.:* Jamil Nizam; *Dist. Mgr.:* Belinda Valle ..... **B•1541-1544**

BRILL
ELECTRONICS
(415) 834-5888
610 E. 10th St., Oakland, CA 94606
MEC MASTER ELECTRONIC CONTROLS
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

Local Sales Offices & Reps

CA	Los Angeles, Master Distrs.	213-829-4656
CA	Santa Monica, Master Distrs.	213-452-1229

Local Distributors

CA	Oakland, Brill Elctrns.	415-834-5888
CA	Santa Monica, Master Distrs.	213-452-1336

MATEC INSTRUMENTS, INC., 75 South St., Hopkinton, MA 01748, Tel: 508-435-9039, FAX: 508-435-5289; Empl.: 55; *Sls. Mgr.:* Harry Ives

MATERIALS RESEARCH CORPORATION, Route 303, Orangeburg, NY 10962, Tel: 914-359-4200, TELEX: 221862 MRC UR, FAX: 914-425-6075; Empl.: 780; *Sls. Mgr.:* Robert S.Kase

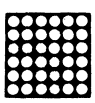
MATH ASSOCS., 2200 Shames Dr., Westbury, NY 11590, Tel: 516-334-6800, FAX: 516-334-6473

MATHEMATICAL SYSTEMS DESIGN, INC., 11835 W. Olympic Blvd., Suite 745, Los Angeles, CA 90064, Tel: 310-479-7180, FAX: 310-479-0942; *Sls. Mgr.:* Lorr Kramer

THE MATHWORKS, INC., 21 Eliot Street, So. Natick, MA 01760, Tel: 508-653-1415, TELEX: 910-240-5521, FAX: 508-653-2997

MATRIX CORP., 2260 Distributors Dr., Indianapolis, IN 46241, Tel: 317-248-2036, FAX: 317-248-8369; Empl.: 10 ..... **D•1185**

MATRIX CORP., 1203 New Hope Rd., Raleigh, NC 27610, Tel: 919-231-8000, FAX: 919-231-8001; Empl.: 65; *Sls. Mgr.:* Michael Bryant



FAX: 818-222-2304

MATRIX SYSTEMS CORP., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, Tel: 818-222-2301; FSC No.: 33281; Empl.: 75; *Sls. Mgr.:* Randy Sue Rabideau ..... **B•1545**

Local Sales Offices & Reps

AL	Huntsville, Reynolds Assoc., Inc.	407-259-7000
AZ	Scottsdale, Faser Techn. Sls.	602-948-4404
CA	Huntington Beach, Scientific Devices-West	714-840-3501
CA	San Jose, Scientific Dvcs. West	408-554-0455
CO	Broomfield, Scientific Dvcs.	303-469-5145
CT	Meriden, Polytek Assocs.	203-634-4499
FL	Melbourne, Reynolds Assocs., Inc.	407-259-7000
FL	Newport Richey/Coral Springs, Reynolds Assocs.	407-259-7000
GA	Duluth, Reynolds Assoc., Inc.	407-259-7000
IL	Arlington Hgts., Comtel Midwest	708-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
MA	Ashland, Polytek Assocs.	508-881-4741
MA	Falmouth Hgts., RJC Assocs.	508-540-8832
MI	Southfield, Comtel-Instr.	313-358-2505
MN	Wayzata, Comtel Midwest	612-476-1551
MO	Manchester, Comtel Midwest	314-227-7220
NY	Mamaroneck, Bassin Tech. Sls. Co.	914-698-9358
NC	Raleigh, Reynolds Assoc.	407-259-7000
OH	Cleveland, Comtel Instr.	216-442-8080
OH	Columbus, Comtel Instr.	614-876-8305
OH	Dayton, Comtel Instr.	513-426-5310
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Pittsburgh, Comtel Instr.	412-922-5720
SC	Greenville, Reynolds & Assocs.	407-259-7000
TX	Carrollton, Seaton Corp.	214-980-9860
UT	Scientific Devices	801-973-9411
VA	Fairfax, Schibley Assocs.	703-591-3008
WA	Bellevue, Topp Engrg. Sls.	206-747-5400
WI	New Berlin, Comtel Midwest	414-544-6042

MATROX ELECTRONIC SYSTEMS, LTD., 1055 St. Regis Blvd., Dorval, QU, Canada H9P 2T4, Tel: 514-685-2630, TELEX: 05-822798, FAX: 514-685-2853; Empl.: 450; *Sls. Mgr.:* Ed Dwyer, VP Sls.; *Dist. Mgr.:* Bruce Seidel



FAX: 714-960-6492

MATSUO ELECTRONICS, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, Tel: 714-969-2491; Empl.: 854; *Sls. Mgr.:* Ted Wiltse ..... **A•1092-1097**

Local Sales Offices & Reps

AZ	Tempe, FP Sls.	602-894-5303
CA	Mission Viejo, Angle Assocs.	714-582-8858
CA	Redwood City, James S. Heaton Co.	415-367-7158
FL	Plantation, Gallagher	305-473-2101
GA	Norcross, Macro Mktg.	404-662-5580
IL	Des Plaines, ESCO Assocs.	312-298-5310
IN	Indianapolis, STB & Assocs.	317-844-9227
MD	Randallstown, Chesapeake Mktg.	301-922-5997
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Grand Rapids, DEM Elctrn. Sls.	616-364-4024
MI	St. Clair Shores, DEM Elctrns.	313-777-1750
MN	St. Paul, Proud Inds.	612-646-9428
NJ	Ft. Lee, Neptune Elctrns.	201-461-2789
NM	Albuquerque, FP Sls.	505-345-5553
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Strongsville, Dolfuss-Root & Co.	216-238-0300
TX	Plano, RAM Elctrns.	214-424-4455
OR	Beaverton, N. R. Schultz	503-643-1644
PA	Pittsburgh, Dolfuss-Root & Co.	412-221-4420
WA	Bellevue, N. R. Schultz	206-454-0300
Can	Scarborough, Ont., Bach-Simpson	416-288-9932

Local Distributors

CA	Garden Grove, Capacitor Supp.	714-638-0510
CA	Garden Grove, National Elctrns.	714-892-7749
CA	San Diego, Southland Comps.	619-673-3800
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Maria, Garrett Instrs.	805-922-0594
CA	W. Covina, CSI	818-960-4761
CA	Yorba Linda, Corona Elctrns.	714-283-8185
GA	Norcross, Spectrum Elctrns.	404-448-1516
IL	Arlington Heights, Mar/Lyn	312-364-0444
IN	Carmel, Altek Elctrns.	317-848-1323
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Billerica, Baldwin Comps.	617-667-6710
MA	Wilmington, Aved Elctrns.	617-657-6310
MN	New Brighton, Parts 1	612-633-8079
NJ	Fairfield, C.H.P.S., Inc.	201-882-0997
NJ	Kenilworth, Ventronics	201-272-9262
NY	Ronkonkoma, Baldwin Comps.	516-588-5700
PA	Norristown, Century Elctrn. Comps.	215-631-5400
TX	Dallas, C & W	817-831-0395
TX	Dallas, Omni-Pro	214-233-0500
VA	Charlottesville, Virginia Elctrns.	804-296-4184
Can	Montreal, Que., Prelco	514-389-8051
Can	N. London, CM Peterson	519-434-3204
Can	Willowdale, Ont., Electro Sonic	416-494-1666

MATTHEY ELECTRONICS, Television Equipment Associates, Box 393, South Salem, NY 10590, Tel: 914-763-8893, TELEX: 493-0698, FAX: 914-763-9158; *Sls. Mgr.:* Bill Pegler

MAUELL CORP., 31 Old Cabin Hollow Rd., P.O. Box 339, Dillsburg, PA 17019-0339, Tel: 717-432-8686, FAX: 717-432-8688; Empl.: 25; *Sls. Mgr.:* Frank A. Ulrich; *Dist. Mgr.:* Frank A. Ulrich

MAUREY INSTRUMENT CORP., 4555 W. 60th St., Chicago, IL 60629, Tel: 312-581-4555, FAX: 312-581-2576; FSC No.: 03942; Empl.: 50; *Sls. Mgr.:* E. Maurey; *Dist. Mgr.:* Louis Derdzinski ..... **A•2045-2053**

Local Sales Offices & Reps

CT	Killingworth, Gallagher Assocs.	203-663-2338
MA	Framingham, Gallagher Assocs.	617-626-2346
TX	Dallas, THT Sls. Co.	214-783-1501

Local Distributors

CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
CT	Ridgefield, PIC	203-451-1533
FL	Margate, Allied Elctrns.	305-973-3070
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	Grand Rapids, SF Elctrn. Supp.	616-459-0216
MI	Westland, Allied Elctrns.	313-595-6565
MO	St. Louis, Allied Elctrns.	314-878-1229
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-821-0415
OH	Akron, Stotts-Friedman	216-253-7000
OH	Cincinnati, Stotts-Friedman	513-574-7701
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Willoughby, Allied Elctrns.	216-951-0908
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-267-6940
TN	Knoxville, Shields Elctrns.	615-588-2421
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-932-7321
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772

MAURY MICROWAVE CORP., 8610 Helms Ave., Cucamonga, CA 91730, Tel: 714-987-4715, FAX: 714-987-1112; FSC No.: 13047; Empl.: 100; *Sls. Mgr.:* M. A. Maury, Jr.

MAXIMUM STRATEGY, INC., 1650 B Berryessa Rd., San Jose, CA 95133, Tel: 408-729-1526, FAX: 408-729-7084; Empl.: 15; *Sls. Mgr.:* Wes Meador; *Dist. Mgr.:* Ernie Ohrenstien

MAXMAR CONTROLS INC., 99 Castleton St., Pleasantville, NY 10570, Tel: 914-747-3540, FAX: 914-747-3567; *Sls. Mgr.:* Julius Chastant; *Dist. Mgr.:* Julius Chastant

MAXON PRECISION MOTORS, INC., 838 Mitten Rd., Burlingame, CA 94010, Tel: 415-697-9614, FAX: 415-697-2887; *Sls. Mgr.:* Sam Robinson

MAXUS ELECTRONIC CORP., 2760 29th St., Boulder, CO 80301, Tel: 303-447-1226, FAX: 303-447-1446; Empl.: 6; *Sls. Mgr.:* Eric Slack

MAXWELL ELECTRONICS, P.O. Box 12033, Research Triangle Park, NC 27609, Tel: 919-846-1633; Empl.: 8; *Sls. Mgr.:* Joe Harrison

MAXWELL LABORATORIES, INC., 8888 Balboa Avenue, San Diego, CA 92123-1506, Tel: 619-279-5100, FAX: 619-279-1554; Empl.: 600; *Sls. Mgr.:* Michael M. Plum, V.P. Mktg.

MBD INTERNATIONAL, P.O. Box 870577, Dallas, TX 75287-0577, Tel: 214-788-5277, FAX: 214-404-0471; Empl.: 5; *Sls. Mgr.:* Robert McLeod; *Dist. Mgr.:* Robert McLeod

MB DYNAMICS INC., 25865 Richmond Rd., Cleveland, OH 44146-1483, Tel: 216-292-5850, TELEX: 510-601, FAX: 216-292-5614; Empl.: 45; *Sls. Mgr.:* Ed Peterson

MCCOY ELECTRONICS CO., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, Tel: 717-486-3411, TWX: 510-650-3548, FAX: 717-486-5920; FSC No.: 00136; Empl.: 450 ..... **A•1380-1387**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Sls., Inc.	205-533-1735
AZ	Phoenix, Sunwest Mktg.	602-893-7677
CA	Chatsworth, Wes-K	818-700-0933
CA	San Mateo, Melvin Sls.	415-349-7445
CO	Grand Function, Krebill Comp. Sls.	303-243-8220
CO	Littleton, Advanced Tech Mktg.	303-798-4200
FL	Oviedo, Conley & Assocs.	407-385-3283
GA	Norcross, Elctrn. Sls., Inc.	404-448-6554
IL	Glendale Heights, Beta Technlg. Sls., Inc.	312-790-9886
IL	Northfield, Feller Assoc.	708-446-8065
IN	Kokomo, Schillinger Assoc., Inc.	317-452-4057
IA	Cedar Rapids, Jack L. Tucker & Assoc.	319-362-1019
KS	Lenexa, Mid-Tech Assoc.	913-541-0505
MD	Towson, Dickison Sls.	301-823-0923
MA	Norwood, Naton Assoc.	617-762-3224
MN	Minneapolis, Dunlop Consits.	612-544-1070
NM	Albuquerque, Sunwest Mktg.	505-898-6471
NY	Binghamton, Foster & Wager, Inc.	607-724-7093
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NY	Rochester, Foster & Wager, Inc.	716-385-7744
NC	Cary, Elctrn. Sls., Inc.	919-467-8486
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OR	Tigard, Eltech Incorp.	503-684-3458
PA	Ft. Washington, Beta Sls.	215-643-6650
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
VA	Charlottesville, PDQ Sls.	804-979-7085
WA	Bellevue, Eltech. Incorp.	206-643-4330
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200

MCCURDY RADIO INDUSTRIES LIMITED, 108 Carnforth Road, Toronto, Ont., CAN M4A 2L4, Tel: 416-751-6262, FAX: 416-751-6455; *Sls. Mgr.:* Murray Porteous; *Dist. Mgr.:* Murray Porteous

MCE SEMICONDUCTOR, INC., 1111 Fairfield Dr., West Palm Beach, FL 33407, Tel: 407-845-2837, TELEX: 44105 (MCE UI), FAX: 407-863-8275; Empl.: 58; *Sls. Mgr.:* Thomas Munn

MCFADDEN SYSTEMS, INC., 11835 E. Smith Ave., Santa Fe Springs, CA 90670, Tel: 213-948-4414, TELEX: 677161, FAX: 213-948-1291; FSC No.: 25750; Empl.: 30

MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125, FAX: 516-586-5120; FSC No.: 29779; Empl.: 45; *Sls. Mgr.:* Don Worden ..... **B•1375-1376**

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FL	Lake Mary, Pure Power,Inc.	407-333-3212
GA	Atlanta, On-Track Sys., Inc.	404-451-8885
IN	Indianapolis, Domino	317-841-6159

MA Woburn, EMS 617-229-6686
MI Brighton, Cesko Sls. Co. 313-227-5061
MN St. Louis Pk., Electro Midwest 612-922-7017
NJ Caldwell, RTS Data 201-228-5249
OK Oklahoma City, Computer Power 405-848-2522
OK Tulsa, Allan & Assoc. 918-663-6713
TN Alcoa, Powerforce Sys. 615-970-7584
TX Richardson, Devices, Inc. 214-991-1202
UT Salt Lake City, S&T Mktg. 801-268-8183
WV Huntington, Seco, Inc. 304-522-9732
Can Richmond Hill, Ont., Computer Power Eng. 416-764-1548

Local Distributors

GA Norcross, Alltel Supply 404-448-5210
NC Charlotte, Data Directions 704-588-5622
PA E. Oakmont, RPC Video 412-828-1414
TX Lubbock, Wesco 806-747-3256

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AL Huntsville, James E. Heusser Agy. 205-836-3896
AR Hot Springs, Automation Supp., Inc. 501-767-5444
CA Cotati, Joseph Foster 707-792-4392
CA Oceanside, Mark Waggoner 213-904-0156
CO Northglenn, Dan Ryall 303-452-8185
CT Bristol, Eric Peterson 203-297-7464
IN Bremen, Jan Richard Stahly 219-282-3592
IA Des Moines, Jerry Bunch Electrical Sls. 515-287-7057
MI Chelsea, Rick Mayday 313-995-2965
MN Eagan, Stan Lock 612-890-9347
MS Brandon, Service Electrical Sls. 601-992-9122
MO St. Peters, Neil Klocke 314-947-2259
NJ Lauren Springs, Jim Cawood 215-359-3708
NM Albuquerque, Paul Atkinson 505-292-1222
NY Old Bethpage, Susan Razzano 718-830-5011
NY Silver Creek, Scott Earsing 716-325-3485
OH Euclid, Joe Ciulla 216-574-7164
SC Columbia, Harold Heaton 803-733-0941
TN Nashville, Richard Hardy 615-748-1150
TX Dallas, Raley Sls. Co. 214-368-1683
UT Salt Lake City, Kev Paul 801-484-9941
VA Richmond, Wynn Meredith 804-275-7970
WI Kenosha, Wally Coats 312-299-2354
Can Mississauga, Ont., Marr Elec. Ltd. 416-277-9481

MCGUIRK ELECTRONICS CO. INC., 212 So. Main St, P. O. Box 853, Middleton, MA 01949, Tel: 617-933-3500; FSC No.: 55902; Empl.: 10; *Sls. Mgr.:* R. O'Neill

MCI TRANSFORMER CORPORATION, 411 Manhattan Ave., Babylon, NY 11704, Tel: 516-587-0510, FAX: 516-587-0624; Empl.: 50; *Sls. Mgr.:* Timothy J. Williams ..... **A•2266-2276**

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MA Orange, MCI Transformer 508-544-8806
NH Nashua, Key Sls. of New England, Inc. 603-888-8742

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MCKENZIE TECHNOLOGY, 44370 Old Warm Springs Blvd., Fremont, CA 94538, Tel: 415-651-2700; Empl.: 175; *Sls. Mgr.:* Kari Trautman; *Dist. Mgr.:* Vicky Wodopianov ..... **C•1467**

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AL Huntsville, Cartwright & Bean, Inc. 205-830-1540
AZ Phoenix, Mercury Engrg. Sls., Inc. 602-265-0344
CA Pleasanton, Moulthrop Sls., Inc. 415-463-0450
CA Westminster, West Elctrn. Sls., Inc. 714-898-0120
CO Denver, Donohue Sls. Co. 303-455-1719
CT Waterbury, Compak, Inc. 203-753-6431
FL Orlando, Cartwright & Bean, Inc. 407-423-1756
GA Atlanta, Cartwright & Bean, Inc. 404-368-0160
IL Chicago, Golten Assocs., Inc. 708-512-0093
MA Boston, Compak Inc. 508-568-0331
MN Twin Cities, GP Sls. Inc. 612-831-2362
MS Jackson, Cartwright & Bean, Inc. 601-981-1170
NH Derry, Compak, Inc. 603-434-8498
NY New York, Sticom 516-724-6814
NC Charlotte, Cartwright & Bean, Inc. 704-536-0303
NC Raleigh, Cartwright & Bean, Inc. 919-876-4130
OH Dayton, Electro-Mktg. 513-890-8322
OR Portland, RTS, Inc. 503-244-4123
PA Philadelphia, TCA 215-692-6853
PA Pittsburgh, Electro-Mktg. 412-823-5400
TN Memphis, Cartwright & Bean, Inc. 901-362-8345
TX Dallas, JYS Co,/Comps. 214-349-1650
WA Seattle, RTS, Inc. 206-285-1363

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AL Huntsville, Allied Elctrns. Inc. 800-433-5700
AL Huntsville, Century Fastners 205-883-5344
AZ Phoenix, Force Elctrns. 602-437-1060
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CA San Diego, Force Elctrns. 619-569-9661
CA El Segundo, Force Elctrns. 213-772-1324
CA Fountain Valley, Comps Ctr., Inc. 714-979-0433
CA Fullerton, Kent 714-773-0781
CA Los Angeles, Allied Elctrns. 714-669-4190
CA Milpitas, R&D Elctrn. Parts 408-262-7144
CA San Diego, Kent 619-271-5404
CA San Francisco, Allied Elctrns. 415-487-5250
CA Santa Clara, Abacus Elctrns. 408-732-2000
CA Santa Clara, D.C. Elctrns. 408-980-1199
CA Santa Clara, Force Elctrns. 408-748-1324
CA Santa Clara, Kent Elctrns. 408-727-9810
CA Temecula, Rancho Elctrns., Inc. 714-676-6454
CA Tustin, D.C. Elctrns. 714-259-9066
CO Denver, Alliance Elctrns. 303-433-1648
CT Danbury, Heilind Elctrns. 203-797-8600
DC Allied Elctrns. Inc. 301-423-1061
FL Clearwater, Allied Elctrns. 800-433-5700
FL Largo, Electronic Precepts 813-544-3636
FL Pompano Bch., Allied Elctrns. Inc. 305-486-0500
FL Tampa, Century Fasteners, Tampa 813-802-5770
GA Atlanta, Allied Elctrns. Inc. 404-377-3555
IL Bensenville, Voyager Elctrns. Corp. 312-860-1300
IL Chicago, Allied Elctrns. 312-697-8200
MA Boston, Allied Elctrns. Inc. 617-942-3150
MA Waltham, Vector Sls.,Inc. 617-787-2790
MA Wilmington, Heilind Elctrns. 1-800-343-5004
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MN New Brighton, Parts 1 612-633-8079
MN Stillwater, Elctrn. Depot Supp. Co. 612-439-9409
NH Atkinson, Astrum Elctrns. 603-898-3399
NY Bohemia, RBD Elctrns. 516-589-7717
NY Mineola, Allied Elctrns. Inc. 516-248-2360
NC Raleigh, Allied Elctrns. 919-876-5845
NC Raleigh, Century Elctrns. Comps., Inc. 919-782-2116
OH Cleveland, CAM RPC Elctrn. 216-461-4700
OR Beaverton, Comp. Resources, Inc. 503-641-8488
PA Pittsburgh, CAM RPC Elctrn. 412-782-3770
RI Warwick, Cal-Greg Comps. 401-738-6170
TX Allen, Prime Distbg. Co. 214-231-0170
TX Austin, Kent Elctrns. 512-834-1900
TX Dallas, Allied Elctrns. 214-553-4370
TX Dallas, Kent Elctrns. 214-669-2600
TX Farmers Branch, Force Elctrns. 214-247-9955
TX Ft. Worth, Allied Elctrns. 214-265-9341
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Force Elctrns. 713-561-8677
TX Stafford, Southwest Elctrns., Inc. 713-240-4000
WA Redmond, Pyramid/Kent 206-883-7200
WA Kent, Comp. Resources, Inc. 206-454-8666

MCL, INC., 501 S. Woodcreek Rd., Bolingbrook, IL 60440-4999, Tel: 708-759-9500, TWX: 910-683-1899, FAX: 708-759-5018; FSC No.: 16469; Empl.: 127; *Sls. Mgr.:* Frank Morgan

MCLEAN ENGINEERING, Zero Corporation, 70 Washington Rd., Princeton Junction, NJ 08550, Tel: 609-799-0100, TWX: 510-685-2543, FAX: 609-799-1081; FSC No.: 03522; Empl.: 118; *Sls. Mgr.:* Craig A. Reed; *Dist. Mgr.:* Craig A. Reed ..... **C•1632-1633**

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CA San Mateo, Halbar Assocs. 415-349-4700
CA Van Nuys, Halbar Assocs. 818-906-3941
CO Aurora, Component Tech 303-680-9550
FL Orlando, Raycom 407-859-5504
GA Duluth, Raycom 404-476-2041
IL Elmhurst, Scott Assocs. 708-279-5681
MD Hunt Valley, Marktron 301-628-1111
MD Rockville, Marktron 301-251-8990
MA Chelmsford, JEBCO 508-256-5800
MI Livonia, Electro-Mktg. 313-421-7590
NY Rochester, Talty Assocs. 716-323-1210
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO Grandview, Harris-Hanson 816-763-6200
MO St. Louis, Harris-Hanson 314-432-3611
NJ Lebanon, Sylvester Sls. Assocs. 201-735-2488
NM Albuquerque, Fry-Gates 505-262-1525
OH Dayton, Electro-Mktg.Grp. 513-890-8322
OH N. Royalton, Electro-Mktg. Grp. 216-582-0075
PA Huntingdon Valley, Inacker Sls. 215-947-5660
PA Pittsburgh, Electro-Mktg. Grp. 412-823-5400
TX Houston, Milco Mktg. 713-469-5156
TX Plano, Milco Mktg. 214-578-1996
WA Redmond, Halbar PNW 206-882-0990
Can Guelph, Ont., Hammond Mfg. Co. 519-822-2960

Local Distributors

FL Ft. Lauderdale, Component Distrs. 305-971-4950
GA Norcross, Component Distrs. 404-441-3320
MI Ann Arbor, Wedemeyer Elctrn. Supp. Co. 313-665-8611
NC Raleigh, Component Distrs. 919-834-9465
TX Dallas, Component Distrs. 214-644-0373
Can Guelph, Ontario, Hammond Mfg. Co. 519-822-2960

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FAX: 612-569-0533

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CA Laguna Hills, Western Automation 714-859-6988
CA Oakland, Powermatic Assocs. 415-635-6825
CO Boulder, Comp. Prod. Sls. Co. 303-530-2800
GA Norcross, Hollingsworth & Still, Inc. 1-800-241-5712
IL Elmhurst, Scott Assocs., Inc. 708-279-5681
MD Rockville, Marktron, Inc. 301-251-8990
MA Chelmsford, John E. Boeing Co. 508-256-5800
MI E. Detroit, Jack M. Thorpe Co. 313-779-6363
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO St. Louis, Harris-Hanson Co. 314-432-3611
NJ Totowa, R.O.I. Sls. Co. 201-812-9606
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FAX: 512-984-2211

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CO Denver 800-328-0201
DC Washington 404-447-7170
GA Atlanta 800-241-3670
IL Chicago 800-942-3961
IN Indianapolis 800-323-4087
MA Boston 800-851-1515
MI Detroit 800-323-4087
MN St. Paul 800-392-0312
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OH Cincinnati 800-523-4441
OH Cleveland 800-523-4441
OH Columbus 800-523-4441
PA Philadelphia 800-524-0168
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Local Sales Offices & Reps

CA Campbell, Olsheski & Assoc. 408-378-6003
CA Danville, Olsheski & Assoc. 415-820-9144
CA Pleasanton, Sedlak, Mike 415-462-4547
CA Valencia, Cessing Assocs. 805-295-0225
CO Wheatridge, Cluff & Assoc. 303-425-6604
CT Chesire, The Macinnis Co. 203-372-3797
FL Apopka, Cartwright & Bean, Inc. 407-889-2168
FL Deerfield Beach, Cartwright & Bean, Inc. 305-429-3400
GA Atlanta, Wallace Elctrn. Sls. 800-334-3518
IL Lombard, RMP/McBride Corp. 312-932-9090
IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
IA Cedar Rapids, T. Dowell & Assoc. 319-364-3880
KS Overland Park, T. Dowell & Assoc. 913-599-1100
LA Slidell, Wallace Elctrn. Sls. 504-643-4751
MD Lisbon, S.K. MacDonald, Inc. 301-442-1590
MA Norwood, The Macinnis Co. 617-762-8090
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MI Wyoming, Burcaw Co. 313-573-4605
MN Edina, Restronics, Inc. 612-941-9135
MO St. Louis, T. Dowell & Assoc. 314-849-4334
NJ Cherry Hill, S.K. MacDonald, Inc. 609-482-2666
NY Hauppauge, Aurora-Schmitt Assoc. 516-434-1572
NY Syracuse, T-Squared Elctrns., Co. 315-463-8592
NY Victor, T-Squared Elctrns. Co. 716-924-9101
NC Kernersville, Wallace Elctrn. Sls. 919-996-2742
OH Beachwood, Elctrns. Salemasters 216-831-9555
OR Beaverton, Pacific Mktg. Specialists ... 503-641-9373
PA Monroeville, S.K. MacDonald, Inc. 412-373-1723
TN Tullahoma, Wallace Elctrn. Sls. 800-334-3518
TX Dallas, Elcom Mktg. 214-241-2166
TX Houston, Elcom Mktg. 713-350-8064
WA Redmond, Pacific Mktg. Specialists ... 206-882-3144
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AZ Phoenix, Hall-Mark 602-437-1200
AZ Tempe, Acacia/Deanco, Inc. 602-894-2874, 602-882-9054
AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
CA Chatsworth, Hall-Mark 818-773-4500
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
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CA Fremont, Acacia/Deanco, Inc. 415-623-7500
CA Garden Grove, Richey/Impact Elctrns. 714-895-0060
CA Irvine, Acacia/Deanco, Inc. 714-660-0834, 213-971-2428
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CA San Diego, Acacia/Deanco, Inc. 619-565-4365
CA San Diego, Hall-Mark 619-268-1201
CA San Diego, Richey/Impact Elctrns., Inc. 619-271-4511
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Jose, Hall-Mark 408-432-0900
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FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
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FL Pompano Beach, Hall-Mark 305-971-9280
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
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IL Wood Dale, Hall-Mark .. 312-860-3800,312-860-0239
IL Wood Dale, NEP Elctrns., Inc. 312-595-8500
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NY Farmingdale, Addem Distrs. 516-752-9303
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NY Medford, Shelley-Ragon, Inc. 516-447-2000
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TX Dallas, Norvell Elctrns. 214-233-0020
TX El Paso, ERA Elctrns. 915-855-3600
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TX Plano, Tactic Elctrns. 214-422-0777
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WA Redmond, Acacia/Deanco, Inc. 206-881-5566
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WI New Berlin, Hall-Mark 414-797-7844

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MDF PRODUCTS INC., 7 Johnson Dr., Danbury, CT 06811, Tel: 203-743-3579, TELEX: 499-8051, FAX: 203-744-2704; FSC No.: 60628 ..... **D•1293**

MDM, INC., 9601 Irondale Ave., Chatsworth, CA 91311, Tel: 818-700-8400, FAX: 818-700-1938; FSC No.: 60994; Empl.: 150; *Sls. Mgr.:* Steven J. LaLonde

MDS CALIBRATION LAB. INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234, FAX: 904-664-6789; *Sls. Mgr.:* Gerry Doiron

MEA DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

MEASUREMENTS GROUP, INC., Box 27777, Raleigh, NC 27611, Tel: 919-365-3800, TELEX: 62919594, FAX: 919-365-3945

MEASUREMENT SYSTEMS, INC., 121 Water St., Norwalk, CT 06854, Tel: 203-838-5561, TELEX: 6813573; Empl.: 97; *Sls. Mgr.:* Gerard M. Lacrocque, Nat'l. Sls. Mgr. ..... **D•1138**

Local Sales Offices & Reps

AZ Scottsdale, Advent Comps. 602-481-0044
CA Anaheim, Gabriel & Assoc. 714-531-7674
IA Cedar Rapids, S & O Sls. 319-393-7331
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MA Hudson, Data Rep 508-481-0333
MN Edina, Elctrn. Sls., Inc. 612-933-9070
MO St. Louis, J. S. DeWeese Co. 314-469-7350
OH Medina, J. C. Hofstetter Co. 216-241-4880
PA Hickory, J. C. Hofstetter Co. 412-356-2305
TX Richardson, Scientific Sls. Co. 214-231-6541
VA Richmond, Robert Elctrn. Sls. 804-276-3979

MEC A/S, Industriparken 23, Ballerup, Denmark DK-2750, Tel: 011-4542973366, TELEX: 9125649, TWX: 2381-125649, FAX: 011-4542 681514; Empl.: 50

MP

FAX: 517-782-2810

MECHANICAL PRODUCTS INC., 1824 River St. P. O. Box 729E, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Dave Olson .... **B•1378-1381**

Local Sales Offices & Reps

AL Huntsville, Electro-Mech 205-533-2100
AZ Scottsdale, Advent Comps. Corp. 602-481-0044
CA Los Angeles, Universal Components Co. 213-641-4255

CA Sunnyvale, Pass Associates 408-735-9040
CO Denver, Advent Comps. Corp. 303-455-1985
FL Tampa, Florida Comp. Sls., Inc. 813-873-3622
GA Atlanta, Electro-Mech 404-447-6478
IL Barrington, Perhats Assocs. 708-381-6360
KS Prairie Village, C. Logsdon & Assoc. .. 913-381-3833
MD Pikesville, Muncy Sls. 301-484-6376
MA Danvers, C. H. Burnham Assoc. 508-774-0111
MN St. Paul, Mackubin Grp. 612-636-5686
MO St.Louis, C. Logsdon & Assoc. 314-849-5125
NH Durham, C. H. Burnham Assocs. 603-868-2282
NJ Pitman, Colrud Corp. 609-589-5866
NY Port Washington, Ashtec, Inc. 516-267-0981
NC Raleigh, Electro-Mech 919-851-8165
OH Euclid, Rockford Controls Ohio, Inc. 216-725-3705
RI Johnston, C. H. Burnham Assocs. 401-231-7475
TN Jonesboro, Electro-Mech 615-753-2964
TX Dallas, Control Comps. Corp. 214-458-8877
Can Downsview, Ont., Har Tech 416-665-7773
Can Pointe Claire, Que., Har Tech 514-694-6110

Local Distributors

AZ Phoenix, Beswitched, Inc. 602-275-4805
CA Gardena, Cal Switch ... 213-770-2330/213-538-9830
CA San Carlos, Campbell & George Co. .. 415-594-1994
FL Ft. Lauderdale, Zelcon, Inc. 305-565-2555/6
FL Lakeland, Wes-Garde Comps. Grp. 800-282-7619
IL Carol Stream, Wes-Garde Comps. Grp. 800-323-9431
IL Chicago, Nep Elctrns. 708-625-8400
MA Danvers, RCI 617-777-4441
MI Grand Rapids, S & F Elec. Supp. Co., Inc. 616-459-0216
MI St. Clair Shore, Spemco Switch, Inc. .. 313-771-2700
MN Minneapolis, Berquist 612-835-2322
NJ Oakland, Relay Specialties 201-337-1000
NY Plainview, Linrose Elctrns. 516-293-2520
NY Woodside, Switches Unlimited 800-221-0487
OH Euclid, Rockford Controls Ohio, Inc. 216-731-5250
TX Arlington, Bell Components Sls., Inc. .. 817-461-5303
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can St. Laurent, Que., Tara Inds. Corp. 514-331-6550

MECHANIZED ELCTRN. ASSEMBLEY DIV., UNIVERSAL INSTRS. CORP., See Dover Electronics Manufacturing

MECHATRONICS

FAX: 206-236-5480

MECHATRONICS INC., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040, Tel: 206-232-4800, TWX: 910-444-4126; Empl.: 40; *Sls. Mgr.:* Jim Innes ..... **C•1636-1639**

Local Sales Offices & Reps

WA Mercer Island, Mechatronics Inc. 206-232-4800

MECO INDUSTRIES, Mechanical Engraving Co., Inc., 4500 Bullard Ave, Bronx, NY 10470, Tel: 212-324-4455, FAX: 212-324-5500; FSC No.: 99040; Empl.: 35

MEDA, INC., Macintyre Electronics Design Assocs., 11260 Roger Bacon Dr., Ste. 202, Reston, VA 22090, Tel: 703-471-1445; Empl.: 8

MEDIA RECOVERY INC., Box 1407, Graham, TX 76046, Tel: 800-527-9497, 214-630-9625 (Texas), TELEX: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

MEGADATA CORP., 35 Orville Dr., Bohemia, NY 11716, Tel: 516-589-6800, FAX: 516-589-6858; FSC No.: 53436; Empl.: 90

MEISSNER INDUSTRIES, 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10

MEKTRONIX TECHNOLOGY, INC., 53 Depot Rd., Goleta, CA 93117, Tel: 805-964-9669, FAX: 805-964-0797; Empl.: 5; *Sls. Mgr.:* Gregory Mayworm

FAX: 508-881-5082

MELCHER, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 800-828-9712, TWX: 5101003630; Empl.: 280; *Sls. Mgr.:* Joe DiPietro ..... **D•1892-1895**

Local Sales Offices & Reps

CA La Habra, West Coast Reps. 213-690-9960
AZ Scottsdale, Power Up Elctrn. Sls. 602-955-1105
CA Granada Hills, West Coast Reps. 818-368-7385
CA San Diego, West Coast Reps. 619-576-9203
FL Coral Springs, Graham Assocs. 305-341-5102
FL Largo, Graham Assocs. 813-539-6779
FL Melbourne, Graham Assocs. 407-773-6631
FL Orlando, Graham Assocs. 407-299-1001
FL Palm Beach Gardens, Graham Assocs. 407-622-4049
WA Snohomish, West Coast Reps. 206-483-5300
FL Winter Garden, Graham Assocs. 407-656-9369
IL Arlington Hgts., Phoenix Elctrn. Sls. ... 708-394-4422
KS Olathe, Tech. Sls. Assocs. 913-829-2800
MI Troy, CB Jensen & Assocs. 313-643-0506
MO St. Louis, Tech. Sls. Assocs. 314-521-2044
NY Wantagh, Bytec Reps. 516-781-7400
NC Winston-Salem, Murcota 919-722-9445
PA Willow Grove, Tech. Sls. Assocs. 215-784-0170
TX Richardson, Jim D. Gray & Assocs., Inc. 214-699-9976
TX Richmond, Jim D. Gray & Assocs., Inc. 713-342-1710
WI Brookfield, McMahon Inc. 414-782-3335

meLCoR

FAX: 609-393-9461

MELCOR/MATERIALS ELCTRN. PRODS., 994 Spruce St., Trenton, NJ 08648, Tel: 609-393-4178, TELEX: 84-3314; FSC No.: 32333; Empl.: 220; *Sls. Mgr.:* M.A. Levine ..... **C•1641-1644**

Local Sales Offices & Reps

CO Fort Collins, Rep Sls., Inc./Andy Cornedi 303-226-1504
CA Mountain View, Shaw Tech, Inc. 415-961-4775
NY W. Henrietta, Exogray Tech. Sls. 716-334-1340

Distributor

FAX: 213-820-6958

MELFESS FIVE, INC., 12304 Santa Monica Blvd., No. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297; Empl.: 7; *Sls. Mgr.:* Michael S. Fisher ..... **D•1106**

MELLES GRIOT, INC., 1770 Kettering St., Irvine, CA 92714, Tel: 714-261-5600, TELEX: 678447; Empl.: 110; *Sls. Mgr.:* Kevin Chittim, VP Mktg.

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527, FAX: 616-657-2528; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEMBRANE SWITCH & PANEL CO., INC., 1537-G McFadden, Santa Ana, CA 92705, Tel: 714-541-5775; Empl.: 8

MI

FAX: 219-356-7376

MEMCOR-TRUOHM, INC., 1320 Flaxmill Rd., Huntington, IN 46750, Tel: 219-356-4300; FSC No.: 24681; Empl.: 250; *Sls. Mgr.:* Ray Vanderspool ..... **A•1946, 2054**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
CA American Canyon, Jacobson & Assoc. 707-552-4412
CA Huntington Bch., Mil-Com Sls. 714-840-2424
FL Indialantic, Raycom 305-727-8860
GA Atlanta, Murcota 404-875-2525
IL Chicago, D. Dolin Sls. 312-286-6200
IN Ft. Wayne, Menze Sls. 219-747-5616
MI St. Clair Shores, J.M. Thorpe 313-779-6363
MO St. Charles, Hayes Elec. Sls. Co. 314-946-6677
NH Atkinson, Mark Rep Assoc. 603-382-9563
NJ Englewood Cliffs, Masin Esco 201-569-8868
NY Hauppauge, Masin Esco 516-273-3500
NY Marcellus, Mullahy Sls. Inc. 315-685-6280
NC Burlington, Murcota 919-585-1577
NC Winston-Salem, Murcota 919-723-1001
OH Cleveland, Glover Sls. 216-842-4520
PA Newtown Square, G.M. Conneen 215-353-2241
TX Dallas, SW Elctrn. Ind. 214-233-9816
TX Houston, SW Elctrn. Ind. 713-729-1670
WA Redmond, Barrett-Squibb 206-885-6991

MEMODYNE, 20 Ossipee Rd., Newton, MA 02164, Tel: 617-964-6556 (in MA), 800-255-1510, FAX: 617-964-2444; Empl.: 40; *Sls. Mgr.:* Leonard Sacon ..... **D•1100**

Local Sales Offices & Reps

AL Huntsville, Dean Assocs. 205-534-2255
AZ Scottsdale, A.M.I. 602-947-4297
CA Carson, Amasco 213-516-8561
CT Portland, BBI Elctrns. 203-342-0648
FL Orlando, DAI Sls. 305-299-7754
IL Elmhurst, Scott Assocs. 312-279-5681
MD Severna Park, Syronics 301-544-8652
MA Holbrook, McLellan Assocs. 617-767-4771
MI Detroit, EQS Sys. 313-961-3042
MI Pontiac, EQS Sys., Inc. 313-338-2280
MN Chanhassen, Jen-Ray Sys. 612-934-8607
NJ Boonton, PAF Assocs. 201-335-0680
NY Liverpool, Syronics 315-451-0968
NY Smithtown, PAF Assocs. 516-360-0940
OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
OH Dayton, EQS Sys., Inc. 513-236-7676
OH Huber Hgts., EQS Sys., Inc. 216-729-2222
OR Lake Oswego, Syntek 503-636-6793
PA Sellersville, Penn-Tech Sls. 215-257-2756
TX Irving, Trice Mktg. 214-255-1877
WA Kirkland, Syntek 206-488-0394

MEMORY PROTECTION DEVICES, INC., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-293-5891, FAX: 516-752-1971; *Sls. Mgr.:* Thomas Blaha ..... **D•1469**

Local Distributors

AL Huntsville, Powell Elctrns. 205-837-5300
AL Huntsville, Resistacap, Inc. 205-883-4270
AZ Phoenix, Lynntronics 602-433-0288
CA Buena Park, Cypress Elctrns. 714-521-5230
CA Costa Mesa, Battery Specialties 800-854-5759
CA Costa Mesa, House of Batteries 714-642-8222
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA San Diego, Tauber Elctrns. 619-274-7242
CA San Jose, Powell Elctrns. 408-943-6438
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Van Nuys, Nesco Corp. 818-781-0522
CO Arvada, Denver Beta Wintronics 303-431-7161
CO Englewood, AVT, Inc. 303-779-8056
CO Englewood, Cypress Elctrns. 303-792-5829
FL Fort Lauderdale, Powell Elctrns. 305-484-8377
FL Tampa, MicroPrecision Inc. 813-854-2861
GA Norcross, Applied Power 404-263-0421
ID Boise, Kimball Elctrns. 208-342-3559
IL Morton Grove, Power Pak 312-966-6000
IN Indianapolis, North American Cap 317-856-3731
MD Annapolis Junction, Powell Elctrns. ... 301-880-3255
MA Andover, Generation Elctrns. 508-683-1177
MA Canton, Richey Impact Elctrns. 617-821-1500
MA Sharon, Adcour Inc. 617-784-8123
MA Sutton, Engrd. Assemblies and Comp. Corp. 508-865-0722
MI Brighton, Applied Power 313-227-3604
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Thief River Falls, Digi Key Corp. 218-681-6674
NJ Camden, Gen. Radio Supp. 609-964-8560
NJ Mountainside, Mars Elctrns. 201-233-0044
NJ Teterboro, Engrd. Assemblies & Comp. Corp. 201-288-4477
NY Buffalo, Summit Distrs. 716-887-2800
NY Rome, Rome Elctrns. 315-337-5400
NC Raleigh, Engrd. Assemblies & Comps. Corp. 919-790-9700
OR Beaverton, Micro Power 503-626-7086
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Dallas, Conformance Technlg., Inc. 214-233-4173
TX Dallas, Computer Comps. Corp. 214-239-0271
TX Dallas, Cypress Elctrns. 214-869-1435
TX Irving, Powell Elctrns. 214-550-0457
UT W. Valley City, Denver Beta Wintronics 801-966-0378
WI Milwaukee, Taylor Elctrns. 414-241-43321

MEMORY X, INC., 5205 Kearny Villa Way, No. 106, San Diego, CA 92123, Tel: 619-292-1151, FAX: 619-292-0774

MEMTEC CORP., 19-B Keewaydin Dr., Salem, NH 03079, Tel: 603-893-8080, FAX: 603-893-8699; Empl.: 35

MEMTRON®

FAX: 517-652-2659

MEMTRON TECHNOLOGIES, INC., 1400 Weiss St, Frankenmuth, MI 48734, Tel: 517-652-2656, 800-234-7525; FSC No.: 6 V 417; Empl.: 130; *Sls. Mgr.:* Daniel T. Ortner ..... **B•1824**

Local Sales Offices & Reps

AZ	Tucson, Intramerica Technlg.	602-326-8997
CA	San Diego, Intramerica Technlg.	619-451-3383
CA	Saratoga, Edward King & Assocs.	408-867-2111
CO	Longmont, Reliance Sls.	303-443-5660
FL	Maitland, EIR, Inc.	305-660-9600
GA	Lawrenceville, Tek-Rep Mktg., Inc.	404-963-1600
IL	Wheaton, CS Tech. Sls.	312-653-8126
IN	Indianapolis, EMCI, Inc.	317-253-1668
MA	Framingham, Stone Comp. Sls. Corp.	508-875-3266
MN	Oakdale, Complete Sls.	612-731-2923
MO	Saint Charles, Buckman & Assocs.	314-946-6201
NY	Islip, ABS Technlgs., Inc.	516-277-7010
NY	Liverpool, Syronics	315-451-0968
OH	Delaware, Bill Romine Co.	614-363-1600
PA	Southampton, Campbell Assocs.	215-322-6630
TX	Richardson, Zonk & Assocs.	214-238-7651, 214-895-9131
VA	Alexandria, Tech-Reps. Inc.	703-370-2600
WA	Renton, K. R. Jensen Sls.	206-277-2772
Can	Toronto, Ont., Reptech	416-863-9510

MENSOR CORPORATION, 2230 IH-35 South, San Marcos, TX 78666, Tel: 512-396-4200

MEPCO/CENTRALAB CORP., See Philips Components Discrete Products Division

MEP CONTROLS, Rising Sun Rd, Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 25; *Sls. Mgr.:* Thomas Thorn

MEPCOPAL

FAX: 619-481-1123

MEPCOPAL COMPANY, 11468 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-453-0332; Empl.: 160 ..... **A•2055-2057; B•1737**

Potentiometers (Cermet, Carbon) Industrial & Military

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Anaheim, Philips Comps.	714-441-0385
CA	Harbor City, Refrigeration Comp.	213-325-3420
CA	Mission Hills, Philips Comps.	818-891-6299
CA	San Diego, Philips Comps.	619-453-0332
CA	Santa Clara, Philips Comps.	408-748-1563
CA	Sunnyvale, Philips Comps.	408-746-2066/2808
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Philips Comps.	407-339-5073
FL	Ft. Lauderdale, Philips Comps.	305-485-0115
GA	Norcross, Over & Over Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Bannockburn, GMR Sls., Inc.	312-295-8440
IL	Des Plaines, Philips Comps.	312-827-4487
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IN	Kokomo, Philips Comps.	317-456-1615
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
KS	Merrian, Lorenz Sls. Inc.	913-384-6556
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6000
MN	Minneapolis, Elec. Comps. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls. Inc.	314-997-4558
NE	Lincoln, Lorenz Sls. Inc.	402-475-4660
NJ	Englewood, Ed Glass Assoc.	201-592-0200
NY	E. Rochester, Empire Tech. Assocs.	716-381-8500
NY	Endwell, Empire Tech. Assoc., Inc.	914-336-6575
NY	Skaneateles, Empire Tech. Assocs.	315-685-5703
NC	Charlotte, Over & Over Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
NC	Raleigh, Philips Comps.	919-782-3334
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
NJ	Englewood Cliff, Ed Glass Assocs.	201-592-0200
PA	Willow Grove, Philips Comps.	215-659-6096
TX	Austin, Philips Comps.	512-331-8828
TX	Houston, Philips Comps.	713-987-0034
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	Milwaukee, Philips Comps.	414-228-7632
PR	Caparra Hgts., M. Anderson Co., Inc.	809-793-6544
Can	Scarborough, Ont., Philips Comps.	416-292-5161

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Scottsdale, Spirit Elctrns.	602-988-1533
CA	Sunnyvale, Hamilton/Avnet	408-743-3355
CO	Englewood, Shelley-Ragon	303-762-0670
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Orlando, TTI, Inc.	407-859-1000
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
IL	Chicago, Nep Elctrns.	312-595-8500
IN	Indianapolis, Marshall Inds.	317-297-0483
MD	Columbia, TTI, Inc.	301-995-1331
MA	Wilmington, Marshall Inds.	508-658-0830
MI	Livonia, Marshall Inds.	313-525-5850
MN	St. Paul, Shelley-Ragon	612-642-2828
NE	Omaha, Scott Elctrns.	402-734-6750
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NC	Raleigh, Hall-Mark	919-872-0712
OH	Independence, TTI, Inc.	216-328-9755
OK	Tulsa, Hamilton/Avnet	918-252-7297
OR	Beaverton, Marshall Inds.	503-644-5050
PA	Norristown, Century Elec. Comp.	215-631-5400
TX	Ft. Worth, TTI, Inc.	817-595-3100
WA	Bellevue, Marshall Inds.	206-747-9100
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Scarborough, Ont., Philips Elctrns.	416-292-5161

MERCER ELECTRONICS, Simpson Electric Co., 853 Dundee Ave., Elgin, IL 60120, Tel: 708-697-2260, TELEX: 72-2416, FAX: 708-697-2272; *Sls. Mgr.:* Ron Barma, Adv. Mgr.; *Dist. Mgr.:* George Oskandy, Sls. Admin. Mgr.

MERCOTAC INC., 6195 Corte del Cedro E, Carlsbad, CA 92009, Tel: 619-431-7723, FAX: 619-431-0905; Empl.: 19; *Sls. Mgr.:* Bruce Enigenburg; *Dist. Mgr.:* Bruce Enigenburg ..... **B•1295**

MERCURY COMPUTER SYSTEMS, 600 Suffolk St, Lowell, MA 01854, Tel: 508-458-3100, FAX: 508-458-9580; FSC No.: 04-2741391; Empl.: 120; *Sls. Mgr.:* Graham V. Smith

MERCURY PLASTICS, A UNIT OF ZERO CORP., See Zero Plastics, A Unit of Zero Corp.

MERECO PRODUCTS DIV., Metachem Resins Corp., 1505 Main St, West Warwick, RI 02893, Tel: 401-822-9300, FAX: 401-822-9311; Empl.: 25; *Sls. Mgr.:* John E. Powell, Jr.

FAX: 213-828-7567

MERET OPTICAL COMMUNICATIONS, INC., An Amoco Co., 1800 Stewart St, Santa Monica, CA 90404-4998, Tel: 213-828-7496; FSC No.: 53071; Empl.: 120; *Sls. Mgr.:* Chris Walters ..... **B•1225**

For all states not listed call Meret Mn. Ofc. 213-828-7496

MERIAM INSTRUMENT, Scott Fetzer, 10920 Madison Ave., Cleveland, OH 44102, Tel: 216-281-1100, FAX: 216-281-0228; Empl.: 85; *Sls. Mgr.:* Russ Arslanian; *Dist. Mgr.:* Russ Arslanian

MERIX CHEMICAL CO., 2234 East 75th St, Chicago, IL 60649, Tel: 312-221-8242; Empl.: 15; *Sls. Mgr.:* E. O. Sonneman; *Dist. Mgr.:* E. O. Sonneman

MERRILL, INC., POB 308, 1316 Sumneytown Pike, Gwynedd Valley, PA 19437, Tel: 215-361-1297; FSC No.: 58624; Empl.: 10; *Sls. Mgr.:* J. Fournier

MERRIMAC INDUSTRIES, 41 Fairfield Pl., West Caldwell, NJ 07006, Tel: 201-575-1300, FAX: 201-575-0531; FSC No.: 12457; Empl.: 150; *Sls. Mgr.:* Tom Cox

J. R. MERRITT CONTROLS, INC., 320 Martin Luther King Dr., Norwalk, CT 06854, Tel: 203-855-9100, 800-333-5762, FAX: 203-855-1038; *Sls. Mgr.:* Earl Atkins ..... **D•1139**

Local Sales Offices & Reps

CA	Laguna Niguel, Simon & Co.	714-495-4583
CA	San Rafael, Bender Sys.	415-472-7033
FL	Lakeland, V-V Assocs., Inc.	813-858-3200
IL	Crestwood, Brisky Assocs., Inc.	708-385-5100
MI	Royal Oaks, J.H. Green Co.	313-543-1200
NY	Jamestown, William R. Arnold, Inc.	716-664-5402
OH	Solon, Black & Coulton, Inc.	216-349-1188
PA	Westchester, Lenape Inds.	215-696-7664
WA	Renton, SAS Fluid Power, Inc.	206-271-5363
Can	Mississauga, Ont., Patlon Inds., Inc.	416-624-5572

MESA POWER SYSTEMS, 2350 Meyers Ave., Escondido, CA 92029, Tel: 619-489-8162, FAX: 619-489-5718; FSC No.: 46937; Empl.: 20; *Sls. Mgr.:* Bob Posten

MESA TECHNOLOGY CORP., 9720 Patuxent Woods Drive, Columbia, MD 21046, Tel: 800-888-0567, FAX: 301-290-9171; Empl.: 106; *Sls. Mgr.:* Howard Parker

MES INDUSTRIES CO., LTD., Fl. No. 93 Lo-Li Rd., Taipei, Tel: 886-2-7363309, TELEX: 20801 MESICO, FAX: 886-2-7364109; Empl.: 25

MESUR-MATIC ELCTRNS., 10 Colonial Rd, Ste. 6, Salem, MA 01970-2294, Tel: 508-745-7000; Empl.: 18; *Sls. Mgr.:* Kosma L. Evangelidis

METALINK CORPORATION, P.O. Box 1329, Chandler, AZ 85244, Tel: 602-926-0797, TELEX: 4998050, FAX: 602-926-1198

METCAL, INC., 1530 O'Brien Dr., Menlo Park, CA 94025, Tel: 415-325-3291, FAX: 415-325-5932; Empl.: 86; *Sls. Mgr.:* Dan Frailey; *Dist. Mgr.:* Dan Frailey

METHODE ELECTRONICS, INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-9600, FAX: 708-867-9130; Empl.: 2000; *Sls. Mgr.:* S. Landeene; *Dist. Mgr.:* Randi Close

METHODE ELECTRONICS, INC., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008, Tel: 708-392-3500, FAX: 708-392-9404; FSC No.: 95354; Empl.: 250; *Sls. Mgr.:* Suzi Landeene; *Dist. Mgr.:* Kathy Lindsey

METRA INSTRUMENTS, INC., 1874 Lundy Ave., San Jose, CA 95131, Tel: 408-432-1110, TELEX: 296698; Empl.: 30

METRAPLEX CORP., 5305 Spectrum Dr., Frederick, MD 21701, Tel: 301-662-8000, TELEX: 697-4248 MPX CORP, FAX: 301-695-8099; Empl.: 105

METRICOR, INC., 18800 - 142nd Ave. NE, Woodinville, WA 98072, Tel: 206-483-5577, FAX: 206-485-2592; Empl.: 50; *Sls. Mgr.:* David W. Cable

METRIC SYSTEMS, 645 Anchors St., Ft. Walton Beach, FL 32548-9990, Tel: 904-244-9600, TELEX: 70-2447; FSC No.: 12339; Empl.: 700

METRIX INSTRUMENT CO., 1711 Townhurst, Houston, TX 77043, Tel: 713-461-2131, TELEX: 77-5486, FAX: 713-461-8223; Empl.: 50; *Sls. Mgr.:* W. B. Brown

METRO CIRCUITS, PJC Technologies, Inc., 205 LaGrange Ave., Rochester, NY 14613, Tel: 716-254-2980, TELEX: 716-254-2980; Empl.: 36; *Sls. Mgr.:* Darlene Gargan

METROLAB INSTRUMENTS SA, 110,Chemin du Pont-du-Centenaire, Geneva, Switzerland CH-1228, Tel: (41-22)794 11 21, TELEX: 41-22-794 11 20

METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477, FAX: 619-755-4752; Empl.: 22

METROPOLE PRODUCTS INC., P. O. Box 309, Stafford, VA 22554, Tel: 703-659-2132, FAX: 703-659-2133; FSC No.: 55908; *Sls. Mgr.:* John DePaola

METROSONICS, INC., Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, TELEX: 853348, FAX: 716-334-2635; FSC No.: 55381; Empl.: 80; *Sls. Mgr.:* R. Branch; *Dist. Mgr.:* S. Macioulis

METRUM INFORMATION STORAGE, P.O. Box 5227, Denver, CO 80217-5227, Tel: 303-773-4581, TELEX: 45793 DVR; Empl.: 1000; *Sls. Mgr.:* C. Miller



FAX: 908-679-3222

METUCHEN CAPACITORS, INC., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, Tel: 908-679-3366, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter ..... **A•1098-1106, 1685-1687; C•1468-1471**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Prods.	205-880-1156
MD	Rockville, C.E. Tech. Elctrns.	301-666-0315
MD	Rockville, Metuchen Capacitors	301-590-0094
MA	Lowell, Underwood Sls.	617-256-8191
MO	Grandview, R. R. Burton Assocs.	816-763-5385
NJ	Brielle, EMC Technlgsts.	908-223-6699
PA	Saegertown, Multi-Phase Comps.	814-763-3640
TX	Dallas, Blackburn Assocs.	214-750-8484

MEXITRONIX (WOMAN OWNED), 2305 Northern Ave., Suite C , Kingman, AZ 86401, Tel: 602-757-9798, FAX: 602-757-8741; Empl.: 4

MEYER WIRE & CABLE CO., Div. of Cole Hersee Co., 1072 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-0817, FAX: 203-281-9648; Empl.: 45; *Sls. Mgr.:* Spencer G. Molloy, VP Sls.

MEYLAN CORPORATION, 543 Valley Rd., Upper Montclair, NJ 07043-1844, Tel: 201-744-6400, FAX: 201-744-1011; Empl.: 8; *Sls. Mgr.:* Stanley Mills

MFE INSTRUMENTS, Stocker & Yale, Inc., 133 Brimbal Ave., PO Box 490, Beverly, MA 01915-0490, Tel: 508-921-9104, 800-472-4633, ESYLNK: 953145, FAX: 508-921-9110; FSC No.: 6640,6685,6625,6660; *Sls. Mgr.:* Dennis A. Doscher; *Dist. Mgr.:* Dennis Doscher ..... **D•1421**

Local Sales Offices & Reps

MA	Natick, Andruss-Peskin Corp.	508-653-3919
NY	Buffalo, Lynn Assocs., Inc.	716-631-0054
OR	Beaverton, Thorson Co. N.W.	503-644-5900
WA	Bellevue, Thorson Co. N.W.	206-455-9180

MF ELCTRNS. CORP., 10 Commerce Dr., New Rochelle, NY 10801, Tel: 914-576-6570, FAX: 914-576-6570; FSC No.: 08111; Empl.: 100; *Sls. Mgr.:* Paul Huron ..... **A•1388-1393**

Local Sales Offices & Reps

AZ	Scottsdale, Haas & Assocs., Inc.	602-998-7195
CA	Irvine, Balzer-Wolf Assocs.	714-261-6877
CA	San Jose, Mac Tron	408-446-8224
AL	Madison, Benchmark Tech. Sls.	205-464-0033
CT	Southington, Orion Group	203-621-8371
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
MA	Peabody, The Orion Group	508-532-6266
MD	Annapolis, Rynone Assocs.	301-263-0794
MN	Edina, Peterson Sls.	612-835-5281
NY	Smithtown, T & K Sls.	516-724-3456
MN	Minneapolis, Ferrian Sls. & Assocs.	612-721-8915
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OR	Beaverton, Core II Mktg.	503-649-0877
OR	Portland, Core II	503-649-0871
PA	Prospect Park, Elf Sls. Co.	215-534-3340
PA	Prospect Park, ELF Sls.	215-534-3340
TX	Austin, Matthews & Assocs.	512-346-2969
TX	Dallas, Matthews & Assocs.	214-248-7881
UT	Salt Lake City, R 2 Mktg. Inc.	801-595-0631
WA	Seattle, Core II Mktg./VMI	206-882-2999

Local Distributors

CA	Burbank, Atwater Elctrns.	818-841-9050
NJ	Bellmawr, Mid Atlantic	609-931-5303
NY	Bohemia, RBD Elec.	516-589-7717
NY	Mt. Vernon, Janesway Elec.	914-699-6710

MFG, Parabam Div., 1130 Watsoncenter Rd., Carson, CA 90745, Tel: 213-549-5044; Empl.: 85

MFI, 12304 Santa Monica Blvd., Ste. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297, FAX: 213-820-6958 ..... **D•1106**

MFM TECHNOLOGY, INC.
An Affiliate of **UNITRODE** Corporation

FAX: 516-467-5176

MFM TECHNOLOGY, INC., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, Tel: 516-467-5151; Empl.: 25 ..... **B•1297**

Local Sales Offices & Reps

AZ	Mesa, Motion Technlgy., Inc.	602-924-0004
MA	Quincy, Lansea Sys.	617-770-1618
IL	Barrington, Design Comps.	312-381-7842
MN	Eden Prairie, M-Tech	612-949-0847
NY	Plainview, Motion Control Sls.	516-756-5656
OH	Broadview Hts., Control Prods. Corp.	216-838-5700
OR	Portland, ControlTek, Inc.	503-641-0876
CA	Alhambra, C. E. Mello Co.	818-282-2000
CA	San Jose, Motion Control-North	408-997-0544

MG ELECTRONICS

FAX: 516-582-3229

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400; Empl.: 14; *Sls. Mgr.:* John Kibbit; *Dist. Mgr.:* Stan Grey ..... **D•1044**

MGR INDUSTRIES INC., 450B Industrial Dr., Ft. Collins, CO 80524, Tel: 303-221-2201, FAX: 303-484-4078; Empl.: 2; *Sls. Mgr.:* Jim Walton; *Dist. Mgr.:* Roger Erickson

MHOTRONICS., INC., 960 Corporate Woods Pkwy., Vernon Hills, IL 60061, Tel: 708-913-9566, FAX: 708-913-9587; Empl.: 45; *Sls. Mgr.:* David McFadden

MICHIGAN MAGNETICS, 203 W. Third St., Vermontville, MI 49096, Tel: 517-726-0590, FAX: 517-726-0078; Empl.: 50; *Sls. Mgr.:* Tom Krul

MICREL SEMICONDUCTOR, 560 Oakmead Parkway, Sunnyvale, CA 94086, Tel: 408-245-2500, FAX: 408-245-4175; FSC No.: 60496; Empl.: 135; *Sls. Mgr.:* Mike O'Neal; *Dist. Mgr.:* Mike O'Neal

MICROAVIONICS CORP., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-957-6904, FAX: 714-957-1614; Empl.: 15; *Sls. Mgr.:* B. H. Corzine

MICROBAR SYSTEMS, INC., 785 Lucerne Drive, Sunnyvale, CA 94086, Tel: 408-720-9300, FAX: 408-773-9475; *Sls. Mgr.:* Alexander London

MICROCAP, INC., A MicroSemi Company, 501 South Andreasen Drive, Escondido, CA 92025, Tel: 619-480-1906, FAX: 619-480-6741; Empl.: 65; *Sls. Mgr.:* Ken Miller, Sls. Mgr.

MICROCHIP TECHNOLOGY INC., 2355 W. Chandler Blvd., Chandler, AZ 85224, Tel: 602-963-7373, FAX: 602-345-3390; Empl.: 1500; *Sls. Mgr.:* Lanny Flessas; *Dist. Mgr.:* Lanny Flessas

MICRO-CIRCUIT ENGRG., See MCE Semiconductor

MICRO-CIRCUITS CO., INC., 10800 Maudlin Rd., New Buffalo, MI 49117, Tel: 616-469-2744, FAX: 616-469-2742 ..... **C•1145**

MICROCOMPATIBLES INC., 301 Prelude Drive, Silver Springs, MD 20901, Tel: 301-593-0683, FAX: 301-593-5151; Empl.: 4; *Sls. Mgr.:* Linda Esterling

MICRO CRYSTAL/DIVISION SMH, 702 West Algonquin Rd., Arlington Heights, IL 60005, Tel: 708-806-1485, FAX: 708-593-5062; *Sls. Mgr.:* William Kaczmarski; *Dist. Mgr.:* William Kaczmarski ..... **A•1395-1398**

Local Sales Offices & Reps

AZ	Scottsdale, E D P & Assoc.	602-991-6119
FL	Pompano Bch., H H P Assocs.	407-740-0320
GA	Tucker, Mackey Smith & Assoc.	404-496-9913
IL	Arlington Heights, Greenslade Sls.	708-593-3450
NH	Nashua, Bell Controls	603-882-6984
OH	Mt. Orab, Benjenn Engrg.	513-444-3175
PA	Glenside, Koebert Assocs.	215-887-2310

MICRO DATA SYSTEMS, P.O. Box 3278, Thomasville, GA 31799, Tel: 912-226-1709, TELEX: 6503406939 MCI CW; Empl.: 5; *Sls. Mgr.:* Sid Davis; *Dist. Mgr.:* Sid Davis

MICRODIMENSIONS, INC., 7345 Production Dr., Mentor, OH 44060, Tel: 216-974-8070, FAX: 216-974-1648; Empl.: 40

MICRODOT, INTERCONNECT SYSTEMS DIVISION, 201 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, FAX: 215-699-5536; FSC No.: 91886; *Sls. Mgr.:* K. A. Neumuller

MICRODRY, INC., 7450 Hwy. 329, Crestwood, Kentucky 40014, Tel: 502-241-8933, FAX: 502-241-8648; Empl.: 16; *Sls. Mgr.:* John Wiedersatz

MICRO ELECTRONIC SYSTEMS, INC., 119 Northrup St., Bridgewater, CT 06752, Tel: 203-350-5004, FAX: 203-350-6966; Empl.: 4; *Sls. Mgr.:* Janine Green, V.P. Sls.

MICRO ELECTRONIC TECHNOLOGIES, 35 South St., Hopkinoon, MA 01748, Tel: 508-435-9057, FAX: 508-435-6481; Empl.: 53; *Sls. Mgr.:* Mike Levangie

MICRO-ETCH PRODUCTS, INC., 94 Dodge Ave., P.O. Box 9712, Stratford, CT 06497, Tel: 203-378-8610, FAX: 203-375-6276; FSC No.: 24846; Empl.: 42; *Sls. Mgr.:* Frank Dichiara; *Dist. Mgr.:* Frank Dichiara

MICROFLECT CO., INC., 3575 25th St. S.E., P.O. Box 12985, Salem, OR 97309-0985, Tel: 503-363-9267, TWX: 510-599-0107, FAX: 503-363-4613; Empl.: 100; *Sls. Mgr.:* John J. Kranitz

MICRO HYBRIDS, INC., 2864 Route 112, Medford, NY 11763, Tel: 516-732-3448, FAX: 516-732-3393; FSC No.: 5962; Empl.: 7; *Sls. Mgr.:* Bruce Richardson

MICRO INDUSTRIES, 691 Greencrest Drive, Westerville, OH 43081, Tel: 614-895-0404, ESYLNK: 759200, FAX: 614-882-6357

MICRO INSTRUMENT COMPANY, 2250 Micro Pl., Escondido, CA 92029, Tel: 619-746-2010, TELEX: 882205 MICROINST ESCD, FAX: 619-746-0433; FSC No.: FSCM 24836; Empl.: 40; *Sls. Mgr.:* C.Marks(East), C. Haas(West)

MICROLAB/FXR, 10 Microlab Rd., Livingston, NJ 07039, Tel: 201-992-7700, FAX: 201-992-0513; FSC No.: 00929; Empl.: 40

MICRO LAMPS, INC., 1530 Hubbard Ave., Batavia, IL 60510-1420, Tel: 708-879-0900; Empl.: 12; *Sls. Mgr.:* Edward R. Beutler

MICROMATH, INC., 2469 E. Fort Union Blvd., Salt Lake City, UT 84121, Tel: 801-943-0290, FAX: 801-943-0299; Empl.: 8

MICROMETALS, 1190 N. Hawk, Anaheim, CA 92807, Tel: 714-630-7420, 800-356-5977, FAX: 714-630-4562; FSC No.: 12856; Empl.: 80; *Sls. Mgr.:* Walt Lewis

MICRO MODE PRODS., 1870 John Towers Ave., El Cajon, CA 92020, Tel: 619-449-3844, TWX: 910-331-1673; FSC No.: 15907; Empl.: 55; *Sls. Mgr.:* V. DeMarco; *Dist. Mgr.:* V. DeMarco

Micro Mo

FAX: 813-821-6220

MICRO MO ELECTRONICS, INC., 742 2nd Ave. S., St. Petersburg, FL 33701, Tel: 813-822-2529, TELEX: 807-982; Empl.: 32; *Sls. Mgr.:* S. J. O'Neil ..... **B•1232, 1298-1301, 1920; D•1140-1141, 2243**

MICRO-MOUNTING DEVICES, 4092 Keith Dr., Campbell, CA 95008, Tel: 408-866-4626; FSC No.: 59058

micronel

FAX: 619-727-4436

MICRONEL U.S., 2142F Industrial Ct., Vista, CA 92083, Tel: 619-727-7400; FSC No.: 61655; Empl.: 10; *Sls. Mgr.:* N. Linko ..... **C•1600, 1646-1649**

MICRO NETWORKS, Unitrode Corporation, 324 Clark St., Worcester, MA 01606, Tel: 508-852-5400, FAX: 508-853-8296; Empl.: 200; *Sls. Mgr.:* Skip Osgood

MICRONICS TECHNOLOGY INC., 7 Alexander Place, Glen Cove, NY 11542, Tel: 516-759-5600, FAX: 516-759-5603; *Sls. Mgr.:* Robert Herrmann, V.P. Oper. .... **A•1399**

Local Sales Offices & Reps

CA	Palo Alto, Microwave Mktg. Assoc.	415-941-9430
CA	Westlake Vl, Westtech Microwave, Inc.	818-991-9219
FL	Melbourne Beach, EDSI Sls.	407-952-1240
MD	Laurel, CSDS, Inc.	301-953-7884
NY	Melville, R.F. Elctrn. Sls.	516-420-8890
MA	Wayland, High Tech Sls.	508-653-3838
WA	Iffaquah, Seaport Tech. Sls.	206-391-6714

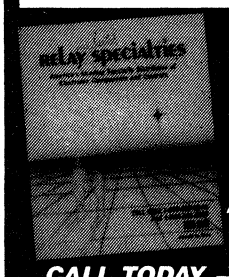
MICRON INDUSTRIES, 4250 Madison St., Hillside, IL 60162, Tel: 708-547-0900, FAX: 708-547-0998; FSC No.: 30882; Empl.: 115; *Sls. Mgr.:* Michael Kitun; *Dist. Mgr.:* Mike Kitun

MICRO-NOW INSTR. CO., INC., 8260 N. Elmwood St., P. O. Box 1488, Skokie, IL 60076, Tel: 708-677-4700, TELEX: RCA 297214-MICRO-UR, FAX: 708-677-0394; FSC No.: 33288; Empl.: 25; *Sls. Mgr.:* C. Arnow

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instr.	205-830-9224
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CA	Mountain View, Mark V Assoc.	415-964-6275

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GA	Norcross, W. A. Brown Instrs., Inc.	404-449-7160
NM	Albuquerque, IMEC	505-275-0936
NY	Kings Park, USTM Tech. Mktg.	516-724-1542
WA	Seattle, Datacom	206-285-2525

MICRON TECHNOLOGY, INC., 2805 East Columbia Rd., Boise, ID 83706, Tel: 208-386-3900, FAX: 208-389-4617; Empl.: approx. 3,100; *Sls. Mgr.:* Jim Garrett

MICRO-OHM CORP., 1088 Hamilton Rd., Duarte, CA 91010, Tel: 818-3575377, FAX: 818-358-6478; FSC No.: 20940; Empl.: 109; *Sls. Mgr.:* Chas. Schwab; *Dist. Mgr.:* Chas. Schwab ..... **A•1947**

Local Sales Offices & Reps

CA	San Juan Capistrano, Craven & Assocs.	714-240-7242
IL	Lake Bluff, R & R Mktg. Assocs.	312-295-6600
MN	Maple Grove, Elctrn. Prods. For Ind.	612-784-5554
TN	Nashville, Strategic Mktg. Inc.	615-883-7882

Local Distributors

CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Huntington Bch., Wyle Labs	714-891-8008
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Jose, Rose Elctrns.	408-943-0255
CO	Englewood, Arrow Elctrns.	303-790-4444
MN	Minneapolis, Electronic Ctr.	612-371-5200
NH	Hampstead, Astrum Elctrns.	603-329-5656
NY	New Rochelle, Derf Elctrns.	914-235-4600
NY	Oceanside, Tritech	516-678-6222
PA	McKean, Advacom	814-476-7774
TX	Ft. Worth, Industrial Elect.	817-731-7321
UT	Provo, Central Utah Elctrns. Supp.	801-373-7522
EXP	Basle, Switzerland, Siabalco W. Siegrist & Co. AG	845-962851
EXP	Huntingdale, Australia, Stewart Elctrn. Comps. Pty.	790-AA36908

MICROPAC INDS., INC., 905 E. Walnut St., Garland, TX 75040, Tel: 214-272-3571, FAX: 214-494-2281; Empl.: 200; *Sls. Mgr.:* Richard Schlueter

MICRO PALM COMPUTERS, INC., 13773-500-ICOT Blvd., Clearwater, FL 34620, Tel: 813-530-0128, FAX: 813-530-0738

MICROPHASE, 587 Connecticut Ave., Norwalk, CT 06856, Tel: 203-866-8000, FAX: 203-866-6727; Empl.: 230; *Sls. Mgr.:* F. S. Parin

MICROPLEX, INC., 1977 State College Blvd., Anaheim, CA 92806, Tel: 714-634-1535, FAX: 714-634-8375; Empl.: 30

MICROPLOT SYSTEMS, 1897 Red Fern Dr., Columbus, OH 43229, Tel: 614-882-4786, FAX: 614-882-3399; Empl.: 5; *Sls. Mgr.:* Steve Bean

MICRO PNEUMATIC LOGIC, INC., 2890 N. W. 62nd Street, Fort Lauderdale, FL 33309-1786, Tel: 305-973-6166, TELEX: 522316, FAX: 305-973-6339; Empl.: 100; *Sls. Mgr.:* Brian Irving

MICRO POWER INTL., INC., 10770 Black Mountain Rd. Ste. 248, San Diego, CA 92126, Tel: 619-271-0831, 619-271-5942; Empl.: 58

MICRO POWER SYS. INC., 3100 Alfred St., Santa Clara, CA 95056, Tel: 408-727-5350, TWX: 910-338-0154; FSC No.: 54186; Empl.: 140; *Sls. Mgr.:* Tom Hardy; *Dist. Mgr.:* Chuck Sweet

MICRO-PRODUCTS ENGINEERING CO., 230 Ridgewood Ave., Newark, NJ 07108, Tel: 201-824-8467, FAX: 201-824-5668; Empl.: 100; *Sls. Mgr.:* Gerald Muller

MICRO QUALITY SEMICONDUCTOR, INC., Microsemi Corp., 1000 N. Shiloh Rd., Garland, TX 75042, Tel: 214-272-7811, FAX: 214-487-0406; Empl.: 70; *Sls. Mgr.:* Bill Vandagriff; *Dist. Mgr.:* Bill Vandagriff

MICROSEMI CORP., 2830 S. Fairview St., Santa Ana, CA 92704, Tel: 714-979-8220, TELEX: 4720306, FAX: 714-557-5989; FSC No.: 14552; Empl.: 1200; *Sls. Mgr.:* Robert Shultz; *Dist. Mgr.:* G. Avila

MICROSEMI CORP. COLORADO, Microsemi Corp., 800 Hoyt St., Broomfield, CO 80020, Tel: 303-469-2161, FAX: 303-466-3775; Empl.: 140; *Sls. Mgr.:* Robert H. Werner; *Dist. Mgr.:* George Avila

MICROSEMI CORP. - SCOTTSDALE, Microsemi Corporation, 8700 E. Thomas Rd., P.O. Box 1390, Scottsdale, AZ 85252, Tel: 602-941-6300, TELEX: 4995412 MICROAZ, FAX: 602-947-1503; FSC No.: 860434040; Empl.: 300; *Sls. Mgr.:* Dean Foster (acting); *Dist. Mgr.:* George Avila

MICROSIGNALS INC., 38-42 9th St., L.I.C., NY 11101, Tel: 718-937-7955, 718-937-0391, 800-648-2252, FAX: 718-729-9140; Empl.: 40; *Sls. Mgr.:* Mr. Greg Villafana

MICROSONICS INCORPORATED

FAX: 617-337-4208

MICROSONICS, INC., 60 Winter St., Weymouth, MA 02188, Tel: 617-337-4200; FSC No.: 11869; Empl.: 120; *Sls. Mgr.:* John Hieber ..... **A•1401**

MICROSTAR LABORATORIES, 2863 152nd Ave. N.E., Redmond, WA 98052, Tel: 206-881-4286, FAX: 206-881-5494; Empl.: 16; *Sls. Mgr.:* Debbie Keefe; *Dist. Mgr.:* Linda Meza

MICRO SWITCH
a Honeywell Division

FAX: 815-235-5574

MICRO SWITCH, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, Tel: 815-235-6600, TELEX: 257499, TWX: 910-642-0922; Empl.: 3000; *Dist. Mgr.:* R. A. Garner ..... **B•1320-1321, 1738-1743, 1916-1919**

Local Sales Offices & Reps

CA	Orange	714-953-4875
CA	San Jose	408-433-3008
CO	Englewood	303-792-1632
CT	Glastonbury	203-659-6472
GA	Atlanta	404-248-2565
IL	Bensenville	312-860-3968
MA	Newton	617-969-0265
MI	Southfield	313-424-3569
MN	Minneapolis	612-830-3516
MO	St. Louis	314-569-7620
NJ	Westfield	201-233-9200
NY	Rochester	716-272-4333
NC	Charlotte	704-362-6948
OH	Brooklyn Heights	216-459-6075
OH	Dayton	513-237-4075
PA	Valley Forge	215-666-8340
TX	Dallas	214-701-2876
TX	Houston	713-780-6651
WA	Bellevue	206-453-7591
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Can	Edmonton	403-483-4727
Can	Ottawa	613-224-3822
Can	Scarsdale	416-293-8111
Can	Vancouver	604-430-3100
Can	Winnepeg	204-783-4545

MICRO/SYS, 1011 Grand Central Ave., Glendale, CA 91201-3010, Tel: 818-244-4600, FAX: 818-244-4246

MICRO SYSTEMS ENGINEERING, INC., 6024 S.W. Jean Rd., Lake Oswego, OR 97035, Tel: 503-635-4016, TELEX: 151-538, FAX: 503-635-9610; FSC No.: 75800; Empl.: 200; *Sls. Mgr.:* Maury Reiter

MICROTECH, 1420 Conchester Hwy., Boothwyn, PA 19061, Tel: 215-459-3566, FAX: 215-358-4827; Empl.: 22; *Sls. Mgr.:* H. Carter

MICRO TECHNICAL INDUSTRIES, 23132 La Cadena Dr. Ste. E, Laguna Hills, CA 92653, Tel: 714-855-4326, TELEX: 371-9688, FAX: 714-855-9545; Empl.: 20; *Sls. Mgr.:* Joe Duarte

MICRO TECHNOLOGY INC., NS6 W13365 Silver Spring Dr., Menomonee Falls, WI 53051, Tel: 414-783-6080, FAX: 414-783-4959; Empl.: 210

MICROTEC RESEARCH, INC., 2350 Mission College Blvd., Santa Clara, CA 95054, Tel: 408-980-1300, FAX: 408-982-8266; Empl.: 100; *Sls. Mgr.:* Derek Taylor; *Dist. Mgr.:* Derek Taylor

MICROTEK INTERNATIONAL/DEV. SYS. DIV., 3300 N.W. 211th Terrace, Hillsboro, OR 97124, Tel: 503-645-7333, FAX: 503-629-8460; Empl.: 120; *Sls. Mgr.:* Chris Bednarek

MICROTOUCH SYSTEMS, INC., 55 Jonspin Rd., Wilmington, MA 01887, Tel: 508-694-9900, TELEX: 530264, FAX: 508-694-9980; FSC No.: 935-0133; Empl.: 100; *Sls. Mgr.:* William Keller

FAX: 516-561-1117

MICROTRAN CO. INC., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, Tel: 516-561-6050; FSC No.: 00348; Empl.: 75; *Sls. Mgr.:* W. Benscher ..... **A•1212, 2130, 2278-2298**

Local Sales Offices & Reps

AZ	Scottsdale, F. Schoeffler	602-948-1004
CA	San Jose, Kottmeier Assocs.	408-371-8700
CA	Torrance, Universal Comp. Co.	213-783-0220
CO	Englewood, Omega, Ltd.	303-762-1921
FL	Winter Pk., HPP Assoc. Inc.	407-740-0320
IL	Wheaton, CS Tech. Sls.	708-653-8126
IN	Fishers, R & D Elctrn. Sls.	317-849-2026
IA	Marion, AEM, Inc.	319-377-1129
KS	Lenexa, AEM, Inc.	913-888-0022
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Wellesley, Newscott Co.	617-235-6868
MN	Minnneapolis, RK Sales	612-571-1001
MO	St. Louis, AEM, Inc.	314-298-9900
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NM	Albuquerque, C.T. Carlberg & Assocs.	505-899-2155
NY	Marcellus, Mullahy-Welch Sls.	315-673-1009
NY	Rochester, J.G. Welch Assocs.	716-244-1100
NC	Greensboro, Arthur, Harris & Assoc.	919-275-3030
OH	Cleveland, J.O. Olsen Co.	216-838-0510
OH	Goshen, J.O. Olsen Co.	513-722-3320
PA	Pittsburgh, J.O. Olsen Co.	412-381-4254
PA	Wynnewood, Metz-Benham Assoc.	215-896-7300
TX	Houston, Spectra Sls. Corp.	713-270-8212
TX	Richardson, Spectra Sls. Corp.	214-234-3600
VA	Lynchburg, Burgin-Kreh Assocs.	804-239-2626
Can	Montreal, Quebec, Hans Brieger	514-486-5869

Local Distributors

AL	Birmingham, MG Elctrns. & Equip.	205-328-4525
CA	Milpitas, Sierra West Elctrns.	408-945-1050
CA	Oakland, Brill Elctrns.	415-834-5888
CA	San Diego, Kent Electronics	619-471-9561
CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Torrance, Kent Elctrns.	213-320-2700
CO	Englewood, Shelley/Ragon Inc.	303-762-0670
FL	Largo, Elctrn. Precepts of Florida	813-544-3636
FL	Pompano Beach, Peerless Radio Corp.	800-327-4993
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
MA	Hingham, Sager Elec. Supp.	617-749-6700
MN	Minneapolis, Bergquist	612-835-2322
NJ	Kenilworth, Federated Elctrns.	201-272-0505
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Summit Distrs.	716-334-8110
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Dayton, J.A. Becker Co.	513-226-1341
PA	McKeesport, Barno Radio Co.	412-751-5971
PA	Philadelphia, Shap Elctrns.	215-969-3300
TX	Austin, Kent Elctrns.	512-834-1900
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Lenert Co.	713-225-1465
TX	Richardson, Kent Elctrns.	214-669-2600
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	New Berlin, Classic Comp.	414-786-5300

MICROVISION CORP., 591 W. Hamilton Ave. Ste. 250, Campbell, CA 95008, Tel: 408-374-3158, FAX: 408-374-9394; Empl.: 15; *Sls. Mgr.:* Les Peterson

MICROWAVE APPLICATIONS GROUP, 3030 Industrial Pkwy., Santa Maria, CA 93455, Tel: 805-928-5711, TWX: 910-351-5808, FAX: 805-925-5903; FSC No.: 26357; Empl.: 63; *Sls. Mgr.:* D. W. Prigge

MICROWAVE DESIGN SVCS., INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234, FAX: 904-664-6789

MICROWAVE DEVELOPMENT LABORATORIES, 10 Michigan Dr., Natick, MA 01760, Tel: 508-655-0060, TWX: 710-386-6850, FAX: 508-655-6972; Empl.: 180; *Sls. Mgr.:* R. Tucker

MICROWAVE DEVICE TECH., 1 Powers St., Lawrence, MA 01843, Tel: 508-688-6000, FAX: 508-688-6220; Empl.: 11; *Sls. Mgr.:* Murthy S. Ayyagari

MICROWAVE FILTER COMPANY, INC.

FAX: 315-463-1467

MICROWAVE FILTER INC., 6743 Kinne St., East Syracuse, NY 13057-0486, Tel: 315-437-3953, 800-448-1666, TELEX: 249-613; FSC No.: 27834; Empl.: 95; *Sls. Mgr.:* E. Bostick, Sls. & Mktg. ..... **A•1688-1695**

Local Sales Offices & Reps

MD	Laurel, CSDS, Inc.	301-490-3800
CA	Mtn. View, Pennisula Tech. Sls.	415-968-3636

Local Distributors

AZ	Mesa, Antenna Techlg. Corp.	602-898-7667
CA	Campbell, Signal Sources	408-866-0600
CA	Torrance, Western CATV	213-539-8030
CO	Englewood, Midwest CATV	303-799-4343
FL	Boca Raton, Passive Dvcs., Inc.	407-998-0600
FL	Miami, Gendra Intl.	305-372-8845
FL	Ocala, Broadcasters Gen. Store	904-622-9058
FL	Panama City, Bay Elctrns. Supp.	904-785-7258
GA	Lawrenceville, John Weeks Entprs.	404-963-7870
IL	Skokie, Anixter Bros.	708-677-2600
IN	Richmond, Allied Broadcast Equip.	317-962-8596
KY	Highland Heights, Midwest Comms. Corp.	606-781-2200
LA	Marnou, Satellite Earth Stas.	318-468-2203
MS	Raymond, Broadcast Equip. Engrg. Sls.	601-857-8578
NE	Dakota City, ATV Research, Inc.	402-987-3771
NE	Omaha, Radio Equip. Co.	404-341-7700
NH	Bow, Earth Terminal, Inc.	603-224-5166
NJ	Union, Avanti Elctrns.	201-964-0333
NC	Pineville, S.C.M.S., Inc.	704-889-4508
PA	Horsham, Toner Cable	215-675-2053
PA	Hummelstown, Winemiller Comms.	717-566-9591
PA	Willow Grove, NCS Inds.	215-657-4690
TX	Bedford, Spectrum Megahertz	817-267-2288
UT	Salt Lake City, RIA Corp.	801-486-8822
VA	Charlottesville, Hall Elctrncs.	804-974-6466
WA	Edmonds, Glade Comms.	206-771-6891
WI	Plymouth, Hi-Tech.	414-892-6210
Can	Burnaby, B.C., Channel One Video Corp.	604-421-2288
Can	Calgary, Alberta, AVR Comms. Ltd.	403-251-0707
Can	Lavel, Que., Incospec Elctrns.	514-686-0033
Can	Markham, Ont., Cabletel Comms.	416-475-1030
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Montreal, Que., Comega Technlgs.	514-355-3105
Can	St. Leonard, Que., Trispec Comms.	514-328-2025

MICROWAVE SOLUTIONS, INC., 3200 Highland Ave., Ste 3A, National City, CA 91950, Tel: 619-474-6906, FAX: 619-474-7003; FSC No.: 65151; Empl.: 12; *Sls. Mgr.:* Edward M. Teyssier

MICROWAY INC. RESEARCH PARK, Research Park, P.O. Box 79, Kingston, MA 02364, Tel: 508-746-7341, FAX: 508-746-4678; Empl.: 49; *Sls. Mgr.:* Donald Greenbaum; *Dist. Mgr.:* Maryann Strassel

MIDAMERICA DESIGN SERVICE, Spirit of America Corp., 10206 Lima Rd., Fort Wayne, IN 46818, Tel: 219-489-2511, FAX: 219-489-2295; Empl.: 350

MIDCOM, INC., 121 Airport Dr., Watertown, SD 57201, Tel: 605-886-4385, FAX: 605-886-4486; FSC No.: 0GP22; Empl.: 300; *Sls. Mgr.:* Dean Ward ..... **A•2300-2305**

Local Sales Offices & Reps

AL	Huntsville, Twentieth Century Mktg.	205-772-9999
CA	Long Beach, Solutech	213-596-5208
CA	San Diego, Pro Sls.	619-571-1133
CA	San Jose, Veer Mktg.	408-432-1818
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
GA	Norcross, Twentieth Century Mktg.	404-446-1999
IL	Downers Grove, Richmar Elctrns. Corp.	312-968-0118
IN	Indianapolis, Richmar Elctrns. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3030
MN	N. Mankato, E.I. Sls.	507-345-5786
NH	Nashua, Bell Controls	603-882-6984
NJ	Medford, Champion Elctrn. Sls. Co.	609-983-0932
NC	Cary, Twentieth Century Mktg.	919-481-3370
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
TX	Round Rock, Richmar Elctrns. Corp.	512-255-2551
WI	Butler, Richmar Elctrns. Corp.	414-781-1730
Can	Gloucester, Ont., True North Technlg. Ltd.	613-837-2553
Can	Rexdale, Ont., True North Technlg. Ltd.	416-744-2233

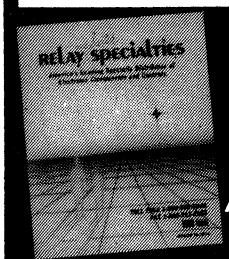
MIDDLEBERG CORPORATION/MIDDCO CONNECTORS, 95 Albany Turnpike, Canton, CT 06019, Tel: 203-693-8361, FAX: 203-693-6403; Empl.: 20; *Sls. Mgr.:* Marty Townsend

MID-EASTERN INDUSTRIES, Technology Dynamics Inc., 100 School Street, Bergenfield, NJ 07621-2915, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 06179; Empl.: 15; *Sls. Mgr.:* Daniel Ellenback ..... **D•1896-1899**

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FL	Land O' Lakes, AJ'S Power Source Inc.	813-996-2583
IL	Des Plains, Marsland Assocs., Inc.	312-298-2620
IN	Indianapolis, Marsland Assocs., Inc.	317-293-5437
IA	Marion, Marsland Assocs., Inc.	319-373-0566
MN	Minneapolis, Marsland Assocs., Inc.	612-545-4481
MO	St. Louis, Marsland Assocs., Inc.	314-991-1399
NM	Albuquerque, Westahl Assocs.	505-881-0995
NY	Huntington, C.R. Mayer Co.	516-692-4221
WA	Seattle, Eicher-Richards Co.	206-LA3-7888
WI	New Berlin, Marsland	414-786-6611

MIDGET LOUVER, 800 Main Ave., Norwalk, CT 06851, Tel: 203-866-2342; Empl.: 10; *Sls. Mgr.:* Helen Monroe; *Dist. Mgr.:* Helen Monroe

MIDLAND-ROSS CORP., NEL UNIT, See NEL Frequency Controls, Inc.

Midtex Relays, Inc.

FAX: 915-772-1116

MIDTEX RELAYS, INC., 9B2 Butterfield Trail, El Paso, TX 79906, Tel: 915-772-1061, 1-800-MIDTEX1, TWX: 910-240-3407, ESYLNK: 62752541; Empl.: 275; *Sls. Mgr.:* Craig Law; *Dist. Mgr.:* Bob Walasiak ..... **B•1546-1549**

Local Sales Offices & Reps

AL	Huntsville, Twentieth Century Mktg.	205-772-9999
AZ	Phoenix, More Sls.	602-788-9181
CA	Los Altos, J.W. Wilholt	415-961-3660
CA	Tustin, Schoenbachler-Dobson	714-544-1888
CO	Longmont, Reliance Sls.	303-443-5660
FL	Orlando, Richmar Elctrns.	407-352-3755
GA	Norcross, Twentieth Century Mktg.	404-446-1999
IL	Downers Grove, Richmar Elctrns.	708-968-0118
IN	Indianapolis, Richmar Elctrns.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
KS	Overland Park, M.I.N.K. Assocs.	913-341-3309
KS	Wichita, M.I.N.K. Assocs., Inc	316-838-0190

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MO	Bridgeton, M.I.N.K. Sls.	314-291-5454
NH	Nashua, Bell Controls	603-882-6984
NJ	Medford, Champion Elctrns.	609-983-0932
NM	Albuquerque, More Sls.	505-265-6265
NY	Rochester, Lamb Comps.	716-328-6350
NC	Raleigh, Twentieth Century Mktg.	919-790-9383
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OK	Tulsa, D.J. Sls.	918-663-8155
OR	Portland, Caruso Assocs.	503-246-5439
TX	Austin, D.J. Sls.	512-258-3002
TX	Dallas, DJ Sls.	214-783-8876
WA	Bellevue, Caruso Inc.	206-455-8811
Can	Ontario, Haltronics Ltd.	416-844-2121

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Control Design Supp.	602-829-7981
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Bay Area, Hall-Mark	408-432-0900
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Orange County, Hall-Mark	714-669-4100
CA	San Carlos, Control Design Supp.	415-592-4806
CO	Santa Monica, Master Dists.	213-452-1229
CO	Denver, Integrated Elctrns.	303-292-5537
CT	Wallingford, Mid State Elctrns.	203-265-9900
FL	Altamonte Springs, Control Design	305-788-3220
FL	Ft. Lauderdale, Hall-Mark	305-971-9280
GA	Stone Mtn., Control Design	404-979-3500
IL	Chicago, Hall-Mark	312-860-3800
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Schaumburg, Control Design	312-307-8900
IN	Indianapolis, Control Design	317-788-4559
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Kansas City, Control Design	913-362-4248
KY	Louisville, Newark	502-423-0280
LA	Shreveport, Indl. Elec. Supp.	318-222-9459
MD	Columbia, Hall-Mark	301-988-9800
MA	Boston, Hall-Mark	617-667-0902
MA	Newton, Green-Shaw Inc.	617-969-8900
MA	Woburn, Control Design Supp.	617-932-9404
MI	Oak Pk., Newark	313-967-0600
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Control Design	612-721-1628
MN	Minneapolis, Hall-Mark	612-941-2600
MS	Jackson, Newark	601-956-3834
MO	St. Louis, Control Design Supp.	314-426-3150
NE	Omaha, Newark	402-392-1221
NV	Las Vegas, Newark	702-796-5090
NH	Nashua, Newark	603-888-5790
NY	Buffalo, Genesse Indl.	716-873-9661
NY	Long Island, Hall-Mark	516-737-0600
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Paterson, Feldman Bros.	201-742-7329
NY	Rochester, Masline	716-546-5373
NY	Woodside, Switches Unltd.	718-478-5000
NC	Charlotte, Control Design	704-588-4410
NC	Raleigh, Hall-Mark	919-872-0712
OH	Cinicinnati, Schuster Elec.	513-489-1400
OH	Cleveland, CAM RPC Elctrns.	216-461-4700
OK	Tulsa, Hall-Mark	918-251-1108
OR	Portland, Integrated Elctrns.	503-641-1690
PA	Malvern, Control Design Supp.	215-296-0150
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Hall-Mark	609-235-1900
PA	Pittsburg, CMD	412-678-6020
SC	Greenville, Newark	803-288-9610
TN	Memphis, Newark	901-365-8060
TX	Dallas, Control Design Supp.	214-358-1441
TX	Dallas, Force-Heiland	214-247-9955
TX	Dallas, Hall-Mark	214-553-4300
TX	El Paso, Midtex (Export)	915-772-1061
TX	Houston, Hall-Mark	713-781-6100
UT	Salt LAke City, Hall-Mark	801-972-1008
VA	Falls Church, Newark	703-522-0880
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WV	Dunbar, Newark	304-768-6872
WI	Milwaukee, Marsh Elctrns.	414-475-6000
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MIDWEST MICROWAVE, 6564 South State Rd., Saline, MI 48176-9569, Tel: 313-429-4773, 800-521-4410, FAX: 313-429-1415; FSC No.: 34078; Empl.: 180; *Sls. Mgr.:* Doug Hartje, Dir. Sls. & Mktg.

MIKRON INSTR., 445 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-7330, TELEX: 361870, FAX: 201-891-1205; Empl.: 60; *Sls. Mgr.:* John Merchant

MIL-COMM DISTRIBUTORS, INC., 9400 Lurline Ave. 6C, Chatsworth, CA 91311, Tel: 818-998-3111

MIL ELECTRONICS, INC., 106 Perimeter Rd., Nashua, NH 03036, Tel: 603-882-3200, FAX: 603-881-8661; FSC No.: 07862; Empl.: 40

MILES PLATTS INC., 901 Touhy Ave., Elk Grove Village, IL 60007, Tel: 1-708-364-0363, FAX: 708-364-0614; Empl.: 7; *Sls. Mgr.:* J. L. Packwood

MILFORD RIVET & MACH., 857 Bridgeport Ave., Milford, CT 06460, Tel: 203-878-4631, TELEX: 964363, TWX: 710-462-0538, FAX: 203-878-5071; Empl.: 200

JAMES MILLEN ELCTRNS., Caywood Elec. Inc., 87 Belmont St., No. Andover, MA 01845, Tel: 508-475-7831, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* R. Jannini

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91731, Tel: 818-444-4555, TWX: 910-587-3438, FAX: 818-443-3267; FSC No.: 91345; Empl.: 200; *Sls. Mgr.:* P. J. Wener, V.P. Membrane

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611, FAX: 213-264-3203; Empl.: 45

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964-0337, Tel: 207-864-3344, 800-227-1415, FAX: 207-864-3344; Empl.: 15

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810-0950, Tel: 203-743-4447, TELEX: 643-711; *Sls. Mgr.:* Mrs. Fran Bodnar

MILLIFLECT, 37444 Sycamore St., Bldg. A, Newark, CA 94560, Tel: 415-791-5188, TELEX: 466465, FAX: 415-791-5237; FSC No.: 52426; Empl.: 39; *Sls. Mgr.:* Don Koijane; *Dist. Mgr.:* Alex Nilva

MILLIVAC INSTRUMENTS, INC., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300, FAX: 518-356-5161; FSC No.: 85711; Empl.: 30; *Sls. Mgr.:* Jan B. Metzger ..... **D•1294**

Local Sales Offices & Reps

CA	San Diego, Advanced Prods. Sls.	619-530-0200
CA	Westlake Vl., Advanced Prods. Sls.	818-706-8351
MD	Laurel, CSDS Inc.	301-490-3800
MA	Needham, Addelco Corp.	617-444-4754
MA	Needham, Addelco, Co.	617-444-4754
GA	Atlanta, Saber Assocs.	800-327-0853
NY	Fayetteville, Martin P. Andrews	315-637-5291
AL	Huntsville, Saber Assocs.	800-327-0853
FL	Ft. Lauderdale, Saber Assocs.	800-327-0853
TX	Houston, Scientific Sls.	713-645-6218
TX	Richardson, Sci. Sls.	214-231-6541
VA	Fairfax, CSDS Inc.	703-385-0139
Can	Downsview, Ont., Tradeport Elctrns. Grp.	416-736-0866

MILL-MAX MANUFACTURING CORP., P.O. Box 300, Oyster Bay, NY 11771-0300, Tel: 516-922-6000, FAX: 516-922-9253; FSC No.: 3N087; Empl.: 200; *Sls. Mgr.:* Richard M. Weiner ..... **C•1473**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mfr's Agt.	800-633-2920
AR	Mabelvale, Erickson Sls., Inc.	501-455-0618
CA	Campbell, Patrick Conahan Assocs.	408-559-2866
CA	Dana Point, Patrick Conahan Assocs.	714-493-9822
CO	Westminister, Straube Assocs., Inc.	303-426-0890
AZ	Scottsdale, B. Breedlove	602-483-1943
FL	Boca Raton, Tech Sls. Specialists	407-391-3718
GA	Roswell, Elctrn. Mfr's Agt.	800-633-2920
IL	Elk Grove Village, Tristar Grp., Inc.	708-593-0200
IN	Indianapolis, M & L Elctrn. Sls., Inc.	317-359-4742
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MA	Scituate, Olsen Tech. Sls.	617-545-5101
MN	St. Paul, Johnson Co.	612-641-1878
NH	Nashua, Olsen Tech. Sls.	603-883-2760
NY	Bohemia, JSA Sls.	516-244-2584
NC	Raleigh, Elctrn. Mfr's Agt.	919-846-6888
OH	Kettering, Catalyst Sls. Co.	513-429-6958
OR	Milwaukie, Comtec	503-654-6626
PA	Doylestown, G. A. Recentio Assocs.	215-348-7577
PA	Pittsburgh, Catalyst Sls. Co.	412-826-3434
TX	Dallas, Erickson Sls., Inc.	214-739-5833
UT	Salt Lake City, Hendrickson Sls.	801-467-1445
WA	Bellevue, Comtec	206-453-1188
WI	Menomonee Falls, Tristar Grp., Inc.	414-628-3583
Can	Gloucester, Ont., True North Technlg., Ltd.	613-837-2553
Can	Rexdale, Ontario, True North Technlg. Ltd.	416-744-2233

FAX: 213-430-8309

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 213-598-2454; FSC No.: 34238; Empl.: 50; *Sls. Mgr.:* S. Kistner; *Dist. Mgr.:* C. Brown ..... **A•1949**

Local Sales Offices & Reps

CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Sacramento, Mills Resistor Co.	916-422-5461
CT	Rocky Hill, Jim McPhail	203-721-1802
MA	Waltham, Dynasel Assocs.	617-890-6777
OR	Gaston, SPS Elctrns.	206-323-4140
PA	Montgomeryville, Quick Response Tech. Sls.	215-362-9225
TX	Houston, Ev Smith Co.	713-649-5756
WA	Seattle, SPS Elctrns.	206-323-4140

Local Distributors

FL	Ft. Lauderdale, Jaro Elctrns.	800-327-5551
PA	Harrisburg, ADTECH	717-939-8337
PA	McKean, Advacom	814-476-7774

MILROSS CONTROLS, INC., 511 Second St. Pike, Southampton, PA 18966, Tel: 215-355-0200, TWX: 510-667-1702, FAX: 215-355-6326; FSC No.: 07047; Empl.: 100; *Sls. Mgr.:* Scott R. Tate

MILTOPE BUSINESS PRODUCTS, Miltope Grp., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, 516-756-7650, TWX: 510-221-1803, FAX: 516-756-7606; Empl.: 650

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; Empl.: 750; *Sls. Mgr.:* Frederick S. Korb; *Dist. Mgr.:* William Jennings

MILWAUKEE ELECTRONICS, 7817 W. Clinton Ave., Milwaukee, WI 53223, Tel: 414-358-4000, FAX: 414-358-4001; FSC No.: 98664; Empl.: 100-150; *Sls. Mgr.:* James Scholler

FAX: 414-271-9876

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807;15109; Empl.: 75; *Sls. Mgr.:* John Dorsha; *Dist. Mgr.:* John Dorsha ..... **A•1950-1954**

Local Sales Offices & Reps

CA	San Carlos, Electro Pacific	415-441-5541
IL	Willow Brook, PVA Corp.	708-655-3355
NC	Kernersville, Heritage Elctrl. Sls.	919-996-4484
MA	Stoughton, EECS-Mel Botsian	617-344-5139
SC	Greer, Heritage Elctrl. Sls.	803-292-1723
NY	Rochester, Gislason Sls.	716-328-7400
NY	Whitestone, M. H. Lynn co.	718-352-9233
OH	Westlake, Assocd. Elctrl. Comps.	216-835-9960

MIMIC, INC., P. O. Box 705, Islington, MA 02090-0705, Tel: 617-329-9593; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINC INCORPORATED, 6755 Earl Dr., Colorado Springs, CO 80918, Tel: 719-590-1155, FAX: 719-590-7330; *Sls. Mgr.:* Mark S. A. Smith

MINCO PRODUCTS, 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, FAX: 612-571-0927; FSC No.: 09359; Empl.: 475; *Sls. Mgr.:* J. Anderson

MIN-E-CON, 3160 Pullman, Costa Mesa, CA 92626, Tel: 714-434-7312, TWX: 910-595-1144; FSC No.: 54455

MINELCO INC. | Talley™ Industries

FAX: 203-283-6527

MINELCO INC. - A TALLEY IND., 135 S. Main St., Thomaston, CT 06787-0459, Tel: 203-283-8261; FSC No.: 07479; Empl.: 70; *Sls. Mgr.:* James A. Myles ... **B•1178**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, R. W. Riedel & Co.	213-283-7694
CA	Anaheim, M.W. Riedel & Co.	213-283-7694
CO	Centerville, West Inc.	303-477-1134
CO	Denver, West Inc.	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Longwood, Delmac	407-831-0040
GA	Atlanta, L & D, Inc.	404-395-7079
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
KS	Wichita, Magna Eng. Sls. Co.	316-744-0851
MD	North East, Magna Eng. Sls. Co.	301-398-4215
MA	Burlington, F.J.S. Assocs.	617-273-5959
MO	St. Louis, Magna Eng. Sls. Co. Inc.	314-878-4441
MO	St. Louis, Magna Eng. Sls. Co. Inc.	314-849-6590
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NY	New Hyde Park, Comp-Tech Sls.	516-593-2628
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Dayton, Electro Mktg. Grp.	513-890-8322
OR	Portland, Caruso & Assocs.	503-246-5439
TX	Roanoke, CMR	817-379-6540
WA	Bellevue, Caruso & Co.	206-455-8811
Can	Rexdale, Ont., Myelco, Inc.	416-674-1636

MINGSTON ELECTRONICS, INC., MEC Inc.(Taiwan), 14145 Proctor Ave. Unit 8, City of Industry, CA 91746, Tel: 818-330-2086, FAX: 818-330-9988; Empl.: 3; *Sls. Mgr.:* Johnny Chao

Mini-Circuits

FAX: 718-332-4661

MINI-CIRCUITS LAB., 13 Neptune Avenue, P.O. Box 350166, Brooklyn, NY 11235-0003, Tel: 718-934-4500, TELEX: 125460, 620156 (Int'l); FSC No.: 15542 ..... **A•1752-1819**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444,FAX:602-998-1236
CA	Los Altos, Cain-White & Co.	415-948-6533, FAX:415-948-0115
CA	Tustin, Youngewirth & Olenick Assocs.	714-838-5144,FAX:714-838-5321
CO	Parker, W. Howard Assocs.	303-841-5755, FAX:303-841-9272
FL	Clearwater, Beacon Microwave & Instrmn., Inc.	813-796-2378,FAX:813-796-0075
FL	Satellite Bch., Beacon Microwave & Instrmn., Inc.	407-777-6303,FAX:407-777-9131
GA	Atlanta, Beacon Microwave & Instrmn., Inc.	404-256-9640,FAX:404-256-1398
GA	Sylvester, Beacon Microwave & Instrmn. Inc.	912-776-4100,FAX:912-776-0831
IL	Mt. Prospect, Cain-Forlaw Co., Inc.	708-253-3578, FAX:708-253-6987
IL	Mundelein, Cain-Forlaw, Inc.	708-540-9962, FAX:708-540-9974
MD	Columbia, M. Lader Co.	800-442-3177, FAX:301-381-6924
MA	Waltham, Scientific Dvcs. New England Inc.	617-890-2252,FAX:617-890-5816
NM	Albuquerque, Thorson Desert States, Inc.	505-883-4343,FAX:505-889-2999
NY	Hartsdale, Spectrum Sls., Inc.	914-472-8600, FAX:914-472-0461
NY	Skaneateles, Robtron, Inc.	315-685-5731, FAX:315-685-3717
NC	Greensboro, M. Lader Co.	800-442-3177, FAX:919-674-7655
NC	Raleigh, Beacon Microwave & Instrmn., Inc.	919-781-8118,FAX:919-781-9058
OH	Worthington, Cain-Forlaw Co. Inc.	614-436-3004, FAX:614-436-3097
OR	Aloha, Cain-Sweet, Co.	503-591-0647, FAX:503-591-0856
PA	Conshohocken, M. Lader Co.	215-825-3177, FAX:215-834-8543

TX Dallas, Beacon Microwave & Instrmn. Inc. 214-437-1505,FAX:214-437-5874
TX Richardson, Beacon Microwave & Instrn., Inc. 214-437-1505,FAX:214-437-5874
TX Round Rock, Beacon Microwave & Instrmn. Inc. 512-244-6675,FAX:512-244-1883
WA Bellevue, Cain-Sweet Co. 206-462-2118, FAX:206-451-9418
PR Santurce, Beacon Elctrns. 809-728-5040, FAX:809-728-5180
Can Ottawa, Ont., Giga-Tron Assocs., Ltd. 613-225-4090,FAX:613-225-4592
Can Vancouver, B.C., Penstock/Canada ... 604-662-3475

Local Distributors

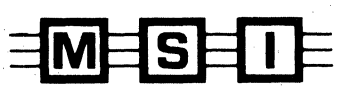
AL Huntsville, Component Distrs., Inc. 205-851-7800, FAX:205-859-2249
AZ Scottsdale, Spirit Elctrns. 602-998-1533, FAX:602-998-1427
CA Sunnyvale, Penstock, Inc. 408-730-0300, FAX:408-730-4782
FL Palm Bay, Component Distrs., Inc. 407-724-9910, FAX:407-729-6579
GA Norcross, Component Distrs., Inc. 404-441-3320, FAX:404-449-1712
IL Mt. Prospect, CFC Distrs., Inc. 708-253-3578, FAX:708-253-6987
IL Mundelein, CFC Distrs., Inc. 708-540-9962, FAX:708-540-9974
MD Columbia, MLC Distrs. 800-442-3177, FAX:301-381-6924
NC Greensboro, MLC Distrs. 919-674-8970, FAX:919-674-7655
NC Raleigh, Comp. Distrs., Inc. 919-859-3391, FAX:919-859-3396
PA Conshohocken, MLC Distrs. 215-825-3177, FAX:215-834-8543
TX Dallas, Comp. Distrs., Inc. 214-644-0373, FAX:214-644-1115
WA Bellevue, Penstock,Inc. 206-454-2371, FAX:206-451-9418

MINI COMPUTER TECHNOLOGY, 696 E. Trimble Rd., San Jose, CA 95131, Tel: 408-435-1616, TWX: 910-338-2281, FAX: 408-435-2709; Empl.: 22; *Sls. Mgr.:* John P. Lazare; *Dist. Mgr.:* John P. Lazare

MINI-SYSTEMS, INC., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel: 508-695-2000, TWX: 510-600-4340, FAX: 508-695-8758; *Sls. Mgr.:* Heather Edwards ..... **A•1735**

Local Sales Offices & Reps

CT Fairfield, Wexler-Court Sls. 203-334-1122
NC Raleigh, Spears & Assocs. 919-846-9711
WA Bellevue, Advanced Power Comps. ... 206-747-9127
Can Ontario, CN, Intrade Canada 613-727-1272



FAX: 508-695-6076

MINI-SYSTEMS, INC., Thick/Thin Film Division, 20 David Rd., North Attleboro, MA 02761, Tel: 508-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 163 ..... **A•1955**

Local Sales Offices & Reps

AL Huntsville, Summit Mktg. Assocs. 205-721-1701, FAX:205-721-9250
AZ Tuscon, Morrison & Fern 602-296-8181, FAX:602-296-4833
CA Brea, S.C.T.S. 213-691-1114,FAX:213-690-0504
CA Mountain View, L.S. Engrg. 415-967-5880, FAX:415-967-5884
CA Woodland Hills, S.C.T.S. 818-704-9087, FAX:818-704-8632
FL Pompano Beach, J.P. Elctrns. 305-782-6830, FAX:305-782-1640
GA Norcross, Summit Mktg. Assocs. 404-498-4530, FAX:404-498-4530
IL Elk Grove, ABC Elctrns. 708-228-1204, FAX:708-228-1249
ME Bethel, Shain Assocs., Inc. 207-836-3200
MA Belmont, Shain Assocs., Inc. 617-484-4376, FAX:617-489-3598
MA Hingham, Shain Assocs., Inc. 617-740-2334, FAX:617-740-2680
MN Minneapolis, Intertec Assocs. 612-921-8443, FAX:612-929-4488
NH Nashua, Shain Assocs., Inc. 603-881-4881, FAX:603-880-8924
NJ Princeton, Wexler-Court Sls. Co. 609-452-8670, FAX:609-452-9213
NY Rockville Centre, Milano Bros. Intl. 516-764-2200, FAX:516-764-4006
OH Maineville, G.A. Barnett Inc. 513-677-0922, FAX:513-677-0922
TX Double Oak, Carolyn Bender Assocs. 214-539-9461,FAX:214-539-7027
TX Lewisville, C & J Assocs. 214-539-0140
TX Richardson, Southwest Microwave Elctrns. 214-669-1195,FAX:214-669-0353
WA Bellevue, Advanced Power Comps. 206-747-9127, FAX:206-641-8655
Can Nepean, Ont., Intrade Canada 613-727-1272, FAX:613-727-0246

MINI-SYSTEMS, INC., Sunbelt Microelectronic Division, 237 Enterprise Rd., Deltona, FL 32725, Tel: 407-574-0208, FAX: 407-574-8262

MINNESOTA WIRE & CABLE, 1835 Energy Park Drive, St. Paul, MN 55108-2721, Tel: 612-642-1800 , 1-800-258-6922(MWCC), FAX: 612-642-9201; Empl.: 155; *Sls. Mgr.:* Paul Wagner

MINOR RUBBER CO., INC., Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6800, 800-433-6886, FAX: 201-893-1399; *Sls. Mgr.:* Tom Fitzhenry

MINT SYSTEMS CORPORATION, 1633 South Main Street, Milpitas, CA 95035-6262, Tel: 408-262-7171, FAX: 408-262-5387; *Sls. Mgr.:* Rudy Juang ..... **D•1295, 1412-1413**

MIRAGE/KLM, 16890 Church St., P.O. Box 1000, Morgan Hill, CA 95037, Tel: 408-779-7363, FAX: 408-779-8845; Empl.: 50; *Sls. Mgr.:* John J. Concialdi

MISCO/MINNEAPOLIS SPEAKER CO., INC., 3806 Grand Avenue, Minneapolis, MN 55409, Tel: 612-825-1010, FAX: 612-825-7010; FSC No.: 14208; *Sls. Mgr.:* Don Ringham

MITCHELL ELECTRONICS CORP., 84 West Grand Street, Mt. Vernon, NY 10552, Tel: 914-699-3800, TELEX: 914-699-1022; Empl.: 30; *Sls. Mgr.:* Jonathan Lerner ..... **A•2306**

MITEC ELECTRONICS, 104 Gun Avenue, Pointe Claire, Quebec, Canada H9R 3X3, Tel: 514-694-6666, FAX: 514-694-3814; FSC No.: FSCM 38494; Empl.: 125; *Sls. Mgr.:* J. Robinson

MITECH ELECTRONICS CORP., 411 Washington St., Otsego, MI 49078, Tel: 616-694-9471, FAX: 616-692-2651; Empl.: 78; *Sls. Mgr.:* Kendall Meyer

MITEL SEMICONDUCTOR DIV. OF MITEL CORP., 360 Legget Dr., PO Box 13089, Kanata, Ont., Canada K2K 1X3, Tel: 613-592-2122, TELEX: 053 3221, FAX: 613-592-6909; Empl.: 1000; *Sls. Mgr.:* Howard Tweddle; *Dist. Mgr.:* Howard Tweddle

MITEQ INC., 100 Davids Drive, Hauppauge, NY 11788, Tel: 516-436-7400, TELEX: 6718148, FAX: 516-436-7430; Empl.: 275

MITRONICS, P.O. Box 2129, Rolling Hills, CA 90274, Tel: 213-377-2022

MITSUBISHI ELECTRONICS, 991 Knox Street, Torrance, CA 90502, Tel: 213-515-3993, TELEX: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; Empl.: 423; *Sls. Mgr.:* Bob Crooks, V.P. Sls.; *Dist. Mgr.:* Bob Crooks, V.P. Sls.

MITSUBISHI ELCTRNS. AMERICA, INC., Elctrn. Device Grp., 1050 East Arques Ave., Sunnyvale, CA 94086, Tel: 408-730-5900, TELEX: 172296, TWX: 910-339-9549, FAX: 408-730-4972; Empl.: 200; *Sls. Mgr.:* John Zucker; *Dist. Mgr.:* Roger Yee

Local Sales Offices & Reps

AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Scottsdale, SMS & Assocs. 602-998-0831
CA San Diego, Mitsubishi Elctrns. Reg. Sls. Off. 619-451-9618
CA San Diego, SC Cubed 619-458-5808
CA San Jose, QCI 408-432-1070
CA Sunnyvale, Mitsubishi Elctrns.-Reg. Sls. Off. 408-730-5900
CA Thousand Oaks, SC Cubed 805-496-7307
CA Tustin, SC Cubed 714-731-9206
CO Englewood, Mitsubishi Elctrns. Reg. Sls. Off. 303-220-0744
CO Littleton, Simpson Assocs. 303-794-8381
CT Yalesville, Comp. Rep Assocs. 203-269-1145
FL Boca Raton, Beacon Elctrns. 407-997-5740
FL Boca Raton, Mitsubishi Elctrns. 407-487-7747
FL Longwood, Beacon Elctrns. 407-332-1940
GA Atlanta, Beacon Elctrns. 404-256-9640
GA Norcross, Beacon Advanced Comps. 404-662-8190
GA Norcross, Mitsubishi Elctrns. Reg. Sls. Off. 404-448-1263
IL Mt. Prospect, Mitsubishi Elctrns.-Reg. Sls. Off. 708-298-9223
IL Rolling Meadows, Phase II Mktg. 708-806-1330
IN Fishers, Carter, McCormick, Pierce 317-842-8277
KS Overland Park, Gibb Tech 913-451-6788
MI Farmington Hills, Carter, McCormick .. 313-477-7700
MN Edina, Gibb Elctrns. Sls. 612-835-3370
MN Minnetonka, Gibb Elctrn. Sls. 612-935-4600
MN Minnetonka, Mitsubishi Elctrns.-Reg. Sls. Off. 612-938-7779
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NJ Parsippany, METEC Sales 201-263-8898
NJ Somerset, Mitsubishi Elctrns.-Reg. Sls. Off. 201-469-8833
NY Fishkill, Mitsubishi Elctrns. Reg. Sls. Off. 914-896-0896
NY Manlius, LAMTEC 313-637-3738
NY Northport, METEC Sales 516-757-1881
NC Cary, Mitsubishi Elctrns. Reg. Sls. Off. 919-460-0404
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Cincinnati, Makin & Assocs., Inc. 513-871-2424
OH Dublin, Makin & Assocs., Inc. 614-793-9545
OH Solon, Makin & Assocs. 216-248-7370
OR Portland, ES/Chase Co., Inc. 503-292-8840
TX Austin, OM Assocs., Inc. 512-794-9971
TX Carrollton, Mitsubishi Elctrns.-Reg. Sls. Off. 214-245-0047
TX Houston, OM Assocs., Inc. 713-789-4426
TX Richardson, OM Assocs., Inc. 214-690-6746
UT Midvale, Simpson 801-566-3691
VA Sterling, Beacon North 703-478-2480
WA Kirkland, ES Chase 206-823-9595
WA Kirkland, Insight Elctrns. 206-820-8100
WI Wauwatosa, Phase II Mktg. 414-771-9986
PR San Truce, Beacon Elctrns. 818-728-5440
Can Kanata, Ont., Mitsubishi Elec. Sls. Canada, Inc. 613-591-3348
Can Mississauga, Mitsubishi Elctrns.Reg. Sls. Off. 416-670-8711

Local Distributors

AZ Scottsdale, Added Value Elctrns. 602-951-9788
AZ Tempe, Insight Elctrns. 602-829-1800
CA Agoura, Insight Elctrns. 818-707-2100
CA Irvine, Insight Elctrns., Inc. 714-727-2111
CA Orange, Western Microtechnlgy. 714-637-0200
CA San Diego, Added Value Elctrns. Dists., Inc. 614-558-8890
CA San Diego, Insight Elctrns., Inc. 619-587-0471
CA San Diego, Western Microtechnlgy. ... 619-453-8430
CA San Jose, Merit Elctrns. Inc. 408-434-0800
CA San Jose, QCI Comp. Sls. 408-432-1070
CA Saratoga, Western Microtechnlg., Inc. 408-725-1660
CA Tustin, Added Value Elctrns. Dist., Inc. 714-259-8258
CO Wheat Ridge, Added Value Elctrns. Dists. Inc. 303-422-1701
CT Milford, Milgray Elctrns., Inc. 203-878-6970
CT Wallingford, Almo Elctrns. Corp. 203-269-6801
FL Ft. Lauderdale, Hammond Elctrns., Inc. 305-973-7103
FL Miami, All American 305-621-8282
FL Orlando, Hammond Elctrns., Inc. 305-841-1010
FL Winter Pk., Milgray Elctrns., Inc. 305-647-5747
GA Norcross, Beacon Advanced Comps. 404-662-8190
GA Norcross, Hammond Elctrns., Inc. 404-449-1996
GA Norcross, Milgray Elctrns., Inc. 404-446-9777
IL Arlington Heights, Milgray Elctrns., Inc. 708-253-1212
IL Bensenville, GBL/Goold Elctrns. Corp. 708-860-7171
KS Overland Pk., Milgray Elctrns., Inc. 913-236-8800
MD Columbia, Milgray Elctrns., Inc. 301-995-6169
MD Tissup, Almo Elctrns. Corp. 301-953-2566
MA Canton, Almo Elctrns. Corp. 617-821-1450
MA Hopkinton, Interface Elctrns. Corp. 617-435-6858
MA Westwood, Comp. Rep. Comps. 617-329-3454
MA Wilmington, JV Elctrns. of Boston, Inc. 617-657-6523
MN Sterling Elctrns., Indl. Comps., Inc. 612-831-2666
NJ E. Brunswick, Almo Elctrns., Inc. 201-613-0200
NJ Marlton, Milgray Elctrns., Inc. 609-983-5010
NY Farmingdale, Milgray Elctrns., Inc. 516-420-9800
NY Rochester, Milgray Elctrns., Inc. 716-235-0830
NY Rome, Rome Elctrns. 315-337-5400
NC Greensboro, Hammond Elctrns., Inc. .. 919-275-6391
OH Cleveland, Milgray Elctrns., Inc. 216-447-1520
OR Beaverton, Western Microtechnlg., Inc. 503-629-2082
PA Maris, Almo Elctrns. Corp. 412-776-9090
PA Trevose, Almo Elctrns. Corp. 215-953-2800

SC Greenville, Hammond Elctrns. 803-233-4121
TX Dallas, Milgray Elctrns. 214-248-1603
WA Redmond, Western Microtechnlg., Inc. 206-881-6737

MKC ELECTRONICS CORP., 9205 Quivira Road, Overland Park, KS 66215, Tel: 913-894-9711, FAX: 913-894-9713; Empl.: 26

MKS INSTRUMENTS, INC., Six Shattuck Road, Andover, MA 01810, Tel: 508-975-2350, TELEX: 94-9375, FAX: 508-975-0094; Empl.: 500

MLI INDUSTRIES, INC., 3 East Main Street, Apalachin, NY 13732, Tel: 607-754-5800, FAX: 607-625-2022; Empl.: 485; *Sls. Mgr.:* Michael T. Mackenzie

MMI-MIRCO MACHINES, INC., P. O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, TWX: 910-338-0260; Empl.: 4; *Sls. Mgr.:* Frank J. Andezzone

MOBILE-TRONICS CO., INC., Box 1147, San Clemente, CA 92674, Tel: 714-361-4305, FAX: 714-361-4356; Empl.: 2

MODULAIR, 4674 Aircenter Circle, Reno, NV 89502, Tel: 702-829-2033, FAX: 702-829-2029; Empl.: 50

MODULAR AUDIO PRODUCTS, Modular Devices, Inc., Brookhaven R & D Plaza, One Roned Road, Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; *Sls. Mgr.:* C. Liptman

MODULAR DEVICES, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; FSC No.: 52202; Empl.: 65; *Sls. Mgr.:* C. Liptman ..... **B•1302; D•1901-1906**

Local Sales Offices & Reps

CA Murrieta, MIL-COM Sls., Inc. 714-677-2097
CA San Diego, Mil-Com Sls. 619-275-0641
CA Santa Clara, Integrated Tech Sls. 408-727-3406
CT Bloomfield, Zaslow Sls. Co. 203-242-7781
KS Prairie Village, Thunderbird Tech. Sls. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. 316-636-5777
MD Towson, Advanced Tech. Sls., Inc. 301-296-9360
MN St. Paul, K-Rep 612-681-9510
MO Maryland Heights, Thunderbird Tech. Sls. 314-298-8940
NY Great Neck, F & F Metro Inc. 516-482-4080
NY Williamsville, NV Elect. Assoc. 716-632-1347
PA Norristown, Rivco January Inc. 215-631-1414
TX Dallas, M-Rep Co. 214-484-5711

MODULAR DEVICES INC., 4115 Spencer St., Torrance, CA 90503, Tel: 213-542-8561, FAX: 213-371-6331; Empl.: 150; *Sls. Mgr.:* A. C. Augusta

MODULAR MINING SYSTEMS, INC., 3289 E. Hemisphere Loop, Tuscon, AZ 85706, Tel: 602-746-9127, FAX: 602-889-5790; Empl.: 60; *Sls. Mgr.:* J.Michael Canty

MODULAR SYSTEMS, INC., 905 Albemarle St., Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 5;. *Sls. Mgr.:* H. N. Patel

FAX: 408-496-0204

MODUPOWER, Inc., 1400 Coleman Ave., Santa Clara, CA 95050, Tel: 408-496-5796; Empl: 3; *Sls. Mgr.:* Art Fury ..... **D•1908-1910**

MOISTURE REGISTER PRODUCTS DIV., Aqua Measure Instrument Co., 1712 Earhart Court, P.O. Box 369, LaVerne, CA 91750-0369, Tel: 714-392-5833, FAX: 714-392-5838; Empl.: 25; *Sls. Mgr.:* Gabriel Cote, Jr.

MOLDCON DIV. OF CONTEX ELECTRONICS, 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, FAX: 413-736-9716; Empl.: 200; *Sls. Mgr.:* Robert Krzynowek

MOLDTRONICS, INC., 703 Rogers St., Downers Grove, IL 60515, Tel: 708-968-7000, FAX: 708-968-5068; Empl.: 100; *Sls. Mgr.:* J.D. Wilson

MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 201-938-9473, TWX: 710-723-6943, FAX: 201-938-3189; Empl.: 125

FAX: 708-969-1352

MOLEX, INC., 2222 Wellington Ct., Lisle, IL 60532, Tel: 708-969-4550, TELEX: 25-4069; Empl.: 6300; *Sls. Mgr.:* Bill Cox; *Dist. Mgr.:* Bill Hickey ..... **C•1474**

Local Sales Offices & Reps

CA Laguna Hills, Molex 714-586-0950
CA Milpitas, Molex 408-946-4700
CO Englewood, Molex 303-779-8321
GA Roswell, Molex 404-992-3715
IL Lisle, Molex 312-969-4550
IN Indianapolis, Molex 317-299-0099
KY Louisville, Molex 502-245-8336
MA Woburn, Molex 617-935-8983
MI Troy, Molex 313-879-7400
TX Dallas, Molex 214-931-0999

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AL Huntsville, Time Elctrns. 205-721-1133
AZ Phoenix, Force Elctrns. 602-437-1060
AZ Phoenix, Sterling Elctrns. 602-437-5565
AZ Tempe, Harper S.I.D. 602-967-1464
AZ Tempe, Time Elctrns. 602-967-2000
AR Ft. Smith, Carlton Bates 501-646-8201
AR Little Rock, Carlton Bates 501-562-9100
AR Pine Buff, Carlton Bates 501-535-1354
AR Springdale, Carlton Bates 501-756-5012
CA Chatsworth, Sterling Elctrns. 818-407-8850
CA Chatsworth, Time Elctrns. 818-998-7200
CA Compton, Harper S.I.D. 213-979-5090
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA El Segundo, Force Elctrns. 213-772-1324
CA Garden Grove, Richey Impact Elctrns. Ltd. 714-895-0060
CA Gardena, Hamilton Avnet 213-217-6700
CA Irvine, Integrated Elctrns. Corp. 714-837-9960
CA Roseville, Hamilton/Avnet 916-925-2216
CA S. San Francisco, Peters-de Laet 415-873-9595
CA Sacramento, Integrated Elctrns. Corp. 916-363-6030
CA San Diego, Force Elctrns. 619-569-9661
CA San Diego, Hamilton Avnet 619-571-1900
CA San Diego, Harper S.I.D. 619-578-2500
CA San Diego, Richey Impact Elctrns. Ltd. 619-271-4511
CA San Diego, Sterling Elctrns. 619-271-6555
CA San Diego, Time Elctrns. 619-586-1331
CA San Jose, Harper S.I.D. 408-943-9490
CA San Jose, Integrated Elctrns. Corp. 408-435-1000
CA San Jose, Richey Western Elctrns. Ltd. 408-432-7100
CA Santa Clara, Force Elctrns. 408-748-1324
CA Sunnyvale, Hamilton Avnet 408-743-3000
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Kent Elctrns. 213-320-2700
CA Torrance, Time Elctrns. 213-320-0880
CA Tustin, Sterling Elctrns. 714-259-0900
CA Tustin, Time Elctrns. 714-669-0100
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Hamilton Avent 303-799-0663
CO Englewood, Sterling Elctrns. 303-792-3939
CO Englewood, Time Elctrns. 303-799-8851
CO Wheatridge, Bell Inds. 303-424-1985
CT Danbury, Hamilton Avnet 203-743-6077
CT Danbury, Heilind Elctrns. 203-797-8600
CT Southbury, Time Elctrns. 203-271-3200
CT Wallingford, Sager Elec. Supp. Co. 203-265-4600
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Ft. Lauderdale, Hamilton Avnet 305-767-6377
FL Ft. Lauderdale, NEWH for Ind. 305-772-5050
FL Ft. Lauderdale, Time Elctrns. 305-484-4778
FL Largo, LoDan 813-586-2851
FL Miami, Time Elctrns. 305-940-8231
FL Orlando, Hamilton/Avnet 407-657-3344
FL Orlando, Time Elctrns. 407-841-6565
FL St. Petersburg, Hamilton Avnet 813-573-3930
FL Winter Park, Hamilton Avnet 407-628-3888
GA Atlanta, Electro Air Corp. 404-351-3545
GA Duluth, Gateway Megatech 404-497-0799
GA Duluth, Hamilton/Avnet 404-446-0611
GA Norcross, Time Elctrns. 404-368-0969
IL Bensenville, Hamilton/Avnet 312-860-7700
IL Chicago, Waldom Elctrns. Inc. 312-585-1212
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Hoffman Estates, Integrated Elctrns. Corp. 708-843-2040
IL Schaumberg, Time Elctrns. 708-303-3000
IN Carmel, Hamilton Avnet 317-844-9333
IN Carmel, Time Elctrns. 800-331-5114
IN Indianapolis, Gateway Megatech 317-298-0111
IN Indianapolis, PEI-Genesis 800-428-5081
IN South Bend, PEI-Genesis 800-348-2996
IN Valparasio, Gateway Megatech 219-477-4255
IA Cedar Rapids, Hamilton Avnet 319-362-4757
IA Cedar Rapids, Time Elctrns. 800-325-9085
KS Lenexa, Hamilton/Avnet 913-888-8900
KS Lenexa, Time Elctrns. 913-492-5406
KY Lexington, Hamilton Avnet 800-543-4783
LA Shreveport, Carlton Bates 318-636-9975
LA Westego, Sterling Elctrns. 504-436-1418
MD Baltimore, Hamilton Avnet 301-995-3500
MD Columbia, Sterling Elctrns. 301-290-3800
MD Columbus, Time Elctrns. 301-964-3090
MD Jessup, Gateway 301-792-7527
MA Canton, Richey/Impact Elctrns. Ltd. ... 617-821-1500
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA Peabody, Hamilton Avnet 508-532-3701
MA Peabody, Time Elctrns. 508-532-6200
MA Wilmington, Heilind Elctrns. 508-657-4870
MA Woburn, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Gateway Megatech 313-761-2980
MI Hamilton/Avnet, Hamilton/Avnet 616-243-8805
MI Novi, Hamilton/Avnet 313-347-4270
MI Troy, Empire Elctrns. 313-585-8130
MN Edina, Time Elctrns. 612-943-2433
MN Minneapolis, Sterling Elctrns. 612-831-2666
MN Minnetonka, Hamilton Avnet 612-932-0600
MO Chesterfield, Hamilton/Avnet 314-537-1600
MO Manchester, Time Elctrns. 314-391-6444
MO St. Charles, Lectronix 800-325-3348
NH Manchester, Hamilton/Avnet 603-624-9400
NH Salem, Sager Elec. Supp. Co. 603-898-1348
NJ Camden, GRS Elctrns. Co., Inc. 609-964-8560
NJ Cherry Hill, Hamilton Avnet 609-424-0100
NJ Edison, Sterling Elctrns. 908-417-1000
NJ Fairfield, Hamilton Avnet 201-575-3390
NJ Marlton, Time Elctrns. 609-596-6700
NJ Teterboro, EAC/JAMAR Corp. 201-772-6400
NM Albuquerque, Hamilton Avnet 505-345-0001
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY Buffalo, Summit Dists. 716-887-2800
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Hauppauge, Time Elctrns. 516-273-0100
NY Rochester, Hamilton Avnet 716-475-9130
NY Rochester, Summit Distrs. 716-334-8110
NY Syracuse, Hamilton Avnet 315-437-2641
NC Charlotte, Time Elctrns. 704-522-7600
NC Raleigh, Hamilton Avnet 919-878-0810
NC Raleigh, Sagar Elctrl. Supp. Co., Inc. ... 919-850-9550
OH Columbus, Gateway Megatech 614-447-0222
OH Columbus, Time Elctrns. 614-761-1100
OH Dayton, Gateway Megatech 513-298-6342
OH Dayton, Hamilton Avnet 513-439-6700
OH Solon, Hamilton Avnet 216-349-5100
OH Westerville, Hamilton Avnet 614-882-7004
OH Willoughby, Gateway Megatech 216-953-0333
OK Oklahoma City, Carlton Bates 405-691-4446
OK Tulsa, Carlton Bates 918-250-1626
OK Tulsa, Hamilton Avnet 918-252-7297
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Hamilton/Avnet 503-627-0201
OR Beaverton, Integrated Elctrns. Corp. ... 503-641-1690
OR Portland, Radar Elec. 503-232-3404
OR Portland, Time Elctrns. 503-684-3780
PA McKean, Advacom 814-476-7774
PA Philadelphia, Sagar Elctrl. Supp. Co. ... 215-464-4336
PA Pittsburg, Hamilton Avnet 412-281-4150
TN Memphis, Carlton Bates 901-365-3539
TN Nashville, Carlton Bates 615-885-3232
TN Soddy-Daisy, Techni-Tronics, Inc. 615-332-2119
TX Austin, Hamilton Avnet 512-837-8911
TX Austin, Kent Elctrns. 512-834-1900
TX Austin, Sterling Elctrns. 512-836-1341
TX Austin, Time Elctrns. 512-339-3054
TX Carrollton, Sterling Elctrns. 214-243-1600
TX Dallas, Carlton Bates 214-404-9906
TX Dallas, Force Elctrns. 214-247-9955
TX Houston, Force Elctrns. 713-561-8644
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Sterling Elctrns. 713-627-9800
TX Houston, Time Elctrns. 713-530-0800
TX Irving, Harper S.I.D. 214-621-0500
TX Richardson, Kent Elctrns. 214-669-2600
TX Richardson, Time Elctrns. 214-644-4644
TX Stafford, Hamilton Avnet 713-240-7733
TX Texarkana, Carlton Bates 214-792-6923
UT Salt Lake City, Bell Inds. 801-255-9611
UT Salt Lake City, Hamilton Avnet 801-266-2022
UT Salt Lake City, Integrated Elctrns. 801-977-9750
UT Salt Lake City, Sterling Elctrns. 801-972-5444
UT Salt Lake City, Time Elctrns. 801-973-8181
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Integrated Elctrns. Corp. 206-455-2727
WA Redmond, Hamilton Avnet 206-881-6697
WA Richland, Radar Elec. 509-943-8336
WA Seattle, Radar Elec. 206-282-2511

WA Spokane, Radar Elec. 509-747-3053
WI Milwaukee, Time Elctrns. 800-331-5114
WI New Berlin, Sub Sem 800-435-6130
WI Waukesha, Hamilton Avnet 414-784-4510
PR Bayamon, NEHW for Ind. 809-798-1300

MOLI ENERGY LIMITED, 20000 Stewart Crescent, Maple Ridge, B.C., Canada V2X 9E7, Tel: 604-465-7911/1-800-663-MOLI, TELEX: 04-356708, FAX: 604-465-4398; FSC No.: 6140; Empl.: 160; *Sls. Mgr.:* Mary Connolly; *Dist. Mgr.:* Mary Connolly

MOLON MOTOR & COIL CORPORATION, 3737 Industrial Avenue, Rolling Meadows, IL 60008, Tel: 708-253-6000, FAX: 708 259-5491; *Sls. Mgr.:* William Steele

MONARCH INSTRUMENT, Monarch International Inc., Columbia Dr., Amherst, NH 03031, Tel: 603-883-3390, 800-999-3390, FAX: 603-886-3300; FSC No.: Cage Code 17500; Empl.: 24; *Sls. Mgr.:* Richard Peters, Prod. Mgr.; *Dist. Mgr.:* Myron Kasok

MONITOR PC

FAX: 619-434-0255

MONITOR PRODUCTS CO., INC., 502 Via Del Monte, Oceanside, CA 92054, Tel: 619-433-4510, ESYLNK: 629 5085; FSC No.: 54331; Empl.: 65; *Sls. Mgr.:* Robert Blasier; *Dist. Mgr.:* Robert Blasier ..... **A•1402-1407**

Local Sales Offices & Reps

AL Huntsville, CSR Elctrns. 205-533-2444
AZ Phoenix, Eltron 602-266-2164
CA Los Angeles, Monitor Prods. Co. 619-433-4510
CA Mountain View, Straube Assocs. 415-969-6060
CA Orange County, Monitor Prods. Co. ... 618-433-4510
CO Denver, Straube Assocs. 303-426-0890
CT Bloomfield, Zaslow Sls., Inc. 203-242-7781
FL Brandon, R.C. Simon & Company 813-689-6524
FL Lighthouse Pt., R.C. Simon & Company 305-941-2757
GA Atlanta, CSR Elctrns. 404-396-3720
MA Westboro, Zaslow Sls., Inc. 617-393-8150
MN Eden Prairie, Elctrn. Innovators 612-941-0830
NY Rochester, Electra Sls. 716-427-7860
NY Syracuse, Electra Sls. 315-463-1248
NC Raleigh, CSR Elctrns. 919-878-9200
PA Philadelphia, Monitor Prods. 904-725-4386
TN Knoxville, CSR Elctrns. 615-673-0222
TX Austin, Mil-Rep Assocs. 512-346-6331
TX Houston, Mil-Rep Assocs. 713-444-2557
TX Richardson, Mil-Rep Assocs. 214-644-6731

Local Distributors

AL Huntsville, Component Distrs., Inc. 205-883-7501
AL Huntsville, Resistacap, Inc. 205-883-4270
AZ Tempe, Harper SID 602-967-1464
AR Little Rock, Component Distrs., Inc. ... 501-227-6305
CA Compton, Harper SID 213-979-5090
CA San Diego, Harper SID 619-560-8545
CA San Diego, Neumann Elctrns. 619-695-3005
CA Sherman Oaks, Delay Line Distrs. 818-986-9455
CA Sunnyvale, Harper SID 408-747-0333
CA Tustin, Added Value Elctrns. 714-259-8258
CO Wheatridge, Added Value Elctrn. 303-422-1701
FL Ft. Lauderdale, Component Distrs., Inc. 305-723-8874
FL Melbourne, Rome Elctrns. 305-242-8151
GA Norcross, Component Distrs., Inc. 404-441-3320
IL Bensenville, Voyager Elctrns. 312-773-4900
MA Hudson, DSC, Inc. 617-562-6920
MN Fridley, Voyager Elctrns. 612-571-7766
NY Johnson City, Help Elctrns. 607-729-3528
NC Greensboro, Golden Elctrns. 919-294-4653
TX Dallas, Component Distrs., Inc. 214-644-0373
TX Fort Worth, C & W Supply 817-831-0395
TX Richardson, Harper SID 214-235-3177
VA Falls Church, Component Distrs., Inc. 703-241-8227

MONOLITHIC SYS. CORP., 7050 South Tuscan Way, Englewood, CO 80112, Tel: 303-790-7400, FAX: 303-790-7118; Empl.: 80; *Sls. Mgr.:* C. Edward O'Neal; *Dist. Mgr.:* C. Edward O'Neal

MONROE ELECTRONICS, INC., 100 Housel Ave., Lyndonville, NY 14098, Tel: 716-765-2254, TELEX: 756662, FAX: 716-765-9330; Empl.: 50; *Sls. Mgr.:* Brian D. Ives

MONSANTO CO., 800 N. Lindbergh Blvd., St. Louis, MO 63167, Tel: 314-694-1000, TELEX: 44-7282; Empl.: 49,197

MONTROSE PRODUCTS COMPANY, Intercole, 28 Sword Street, Auburn, MA 01501, Tel: 508-791-3161, FAX: 508-793-9862; Empl.: 250; *Sls. Mgr.:* Michael McLaughlin, OEM Sls. Mgr.; *Dist. Mgr.:* Bill Wilmot

MOODY TOOLS, INC., 43 Crompton Ave., E. Greenwich, RI 02818, Tel: 401-885-0911, FAX: 401-885-4565; Empl.: 11; *Sls. Mgr.:* J. H. Moody; *Dist. Mgr.:* D .H. Moody

MOORE PRODUCTS CO., Sumneytown Pike, Spring House, PA 19477, Tel: 215-646-7400, FAX: 215-283-6358; Empl.: 1000; *Sls. Mgr.:* J. McDonald

MOORE REED & CO. LTD., Southway Walworth, Andover, Hampshire SP 105AB, Tel: 0264-324155, TELEX: 47654, FAX: 0264-356561; Empl.: 150; *Sls. Mgr.:* W. North

MORGAN-MATROC, Vernitron Div., 232 Forbes Rd., Bedford, OH 44146-5478, Tel: 216-232-8600, TWX: 810-427-2274, FAX: 216-232-8731; Empl.: 100; *Sls. Mgr.:* D.W. Bacso ..... **B•1921**

Local Sales Offices & Reps

CA El Toro, Morgan Matroc, Inc. 714-768-8672
IL Des Plaines, Esco Assoc. 312-298-5310

MORRIS, J. I., CO., 372 Elm St, Southbridge, MA 01550, Tel: 508-764-4394, FAX: 508-764-7350; FSC No.: 95548; Empl.: 25

MORRIS ENTERPRISES, 16799 Schoenborn St, Sepulveda, CA 91343, Tel: 818-894-9103, TELEX: 6-74681, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 54918; Empl.: 50; *Sls. Mgr.:* J. Dumpert

MORS ASC®

FAX: 617-245-4531

MORS/ASC, 134 Water St., PO Box 544, Wakefield, MA 01880-4444, Tel: 617-246-1007; FSC No.: 54659; Empl.: 35; *Sls. Mgr.:* Mike Palmerino; *Dist. Mgr.:* Mike Palmerino ..... **B•1745**

Local Sales Offices & Reps

CA Arcadia, HMC, Inc. 818-447-0958
CA San Jose, Vernexx 408-972-9072
CO Boulder, Stratford Grp. 303-530-3194
FL Boca Raton, Newell-Hynes 407-392-3186
GA Norcross, Mountain Electro Mktg. 404-448-5594
IL Wheaton, C-S Technical Sls. 708-653-8126
IA Marion, MSB Assocs. 319-377-6261
KS Shawnee Mission, MSB Assocs. 913-432-2131
MA Andover, Crawford Assocs. 508-470-2122
MI Farmington Hills, W. R. Hummon 313-474-0661
MN Golden Valley, Highland Sls. 612-546-2123
MO St. Charles, MSB Assocs. 314-946-5577
NY Fairport, Andres Component Sls. 716-223-2430
NY Patchogue, Optimum Metro Sls. 516-758-0644
OH Willoughby, Nationwide Comps. 216-946-3226
OR Hillsboro, Doran Sls. 503-640-4500
PA Wynnewood, Metz-Benham Assoc. ... 216-896-7300
TX Bedford, El-Tec Sls. 817-268-2896
VA Ashland, Glasscock Assoc. 804-798-2125
WA Redmond, Doran Sls. 206-885-1885
EXP CT/Litchfield, Intrade 203-567-5901

Local Distributors

AL Birmingtón, Forbes Distbg. 205-251-4104
AZ Phoenix, Arizona Comps. 602-269-5655
AZ Tempe, RCD Inds. 602-838-0979
CA Fremont, KEA Elctrns. 415-651-2600
CA Los Angeles, Elec. Switches 213-660-1310
CA San Jose, Rose Elctrns. 408-943-0200
CA San Jose, Sierra West 408-435-7477
CA Santa Monica, Master Dists. 213-452-1229
CA Sunnyvale, PSC 408-737-1333
CA Tustin, Western Switch & Controls 714-731-4333
CO Denver, CSID 303-292-9594
CO Englewood, Indelco 303-694-9444
CT Bridgeport, Park Dists. 203-366-7200
CT Wallingford, Mid-State Elctrns. 203-265-9900
DE New Castle, Elctrns. Exchange 302-322-5401
FL Boca Raton, Zelcon 407-451-1600
FL Ft. Lauderdale, Brothers Elctrns. 305-561-6700
FL Melbourne, GRS/Rome Elctrns. 407-242-8151
GA Norcross, Dow Elctrns. 404-448-4004
ID Spirit Lake, A-I Elctrns. 208-623-3111
IL Addison, Belford Elctrns. 708-691-1100
IL Chicago, Leeds Elctrns. 312-625-3800
IL Wheeling, Hawk Elctrns. 312-459-4030
IL Wood Dale, Nep Elctrns. 312-595-8500
IN Carmel, Altex Elctrns. 317-848-1323
IN Terre Haute, Midwest Supp. 812-232-0187
IA Cedar Rapids, Iowa Radio Supp. 319-393-4510
IA W. Des Moines, Ramco Co. 515-225-6933
KS Wichita, Radio, Inc. 316-264-2798
MD Beltsville, PSI 301-937-4960
MD Jessup, Treeko Elec. 301-470-3300
MD Kensington, Marine Air Supp. 301-949-9560
MA Marlboro, Hardware Specialties 617-481-8622
MA Westborough, In Stock Prods. 617-870-5750
MA Wilmington, North Star Elec. 617-657-5155
MI Battle Creek, Great Lakes Elctrns. 616-731-4156
MI Grand Rapids, Calder Elctrns. 616-698-7400
MI St. Clair Shores, Spemco 313-771-2700
MN Burnsville, Cassidy Elctrns. 612-895-9026
MN Fridley, Voyager Elctrns. 612-571-7766
MN Minneapolis, Tortec Corp. 612-866-3662
MO St. Louis, Wes-Garde Comps. 314-567-7776
NH Salem, Diamond Elec. 603-894-4420
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Mt. Laurel, New Jersey Comps. 609-722-7108
NJ Oakland, Relay Specialties 201-337-1000
NM Albuquerque, Harrison/Int'l 505-345-8127
NY Amherst, Std. Elctrns. 716-691-3801
NY Bohemia, Key Comps. 516-567-7500
NY Hempstead, Davis Elect. 516-483-9200
NY Mt. Vernon, QAR/All American 914-699-2224
NY Rome, Rome Elctrns. 315-337-5400
NY Woodside, Switches Unltd. 718-478-5000
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Dayton, Stotts-Friedman 513-298-5555
OH Willoughby, Gateway Megatech 216-953-0333
OR Beaverton, Rose Elctrns. 503-629-9288
PA Norristown, Kimberly James Co. 215-666-7286
PA Philadelphia, Shap Elctrns. 215-969-3300
RI Pawtucket, Major/Edwards 401-725-7400
TX Arlington, Bell Comp. Sls. 817-461-5303
TX Dallas, Wholesale Elctrns. 214-824-3001
TX Ft. Worth, Indl. Elctrns. 817-731-7321
TX Garland, J & S Elctrns. 214-487-8808
UT Salt Lake City, Std. Supp. Co. 801-486-3371
WA Redmond, Kent Elctrns. 206-883-7200
WA Vancouver, Interconnect Sls. 206-256-4085
WV Huntington, Elctrn. Supp. 304-523-6443
WI Mequon, Lake-View Elctrns. 414-377-8250
WI Milwaukee, Progressive Image 414-321-4722
WI New Berlin, Nep Elctrns. 414-785-9100
Can Markham, Ont., Deskin Sls. 416-475-1412
Can Montreal, Que., Versatech Elctrns. 514-481-0196
Can Quebec, A.R. Gray & Assoc. 514-694-6378
Can Surrey, B.C., Memco 604-590-1553

MORS TECHNOLOGIES INC., Mors Group-France, 225 Industrielle, Delson, Quebec, Canada J0L 1G0, Tel: 514-638-4150, FAX: 514-638-2270

MOSAIC SEMICONDUCTOR INC., Implex Inc., 7420 Carroll Rd., San Diego, CA 92121, Tel: 619-271-4565, FAX: 619-271-6058; Empl.: 45; *Sls. Mgr.:* Derek Best, Gary Brown; *Dist. Mgr.:* Derek Best

MOTION ENGINEERING, INC., 520 E. Montecito St, Santa Barbara, CA 93103, Tel: 805-962-5409, FAX: 805-962-8001; Empl.: 6; *Sls. Mgr.:* Matt Cheresh

MOTION SCIENCE INC., 830-6 Jury Ct., San Jose, CA 95112, Tel: 408-993-0300, FAX: 408-993-0123; Empl.: 27

MOTION SENSORS, INC., 12 Park Street, Cranford, NJ 07701, Tel: 908-709-0025, FAX: 908-709-1144; Empl.: 6; *Sls. Mgr.:* Arthur Bergman

MOTOR CAPACITORS, INC., 6655 N. Avondale Ave., Chicago, IL 60631, Tel: 312-631-0713, FAX: 312-774-8778; Empl.: 14

MOTOROLA CERAMIC PRODUCTS, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113, Tel: 505-822-8801; Empl.: 600; *Sls. Mgr.:* Tom Gilder

MOTOROLA INC., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., 4000 Commerical Ave., Northbrook, IL 60062, Tel: 708-205-2867, TELEX: 671-5420 MOT APD; Empl.: 2500

MOTOROLA SEMICONDUCTOR PRODS. SECTOR, 2100 East Elliot, Tempe, AZ 85284, Tel: 602-244-6900, TWX: 910-951-1334; FSC No.: 04713; *Sls. Mgr.:* Ted Jaros; *Dist. Mgr.:* Brian Hilton

MOTOR TECHNOLOGY, INC., 2798 Culver Ave., Dayton, OH 45429, Tel: 513-294-1041, FAX: 513-294-8336; Empl.: 35 ..... **B•1303-1305**

Local Sales Offices & Reps

OH Dayton, Motor Technology, Inc. 513-294-1041

MOTORTEST, INC., PO Box 292633, Columbus, OH 43229, Tel: 614-882-7821, FAX: 614-841-9007

MOTOR-TRONICS, INC., 2142 Industrial Ct., Bldg. 'F', Vista, CA 92083, Tel: 619-727-7430, FAX: 619-727-4436; *Sls. Mgr.:* Bill Linko

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 619-449-2222, TELEX: 619-44; Empl.: 200; *Sls. Mgr.:* C. Degurse; *Dist. Mgr.:* G. Rye

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 800-346-6873, FAX: 817-483-0931; Empl.: 200; *Dist. Mgr.:* G. Rye

MOXNESS PRODUCTS, INC., Versa Technologies, 1914 Indiana St., Racine, WI 53405, Tel: 414-554-5050, 800-558-5706, FAX: 414-554-2321; Empl.: 250; *Sls. Mgr.:* Ronald M. Buono; *Dist. Mgr.:* Ronald M. Buono

MPB CORP., Miniature Precision Bearings Div., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; FSC No.: 40920; Empl.: 1900; *Sls. Mgr.:* T. A. Rudziensky; *Dist. Mgr.:* R. F. Chartier

M P C, 150 S. Harbor Blvd. Unit J, Santa Ana, CA 92704, Tel: 714-775-0211, FAX: 714-775-1674; Empl.: 25; *Sls. Mgr.:* Sam Granat

MPC, Div. of Consulting Systems, 638 Main St., Danville, NH 03819, Tel: 603-642-5913, FAX: 603-642-5913; *Sls. Mgr.:* W. Morse ..... **D•1911**

Local Distributors

TN	Knoxville, Indl. Elctrns.	615-573-7135

MP/CAPAR, Multi Products International, 250 Lackawanna Ave., P.O. Box 737, West Paterson, NJ 07424, Tel: 201-890-1344, FAX: 201-890-1677; *Sls. Mgr.:* Leroy Gray ..... **A•1107**

Local Sales Offices & Reps

AZ	Phoenix, JBS Assocs.	602-893-2382
CA	Mission Viejo, Jay Mktg. Assoc.	714-768-7519
CA	Santa Clara, Nova-Tronix, Inc.	408-727-0261
CO	Denver, Electrophase	303-296-0443
FL	Indian Rocks Bch., Electronic Mfrs. Agt.	813-596-5053
GA	Lawrenceville, Tek Rep Mktg.	404-963-1600
IL	Des Plaines, ESCO Assocs.	312-298-5310
IN	Frankfort, CS Elctrns. Sls.	317-659-1874
IA	Marion, MSB Assocs	319-377-6261
KS	Shawnee Mission, MSB Assocs.	913-432-2131
MA	Norwood, The MacInnis Co.	617-762-8090
MI	Lathrup Village, RC Nordstrom & Co.	313-559-7373
MN	St. Paul, Proud Inds.	612-646-9428
MO	St Charles, MSB Assocs.	314-967-5577
NY	Farmingdale, BDK Mktg., Inc.	516-694-5500
NY	Rochester, Ontec Elctrn. Mktg.	716-464-8636
OH	Dayton, KW Elctrn. Sls.	513-890-2152
OR	Tigard, Eltech Inc.	503-684-3458
PA	Collegeville, Beacon North	703-478-2480
TX	Irving/Dallas, AID Elctrns	214-790-4761
WA	Bellevue, Eltech Inc.	206-643-4330

Local Distributors

AL	Huntsville, Components Resources	205-533-2862
CA	Chatsworth, Passive Comps.	818-700-8838
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Huntington Beach, Capacitor Specialists	714-843-1815
CA	Irvine, Kelex Inc.	714-863-1230
CA	Sunnyvale, Capsco Sls.	408-734-3020
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
IL	Lisle, Components Inc.	312-852-7707
IN	Carmel, Altex Elctrns.	317-848-1323
MD	Gaithersberg, Axis Elctrns.	301-840-9640
MD	Spencerville, US Elctrns.	301-384-3300
MA	Bellrica, Baldwin Comps.	508-667-6710
MA	Tyngsboro, Port Elctrns.	508-649-4880
MI	Grand Rapids, RM Elctrns. Co.	616-531-9300
MN	New Brighton, Chris Elctrns.	612-631-2647
MN	New Brighton, Parts I	612-633-8079
NJ	Rockaway, Tonar Inds.	201-986-9000
NY	Bohemia, Key Components	516-567-7500
NY	Ronkomkoma, Baldwin Comps.	516-588-5700
OR	Portland, Radar Elec.	503-232-3404
OR	Tualatim, Moore Elctrns.	503-692-5333
PA	York, E C I	717-846-5334
PA	Bristol, Aim Elctrns.	215-785-3510
RI	Pawtucket, Major Edward Elctrns.	401-725-7400
TX	Ft. Worth, Allied Elctrns.	817-336-9168
TX	Richardson, GTT	214-437-4747
WA	Seattle, Radar Elctrns.	206-282-2511
WI	Grafton, Lakeview Elctrns.	414-377-8250
Can	Montreal, Prelco Elctrns.	514-389-8051
Can	St. Laurent, Que., ZEI Elctrns.	514-342-6211

MRL, Missouri Research Labs., 3800 West Clay, St. Charles, MO 63301, Tel: 314-946-6900, 1-800-325-0223, FAX: 314-946-2860; Empl.: 100; *Sls. Mgr.:* Virgil Beer

MSC AUTOMATION, Miller Sales Co., 1111 Old Rand Rd., Wauconda, IL 60084, Tel: 708-526-9200, 800-323-5294, FAX: 708-526-9206; Empl.: 23; *Sls. Mgr.:* Paula Bilinski; *Dist. Mgr.:* Lena Nilsson



FAX: 803-393-4123

MSD, INC., Magnecraft, 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421; Empl.: 210; *Sls. Mgr.:* Bob Forbes ..... **B•1551-1556**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
AZ	Tuscon, Clemick	602-749-4003
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	Torrance, MG Sls.	213-533-1808
CO	Englewood, CSI	303-779-8060
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Orlando, CDM	407-240-3903
GA	Chamblee, BCI	404-455-0405
IL	Downers Grove, Rockford Controls Co.	312-960-2046
KS	Olathe, Advanced Tech Sls.	913-782-8702
MA	Millis, Zaslow Sls.	508-393-8150
MD	Towson, Bresson	301-321-0326
MI	Southfield, L.H. Dickelman Co.	313-353-8210
MN	Edina, Dunlop	612-559-9693
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, GSA	201-575-9300
NH	Portsmouth, Zaslow	508-393-8150
NY	Buffalo, Zang Agency	716-877-3677
OR	Tigard, Eltech	503-684-3458
OH	Cincinnati, Stegman Blaine	513-729-1969
VA	Moneta, Bresson	804-525-7445
PA	Narberth, Bresson	215-664-6460
TN	Memphis, Lesley Assocs.	901-755-9492
TX	Richardson, Texoma	214-238-8127
WA	Bellevue, Eltech, Inc.	206-643-4330
UT	Midvale, CSI	801-561-5099
WI	Sun Prairie, Rockford Controls	608-837-3350

Local Distributors

AL	Birmingham, M G Elctrns.	205-328-4525
AL	Decatur, M-G Elctrns. & Equip.	205-355-6121
AL	Huntsville, Wyle Lab.	205-837-4411
AL	Montgomery, Southern Controls, Inc.	205-277-5030
AR	Little Rock, Carlton-Bates	901-755-1249
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Hayward, Electro Comps. Inc.	415-783-5800
CA	Hayward, Western Electro Sls.	415-489-2211
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Oakland, Brill Elctrs.	415-834-5888
CA	San Diego, Johnstone Supply	619-298-7168
CA	Santa Ana, Norstan Elctrns. Inc.	714-540-4165
CA	Woodland Hills, Cypress Elctrns., Inc.	818-710-7730
CO	Aurora, Comp. Specialties, Inc.	303-341-0160
CO	Denver, Newark-Denver Elctrns.	303-757-3351
CT	Wallingford, Sager Elec Supp. Co.	203-265-4600
CT	West Hartford, HESCO	203-236-6363
FL	Lakeland, A-A Elec. Inc	813-665-6941
FL	Orlando, T & T Prods., Inc.	407-857-2282
GA	Atlanta, Brownell-Electro, Inc.	404-762-5181
GA	Norcross, A-A Elec. Inc.	404-449-8670
IL	Bensenville, Voyager Elctrns.	312-860-1300
IL	Chicago, Newark Elctrns. Corp.	312-784-5100
IL	Hinsdale, Whiteco,Inc.	312-654-3326
IL	Peoria, Klaus Radio, Inc.	309-691-4840
IN	Ft. Wayne, Bell Inds., Inc.	219-423-3422
IA	Cedar Rapids, The Van Meter Co.	319-366-5301
KS	Kansas City, Kornfeld-Thorp Elec.	913-321-7070
LA	Baton Rouge, Menard Elctrns. Inc.	504-355-0323
MA	Harrahan, M-G Electrns. & Equip. Co.	504-733-0070
LA	Lafayette, Ralph's of Lafayette Inc.	318-233-0105
LA	Shreveport, Ind. Elctr. Supp.	318-222-9459
ME	lakeland Engrg. Equiq.	
MD	Baltimore, Whitney Distrs. Inc.	301-944-8080
MA	Springfield, T.F. Cushing Inc.	413-788-7341
MA	Woburn, Apparatus Svce. Co.	617-933-5999
MI	Battle Creek, Kendall Elec. Supp.	616-963-5585
MI	Oak Park, Newark-Detroit Elctrn.	313-967-0600
MI	Troy, Teal Elec. Co.	313-689-3000
MN	Fridley, Voyager Elctns. Corp.	612-571-7766
MN	Hibbing, Jasper Engnrg. & Equip.	218-262-3421
MO	Maryland Hgts., L Comp. Inc.	314-291-6200
NJ	Audubon, Universal Elctrns. Supp.	800-327-3529
NJ	E. Hanover, State Elctrn. Parts	201-887-2550
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NM	Albuquerque, Summit Elec. Supp.	505-884-4400
NY	Buffalo, L.A. Wooley Co.	716-821-1200
NY	Buffalo, Summit Dists.	716-887-2800
NY	Plainview, A.C.I. Elctrns.	516-293-6630
NY	Rochester, Requa Elec. Co.	716-475-1600
NY	Rome, Rome Elctrns., Inc.	315-337-5400
NY	Woodside, Switches Unlimited	718-478-5000
NC	Goldsboro, Shepherd Elec. Supp.	919-735-1701
OH	Akron, Aesco Elctrns., Inc.	216-762-8818
OH	Cincinnati, Hughes-Peters, Inc.	614-294-5351
OH	Cincinnati, Wesco	513-542-4300
OH	Columbus, E & M Equip.	614-236-0888
OH	Toledo, F.N. Cuthbert, Inc.	419-385-0881
OH	Warren, REM Elctrns.	216-373-1300
OK	Tusla, Radio, Inc.	918-587-9123
OR	Portland, Johnstone Supp., Inc.	503-231-4833
PA	McKean, Advacom Inc.	814-476-7774
PA	McKeesport, Barno Radio Co.	412-751-5966
PA	Murrysville, Wesco	412-733-6800
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	St. Marys, B & R Elec. Co.	814-834-2814
PA	West Chester, West Chester Elec.	215-696-7500
PA	York, E.C.I. Inc.	717-846-5334
SC	Charleston, Cameron & Barkley Co.	803-745-2900
SC	Greenville, Emsco	803-233-4121
TN	Chattanooga, Electr. Motor Sls. & Supp.	615-899-1126
TN	Kingsport, WESCO	615-247-6190
TN	Nashville, Electra Distrbg. Co.	615-256-0800
TX	Dallas, Assocd. Aircraft	214-331-4381
TX	Dallas, Wholesale Elctr. Supp.	214-824-3001
TX	Fort Worth, Allied Elctrs.	817-595-3500
TX	Houston, Lenert Co.	713-225-1465
UT	Salt Lake City, Stuart Elec. Supp.	801-466-8603
WA	Redmond, EIL Insts. Inc.	206-882-3222
WV	Huntington, State Elec. Supp. Co.	304-523-7491
WV	South Charleston, Allied Controls Co.	304-768-7313
WI	Cedarburg, Automation Engrg.	414-377-7500
WI	Milwaukee, Marsh Elctrs.	414-475-6000
IA	Cedar Rapids, Advanced Tech. Sls.	319-393-8280

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 718-672-6500, TELEX: 426407, FAX: 718-397-0972; FSC No.: 18518; Empl.: 18; *Sls. Mgr.:* A. Lederman

M. SYSTEM TECHNOLOGY, INC., 15028 Beltway Dr., Dallas, TX 75244, Tel: 800-544-3181, FAX: 214-385-2299; Empl.: 10; *Sls. Mgr.:* Chuck Seifert

MTE CORP., W147 N 9525 Held Dr., Menomonee Falls, WI 53051, Tel: 414-253-8200, FAX: 414-253-8222; FSC No.: 5950; Empl.: 120; *Sls. Mgr.:* John Houdek; *Dist. Mgr.:* John Houdek

M-TEK, 2419 Smallman St., Pittsburgh, PA 15222, Tel: 800-245-5101 , 412-261-9030, TELEX: 812-569, FAX: 412-261-7220; FSC No.: 56452; Empl.: 20; *Sls. Mgr.:* John Hartnett



FAX: 605-665-1709

M-TRON INDUSTRIES, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603; FSC No.: 23875; Empl.: 150; *Sls. Mgr.:* Larry Barbary; *Dist. Mgr.:* Les Willman ..... **A•1408-1409**

Local Sales Offices & Reps

AL	Huntsville, Group 2000 Sls. Inc.	205-536-2000
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	Torrance, Universal Comps. Co.	213-783-0220
CO	Englewood, Comp. Sls; Inc.	303-779-8060
CT	Fairfield, Comptech/NRG Ltd.	203-384-1112
FL	Ft. Lauderdale, QXI of Florida Inc.	305-978-0120
FL	Melbourne, QXI of Fl., Inc.	407-723-4384
FL	Orlando, QXI of Florida Inc.	407-872-2321
FL	St. Petersburg, QXI of Florida Inc.	813-894-4556
GA	Norcross, Group 2000 Sls. Inc.	407-729-1889
IL	Arlington Hgts., KMA Sales	708-398-5300
IN	Ft. Wayne, Alpha Tech, Inc.	219-447-0040
MD	Columbia, Robert Electronic Sales	301-995-1900
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Tyngsboro, Comptech, Inc.	508-649-3030
MI	Farmington Hills, Tritech Sales, Inc.	313-553-3370
MN	Edina, OHMS Technology Inc.	612-932-2920
NJ	E. Brunswick, Winch Sales Associates	201-613-1515

NJ Marlton, Naudain Associates, Inc. 609-983-5300
NY Farmingdale, Milgray Int'l 516-420-9800
NY Pittsford, James E. Zimmerman Sales 716-381-3186
NY Plainview, Winch Sales Associates ... 516-681-3163
NC Raleigh, Robert Electronic Sales 919-878-4465
NC Sapphire, Robert Electronics Sales ... 704-877-3280
OH Dayton, Lyons Corporation 513-278-0714
OH Richfield, Lyons Corporation 216-659-9224
OH Westerville, Lyons Corporation 614-895-1447
OR Portland, K-Tek Intl. Inc. 503-624-0315
TX Austin, Ram Electronics Sales, Inc. 512-250-5082
TX Houston, Ram Electronics Sales, Inc. 713-955-0768
TX Plano, Ram Electronic Sales, Inc. 214-424-4455
UT Midvale, Component Sales, Inc. 801-561-5099
WA Lynnwood, Quadra Sales 206-743-2633
WI Milwaukee, KMA Sales 414-259-1771
Can Burnaby, BC., Kaytronics 604-294-2000
Can Concord, Ont., Kaytronics 416-669-2262
Can Kantata, Ont., Kaytronics 613-564-0080
Can Ville St. Laurent, Que., Kaytronics 514-745-5800

Local Distributors

AL Huntsville, Bell Industries 205-837-1074
AL Huntsville, Pioneer Electronics 205-837-9300
AZ Phoenix, Sterling Electronics 602-437-5565
AZ Tempe, Acacia 602-894-2874
AZ Tempe, Bell Industries 602-966-7800
AR Little Rock, Carlton-Bates 501-562-9100
CA Agoura Hills, Bell Industries 818-706-2608
MA Auburn, Dove Electronics 508-832-2730
WI Brookfield, Pioneer 414-784-3480
CA Chatsworth, Sterling Electronics 818-407-8850
CA Cypress, Bell Industries 714-895-7801
CA Fremont, Acacia 415-623-7500
CA Gardena, Bell Industries 213-515-1800
CA Huntington, Wyle Kitting 714-373-9944
CA Irvine, Acacia 714-660-0834
CA Los Angeles, Bell Industries 213-826-6778
CA Rocklin, Bell Industries 916-652-0414
CA San Diego, Acacia 619-597-0577
CA San Diego, Bell Industries 619-268-1277
CA San Diego, Pyramid Electronics/Kent 619-271-5404
CA San Diego, Sterling Electronics 619-271-6555
CA San Jose, All American 403-943-1200
CA San Jose, Compass Components 408-432-7525
CA Santa Clara, Pyramid/Kent Elect. 408-727-9810
CA Sherman Oaks, DLDI 213-283-2058
CA Stanton, Inductive Comp/Crystal 714-828-3420
CA Sunnyvale, Bell Industries 408-745-0400
CA Sunnyvale, Bell Industries 408-734-8570
CA Torrance, All American 213-320-0240
CA Torrance, Pyramid/Kent Electronics .. 714-773-0781
CA Tustin, Sterling Electronics 714-259-0900
CO Englewood, Component Sales, Inc. ... 303-779-8060
CO Englewood, Sterling Electronics 303-792-3939
CO Lakewood, Acacia 303-232-2882
CO Wheatridge, Bell Industries 303-424-1985
CT E. Haven, J.V. Electronics 203-469-2321
CT Norwalk, Pioneer Electronics 203-853-1515
FL Altamonte Springs, Bell Industries 407-339-0078
FL Altamonte Springs, Pioneer 407-834-9090
FL Clearwater, All American 813-536-0445
FL Miami, All American 305-621-8282
CA Santa Fe Springs, Bell Industries 213-921-3611
GA Norcross, Bell Industries 404-662-0923
GA Norcross, Pioneer Electronics 404-623-1003
IL Addison, Pioneer Electronics 708-495-9680
IL Elk Grove Vl, Bell Industries 312-640-1910
IL Rosemont, Advent Electronics 708-297-6200
IL Schaumburg, Sterling Electronics 707-303-9900
IN Ft. Wayne, Bell Industries 219-423-3422
IN Indianapolis, Advent Electronics 317-872-4910
IN Indianapolis, Bell Industries 317-875-8200
IN Indianapolis, Pioneer Electronics 317-573-0880
IA Cedar Rapids, Advent Electronics 319-363-0221
IA Cedar Rapids, Bell Industries 319-395-0730
CA San Jose, Pioneer Technologies 408-954-9100
FL Sunrise, All American 305-572-7999
MD Baltimore, Resco Baltimore 301-931-8200
MD Beltsville, Resco/Washington 301-937-9100
MD Gaithersburg, Pioneer Electronics 301-921-0660
MA Andover, Bell Industries 508-474-8880
MA Billerica, A. W. Mayer Co. Inc. 508-229-2255
FL Clearwater, Pioneer/Tampa 813-536-0445
MA Lexington, Pioneer Electronics 617-861-9200
MD Rockville, All American 301-251-1205
MA Wakefield, All American 617-246-2300
MA Wilmington, J.V. Electronics 508-833-0700
MA Winchester, Bell Industries 617-729-5800
MI Ann Arbor, Bell Industries 313-347-6633
MI Farmington Hills, Advent Industries ... 313-477-1650
MI Grand Rapids, Pioneer Electronics 616-698-1800
MI Livonia, Pioneer Electronics 313-525-1800
MN Eden Prairie, All American 612-944-2151
MN Eden Prairie, Pioneer 612-944-3355
MN Hibbing, Minntech Electronics 218-262-5228
NJ Hopeland, Dove Electronics 201-324-7830
MN Minneapolis, Stark Electronics 612-332-1325
MO St Louis, Ric-tronics 314-997-0747
MO St. Louis, Pioneer Electronics 314-432-4350
NH Hudson, Bell Industries 603-882-1133
NH Nashua, Brevan Electronics 603-889-7230
NJ Fairfield, Pioneer Electronics 201-575-3510
NJ W. Berlin, GCI 609-768-6767
NM Albuquerque, Bell Industries 505-292-2700
NM Albuquerque, Sterling Electronics 505-884-1900
NJ Berlin, P.A.C. Electronics 609-768-5180
NY Binghamton, Pioneer Electronics 607-722-9300
NY Bohemia, Key Components Inc. 516-567-7500
NY Fairport/Rochester, Pioneer 716-381-7070
NY Farmingdale, Bell Industries 516-752-9303
NY Ronkonkoma, All American 516-981-3935
NY Ronkonoma, M-tron Components 516-467-5100
NY Stony Brook, Dove Electronics 516-689-7733
NY Woodbury, Pioneer Electronics 516-921-8700
NC Charlotte, Pioneer Electronics 704-527-8188
NC Durham, Pioneer Electronics 919-544-5400
NC Raleigh, Century Electronics 919-782-2116
NC Raleigh, Sterling 804-226-2190
OH Cleveland, Pioneer Electronics 216-587-3600
OH Dayton, Bell Inds. (Industrial) 513-435-8660
OH Dayton, Bell Inds. (Military) 513-434-8231
OH Dayton, Pioneer Electronics 513-236-9900
OK Oklahoma City, Radio Inc. 405-789-0741
OK Tulsa, Altair 918-252-5781
OK Tulsa, Radio Inc. 918-587-9123
OR Beaverton, Acacia 503-646-3377
OR Lake Oswego, Bell Industries 503-635-6500
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TX Houston, Sterling 713-627-9800
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TX Richardson, Bell Industries 214-690-0466
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VA Richmond, Sterling Electronics 804-226-2190
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WA Redmond, Priebe Electronics 206-881-2363
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Can Winnepeg, Man., Zentronics 204-694-1957
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Can Winnipeg, MN, ITT/R-A-E Ltd. 204-786-8401

MTS SYSTEMS, Box 24012, Minneapolis, MN 55424, Tel: 612-937-4000, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 1300; *Sls. Mgr.:* Ted Beaudoin

MUELLER ELEC. CO., 1583 E. 31st St., Cleveland, OH 44114, Tel: 216-771-5225, FAX: 216-771-3068; Empl.: 156; *Sls. Mgr.:* J. E. Wisneski

MULTI-AMP CORP., TBG, 4271 Bronze Way, Dallas, TX 75237, Tel: 214-333-3201, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 350; *Sls. Mgr.:* Hermann Michaeli

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IL Chicago, Multi-Contact 312-286-1666

MULTICORE SOLDERS, 1751 Jay Ell Drive, Richardson, TX 75081, Tel: 214-238-1214; Empl.: 1000

MULTICORE SOLDERS, 400 Post Ave. Ste., 306, Westbury, NY 11590, Tel: 516-334-7997, FAX: 516-334-7098

MULTIPOWER, INC., Spectrum Electronics Corp., 3005 S.W. 154th Terrace No. 1, Beaverton, OR 97006, Tel: 503-646-4700, FAX: 503-643-4889; FSC No.: 75498; Empl.: 33 ..... **D•1912**

Local Sales Offices & Reps

OR Beaverton, MultiPower, Inc. 503-646-4700

MULTI PRODUCTS INTERNATIONAL, 250 Lackawanna Ave., West Paterson, NJ 07424, Tel: 201-890-1344, TELEX: 219289, FAX: 201-890-1677; Empl.: 28; *Sls. Mgr.:* LeRoy Gray ..... **A•2309; D•1913**

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CA Mission Viejo, Jay Mktg. 714-768-7519
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FL Longwood, Elctrn. Mfgs. Agt. 305-682-1202,
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IL Des Plaines, Esco Assocs. 312-298-5310
IN Frankfort, C-S Elctrns. Sls. 317-659-1874
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MI Lathrup Vl, R. C. Nordstrom & Co. 313-559-7373
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MO St. Charles, MSB Assocs. 314-967-5577
NJ Cedar Grove, Legtonics Assocs. 201-239-4098
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MULTISENS INC, 2633 Blv. Le Corbusier, Laval, Que., Canada H7S 2E8, Tel: 514-629-5646, FAX: 514-629-6801; Empl.: 20; *Sls. Mgr.:* Jean-Franqois Olivier

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FAX: 404-436-3030

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FL Satellite Beach, Glen White Assoc. 407-773-3514
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AZ Phoenix, Sterling Elctrns. 602-437-5565
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AZ Tempe, Time Elctrns. 602-967-2000
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CA Chatsworth, Passive Technlg. 818-882-2277
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CA Chatsworth, Time Elctrns. 818-998-7200
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CA Irvine, Future Elctrns. 714-250-4141
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CA San Diego, Future Elctrns. 619-278-5020
CA San Diego, Sterling Elctrns. 619-271-6555
CA San Diego, Time Elctrns. 619-586-1331
CA San Jose, Future Elctrns. 408-434-1122
CA San Jose, Future Elctrns. 408-434-1114
CA San Jose, Passive Technlg. 408-435-5566
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CT Wallingford, Sterling Elctrns. 203-265-9535
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FL Winter Park, Milgray Elctrns. 407-647-5747
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IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
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NC Charlotte, Time Elctrns. 704-522-7600
NC Oxford, Time Elctrns. 919-693-5166
NC Raleigh, Future Elctrns. 919-790-7111
NC Raleigh, Milgray Elctrns. 800-562-3118, 919-790-8094
OH Cleveland, Milgray Elctrns. 216-447-1520
OH Columbus, Elctrn. Mktg. Corp. 614-299-4161
OH Dublin, Time Elctrns. 614-761-1100
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VA Richmond, Sterling Elctrns. 804-226-2190
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NAMCO CONTROLS, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060, Tel: 216-946-9900, TELEX: 24-1566, FAX: 216-946-1228; Empl.: 200; *Sls. Mgr.:* Jon Slayburgh, Pres., Gen. Mgr.

NAMIKI, Precision of America, Inc., 201 West Passaic St., Rochelle Park, NJ 07662, Tel: 201-368-0123, FAX: 201-368-2244; FSC No.: 201-343-3172

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CO Colorado Springs, Natl. Instrs. 719-542-2815
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MA Norwell, Natl. Instrs. 617-659-9444
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VA Herndon, Natl. Instrs. 703-709-9874

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WA Woodenville, Team, Inc. 206-485-1111
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NATIONAL LAMINATION CO., National Material Ltd., 555 Santa Rosa Dr., Des Plaines, IL 60018, Tel: 708-298-7676, FAX: 708-635-8624; Empl.: 210

NATIONAL MANUFACTURING CO., INC., 12 River Rd., Chatham, NJ 07928, Tel: 201-635-8846, FAX: 201-635-7810; Empl.: 150; *Sls. Mgr.:* Otto Stahl, Jr.

NATIONAL MICRONETICS, 71 Smith Ave., Kingston, NY 12401, Tel: 914-338-0333, TWX: 510-247-8046, FAX: 914-338-0377; Empl.: 700; *Sls. Mgr.:* Richard Carlton

NATIONAL POWER TECHNLG., See Intelligence Power Technology

NATIONAL SEMICONDUCTOR, 2900 Semiconductor Dr., Santa Clara, CA 95052, Tel: 408-721-2641, FAX: 408-245-9655; Empl.: 30,000

NATIONAL SEMICONDUCTORS, LTD., See Silonex Inc.

NATIONAL-STANDARD CO., 1618 Terminal Rd., Niles, MI 49120, Tel: 616-683-8100, TELEX: 295187, FAX: 616-683-6249; Empl.: 2800; *Sls. Mgr.:* A. Osos; *Dist. Mgr.:* D. M. Wedsworth

NATIONAL TELEPHONE & ELECTRONICS INC., 2350 N.W. 96 Avenue, Miami, FL 33172, Tel: 305-592-0551, FAX: 305-599-0948; Empl.: 50

FAX: 213-225-4630

NATIONAL WIRE & CABLE CORP., 136 San Fernando Rd., Los Angeles, CA 90031-1780, Tel: 213-225-5611, TELEX: 181409, TWX: 910-321-4155; FSC No.: 04569; Empl.: 225 ..... **C•1704, 1776-1797**

Local Sales Offices & Reps

AZ Mesa, System Sls. 602-464-9989
AR Cotter, P.M.I. Sls. Co. 501-430-5525
CA San Diego, C.K. Sales 619-279-0420
CA Santa Clara, Ross Mktg. 408-988-8111
CO Arvada, Arrowhead/CSI Sls. 303-423-5597
FL Altamonte Springs, Gugel Assocs. 407-788-0845
GA Lawrenceville, Tek-Rep Mktg. 404-963-1600
HI Hilo, Kirco Corp. 808-959-3888
IL Northfield, H. S. Tollaksen 708-441-6644
MD Glen Burnie, Faion Lott 301-744-4611
MA Norwood, Tom Maguire Assocs., Inc. .. 617-551-0500
MI Farmington Hills, Luebbe Sls. 313-489-8828
MN Minnetonka, Producton Automation ... 612-935-1414
MO St. Louis, P.M.I. Sls. Co. 314-963-0001
NJ Wayne, GT Assoc. 201-694-6040
NY Sodus, S.W. Woolard 315-655-8145
OH Cincinnati, Luebbe Sls. 513-530-0600
OH Dayton, Luebbe Sls. 513-294-0426
OH Westlake, Luebbe Sls. 216-899-0071
PA Hatboro, Jacobsen Assocs. 215-674-2937
PA Pittsburgh, Luebbe Sls. Co. 412-364-0490
TX Ft. Worth, Tesco, Inc. 214-553-1200
WA Redmond, Halbar Assocs. 206-882-0990

NATIONWIDE ELECTRONIC SYSTEMS, See Weschler/NES Instruments

NAUGLER ENGINEERING, INC., Off Dunham Rd., Beverly, MA 01915, Tel: 617-922-5634, FAX: 617-468-1272; FSC No.: 05222; Empl.: 10; *Sls. Mgr.:* Kristen N. Bonnette

NAVAN CORPORATION, 20 West Front Street, Media, PA 19063, Tel: 215-543-8066, FAX: 215-543-2151; FSC No.: 6695; Empl.: 6; *Sls. Mgr.:* Howland St. Clair

NAZ-DAR/K.C., Thrall Enterprises, 1087 N. Branch St., Chicago, IL 60622, Tel: 312-943-8338, FAX: 312-943-8215; Empl.: 53; *Sls. Mgr.:* Kent Schnese; *Dist. Mgr.:* Kent Schnese

NCE:NATIONAL CUSTOM ENTERPRISES, INC., 400 Gateway Blvd., Burnsville, MN 55337-2559, Tel: 612-890-1360, FAX: 612-890-1014; FSC No.: 1FS75; Empl.: 25; *Sls. Mgr.:* J. A. Carlson

NCGI/STRUTHERS-DUNN, INC., INDUSTRIAL/COMMERICAL RELAYS, See MSD, Div. of Magnecraft

NCI, 6438 University Drive, Huntsville, AL 35806, Tel: 205-837-6667, FAX: 205-837-5221; Empl.: 8; *Sls. Mgr.:* Hal Newcomb; *Dist. Mgr.:* David Newcomb

NCR COMTEN, INC., NCR Corp., 2700 Snelling Avenue N., St. Paul, MN 55113, Tel: 612-638-7777, TELEX: 6879018 Comten, FAX: 612-638-8573; FSC No.: 7025-0010; Empl.: 1000; *Sls. Mgr.:* Gerry Fisher; *Dist. Mgr.:* Gerry Fisher

NCR POWER SYSTEMS, 3200 Lake Emma Rd., Lake Mary, FL 32746, Tel: 407-323-9250, FAX: 407-333-8312; Empl.: 156; *Sls. Mgr.:* Rick Ullinger

NDK

FAX: 415-623-6590

NDK AMERICA, INC., 47671 Westinghouse Dr., Fremont, CA 94539, Tel: 415-623-6500; Empl.: 28; *Sls. Mgr.:* Mike Kurihara, VP ..... **A•1416-1423**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Mktg. Assoc. 205-880-8050
AZ Scottsdale, Carefree 602-951-9121
TX Dallas, SW Tech. 214-369-0977
CA Irvine, Quad-Rep South, Inc. 714-727-4222
CA Orangevalle, I Square, Inc. 916-989-0843
CA San Diego, Quad-Rep. 619-560-8330
CA Santa Clara, I Square, Inc. 408-988-3400
CO Englewood, CSI 303-779-8060
CT Woodbury, Anacon 203-266-0707
DE Medford, Jack McCoy 609-953-0770
GA Atlanta, Elctrn. Mktg. Assoc. 404-448-1215
ID Boise, Intermountain Tech. 208-888-6071
IL Chicago, M. Gottlieb & Assocs. 312-775-1151
IN Carmel, Fred A. Dorsey & Assocs. 317-844-4842
IA Davenport, Rush & West Assocs. 319-388-9494
KS Olathe, Rush & West Assocs. 913-764-2700
MD Annapolis, E.E.S Assoc. 301-269-4234
MA Burlington, Anacon Sls. Assocs., Inc. .. 617-272-9080
MI Grand Rapids, Miltimore Sls. 616-942-9721
MI Novi, Miltimore Sls. 313-349-0260
MO St. Louis, Rush & West Assocs. 314-965-3322
MT Boise, Inter-Mtn. Tech. 208-888-6071
NE Davenport, Rush & West 319-388-9494
NV Santa Clara, I Squared 408-988-3400
NY Syracuse, Rep Tech., Inc. 315-437-2845
NJ Fairfield, Tech. Applications & Mktg. ... 201-575-4130
NJ Medford, Jack McCoy, Inc. 609-953-0770
NM Albuquerque, Nelco Elctrns. 503-293-1399
NY Fairfield, TAM 201-575-4130
NC Raleigh, Elctrn. Mktg. Assoc. 919-847-8800
OH Cincinnati, Makin Assocs. 513-871-2424
OH Columbus, Makin Assocs. 614-848-5424
OH Solon, Makin Assocs. 216-248-7370
OR Tigard, Comps. West 503-684-1671
PA Medford, Jack McCoy, Inc. 609-953-0770
PA Solon, Makin Assocs. 216-248-7370
SC Greenville, Elctrn. Mktg. Assoc. 803-233-4637
TX Austin, Southwestern Tech. Sls. 512-440-0499
TX Dallas, Southwestern Tech. Sls. 214-369-0977
TX Houston, Southwestern Tech. Sls. 713-440-9200
UT Boise, Inter-Mtn Tech. 208-888-6071
VT Wilmington, Anacon 617-270-3712
WA Redmond, Comps. West 206-885-5880
WI Chicago, M. Gottlieb Assocs. 312-775-1151

Local Distributors

AL Huntsville, Lex Elec. 205-895-0480
AL Huntsville, Time Elctrns. 214-721-1134
AZ Tempe, Lex Elec. 602-431-0030
AZ Tempe, Time Elctrns. 602-967-2000
CA Calabassas, Lex Elec. 818-880-9686
CA Chatsworth, Time Elctrns. 818-988-7200
CA Irvine, Lex Elec. 714-987-0404
CA San Diego, Time Elctrns. 619-986-0129
CA San Jose, Lex Elec. 408-432-7171
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Englewood, Lex Elec. 303-799-0258
CO Englewood, Time Elctrns. 303-721-8882
CT Danbury, Lex Elec. 203-264-4700
FL Deerfield, Lex Elec. 305-977-7511
FL Ft. Lauderdale, Time Elctrns. 305-484-7778
GA Norcross, Lex Elec. 404-449-9170
GA Norcross, Time Elctrns. 404-448-4488
IL Schaumburg, Lex Elec. 708-330-2888
IL Wood Dale, Time Elctrns. 312-350-0610
KS Overland Pk., Lex Elec. 913-492-2922
MD Columbia, Lex Elec. 301-996-7800
MD Columbia, Time Elctrns. 301-964-3090
MA Peabody, Time Elctrns. 508-532-9900
MA Wilmington, Lex Elec. 508-694-0962
MI Livonia, Lex Elec. 313-525-8100
MN Eden Prairie, Lex Elec. 612-941-5280
MN Edina, Time Elctrns. 612-943-2433
MO Manchester, Lex Elec. 314-391-6444
MO St. Louis, Time Elctrns. 314-391-6444
NH Manchester, Lex Elec. 603-625-2250
NJ Marlton, Time Elctrns. 609-996-6700
NJ Pinebrook, Lex Elec. 201-227-7880
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Hauppauge, Lex Elec. 516-231-2900
NY Hauppauge, Time Elctrns. 516-434-3344
NY Rochester, Lex Elec. 716-424-2222
NY Westbury, Lex Elec. 516-876-4000
NC Raleigh, Lex Elec. 919-876-0000
NC Raleigh, Time Elctrns. 919-847-9650
OH Beachwood, Lex Elec. 216-464-2970
OH Columbus, Time Elctrns. 614-794-3309
OH Dayton, Lex Elec. 513-439-1800
OK Tulsa, Lex Elec. 918-622-8000
OR Portland, Time Elctrns. 503-684-3782
PA Pittsburgh, Lex Elec. 412-963-6804
TX Austin, Lex Elec. 512-339-3051
TX Austin, Time Elctrns. 512-346-7346
TX Dallas, Lex Elec. 214-247-6300
TX Houston, Lex Elec. 713-784-3600
UT West Valley City, Time Elctrns. 801-973-8494
WA Kirkland, Time Elctrns. 206-820-1525
WI New Berlin, Lex Elec. 414-784-9451
Can Ontario, Time Elctrns. 416-672-5300

NEC

FAX: 415-965-6272

NEC ELECTRONICS, INC., 401 Ellis Street, P.O. Box 7241, Mountain View, CA 94039, Tel: 415-960-6000, TWX: 910-379-6985; Empl.: 1200; *Sls. Mgr.:* Mike Despotes, Sls. V.P.; *Dist. Mgr.:* Michael Kelly ..... **A•1115-1119; B•1100-1102, 1324-1332, 1558-1564**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
AZ	Phoenix, Oasis Sls., Inc.	602-277-2714
CA	Cardiff, Mission Technlg.	619-753-5092
CA	Mtn. View, NEC Elctrns.	415-965-6000
CA	San Jose, Exis	408-456-1650
CA	Santa Ana, NEC Elctrns.	714-546-0501
CO	Aurora, NEC Elctrns.	303-755-6353
CO	Boulder, Promotional Technlg.	303-447-2474
CO	Parker, Promotional Technlg.	303-841-4664
CT	Cheshire, Datatrack Engrg., Inc.	203-271-1311
FL	Altamonte Springs, V.G. Sls., Inc.	407-831-8688
FL	Ft. Lauderdale, V.G. Sls. Inc.	305-938-4333
FL	Largo, V.G. Sls. Co., Inc.	813-536-7787
FL	Maitland, NEC Elctrns.	407-875-1145
GA	Norcross, NEC Elctrns.	404-447-4409
GA	Norcross, 20th Century Mktg. Inc.	404-446-1999
IL	Arlington Hgts., NEC Elctrns.	312-577-9090
IL	Schaumburg, Martan Inc.	312-303-5660
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, Stan Clothier Co.	319-393-1576
KS	Overland Pk., AME Sls.	913-492-3971
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Glen Burnie, TRI-MARK Inc.	301-761-6000
MA	Natick, NEC Elctrns.	508-650-4100
MA	Woburn, Compass Technlg.	617-933-3336
MI	Grand Rapids, Miltimore Sls.	616-942-9721
MI	Novi, Miltimore Sls.	313-349-0260
MI	Troy, NEC Elctrns.	313-680-0506
MN	Bloomington, NEC Elctrns.	612-854-4443
MN	Minneapolis, Stan Clothier Co.	612-944-3456
MO	St. Charles, AME Sls.	314-928-2599
NJ	Bellmawr, TAI Corp.	609-778-5353
NJ	Saddle Brook, Metro Logic Corp.	201-575-5585
NY	Fishkill, NEC Elctrns.	914-897-2101
NY	Melville, NEC Elctrns.	516-753-7526
NY	Pittsford, Elcom Sls.	716-385-1400
NY	Skaneateles, Elcom Sls.	315-685-8245
NC	Charlotte, Quantum Mktg. Inc.	704-523-8822
NC	Durham, NEC Elctrns.	919-544-4132
NC	Raleigh, Quantum Mktg. Inc.	919-846-5728
OH	Columbus, NEC Elctrns.	614-436-1778
OH	Pepper Pike, NEC Elctrns.	216-831-0067
OR	Portland, Venture Elctrns.	503-624-0617
OR	Tigard, NEC Elctrns.	503-671-0177
PA	Allentown, NEC Elctrns.	215-391-9094
TX	Austin, TL Mktg., Inc.	512-837-7272
TX	Dallas, NEC Elctrns.	214-931-0641
TX	Dallas, TL Mktg., Inc.	214-484-6800
TX	Houston, NEC Elctrns.	713-955-2191
TX	Houston, TL Mktg., Inc.	713-589-2763
UT	Midvale, Promotional Technlg. Corp.	801-566-8919
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Mequon, Martan Inc.	414-241-4955
PR	Mayaguez, V. G. Sls. Co., Inc.	809-831-4150
Can	Concord, Ont., Kaytronics	416-669-2262
Can	Kanata, Ont., Kaytronics	613-592-6606
Can	Surrey, BC, Kaytronics Western	604-294-2000
Can	Ville St.-Laurent, Que., Kaytronics	514-745-5800

NEARFIELD SYSTEMS, INC., 1330 E. 223rd St. 524, Carson, CA 90745, Tel: 213-518-4277, FAX: 213-518-4279; Empl.: 6

NECOA, INC., Nittoku Engineering Group, 9321A Philadelphia Rd., Baltimore, MD 21237, Tel: 301-574-4960, FAX: 301-574-7083; *Sls. Mgr.:* Larry Whyte

NEC TECHNOLOGIES, INC., 1414 Massachusetts Ave., Boxborough, MA 01719, Tel: 508-264-8000, TELEX: 910-997-0594; Empl.: 2700; *Sls. Mgr.:* Richard Gilbert/Jim Gregg

NEDAP N.V., P.O. Box 6, Groenlo, Holland 7140 AA, Tel: ò31-5440-71111, TELEX: 44253, FAX: ò31.5440.62745; Empl.: 420; *Sls. Mgr.:* W. Bonnemeier

NEDCO ELECTRONICS, INC., 8246 LeHigh, Morton Grove, IL 60053, Tel: 312-967-0500, FAX: 312-967-0505; Empl.: 10

NEEDHAM'S ELECTRONICS, 4539 Orange Grove Ave., Sacto, CA 95841, Tel: 916-924-8037, FAX: 916-972-9960; Empl.: 5

NEFF INSTR., 700 S. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-2281, TWX: 910-585-1833, FAX: 818-303-2286; Empl.: 125; *Sls. Mgr.:* Louis P. Lang

NEL FREQUENCY CONTROLS, INC., 357 Beloit St., Burlington, WI 53105, Tel: 414-763-3591, FAX: 414-763-2881; FSC No.: 00815; Empl.: 160; *Sls. Mgr.:* Dick Griebel, VP Sls. & Mktg.; *Dist. Mgr.:* Boyd Recknagel ... **A•1425**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
FL	Valrico, Richmar Elctrns.	813-654-8032
CA	Burlingame, Wm. J. Purdy Co.	415-347-7701
CA	Westlake Vlg., Elkin & Assoc.	818-597-1075
CO	Parker, A5 Co.	303-841-3651
FL	Orlando, Richmar Elctrns.	407-352-3755
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Downers Grove, Richmar Elctrns.	708-968-0118
IN	Indianapolis, Richmar Elctrns.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
MI	Adrian, Elctrn. Salesmasters	517-263-2500
MI	Wixom, Elctrn. Salesmasters	313-669-0015
NH	Nashua, Bell Controls	603-882-6984
NY	Glen Cove, DynoRep	516-676-1598
NJ	Medford, Champion Elctrn. Sls. Assoc.	609-983-0932
NJ	Somerville, DynoRep	201-874-4670
NY	Attica, PSR Co.	716-591-1219
NY	Auburn, PSR Co.	315-253-4109
NY	Endicott, PSR Co.	607-754-7846
NY	Port Jefferson Sta., DynoRep	516-928-5135
NC	Raleigh, 20th Century Mktg.	919-790-9383
OH	Beechwood, Elctrn. Salesmasters	216-831-9555
OR	Tigard, RTS, Inc.	503-244-4123
TX	Plano, Richmar Elctrns.	214-424-8388
TX	Round Rock, Richmar Elctrns.	512-255-2551
WA	Edmonds, RTS Inc.	206-745-5445
WA	Vashon, RTS, Inc.	206-285-1363
WI	Butler, Richmar Elctrns.	414-781-1730
EXP	San Juan, Puerto Rico, Elctrn. Tech. Sls.	809-798-1300

Local Distributors

AZ	Tempe, Time Elctrns.	602-967-2000
CA	Chatsworth, Time Elctrns.	818-998-7200
MA	Auburn, Dove Elctrns.	508-832-2730
CA	Canoga Pk., Tim-Co Sls.	818-992-5040
CA	Irvine, Integrated Elctrns.	714-837-9960
NH	Manchester, Glynn Elctrns.	603-622-8131
CA	Milpitas, Sierra West	408-945-1050
MN	New Brighton, Chris Elctrns.	800-356-6599
CA	Sacramento, Integrated Elctrns.	916-363-6030
CA	San Jose, All American	408-943-1200
CA	San Jose, Integrated Elctrns.	408-435-1000
CA	Sunnyvale, Target	408-733-0384
CA	Torrance, All American	800-669-8300
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CA	Van Nuys, C. W. Swift	818-989-1133
CA	Westlake Village, Sertek	818-707-2872
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Yalesville, Glynn	203-265-2498
FL	Miami, All American	305-621-8282
FL	Sunrise, All American	800-327-6237
IL	Hoffman Estates, Integrated Elctrns.	708-843-2040
IL	Lisle, Components Inc.	312-852-7707
IL	Northbrook, Classic Comps.	708-272-9650
IL	Rosemont, Advent	800-323-1270
IN	Indianapolis, Advent	317-872-4910
IA	Cedar Rapids, Advent	319-363-0221
MD	Jessup, Treeko Elctrns.	301-792-0112
MD	Rockville, All American	800-426-0420
MA	Billerica, Mayer Elctrns.	617-229-2255
MA	Middleboro, Glynn Elctrns.	800-225-8684
MA	Wakefield, All American	800-874-2834
MI	Farmington Hills, Advent	313-477-1650
MN	Eden Prairie, All American	612-944-2151
MN	Minneapolis, Bergquist	612-835-2322
NJ	Hopelawn, Dove Elctrns.	908-324-7830
NY	Buffalo, Genesee Indl.	716-873-9661
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Ronkonkoma, All American	800-874-2830
NY	Stony Brook, Dove Elctrns.	516-689-7733
OH	Englewood, Argent	513-836-8633
OH	Solon, Repco Elctrns.	216-248-8900
OK	Tulsa, Altair	918-252-5781
OR	Beaverton, Integrated Elctrns.	503-641-1690
TX	Austin, Altair Co.	512-837-4970
TX	Dallas, Off The Shelf	214-247-0052
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, All American	800-541-1435
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Off The Shelf	214-238-0808
UT	Salt Lake City, Integrated Elctrns.	801-977-9750
WA	Bellevue, Integrated Elctrns.	206-455-2727
WI	Mequon, Taylor Elec.	800-242-8914
WI	New Berlin, Classic Comps.	800-242-7408
Can	Calgary, Alberta, Memco	403-258-3399
Can	Surrey, B.C., Memco	604-590-1553

NEMETH ENGINEERING ASSOCIATES, INC., 5901 West Highway 22, Crestwood, KY 40014, Tel: 502-241-1502, FAX: 502-241-5907; Empl.: 36

NEPENTHE, INC., 2479 E. Bayshore Rd. 800, Palo Alto, CA 94303, Tel: 415-496-6666, FAX: 415-856-8650; FSC No.: 415.856 8650; Empl.: 50; *Sls. Mgr.:* Kirk Feyerabend

NESCO BATTERY SYSTEMS, National Electro-Sales Corp., 7110 Gerald Ave., Van Nuys, CA 91406-7840, Tel: 818-781-0505, 1-800-423-2664, FAX: 818-786-2758

NESHAMINY TRANSFORMER CORP., Edison-Furlong Road, Furlong, PA 18925, Tel: 215-794-7411, FAX: 215-794-3894; Empl.: 70; *Sls. Mgr.:* Tom Linton

NES, INC.(NATIONWIDE ELECTRONIC SYSTEMS), See Weschler Instruments

N.E.S., INC., 502 Union St., Box 29, W. Springfield, MA 01090, Tel: 413-734-6491; FSC No.: 3439; Empl.: 10; *Sls. Mgr.:* Sandy Saffer

NETCOM, INC, 3000 Commerical Ave.,P.O.Box 3025, Northbrook, IL 60065-3025, Tel: 708-564-5100, FAX: 708-564-2279; FSC No.: 57193; Empl.: 105; *Sls. Mgr.:* Wayne Roeder

NETWORKS INTERNATIONAL CORPORATION, 13924 W. 108th St., Lenexa, KS 66215, Tel: 913-469-6494, FAX: 913-469-6495; Empl.: 20; *Sls. Mgr.:* Abhay Bisarya; *Dist. Mgr.:* Abhay Bisarya

NETWORK SOFTWARE ASSOCIATES, INC., 39 Argonaut, Laguna Hills, CA 92656, Tel: 714-768-4013, FAX: 714-768-5049; Empl.: 50; *Sls. Mgr.:* Raymond Chan; *Dist. Mgr.:* Raymond Chan

NETWORK TECHNOLOGIES INC., 7322 Pettibone Rd., Chagrin Falls, OH 44022, Tel: 216-543-1646, FAX: 216-543-5423

NEURAL SYSTEMS INC., 2827 West 43rd Ave., Vancouver, BC, Canada V6N 3H9, Tel: 604-263-3667, FAX: 604-263-3667; Empl.: 2; *Sls. Mgr.:* Gary Josin

NEURON ELECTRONICS, INC., 3914 Del Amo Blvd., Ste. 902, Torrance, CA 90503, Tel: 213-793-1300, 1-800-FON-4-NEI, FAX: 213-793-1304; Empl.: 4; *Sls. Mgr.:* Steve Stone

NEUTRIK PRODUCTS, See Kulka Smith

NEW ENGLAND KEYBOARD INC., 191 Cleghorn St., Fitchburg, MA 01420, Tel: 508-345-8332, FAX: 508-345-4329; Empl.: 16; *Sls. Mgr.:* Mark A. Yates ..... **B•1825**

NEW HAMPSHIRE BALL BEARING, INC., Corp. Hdgtrs & Hitech Div., Rte. 202, Peterborough, NH 03458, Tel: 603-924-3311, FAX: 603-924-6632; Empl.: 1200; *Dist. Mgr.:* Alan Paynter

NEW HAMPSHIRE BALL BEARINGS, INC., 9727 DeSoto Ave., Chatsworth, CA 91311, Tel: 818-407-9300, FAX: 818-407-5020; FSC No.: 50294; Empl.: 245; *Sls. Mgr.:* Paul M. Spencer; *Dist. Mgr.:* Alan H. Paynter

NEWMAN, M. M., CORP., Heli-Tube Div., P.O. Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; FSC No.: 09106; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel ..... **C•1798**

NEW MEDIA GRAPHICS CORP., 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-0666, FAX: 508-663-6678; Empl.: 50



FAX: 714-546-3022

NEWPORT ELECTRONICS, 2229 S.Yale St., Santa Ana, CA 92704-4426, Tel: 714-540-4914, 800-NEWPORT, TWX: 910-595-1787; Empl.: 120; *Sls. Mgr.:* Chris Salzer; *Dist. Mgr.:* Chris Salzer ..... **D•1363-1364, 1366**

Local Sales Offices & Reps

AL	Birmingham, Richardson Co.	205-823-2200
CO	Denver, AKI Entprs.	303-388-4488
IA	Davenport, H & H Vega Sls. Assocs.	319-326-5664
KS	Shawnee Mission, H & H Vega Sls.	913-432-6363
MD	Joppa, Electra-Tech	301-877-0344
MI	Livonia, Amtech Reps.	313-474-8300
MN	Eden Prairie, Rockmore Sls. Corp.	612-941-1390
NJ	Parlin, JMR Sls.	201-525-8000
NY	Albany, Expert Indl. Sys.	518-869-3355
NY	Wading River, JMR Sls., Inc.	516-929-5756
NC	Charlotte, SPK Instrmn.	704-535-2345

PA Valley Forge, J. E. Cuesta & Co., Inc. .. 215-935-0400
TN Memphis, Southeastern Marketing 901-794-1230
TX Richardson, ADI Instrs., Inc. 214-680-2222
VA Dumfries, Electra-Tech 703-670-6962

Local Distributors

AL Birmingham, Brownell Instrs. 205-332-3374
AZ Tempe, Metermaster 602-431-0880
AR Little Rock, Brownell Instrs. 501-562-2061
CA Costa Mesa, FLW, Inc 714-751-7512
CA Foster City, Therm-X 415-571-1166
CA Fremont, FLW, Inc. 415-651-6511
CA Hayward, Coast Instr. 415-786-9300
CA Los Angeles, EIL Instrs., Inc. 213-685-7020
CA S. San Francisco, Steven Engrg. 415-588-9200
CA Yorba Linda, Metermaster 714-921-2101
CO Denver, Brownell 303-333-3541
CT Middletown, EIL Instrs., Inc. 203-346-6646
FL Orlando, FLW, Inc. 407-894-9671
GA Atlanta, Inotek/Sesco, Inc. 404-458-6423
GA Atlanta (Hapeville), Brownell Electro .. 404-362-9009
GA Marietta, FLW Southeast 404-424-1731
HI Kailua, FLW, Inc. 808-262-0818
IL Chicago, Data Elctrns. Co. 708-283-0300
IL Countryside, Inotek 708-352-3500
IL Glendale Heights, Crompton Metermaster 708-351-4554
IN Evansville, Electro-Lab Svcs. 812-423-5211
IA Davenport, Interstate Indl. 319-355-5959
KS Kansas City, Process Measurement .. 913-384-2064
KY Louisville, EIL Instrs. 502-454-3420
LA Baton Rouge, SIA, Inc. 504-756-4631
MD Sparks, EIL Instr. 301-771-4800
MA Waltham, Calibron Instrs. 617-894-6440
MI Royal Oak, George Instr. 313-280-1111
MN Minneapolis, Instrmn. Svcs. 612-544-8916
MN Minneapolis, Process Meas. 612-544-4035
MO Kansas City, ISL Corp. 816-587-5400
MO St. Louis, Universal Precision Inst. 314-394-4693
NE Omaha, Interstate Indl. 402-331-3535
NJ Edison, Brownell 201-287-2030
NJ Newfoundland, Hosica Labs. 201-697-6111
NY Buffalo, EIL 716-634-8500
NY Buffalo, KOM Lamb 716-874-3530
NY Hauppauge, Brownell Electro 516-234-8600
NC Charlotte, EIL 704-376-2237
OH Cincinnati, Schlemmer 513-522-8340
OH Cleveland, Pioneer Instr. 216-248-8710
OH Cleveland, Weschler Elec. 216-238-2550
OH Dayton, Pioneer Instr. 513-236-9900
PA Philadelphia, Shelby-Jones 215-446-6600
OK Tulsa, Inotek 918-627-1500
OR Portland, Branom 503-283-2555
OR Portland, Westcon 503-283-0132
PA Philadelphia, Sunshine Scientific 215-673-5600
PA York, Trola Inds. 717-848-3700
SC Columbia, Brownell Instrs. 803-772-6111
TN Knoxville, Brownell 615-966-3441
TX Dallas, EIL Instrs. 214-357-0297
TX Dallas, Inotek 214-243-7000
TX Houston, American Analog 713-941-7265
UT N. Salt Lake, Western Controls 801-292-5900
VA Richmond, Metermetrics 804-275-1431
WA Redmond, EIL Instruments 201-882-3222
WA Seattle, Branom Instrs. 206-762-6050
WI Milwaukee, E-M Instrs. 414-272-7799

NEW WAVE INSTRUMENTS, 128 W 3100 N., Provo, UT 84604, Tel: 801-373-4909, FAX: 801-373-4909; *Sls. Mgr.:* Larry Christensen

THE J. M. NEY COMPANY, Ney Industrial Park, Bloomfield, CT 06002, Tel: 203-242-2281, TELEX: 9-9238, FAX: 203-242-5688; *Sls. Mgr.:* Terrence P. Dunn

NF ELECTRONIC INSTRUMENTS, 3303 Harbor Blvd., Ste.G-14, Costa Mesa, CA 92626, Tel: 714-557-1684, FAX: 714-549-9742; Empl.: 250; *Sls. Mgr.:* Jeff Dwyer; *Dist. Mgr.:* Jeff Dwyer

NH RESEARCH

FAX: 714-474-7062

NH RESEARCH, INCORPORATED INSTRUMENTATION PRODUCTS DIVISION, 16601 Hale Ave., Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377; Empl.: 120; *Sls. Mgr.:* Fred Sabatine ..... **D•1299**

Local Sales Offices & Reps

FL Treasure Island, NH Research 813-367-5101

NH RESEARCH, 16601 Hale Avenue, Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377, FAX: 714-474-7062; FSC No.: 24862; Empl.: 125; *Sls. Mgr.:* Gary Pollard ..... **D•1299**

Local Sales Offices & Reps

CA Irvine, NH Research, Inc. 714-474-3900
IL Naperville, NH Research, Inc. 312-355-5991
NJ Totowa, NH Research, Inc. 201-785-2261

NIC COMPONENTS CORP., 6000 New Horizons Blvd., N. Amityville, NY 11701, Tel: 516-226-7500, TELEX: 221-228, FAX: 516-226-6262; Empl.: 50; *Sls. Mgr.:* Robert Schatz; *Dist. Mgr.:* Nancy Lamendola

NICHICON (AMERICA) CORP., 927 E. State Pkwy., Schaumburg, IL 60173, Tel: 708-843-7500, TELEX: 20-6577, FAX: 312-843-2798/7125; *Sls. Mgr.:* Russ Edwards; *Dist. Mgr.:* Buddy Black

NICHIFU AMERICA, INC., 60 Robinson St, Pottstown, PA 19464, Tel: 215-323-7120, FAX: 215-970-2096; *Sls. Mgr.:* Roy Allen

NICOLET INSTRUMENT CORP., Test Instrument Division, 5225 Verona Rd., Madison, WI 53711, Tel: 608-271-3333, TELEX: 608-273-5061, TWX: 910-286-2737; Empl.: 700; *Sls. Mgr.:* Robert Terrio

NICOLET COMPUTER GRAPHICS DIV., See Bruning Computer Graphics

NIDEC CORPORATION, 318 Industrial Lane, Torrington, CT 06790, Tel: 203-482-4422, FAX: 203-489-7201; Empl.: 350; *Sls. Mgr.:* John Mills; *Dist. Mgr.:* Richard Bagg

NIEC-BASISTA, 3401 Brecksville Rd 110, Richfield, OH 44286, Tel: 216-659-9287, FAX: 216-659-3580; Empl.: (NIEC-Japan) 1200 230M Sales

NIEC, See QMI/NIEC

NISSEI DENKI AMERICA, INC., 7873 S.W. Nimbus Ave., Beaverton, OR 97005, Tel: 503-646-1434, FAX: 503-641-9594; Empl.: 6; *Sls. Mgr.:* T. Watanabe

Nissei Electronics

FAX: 415-961-7259

NISSEI ELECTRONICS, 460 E. Middlefield Rd., Mountain View, CA 94043, Tel: 415-969-1100 ..... **B•1103-1105**

NITTANY PIEZO CERAMICS, See Piezo Kinetics, Inc.

NJE CORPORATION, 329 Culver Rd, P.O. Box 669, Dayton, NJ 08810-0669, Tel: 201-329-4611, TWX: 710-480-5674, FAX: 201-329-6185; FSC No.: 98380; Empl.: 105; *Sls. Mgr.:* John Slavik

nkk switches OF AMERICA INC

FAX: 602-998-1435

NKK SWITCHES OF AMERICA, INC., 7850 E. Gelding Dr., Scottsdale, AZ 85260, Tel: 602-991-0942; FSC No.: 63426; Empl.: 459; *Sls. Mgr.:* Joseph Nessim; *Dist. Mgr.:* Joseph Nessim ..... **B•1638, 1746-1752**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Phoenix, C.T. Carlberg & Assocs. 602-468-0750
AZ Scottsdale, NKK Switches 602-991-0942
CA Cupertino, Getsales 408-725-8384
CA Torrance, Universal Comps. 213-783-0220
CO Wheat Ridge, Cluff & Assocs. Inc. 303-425-6604
FL Altamonte Springs, Over & Over, Inc. 407-332-1222
FL Coral Springs, Over & Over Inc. 305-753-7050
FL Tampa, Over & Over Inc. 813-626-9100
GA Norcross, Over & Over, Inc. 404-449-6205
IL Mt. Prospect, The Dombrow Co., Inc. .. 708-253-3326
IN Carmel, Frank E. Kahsar Sls. 317-844-9353
KS Overland Park, Spectrum Sls. 913-648-6811
MD Baltimore, Eastern Comp. Sls. 301-788-7050
MA Harvard, Cycle Sls. Inc. 508-456-6868
MI Warren, Frank E. Kahsar Sls. 313-795-3530
MI Grand Haven, Frank E. Kahsar Sls. ... 616-846-7590
MN Minneapolis, Boerger & Assocs. 612-560-3435
MO Hazelwood, Spectrum Sls. 314-731-5151
NM Albuquerque, C. T. Carlberg & Assocs. 505-899-2155
NY Fairport, Lamtec Sls. Corp. 716-377-1210
NY Manlius, Lamtec Sls. Corp. 315-682-4780
NY Melville, Comtronic Assocs., Inc. 516-249-0505
NC Charlotte, Over & Over Inc. 704-542-9111
NC Raleigh, Over & Over Inc. 919-876-7338
OH Cincinnati, Frank E. Kahsar Sls. 513-922-3133
OH Columbus, Frank E. Kahsar Sls. 614-252-4009
OH Elyria, Frank E. Kahsar Sls. 216-365-5219
OH Mentor, Frank E. Kahsar Sls. 216-257-1166
OR Beaverton, Pacific Mktg. Spec. 503-641-9373
PA West Conshohocken, Eastern Comps. Sls. 215-825-8610
PA Wexford, Frank E. Kahsar Sls. 412-935-8561
TX Dallas, Rem Air Components Corp. ... 214-234-1069
TX Houston, Rem-Air Comps. Corp. 713-589-9721
UT Salt Lake City, Cluff & Assocs. 801-486-7297
WA Redmond, Pacific Mktg. Specs. 206-882-3144
Can Dorval, Que., John G. Weiss Co., Ltd. 514-685-6644
Can Mississauga, Ont., John G. Weiss Co., Ltd. 416-673-0011
Can Nepean, Ont., John G. Weiss Co., Ltd. 613-825-0545
Can Vancouver, B.C., John G. Weiss Co., Ltd. 604-873-1112
Can Winnipeg, Man., John G. Weiss Co., Ltd. 204-772-3665

Local Distributors

AL Huntsville, Powell Elctrns. 205-837-5300
AZ Glendale, Powell Elctrns. 602-938-5552
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2885
AZ Tempe, L Comp. Inc. 602-730-1633
AZ Tucson, Dalis Elctrn. Supp. 602-294-2628
AR Ft. Smith, Radio, Inc. 501-646-5200
AR Little Rock, Bluff City Elctrns. 501-376-7044
CA Costa Mesa, Eric Elctrns. 714-751-1185
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Fountain Valley, Components Ctr. 714-979-0433
CA Irvine, ITT Multicomps. 714-727-4001
CA Los Angeles, Electric Switches, Inc. ... 213-660-1310
CA Milpitas, Zack Elctrns. 415-942-5432
CA Red Bluff, N. Valley Distrs. Co. 916-529-1130
CA Redding, N. Valley Distrs. Co. 916-222-1500
CA Sacramento, Zack Elctrns. 916-369-1786
CA San Diego, Mock III Sls. Co., Inc. 619-693-8230
CA San Diego, Shanks & Wright 619-239-0176
CA San Diego, Southland Comps. 619-673-3800
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Eric Elctrns. 408-432-1111
CA San Jose, ITT Multicomps. 408-453-1404
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Rose Elctrn. Dist. Co. 408-943-0200
CA Santa Clara, Components Ctr. 408-988-3751
CA Tustin, Western Switches & Controls 714-259-8144
CA Vallejo, Zack Elctrns. 707-644-6676
CO Arvada, Denver Beta 303-431-7161
CO Aurora, Jet Elctrns. Supp. Co. 303-364-1000
CO Colorado Springs, Colorado Springs Wintronic Co., Inc. 719-636-1661
CO Denver, Denver Walker Wintronic Co., Inc. 303-744-9505
CO Englewood, Kimball Elctrns. 303-799-0317
CO Fort Collins, Fort Collins Wintronic Co., Inc. 303-482-1155
CO Grand Junction, Grand Junction Wintronic Co., Inc. 303-242-4435
CO Pueblo, Pueblo Wintronic Co., Inc. 719-542-1924
CO Westminster, ITT Multicomps. USA ... 303-451-8740
CT Danbury, Pilgrim Elctrns., Inc. 203-792-7274
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
CT Wallingford, Greene Shaw 203-265-3333
CT Wallingford, Midstate Elctrns. 203-265-9900
CT Yalesville, Glynn Elctrns., Inc. 203-265-2498
DE Milford, Harco Elctrns. 302-422-3105
DE Wilmington, Wholesale Elctrns. 302-652-3222
FL Altamonte Springs, Control Des. Supp., Inc. 407-788-3220
FL Clearwater, Atlantic Elctrns., Inc. 813-531-5900
FL Deerfield Beach, Atlantic Elctrns., Inc. 305-698-6400
FL Ft. Lauderdale, Bros. Elctrns. 305-561-6700
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
FL Ft. Meyers, Dow Elctrns. 813-334-6577
FL Gainesville, Dow Elctrns. 904-376-3231
FL Jacksonville, Dow Elctrns. 904-356-8426
FL Lakeland, Atlantic Elctrns., Inc. 813-687-0200
FL Longwood, RM Elctrns. 407-767-8005
FL Maitland, Elctrn. Equip. 407-539-0888
FL Melbourne, Greene Shaw 407-951-3636
FL Miami, Elctrn. Equip. 305-526-6000

FL Orlando, Dow Elctrns. 407-299-2771
FL Orlando, Wallace 407-841-0400
FL Pompano Beach, Control Design Supp. 305-782-1311
FL Pompano Beach, Elctrn. Equip. Co., Inc. 305-960-1200
FL Tampa, Dow Elctrns. 813-626-5191
FL Tampa, Elctrn. Equip. 813-988-0810
FL West Palm Beach, Atlantic Elctrns., Inc. 407-686-8553
GA Albany, Dow Elctrns. 912-435-1711
GA Augusta, Dixie Elctrns., Inc. 404-722-2055
GA Augusta, Dow Elctrns. 404-722-1526
GA Macon, Dow Elctrns. 912-743-5421
GA Norcross, Applied Power, Inc. 404-263-0421
GA Norcross, Dow Elctrns. 404-448-4004
GA Norcross, Whitehead Elctrns. 404-923-6667
CA Redwood City, HdB Elctrns. 415-368-1388
GA Savannah, Dow Elctrns. 912-234-1684
ID Boise, Kimball Elctrns., Inc. 208-342-3559
ID Pocatello, Kimball Elctrns., Inc. 208-232-2201
IL Addison, Belford Elctrns. 708-691-1100
IL Addison, L Comp, Inc. 708-628-1400
IL Algonquin, Marshall Wolf Automation 708-658-8130
IL Bensenville, Goold Elctrns. 708-860-7171
IL Chicago, Leeds Electro Comps. 312-625-3800
IL Crystal Lake, Sub-Sem Inc. 815-459-4139
IL Glendale Heights, Belford Elctrns. 708-858-4960
CA Santa Ana, BDS 714-662-1050
IL Wheeling, Hawk Elctrns., Inc. 708-459-4030
IL Wood Dale, Nep Elctrns. 708-595-8500
IN Indianapolis, CAM RPC 317-578-1111
IN Indianapolis, MAR Elctrns. 317-633-6699
IN Indianapolis, RM Elctrns. 317-291-7110
IA Sioux City, Molstad Distrbg. 712-255-8023
KS Wichita, Airtechnics, Inc. 316-267-2849
KS Wichita, Radio Inc. 316-264-2798
KS Wichita, RSC Elctrns., Inc. 316-267-5213
KY Florence, URI Elctrns., Inc. 606-371-4423
KY Louisville, Peerless Elctrn. Supps. 502-637-7674
LA New Orleans, Southern Radio Supp. Co. 504-524-2343
MD Aberdeen, Harco Elctrns. 301-838-7990
MD Annapolis Jct., Powell Elctrns. 301-880-3255
MA Billerica, Mayer Elctrns. 617-229-2255
MD Gaithersburg, Axis Elctrns., Inc. 301-840-9640
MD Kensington, Marine Air Supply Co. 301-949-9560
MD Rockville, Capitol Radio Wholesalers 301-881-2270
MA Avon, Controller Svc. & Sls. 508-584-9010
MA Billerica, Mayer Elctrns. Co. 617-229-2255
MA Middleboro, Glynn Elctrns., Inc. 508-947-4262
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MA Newton, Greene Shaw 617-969-8900
MA Sandwich, JV Elctrns. 508-833-0700
MA Westborough, Powell Elctrns. 508-366-6100
MI Ann Arbor, Wedemeyer Elctrn. Supp. 313-665-8611
MI Brighton, Applied Power, Inc. 313-227-3604
MI Grand Rapids, RM Elctrns. 616-531-9300
MI Lansing, Wedemeyer Elctrn. Supp. 517-484-9009
MI Mt. Clemens, Spec Connector Corp. 313-465-3232
MI Novi, Belford Elctrns. 313-349-6842
MI St. Clair Shores, Spemco Switches 313-771-2700
MN Brooklin Center, Powell Elctrns. 612-566-8682
MN Burnsville, Cassidy Elctrns. 612-895-9026
MN Minneapolis, Bergquist Co. 612-835-2322
MN Minneapolis, Stark Elctrns. Supp., Inc. 612-332-1325
MN Minneapolis, Tor Tec 612-866-3662
MN Plymouth, Leeds Electro Comps. 612-557-1277
MS Columbus, Bluff City Elctrns. 601-328-6212
MS Tupelo, Bluff City Elctrns. 601-842-6832
MO Kansas City, L Comp., Inc. 816-221-2400
MO Kansas City, Walters Indl. 816-531-7015
MO Maryland Hgts., L Comp., Inc. 314-291-6200
MO St. Louis, Franklin Elctrns. Co. 314-429-3111
NE Lincoln, Scott Elctrns. 402-466-8221
NE Omaha, Scott Elctrns. 402-734-6750
NV Las Vegas, Kiesub Corp. 702-733-0024
NH Manchester, Controller Svc. & Sls. 603-623-7225
NH Manchester, Cronin Elctrns., Inc. 603-624-0105
NH Manchester, Glynn Elctrns., Inc. 603-622-8131
NH Salem, Diamond Elctrns. 603-894-4420
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Little Falls, Powell Elctrns., Inc. 201-890-0010
NM Albuquerque, Dalis Elctrns. Supp. 505-888-4525
NM Albuquerque, Walker Elctrn. Supp. Co. 505-883-2992
NM Farmington, Farmington Wintronics 505-327-6356
NY Buffalo, Crest Audio, Video Elctrns. 716-885-5878
NY E. Rochester, Rome Elctrns. 716-248-0160
NY Mt. Vernon, All American/QAR Inc. 914-699-2224
NY Rochester, Masline Elctrns., Inc. 716-546-5373
NY Rome, Rome Elctrns. 315-337-5400
NY Troy, Trojan Elctrn. Supp. Co. 518-274-4481
NC Cary, Powell Elctrns. 919-467-1212
NC Charlotte, Dixie Elctrns., Inc. 704-377-5413
NC Raleigh, Greene-Shaw Co., Inc. 919-954-7138
NC Raleigh, Resco/Raleigh 919-781-5700
NC Winston-Salem, Dixie Elctrns., Inc. 919-724-5961
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Cincinnati, URI Elctrns. 513-761-4030
OH Columbus, Wedemeyer Elctrn. Supp. Co., Inc. 614-436-9600
OH Columbus, Whitehead Elctrns. 614-224-4234
OH Dayton, Srepco 513-293-0871
OH Dayton, Whitehead Elctrns. 513-293-2947
OH Highland Hgts., CAM RPC Elctrns. 216-461-4700
OH Lima, LRP Elctrns. 419-228-1220
OH Twinsburg, Schuster Elctrns. 216-425-8134
OH Warren, REM Elctrns. 216-373-1300
OK Lawton, Lawton Wintronic 405-355-0603
OK Oklahoma City, Oklahoma City Wintronic Co., Inc. 405-682-0545
OK Oklahoma City, Radio, Inc. 405-789-0741
OK Oklahoma City, RSC Elctrns. 405-631-7729
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Comp. Resources 503-641-8488
OR Beaverton, Norvac Elctrns. 503-626-2200
OR Beaverton, Rose Elctrn. Distr. 503-629-9288
OR Eugene, Norvac Elctrns. 503-345-2905
OR Medford, Valley Indl. Elctrns. 503-779-3995
OR Portland, URS Elctrns. 503-233-7151
OR Salem, Norvac Elctrns. 503-585-9810
OR Tigard, Priebe Elctrns. 206-881-2363
PA Allentown, Federated Purchaser 215-437-4481
PA Allentown, P. A. Peters Co. 215-434-5237
PA Allentown, Whisle. Elctrns. 215-436-6743
PA Erie, Rem Elctrns. 814-453-5626
PA Lancaster, Harco Elctrns. 717-291-1861
PA N. Huntington, Rem Elctrns. 412-864-7423
PA Philadelphia, Brothers Elctrns. 215-425-7962
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, CAM RPC Elctrns. 412-782-3770
PA Reading, Barbey Elctrns. 215-376-7451
RI Pawtucket, Major/Edwards Elec. Supp. 401-727-1430
RI Providence, Controller Svc. & Sls. 401-781-7100
SC Columbia, Dixie Elctrns. 803-779-5332
SC Greenville, Dixie Elctrns. 803-297-1430
SC N. Charleston, Dixie Elctrns. 803-552-2671
SC Taylors, Cantrell Whlse. Prods. 803-268-1194
SD Mitchell, Wholesale Elctrns. 605-996-2233
TN Chattanooga, Dow Elctrns. 615-624-1040
TN Gray, Dixie Elctrns. 615-477-3838
TN Knoxville, Bondurant Bros. 615-573-9151
TN Knoxville, Dixie Elctrns. 615-938-4131
TN Memphis, Bluff City Elctrns. 901-345-9500
TN Nashville, Bluff City Elctrns. 615-242-8000
TX Austin, Southwest Elctrns. 512-837-8971
TX Austin, Wofford Elctrns. 512-339-1131
TX Brownsville, Carden Indl. Grp. 512-541-3660
TX Corpus Christi, Douglas Elctrns. 512-883-5103
TX Corpus Christi, Sherman Elctrns. Supp., Inc. 512-888-9454
TX Dallas, Off The Shelf Comps., Inc. 214-247-0052
TX Dallas, Wallace Elctrns. 214-340-0400
TX Dallas, Wofford Elctrns. 214-320-0294
TX El Paso, Midland Wintronic 915-779-8391
TX El Paso, Rem Elctrns. 915-778-7333
TX Ft. Worth, Ft. Worth Wintronic 817-534-7696
TX Houston, Angie Elctrns. 713-659-8386
TX Houston, Wofford Elctrns. 713-847-3583
TX Irving, Powell Elctrns. 214-550-0547
TX Laredo, REM Elctrns. 512-725-3100
TX N. Richland Hills, Swieco, Inc. 817-281-1811
TX Richardson, Off the Shelf Comps., Inc. 214-238-0808
TX Richardson, RSC Elctrns. 214-644-3444
TX Richardson, Southwest Elctrns. 214-234-3050
TX Round Rock, Southwest Elctrns., Inc. 512-837-8971
TX San Antonio, Sherman Elctrns. Supp., Inc. 512-224-1004
TX Stafford, Southwest Elctrns. 713-240-4000
TX Waco, Hargis Co. 817-754-5667
UT Ogden, Ogden Wintronic 801-393-8603
UT Salt Lake City, Ballard Supp. Corp. 801-972-2430
UT Salt Lake City, Kimball Elctrns. 801-328-2075
UT Salt Lake City, Salt Lake Beta 801-966-0236
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Harrisburg, CCI Elctrns. 703-434-8420
VA Norfolk, Priest Elctrns. 804-855-0105
VA Roanoke, Peoples Elctrns. 703-342-8933
WA Kent, Comp. Resources 206-251-9771
WA Redmond, Priebe Elctrns. 206-881-2363
WA Seattle, Powell Elctrns., Inc. 206-641-4446
WI Mequon, Taylor Elec. Co. 414-241-4321
WI New Berlin, NEP Elctrns., Inc. 414-785-9100
WI Oconomowoc, GW Elctrns., Ltd 414-367-6003
WI Waukesha, Hawk Elctrns. 414-547-4457
Can Burnaby, BC, ITT Multicomps. 604-291-8866
Can Burnaby, BC, SEMAD 604-420-9889
Can Calgary, Alberta, ITT Multicomps. 403-273-2780
Can Calgary, Alberta, SEMAD 403-252-5664
Can Concord, Ont., ITT Multicomps. 416-736-1588
Can Dartmouth, NS, Arcom 902-464-1600
Can Edmonton, Alberta, ITT Multicomps. 403-436-9555
Can Markham, Ont., SEMAD 416-475-8500
Can Montreal, PQ, Ferro-Technique 514-341-3450
Can Nepean, Ont., ITT Multicomps. 613-596-6980
Can Ottawa, Ont., SEMAD 613-727-8325
Can Pointe Claire, Que., SEMAD 514-694-0860
Can St. Laurent, PQ, ITT Multicomps. 514-335-7697
Can Waterloo, ON, Sanbek Sls. 519-746-5801
Can Winnipeg, Manitoba, ITT Multicomps. 204-697-2300

NKR PRECISION MANUFACTURING, Rte. 17M, Box 333, Harriman, NY 10926, Tel: 914-782-8562, FAX: 914-783-2929; Empl.: 17

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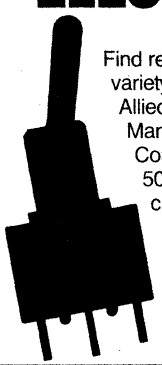
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NMB TECHNOLOGIES, 9730 Independence Avenue, Chatsworth, CA 91311, Tel: 818-341-3355; *Dist. Mgr.:* Brian Lennox ..... **B•1306-1307; C•1650-1652**

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AL Huntsville, DHR Mktg., Inc. 205-722-0440
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GA Atlanta, NMB Technlgs. 404-984-9455
GA Duluth, DHR Mktg. Inc. 404-564-0529
IL Schaumburg, NMB Technlgs. 708-843-0202
MA Burlington, Gerber Sls., Corp. 617-229-1150
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MN Minneapolis, Holmgren Assocs. 612-574-9983
NJ Mt. Laurel, SJ Assocs. 609-866-1234
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FL Tampa, Reptron Elctrns. 813-855-4656
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OH Columbus, CAM-RPC Elctrns. 614-895-5449
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OH Dayton, Stotts-Friedman 513-298-5555
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UT Salt Lake City, Sterling Elctrns. 801-972-5444
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VA Herndon, Sterling Elctrns. 703-742-8400
VA Richmond, Sterling Elctrns. 804-226-2190
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WI New Berlin, Classic Comps. 414-786-5300
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NMC FASTENING SYSTEMS, Nylon Molding Corp., 1617 S. California, Monrovia, CA 91016, Tel: 818-357-0901, FAX: 818-303-6085; Empl.: 45; *Sls. Mgr.:* Gary Fraze

NOBLE U.S.A., INC., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008, Tel: 708-364-6038, TELEX: 206745, FAX: 1-708-364-6045; *Sls. Mgr.:* Robert K. Burdick ..... **A•2061**

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AL Huntsville, Electro Mech Sls. 205-880-0592
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CA Napa, Stewart-Fullerton Assoc. 707-258-1160
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FL Plantation, Gallagher & Assocs. 305-473-2101
GA Norcross, Electro Mech Sls. 404-447-6478
IL Chicago, BNI Elctrns. 312-775-1717
IN Carmel, Fred A. Dorsey Assoc. 317-844-4842
KY Jamestown, Fred A. Dorsey Assoc. ... 502-343-4624
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IL Addison, Belford Elctrns. 708-691-1118
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MO St. Louis, Franklin Elctrns. 314-429-3111
NY Ronkonkoma, Baldwin Comps. 516-588-5700
OH Cleveland, CAM/RPC Elctrns. 216-461-4700

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WA Bothell, Exectronics 206-947-2115
Can Laval,Que., Techmation Instrs. 514-689-5889

NOISE COM INC., E. 49 Midland Ave., Paramus, NJ 07652, Tel: 201-261-8797, FAX: 201-261-8339; FSC No.: 65185; Empl.: 18; *Sls. Mgr.:* Gary Simonyan ..... **A•1821; D•1304-1305**

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MN Minneapolis, Baltz Assocs. 612-546-8520
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OH Centerville, Extensive Entprs. 513-434-5078
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EXP Palo Alto, Ca, Radar Systems 415-322-7448
Can Ottawa, Giga-Tron Assocs. Ltd. 613-225-4094

NOLATRON, P.O. Box 4042, Harrisburg, PA 17111, Tel: 717-564-3398, FAX: 717-939-5831; Empl.: 5

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NORITAKE CO., INC., Noritake Co., Limited (Japan), 23820 Hawthorne Blvd., Ste. 100, Torrance, CA 90505, Tel: 213-373-6704; FSC No.: 213-772-3918; Empl.: 7; *Sls. Mgr.:* Y. Tatsuta

NORMA MESSTECHNIK OPTIK, Elektronik GmbH., Eumigweg 7, Wr. Neudorf, Austria 2351, Tel: 02236 61530, TELEX: 79316, FAX: 02236 63080; Empl.: 250; *Sls. Mgr.:* Hr. Weber; *Dist. Mgr.:* Hr. Kohlhauser

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NORTH AMERICAN PHILIPS LIGHTING, 200 Franklin Sq. Dr., Somerset, NJ 08875, Tel: 201-563-3000, TWX: 510-685-5651; Empl.: 600; *Sls. Mgr.:* C. J. Lehmann

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IL Chicago, Pat Lind Elctrns. 312-726-3513
IN Indianapolis, Pat Lind Elctrns. 317-632-7444
IA Cedar Rapids, Palatine Engrg. 319-365-8071
MA Burlington, Intersell 617-273-3844
MI Madison Heights, WKM Assoc. 313-588-2300
MN Circle Pines, Pat Lind Elctrns. 612-786-5770
MO Florissant, Palatine Engrg. 314-839-0800
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NC Winston-Salem, Teqspec III 919-765-5553
OH Dayton, WKM Assoc. 513-434-7500
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PA Horsham, Pennsylvania Sci. Dvcs. 215-956-0700
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TX Richardson, Scientific Sls. 214-231-6541
WI Milwaukee, Pat Lind Elctrns. 414-224-0146

NORTHEAST INNOVATIONS, INC., PO Box 1214, Concord, NH 03302, Tel: 603-736-8260, FAX: 603-736-4506; Empl.: 10; *Sls. Mgr.:* Ryan Irving

NORTHERN AMPOWER CORP., 47087 Grand River, Novi, MI 48374, Tel: 313-349-4860, FAX: 313-349-5692; Empl.: 30; *Sls. Mgr.:* Ronald Kirsch .... **D•1914**

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NORTHERN PRECISION LABS., 11 Madison Rd, Fairfield, NJ 07006, Tel: 201-227-4800, FAX: 201-575-5973; Empl.: 95; *Sls. Mgr.:* P. Pytal

NORTHERN TECHNOLOGIES CORP., 35 Rivera Dr., Unit No. 5, Markham, Ont., CAN L3R 8N4, Tel: 416-475-9320, 1-800-456-1875, FAX: 416-475-5719; Empl.: 30; *Sls. Mgr.:* Alan Pett

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NORTH HILLS ELECTRONICS, 1 Alexander Pl., Glen Cove, NY 11542, Tel: 516-671-5700, TELEX: 46-6886; FSC No.: 98821; Empl.: 100; *Sls. Mgr.:* Steve Muth .... **A•2310-2313**

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CA North Palo Alto, Tri-Rep 415-965-1822
CA Palo Alto, Tri Rep 415-965-1822
CA South El Toro, Par Mktg. 714-768-6021
CO Littleton, Mercier & Assoc. 303-770-0666
CT Wethersfield, Underwood Sls. Corp. 203-563-3046
FL Clearwater, Brennan Assocs. 813-446-5006
MD Baltimore, Stemler Assocs. Inc. 301-944-4840
IL Wheaton, Vine Tech. Sls. 913-642-7220
MD Laurel, CSDS 301-953-7884
MA Hingham, Northeast Rep. 617-749-8700
MA Lowell, Underwood Sls. Corp. 617-256-8191
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MO St. Louis, Thunderbird Tech. Sls. 314-298-8984
NY Whitney Point, T.A.E. Reps 607-692-3705
NY Albertson, DOL Engrg. 516-747-3944
OH Dayton, Mid-Con Elctrns. 513-837-2643
OR Portland, Evergreen Mktg. Grp. 503-643-8020
TX Dallas, Milestek, Inc. 817-455-7444
TX Houston, Milestek, Inc. 713-376-6776
WA Seattle, Evergreen Mktg. Grp. 206-633-3160
WI Genoa City, Vine Tech. Sls. 414-279-3871
Can Montreal, Componetics Ltd. 514-331-9930

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MD Laurel, Rayma 1-800-447-2962
TX Argyle, Miles Tek, Inc. 817-455-7444

NORTH HILLS ELECTRONICS INC., Power Products Div., 1 Alexander Place, Glen Cove, NY 11542-3796, Tel: 516-671-5700, TELEX: 46-6886 NOHILL CI, FAX: 516-759-3327; Empl.: 135; *Sls. Mgr.:* Jay M. Mohr

NORTHLAKE ENGINEERING, INC., 999 Anita Ave., Antioch, IL 60002, Tel: 708-395-5710, FAX: 708-395-9101; FSC No.: 50638; Empl.: 120; *Sls. Mgr.:* W. A. Hardt

NORTHWEST ANALYTICAL INC., 520 N. W. Davis St., Portland, OR 97209, Tel: 503-224-7727, FAX: 503-224-5236; Empl.: 14

NORTHWEST MICROCIRCUITS, INC., 211 S. 9th - P.O. Box 1199, Philomath, OR 97370, Tel: 503-929-6424, FAX: 503-929-6428; Empl.: 15; *Sls. Mgr.:* Matt Granam

NORTON ASSOCIATES, INC., 557 Oak St., Copiague, NY 11726, Tel: 516-842-4666, FAX: 516-842-4667; FSC No.: 08739

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NORWESCO INTERCONNECT DEVICES, 2633 Plastics Drive, Gastonia, NC 28053, Tel: 704-868-3581, FAX: 704-867-0577; Empl.: 80; *Sls. Mgr.:* Frank Pellatt

NOVA ELECTRIC CORP., Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07652, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 29019; Empl.: 50; *Sls. Mgr.:* Kenneth Niovitch .... **D•2214-2215**

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CA Flintridge, Synertek Mktg. 818-915-1439
CA Los Altos, Jay Stone Assoc. 415-948-4563
CO Englewood, Odyssey 1 303-773-8176
CT W. Hartford, Power Factor Assoc. 203-233-0600
FL Orlando, Truex Assoc. 407-859-2160
KS Kansas City, Harris-Hansen Co. 816-763-6200
MD Rockville, Marktron 301-251-8990
MA Whitinsville, Power Factor Assoc. 508-234-6415
MI Detroit, Comtel 313-358-2505
MN Minneapolis, White Sls. Co. 612-553-1818
MO St. Louis, Harris-Hansen Co. 314-432-3611
NJ Westfield, Metro-Mics 201-233-6116
NM Albuquerque, Fry-Gates Assoc. 505-262-1525
NY Hauppauge, Metro-Mics 516-361-6134
OH Cleveland, Comtel Assoc. 216-442-8080
TN Knoxville, Southern Automation Sls. 615-690-8488
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Can Ottawa, Ont., Subtec 613-723-7720

NOVATEK CORPORATION, 3700 NW 124th Ave., Coral Springs, FL 33065, Tel: 305-341-7700, TELEX: 522600 AAA EXECT, FAX: 305-345-9334; Empl.: 15; *Sls. Mgr.:* Joe DiBrigida

NOVA TRAN CORPORATION, Union Carbide Corporation, 100 Deposition Dr., Clear Lake, WI 54005, Tel: 715-263-2333, FAX: 715-263-3189; Empl.: 85; *Sls. Mgr.:* Bill Henry

NOVATRONICS INC., 677 Erie St., P.O. Box 610, Stratford, Ontario, Canada N5A 6V6, Tel: 519-271-3880, TELEX: 06-955394, FAX: 519-271-9781; Empl.: 100; *Sls. Mgr.:* Laraine Murray

NOVOTECHNIK U.S., INC., 237 Cedar Hill St., Marlborough, MA 01752, Tel: 508-485-2244, FAX: 508-485-2430; FSC No.: MULTIPLE; Empl.: 8

NRD INC., Subsidiary of Mark IV Inds., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, Tel: 716-773-7634, TELEX: 91578 NRD GRDI, FAX: 716-773-7744; Empl.: 100; *Sls. Mgr.:* James Curtis; *Dist. Mgr.:* Larry Keating .... **D•2238**

Local Sales Offices & Reps
AZ Tempe, Frank Steinmetz & Assoc. 602-829-0654
CA Santa Clara, Tech-Ser, Inc. 408-496-1004
CA Torrance, Tech-Ser, Inc. 213-370-7200
FL St. Cloud, Kurt Whitlock Assoc., Inc. 407-892-9876
IL Chicago, MGA Kokomo 312-775-1151
FL Kokomo, MGA Kokomo 317-455-0444
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MA Salem, Alpha-Stat 508-744-1100
MI Southfield, M. Gottlieb Assoc.,Inc. 313-358-4151
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MO St. Louis, Midtec Assoc., Inc. 314-275-8666
NY Fairport, Rod Patterson Assocs. 716-425-2738
NC Charlotte, Electro-Rep Assocs. 704-527-2530
PA Feasterville, ARC Assocs. 215-364-1050
TX Dallas, Scalon, Hughes & Assocs. 214-739-2888

NTE ELECTRONICS, INC., 44 Farrand St., Bloomfield, NJ 07003, Tel: 201-748-5089, FAX: 201-748-6224; FSC No.: 7T184; Empl.: 60; *Sls. Mgr.:* Cindy Habick; *Dist. Mgr.:* Mary Damiano

NTK

FAX: 708-390-6482

NTK TECHNICAL CERAMICS, NGK Spark Plugs (USA), 1200 Business Ctr. Dr., Suite 300, Mt. Prospect, IL 60056, Tel: 708-824-1133; FSC No.: 95-246-1286; *Sls. Mgr.:* Mark Ota; *Dist. Mgr.:* Chuck Ito .... **A•1699-1704, 1822**

Local Sales Offices & Reps
AZ Mesa, NTK Tech. Ceramic 602-820-4900
CA San Jose, NTK Tech. Ceramic 408-727-5180
FL Longwood, D-Assocs. 407-321-9594
FL Maitland, D. J. Ellis & Assocs., Inc. 305-645-1101
GA Atlanta, L&D Inc. 404-455-3483
IL Mt. Prospect, NTK Tech. Ceramic 708-824-1133
IN Ft. Wayne, T.X. Sls. 219-489-4447
IA Chanhassen, Barnes Sls. Assocs. 612-934-2907
MA Farmingham, NTK Tech. Ceramic 508-820-0220
MI Ann Arbor, Jordan-Elliott Sls. Inc. 313-662-4087
MI Jackson, Jordan-Elliottt Inc. 517-788-8353
MN Chanhassen, Barnes Sales Assocs. 612-934-2907
NJ Springfield, NTK Tech. Ceramic 201-376-6070
TX Dallas, NTK Tech. Ceramic 214-404-1173
Can Ontario, NGK Spark Plugs Canada 416-291-9746
Can Scarborough, Ont., NGK Spark Plugs Canada Ltd. 416-291-1927

NUCLEAR RESEARCH CORP., 125 Titus Ave., Box H, Warrington, PA 18976, Tel: 215-343-5900, TELEX: 510-665-8525 NRC WNTN, FAX: 215-343-4670; FSC No.: 96696; Empl.: 130; *Sls. Mgr.:* Tom O'Malley; *Dist. Mgr.:* Tom O'Malley

NUCLEONIC PRODS., See Thomson-CSF Comps. Corp., Passive Comps. Div.

NU-CONCEPT SYSTEMS, 2725 Advance La.,P. O. Box 587, Colmar, PA 18915, Tel: 215-822-8400, FAX: 215-822-1427; FSC No.: 58561; Empl.: 10; *Sls. Mgr.:* Robert F. Scheuerle

NU DATA, INC., 32 Fairview Ave., Little Silver, NJ 07739, Tel: 908-842-5757, TELEX: 271139, FAX: 908-842-5757; Empl.: 20; *Sls. Mgr.:* Richard A. Previte; *Dist. Mgr.:* George Serbe

NUMERIX CORP., 20 Ossipee Rd., Newton, MA 02164, Tel: 617-964-2500, TELEX: 948032, FAX: 617-969-4380

NWL CAPACITORS, NWL Transformers, 1 Industrial Drive, Snow Hill, NC 28580, Tel: 919-747-5943; Empl.: 55 .... **A•1120-1122**

Local Sales Offices & Reps
NJ Haddonfield, M&S Mesa Inc. 609-429-7055
NM Albuquerque, Westfahl & Assocs. 505-268-1433
NY Canandaigua, Jones/Sudder 716-384-2628
NY Nassau, Dave Jones(Jones/Sudder) 518-766-9575
OH Maineville, George Barnet 513-677-0922
VT White River Junction, Gary Jones(Jones/Sudder) 802-295-5260

NWL TRANSFORMERS, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 225; *Sls. Mgr.:* Helmut Herder .... **A•1120-1121, 2314-2315; D•1915**

WILLIAM F. NYE, INC., P.O. Box G-927, New Bedford, MA 02742-0927, Tel: 508-996-6721, TELEX: 940807, FAX: 508-997-5285; Empl.: 27; *Sls. Mgr.:* Donald R. Fairbanks .... **C•1146**

Local Sales Offices & Reps
MI Pleasant Ridge, Brian C. Holley 313-542-2720

NY GLASS PLASTICS, Calnetics Corp., 7314 E. Madison St., Paramount, CA 90723, Tel: 213-636-1035, FAX: 213-531-0693; Empl.: 60; *Sls. Mgr.:* Chris Ward

NYTRON INDUCTORS, INC., 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421, TWX: 810-665-2182, FAX: 803-393-4123; FSC No.: 83125; Empl.: 450; *Sls. Mgr.:* John Elliot .... **A•1214-1235; B•1023**

OAKGRIGSBY

FAX: 708-556-4216

OAKGRIGSBY INC., 88 N. Dugan Rd., Sugar Grove, IL 60554, Tel: 708-556-4200; FSC No.: 76854; Empl.: 300 .... **B•1633, 1754-1759**

Local Sales Offices & Reps
AL Huntsville, Electramark, Inc. 205-830-4400
AZ Scottsdale, Carefree Elctrns. Sls. 602-951-9121
CA Laguna Hills, Fitch Assocs. 714-951-0196
CA Los Gatos, Stewart/Fullerton 408-376-0368
CA Mountain View, Stewart/Fullerton 415-964-7870
CA Napa, Stewart Fullerton & Assoc. 707-258-1160
CO Englewood, Krebill Comp. Sls. 303-771-0955
CO Grand Junction, Krebill Comp. Sls. 303-243-8220
FL Altamonte Springs, Electramark FL 407-830-0844
GA Norcross, Electramark, Inc. 404-446-7915

IL Cary, Golbeck/Milota 708-639-3424
IL Crystal Lake, Oak Switch Sys. Inc. 815-459-5000
IA Cedar Rapids, Pattison Sls. 319-395-9866
KS Parker, S.W. Wollard Assocs. 913-898-6552
MA Acton, Boston Elctrns. Assocs. 508-264-4456
MI White Pigeon, Jim Wells & Assoc. 616-483-7179
MN Bloomington, Murnco & Assocs. 612-854-4161
FL Boca Raton, Electramark FL 407-392-1763
NV Henderson, Carefree Elctrns. Sls. 702-386-8858
NJ Mountainside, Henry G. Richter 201-233-4615
NJ Mt. Laurel, Eastern Elctrns. 609-778-3106
FL Tampa, Electramark FL 813-889-7775
NY Pittsford, A.C.S. 716-381-3818
NC Raleigh, Eastern Elctrns. 919-876-7591
OH Cincinnati, JMK Elctrns. 513-271-3860
OH Middlebury Heights, JMK Elctrns. 216-234-1202
OR Tigard, Rep-West 503-639-0325
PA Phoenixville, Henry G. Richter 215-495-6176
TX Dallas, Dal/Tex Rep., Inc. 214-991-7799
WA Seattle, Rep-West 206-283-8351
Can Mississauga. Ont., GMA (Toronto) 416-671-8111
Can Richmond, Ont., GMA(Ottowa) 613-838-4480
Can St. Laurent, Que., GMA (Montreal) 514-335-9572

Local Distributors

AL Huntsville, Component Distr. 205-883-7501
AZ Scottsdale, Harper SID 800-442-7737
CA Compton, Harper SID 213-979-5090
CA San Diego, Harper SID 619-578-2500
CA San Jose, Harper SID 408-943-9490
CO Denver, CSID 303-292-9594
CO Englewood, Component Distrs. 303-799-4916
FL Melbourne, Component Distr. 407-724-9910
FL W. Palm Bch., Wings Electro Sls. Co. 407-798-6606
GA Norcross, Component Distr. 404-441-3320
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Rosemont, Advent Elctrns. 708-297-6200
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IN Indianapolis, Advent Elctrns. 317-872-4910
MA Canton, Impact Sls. 617-821-1500
MA Westborough, In-Stock Prods. 508-870-5750
MA Westwood, Semad 617-329-7373
MA Wilmington, North Star Elctrns. 508-657-5155
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN Minneapolis, Berquist 800-328-3882
NY Hauppauge, Fairmont Elec. 516-231-3313
NY Jamaica, Calson Co. 718-525-5900
NY Northport, Coke-el Aerospace Co. 516-754-2233
NC Raleigh, Component Distr. 919-787-7311
OH Centerville, IPD 513-435-2086
TX Dallas, Component Distr. 214-644-0373
TX Irving, Harper S. I. D. 214-621-0500
WI Milwaukee, Progressive Image, Inc. ... 414-321-4722
Can Burnaby, B.C., Semad Elctrn. Dist. 604-420-9889
Can Calgary, Alberta, Semad Elctrn. Dist. .. 403-252-5664
Can Concord, Ontario, Westburne Elec. Supp. 416-660-3545
Can Markham, Ont., Semad Elctrn. Dist. 416-475-3922
Can Ottawa, Ont., Semad Elctrn. Dist. 613-727-8325
Can Pointe Claire,Quebec, Semad Elctrn. Dist. 514-694-0860
AZ Tucson, Carefree Elctrns. Sls. 602-882-8642

OAK SWITCH SYSTEMS, See OakGrigsby, Inc.

OAKTRON CORPORATION, Mtx, 704 30th St., Monroe, WI 53566, Tel: 608-328-5560, FAX: 608-328-5575; FSC No.: 07109; Empl.: 100; *Sls. Mgr.:* J. F. Disch

OAL ASSOCIATES, INC., P.O. Box J, Escondido, CA 92033, Tel: 619-743-7143, FAX: 619-743-2460; Empl.: 18; *Sls. Mgr.:* Mark Lohkemper

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OCEAN MOTIONS CO., P.O. Box 130, Barrington, RI 02806, Tel: 401-246-1394, FAX: 401-246-0075; FSC No.: 64654 ..... **B•1924**

Local Sales Offices & Reps

CO Denver, Control Agcy., Inc. 303-694-9214
UT Salt Lake City, Control Agcy. 801-268-9880, FAX:801-268-9924

OCEAN STATE THERMOTICS, INC., 27 Thurber Blvd., Smithfield, RI 02917, Tel: 401-231-4640, FAX: 401-231-4641; Empl.: 50; *Sls. Mgr.:* Stephen R. Hecht; *Dist. Mgr.:* Stephen R. Hecht

OCE' GRAPHICS, 385 Ravendale Dr., Mountain View, CA 94039, Tel: 415-964-7900, FAX: 415-961-6152; *Sls. Mgr.:* Bill Manos; *Dist. Mgr.:* Bill Manos

OCTAGON SYSTEMS, 6510 W. 91st Ave., Westminster, CO 80030, Tel: 303-430-1500, FAX: 303-426-8126

OCULAR INC., 610 Presidential, Ste. 100, Richardson, TX 75081, Tel: 214-437-2561, FAX: 214-437-2562; Empl.: 110; *Sls. Mgr.:* Ben Kwong ..... **B•1106-1107**

Local Sales Offices & Reps

CA San Dimas, A-F Sls. Engrg. 714-599-4412
CO Arvada, Arrowhead Sls. 303-423-5556
FL Hollywood, Advantage Comps. 305-962-2255
IL Arlington Hgts., Coombs & Assocs. 708-439-9810
IN Fort Wayne, Menze Sls. 219-747-5616
MA Swansen, Wm. Poisson & Assocs. 508-677-3655
MN Corcoran, Mktg. Assocs. 612-420-2506
MO Kansas City, EPI, Inc. 816-523-8911
NJ Wayne, Paul Breen Assocs. 201-696-8683
NC Durham, Advantage Comps. 919-383-0933
PA Newton, Indl. Sls. Assoc. 215-860-2076
TX Dallas, Component Technlg. 214-783-8831
WA Renton, K.R. Jensen Sls. Co. 206-277-2772
WI Milwaukee, Coombs & Assocs. 414-351-6123

ODU-USA, INC., ODU-KONTAKT GmbH, 4620 Calle Quetzal, Camarillo, CA 93012, Tel: 805-484-0981, FAX: 805-484-7458; Empl.: 1; *Sls. Mgr.:* Ralf Eberlein

OECO CORP., 4607 S.E. International Way, Milwaukie, OR 97222, Tel: 503-659-7932, TELEX: 36-0350, FAX: 503-653-6310; FSC No.: 95266; Empl.: 700; *Sls. Mgr.:* Dave Fuller, VP Sls.

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093, FAX: 308-284-4740; Empl.: 41; *Sls. Mgr.:* H. L. Harrington

OGDEN MANUFACTURING CO., 48 W. Seegers Road, Arlington Heights, IL 60005, Tel: 708-593-8050, FAX: 708-593-8062; Empl.: 250; *Dist. Mgr.:* Gordon D. Hollander

OSI

FAX: 614-486-0743

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-9561; FSC No.: 12066; Empl.: 47; *Sls. Mgr.:* G. Clagett ..... **B•1925-1944**

Local Sales Offices & Reps

AL Huntsville, Datarep Inc. 205-881-0361
AZ Tucson, Sheldon Equip. 602-722-1452
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Fremont, FLW, Inc. 415-651-6511
CO Denver, MC Squared Inc. 303-286-1414
DC Dumfries, Electra-Tech 703-670-6962
FL Margate, Datarep 305-968-6568
FL Orlando, Datarep 407-843-5224
GA Marietta, FLW 404-424-1731
IL Columbia, R.L. Weisheimer & Assocs. 314-487-7328
IL Park Ridge, Elctrn. Instr. Assocs. 708-298-2290
IN Indianapolis, Electronic Instr. Assocs. 317-257-7231
KS Kansas City, R.L. Weisheimer & Assocs. 816-561-1711
MD Edgewood, Electra-Tech, Inc. 301-676-2254
MI Milford, TMS 313-360-1514
MN Minneapolis, The Mark Co. 612-933-3026
NJ Garwood, E.R. Mertz, Inc. 201-232-4643
NJ Haddonfield, G.L. Williams & Assoc. ... 609-428-6060
NM Albuquerque, MC Squared Inc. 505-293-9090
NY Latham, L-Tron Corp. 518-489-7810
NC Charlotte, Zeico Assocs. 704-541-6122
OH Columbus, Ohio Semitronics Inc. 614-486-9561
OH Dayton, Mohawk Intronics 513-434-8873
OH No. Ridgeville, TMS, Inc. 216-327-3527
OK Stillwater, Acudata Inc. 405-743-1886
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Pittsburg, TMS 412-221-2338
RI Narragansett, Pat Assocs. 401-783-9598
TX Austin, Acudata Inc. 214-424-3561
TX Houston, Acudata Inc. 713-580-2451
TX Plano, Acudata Inc. 512-478-1018
UT Salt Lake City, MC Squared, Inc. 801-298-3388
VA Waverly, Electra-Tech 804-834-2417
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
Can Brossard, Ont., CTH Industrial Controls. 514-671-2181
Can Edmonton, Alb., CTH Instrs. 403-466-2900
Can Sarnia, Ont., Armatek Controls 519-332-0100
Can Toronto, Ont., Armatek Controls 416-251-3111



FAX: 708-675-1505

OHMITE MANUFACTURING CO., 3601 W. Howard St., Skokie, IL 60076, Tel: 708-675-2600, TELEX: 72-4433; FSC No.: 44655; *Sls. Mgr.:* Kim Youngblood; *Dist. Mgr.:* Ed Kason ..... **A•1958-1964**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Tempe, Elctrn. Dev. Sls. 602-438-1547
CA Los Angeles, Wiley Co. 213-666-1611
CA Santa Clara, Ross Mktg. 408-492-0197
CO Wheat Ridge, Cluff & Assocs. 303-425-6604
FL Altamonte Spgs., Over & Over 407-332-1222
GA Norcross, Over & Over 404-449-6205
IL Mt. Prospect, Dombrow Co. 708-253-3326
IN Indianapolis, Leslie M. DeVoe Co. 317-842-3245
IA Cedar Rapids, Spectrum Sls. 319-366-0576
KS Overland Pk., Spectrum Sls. 913-648-6811
MA Norwood, MacInnis Co. 617-762-8090
MI Farmington Hills, R.C. Merchant Co. ... 313-476-4600
MN Minneapolis, Elec. Comp. Sls. 612-933-2594
MO Florissant, Spectrum Sls. 314-921-1313
NJ Englewood Cliffs, Ed Glass Assocs. ... 201-592-0200
NY Victor, Net Sls. 716-924-1844
NC Charlotte, Over & Over 704-542-9111
NC Raleigh, Over & Over 919-876-7338
OH Westlake, Baehr Greenleaf & Assoc. .. 216-892-1770
OR Beaverton, Eclipse Mktg. 503-642-1661
PA Narbeth, Bresson Assocs. 215-664-6460
PA Warrendale, Baehr Greenleaf & Assoc. 412-934-3088
TX Richardson, Pro-Comp Sls. 214-669-1500
WA Redmond, Eclipse Mktg. 206-885-6991
EXP Skokie, IL, Ohmite Mfg. Co. 708-675-2600
Can Pickering, Ont., A.C. Simmonds & Sons 416-839-8041

Local Distributors

AR Ft. Smith, Carlton Bates 501-646-8201
CA El Monte, Kimball & Stark 818-444-2594
CA Fountain Valley, Component Ctr. 800-879-3550
CA Oakland, Brill Elctrns. 415-834-5888
FL Orlando, Hammond Elctrns. 407-849-6060
IL Chicago, Newark Elctrns. 312-784-5100
IL Palatine, Ohm Elctrns. 708-359-5500
IN Indianapolis, Bell Inds. 317-875-8200
MA Hingham, Sager Elctrns. 617-749-6700
MI Livonia, RS Elctrns. 313-525-1155
MN St. Paul, Gopher Elctrns. 612-490-4900
NJ Camden, GRS Elctrns. 609-964-8560
NY Buffalo, Summit Distrs. 716-887-2800
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Rome, Rome Elctrns. 315-337-5400
OH Akron, AESCO Elctrns. 216-762-8818
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Warren, REM Elctrns. Supp. 216-373-1300
SC Columbia, Dixie Elctrns. 803-779-5332
TX Richardson, Altair Co. 214-231-5166
TX Stafford, Harrison Equip. 713-879-2600
WA Richland, Radar Elec. 509-943-8336
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Don Mills, Ont., Saynor Varah 416-445-2340
Can Willowdale, Ont., Electro-Sonic 416-494-1666

OHMTEK INC., Vishay, 2160 Liberty Dr., Niagara Falls, NY 14304, Tel: 716-283-4025, FAX: 716-283-5932; FSC No.: 57489; Empl.: 205; *Sls. Mgr.:* William Cuviello ..... **A•1965-1967**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
AZ Chandler, Mission Mktg. Grp. 602-786-0804

AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, V.E.C.	619-690-5112
CA	Tustin, V.E.C.-Los Angeles	714-544-7024
CO	Loveland, V.E.C.-Rocky Mtn.	303-667-7500
CT	Wallingford, Comp Rep Assoc., Inc.	203-269-1145
FL	Altamonte Springs, Semtronic Assoc., Inc.	407-831-8233
FL	Clearwater, Semtronic Assoc., Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assoc., Inc.	305-731-2484
GA	Roswell, JWL Assocs.	404-993-0100
IL	Skokie, IRI-Illinois	312-967-8430
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
KS	Olathe, Tech. Sls. Assoc., Inc.	913-829-2800
MD	Lutherville, J.A. Dougherty Sls., Inc.	301-321-7890
MA	Sterling, Compatable Comps. Inc.	508-422-7641
MA	Westwood, Comp. Rep. Assoc., Inc.	617-329-3454
MI	Plymouth, Jay Mktg. Assoc.	313-459-1200
MN	Bloomington, IRI of MN.	612-854-8027
MN	Edina, Dunlop Consultants	612-933-9070
MN	Minneapolis, Dunlop Consits.	612-544-1070
MO	St. Louis, Tech. Sls. Assoc., Inc.	314-521-2044
NJ	Flanders, K & R Eng. Sls., Inc.	201-584-5235
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	Rochester, L-Mar Assocs.	716-381-9100
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Aurora, EMA, Inc.	216-562-6104
OH	Centerville, EMA, Inc.	513-433-2800
OH	Worthington, EMA, Inc.	614-436-9452
OR	Beaverton, N.R. Schultz Co.	503-643-1644
PA	Horsham, TMI, Inc.	215-441-4300
TX	Dallas, Edward F. Avmond Co.	214-826-7620
TX	Houston, Edward F. Avmond Co.	713-943-3149
WA	Bellevue, UniComp	206-868-5124
WI	Milwaukee, IRI-Wisconsin	414-789-9393
PR	Caguas, Comp. Rep. Assoc., Inc.	809-746-6550
Can	Concord, Ont., Kaytronics, Inc.	416-669-2262
Can	Kanata, Ont., Kaytronics, Inc.	613-564-0080
Can	Ville St. Laurent, Que., Kaytronics, Inc.	514-745-5800

OK INDUSTRIES, INC., 4 Executive Plaza, Yonkers, NY 10701, Tel: 914-969-6800, TELEX: 12-5091, FAX: 914-969-6650; Empl.: 200; *Sls. Mgr.:* John Malboeuf

OLEKTRON CORP., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570, Tel: 508-943-7440, FAX: 508-949-1804; FSC No.: 32252; Empl.: 160; *Sls. Mgr.:* Michael Smith

OLFLEX WIRE & CABLE, INC., 30 Plymouth Street, Fairfield, NJ 07004, Tel: 201-575-1101, FAX: 201-575-7178; Empl.: 25; *Sls. Mgr.:* Peter Deschner

OLIVER ADVANCED ENGINEERING, 320 W. Arden St., Glendale, CA 91203, Tel: 818-240-0080, FAX: 818-240-6131; Empl.: 28

OLYMPIC WIRE & CABLE, 1 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-7996, FAX: 201-227-1606; FSC No.: 63830; Empl.: 35; *Dist. Mgr.:* Yvette Archer

OLYMPUS CORPORATION, Industrial Fiberoptics Division, 4 Nevada Dr., Lake Success, NY 11042-1179, Tel: 516-488-3880, FAX: 516-488-3973

OMATION INC., 801 Presidental Dr., Richardson, TX 75081, Tel: 214-231-5167, 800-553-9119, FAX: 214-783-9072; Empl.: 15; *Sls. Mgr.:* Nancy James

OMEGA®

FAX: 203-359-7990

OMEGA ENGINEERING, Box 4047, Stamford, CT 06907, Tel: 800-826-6342; Empl.: 500; *Sls. Mgr.:* Peter Casiraghi & Nelson Hart ..... **B•1760, 1854-1855, 1945-1946; C•1799; D•1013, 1101, 1142, 1191, 1307, 1368-1369, 1422**

OMICRON ELECTRONIC, Ang-Kauffmann-Str. 8, Hohenems, Austria A-6845, Tel: ò/5576/4010-0, FAX: ò/5576/5153; Empl.: 10; *Sls. Mgr.:* Marc Andreas Vogg; *Dist. Mgr.:* Marc Andreas Vogg

OMNICOMP GRAPHICS CORP., 1734 W. Sam Houston Pkwy N., Houston, TX 77043, Tel: 713-464-2990, TELEX: 285801, FAX: 713-827-7540; Empl.: 40; *Sls. Mgr.:* Richard A. Jones

OMNIBYTE CORP., 245 W. Roosevelt Rd., Bldg. 1-5, W. Chicago, IL 60185, Tel: 708-231-6880, FAX: 708-231-7042; Empl.: 30; *Sls. Mgr.:* Peter Czuchra

OMNIPrint

FAX: 408-747-0358

OMNIPRINT, INC., 1188 Elko Drive, Sunnyvale, CA 94089, Tel: 408-745-6400; Empl.: 12 ..... **D•1102-1105**

Local Sales Offices & Reps

CA	Irvine, OBI Distrs.	714-250-9003
IL	Arlington Heights, Coombs Assoc., Inc.	312-439-9810
NJ	Fords, Marlin Data	201-738-7200

OMNI SWITCH USA, INC., 21630 N. 19th Ave., Ste. B-16, Phoenix, AZ 85027, Tel: 602-582-0629, FAX: 602-582-0665; Empl.: 100; *Sls. Mgr.:* Peggy Ann Wenzel, V.P.

oVi

FAX: 708-893-9991

OMNI VISION INC., 168 N. Brandon Dr., Glendale Heights, IL 60139, Tel: 708-893-1720; *Sls. Mgr.:* Walt Kowalski ..... **B•1109**

OMRON ELECTRONICS, INC., Control Components Division, 1 East Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, FAX: 708-843-8081; Empl.: 300; *Dist. Mgr.:* Mac Rowell

OMRON ELECTRONICS, INC., F A Systems Div., One E. Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, FAX: 708-843-7787; Empl.: 300; *Sls. Mgr.:* Sal Scafidi

OMUTEC, Odetics, Inc., 1515 S. Manchester Ave., Anaheim, CA 92802, Tel: 714-758-0200, TWX: 910-594-1461; *Sls. Mgr.:* Robert Asher

ONAN POWER/ELECTRONICS, 9713 Valley View Rd., Minneapolis, MN 55344, Tel: 612-943-4600, FAX: 612-943-4627; FSC No.: 3Z577; Empl.: 500; *Sls. Mgr.:* Jim Vogt

ONEAC CORPORATION, 27944 N. Bradley Rd., Libertyville, IL 60048, Tel: 708-816-6000,800-327-8801, TWX: 757024 ONEAC USA; Empl.: 250; *Sls. Mgr.:* John Jeter; *Dist. Mgr.:* Herb Goldstein

ONSET COMPUTER CORP., 199 Main St., PO Box 1030, N. Falmouth, MA 02556, Tel: 508-563-9000, FAX: 508-563-9477; Empl.: 10; *Sls. Mgr.:* Lon Hocker

ONSHORE TECHNOLOGY, 1917 W. 3rd St., Tempe, AZ 85281, Tel: 602-921-3000

ONTRACK DATA RECOVERY, INC., Ontrack Computer Systems, Inc., 6321 Bury Drive, Ste.15-19, Eden Prairie, MN 55346, Tel: 800-872-2599, FAX: 612-937-5750

OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566, FAX: 213-462-6490; FSC No.: 24699; Empl.: 18 ..... **D•1014**

OPHIR TECHNOLOGY INC., 4001 Via Oro Ave., Long Beach, CA 90810, Tel: 213-834-0202, FAX: 213-834-7730; Empl.: 26

OPTEK®

FAX: 214-323-2396

OPTEK TECHNOLOGY INC., 1215 West Crosby Rd., Carrollton, TX 75006, Tel: 214-323-2200; Empl.: 2000; *Sls. Mgr.:* Larry Newman; *Dist. Mgr.:* Kas Kunz ..... **B•1333**

Local Sales Offices & Reps

AZ	Scottsdale, Pinnacle Comp. Sls.	602-994-0441
CA	Torrance, Detomas;& Grupp Inc.	213-618-8898
AZ	Tucson, Pinnacle Comp. Sls.	602-886-1726
CA	Escondido, Uni Rep Co.	619-746-5131
CA	Mission Hills, Detomas; & Grupp Inc.	818-365-5300
CA	Mountain View, Marcon	415-964-8046
CO	Wheat Ridge, Waugaman Assoc.	303-423-1020
CT	Stratford, VISTAssociates	203-375-5456
FL	Boca Raton, S. Atlantic Comp. Sls.	407-391-1034
FL	Orlando, South Atlantic Comp. Sls.	407-857-3650
FL	Winter Haven, S. Atlantic Comp. Sls.	813-423-0953
GA	Norcross, South Atlantic Comp. Sls.	404-447-6154
IL	Arlington Heights, KMA Sls. Co.	708-398-5300
IN	Indianapolis, Elctrns Sls. & Engrg.	317-849-4260
KS	Parker, S.W. Assoc.	913-898-6552
IA	Cedar Rapids, C.H. Horn & Assoc.	319-393-8703
MA	Marlborough, VISTAssociates	617-481-9277
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Bloomington, Tecteam	612-854-6616
MO	St. Louis, John G. Macke	314-432-2830
NJ	West Caldwell, Technical Mktg. Grp.	201-226-3300
NM	Albuquerque, S.W. Sls.	505-899-9005
NY	Clark Mills, KLM Garner	315-853-6126
NY	Melville, Technical Mktg. Grp.	516-351-8833
NY	Pittsford, KLM Garner	716-381-8350
NC	Raleigh, South Atlantic Comp. Sls.	919-852-4676
OH	Dayton, Midwest Mktg. Assocs.	513-433-2511
OR	Beaverton, Earl & Brown Co. Inc.	503-643-5500
PA	Broomall, L.D. Lowery Inc.	215-356-5300
TX	Austin, Ion	512-331-7251
TX	Grand Prairie, Ion	214-647-8225
TX	Houston, Ion	713-537-7717
UT	Salt Lake City, Waugaman	801-261-0802
WA	Redmond, Earl & Brown Co. Inc.	206-885-5064
WI	Milwaukee, KMA	414-259-1771
Can	Richmond, Ont., Renmark Elctrns. Ltd.	416-881-8844

Local Distributors

CA	Compton, Harper-S.I.D.	213-979-5090
CA	Culver City, Hamilton-Avnet	213-558-2000
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Tustin, Added Value	714-259-8258
CA	Tustin, AVED	714-259-8258
FL	Orlando, Chip Supp.	407-298-7100
IL	Chicago, Newark Elctrns.	312-784-5100
MD	Gaithersburg, Pioneer-Technlg.	301-921-0660
MA	Norwood, Gerber Elctrns.	617-769-6000

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WA Belleview, Bell Inds. 206-747-1515
Can Pointe Claire, Que., Future Elctrns. 514-694-7710

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OPTELECOM, INC., 15930 Luanne Dr., Gaithersburg, MD 20877, Tel: 301-840-2121; FSC No.: 59338; Empl.: 50; *Sls. Mgr.:* Pam Imes ..... **B•1227-1229**

OPTICAL & CONDUCTIVE COATINGS, Meridian Inds., Inc., 428 N. Buchanan Cir., 68, Pacheco, CA 94553, Tel: 415-798-6066, FAX: 415-798-4789; FSC No.: 9U775; Empl.: 8; *Sls. Mgr.:* Glenn G. Grupe

OPTICAL CABLE CORP., P.O. Box 11967, Roanoke, VA 24022-1967, Tel: 1-800-622-7711, TELEX: 705-290, FAX: 703-265-0724; FSC No.: 6Y528; Empl.: 50; *Sls. Mgr.:* Luke J. Huybrechts, VP/Sls.; *Dist. Mgr.:* Chuck Surat, Natl. Accts. Exec.

OPTICS FOR RESEARCH, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4480, TELEX: 497-4643, FAX: 201-228-0915; Empl.: 27; *Sls. Mgr.:* Donald K. Wilson

OPTIMA ELECTRONIC PACKAGING SYSTEMS, 2166 Mountain Industrial Blvd, Tucker, GA 30084-5088, Tel: 404-496-4000, FAX: 404-496-4041; FSC No.: 10110; Empl.: 150; *Sls. Mgr.:* Don Southwell ..... **C•1064-1069**

Local Sales Offices & Reps
AZ Scottsdale, Arcom Sls., Inc. 602-947-5745
CA Garden Grove, Elsco Elctrns., Inc. 714-891-4621
CA Santa Clara, Nova-Tronix 408-727-9530
CO Denver, Promotech, Inc. 303-692-8484
FL Oviedo, Conley & Assocs., Inc. 407-365-3283
GA Roswell, Acurep Associates, Inc. 404-998-5008
GA Tucker, Optima Elctrn. Packaging 404-496-4000
IL Arlington Heights, Berndt Assocs., Inc. 708-632-0900
MA Millis, Selmark Assocs., Inc. 508-376-2914
MI Madison Hgts., DEM Electronic Sls., Inc. 313-583-1500
MN Minneapolis, Holmgren Assocs., Inc. .. 612-574-9983
MO Bridgeton, BC Elctrn. Sls. 314-739-6683
NJ Berkeley Heights, Cambridge Allen & Assocs. 908-464-0203
NC Raleigh, Godwin Assocs. 919-878-8000
OH Cleveland, C.A. Robinson Co., Inc. 216-473-6044
UT Salt Lake City, Sierra Technical Sales 801-566-9719
VA Sterling, Beacon North, Inc. 703-478-2480
WA Bellevue, El Tech 206-746-7780

OPTIMA PRECISION, INC., 775 SW Long Farm Rd., West Linn, OR 97068, Tel: 800-544-4118, 503-638-2525, FAX: 503-638-4545; Empl.: 6

OPTIMATION, See Julie Research Labs

OPTIMIZED DEVICES, INC., 220 Marble Ave., Pleasantville, NY 10570, Tel: 914-769-6100, FAX: 914-741-0729; Empl.: 30

OPTIMUM APPLIED SYSTEMS, 145 Palisade St., Dobbs Ferry, NY 10522-1696, Tel: 914-693-9001; Empl.: 30; *Sls. Mgr.:* H. Joseph Brakl

OPT INDUSTRIES, INC., 300 Red School Lane, Phillipsburg, NJ 08865, Tel: 908-454-2600, FAX: 908-454-3742; Empl.: 290; *Dist. Mgr.:* Sandra Keefe

OPTIVISION, INC., 1477 Drew Ave., Suite 102, Davis, CA 95616, Tel: 916-756-4429, 800-562-8934, FAX: 916-756-1309; Empl.: 19; *Sls. Mgr.:* Kathy Ernest

OPTO DIODE CORP., 750 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-499-0335, FAX: 805-499-8108; FSC No.: 67109; Empl.: 12; *Sls. Mgr.:* Russell Dahl

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OPTOELECTRONICS/TEXTRON, 1309 Dynamic St., Petaluma, CA 94975-0039, Tel: 707-763-5900, FAX: 707-762-7383; Empl.: 125

OPTO PLUS o INC., 23382 Madero, Unit A, Mission Viejo, California, CA 92691, Tel: 714-380-8654, 800-486-6786, FAX: 714-380-0761; Empl.: 7

OPTO TECHNOLOGY, INC., 562 Chaddick Dr., Wheeling, IL 60090, Tel: 708-537-4277, FAX: 708-537-4785; Empl.: 25; *Sls. Mgr.:* Thomas W. Hegberg, Sls. Mgr.

OPTO 22, 15461 Springdale St., Huntington Bch., CA 92649, Tel: 714-891-5861, FAX: 714-893-0867; Empl.: 140

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CA Santa Clara, Nova-Tronix 408-727-9530
CA Torrance, Satori Elec. 213-378-9478
CO Denver, Aki Entprs. 303-388-4488
CO Denver, AKI Entprs. 303-388-4488
GA Atlanta, Satori Elec. 404-320-8482
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WA Seattle, Venture Elctrns. 206-454-4594
TX Dallas, Satori Elec. 214-518-1946
WA Bellevue, Venture Elex. 206-454-4594
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Local Distributors
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CA San Diego, Cypress Elctrns. 619-535-0011
CA San Jose, Sierra West 408-435-7477
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Englewood, Cypress Elctrns. 303-792-5829
OR Beaverton, Cypress Elctrns. 503-641-2233
OR Beaverton, I E C 503-641-1690
OR Beaverton, IEC 503-641-1690
WA Bellevue, I.E.C. 206-455-2727
WA Bothell, Cypress Elctrns. 206-483-1144
WA Bothwell, Cypress Elctrns. 206-483-1144

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ORAM HIGH VOLTAGE, Klemp Road, P.O. Box 1176, Dayton, TX 77535, Tel: 409-258-5553; Empl.: 27; *Sls. Mgr.:* M. Su ..... **D•1916-1917**

ORBIT INDUSTRIES, Countis Industries, 2670 Lockheed Way, Carson City, NV 89706, Tel: 702-882-6123; Empl.: 11; *Sls. Mgr.:* James T. Countis

ORBIT INSTRUMENT CORP., 80 Cabot Ct., Hauppauge, NY 11788, Tel: 516-435-8300, TWX: 510-221-2122, FAX: 516-435-8458; FSC No.: 11263; *Sls. Mgr.:* Jeanne Szabodas

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Local Sales Offices & Reps
CA San Diego, D. Cary 619-222-8839
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Local Distributors
AZ Scottsdale, Tusar 602-988-3688
CA Garden Grove, Advanced Digital Grp. 714-897-0319
CA Santa Clara, Elcor Assocs. 408-980-8868
GA Snellville, Electro-Cadd 404-552-8613
KS Overland Park, Walker Engrg., Inc. 913-888-0089
MA Wilmington, DGA Assocs., Inc. 617-935-3001
MI Bloomfield Hills, MacKellar Assocs. ... 313-335-4440
NJ Manalapan, Beta Lambda, Inc. 201-446-1100
NC Raleigh, Tingen Techn. Sls., Inc. 919-870-6670
OR Portland, AVCOM EDA 408-980-8868
TX Houston, Abcor, Inc. 713-486-9251

ORCUS, Box 16022, Kansas City, MO 64112, Tel: 913-897-5128, TELEX: 4994037, FAX: 913-897-5468; *Sls. Mgr.:* Manford Eaton

OREGON MICRO SYSTEMS, INC., 1800 N.W. 169th Pl, A400, Beaverton, OR 97006, Tel: 503-644-4999, FAX: 503-629-0688; Empl.: 8; *Sls. Mgr.:* Wayne Hunter

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ORIENTAL MOTOR USA CORP., Super Vexta, 2580 W. 237th Street, Torrance, CA 90505-5217, Tel: 213-515-2264, TELEX: 664231, FAX: 213-515-2879; Empl.: 4

ORIENTATION INC., 101 Coolidge St., Hudson, MA 01749, Tel: 508-568-0509, FAX: 508-562-3789; *Sls. Mgr.:* Mark Johnson

ORIGINAL ELECTRIC MFG. CO., INC., 123 Lincoln Blvd., Middlesex, NJ 08846, Tel: 201-271-5770, FAX: 201-271-5774

ORION INSTRUMENTS

FAX: 415-327-9881

ORION INSTRUMENTS, INC., 180 Independence Dr., Menlo Park, CA 94025, Tel: 415-327-8800, 800-767-4666, TELEX: 530942; *Sls. Mgr.:* Joe Murdica, VP Sls. ..... **D•1308-1309**

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CA Belmont, WDI, Inc. 415-591-6535
CA Redondo Beach, Ward/Davis Assocs. 213-643-6977
CO Denver, Aztec Entprs. 303-779-5285
FL Seminole, Hartek Corp. 813-584-0190
IL Chicago, MacKellar Assocs. 312-243-1400
MD Ellicott City, Technology Sls. 301-461-7802
MI Bloomfield Hills, MacKellar Assocs. ... 313-335-4440
MI Grand Rapids, MacKellar Assocs. 616-956-1177
MO St. Louis, HSES, Inc. 314-567-7565
NH Nashua, MJT Assocs. 603-889-5373
NJ E. Hanover, General Calibration 201-428-2880
NM Albuquerque, Aztec Entprs. 505-262-1688
NY Frankfort, Kapital Instrs. 315-894-4245
NC Apex, Miller Technlgs. 919-362-7587
OH Columbus, MacKellar Assocs. 614-848-3552
OK Tulsa, Scientific Dvcs. SW 918-665-8899
TX Houston, Scientific Devices SW 713-645-4100
TX Richardson, Scientific Dvcs., SW 214-231-8106
UT Salt Lake City, Aztec Entpr. 801-467-4675

Local Distributors
Can Scarborough, Ont., Multitest Elctrns. ... 416-609-8396

ORMEC SYSTEMS CORP., 19 Linden Park, Rochester, NY 14625, Tel: 716-385-3520, FAX: 716-385-5999; Empl.: 50; *Sls. Mgr.:* Gregory Woods

ORTEL CORP., 2015 W. Chestnut St., Alhambra, CA 91803, Tel: 818-281-3636, TELEX: 752434, FAX: 818-281-8231; *Sls. Mgr.:* Bill Moore, V.P. of Sls.

OSBORNE TRANSFORMER, 19636 Derby St., Detroit, MI 48203, Tel: 313-468-9410, FAX: 313-468-4828; Empl.: 20; *Sls. Mgr.:* J. R. Osborne

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OSCILLATEK, A Dover Technology Company, 620 North Lindenwood Dr., Olathe, KS 66062, Tel: 913-829-1777; FSC No.: 57693; Empl.: 80; *Sls. Mgr.:* John S. Passiglia ..... **A•1426-1430**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Scottsdale, Thorson Desert States	602-998-2444
CA	Long Beach, L & M Engrg.	714-770-2067
CA	Los Angeles, L & M Engrg.	213-417-3044
CA	San Diego, L & M Engrg.	619-486-1246
CA	San Fernando, L & M Engrg.	805-493-0262
CO	Aurora, Thorson Desert States	303-671-7344
FL	Boca Raton, Beacon Elctrns.	305-997-4518
FL	Clearwater, Beacon Elctrns.	813-796-2378
FL	Longwood, Beacon Elctrns.	305-332-1940
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Barrington, R-Tek	312-382-4600
IN	Ft. Wayne, R-Tek	219-432-8783
IA	Cedar Rapids, Midwest Tech. Sls.	319-365-4011
KS	Gooddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Addelco Corp.	617-444-4754
NM	Albuquerque, Thorson Desert States	505-293-8555
NY	Fairport, bbd Elctrns., Inc.	716-425-1112
NY	Hartsdale, Spectrum Sls.	914-472-8600
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Miamisburg (Dayton), Elctrn. Comps. Inc.	513-866-3340
OR	Beaverton, Thorson Co. Northwest	503-644-5900
PA	Southampton, Eastern Instrmn. of PA	215-355-7700
TX	Dallas, McDonald Assocs.	214-239-7236
WA	Bellevue, Thorson Co. Northwest	206-455-9180

OSCILLOQUARTZ, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325, Tel: 818-993-0048, TELEX: 650 2068183, FAX: 818-993-5758; Empl.: 125; *Sls. Mgr.:* Alain Jendly

OSHINO LAMPS LIMITED, 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, Japan, Tel: 03-3471-8548, TELEX: 0242-2117, FAX: 03-3450-3939; Empl.: 300; *Sls. Mgr.:* T. Koyama ..... **B•1180-1181**

OSLO CONTROLS, 328 Industrial Ave., Cheshire, CT 06410-1511, Tel: 203-272-2794, FAX: 203-272-3492; *Sls. Mgr.:* J. J. Martinez ..... **B•1761**

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AZ	Phoenix, Western Automation	602-973-2384
CA	Laguna Hills, Western Automation	714-859-6988
CA	Mountain View, Frauman Assoc.	415-964-9464
CO	Englewood, CompuTech Mktg.	303-773-3981
CT	Glastonbury, Pace Assocs.	203-659-2266
FL	Boca Raton, Newell-Hynes	407-392-3186
FL	Deerfield Beach, Newelt Hynes	305-429-3207
GA	Lawrenceville, R.L. Panyik & Assoc.	404-923-3703
IL	Lisle, W-G Controls	708-963-5954
IA	Anamosa, WG Controls	319-462-3456
MN	St. Pauls, Kentronics	612-645-7717
MO	Creve Coeur, Hill & Co.	314-432-1136
NJ	Englewood, Gray Assocs.	201-894-0894
NY	Syracuse, Canavan-Scanlon Assocs., Inc.	315-437-1271
OH	Cincinnati, O. H. Bromberg & Assocs.	513-771-9333
PA	West Chester, All Tech. Mktg.	215-344-0134
TX	Dallas, Glidden Electro Equip.	214-341-0610
WA	Bellevue, MC Assocs.	206-746-7780
Can	Scarborough, Ont., Banke Elctrns.	416-292-5152

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Tempe, LComp., Inc.	602-730-1633
CA	Anaheim, Deco Elctrns., Inc.	714-630-8252
CA	Gardena, California Switch & Signal	1-800-421-2471
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Redwood City, HdB	415-368-1388
CA	San Diego, Deco Elctrns., Inc.	619-693-1595
CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Tustin, Western Switches & Controls, Inc.	714-259-8144
CA	Van Nuys, Wes Garde Components	213-873-4802
CO	Aurora, Jet Elctrn. Supp., Co., Inc.	303-364-1000
CT	Fair Haven, Control Comps.	203-865-0300
CT	Waterbury, Century Elec. Supps., Inc.	203-755-0405
CT	West Hartford, Wes Garde Components	203-527-7705
FL	Lakeland, A A Elec.	800-237-8274
FL	Lakeland, Wes Garde Components	813-644-7564
IL	Addison, LComp., Inc.	312-628-1400
IL	Carol Stream, Wes Garde Components	1-800-323-9431
IL	Crystal Lake, Sub Sem	815-459-4139
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
KS	Overland Park, Wes-Garde	913-262-2718
KS	Wichita, LComp.,Inc.	316-265-5100
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Canton, Impact Sls. Co., Inc.	617-821-1500
MA	Marlboro, Hardware Specialties	508-481-8622
MI	St. Clair Shores, SPEMCO, Inc.	313-771-2700
MN	Minneapolis, Dot Elctrns.	612-861-4561
MN	Minneapolis, Elctrn. Center, Inc.	612-371-5200
MO	Maryland Hgts., LCOMP, Inc.	800-325-1393
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NJ	Mt. Laurel, Wes Garde Components	609-778-8190
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Bohemia, Key Comps.	516-567-7500
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Woodside, Switches Unltd., Inc.	718-478-5000
OH	Shandon, Cartessa Corp.	513-738-4477
OH	Westerville, Wes Garde Components	614-885-0319
TX	Dallas, GEECO Sls. Co.	214-341-0610
TX	Dallas, Wes Garde Components	214-357-1768
WI	Grafton, Lakeview Elctrns.	414-377-8250
WI	Mequon, Taylor Elec.	414-241-4321
Can	Downsview, Ont., Westburne Elctrns.	416-635-2950

OSTBY-BARTON TEST PROBES, 487 Jefferson Blvd., Warwick, RI 02886, Tel: 401-739-7310, TELEX: 927573, TWX: 401-732-4937; Empl.: 75; *Sls. Mgr.:* Joe Burns

OTTO CONTROLS, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, Tel: 708-428-7171, FAX: 708-428-1956; FSC No.: 21649: Empl.: 200; *Sls. Mgr.:* R. E. Sparks ..... **B•1762-1763**

Local Sales Offices & Reps

CO	Denver, Advent Comps. Corp.	303-455-1985
AZ	Scottsdale, Advent Comps. Corp.	602-481-0044
CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	San Jose, Westron Assocs.	408-997-7332
CT	Gulliford, Norris & Assocs.	203-453-1613
GA	Norcross, South Atlantic Comp.	404-447-6154
IL	Itasca, LTD Technlgs., Inc.	708-773-2900
IN	Ft. Wayne, Menze Sls.	219-747-5616
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040
MI	Madison Heights, Pine Sls., Inc.	313-589-0350
MN	Roseville, Vector Comp. Sls.	612-631-1334
MO	Florissant, Spectrum Sls.	314-921-1313
KS	Overland Pk., Spectrum Sls.	913-648-6811
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
NJ	Hackensack, Coakley, Boyd & Abbett	201-440-4114
NC	Raleigh, S. Atlantic Comp. Sls.	919-859-9970
FL	Orlando, S. Atlantic Comp. Sls.	407-857-3650
TX	Dallas, Control Comps. Corp.	214-458-8877
WA	Bellevue, James Findlay Co.	206-455-9597
WI	Mequon, Badgerep, Inc.	414-241-9200
Can	Toronto, Ont., Wilson Entprs.	416-766-0510

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Tempe, LCOMP	602-730-1633
CA	Gardena, Cal Switch	213-770-2330
CA	Los Angeles, Electric Switches, Inc.	213-660-1310
CA	Santa Ana, Norstan Elctrns.	714-540-4163
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
FL	Orlando, Sager Elctrns.	407-240-3114
FL	Pompano Beach, Peerless Radio Corp.	305-973-4141
IL	Addison, LCOMP	708-628-1400
IL	Carol Stream, Wes-Garde Comps. Grp.	708-653-1460
MD	Columbia, Sager Elctrns.	301-995-6580
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Hingham, Sager Elec. Supp.	617-749-6700
MI	Grand Rapids, RM Elctrns.	616-531-9300
MO	Kansas City, LCOMP	816-241-0111
MO	Maryland Heights, LCOMP	314-291-6200
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NC	Raleigh, Sager Elctrns.	919-850-9550
NC	Winston, Kirkman Elctrns.	919-722-9131
PA	Trevose, Sager Elctrns.	215-638-7491
TX	Dallas, Associated Aircraft Supp.	214-331-4381

OUPIIN AMERICA, INC., 65 W. Easy Street 201, Simi Valley, CA 93065, Tel: 805-520-0862, FAX: 805-520-0864; *Sls. Mgr.:* Randy Ryan

OUTLAND TECHNOLOGY INC., 2144 S. Glencove Ln., Gretna, LA 70056, Tel: 504-394-4354, FAX: 504-394-4354; Empl.: 4; *Sls. Mgr.:* George J. Mayfield; *Dist. Mgr.:* George J. Mayfield

OUTLOOK TECHNOLOGY, INC., 200 E. Hacienda Ave., Campbell, CA 95008, Tel: 408-374-2990, TELEX: 350479, FAX: 408-374-9273; *Sls. Mgr.:* Walter A. Klees

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Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	EL toro, Marktronix	714-858-0632
CA	Los Angeles, Martronix	213-782-7826
CA	San Mateo, Melvin Sls.	415-349-7445
DC	Towson, Dickison Sales Co.	301-823-0923
FL	Longwood, D. Assocs.	407-830-8976
FL	Maitland, Ellis & Assocs.	407-645-11-1
GA	Atlanta, L & D Inc.	404-395-7079
KS	Lexena, MIDTEC Associates	913-541-0505
MD	Towson, Dickison Sls. Co.	301-823-0923
MA	Milton, Naton Assocs.	617-698-0670
NJ	Paramus, Eltech Sls.	201-967-1309
NY	Buffalo, Quality Comps.	716-837-5430
NC	Greensboro, L & D, Inc.	919-292-3201
NC	Raleigh, L&D Inc.	919-876-5301
TN	Bristol, L&D Inc.	615-878-2266
TX	Euless, W. Pat Fralia Co.	817-354-1144
WA	Seattle, Eltech, Inc.	206-643-4330
Can	Mississauga, Vitel Electronics	416-676-9720

OVEN INDUSTRIES, 207 Hempt Rd, P.O. Box 290, Mechanicsburg, PA 17055, Tel: 717-766-0721, FAX: 717-766-4786; FSC No.: 21302; Empl.: 60; *Sls. Mgr.:* T. M. Nolan

OXLEY INC., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, Tel: 203-488-1033, FAX: 203-481-6971; FSC No.: 3R006; *Sls. Mgr.:* Carol Carr .... **A•1705; B•1025, 1179, 1335; C•1479**

Local Sales Offices & Reps

CA	Irvine, Balzer Wolf Assocs.	714-261-6877
CA	Sunny Vale, Stout Inds.	408-746-0470
MN	St. Paul, Hanks	612-484-8531
PA	Paoli, Stitzer Co. Inc.	215-644-5500
TX	Richardson, Eagle Marketing	214-238-5383

PACCOM, 3928 148th NE, Redmond, WA 98052, Tel: 206-883-9200, 800-426-6254, TWX: 910-449-2973, FAX: 206-881-0506; Empl.: 20; *Sls. Mgr.:* B. Rudd

PACE INC., 9893 Brewers Ct., Laurel, MD 20723-1990, Tel: 301-490-9860, TELEX: 198296, FAX: 301-498-3252; *Sls. Mgr.:* James K. Bausell

PACER INDUSTRIES, INC., 1450 First Ave., Chippewa Falls, WI 54729, Tel: 715-723-1141, TELEX: 284755, FAX: 715-723-7890; FSC No.: 60162; Empl.: 13; *Sls. Mgr.:* Patrick Brennan; *Dist. Mgr.:* Patrick Brennan

PACER SYSTEMS, INC., 900 Technology Park Dr., Billercia, MA 01821, Tel: 508-667-8800, FAX: 508-663-5155; Empl.: 325; *Sls. Mgr.:* E. Childress

PACIFIC ATLANTIC ELCTRNS., Patronix, Inc., Box 754, El Cerrito, CA 94530, Tel: 415-237-5837, FAX: 415-524-9267; Empl.: 4; *Sls. Mgr.:* P. Yen; *Dist. Mgr.:* P. Yen

PACIFIC COAST CIRCUITS, INC., 189 Granada Dr., San Luis Obispo, CA 93401, Tel: 805-544-4881, FAX: 805-544-6475; FSC No.: 66107; Empl.: 18; *Sls. Mgr.:* Chris Cofer

PACIFIC COIL CO., Inductor Supp., Inc., 430 E. 19th St., Bakersfield, CA 93305-5495, Tel: 805-323-7714, 800-332-COIL, FAX: 805-325-9732; Empl.: 23

PACIFIC COMMUNICATIONS, 2041 S. Grand Ave., Santa Ana, CA 92705, Tel: 714-546-0147, FAX: 714-546-0084; Empl.: 60

PACIFIC ELECTRICORD, 747 W. Redondo Bch. Blvd., Gardena, CA 90247, Tel: 213-532-6600, TWX: 910-346-7619, FAX: 213-532-5044; Empl.: 1000; *Sls. Mgr.:* Alan Manzo; *Dist. Mgr.:* Alan Manzo

PACIFIC ELECTRO DYNAMICS, INC., 11465 Willows Rd. N.E., Redmond, WA 98073-9745, Tel: 206-881-1700, TWX: 901-449-29-77; Empl.: 420

PACIFIC INDUSTRIAL COMPONENTS CORP., See Altair Exchange Corp.

PACIFIC INDUSTRIAL COMPONENTS CORP., 19201 Parthenia St. No.E, Northridge, CA 91324, Tel: 818-775-1007, FAX: 818-701-5508; *Sls. Mgr.:* Ray Pross ..... **B•1036**

Local Sales Offices & Reps

IL	Elk Grove Village, Pacific Comps.	708-228-0030

PACIFIC INSTRUMENTS INC., 215 Mason Circle, Concord, CA 94520, Tel: 415-827-9010, FAX: 415-827-9023; Empl.: 40

PACIFIC MAGNETICS CORP., 2602 Transportation Ave., Ste. G, National City, CA 92050, Tel: 619-474-8216, FAX: 619-474-3979; *Sls. Mgr.:* Mary Hill

PACIFIC MICROCOMPUTERS, Signal Technology, 5855 Oberlin Dr. Ste. B, San Diego, CA 92121, Tel: 619-453-8649; Empl.: 15; *Sls. Mgr.:* Guy Halac

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POWER SOURCE CORP

FAX: 714-891-1928

PACIFIC POWER SOURCE CORP., 15122 Bolsa Chica St., Huntington Bch., CA 92649, Tel: 714-898-2691, 800-854-2433; FSC No.: 57148; Empl.: 50; *Sls. Mgr.:* Russ Engle ..... **D•2216-2221**

Local Sales Offices & Reps

AL	Huntsville, W A Brown Instrs.	205-830-9224
CA	San Jose, Amasco Corp.	408-262-1500
CA	Torrance, Amasco Corp.	213-781-9494
CO	Denver, Aztec Entprs.	303-779-5285
AZ	Tempe, Aztec Entprs.	602-431-8401
FL	Ft. Lauderdale, W. A. Brown Instrs.	305-581-6444
FL	Melbourne, W.A. Instrs.	407-723-0766
FL	Orlando, W.A. Brown Instrs.	407-648-9660
GA	Norcross, W.A. Brown Instrs.	404-449-7160
IL	Arlington Hgts., Comtel Midwest	708-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest Co.	913-268-0762
MA	Hopkinton, Eastern Sys. Inc.	508-435-2151
MI	Plymouth, EQS Sys.	313-455-7920
MO	St. Louis, Comtel Midwest Co.	314-227-7220
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Liverpool, Northern Tech. Sls. Assocs., Inc.	315-451-1091
NY	Wantagh, Bytec Reps.	516-781-7400
NC	Cary, W.A. Brown Instrs.	919-460-1120
OH	Chesterland, EQS Sys.	216-729-2222
OH	Dayton, EQS Sys.	513-236-7676
OR	Portland, Westcon	503-283-0132
NJ	Fairfax, Sci. Reps.,Inc.	609-662-5222
PA	Huntingdon Valley, Sci-Rep Inc.	215-322-6500
PA	Pittsburgh, EQS Sys.	800-729-8084
TX	El Paso, Aztec Entprs.	505-262-1688
VA	Fairfax, Sci-Rep, Inc.	703-385-0600
WA	Kent, Westcon, Inc.	206-824-8922
Can	Ottawa, Ont., Multitest Midwest Elctrns.	613-727-0848
UT	Salt Lake City, Aztec Entprs., Inc.	801-467-4675
WI	New Berlin, Comtel Midwest Co.	414-544-6042
Can	Scarborough, Ont., Multitest Elctrns.	416-609-8396
Can	St. Laurent, PQ, Multitest Elctrns.	514-337-0723

PACIFIC RESISTOR CO., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, FAX: 818-345-1507; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt ... **A•1968-1970**

Local Sales Offices & Reps

CA	San Jose, Comtech Mktg.	408-294-5448

Local Distributors

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PACIFIC SCIENTIFIC CO., 4301 Kishwaukee, Rockford, IL 61109, Tel: 815-226-3100, TELEX: 386743, FAX: 815-226-3122; Empl.: 400; *Dist. Mgr.:* Steve Earley

PACIFIC SCIENTIFIC, Electro Kinetics Division, 402 E. Gutierrez St., Santa Barbara, CA 93101, Tel: 805-963-2055, TWX: 910-334-1177; Empl.: 220; *Sls. Mgr.:* Robert E. Lynch

PACIFIC TRANSDUCER CORP., 2301 Federal, Los Angeles, CA 90064-1482, Tel: 213-478-1134, FAX: 213-312-0826; Empl.: 22; *Sls. Mgr.:* Laura Barba

PACIFIC TRANSFORMER CORP., 4750 Wesley Dr., Anaheim, CA 92807, Tel: 1-800-325-0501, FAX: 714-779-0718; Empl.: 75

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Division of LaFrance Corp

FAX: 215-365-4420

PACTEC, LaFrance Corp., Enterprise & Executive Avenues, Philadelphia, PA 19153, Tel: 215-365-8400; Empl.: 503; *Sls. Mgr.:* J. Singer .... **C•1002, 1070-1076**

Local Sales Offices & Reps

AL	Huntsville, Scott Ray	205-883-2159
CA	Anaheim, Jonathan Winters	714-779-8092
CA	San Jose, Michael Bennett	408-943-0360
FL	Palm Harbor, Roger Hauck	813-784-7895
IL	Lisle, Jim McCloskey	708-969-8821
MA	Burlington, Jim Craig	617-221-4824
EXP	Philadelphia, PA, PacTec Export Sls. Dept.	215-365-8400
NJ	Merchantville, Bill Boucot	609-488-9086
NC	Thomasville, Keith Pierce	919-472-2030
OH	Perrysburg, Bruce Brown	419-874-1110
TX	Dallas, Craig LaDue	214-340-6288
WA	Seattle, Mike Werttemberger	206-363-9899
WI	Appleton, Ed Sabish	414-731-7212

Local Distributors

AL	Birmingham, American Elctrns. Supp.	205-942-4656
AZ	Tempe, Circut Specialists, Inc.	602-966-0764
CA	Anaheim, R&D Elctrns.	714-773-0240
CA	Burbank, Electronic City	213-842-5275
CA	Canoga Park, Sandy's Elctrns. Supp.	213-346-8353
CA	Carpenteria, Electronic Resources	805-684-5439
CA	Costa Mesa, Marvac	714-540-3280
CA	El Segundo, Force Elctrns.	213-772-1324
CA	El Toro, R-Vac	714-586-1210
CA	Gardena, California Switch & Signal	213-538-9830
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Diego, Southland Comps.	619-673-3800
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Santa Clara, Force Elctrns.	408-435-1324
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CA	Vallejo, Zackit (Vallejo)	707-644-6676
CO	Aurora, Jet Elctrn. Supp.	303-364-1000
CO	Littleton, Display's Plus	303-730-7333
CT	Wallingford, Midstate Elctrns.	203-265-9900
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
CT	Wallingford, Utronics, Inc. Coghlin	203-265-2724
DE	Wilmington, Wholesale Elctrns. Inc.	302-656-9988
FL	Largo, Electronic Precepts of FL	813-544-3636
FL	Longwood, Intertec Comps.	305-834-7777
FL	Tampa, Sunex Elctrns.	813-885-4074
FL	West Palm Beach, Nurmi Elctrns.	305-686-8553
GA	Norcross, American Elctrn. Supp.	800-562-8740
GA	Norcross, Dow Elctrns., Inc.	404-448-4004
GA	Norcross, EMSCO	404-925-8366
HI	Honolulu, Precision Radio, Ltd.	808-537-5291
ID	Boise, Radar Elec.	208-336-2227
IL	Berwyn, BB & W Inc.	312-242-1533
IL	Champaign, Klaus Radio	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove, Martec Assocs.	312-956-8090
IL	Mt. Prospect, Tri State Elctrns.	312-255-0600
IL	Northbrook, Classic Comps.	312-291-0019
IL	Peoria, Klaus Radio	309-691-4840
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Meunier Elctrns.	317-635-3511
IA	Cedar Rapids, Iowa Radio Supply	319-393-4510
MD	Beltsville, P.S.I.	301-937-4960
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Westborough, In-Stock Products Co.	508-870-5750
MI	Grand Rapids, S. F. Elctrns.	616-459-0216
MI	Livonia, RS Elctrns.	313-525-1155
MI	Taylor, Tel Van Elctrn. Supp.	313-291-3515
MN	Minneapolis, AEI Elctrn. Parts	612-338-4754
MN	Minneapolis, Berquist	612-835-2322
MN	New Brighton, Parts I	612-633-8079
MO	Kansas City, Walters Indl. Elctrns.	816-531-7015
NE	Lincoln, Scott Elctrns.	402-466-8221
NH	Salem, Sager Elctrl. Supp.	603-898-1348
NJ	Rockaway, Tonar Inds., Inc.	201-586-9000
NM	Albuquerque, Walker Elctrns. Supp.	505-883-2992
NY	Buffalo, Summit Distr.	716-887-2800
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
NY	Rochester, Summit Distr.	716-334-8110
NC	Raleigh, Sager Svc. Plus Elctrns.	919-850-9550
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, R. S. Elctrns.	513-793-2450
OH	Cleveland, Roberts Elctrns.	216-238-1711
OH	Columbus, Hughes-Peters	614-294-5351
OK	Tulsa, Radio Inc.	918-587-9123
OR	Beaverton, Rose Elctrns	503-629-9288
OR	Portland, Radar Elec.	503-232-3404
PA	Exton, VSH Elctrns.	215-363-2250
PA	Mars, Sager Elctrns.	412-772-2233
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Force Elctrns.	214-247-9955
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Ft. Worth, Tandy Natl. Pts.	817-870-5600
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
UT	Salt Lake City, Standard Supp.	801-486-3371

VA Charlottesville, Virginia Elctrn. Comps. 804-296-4184
WA Seattle, Radar Elec. 206-282-2511
WI Grafton, Lake View Elctrns. Corp. 414-377-8250
WI Milwaukee, Industrial Elctrns., Inc. 414-276-1212
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Classic Comps. Supp., Inc. 414-786-5300
WI Oshkosh, Electronic Inds., Inc. 414-235-8930
Can Burnaby, BC, Intek Elctrns. 604-294-8100
Can Mississauga, Ont., Rush Elctrns. 416-677-7280
Can Pointe Claire, Future Elctrns. 514-694-7710
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Vancouver, BC, Future Elctrns. 604-294-1166
Can Victoria, BC, Queale Elctrns., Ltd. 604-388-6111

PAINE CORPORATION, 2401 S. Bayview St., Seattle, WA 98144, Tel: 206-329-8600, 800-426-0366, FAX: 206-329-1615; FSC No.: 13624; Empl.: 93; *Sls. Mgr.:* John Sagvold

PAKTRON, See ITW Paktron

PAK-TRONIC, See Tracor Paktronics

PAKTRONICS CONTROLS, INC., P.O. Box 185669, Ft. Worth, TX 76181, Tel: 817-284-5241, FAX: 817-284-1712; Empl.: 30; *Sls. Mgr.:* D. R. Sundberg, Acting

PALADIN CORP., 3543 Old Conejo Rd., No.101-102, Newbury Park, CA 91320, Tel: 805-499-0318, FAX: 805-499-4006; Empl.: 20; *Sls. Mgr.:* Scott Allen

PALOMAR ENGINEERS, Box 455, Escondido, CA 92033, Tel: 619-747-3343, FAX: 619-747-3346; Empl.: 9

PAMRAN INC., 1900 Williams St., Young Ind. Pk., Racine, WI 53404, Tel: 414-637-7999, FAX: 414-637-2303; FSC No.: K 8-67203; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

PANAMETRICS, 221 Cresent St., Waltham, MA 02154-3497, Tel: 617-899-2740, TELEX: 6817337, TWX: 951006, FAX: 617-899-1552; Empl.: 200; *Sls. Mgr.:* Bob Mel

PANASONIC FACTORY AUTOMATION CO., Matsushita Elect. Corp. of America, 9401 W. Grand Ave., Franklin Park, IL 60131, Tel: 708-452-2410, 708-452-2650, FAX: 708-452-2575; *Sls. Mgr.:* Art Hagiwara

Panasonic

FAX: 201-392-4782

PANASONIC INDUSTRIAL CO., Battery Sales GP, Box 1511, Secaucus, NJ 07096-1511, Tel: 201-348-5266; Empl.: 25 ..... **D•1470-1475**

Local Sales Offices & Reps

AZ Scottsdale, Dar-C 602-948-2240
CA Glendale, Halbar Assocs. Inc. 818-246-8263
CA Pleasanton, Moulthrop Sls. Inc. 415-463-0450
CA San Diego, Tauber & Assocs. 619-274-7242
MA Burlington, Conti-Younger Assocs. Inc. 617-273-1582
MN Eden Prairie, Electro Mark Inc. 612-944-5850
OH Beachwood, Elctrn. Salesmasters Inc. 216-831-9555
OR Beaverton, Advanced Power Prods. ... 503-646-0994

Local Distributors

AL Huntsville, Resistacap Inc. 205-883-4270
AZ Scottsdale, Electro Mktg. 602-991-0110
CA San Diego, Tauber Elctrns. Inc. 619-274-7242
CA San Jose, Rose Elec. Distrbg. Co. 408-943-0440
CA Santa Clara, Cypress Elctrns. Inc. 408-980-2500
CA Van Nuys, NESCO 818-781-0505
CO Englewood, AVT 303-779-8056
CT Woodbury, Cell Technlg. 203-575-1103
FL St. Petersburg, Micro Precision 813-854-2861
GA Norcross, Applied Power, Inc. 404-263-0421
IL Morton Grove, Power Pak Inc. 312-966-6000
IL Palatine, Ohm Elctrns. 708-359-9686
IN Indianapolis, Bell Inds. 317-634-8200
MD Beltsville, Mark Elctrns. 301-792-0072
MA Canton, Impact Sls. Co. Inc. 617-821-1500
MI Danvers, Generation Elctrns. Inc. 508-683-1177
MI Brighton, Applied Power Inc. 313-227-3604
MN Thief River Falls, Digi-Key 800-344-4539
MN Minneapolis, Stark Elctrns. Supp. Inc. 612-332-1325
NJ Camden, Gen. Radio 609-964-8560
NJ Clifton, Engineered Assem. 201-288-4477
NC Raleigh, Engrd. Assemblies Inc. 919-790-9700
NC Winston Salem, Kirkman Elctrns. 800-334-0158
OH Columbia, Promark Elctrns. Inc. 614-876-8885
OH Columbus, Hughes-Peters 614-294-5351
OR Beaverton, Micro Power 503-626-7086
TX Dallas, Computer Comps. Corp. 214-239-0271
TX Dallas, Norvell Elctrns. Inc. 214-233-0020
TX Fort Worth, Allied Elctrns. 817-336-5401
WI Mequon, Taylor Elec. Co. 414-241-4321

PANASONIC INDUSTRIAL COMPANY, Custom Peripheral Dept., Two Panasonic Way, Secaucus, NJ 07094, Tel: 201-392-6313, FAX: 201-348-7849; *Dist. Mgr.:* Edmund Silvia Jr., Prod. Mgr.

PANASONIC INDUSTRIAL CO., 1616 McCandless Dr., Milpitas, CA 95035, Tel: 408-946-7200, FAX: 408-946-3753

PANAVISE PRODUCTS, INC., 1485 Southern Way, Sparks, NV 89431, Tel: 702-353-2900, FAX: 702-353-2929; Empl.: 35; *Sls. Mgr.:* Mark Thorsell; *Dist. Mgr.:* Mark Thorsell

PANDUIT CORP., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, Tel: 800-777-3300, FAX: 708-532-1811; FSC No.: ;06383; Empl.: 2000 .... **C•1480-1482, 1800-1802**

Local Sales Offices & Reps

AL Birmingham, Frank Parker & Assocs. 205-655-4801
AL Mobile, Frank Parker & Assocs. 205-675-7213
AK Anchorage, Bar Elec. Agt. 907-562-0011
AZ Phoenix, Maddox Sls. 602-437-1002
AR Little Rock, Byron Carson Co. 501-663-6870
CA Los Altos, Ewing-Foley, Inc. 415-941-4525
CA Los Angeles, Maddox Sls. 213-949-7400
CA Sacramento, Ewing-Foley, Inc. 916-885-6591
CO Denver, Panduit Corp. 800-777-3300
CT Glastonbury, Panduit Corp. 203-657-4105
DC Washington, Agency Group, Inc. 301-858-1600
FL Ft. Lauderdale, Panduit Corp. 800-282-9209
FL Orlando, Panduit Corp. 800-282-9209
GA Atlanta, Panduit Corp. 404-256-5940
HI Honolulu, PEFCO, Inc. 808-832-0000
IL Burr Ridge, Panduit Corp. 708-887-1000
IN Indianapolis, Panduit Corp. 800-777-3300
KS Kansas City, Panduit Corp. 800-777-3300
KY Louisville, A. L. Pickens Co. 502-491-4215
LA Baton Rouge, Wells-Keown & Assocs. 504-292-6578
LA New Orleans, Wells- Keown & Assocs. 504-733-0301
LA Shreveport, Wells-Keown & Assocs. .. 318-688-6040
MD Baltimore, Agency Group, Inc. 301-793-0023
MA N. Andover, Panduit Corp. 508-681-0451
MI Fraser, Panduit Corp. 313-791-1700
MI Grand Rapids, Panduit Corp. 800-777-3300
MN Minneapolis, Electric Comp. Sls. 612-933-2594
MO St. Louis, Panduit Corp. 314-894-7800
NE Omaha, Panduit Corp. 402-391-0452
NV Las Vegas, Maddox Sls. 702-870-1151
NJ Leonia, Panduit Corp. 201-461-7790
NM Albuquerque, F P Sls. 505-345-5553
NY Buffalo, Panduit Corp. 800-777-3300
NY Rochester, Panduit Corp. 800-777-3300
NY Schenectady, Panduit Corp. 800-777-3300
NY Syracuse, Panduit Corp. 800-777-3300
NC Raleigh, L. G. White Southern 919-872-6049
NC Winston-Salem, L. G. White Southern 919-725-3612
OH Cincinnati, Panduit Corp. 800-777-3300
OH Cleveland, Panduit Corp. 800-777-3300
OH Columbus, Panduit Corp. 614-888-6224
OK Oklahoma City, Elctrl. Prods. of Okla. 405-842-8371
OR Portland, Panduit Corp. 503-654-9455
PA Philadelphia, Kunz, Powell & Assoc. .. 215-296-9490
PA Pittsburgh, Cody Assocs., Inc. 412-787-5336
SC Greenville, L. G. White Southern 803-271-0630
TN Memphis, Byron Carson Co. 901-276-0614
TN Nashville, Panduit Corp. 800-777-3300
TX Dallas, Panduit Corp. 214-518-0004
TX Houston, Panduit Corp. 713-686-5600
UT Salt Lake City, Ray Walker Co. 801-973-7454
VA Richmond, L. G. White Southern 804-752-7055
WA Seattle, Panduit Corp. 800-777-3300
WA Spokane, Lighting, Inc. 509-467-6650
WI Appleton, H. Mercer Co. 414-739-6223
WI Milwaukee, Panduit Corp. 800-777-3300
PR Santurce, L. Gandia & Assocs. 809-725-3473
Can Markham, Ont., Panduit Canada Ltd. .. 416-475-6922

PANEL COMPONENTS CORPORATION

FAX: 707-578-5478

PANEL COMPONENTS CORP., P.O. Box 6626M, Santa Rosa, CA 95406, Tel: 707-523-0600; Empl.: 25 ..... **A•2316; B•1382-1383; C•1484-1492, 1804-1809; D•2222**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg. Inc. 205-722-0440
CA Santa Clara, Ross Mktg. Assoc. 408-988-8111
CA Tustin, Schoenbachler-Dobson Co. ... 714-544-1888
CO Englewood, Omega Ltd. 303-762-1921
GA Duluth, DHR Mktg., Inc. 404-564-0529
IL Northbrook, Raines & Assocs. 708-498-0890
IA Marion, M-S-B Assocs., Inc. 319-377-6261
KS Roeland Park, M-S-B Assocs., Inc. 913-432-2131
MA Scituate, Olsen Tech. Sls. 617-545-5101
MN St. Paul, Arkco Sls. 612-777-7454
MO St. Louis, M-S-B Assocs., Inc. 314-946-5577
NJ Kenvil, CFE/Gray 201-927-6662
NY Victor, Net Sls. 716-924-1844
NC Raleigh, DHR Mktg., Inc. 919-829-1970
OH Medina, Rockford Controls 216-725-3705
OR McMinnville, Electro-Design 503-472-0481
PA Philadelphia, Eastern Sci. Mktg. 215-368-4570
SC Greenville, DHR Mktg. Inc. 803-235-3594
TX Lewisville, Jim Hughes Co. 214-221-1536
WA Redmond, Electro-Design 206-867-9300
EXP Burnaby, B.C., Darmac Agencies, Ltd. 604-520-7121
Can Ottawa, Ont., Ellam & Assoc. 613-727-3892

PANELTEC, 3307 Edward Ave., Santa Clara, CA 95054, Tel: 408-496-1175, FAX: 408-970-1277; Empl.: 65

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(213) 452-8002
1220 Olympic Bl Santa Monica, CA 90404

Pan-International (U.S.A.) Inc.

FAX: 714-989-9935

PAN INTERNATIONAL (USA), INC., 9477 E. Archibald Ave., Rancho Cucamonga, CA 91730, Tel: 714-945-1365; Empl.: 21; *Sls. Mgr.:* Barry Park; *Dist. Mgr.:* Barry Park, Natl. Sls. Mgr. ..... **C•1810-1812; D•1107**

Local Sales Offices & Reps

CA	San Jose, Enhance Sls.	408-293-2425
CO	Littleton, Taylor Mktg.	303-850-0207
NH	Londonderry, RJR Assoc.	603-437-6343
TX	Garland, Hamilton & Savarese	214-271-4003
UT	Ogden, Taylor Mktg.	801-546-9570

Local Distributors

CA	San Jose, Enhance Sls.	408-293-2425
NH	Londonderry, RJR Assoc.	603-437-6343

PAN-MAGNETICS, See Tamura Corp. of America

PAPST

FAX: 401-849-4640

PAPST MECHATRONIC CORP., Aquidneck Indl. Pk., Newport, RI 02840, Tel: 401-849-8810; Empl.: 30 ..... **C•1654-1659**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Phoenix, Jr. Engrg. Sls., Inc.	602-956-4670
CA	Foster City, Papst Mechatronic Corp.	415-571-9591
CA	Los Gatos, Luscombe Engrg. Co of San Francisco	408-370-2020
CA	Montrose, Luscombe Engrg. Co. of So. Calif.	818-249-9000
CA	San Diego, Luscombe Engrg. Co. of So. Calif.	619-549-9699
CO	Englewood, Quorum 3	303-799-8100
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Altamonte Springs, Over & Over, Inc.	407-332-1222
GA	Norcross, Over & Pver, Inc.	404-449-6205
IL	Arlington Heights, Brainard-Wilson Mktg; Inc.	708-437-2700
IL	Arlington Heights, Papst Mechatronic Corp.	708-981-1404,FAX:708-981-1642
IL	Arlington Hgts., Brainard-Wilson Mktg.	708-437-2700
IN	Indianapolis, Elctrn. Mktg. Consits.	317-921-3450
IA	Marion, MSB Assocs. Inc.	319-377-6261
KS	Shawnee Mission, MSB Assocs., Inc.	913-432-2131
MA	Needham, Sturgeon Tech. Sls.	617-444-6603
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NJ	Englewood, Harold Gray Assocs., Inc.	201-894-0894
NY	Johnson City, Tech-Mark, Inc.	607-729-6340
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Utica, Tech-Mark, Inc.	315-733-0575
NC	Charlotte, Over & Over, Inc.	704-542-9111
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Venture Elctrns.	503-624-0617
PA	Knoxville, Trinkle Sls., Inc.	215-922-2080
RI	Newport, Papst Mechatronic Corp.	401-849-8810
TX	Dallas, JYSCO/Comps., Inc. (except El Paso)	214-349-1650
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Pickering, Ont., A.C. Simmonds & Sons, Ltd.	416-839-8041

PARAGON ELECTRIC CO., INC., 606 Parkway Blvd., Two Rivers, WI 54241, Tel: 414-793-1161, TELEX: 26-3450, FAX: 414-793-3736; Empl.: 500; *Sls. Mgr.:* Don Karman

PARALINE

FAX: 818-281-5867

PARA-LINE TRANSFORMER CO., INC., 511 South Palm Ave., Alhambra, CA 91803, Tel: 818-281-0222; FSC No.: 59465 ..... **A•2317**

PARKER HANNIFIN CORP., 17325 Euclid Ave., Cleveland, OH 44112-1290, Tel: 800-272-7537, 800-C-PARKER, TELEX: 980636; Empl.: 33,225

PARKER HANNIFIN CORP., Compumotor Div., 5500 Business Park Dr., Rohnert Pk., CA 94928, Tel: 707-584-7558, FAX: 707-584-8015

PARKER HANNIFIN CORP., Daedal Div., P.O. Box 500, Sandy Hill Road, Harrison City, PA 15636, Tel: 412-744-4451, FAX: 412-744-7626

PARKER HANNIFIN CORP., Filter Division, 16810 Fulton County Rd. No.2, Metamora, OH 43540, Tel: 419-644-4311, FAX: 419-644-6205

PARKER HANNIFIN CORP., Fluidpower Pump Division, 100 Parker Drive, Ostego, MI 49078-1495, Tel: 616-694-9411, FAX: 616-694-4638

PARKER HANNIFIN CORP., Hose Products Division, 30240 Lakeland Blvd., Wickliffe, OH 44092, Tel: 216-943-5700, FAX: 216-943-7088

PARKER HANNIFIN CORP., Hydraulic Valve Division, 520 Ternes Ave., Elyria, OH 44035, Tel: 216-366-5100, FAX: 216-366-5253

PARKER HANNIFIN CORP., Instrumentation Connectors Div., 9400 S. Memorial Pkwy., Huntsville, AL 35802, Tel: 205-881-2040, FAX: 205-881-5730

PARKER HANNIFIN CORP. PARFLEX DIVISION, 1300 N. Freedom Street, Ravenna, OH 44266, Tel: 216-296-2871, FAX: 216-296-8433

PARKER HANNIFIN CORP. PNEUMATIC DIV., 8676 E M-89, Richland, MI 49083, Tel: 616-694-9411, FAX: 616-629-5385

PARKER HANNIFIN CORP., Refrigerating Specialties Division, 2445 South 25th Ave., Broadview, IL 60153, Tel: 708-681-6300, FAX: 708-681-6300 Ext.315

PARKER HANNIFIN CORP., Rotary Actuator Division, 135 Quadral Drive, Wadsworth, OH 44281-0450, Tel: 216-336-3511, FAX: 216-334-3335

PARKER HANNIFIN CORP., Schrader Bellows Division, 200 W. Exchange Street, Akron, OH 44309-0631, Tel: 216-375-5202, FAX: 1-800-446-7451

PARKER HANNIFIN CORP., Seal Group, 18321 Jamboree Rd., P.O. Box C-19510, Irvine, CA 92713, Tel: 714-851-3763, FAX: 714-851-2127

PARKER HANNIFIN CORP., Tube Fittings, 3885 Gateway Blvd., Columbus, OH 43228, Tel: 614-279-7070, FAX: 614-279-7685

PARKER MCCRORY MFG. CO., 2000 Forest Ave., Kansas City, MO 64108, Tel: 816-221-2000, FAX: 816-221-9879; *Sls. Mgr.:* Ken Turner; *Dist. Mgr.:* Ken Turner

PARKER SEAL GROUP, 18321 Jamboree Road, Irvine, California 92715, Tel: 714-851-3763, FAX: 714-851-2127; Empl.: 2,200; *Sls. Mgr.:* Joe Vicic; *Dist. Mgr.:* John Dick

Local Sales Offices & Reps

CA	Arcadia, Van Gott & Assocs.	818-445-9728
TX	Dallas, Glitsh Special Prods.	214-631-0120

Local Distributors

AL	Birmingham, Alabama Seal & Packing	205-879-7225
AZ	Phoenix, State Seal Co.	602-437-1532
CA	Garden Grove, Cal-State Seal & Fluid Comps., Inc.	714-554-9080
CA	La Mirada, Ad-Tech Seal, Inc.	213-921-6608
CA	San Leandro, Nor-Cal Seal Co.	415-568-7371
CA	Woodland Hills, Valley Seal Co.	213-873-3630
CO	Englewood, Aspen Seal & Packing	303-761-9049
CT	Newington, Niantic Rubber Co.	203-666-5661
GA	Atlanta, United Seal & Rubber	404-729-8880
GA	Hapeville, Go-Air, Inc.	404-768-1121
IN	Indianapolis, Seal Prods., Inc.	317-633-7277
MA	Northborough, Hope Co.	508-393-7660
MA	Woburn, Seal Distrbn. Ctr.	617-491-0100
MI	Farmington Hills, Roger Zatkoff Co., Inc.	313-478-2400
MI	Grand Rapids, Roger Zatkoff Co., Inc.	616-698-6880
MI	Kalamazoo, Depatie Fluid Power Co.	616-381-4590
NY	Rochester, Web Seal, Inc.	716-546-1320
NC	Raleigh, Smith Seal of North Carolina	919-790-1000
OH	Holland, Roger Zatkoff Co.	419-866-1600
OR	Portland, Air-Oil Prods.	503-234-0866
PA	Allentown, Staver Hydraulics Co., Inc.	215-837-1818
PA	Exton, Staver Hydraulics Co., Inc.	215-594-0540
PA	Newton, D.B.R. Inds.	215-968-6100
RI	Cranston, Niantic Rubber Co.	401-942-0900
TX	Arlington, Texas Seal Supp. Co.	817-640-1193
TX	Houston, Parker Seal Distrbn. Ctr.	713-649-7592
Can	Mississauga, D & D Packing & Seals	416-625-2033
Can	Mississauga, Sealtech Supply, Inc.	416-238-5885
Can	Port Credit, Seals Unlimited, Inc.	416-278-1326
Can	Ville St. Laurent, Les Joints & Garnitures D & D	514-745-4044
Can	Ville St. Laurent, Les Joints Entanches R.B	514-334-2220



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PAR METAL PRODUCTS, INC., Par Industrial Complex, 1246 Atlantic Ave., Brooklyn, NY 11216, Tel: 718-774-5900, TELEX: 424 823 SNDS UI ATTN:PAR; FSC No.: 3449;3469; Empl.: 100; *Sls. Mgr.:* J. Troiano ..... **C•1077**

PARSONS MANUFACTURING, 1055 O'Brien Dr., Menlo Park, CA 94025-1476, Tel: 415-324-4726, FAX: 415-324-3051; Empl.: 45; *Sls. Mgr.:* S. Wurzer

PARSYTEC INC., Bldg. 9, Unit60, 245 W. Roosevelt Rd., West Chicago, IL 60185, Tel: 708-293-9500, FAX: 708-293-9525; Empl.: 8; *Sls. Mgr.:* Reinhard Rinn

PARVEX SERVO SYSTEMS, GEC Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977, Tel: 914-425-6908, FAX: 914-425-6314

PASO SOUND PRODUCTS, 14 First St, Pelham, NY 10803, Tel: 914-738-4800, FAX: 914-738-3954; Empl.: 18; *Sls. Mgr.:* Ken O'Brien

PASS & SEYMOUR/LEGRAND, Pass & Seymour/Inc., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211, TELEX: 93-7232, FAX: 315-468-6305; Empl.: 1700; *Sls. Mgr.:* Sergio Palluci, Sls. Mgr./Kristin Northrop, Prod. Mgr.

PASTERNACK ENTERPRISES, P.O. Box 16759, Irvine, CA 92713, Tel: 714-261-1920, FAX: 714-261-7451; FSC No.: 53919; *Sls. Mgr.:* Elayne Wilson

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000, FAX: 401-941-5290; FSC No.: 77147; Empl.: 45; *Sls. Mgr.:* F. Spunzo

PAVE TECHNOLOGY CO., INC., 2751 Thunderhawk Ct., Dayton, OH 45414-3445, Tel: 513-890-1100, FAX: 513-890-5165

PAYNE ENGINEERING, Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, TELEX: 88-5452, FAX: 304-757-7305; Empl.: 40; *Sls. Mgr.:* R. B. Vogelbach

PCA ELECTRONICS, 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-892-0761, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 97722; Empl.: 45; *Sls. Mgr.:* Nand Aggarwal ..... **A•1589-1594, 2318-2322**

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	Irvine, Ramsey & Assocs.	714-851-2340
CA	San Diego, Ramsey & Assocs.	619-451-8865
CA	San Jose, Arnold Techn. Sls.	408-954-0400
FL	Ft. Lauderdale, Sunland Assoc.	305-561-1303

FL Goldenrod, Sunland Assocs. 305-365-9533
IL Westchester, Emtronics, Inc. 312-345-6500
IL Wheaton, Emtronics, Inc. 708-665-6222
IN Carmel, Emtronics, Inc. 317-848-2016
MA Sudbury, KSA of New England 508-443-5881
MN Bloomington, Bill Deming and Assocs. 612-888-5000
MS Meridan, Southeast Tech. Grp. 601-485-7055
AL Huntsville, Southeast Tech. Grp. 205-534-2376
GA Lawrenceville, Southeast Tech. Grp. .. 404-979-2055
NC Zebulon, Southeast Tech. Grp. 919-269-5589
OH Beavercreek, Electro-Com 513-299-0864
OH Dayton, Electro-Com 513-898-5140
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
PA Exton, Linear Sls. 215-524-8080
TX Dallas, Blackburn Assocs. 214-750-8484
UT Salt Lake City, Sage Sls. 801-467-5451
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

Local Distributors

CA Buena Pk, Cypress Elctrns. Inc. 714-521-5230
CA San Diego, Cypress Elctrns. Inc. 619-535-0011
CA San Jose, Cypress Elctrns. 408-980-2500
CA Santa Clara, Cypress Elctrns. Inc. 408-980-8400
CA Sherman Oaks, DLDI-Delay Lines Distrs. 818-986-9455
CO Englewood, Cypress Elctrns. 303-792-5829
CO Wheatridge, Cypress Elctrns. Inc. 303-431-2622
MA Sudbury, ASK Elctrns. 508-443-5880
NJ Rockaway, NASCO Elctrns. 201-625-7777
OR Beaverton, Cypress Elctrns. 503-641-2233
OR Portland, Cypress Elctrns. 503-223-8900
PA Exton, VSH Elctrns. 215-363-2250
WA Bothwell, Cypress Elctrns. 206-483-1140

P.C. BOARDS, INC., 210 West Main, Chanute, KS 66720, Tel: 316-431-0406, FAX: 316-431-2013; Empl.: 43; *Sls. Mgr.:* Greg Bilyeu

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371, FAX: 716-684-0987; Empl.: 210; *Sls. Mgr.:* John Lally

PCD, 2 Technology Dr., Peabody, MA 01960, Tel: 508-532-8800, FAX: 508-532-6800; FSC No.: 58982; *Sls. Mgr.:* A. Arcisz

P C EXPRESS, INC., 15103 U.S. Hwy. 19, Hudson, FL 34667, Tel: 813-863-6114; Empl.: 15

PCI, INC., 1530 Parkmoor Ave.-Ste. A, San Jose, CA 95128, Tel: 408-282-0200, FAX: 408-282-0216; Empl.: 2500; *Sls. Mgr.:* Mike Clarke; *Dist. Mgr.:* Jane Campbell

PCK ELASTOMERICS, INC., See Elastomeric Technologies, Inc.

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300, FAX: 516-491-3689; FSC No.: 62281; Empl.: 15; *Sls. Mgr.:* Stanley L. Goldstein ..... **A•2324-2331**

PDS TECHNOLOGIES, See Power-Pac

PEARL TECHNOLOGY, 1000 E. William St.-Ste. 100, Carson City, NV 89701, Tel: 702-883-1979, FAX: 702-883-4874

PEARSON ELECTRONICS, INC., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, TELEX: 171-412, FAX: 415-494-6716; FSC No.: 05280; Empl.: 23; *Sls. Mgr.:* Michelle Kelsey ..... **A•2332**

PECA, INC., 592 Winks Lane, Bensalem, PA 19020, Tel: 215-245-1550, FAX: 215-639-3545; Empl.: 30; *Sls. Mgr.:* Jean Douglass

THE PEDRO COMPANIES, 104 E. 10th St., St. Paul, MN 55101, Tel: 612-224-9491, FAX: 612-224-8674; Empl.: 100ò; *Sls. Mgr.:* Douglas Bieniek

PEERLESS, 19 Wilbur St., Lynbrook, NY 11563, Tel: 516-593-2121, 1-800-645-2268

PEER PROTOCOLS, 3176 Pullman, Ste. 101, Costa Mesa, CA 92626, Tel: 714-662-1929, FAX: 714-662-1437; Empl.: 10; *Sls. Mgr.:* Don Bergis

PENBERTHY, INC., De Vlieg-Bullard, P.O. Box 112, Locust St., Prophetstown, IL 61277, Tel: 815-537-2311, TWX: 257-339 PMCO PRWN, FAX: 815-537-5764; Empl.: 160; *Sls. Mgr.:* Craig Hagel

PENFIELD, INC., 8 West St., Plantsville, CT 06479, Tel: 203-621-9141, TWX: 5101003285, ESYLNK: 6287757, FAX: 203-621-2380; Empl.: 77; *Sls. Mgr.:* Gary Zoccolante; *Dist. Mgr.:* Gary Zoccolante

PENN ENGINEERING & MANUFACTURING CORP., 5190 Old Easton Rd. PO Box 1000, Danboro, PA 18916, Tel: 215-766-8853, 800-237-4736, FAX: 215-766-0143; FSC No.: CAGE 46384; Empl.: 850; *Sls. Mgr.:* John E. O'Brien

PENN KEYSTONE CORP., 30 N. Plains Ind. Ste.13, Wallingford, CT 06492, Tel: 203-294-0537, FAX: 203-294-0361; FSC No.: 03034; *Sls. Mgr.:* Robert Ginter

PENN-TRAN CORP.,SUB. OF SPECTRUM ELCTRNS. INC., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, FAX: 814-355-1524; FSC No.: 50783; Empl.: 80; *Sls. Mgr.:* Jeffrey Krauss ..... **D•1918**

Local Sales Offices & Reps

CA Los Altos, Cain-White & Co. 415-948-6533
CA Pasadena, A-F Sls. Engrg., Inc. 213-681-5631
MN Minneapolis, International Sls. Co. 612-831-8423
OR Portland, Intertech Sls. 503-775-7885
PA Glenside, Koebert Assocs., Inc. 215-887-2310
TX Dallas, Seaton Corp. 214-980-9860

PENNY & GILES, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401, Tel: 213-393-1497, TELEX: 65-2337; *Dist. Mgr.:* Rose Riedel Prod. Mgr.

Penny+Giles

FAX: 404-740-0420

PENNY & GILES DATA SYSTEMS, INC., 1250 Northmeadow Pkwy., Ste. 114, Roswell, GA 30076, Tel: 404-740-0415, FAX: 404-740-0420 ..... **D•1310**

Local Sales Offices & Reps

AZ Tempe, Scientific Dvcs.-West 602-730-9774
GA Atlanta, Magard & Assocs. 404-451-8862
CA Huntington Bch., Scientific Dvcs.-West 714-840-3501
CA San Jose, P & M Elctrns. 408-287-0402
CO Denver, Scientific Dvcs.-West 303-469-5145
IL Chicago, Sector Eng. 312-530-7850
IN Indianapolis, Sector Eng. 317-253-9221
MD Annapolis, Blackwood Associates 301-269-1676
MA Andover, Saret Assocs. 508-475-9332
MN Minneapolis, Sector Eng. 612-378-2123
NM Albuquerque, Scientific Dvcs.-West ... 505-883-3668
NC Raleigh, Lee Assoc./Carolinas 919-848-8818
OH Columbus, Robert Cloon Assocs. 614-459-2890
PA Philadelphia, G.L. Williams Assocs. 609-428-6060
TX Dallas, Scientific Dvcs.-Southwest 214-231-8106
WA Seattle, Scientific Dvcs.-West 206-637-0945
WI Milwaukee, Sector Eng. 414-352-8280
Can Ontario, Giga-Tron Assocs. Ltd. 613-225-4090

PENRIL DATACOMM NETWORKS, 1300 Quince Orchard Blvd., Gaithersburg, MD 20878, Tel: 301-921-8600, TWX: 710-828-0522; Empl.: 200

PENSTOCK ENGINEERING LABS., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, Tel: 408-730-0300, 800-PENSTOCK, FAX: 408-730-4782; Empl.: 46; *Sls. Mgr.:* Steve Ulett; *Dist. Mgr.:* Steven Ulett

Local Sales Offices & Reps

CA Sunnyvale, Penstock, Inc. 800-PENSTOCK

Local Distributors

AZ Phoenix, Penstock Desert Sls. 800-PENSTOCK
CA Anaheim, Penstock, Inc. 800-PENSTOCK
CA Beverly Hills, Penstock, Inc. 800-PENSTOCK
CA San Diego, Penstock, Inc. 800-PENSTOCK
CA Sunnyvale, Penstock Intl. 800-PENSTOCK
CA Sunnyvale, Penstock, Inc. 800-PENSTOCK
CO Denver, Penstock, Inc. 800-PENSTOCK
IL Palatine, Penstock Midwest 800-PENSTOCK
IN Indianapolis, Penstock, Inc. 800-PENSTOCK
NJ Fairfield, Penstock East 800-PENSTOCK
NJ Teterboro, Penstock East 800-PENSTOCK
OR Portland, Penstock Northwest 800-PENSTOCK
UT Salt Lake City, Penstock, Inc. 800-PENSTOCK
WA Bellevue, Penstock Northwest 800-PENSTOCK
EXP CA/Sunnyvale, Penstock Intl. 800-PENSTOCK
Can Vancouver, BC, Penstock Canada 604-662-3475

PERCEPTICS CORP., 725 Pellissippi Parkway, Knoxville, TN 37922, Tel: 615-966-9200, FAX: 615-966-9330; Empl.: 90; *Sls. Mgr.:* J.R. Johnson; *Dist. Mgr.:* J.R. Johnson

PENTICA SYSTEMS, INC., One Kendall Sq., Bldg. 200, 4th Floor, Cambridge, MA 02139, Tel: 617-577-1101, FAX: 617-494-9162; Empl.: 4

PERCON, INC., 1710 Willow Creek Circle, Ste. 37, Eugene, OR 97402-9153, Tel: 1-800-8-PERCON, 503-344-1189, FAX: 503-344-1399; Empl.: 26; *Sls. Mgr.:* Nonie Mansfield, Sls.; *Dist. Mgr.:* Dean VanPeursem, V.P. Mktg/Sls.

PERFECT GEAR & INSTRUMENT, Designatronics, Inc., 2101 Jericho Tpk., New Hyde Park, NY 11040, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 210; *Sls. Mgr.:* Murray Ores

PERFECTION MICA CO., See Magnetic Shield Corp.

PERFORMANCE CONTROLS, INC., 433 Caredean Drive, Horsham, PA 19044, Tel: 215-675-6500, TELEX: 88-1478, FAX: 215-674-8714; FSC No.: 61773; Empl.: 40

PERIPHERALS, 1363 Logan Ave., Costa Mesa, CA 92626, Tel: 714-540-4925, 800-468-6888, FAX: 714-540-2026; Empl.: 20; *Sls. Mgr.:* Elizabeth O'Rouke

PERKIN-ELMER CORP., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, Tel: 203-762-4786, TWX: 710-468-3213; Empl.: 70; *Sls. Mgr.:* D. P. Duggan

PERMALUSTER, INC., 1844 N. Keystone St., Burbank, CA 91504, Tel: 213-849-4543, 213-849-6454, FAX: 818-566-4232; Empl.: 6; *Sls. Mgr.:* J. Ross

PERMA POWER ELCTRNS., 5601 W. Howard Ave., Chicago, IL 60648, Tel: 312-763-0763, FAX: 312-763-8330; Empl.: 80/100; *Sls. Mgr.:* Michael Shatz; *Dist. Mgr.:* Michael Shatz

Local Distributors

CA Los Angeles, Marshall Ind. 800-522-0084
IL Chicago, Newark Elctrns. 800-367-3573
TX Ft. Worth, Allied Elctrns. 800-433-5700

PERRY AMPLIFIER, 138 Fuller St., Brookline, MA 02146, Tel: 617-734-0844; Empl.: 18; *Sls. Mgr.:* N. Geskos

PERX,INC., 525 Tamal Plaza, Corte Madera, CA 94925, Tel: 415-927-0155, FAX: 415-927-0159; Empl.: 5

PETER PARTS & ASSOCS., 82 E. Main St., Webster, NY 14580, Tel: 716-265-2540, FAX: 716-265-2542; *Sls. Mgr.:* Peter Parts

PFC, See Southern Elctrns. Co. Inc.

P.G. ELECTRONICS LTD., 800 Arrow Rd., 8, Weston, Ont., Canada M9M2Z8, Tel: 416-741-7682, FAX: 416-741-9927; FSC No.: 38243

PHASE CONTROL ELECTRONICS, 87-27 Myrtle Ave., Glendale, NY 11385, Tel: 718-441-4278; Empl.: 16; *Sls. Mgr.:* Jack Stanley

PHELPS DODGE MAGNET WIRE, P.O. Box 600, Ft. Wayne, IN 46801, Tel: 219-458-4444, 800-255-CLIC (2542), TWX: 810-332-1506, FAX: 219-422-1667; *Sls. Mgr.:* G. H. Guyer

PHENIX TECHNOLOGIES, Central Garrett Ind'l. Pk., Accident, MD 21520, Tel: 301-746-8118, FAX: 301-895-5570; Empl.: 35; *Sls. Mgr.:* Bill Robeson

PHILADELPHIA INSULATED WIRE CO. INC., 333 New Albany Rd., Moorestown, NJ 08057, Tel: 800-257-8357, 609-235-6700, FAX: 609-235-5480; Empl.: 150; *Sls. Mgr.:* Glenn McCleery

PHILIPS AUDIO VIDEO SYS. CORP., See AKG Acoustics

PHILIPS CIRCUIT ASSEMBLIES:A DIVISION OF NORTH AMERICAN PHILIPS CORP., 2601 S. Moorland Rd., New Berlin, WI 53151, Tel: 414-785-6506, TWX: 910-262-3032, FAX: 414-785-6516

PHILIPS CIRCUIT ASSEMBLIES, 3602 W. Waters Avenue, Tampa, FL 33614-2797, Tel: 813-933-5113, TELEX: 3727509, FAX: 813-932-1373; *Sls. Mgr.:* C. Maslona

PHILIPS CIRCUIT ASSEMBLIES:NORTH AMERICAN PHILIPS CORP., 100 Providence Pike, Slatersville, RI 02876-2078, Tel: 401-762-3800, FAX: 401-762-2324

Philips Components
Discrete Products Division
A North American Philips Company

FAX: 407-881-3300

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, A North American Philips Company, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404, Tel: 407-881-3200, TELEX: 136461, TWX: 810-848-0228; *Dist. Mgr.:* Jess Hall ..... **A•1124-1128, 1286-1287, 1289-1292, 1972-1974, 2100-2116; B•1026-1027, 1112-1113, 1336-1338, 1856-1857**

Local Sales Offices & Reps

AL	Huntsville, Over & Over Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Anaheim, Philips Comps.	714-441-0385
CA	Folsom, Webster Assocs.	916-989-0843
CA	Harbor City, Refrigeration Comp.	213-325-3420
CA	Mission Hills, Philips Comps.	818-891-6299
CA	San Diego, Philips Comps.	619-453-0332
CA	Santa Clara, Philips Comps.	408-748-1563
CA	Sunnyvale, Philips Comps.	408-746-2066/2808
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Philips Comps.	407-339-5073
FL	Ft. Lauderdale, Philips Comps.	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Bannockburn, GMR Sls., Inc.	312-295-8440
IL	Rolling Meadows, Philips Comps.	708-670-9494
IN	Fort Wayne, Corrao Marsh, Inc.	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IN	Kokomo, Philips Comps.	317-456-1615
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Merriam, Lorenz Sls., Inc.	913-384-6556
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6000
MN	Minneapolis, Electric Comp. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Englewood Cliffs, ED Glass Assocs.	201-592-0200
NJ	Parsippany, Philips Comps.	201-455-1507
NY	Binghamton, Empire Tech. Assoc., Inc.	607-772-0651
NY	East Rochester, Empire Tech. Assoc., Inc.	716-381-8500
NY	Port Ewen, Empire Tech. Assoc., Inc.	914-331-5553
NY	Skaneateles, Empire Tech. Assoc., Inc.	315-685-5703
NC	Charlotte, Over & Over, Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
NC	Raleigh, Philips Comps.	919-782-3334
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Willow Grove, Philips Comps.	215-659-6069
TX	Austin, Philips Comps.	512-331-8828
TX	Houston, Philips Comps.	713-987-0034
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	Milwaukee, Philips Comps.	414-228-7632
PR	Caparra Hgts., M. Anderson Co. Inc.	809-793-6544
Can	Scarborough, Ont., Philips Comps.	416-292-5161

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 5083 Kings Hwy., Saugerties, NY 12477, Tel: 914-246-2811, TWX: 510-247-5410, FAX: 914-246-2811(Ext 427); FSC No.: 02114; *Sls. Mgr.:* B. Grindle ..... **A•1286-1292**

Local Distributors

CA	Canoga Park, Philips Comps. Magnetic Prods.Svc.Ctrs.	1-800-343-1370
IL	Rolling Meadows, Philips Comps. Magnetic Prods. Svc. Ctrs	1-800-241-7667
MA	Norwood, Philips Comps. Magnetic Prods.Svc.Ctrs.	1-800-367-8083
NY	Woodstock, Elna Ferrite	914-246-5861
PA	West Conshohocken, Eastern Comps.	215-825-8610

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 5900 Australian Avenue, W. Palm Bch., FL 33407, Tel: 407-863-1800, TELEX: 820677, FAX: 407-863-1811 ..... **A•1124**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 6071 St. Andrews Rd., Columbia, SC 29212-3198, Tel: 803-772-2500, TELEX: 805024, FAX: 803-772-2445; *Sls. Mgr.:* Bill Cvirko ..... **A•1125-1126**

DC Aluminum Electrolytic Capacitors(Computer Grade, Radial)Indl. & Consumer AC Motor Starts, Film Capacitors (Film/Foil, Metallized) Tantalum Capacitors (Foil) Film Trimmer Capacitors

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV, A North American Company, 6-D Founders, El Paso, TX 79906, Tel: 915-775-4200, FAX: 915-775-4249 ..... **A•1128**

See Philips Components, Riviera Beach

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, FAX: GPR 817-325-1052 SPR 817-325-8397; *Sls. Mgr.:* Tom McKelvy ... **A•1972-1973**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A NORTH AMERICAN PHILIPS CO., Professional Components Grp, 100 Providence Pike, Slatersville, RI 02876, Tel: 401-762-3800, FAX: 401-762-4497(mktg); FSC No.: 73445 ..... **B•1112-1113**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A NORTH AMERICAN PHILIPS CO., Discrete Semiconductor Group, 100 Providence Pike, Slatersville, RI 02876-2078, Tel: 401-762-3800, FAX: 401-767-4497 ..... **A•2100-2109, 2111-2116; B•1112-1113, 1336-1338**

PhilipsECG
A North American Philips Company

FAX: 717-323-4691

PHILIPS ECG, North American Philips Co., 1025 Westminster Dr., Williamsport, PA 17701, Tel: 717-323-4691; *Sls. Mgr.:* L.R. Brophy, Gen. Mgr. Mktg.; *Dist. Mgr.:* E. H. Frost ..... **A•2118-2119**

Local Sales Offices & Reps

CA	Anaheim, Philips ECG	714-441-0385
CA	Santa Clara, Philips ECG	408-727-6132
FL	Maitland, Hutto Hawkins Assoc.	407-831-2474
FL	Tampa, Hutto Hawkins Assoc.	813-251-2970
GA	Atlanta, Millar Elctrns.	404-634-3350
MA	Woburn, Philips ECG	617-932-4748
MI	Farmington Hills, R.C. Merchant & Co.	313-476-4600
MO	Kansas City, Philips ECG	816-741-4019
NY	Seneca Falls, Philips ECG	315-568-5432
NC	Raleigh, Millar Elec., Inc.	919-828-8840
OH	Dayton, Philips ECG	513-436-0066
PA	Willow Grove, Philips ECG	215-659-6096
TX	Richardson, Philips ECG	214-231-8274
Can	Dorval, Que., ECG Canada Inc.	514-685-5800

For distributor information, call 1-800-225-8326. (In Massachusetts, call 1-890-6107.)

Local Distributors

MA	For Distributor information,call	800-526-9354

PHILMORE MANUFACTURING, 2240 15th St. P.O. Box 6386, Rockford, IL 61125-1386, Tel: 815-229-7773, FAX: 815-229-7785; Empl.: 18

PHI TECHNOLOGIES, INC., 4605 North Stiles, Oklahoma City, OK 73105, Tel: 405-521-9000, TWX: 910-831-3286, FAX: 405-524-4254; Empl.: 40; *Sls. Mgr.:* Robert P. Gelemter ..... **D•1048-1049**

Local Sales Offices & Reps

CA	North Hollywood, Martin & Assocs.	213-872-1990
DC	Gans & Pugh Assoc.	703-527-3262
MA	Wenham, Ellis Assoc.	508-468-4990

PHOENIX CONTACT INC., P.O. Box 4100, Harrisburg, PA 17111, Tel: 717-944-1300, FAX: 717-944-1625; *Sls. Mgr.:* Howard C. Minnick, Jr.; *Dist. Mgr.:* Mark F. Gilliford

PHOENIX DATA, INC., 3384 W. Osborn Rd., Phoenix, AZ 85017, Tel: 602-278-8528, 800-828-4327, FAX: 602-278-8679; Empl.: 55; *Sls. Mgr.:* David Norgord

PHOENIX MICROSYSTEMS, 991 Discovery Dr., Huntsville, AL 35806, Tel: 205-922-1200, TELEX: 752592, FAX: 205-837-1256; Empl.: 180

PHOENIX WIRE, INC., 100 Teflon Ave., S. Hero, VT 05486, Tel: 802-372-4561; Empl.: 25; *Sls. Mgr.:* Ohmer Corbin; *Dist. Mgr.:* Ohmer Corbin ..... **C•1813**

PHONON CORPORATION, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070, Tel: 203-651-0211, TELEX: 294705, FAX: 203-651-8618; FSC No.: 6Y858; Empl.: 24

PHOTON, INC., 1115 Space Park Dr., Santa Clara, CA 95054-3432, Tel: 408-492-9449, FAX: 408-492-9659; *Sls. Mgr.:* J. M. Darchuk

PHOTON SOURCES, INC., See Lumonics Material Processing Corp.

PHOTO RESEARCH:KOLLMORGEN, 9330 DeSoto Ave./PO Box 2192, Chatsworth, CA 91313-2192, Tel: 818-341-5151, TELEX: 69-1427; FSC No.: 92434; Empl.: 90; *Sls. Mgr.:* M. L. Woolsey

PHO-TRONICS DIV., E. R. Wagner Mfg. Co., 8701 W. Bradley Rd., Milwaukee, WI 53224, Tel: 414-355-6704, FAX: 414-355-0593; Empl.: 155; *Sls. Mgr.:* Steven J. O'Brien, Sls./Mktg. Mgr.

PHYSICS INTERNATIONAL CO., Olin Defense Systems Grp., 2700 Merced St., San Leandro, CA 94577, Tel: 415-577-7236, TWX: 910-366-7033; Empl.: 360

PIC DESIGN, Remington Technologies, Inc., P.O. Box 1004, Middlebury, CT 06762, Tel: 203-758-8272, TWX: 910-997-0989, FAX: 203-758-8271; FSC No.: 00141; Empl.: 105; *Sls. Mgr.:* Gary Hampton

PICO Electronics, Inc.

FAX: 914-699-5565

PICO ELECTRONICS, INC., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, Tel: 914-699-5514, 800-431-1064; FSC No.: 31669; *Sls. Mgr.:* Joe Sweeney ..... **A•1236-1246, 2333-2366; D•1919-1959**

Local Sales Offices & Reps

CA	Santa Clara, Fisher Assocs.	408-733-7350
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665/1264
WA	Seattle, W. Spaulding Co.	206-282-9173

FAX: 508-649-9643

PICONICS, INCORPORATED, 26 Cummings Road, Tyngsboro, MA 01879, Tel: 508-649-7501, TELEX: 754759; FSC No.: 26618; Empl.: 48; *Sls. Mgr.:* V. Dibiase ..... **A•1248-1249, 1975**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Scottsdale, Semper-Fi Sls.	602-730-9553
CA	N. Hollywood, Jewett Co.	818-789-8103
CA	Palo Alto, J/M Assocs.	415-857-1260
CO	Parker, Mikro Sls. Co.	303-841-4131
FL	Lighthouse Point, R.C. Simon & Co.	305-941-2757
IL	No. IL.& WI, R.H.I. Sls.	708-888-0099
IN	Huntington, Ellet Sls.	219-356-1866
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Natick, Wayland Engrg. Sls. Co.	508-655-6080
MN	Minneapolis, Peterson Sls. Assocs.	612-835-5281
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NY	Huntington, Regulus Indl. Sls. Co.	516-673-6252
NY	Rochester, Welch/Mulgahy Inc.	716-244-1100
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Cincinnati, G & H Sls. Co.	513-272-0580
PA	Glenside, Koebert Assocs. Inc.	215-887-2310
TX	Ft. Worth, El-Tec Sls.	817-268-2896
WA	Belleview, Reptronix	206-820-0833
WV	Inwood, Koebert & Assocs., Inc.	304-229-8401

PICOSECOND PULSE LABS, INC., P.O. Box 44, Boulder, CO 80306, Tel: 303-443-1249, FAX: 303-447-2236; Empl.: 6; *Sls. Mgr.:* J.R. Andrews; *Dist. Mgr.:* J.R. Andrews

PIEZO CRYSTAL CO., 100 K St., Box 619 , Carlisle, PA 17013, Tel: 717-249-2151, FAX: 717-249-7861; FSC No.: 74306; Empl.: 250; *Sls. Mgr.:* Glenn R. Kurzenknabe

PIEZO ELECTRIC PRODUCTS, INC., 212 Durham Ave., Metuchen, NJ 08840, Tel: 908-548-2800, TWX: 710-998-0592, FAX: 908-548-3625; Empl.: 75; *Sls. Mgr.:* M.R. Scarillo

PIEZO KINETICS INC., P.O. Box 756, Pine and Mill Streets, Bellefonte, PA 16823, Tel: 814-355-1593, FAX: 814-355-4342; FSC No.: 5Y690; Empl.: 28; *Sls. Mgr.:* Harry D. Shirey

PIEZO TECHNOLOGY INC., 2525 Shader Rd., Orlando, FL 32804, Tel: 407-298-2000, TWX: 810-850-4136, FAX: 407-293-2979; FSC No.: 25120; *Sls. Mgr.:* Paul Dechen

PIHER INTERNATIONAL CORP., 903 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 708-390-6680, 800-323-6693, FAX: 708-390-9866; FSC No.: 54869; Empl.: 25; *Sls. Mgr.:* Kimberly Mack, Sls. Supp. Mgr.

PILLAR INDUSTRIES, INC., 1780 Evergreen Street, Duarte, CA 91010, Tel: 818-358-1337, FAX: 818-358-0398; Empl.: 3 ..... **D•1960-1961**

Local Sales Offices & Reps

CA	Los Angeles, Power Partner, Inc.	213-215-0800
CA	Santa Cruz, LEREP	408-458-0667

PIND TESTERS INC., 19-B Thomas, Irvine, CA 92718, Tel: 714-380-1551, FAX: 714-951-1269; FSC No.: 66; Empl.: 25; *Sls. Mgr.:* J. Baker

PINE INSTRUMENT CO., 101 Industrial Dr., Grove City, PA 16127, Tel: 412-458-6391, FAX: 412-458-4648; Empl.: 60

PIONEER COMPONENTS, 2352 E. 66th St., Brooklyn, NY 11234, Tel: 718-444-3880; Empl.: 3; *Sls. Mgr.:* Michael R. Verter; *Dist. Mgr.:* Michael R. Verter

Pioneer Magnetics

FAX: 213-453-3929

PIONEER MAGNETICS, 1745 Berkeley St., Santa Monica, CA 90404, Tel: 213-829-6751, TELEX: 182-093, TWX: 910-343-6249; FSC No.: 08676; Empl.: 475; *Sls. Mgr.:* A. Hagiwara, V.P. of Mktg. ..... **D•1963-1965**

Local Sales Offices & Reps

AL	Huntsville, Pen-Tech Assocs.	205-881-9298
AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	Santa Monica, Pioneer Magnetics, Inc.	213-829-6751
CO	Commerce City, Williams Assocs.	303-289-5647
FL	Boca Raton, Pen-Tech Assocs.	305-394-7400
GA	Marietta, Pen-Tech Assocs.	404-424-1931
MD	Columbia, Stein Instrmn.	301-596-3748
MA	Needham Hts., Kanan Assoc.	617-449-7400
MI	Ann Arbor, KRW Sls., Inc.	313-769-0056
MN	St. Paul, Cahill, Schmitz & Cahill	612-636-7217
MO	Lee's Summit, Omni Tech. Sls.	816-578-4221
NJ	Glen Gardner, Daner-Hayes Inc.	201-537-4534
NM	Albuquerque, Williams Assocs.	505-255-1368
NY	Brewster, Daner-Hayes Inc.	914-279-2168
NY	E. Norwich, Daner-Hayes Inc.	516-922-0080
NC	Greensboro, Pen-Tech Assocs.	919-852-6000
OH	Dublin, KRW Sls. Inc.	614-885-2598
OH	Westlake, KRW Sales	216-871-7521
OR	Lake Oswego, RTS, Inc.	503-244-4123
PA	Cheltenham, Stein Instrm.	215-379-1990
PA	Oakmont, KRW Sls. Inc.	412-828-1490
TX	Dallas, Kruvand	214-437-3355
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Vashon, RTS, Inc.	206-285-1363
Can	LaSalle, Electrodesign Ltd.	514-363-0245

PIONEER RESEARCH, INC., 1745 Berkeley St., Santa Monica, CA 90404, Tel: 213-829-6751, FAX: 213-453-3929; Empl.: 450; *Sls. Mgr.:* A. Hagiwara

PIRELLI CABLE CORP., See Specialty Cable Corp.

PITTMAN®

FAX: 215-256-1338

PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, Tel: 215-256-6601; FSC No.: 98938; Empl.: 165 ..... **B•1308-1309**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Leucadia, Halbar Assocs.	619-942-4075
CA	San Mateo, Halbar North, Inc.	415-349-4700
CA	Van Nuys, Halbar Assocs.	818-906-3941
CO	Englewood, Integrated Motion Sys.	303-792-5516
CT	Bristol, M. L. Assocs., Inc.	203-589-2856
FL	Fort Lauderdale, Motion Controls, Inc.	305-434-4197
IL	Mount Prospect, K-W Assocs.	708-253-6680
IN	Elkhart, Shaum Mfg., Inc.	219-264-0771
MA	Wayland, M. L. Assocs.	508-358-5540
NY	Glen Head, Marcus Sls. Assocs., Inc.	516-671-6820
NY	Rochester, Application Spec.	716-586-6226
OH	Cleveland, Servo-Mark	216-871-2353
OK	Edmond, Motion Reps, Inc.	405-340-8100
PA	Exton, Kiley Elect. Co., Inc.	215-363-8550
TX	Austin, Motion Reps, Inc.	512-288-5758
TX	Denton, Motion Reps, Inc.	817-382-4159
TX	Houston, Motion Reps, Inc.	713-981-8700
WA	Redmond, Halbar PNW, Inc.	206-882-0990
Can	Downsview, Ont., Electomate Indl. Sls. Ltd.	416-665-0221

PIXELWORKS, INC., 7 Park Ave., Hudson, NH 03051, Tel: 603-880-1322, FAX: 603-880-6558; Empl.: 30; *Sls. Mgr.:* Rattan Dhar; *Dist. Mgr.:* Rattan Dhar

PLAINVIEW BATTERIES, INC., 23 Newtown Rd., Plainview, NY 11803, Tel: 516-249-2873, FAX: 516-249-2876; *Sls. Mgr.:* B. Erde ..... **D•1476-1479**

PLAINVIEW ELECTRONICS, See Plainview Battieries, Inc.

PLANAR SYSTEMS, INC., 1400 N.W. Compton Dr., Beaverton, OR 97006-1992, Tel: 503-690-1100, TELEX: 551961 Planer Syst, FAX: 503-645-7024; FSC No.: 5Z179; Empl.: 121; *Sls. Mgr.:* Jeff Hopkins

PLANT SPECIALTIES, INC., P.O. Box 110537, Carrollton, TX 75011-0537, Tel: 214-245-9673, FAX: 214-245-9673; *Sls. Mgr.:* J. E. Bryer

PLASMA RESEARCH CORP., 5675 Chappell Pl., Oakland, CA 94619, Tel: 415-530-1468, FAX: 415-530-2811; FSC No.: 8Y067; Empl.: 7

PLASTIC CAPACITORS, INC., 2623 N. Pulaski Rd., Chicago, IL 60639, Tel: 312-489-2229, FAX: 312-489-0496; FSC No.: 99120; Empl.: 90; *Sls. Mgr.:* Thomas J. Brown; *Dist. Mgr.:* Thomas J. Brown

PLASTIC FORMING, 20 S. Bradley Rd., Woodridge, CT 06525, Tel: 203-397-1338, TELEX: 963437, FAX: 203-389-0420; Empl.: 80; *Sls. Mgr.:* Bruce J. Dokumo

PLASTICORP, 24105 S. Frampton Ave., Harbor City, CA 90710, Tel: 213-539-9530, FAX: 213-539-8325; Empl.: 120; *Sls. Mgr.:* Robert Hurley

PLASTIMATIC, INC., Glynwed Int'l, 3 Oak Rd., Fairfield, NJ 07004, Tel: 201-575-0038, FAX: 201-575-8748; Empl.: 95; *Sls. Mgr.:* Art Lappine

PLASTOID CORPORATION, 45 Gingerbread Castle Rd., Hamburg, NJ 07419, Tel: 201-827-7141, FAX: 201-827-7141 (ext 52); Empl.: 200

PLASTRON CORP., 429 S. Evergreen St., Bensenville, IL 60106, Tel: 708-595-2212, FAX: 708-595-2599; Empl.: 245; *Sls. Mgr.:* Don Hennings

PLATO PRODUCTS, INC., 2120 Auto Center Dr., Glendora, CA 91740, Tel: 818-967-3821, TELEX: 287291, FAX: 714-592-7062; FSC No.: 32399; Empl.: 75; *Sls. Mgr.:* Walter Schaub

PLESSEY ELECTRIC SYSTEMS CORP., See GEC-Marconi

PLETRONICS, INC., 19015 36th Ave. West, Ste. H, Lynnwood, WA 98036, Tel: 206-776-1880, FAX: 206-776-2760; Empl.: 11; *Sls. Mgr.:* Les Podgorny; *Dist. Mgr.:* Les Podgorny ..... **A•1437-1443**

Local Sales Offices & Reps

AL	Huntsville, MacKay, Smith & Assocs.	205-539-8000
AZ	Phoenix, Sanford Sls. Assocs.	602-957-3570
CA	Mission Viejo, Jay Mktg. Assocs.	714-768-7519
CA	Pleasanton, Moulthrop	415-463-0450
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CO	Aurora, Electrodyne	303-695-8903
FL	Ft. Lauderdale, MacKay, Smith & Assocs.	305-973-3324
CT	N. Haven, Radix	203-239-3611
FL	Madeira Beach, MacKay, Smith & Assocs.	813-530-1873
FL	Orlando, MacKay, Smith & Assoc.	407-423-4353
FL	Orlando, MacKay, Smith & Assocs.	407-423-4353
GA	Tucker, MacKay, Smith & Assoc.	404-496-9913
GA	Tucker, MacKay, Smith & Assocs.	404-496-9913
IL	Downers Grove, Golten Assocs.	708-512-0093
MD	Baltimore, Chesapeake Ind. Mktg.	301-653-0476
MA	Randolph, Bengal	617-961-4120
MN	St. Paul, Countryman	612-645-9151
NJ	Springfield, Radix	201-467-4970
NC	Raleigh, MacKay, Smith & Assocs.	919-847-2277
OH	Centerville, Omega	513-434-5507
OH	Cleveland, Omega Sls.	216-360-9400
OH	Shaker Hgts., Omega	216-751-9600
OR	Oregon City, Halbar PNW, Inc.	503-656-3714
TX	Austin, Sage Mktg.	512-335-0300
TX	Bedford, Sage Mktg.	817-267-7781
UT	Salt Lake City, Electrodyne	801-264-8050
WA	Redmond, Halbar	206-882-0990

Local Distributors

AZ	Phoenix, Arizona Comps	602-269-5655
CA	El Segundo, Force	213-772-1324
CA	San Diego, Kent Elctrns.	619-471-9561
CA	Santa Clara, Force	408-748-1324
CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Santa Clara, Pyramid	408-727-9810
CA	Sunnyvale, Capsco	408-734-3020
CA	Sunnyvale, Target	408-733-0384
CA	Torrance, Kent Elctrns.	213-320-2700
CA	Yoriba Linda, Target Elctrns.	714-692-1630
CT	Norwalk, Cobra Comps.	203-847-6442
GA	Norcross, Century Elctrns.	404-729-2522
FL	Sunrise, All American	800-432-6838
IL	Downers Grove, Golten Assocs.	708-512-0093
MD	Beltsville, PSI	301-937-4960
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Norwood, Gerber Elctrns.	619-796-6000
MA	Wakefield, All American	617-246-2300
MN	Fridley, Voyager	612-571-7766
NJ	Hopelawn, Dove Elctrns.	201-324-7830
NY	Mt. Vernon, All American	800-926-6668
NY	Mt. Vernon, QAR/All American	1-800-456-2626
NY	Stony Brook, Dove Elctrns.	516-689-7733
NC	Raleigh, Century Elctrns.	919-782-2116
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OH	Twinsburg, Schuster Elctrns.	216-425-8134
PA	Norristown, Century Elctrns.	215-631-5404
TX	Richardson, Ewing	800-966-9738
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Redmond, Priebe	206-881-2363
WA	Woodinville, Capsco	206-885-5283

PLITRON, 250 Wildcat Rd., Downsview, Ont., CAN M3J 2N5, Tel: 416-667-9914, FAX: 416-667-8928; Empl.: 25; *Sls. Mgr.:* Brad Jolly ..... **A•2368-2369**

Local Sales Offices & Reps

CA	Burbank, De Angelo, Rothman & Co.	818-504-2425
FL	Oviedo, Comps. Co.	407-366-7399
FL	Tamarac, Southtech Instrs.	305-762-5120
NJ	Rahway, R.E. Breuer	201-388-5045
IL	Schaumberg, McNulty & Assocs.	708-980-9868
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
PA	Pittsburg, J. C. Hofstetter	513-296-1010
Can	Toronto, Plitron	416-667-9914

PLUMER PRECISION OPTICS, 601 Montgomery Ave., Pennsburg, PA 18073, Tel: 215-679-6272, FAX: 215-679-2277; Empl.: 180; *Sls. Mgr.:* Joe Tiberii

PMC/BETA LTD. PARTNERSHIP, 4 Tech Circle, Natick, MA 01760, Tel: 617-237-6920, FAX: 508-651-9762; Empl.: 25; *Sls. Mgr.:* Jack Newton

PMI MOTION TECHNOLOGIES, Kollmorgen Corporation, 49 Mall Dr., Commack, NY 11725-5703, Tel: 516-864-1000, FAX: 516-864-2084; Empl.: 175; *Sls. Mgr.:* Peter Dougherty

PMT DIVISION, Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19053, Tel: 215-355-6900, FAX: 215-355-2937; Empl.: 125; *Sls. Mgr.:* James Snyder

POCO SLS., Porter Co., 8925 Fullbright St., Chatsworth, CA 91311, Tel: 818-700-8727, FAX: 818-700-8453; FSC No.: 69-1603; Empl.: 8

POINT 4 DATA CORP., 15442 Del Amo Ave., Tustin, CA 92680, Tel: 714-259-0777, FAX: 714-259-0921; Empl.: 50; *Sls. Mgr.:* Mr. Ted Cooper; *Dist. Mgr.:* Mr. Ted Cooper

POLARA ENGINEERING INC., 4115 W. Artesia Ave., Fullerton, CA 92633, Tel: 714-521-0900, TELEX: 688489, FAX: 714-522-8001; Empl.: 62

POLAROID CORPORATION, Polarizer Div., 1 Upland Rd., Norwood, MA 02062, Tel: 800-225-2770, FAX: 617-446-4600

POLE/ZERO CORPORATION, 4480 Lake Forest Dr. Ste. 308, Cincinnati, OH 45242, Tel: 513-563-1133, FAX: 513-563-4345; *Sls. Mgr.:* Joseph J. Janning

POLYCASE PRODS., ECP Corp., 4726 Superior Ave, Cleveland, OH 44103, Tel: 216-391-0444, FAX: 216-391-2891; Empl.: 14 ..... **C•1078**

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Torrance, Allied Elctrns.	213-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Casselberry, Allied Elctrns.	407-831-3331
FL	Pompano Beach, Allied Elctrns.	305-978-3008
GA	Norcross, Allied Elctrns.	414-446-8595
IL	Des Plaines, Allied Elctrns.	312-803-1040
IN	Indianapolis, Allied Elctrns.	317-875-0448
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Billerica, Allied Elctrns.	508-667-7921
MI	Livonia, Allied Elctrns.	313-462-0190
MN	Eden Prairie, Allied Elctrns.	612-829-7554
NJ	Fairfield, Allied Elctrns.	201-227-8776
NJ	Mt. Laurel, Allied Elctrns.	609-234-7769
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OH	Worthington, Allied Elctrns.	614-785-1270
PA	Pittsburgh, Allied Elctrns.	412-367-4124
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Fort Worth, Allied Elctrns.	1-800-433-5700
WA	Seattle, Allied Elctrns.	206-547-2827
WI	New Berlin, Allied Elctrns.	414-796-1280

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POLYFET RF DEVICES, 1090 Lawrence Dr. No. 101, Newbury Park, CA 91320, Tel: 805-498-4552, FAX: 805-498-2230; Empl.: 9; *Sls. Mgr.:* S.K. Leong

POLYFLON COMPANY, Crane Co., 35 River Street, New Rochelle, NY 10801, Tel: 914-636-7222, FAX: 914-633-3664; Empl.: 32; *Sls. Mgr.:* Joseph A. Seminoro

POLYGENEX INTERNATIONAL INC., 105 Eaton Place, Cary, NC 27513, Tel: 919-380-8100, FAX: 919-380-9556; *Sls. Mgr.:* J.D. McGarry

POLYPHASE INSTRUMENT, 175 Commerce Dr., Ft Washington, PA 19034, Tel: 215-643-6950, FAX: 1-215-643-5237; FSC No.: 98330; Empl.: 160; *Sls. Mgr.:* Paul Stevens

PolyPhaser Corporation

FAX: 702-782-4476

POLYPHASER CORPORATION, 2225 Park Place, P.O. Box 9000, Minden, NV 89423-9000, Tel: 702-782-2511, 800-325-7170, TELEX: 272718 PolyPhaser; FSC No.: 61114; Empl.: 45 ..... **B•1385**

Local Sales Offices & Reps

CA	Costa Mesa, Tech Mktg. Assoc., Inc.	714-979-0412
CO	Aurora, Electro-Tek Sls., Inc.	303-343-8020
FL	Coral Springs, Cemco	305-753-6777
KS	Lenexa, Maury E. Bettis Co.	913-541-9552
MI	Rochester Hills, Webster Assocs., Inc.	313-375-0420
MN	Stillwater, Ned Gordon & Assocs.	612-430-1572
NV	Minden, PolyPhaser Corp.	702-782-2511
NH	Manchester, Assocd. Sys.	603-472-2297
TX	Rowlett, Horizon Comm. Sls. Co.	214-475-1179
WA	Kirkland, Manon Engrg.	206-827-7449

Local Distributors

CA	Hayward, Talley Elctrns.	415-783-2111
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CO	Aurora, Electro-Comm Distrs.	303-343-8937
FL	Melbourne, Technical Equip. Dist., Inc.	407-259-2711
HI	Honolulu, Honolulu Elctrns.	808-949-5564
IL	Joliet, Primus Elctrns. Corp.	815-436-8945
IL	Libertyville, Harger Lightning Protection	708-362-4848
MD	Hunt Valley, Tessco	301-785-5300
MN	St. Paul, Pulstar Dist., Inc.	612-645-3411
NV	Minden, PolyPhaser Corp.	702-782-2511
NJ	Clarksboro, W.R. Block & Assocs.	800-421-7170
NC	Greensboro, West Antenna	919-621-2473
OH	Cincinnati, Cartwright Comms. Co.	513-489-1755
TX	Rowlett, Horizon Comm. Sls. Co.	214-475-1179
EXP	Minden, PolyPhaser Corp.	702-782-2511
Can	Aurora, Ont., Sinclabs, Inc.	416-841-0624

POLY-PLANAR INC., 1800 Mearns Rd., Unit J - P.O. Box 2578, Warminster, PA 18974, Tel: 215-675-7805, FAX: 215-675-7920; Empl.: 12

POLYPLY INC., Rd. No. 1, Route 5 South, Amsterdam, NY 12010, Tel: 518-843-3900, FAX: 518-843-5829

POLYTRON DEVICES, INC

FAX: 201-345-1264

POLYTRON DEVICES, INC., Box 398 - River St. Sta., Paterson, NJ 07544, Tel: 201-345-5885; Empl.: 26 ..... **D•1966-1973**

Local Sales Offices & Reps

CA	San Jose, P & M Elctrns.	408-287-0402
NY	Canandaigna, Mamula Sls.	716-394-5560

POLYTRONIX, INC., 805 Alpha Dr., Richardson, TX 75081, Tel: 214-238-7045, FAX: 214-644-0805; Empl.: 65

POMFRET RESEARCH OPTICS, P. O. Box 1265, Orange, VA 22960, Tel: 703-854-4350; Empl.: 5

POMONA ELECTRONICS, 1500 E. 9th St, P.O. Box 2767, Pomona, CA 91766, Tel: 714-623-3463, FAX: 714-629-3317; FSC No.: 05276; Empl.: 170; *Sls. Mgr.:* Thomas Barber; *Dist. Mgr.:* Thomas Barber ..... **C•1493-1499**

Local Sales Offices & Reps

AL	Hazel Green, Braden & Assocs.	205-828-6290
AZ	Phoenix, More Sls.	602-788-9181
AR	Little Rock, Erickson Sls., Inc.	501-455-0618
CA	Burbank, Darco	818-504-2425
CA	Irvine, Vale Elctrn. Assocs.	714-551-4004
CA	Santa Clara, Engrg. Assocs. Corp.	408-988-5001
CA	So. San Francisco, Carelli/EMA	415-873-2524
CO	Broomfield, Connors Co.	303-466-9628
FL	Maitland, EIR Inc.	407-660-9600
IL	Palatine, W. M. Linz	708-705-8555
IN	Indianapolis, Blind Elctrn. Sls. Co.	317-241-3742
IA	West Des Moines, Nevco	515-225-9866
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MD	Baltimore, David S. Linz, Inc.	301-882-6289
MA	Burlington, Gerber Sls. Corp.	617-229-1150
MI	Jenison, C. A. Geer Co.	616-534-9449
MI	Kentwood, C. A. Geer Co.	616-534-9449
MN	Minneapolis, Hei-lite Sls., Inc.	612-550-0506
OH	Cleveland, Marlow Assocs.	216-831-8232
MO	Crestwood, Nevco, Inc.	314-843-7406
NJ	Franklin, D. F. Tobias & Co.	201-209-7255
OR	Beaverton, Eclipse Mktg. Grp. Ltd.	503-642-1661
PA	Philadelphia, David S. Linz, Inc.	215-379-0734
NC	Raleigh, Pinnacle Mktg.	919-878-4658
TX	Dallas, Erickson Sls., Inc.	214-739-5833
TX	Houston, Erickson Sls., Inc.	713-266-1604
TX	Round Rock, Erickson Sls., Inc.	512-244-3068
WA	Redmond, Eclipse Mktg. Grp., Ltd	206-885-6991
WA	Spokane, Eclipse Mktg. Grp., Ltd.	509-922-3972
EXP	CA, Tarzana, Nate Beckerman & Co., Inc.	818-708-0021
Can	Pickering, AC Simmons & Sons	416-739-8041

PORTASOL, Oglesby and Botler Ltd., 7422 Carmel Executive Park, Charlotte, NC 28226, Tel: 704-543-6239, FAX: 704-543-6839; Empl.: 100; *Sls. Mgr.:* Tom Carbott; *Dist. Mgr.:* Tom Carbott

PORTESCAP U.S., INC., 36 Central Ave., Hauppauge, NY 11788, Tel: 516-234-3900, FAX: 516-234-3986; Empl.: 16

POSITRONIC INDUSTRIES, INC., 423 N. Campbell St, P.O. Box 8247, Springfield, MO 65801, Tel: 417-866-2322, TELEX: 436445, FAX: 417-866-4115; FSC No.: 28198; Empl.: 300

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POTRANS INTERNATIONAL INC., Potrans Electrical Corp., Ltd., 17935 Sky Park Circle No. H, Irvine, CA 92714, Tel: 714-975-1222, TELEX: 244319; Empl.: 300; *Sls. Mgr.:* Chris Witham ..... **D•1974-1976**

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs., Inc.	205-881-1096
AZ	Phoenix, More Sls.	602-788-9181
CA	Santa Clara, Premier Tech.	408-736-2260
CO	Boulder, Promotional Technlgs.	303-447-2474
FL	Tampa, APM Assoc.	813-447-2474
GA	Norcross, Interep Assocs., Inc.	404-449-8680
IL	Chicago, Rendell Sls. Co.	312-539-1820
IN	Carmel, Frank E. Kahsar Sls.	317-844-9353
MA	Burlington, New Tech Solutions	617-229-8888
MI	Spring Lake, Frank E. Kahsar Sls.	616-846-7590
MI	Warren, Frank E. Kahsar Sls.	313-795-3530
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NH	Merrimack, New Tech Solutions	603-424-8149
NM	Albuquerque, More Sls.	505-265-6265
NY	Skaneateles, Empire Tech. Assocs.	315-685-3077
OH	Cincinnati, Frank E. Kahsar Sls.	513-922-3133
OK	Tulsa, Advance Tech. Sls.	918-664-0482
PA	Wexford, Frank E. Kahsar Sls.	412-935-8561
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Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean 205-830-1540
AZ Phoenix, Howe & Howe Sls. 602-264-7971
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, CERCO 619-792-5555
CA Santa Ana, Jones & McGeoy Sls., Inc. 714-547-6466
CO Littleton, Simpson Assocs. 303-794-8381
CT Wallingford, John E. Boeing Co. 203-265-1318
FL Apopka, Cartwright & Bean 407-889-9100
FL Deerfield Beach, Cartwright & Bean ... 305-429-3400
GA Norcross, Cartwright & Bean 404-368-0160
IL Rolling Meadows, Sumer, Inc. 708-991-8500
IN Fort Wayne, R. O. Whitesell & Assocs. 219-432-5591
IN Indianapolis, R. O. Whitesell & Assocs. 317-876-9000
IN Kokomo, R. O. Whitesell & Assocs. ... 317-457-9127
IN Princeton, Potter & Brumfield- S & SW 812-386-2211
IN Princeton, Potter & Brumfield-N & NW U.S. 812-386-2130
IA Cedar Rapids, Dy-Tronix, Inc. 319-377-8275
KS Leawood, Dy-Tronix, Inc. 913-339-6333
KS Wichita, Dy-Tronix, Inc. 316-838-0884
KY Versailles, R. O. Whitesell & Assocs. .. 606-873-1182
LA Covington, Cartwright & Bean 504-892-1780
MD Baltimore, Micro-Comp 301-644-5700
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MI Grand Blanc, R. O. Whitesell & Assocs. 313-695-0770
MI Grand Rapids, R. O. Whitesell & Assocs. 616-942-5420
MI Southfield, R. O. Whitesell & Assocs. .. 313-559-5454
MI St. Joseph, R. O. Whitesell & Assocs. 616-983-7337
MN Edina, Mel Foster Tech. Sls. 612-941-9790
MS Jackson, Cartwright & Bean 601-981-1170
MO Bridgeton, Dy-Tronix, Inc. 314-291-4777
NJ Medford, The McCoy Grp., Inc. 609-953-0770
NM Albuquerque, C. T. Carlberg & Assocs. 505-899-2155
NY Kingston, Micro-Tech Mktg. Inc. 914-338-7588
NY Melville, Comtronic Assocs. 516-249-0505
NY N. Syracuse, Micro-Tech Mktg. Inc. ... 315-458-5254
NY Rochester, Micro-Tech Mktg. Inc. 716-426-0806
NC Charlotte, Cartwright & Bean 704-536-0303
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WI Brookfield, Sumer, Inc. 414-784-6641
PR San Juan, Electronic Tech. Sls. 809-798-1300
Can Mississauga, Ont., Siemens Elec. Ltd. 416-564-1995

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POWERBOX INC., 1503 Spruce St., Boulder, CO 80302, Tel: 303-444-1461, 800-444-1461, FAX: 303-444-3135; *Sls. Mgr.:* James Jones ..... **C•1079**

Local Sales Offices & Reps

MN St. Paul, Heyda/Hanks Assocs. 612-484-8531
Can Mississauga, Ont, Hi-Pac Enclosures 416-279-4860

POWERCARD CORP., 393 Totten Pond Rd., Waltham, MA 02159, Tel: 617-890-6789, FAX: 617-890-1390; *Sls. Mgr.:* Fredric Cohen

POWER COMPONENTS CO., Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248, Tel: 213-323-8120, TWX: 910-346-7067, FAX: 213-329-8427; FSC No.: 213-329-8427; *Sls. Mgr.:* Avi Kandola

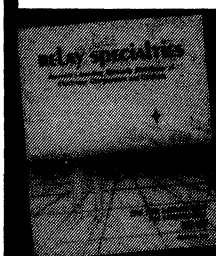
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Local Sales Offices & Reps

CA Anaheim, Westrep 714-527-2822, FAX:714-527-3868
CA Hayward, Pacific Mktg., Inc. 415-887-1620, FAX:415-887-7595
CO Parker, High Plains Mktg. 303-841-6464,FX, 303-841-6262
FL Tampa, SRT Mktg. 813-884-4805, FAX:813-882-9149
GA Atlanta, Naylor Assocs., Inc. 404-373-5036, FAX:404-373-5052
IL Des Plaines, Esco Assocs. 708-298-5310, FAX:708-298-3833
MA Burlington, Tritek, Inc. 617-272-4550, FAX:617-270-9147
MN Minnetonka, Mill-Tech Sls., Inc. 612-933-8090, FAX:612-933-2353
NJ Haddonfield, M & S Assocs., Inc. 609-429-7055, FAX:609-795-1493
NY Great Neck, F & F Metro, Inc. 516-482-4080, FAX:516-482-4589
NY Newark, W-L Sls. 315-331-1645, FAX:315-331-2143
NC Cornelius, Naylor Assocs., Inc. 704-892-1366, FAX:704-892-9758
NC Durham, Naylor Assocs., Inc 919-544-6630, FAX:919-544-7211
OH Dayton, Five Star Elctrns., Inc. 513-299-1718, FAX:513-299-1345
OH Solon, Five Star Elctrns., Inc. 216-349-1611, FAX:216-349-0381
OK Tulsa, Comptech Sls. 918-622-7744, FAX:918-660-0340
OR Albany, Henry Sharpe 503-928-9221, FAX:503-928-5604
TX Austin, Comptech Sls. 512-343-0300, FAX:512-345-2530
TX Harlingen, Comptech Sls. 512-428-7503, FAX:512-345-2530
TX Houston, Comptech Sls. 713-492-0005, FAX:713-492-6116
TX Irving, Comptech Sls. 214-751-1181, FAX:214-550-8113
WA Redmond, Projects Intl. 206-883-8212
Can Ontario, Ed Irving 519-822-9795, FAX:519-763-1931

Local Distributors

CA Costa Mesa, Battery Specialties 714-755-0888, FAX:714-755-0889
CA Mountainview, Energy Sls., Inc. 415-969-0800, FAX:415-961-2000
CA San Diego, Tauber Elctrns. 619-274-7242, FAX:619-274-2220
CO Denver, Cargo Batteries 303-296-8763, FAX:303-295-7125
MD Beltsville, Mark Elctrns. Supp. 301-595-5040, FAX:301-937-0491
MA Sandwich, JV/EPC Elctrns., Inc. 508-833-0700
MN Minneapolis, Stark Elctrns. 612-333-3361, 800-334-6154
NJ Bellmawr, Mid-Atlantic Elctrns. Corp. 609-931-5303,F,609-931-4928
NY Bohemia, Lamp Technlg., Inc. 516-567-1800, FAX:516-567-1806
NY Farmingdale, Delta Concepts 516-845-1294, FAX:516-293-0493
NY Plainview, Plainview Batteries 516-249-2873, FAX:516-249-2876
WA Redmond, Energy Sls. 206-883-2343, FAX:206-867-0606
WI Fond-Du-Lac, Fedco Elctrns. 414-922-6490, FAX:414-922-6750

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POWERCUBE CORP., Sub. Unitrode Corp., 8 Suburban Pk. Dr., Billerica, MA 01821, Tel: 617-667-9500, FAX: 508-667-6280; FSC No.: 31557; Empl.: 150; *Sls. Mgr.:* Roger LaFontaine

POWER DESIGNS

FAX: 516-333-6512

POWER DESIGNS, INC., 1700 Shames Dr., Westbury, NY 11590, Tel: 516-333-6200, TWX: 510-222-6561; Empl.: 48; *Sls. Mgr.:* Mary Loop ..... **D•1978-1986**

Local Distributors

AZ	Phoenix, U.S. Instr. Rentals	602-257-1345
CA	Los Angeles, EIL Instrs.	213-685-7020
CA	N. Hollywood, O'Halloran Assocs.	213-877-0173
CA	Palo Alto, O'Halloran Assocs.	415-969-1600
CA	Santa Clara, EIL Instrs.	408-727-0396
CO	Denver, EIL Instrs.	303-534-4160
CT	Middletown, EIL Instrs.	203-346-6646
FL	Palm Bay, EIL Instrs.	305-725-8300
GA	Atlanta, U.S. Instr. Rentals	404-955-4473
IL	Chicago, EIL Instrs.	312-430-2292
IN	Indianapolis, EIL Instrs.	317-545-1373
KS	Kansas City, U.S. Instr. Rentals	913-677-0011
KY	Louisville, EIL Instrs.	502-454-3420
MD	Sparks, EIL Instrs.	301-771-4800
MA	Burlington, EIL Instrs.	617-272-9450
MI	Detroit, U.S. Instr. Rentals	313-493-1919
MN	Minneapolis, U.S. Instr. Rentals	612-881-3743
MO	St. Louis, U.S. Instr. Rentals	314-454-0210
NJ	Belmar, Accutest Instrs.	201-681-6560
NJ	Rockaway, A&J Assocs.	201-625-3169
NM	Albuquerque, U.S. Instr. Rentals	505-884-0529
NY	Great Neck, The Instr. Mart	516-487-7430
NY	Hauppauge, EIL Instrs.	516-231-6333
OH	Cincinnati, U.S. Instr. Rentals	513-863-4446
OH	Dayton, EIL Instrs.	513-435-2134
OK	Oklahoma City, U.S. Instr. Rentals	405-525-2659
PA	Philadelphia, EIL Instrs.	609-488-0474
TX	Dallas, EIL Instrs.	214-931-1236
TX	Houston, EIL Instrs.	713-271-3100
UT	Salt Lake City, U.S. Instr. Rentals	801-582-0116
VA	Springfield, EIL Instrs.	703-569-2611
WA	Springfield, EIL Instrs.	206-575-1888
Can	Toronto, EIL Instrs.	416-624-6660

POWER DEVICES INC., 27071 Cabot Rd., Bldg. 114, Laguna Hills, CA 92653, Tel: 714-582-6712, FAX: 714-582-6722; Empl.: 10; *Sls. Mgr.:* G. E. Flynn

Power Dynamics, Inc.

FAX: 201-736-8930

POWER DYNAMICS INC., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052, Tel: 201-736-5722, TELEX: 666173(PDI); FSC No.: 60046; *Sls. Mgr.:* James Papianni; *Dist. Mgr.:* Lyle Scott ..... **A•1628-1631; B•1764; C•1500-1506, 1592, 1814; D•1484-1485**

Local Sales Offices & Reps

CA	Laguna Hills, David Budge & Assoc.	714-582-8720
CA	San Diego, Bart Budge Assocs.	619-272-8630
CA	San Diego, David Budge Assocs.	619-272-8630
CA	San Jose, Ruppert Sls.	408-998-8717
CO	Denver, West Inc.	303-477-1134
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
GA	Lilburn, Adams Elctrns.	404-925-9115
IL	Palatine, Golbeck & Milota Assocs., Inc.	312-705-0602
IN	Indianapolis, L.M. DeVoe Assocs.	317-842-3245
KS	Shawnee Mission, Microtronics, Inc.	913-262-1444
MI	Grand Rapids, R.P. Urban Assocs.	616-245-0511
MN	Bloomington, Horizon Technlgs.	612-884-6515
MO	St. Charles, Microtronics, Inc.	314-946-8500
NH	Amherst, D.A. Crowley & Assocs	603-673-7050
NJ	Audubon, DAS Assocs.	609-546-1133
NJ	Pt. Pleasant, Jade Mktg.	201-899-8108
NJ	Audubon, D.A.S. Assocs.	609-546-1133
NY	Marcellus, Mullahy-Welch Sls.	315-673-3891
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Raleigh, Barker Assocs.	919-876-0282
OH	Dayton, Shamrock Sls. Inc.	513-258-1227
OH	Worthington, Shamrock Sls. Inc.	614-888-7638
OR	Tigard, Electronic Comp. Sls.	503-245-2342
MI	Detroit, R.P. Urban Assocs.	313-535-2355
TX	Dallas, Rem-Air Comp.	214-234-1069
UT	Murray, Aspen Sls., Inc.	801-265-8365
UT	Salt Lake City, Aspen Sls., Inc.	801-467-2401
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
Can	Downsview, Tienkay, Inc.	416-736-1221

Local Distributors

AR	Ft. Smith, Radio, Inc.	501-646-5200
CA	El Segundo, Force Elctrns.	714-522-1324
CA	Livermore, Fuse-Com	415-449-1313
CA	San Diego, Fuses Unlimited/Western Fuse	619-569-9620
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	So. San Francisco, Peters-DeLaet, Inc.	415-873-9595
CA	Van Nuys, Fuses Unlimited	818-786-8111
CO	Arvada, Denver Wintronics	303-431-7161
CT	Hamden, Connector Co.	203-288-0044
CT	Wallingford, Sager Elect. Supp. Co.	203-265-4600
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
GA	Atlanta, KSM Elctrns.	404-458-2013
IL	Cary, Gama Elctrns.	708-639-3322
IL	Crystal Lake, Sub-Sem	312-782-3954
MA	Canton, Impact Sls.	617-821-1500
MA	Hingham, Sager Elect. Supp. Co.	508-749-4700
MA	Marlboro, Now Elctrns.	508-460-0187
MN	Hibbing, Minn Tech Elctrns.	218-262-5228
TX	Dallas, Wofford Elec.	214-320-0294
NH	Salem, Sager Elctr.	603-898-1348
NJ	Kenilworth, Federated Purchaser Co.	201-272-0505
NY	Hauppauge, Sager Elctrns	516-348-1300
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Pennyan, Advcom Technlg.	716-396-9050
NC	Raleigh, Sager Svc. Plus Elctrns.	919-850-9550
OH	Cincinnati, Schuster Elctrns	513-489-1400
OH	Twinsburg, Schuster Elctrns	216-425-8134
OK	Oklahoma City, Radio, Inc.	405-789-0741
OK	Tulsa, Radio, Inc	918-587-9123
OR	Beaverton, Micro Power Elctrns.	503-626-7086
PA	Bristol, Aim Elctrns	215-785-3500
TX	Austin, Wofford Elctrns.	512-339-1131
OR	Beaverton, Rose Elctrns.	503-629-9288
TX	Dallas, Off The Shelf Comps.	214-247-0052
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Richardson, Off The Shelf Comps.	214-238-0808
WI	Milwaukee, Progressive Image	414-321-4722
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Redmond, Energy Sls.	206-883-2343
WA	Redmond, Fuse-Com	206-881-2442
Can	Downsview, Ont., PS Comps.	416-665-9546

POWER ELECTRONIC COMPONENTS, INC., PEC, Inc, 3408 Kamer Miller Rd., New Albany, IN 47150, Tel: 812-941-9205, 800-245-0193, FAX: 812-941-9205; *Dist. Mgr.:* Brenda DeSpain

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FAX: 412-925-4393

POWEREX, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697, Tel: 412-925-7272, TWX: 510-468-2840; Empl.: 550; *Dist. Mgr.:* Kathy Cullen ..... **A•2117**

Local Sales Offices & Reps

AZ	Chandler, Lindberg Co.	602-786-9115
CA	Agoura Hills, Westpower Assocs.	818-706-2550
CA	Laguna Hills, Westpower Assocs.	714-582-6716
CA	Santa Clara, Engineering Assocs. Corp.	408-988-5001
CO	Denver, Lindberg Co.	303-758-9033
CO	Westminster, Jerry Wolfgang	303-252-0215
CT	Southington, The Orion Grp.	203-621-8371
FL	Maitland, EIR, Inc.	407-660-9600
GA	Alpharetta, Southeast Power Comps.	404-664-5460
GA	Norcross, Southeast Power Comps.	404-448-2458
IL	Naperville, L&W Power Corp.	708-416-8838
IN	Carmel, Giesting & Assocs.	317-844-5222
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
KY	Versailles, Giesting & Assocs.	606-873-2330
MA	Newton, Ed Freeley	617-630-9512
MA	Peabody, The Orion Grp.	508-532-6266
MI	Plymouth, L&W Power Corp.	313-451-1150
MN	Minneapolis, PSI Co.	612-944-8545
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NJ	Ringwood, J&L Sls. Assocs., Inc.	201-962-6315
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, J&L Sls. Assocs., Inc.	516-737-2801
NY	Wappinger Falls, Bob Dean, Inc.	914-297-6406
NC	Charlotte, Southeast Power Comps.	704-846-8532
NC	Greensboro, Southeast Power Comps.	919-854-9410
NC	Henderson, Southeast Power Comps.	919-438-4450
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OH	Columbus, Giesting & Assocs.	614-459-4800
OK	Tulsa, NOVA Mktg.	918-660-5105
OR	Tigard, Vantage Corp.	503-620-3280
PA	Hatboro, Delta Tech. Sls., Inc.	215-957-0600
PA	Pittsburgh, Bear Mktg.	412-531-2002
PA	Youngwood, Bob Hirche	412-925-4468
PA	Youngwood, Powerex, Inc.-USA/Intl.	412-925-7272
TX	Austin, NOVA Mktg., Inc.	512-343-2321
TX	Dallas, NOVA Mktg., Inc.	214-750-6082
TX	Houston, NOVA Mktg., Inc.	713-988-6082
VA	Roanoke, Southeast Power Comps.	703-774-8478
WA	Bellevue, Vantage Corp.	206-455-3460
WI	Elm Grove, L&W Power Corp.	414-782-0799
Can	Montreal, Que., GMA Assocs.	514-335-9572
Can	Ottawa, Ont., GMA Assocs.	613-838-4480
Can	Toronto, Ont., GMA Assocs	416-671-8111
Can	Vancouver, B.C., Blakewood Elec. Sys., Inc.	604-273-9910

Local Distributors

AL	Birmingham, Industrial Elec. Supp. Co.	205-951-4601
AL	Huntsville, Hamilton/Avnet	205-837-7210
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Chandler, Hamilton/Avnet	602-961-6411
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Agoura Hills, Almo Elctrns.	818-991-3984
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Costa Mesa, Hamilton Electro Corp.	714-754-6097
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4100
CA	Culver City, Hamilton Electro Sls.	213-558-2000
CA	Gardena, Hamilton/Avnet	213-217-6888
CA	Roseville, Hamilton/Avnet	916-781-6614
CA	San Diego, All American	619-268-1505
CA	San Diego, Hamilton/Avnet	619-571-7510
CA	San Diego, Time Elctrns.	619-586-1331
CA	San Jose, All American	408-943-1200
CA	San Jose, Almo Elctrns.	408-436-8822
CA	Santa Ana, Almo Elctrns.	714-757-0444
CA	Sunnyvale, Hamilton/Avnet	408-743-3610
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, All American	213-320-0240
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CA	Woodland Hills, Hamilton/Avnet	818-594-0404
CO	Englewood, Hamilton/Avnet	303-799-7800
CO	Englewood, Time Elctrns.	303-799-8851
CT	Cheshire, Time Elctrns.	203-271-3200
CT	Danbury, Hamilton/Avnet	203-797-2800
CT	East Haven, J. V. Elctrns.	203-469-2321
CT	Wallingford, GRS Midan Elects.	203-265-2077
FL	Ft. Lauderdale, Hamilton/Avnet	305-971-2900
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Miami, All American	305-621-8282
FL	Orlando, Time Elctrns.	407-841-6565
FL	St. Petersburg, Hamilton/Avnet	813-573-3930
FL	Winter Park, Hamilton/Avnet	407-628-3888
GA	Norcross, Hamilton/Avnet	404-447-7507
GA	Norcross, Time Elctrns.	404-448-4448
IL	Bensenville, Hamilton/Avnet	312-860-7700
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elmhurst, Semiconductor Specialists, Inc.	708-279-1000
IL	Schaumberg, Time Elctrns.	708-308-3000
IL	Schaumburg, QPS Elect., Inc.	708-884-6620
IN	Carmel, Hamilton/Avnet	317-844-9333
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Hammond, WESCO	312-454-6970
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Cedar Rapids, Hamilton/Avnet	319-362-4757
KS	Lenexa, Hamilton/Avnet	913-888-1055
KY	Lexington, Hamilton/Avnet	606-259-1475
MD	Columbia, GRS Elctrns.	301-995-6744
MD	Columbia, Hamilton/Avnet	301-995-3500
MD	Columbia, Time Elctrns.	301-964-3090
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Peabody, Hamilton/Avnet	508-531-7430
MA	Peabody, Time Elctrns.	508-532-6200

MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Madison Heights, Galco Elctrns. 313-542-9090
MI Novi, Hamilton/Avnet 313-347-4270
MN Edina, Time Elctrns. 612-835-1250
MN Minnetonka, Hamilton/Avnet 612-932-0600
MO Chesterfield, Hamilton/Avnet 314-537-1600
MO Manchester, Time Elctrns. 314-391-6444
NJ Camden, GRS Elctrns. 609-964-8560
NJ Cherry Hill, Hamilton/Avnet 609-424-0100
NJ East Hanover, Delburn Elctrns., Inc. ... 201-884-0800
NJ Fairfield, Hamilton/Avnet 201-575-3390
NJ Marlton, Time Elctrns. 609-596-6700
NJ Wayne, Time Elctrns. 201-882-4611
NM Albuquerque, Hamilton/Avnet 505-345-0001
NM Albuquerque, Harrison Equip. Co. 505-291-9951
NY East Syracruse, Time Elctrns. 315-432-0355
NY Fairport, Time Elctrns. 716-383-8853
NY Freeport, Semtex Inds. Corp. 516-223-0200
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Hauppauge, Time Elctrns. 516-273-0100
NY Plainview, ACI Elctrns. 516-293-6630
NY Rochester, Hamilton/Avnet 716-475-9130
NY Rome, Rome Elctrns. 315-337-5400
NY Syracruse, Hamilton/Avnet 315-437-2641
NY Westbury, Hamilton/Avnet 516-997-6868
NC Charlotte, Electronics Mktg. Corp. 704-394-6195
NC Charlotte, Time Elctrns. 704-522-7600
NC Raleigh, Hamilton/Avnet 919-878-0810
OH Cincinnati, Hughes Peters 513-351-2000
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Cleveland, Darrah Elec. 216-631-0912
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Electronics Mktg.Corp. 513-439-4711
OH Dayton, Hamilton/Avnet 56 513-439-6732
OH Dayton, Hamilton/Avnet 64 513-439-6700
OH Dublin, Time Elctrns. 614-761-1100
OH Highland Heights, Electronics Mktg.Corp. 216-442-3441
OH Solon, Hamilton/Avnet 216-349-5100
OH Westerville, Hamilton/Avnet 614-882-7004
OK Tulsa, Altair Co. 918-252-5781
OK Tulsa, Hamilton/Avnet 918-252-7297
OR Beaverton, Hamilton/Avnet 503-627-0201
OR Portland, Dunn Elctrns. 503-285-0214
OR Portland, Time Elctrns. 503-684-3780
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Pittsburgh, Hamilton/Avnet 412-281-4150
TX Addison, Hamilton/Avnet 214-308-8140
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Harrison Equip. Co. 512-258-1320
TX Austin, Time Elctrns. 512-339-3051
TX Brownsville, Harrison Equip. Co. 512-548-2376
TX Dallas, Harrison Equip. Co. 214-239-2750
TX El Paso, Harrison Equip. Co. 915-598-3406
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
TX Stafford, Hamilton/Avnet 713-240-7733
TX Stafford, Harrison Equip. Co. 713-879-2750
UT Salt Lake City, Hamilton/Avnet 801-972-2800
UT West Valley, Time Elctrns. 801-973-8181
VA Charlottesville, Virginia Elec. Comps. .. 804-296-4184
WA Redmond, Hamilton/Avnet 206-881-6697
WA Redmond, Time Elctrns. 206-882-1600
WV Charleston, McJunkin Corp. 304-348-5211
WI Mequon, Taylor Elec. Co. 414-241-4321
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Waukesha, Hamilton/Avnet 414-784-4510
WY Gillette, WESCO 307-687-0014
Can Burnaby, BC, Hamilton/Avnet 604-420-4101
Can Burnaby, BC, ITT/Multicomps. 604-291-8866
Can Calgary, Alberta, Hamilton/Avnet 403-250-9380
Can Calgary, Alberta, ITT/Multicomps. 403-273-2780
Can Concord, Ont., ITT/Multicomps. 416-736-1144
Can Dartmouth, Nova Scotia, ITT/Multicomps. 902-465-2350
Can Edmonton, Alberta, ITT/Multicomps. .. 403-438-4982
Can Mississauga, Ont., Hamilton/Avnet 416-677-7432
Can Mississauga, Ont., Time Elctrns. 416-672-5300
Can Nepean, Ont., Hamilton/Avnet 613-226-1700
Can Nepean, Ont., ITT/Multicomps. 613-596-6980
Can St. Laurent, Que., Hamilton/Avnet 514-335-1000
Can St. Laurent, Que., ITT/Multicomps. 514-335-7697
Can Stoney Creek, Ont., Westinghouse Canada, Inc. 416-664-3300
Can Willowdale, Ont., Electro Sonic, Inc. ... 416-494-1666
Can Winnipeg, Manitoba, ITT/Multicomps. 204-786-8401

POWER FUNCTIONS ENGINEERING, 3831 Cavalier Dr., Garland, TX 75042, Tel: 214-278-0996; Empl.: 9

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POWER GENERAL, Unitrode Corp., 152 Will Dr., Canton, MA 02021, Tel: 617-828-6216; Empl.: 300; *Sls. Mgr.:* Steve Forrester ..... **D•1987**

Local Sales Offices & Reps

AL Huntsville, Elec. Mktg. Assoc., Inc. 205-880-8050
AZ Tempe, Westrep 602-820-9932
CA Anaheim, Westrep 714-527-2822
CA Buena Park, Cypress Elctrns. 714-521-5230
CA San Diego, Cypress Elctrns. 619-535-0018
CA San Diego, Westrep 619-566-6580
CA Santa Clara, Westrep 408-988-8833
CO Englewood, Delltron Co. 303-741-2122
CT Wallingford, APEX Assocs. 203-267-6914
FL Altamonte Springs, Vantage Comp. ... 407-682-1199
FL Margate, EPM Corp. 305-977-0331
FL Orlando, EPM Corp. 407-425-6149
GA Atlanta, Elec. Mktg. Assoc., Inc. 404-448-1215
IL Itasca, Beta Technlg. Sls. 708-250-9586
IN Indianapolis, Schuster Elctrns. 317-253-9065
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Spectrum Sls. 319-366-0576
KS Overland Pk, SPECTRUM Sls. 913-648-6811
MD Columbia, Sager 301-995-6580
MA Canton, Power Gen. 617-828-6216
MA Westwood, APEX Assocs. 617-444-8070
MI Brighton, Applied Power 313-227-3604
MI Flint, RS Elctrns. 313-472-5000
MI Livonia, Leading Edge Sls. 313-478-6700
MN Eden Prairie, Com-Tek Sls. 612-941-7181
MO Florissant, Spectrum Sls. 314-921-1313
MO Hazelwood, Spectrum Sls. 314-921-1313
NJ Clifton Parks, Net Sls. 518-371-6864
NY Cortland, Net Sls. Co. 607-756-6592
NY Great Neck, F & F Metro, Inc. 516-482-4080
NY Victor, Net Sls. Co. 716-924-1844
NC Raleigh, Elec. Mktg. Assoc., Inc. 919-847-8800
OH Cincinnati, RS Elec. 513-793-2450
OH Cleveland, Schuster Elctrns. 216-425-8134
OH Cleveland, Schuster Elec. 216-425-8134
OH Columbus, McFadden Sls. 614-761-3177
OH Toledo, RS Elec. 419-893-0721
OR Portland, Venture Elctrns., Inc. 503-624-0617
PA Mars, Sager 412-772-2233
SC Greenville, EMA, Inc. 803-233-4637
TX Austin, Tesco, Inc. 512-834-8374
TX Dallas, Tesco, Inc. 214-553-1200
TX Houston, Tesco, Inc. 713-690-4909
TX Stafford, Southwest Elctrns. 713-240-4000
UT American Fork, Delltron Co. 801-263-9413
VA Sterling, Beacon North .. 800-877-3747,703-478-2480
WA Bellevue, Venture Elctrns. 206-454-4594
WI Milwaukee, Beta Technlg. Sls., Inc. 414-543-6609
Can Burnaby, B.C., Kaytronics Vancouver .. 604-294-2000
Can Concord, Ont., Kaytronics Inc.-Toronto 416-669-2262
Can Edmonton, I.T.T. Multicomp. 403-436-9555
Can Kanata, Ont., Kaytronics Inc.-Ottawa .. 613-564-0080
Can Montreal, Que., Kaytronics 514-745-5800
Can Ottawa, I.T.T. Multicomp. 613-596-6980
Can Winnipeg, I.T.T. Multicomp. 204-697-2300

Local Distributors

AL Huntsville, Cypress Elctrns. 800-526-6231
AZ Tempe, Cypress Elctrns. 602-966-2256
CA Buena Park, Cypress Elctrns. 714-521-5230
CA San Diego, Cypress Elctrns. 619-535-0018
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Englewood, Cypress Elctrns. 303-792-5829
CT Wallingford, Sager 203-265-4600
FL Deerfield Beach, Vantage Comps., Inc. 305-429-1001
FL Orlando, Sager 407-240-3114
GA Norcross, Applied Power 404-263-0421
IL Bensenville, Cypress Elctrns. 708-350-2005
IL Wood Dale, N. E. P. Elctrns. 708-595-8500
IA Cedar Rapids, Dee Elctrns. 319-365-7551
KS Kansas City, Olive Elctrns 913-362-1923
KS Overland Park, RS Elctrns. 913-362-1923
MD Columbia, Vantage Comp. 301-720-5100
MA Andover, Vantage Comp. 508-687-3900
MA Hingham, Sager 617-749-6700
MI Grand Rapids, RS Elctrns. 616-241-3483
MI Livonia, RS Elctrns. 313-525-1155
MN Eden Prairie, Cypress Elctrns. 612-934-2104
MO St. Louis, Olive Elctrns. 314-997-7709
NH Salem, Sager 603-898-2741
NY Buffalo, Summit Distrs. 716-887-2800
NY Hauppauge, Fairmont Elec. 516-231-3313
NY Hauppauge, Sager 516-348-1300
NC Raleigh, Sager 919-850-9550
OH Cincinnati, Schuster Elctrns. 513-489-1400
OR Beaverton, Cypress Elctrns. 503-223-8900
PA Philadelphia, Sager 215-464-4336,609-964-0830
TX Dallas, Cypress Elctrns. 214-255-0065
TX Stafford, Southwest Elctrns. 713-240-4000
WA Bothell, Cypress Elctrns. 206-483-1144
WI New Berlin, NEP Elctrns. 414-785-9100
Can Burnaby, B.C., I.T.T. Multicomps. 604-291-8866
Can Calgary, Alb., I.T.T. Multicomps. 403-273-2780
Can Concord, Ont., I.T.T. Multicomps. 416-736-1144
Can Montreal, I.T.T. Multicomp. 514-335-7697

POWER INTEGRITY CORP., 1834 Pembroke Rd., Greensboro, NC 27429-0682, Tel: 919-379-9773, 800-237-6260, TELEX: 919-379-1301; *Sls. Mgr.:* James T. Fesmire

POWERLINE,INC., Chloride Power Elctrns., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7329, TELEX: 5161003630, FAX: 508-879-8669

POWER MAGNE-TECH CORPORATION, 441 High Street, Perth Amboy, NJ 08861, Tel: 908-826-4700, FAX: 908-826-4706; Empl.: 65; *Sls. Mgr.:* Arthur Zuckerman; *Dist. Mgr.:* Arthur Zuckerman ..... **A•2371**

POWERMARK, See Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123

POWER/MATE CORPORATION, 2727 Kurtz St., San Diego, CA 92110, Tel: 800-843-8544, 619-299-3800, TWX: 910-335-1241, FAX: 619-291-2584; Empl.: 175

POWER MEASUREMENT LTD., 6702 Rajpur Place, Victoria, BC, Canada V8X 3X1, Tel: 604-652-5118, FAX: 604-652-0411; Empl.: 25; *Sls. Mgr.:* William I. McMillan, Gen. Mgr.

POWERNETICS LTD., Clarence St. Loughborough, Leics, ENG LE11 1DX, Tel: 0509 214153, TELEX: 34306, FAX: 0509 262460; Empl.: 66; *Sls. Mgr.:* Margaret A. Foggon, Export Sls. Mgr.

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AZ Huntsville, Capstone Elctrns. 602-437-0172
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CO Denver, Quorum 3 303-799-8100
CT Hamden, Datcom 203-288-7005
FL Boca Raton, Electrocraft 407-394-9686
FL Clearwater, Electrocraft 813-573-2277
GA Norcross, Montgomery Mktg. Inc. 404-447-6124
IL Chicago, M. Gottlieb & Assocs. 312-775-1151
IN Carmel, Technlg. Mktg. Corp. 317-844-8462
MN Edina, G.P. Sls., Inc. 612-831-2362
IN Ft. Wayne, Technlg. Mktg. Corp. 219-432-5553
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
KS Lenexa, Midwest Tech. Sls. 913-888-5100
KY Louisville, Technlg. Mktg. Corp. 502-893-1377
MD Baltimore, Eastern Comps. Sls. 800-223-3851
MA Waltham, Datcom, Inc. 617-891-4600
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NY Syracuse, Nycom, Inc. 315-437-8343
NC Cary, Montgomery Mktg. Inc. 919-467-6319
NC Raleigh, Montgomery Mktg. Inc. 919-851-0010
OH Columbus, Tom Mulligan Co. 614-457-2242
OK Tulsa, Advance Tech. Sls. 918-664-0482
OR Beaverton, Pacific Mktg. Specialist 503-641-9373
PA W. Conshohocken, Eastern Comp. Sls. 215-825-8610
TX Dallas, Advance Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
UT Salt Lake City, Quorum 3 801-943-9227
VA Redmond, Pacific Mktg. Specialist 206-882-3144
WI Milwaukee, M. Gottlieb & Assocs. 414-546-4466

Local Distributors

AL Huntsville, Bell Inds. 205-837-1074
AL Huntsville, Capstone Elctrns. 205-837-2141
AL Huntsville, Pioneer Elctrns. 205-837-9300
AK Anchorage, Frigid North 907-561-4633
AZ Phoenix, Sterling Elctrns. 602-268-2121

NY Tempe, Bell Inds. 602-966-7800
AZ Tempe, Capstone Elctrns. 602-437-0172
AR Ft. Smith, Carlton-Bates 501-646-8201
AR Little Rock, Carlton-Bates 501-562-9100
AR Pine Bluff, Carlton-Bates 501-535-1354
AR Springdale, Carlton-Bates 501-756-5012
CA Canoga Pk., FLW 818-719-0037
CA Chatsworth, Capstone Elctrns. 818-701-1424
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CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Los Alamitos, Compumech Elctrns. 714-826-0866
CA Mtn. View, Bell Inds. 408-745-0400
WA Richard, Radar Elec. 509-943-8836
CA Rocklin, Bell Inds. 916-652-0414
CA Sacramento, Bell Inds. 916-652-0414
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Capstone Elctrns. 619-277-7767
CA San Diego, FLW 619-434-5251
CA San Jose, Compumech Elctrns. 408-945-9100
CA Sunnyvale, Bell Inds. 408-745-0400
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvale, Capstone Elctrns. 408-453-9804
CA Thousand Oaks, Bell Inds. 805-499-6821
CA Tustin, Capstone Elctrns. 714-730-0349
CO Aurora, Capstone Elctrns. 303-790-7644
CO Denver, Bell Inds. 303-424-1985
CO Englewood, Sterling Elctrns. 303-792-3939
CT New Haven, Greene-Shaw Co. 203-265-3333
CT Norwalk, Capstone Elctrns. 203-265-4001
CT Norwalk, Pioneer Elctrns. 203-853-1515
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Altamonte Springs, Pioneer Elctrns. 407-834-9090
FL Deerfield Bch, Pioneer Elctrns. 305-428-8877
FL Ft. Lauderdale, Capstone Elctrns. 305-492-1211
FL Lake Mary, Capstone Elctrns. 407-333-9758
FL Largo, Bell Inds. 813-541-4434
FL Miami, Elctrn. Equip. Co. 305-526-6000
FL Tampa, Elctrn. Equip. 813-988-0810
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Capstone Elctrns. 404-623-3643
GA Norcross, Pioneer Elctrns. 404-448-1711
ID Boise, Radar Elec. 208-336-2227
IL Addison, Pioneer Elctrns. 312-495-9680
IL Arlington Heights, C. W. Elctrns. 312-439-9880
IL Arlington Hts., C.W. Elctrns. 708-439-9880
IL Bensonville, Voyager Elctrns. 312-860-1300
IL Elk Grove Village, Bell Inds. 312-640-1910
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IN Indianapolis, Capstone Elctrns. 317-290-9114
IN Indianapolis, Classic Comps. 317-872-4777
IN Indianapolis, Pioneer Elctrns. 317-849-7300
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IA Cedar Rapids, Capstone Elctrns. 319-395-9986
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KS Lenexa, Pioneer 913-492-0500
KS Overland Pk., Sterling Elctrns. 913-236-5589
LA Metarie, Sterling Elctrns. 504-436-1418
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MD Baltimore, Capstone Elctrns. 301-995-6775
MD Gaithersburg, Pioneer Elctrns. 301-921-0660
MD Rockville, Capstone Elctrns. 301-424-0244
MA Binghamton, Pioneer Elctrns. 617-748-8211
MA Canton, Richey/Impact Sls. 617-821-1500
MA Lexington, Pioneer Elctrns. 617-861-9200
MA Newton, Greene-Shaw Co. 617-969-8900
MA Wilmington, Capstone Elctrns. 508-657-5874
MA Wilmington, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Bell Inds. 313-971-9093
MI Ann Arbor, Capstone Elctrns. 313-462-9435
MI Grand Rapids, Capstone Elctrns. 616-243-9417
MI Grand Rapids, Pioneer 616-698-1800
MI Livonia, Chelsea Indl. RS Elctrns. 313-525-1155
MI Livonia, Pioneer Elctrns. 313-525-1800
MN Edina, Capstone Elctrns. 612-832-0066
MN Edina, Pioneer 612-944-3355
MN Fridley, Voyager 612-571-7766
MN Minneapolis, Sterling 612-831-2666
MO Springfield, Carlton-Bates 417-862-1699
MO St. Louis, Capstone Elctrns. 314-993-3837
MO St. Louis, Pioneer 314-432-4350
MO St. Louis, R. S. Olive Elec. 314-997-7709
NE Lincoln, Scott Elctrns. 402-466-8221
NE Omaha, Scott Elctrns. 402-734-6750
NH Hudson, Bell Inds. 603-882-1133
NH Manchester, Capstone Elctrns. 603-668-3633
NJ Mt. Laurel, Capstone Elctrns. 609-727-7800
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NY Hauppauge, Capstone Elctrns. 516-231-1574
NY Mamaroneck, Logicomp Elctrns. 914-698-9332
NY Rochester, Capstone Elctrns. 716-427-8863
NY Rochester, CAM/RPC Elctrns., Inc. 716-427-9999
NY Rochester, Pioneer Elctrns. 716-381-7070
NY Rochester, Zeller Elctrns. 716-254-8840
NY Woodbury, Pioneer Elctrns. 516-921-8700
NC Charlotte, Pioneer Elctrns. 704-527-8188
NC Raleigh, Capstone Elctrns. 919-954-0600
OH Centerville, Capstone Elctrns. 513-435-8815
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Cleveland, Pioneer Elctrns. 216-587-3600
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Bell Inds. (Military) 513-434-8231
OH Dayton, Pioneer Elctrns. 513-236-9900
OH Solon, Capstone Elctrns. 216-498-0105
OK Oklahoma City, Carlton-Bates 405-681-4446
OK Tulsa, Capstone Elctrns. 918-254-7811
OK Tulsa, Carlton-Bates 918-250-1626
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Capstone Elctrns. 503-626-0608
OR Portland, Bell Inds. 503-635-6500
OR Portland, Radar Elec. 503-232-3404
PA Horsham, Pioneer Elctrns. 215-674-4000
PA Monroeville, Capstone Elctrns. 412-372-4800
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Pittsburgh, Pioneer Elctrns. 412-782-2300
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TN Memphis, Carlton-Bates 901-365-3539
TN Nashville, Bell Inds. 615-367-4400
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TX Austin, Capstone Elctrns. 512-834-2671
TX Austin, Carlton-Bates 512-837-9098
TX Austin, Pioneer Elctrns. 512-835-4000
TX Austin, Sterling 512-836-1341
TX Carrollton, Capstone Elctrns. 214-380-9049
TX Dallas, Pioneer Elctrns. 214-386-7300
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TX Houston, Capstone Elctrns. 713-229-0475
TX Houston, Pioneer Elctrns. 713-988-5555
TX Houston, Sterling Elctrns. 713-623-6600
TX Texarkana, Carlton-Bates 214-792-6923
UT Midvale, Bell Inds. 801-255-9611
UT Salt Lake City, Capstone Elctrns. 801-973-9183
VA Herndon, Sterling Elctrns. 703-742-8400
VA Richmond, Sterling Elctrns. 804-226-2190

WA Bellevue, Bell Inds. 206-747-1515
WA Kent, Capstone Elctrns. 206-643-1388
WA Richardson, Radar Elec. 509-747-3053
WA Seattle, Radar Electric 206-282-2511
WA Spokane, Radar Elec. 509-747-3053
WI Brookfield, Capstone Elctrns. 414-792-1170
WI New Berlin, Classic Comps. 414-786-5300
WI Waukesha, Bell Inds. 414-547-8879
EXP CA, Los Angeles, Hanex, Inc. 213-556-3807
TX Austin, Advance Tech. Sls. 512-467-9209

POWER PAC, 875 Bridgeport Ave., Shelton, CT 06484, Tel: 203-925-0123, FAX: 203-929-4281; Empl.: 95; *Sls. Mgr.:* Guy Favreau ..... **D•2000-2002**

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AZ Tempe, Hanna-Hill Inc. 602-431-1771
CA Long Beach, QPI Sls., Inc. 213-596-1233
CA Oceanside, QPI Sls. 714-552-2849
CA Simi Valley, QPI Sls., Inc. 805-522-3060
CA Sunnyvale, Zytronix, Inc. 408-749-1326
CO Broomfield, Hanna-Hill Inc. 303-460-0602
CT Norwalk, J. Magnano Assoc. 203-847-9704
GA Marietta, B C Elctrn. Sls., Inc. 404-565-2088
IL Westchester, Cadre Techn. Rep., Inc. 312-449-3900
IN Fishers, Carter Techn., Inc. 317-842-9277
MD Lanham, W. A. Brown Equip. Corp. 301-577-6105
MA Marlborough, Digital Sls. Assocs., Inc. 508-480-0516
MI Farmington Hills, Carter Techn., Inc. 313-477-7700
MN Minneapolis, R J, Inc. 612-866-3661
NM Albuquerque, Hanna-Hill, Inc. 505-268-0950
NY Amsterdam, Traxonics, Inc. 518-843-1445
NY Great Neck, Mos Assocs. 516-487-3966
OH Berea, Carter Technlgs., Inc. 216-826-0400
PA King of Prussia, Kirk Sls., Inc. 215-783-6400
PA Pittsburgh, Carter Technlgs., Inc. 412-826-3800
TX Plano, GW Prods. 214-422-1746
UT Salt Lake City, Hanna-Hill, Inc. 801-364-0606
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POWER-PAK, INC., 6216 Oakton St., Morton Grove, IL 60053, Tel: 708-966-6000, FAX: 708-966-6009; Empl.: 35; *Sls. Mgr.:* Robert Villari

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CA Irvine, English/Damco 714-753-1950
CO Denver, Rick Moody 303-893-3771
FL Tampa, SRT Mktg. 813-884-4805
IL Chicago, Rendell Sls. Co. 312-539-1820
MD Sykesville, DJC Elctrns. 301-795-7020
MA Norwood, Assocd. Power Prods. 617-769-7516
MS Jackson, Doby Assocs. 601-981-1138
NJ Dumont, John Hart 201-385-5595
MN Bloomington, J.L.K. Tech. Sls. 612-884-0009
OH Chagrin Falls, L. W. Bennett & Assoc. 216-247-2174
TX Dallas, Power Connection 214-401-3490

Local Distributors

AK Anchorage, Revl 907-349-8790
CA Long Beach, Battery Specialties 800-352-3706
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CA Redmond City, HDB Elctrns. 415-368-1388
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AZ Phoenix, Lynntronics 602-433-0288
FL Altamonte Springs, TNR Tech. 800-346-0601
GA Decatur, Emergency Lighting Srvc. 404-981-2288
ID Boise, Kimball Elctrns. 208-342-3559
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KS Kansas City, Elctrn. Supply 816-931-0250
LA Lafayette, Ralph's Elctrns. 318-233-0105
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NE Lincoln, Scott Elctrn. Supp. 402-466-0221
NJ Fairfield, AFY Security Dist. 201-882-2888
NY Ridgewood, J.A. McDermott Corp. 718-456-3606
OH Cleveland, Security Prods. Co. 216-451-1400
TX Austin, Galtronics 512-837-7470
TX Ft. Worth, Allied Elctrns. 800-433-5700
VA Tabb, Battery Outlet 804-867-8280
WA Redmond, Energy Sls. 206-883-2343

POWER STAR, INC., P.O. Box 18701, Irvine, CA 92713, Tel: 714-261-5377, 800-854-9420, FAX: 714-261-5381; Empl.: 11

POWER SUPPLY CONCEPTS INC., 1 Commerical Dr., Florida, NY 10921, Tel: 914-651-5000, FAX: 914-651-5050 ..... **D•2004-2005**

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POWER SWITCH CORPORATION, 17 Vreeland St., Lodi, NJ 07644, Tel: 201-478-5788; Empl.: 33; *Sls. Mgr.:* Danice Donito ..... **D•2007-2011**

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OH Cleveland, Bradcor Elctrns. 216-671-1200
OH Dayton, Bradcor Elctrns. 216-671-1200
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POWER SYSTEMS, INC., 45 Griffin Rd., South, Bloomfield, CT 06002, Tel: 203-726-1300, FAX: 203-726-1495; FSC No.: 50463; Empl.: 310; *Sls. Mgr.:* Leon Gedacht ..... **D•2012**

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CA Los Altos, Recht Assocs. 415-964-6038
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FL Mt. Dora, Hedrick, Walker & Assoc. 904-735-2600
FL Riviera Bch., Hedrick, Walker & Assoc. 407-842-5015
GA Dunwoody, Hedrick, Walker & Assoc. 404-390-9718
MA Needham Hgts., Todino Engrg. Sls. 617-444-7925
MO Kansas City, EPI Inc. 816-523-8911
MO St. Louis, EPI, Inc. 314-962-1411
NJ Marlton, BGR Assocs. 609-683-1020
NJ S. Orange, Kahgan Brody Assocs. 201-763-6038
NY Fayetteville, H.C. Johnson Agencies, Inc. 315-637-1143
NY Hempstead, Kahgan Brody Assocs 516-538-2300
NY Rochester, H.C. Johnson Agencies, Inc. 716-586-0777
NC Carrboro, Hedrick, Walker & Assoc. 919-967-6725
OH Cleveland, Elctrn. Comps., Inc. 216-331-5330
OH Columbus, Elctrn. Comps., Inc. 614-231-2318
OH Miamisburg, Elctrns. Comps. 513-866-3340
OH West Lake, Elctrn. Comps., Inc. 216-835-4856
TX Seagoville, Delta Comps., Inc. 214-287-6333
VA Falls Church, S-J Chesapeake 703-533-2233
WA Kirkland, Northwest Comps. Sls. 206-828-2104
WA Vancouver, Northwest Comp. Sls. 206-695-1331

POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803, FAX: 804-358-0498; Empl.: 55

POWER SYS. GRP., Rantec Div., Emerson Elec. Co., 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247; FSC No.: 04971; Empl.: 265; *Sls. Mgr.:* Fred Silver

POWERTEC
A DIVISION OF ASTEC AMERICA, INC.

POWERTEC POWER SUPPLIES, INC., DIV. OF ASTEC AMERICA, See Astec America

POWERTECH, INC., 0-02 Fairlawn Ave., Fairlawn, NJ 07410, Tel: 201-791-5050, TELEX: 353970; FSC No.: 32953; Empl.: 49; *Sls. Mgr.:* C. Sokolowski

POWER TECHNOLOGY COMPONENTS, A Div. of Microsemi Corp., 23201 S. Normandie Ave., Torrance, CA 90501, Tel: 213-534-3737, FAX: 213-530-5609; *Sls. Mgr.:* Robert Veeck

POWER TECHNOLOGY, INC., P.O. Box 191117, Little Rock, AR 72219-1117, Tel: 501-568-1995, FAX: 501-568-1994; Empl.: 85; *Sls. Mgr.:* John Webb

POWER TEN, INC., 486 Mercury Dr., Sunnyvale, CA 94086, Tel: 408-738-5959, FAX: 408-738-4326; FSC No.: 61987; *Sls. Mgr.:* Vince Mutascio ..... **D•2013**

Local Sales Offices & Reps
AL Huntsville, Scientific Devices-SE 205-536-1969
AZ Phoenix, Jayson Co., Inc. 602-867-1964
CA Los Alamitos, Power Specialists 213-594-9418
CA San Diego, Power Specialists 619-726-4799
FL Orlando, Scientific Devices-SE 407-841-8180
IL Arlington Hgts., Comtel Midwest Co. 708-392-4040
IN Indianapolis, Comtel Midwest Co. 317-253-1681
KS Shawnee Mission, Comtel Midwest Co. 913-268-0762
MD Hunt Valley, Elctrn. Resources, Inc. 301-584-8157
MA Westford, ICS Assocs. 508-692-3545
MN Wayzata, Comtel Midwest Co. 612-476-1551
MO Manchester, Comtel Midwest Co. 314-227-7220
NM Aluquerque, Fry-Gates 505-262-1525
NC Raliegh, Scientific Devices-SE 919-859-0868
PA West Chester, Elctrn. Resources, Inc. 215-431-0198
TX Austin, Eberts Elctrns. Sls. 512-258-1067
TX Latexo, Eberts Elctrns. Sls. 409-687-4342
VA Norfolk, Elctrn. Resources, Inc. 804-583-4859
WA Bellevue, A. J. Smith Co. 206-746-6770
WI New Berlin, Comtel Midwest Co. 414-544-6042
Can N. Vancouver, BC, Jerome & Francis 604-986-1286
Can Toronto, Duncan Instruments 416-742-4448

POWER TEST DIVISION, INC., Subsidiary of Analogic Corp., 1701 Rollins Rd., Burlingame, CA 94010, Tel: 415-692-8001, FAX: 415-692-8044; *Sls. Mgr.:* Tom Mahr

POWERTREND, INC., 1111 Rancho Conejo Blvd., Ste. 401, Newbury Pk., CA 91320-1415, Tel: 805-496-2945, FAX: 805-498-6880; *Sls. Mgr.:* R. Jones

POWER TRENDS, INC., 1101 N. Raddant Rd., Batavia, IL 60510, Tel: 708-406-0900, FAX: 708-406-0901; Empl.: 12; *Sls. Mgr.:* Don Matthiesen

Powertron

FAX: 516-883-7155

POWERTRON CORPORATION, Industrial Test Equipment Co., Inc., 21 Yennicock Ave., Port Wash., NY 11050, Tel: 516-883-1700; Empl.: 6; *Sls. Mgr.:* Barbara Assa ..... **D•1266, 2204-2205**

POWERTRON, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210, Tel: 704-525-8962, TELEX: 572-444

POWERTRON CORP., Rte. 15, P.O. Box 932, Dept. E, Sparta, NJ 07871, Tel: 201-579-5599, TELEX: 136198; *Sls. Mgr.:* William E. Cannon; *Dist. Mgr.:* William E. Cannon

POWR-UPS CORP., Brookhaven R&D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-5700, 1-800-333-POWR, FAX: 516-345-3106; Empl.: 50; *Sls. Mgr.:* Mary Del Rios

PPC PRODUCTS CORPORATION, 7516 Central Industrial Dr., Riviera Beach, FL 33404, Tel: 407-848-9606, TWX: 510-952-7611; FSC No.: 33178; Empl.: 75; *Sls. Mgr.:* Nick Ernick

PPD

FAX: 919-781-4980

PPD, INC., 6001 Resco Ct., Raleigh, NC 27613, Tel: 919-781-3955; Empl.: 25 ..... **A•1130-1137; B•1386-1387**

Local Sales Offices & Reps
NC Raleigh, Godwin Assocs. 919-878-8000

PPM, INC., 5835 Harper Rd., Cleveland, OH 44139, Tel: 216-349-2300, FAX: 216-349-2302; FSC No.: 29504; Empl.: 20; *Sls. Mgr.:* A. L. Bletcher ..... **D•1311**

Local Sales Offices & Reps
AL Huntsville, Jim Springer, Inc. 205-883-4163
AZ Phoenix, J. Smith & Assocs. 602-267-0981
CA Montrose, Luscombe Engrg. Co. 818-249-9000
CO Colorado Springs, J. Smith & Assocs. 719-597-5343
MI Ferndale, Tiby Co. 313-547-3550
NM Albuquerque, J. Smith & Assocs. 505-345-6501
OH Cleveland, Tiby Co. 216-371-5335
OH Dayton, Tiby Co. 513-277-3822

PRACTICAL AUTOMATION, INC., 2 Research Dr., Shelton, CT 06484, Tel: 203-929-5381, TELEX: 6813310, FAX: 203-929-9941; Empl.: 150; *Sls. Mgr.:* R. M. Banzaca

PRD ELCTRNS., DIV. OF HARRIS CORP., see Harris Corp., PRD Electronics Div.

PRECICONTACT, INC., 835 Wheeler Way, Langhorne, PA 19047, Tel: 215-757-1202, TELEX: 83-4253, FAX: 215-757-8025; FSC No.: 60197; Empl.: 60; *Sls. Mgr.:* Paul F. Ruo

PRECI-DIP, See Mill-Max Mfg. Corp.

PRECISE SENSORS, INC., 235 West Chestnut Ave., Monrovia, CA 91016, Tel: 818-358-4578, FAX: 818-358-3546; Empl.: 35

PRECISION COMPONENTS, INC., 1110 W. National Ave., Addison, IL 60101, Tel: 312-543-6400, FAX: 312-628-8788

PRECISION CONTROL MANUFACTURING, INC., 1509-B Queen Anne Ave. N., Seattle, WA 98109, Tel: 206-281-9380; FSC No.: 64782; Empl.: 5; *Sls. Mgr.:* Steve L. Deters ..... **A•2062**

Local Sales Offices & Reps
WA Seattle, Precision Control Mfg., Inc. 206-281-9380

Local Distributors
CA Granada Hills, Lion Elctrn., Inc. 818-363-0993

PRECISION DIGITAL CORP., 15 Mercer Road, Natick, MA 01760, Tel: 508-655-7300, FAX: 508-655-8990; *Sls. Mgr.:* Jeffrey Peters

PRECISION ELECTRONIC HARDWARE, INC., 987 Woodtick Road, Waterbury, CT 06705, Tel: 203-754-0779, FAX: 203-755-7996; Empl.: 25; *Sls. Mgr.:* Jeffrey A. Balko

PRECISION ELECTRONICS, 9101 King Ave., Franklin Park, IL 60131, Tel: 708-678-5350, FAX: 708-678-0511; Empl.: 25; *Sls. Mgr.:* William Stow

PRECISION ELECTRO-OPTICS, INC., 30 Commerce St., Box 1039, Chatham, NJ 07928, Tel: 201-635-8811, FAX: 201-635-0437; FSC No.: OG1WB-Cage Code; Empl.: 8; *Sls. Mgr.:* Jim Ingram

PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 708-766-0340, FAX: 708-766-0495; Empl.: 185; *Sls. Mgr.:* Richard Ziehm

PFT

FAX: 219-253-6570

PRECISION FABRICATION TECHNOLOGIES, INC., State Road 16 W., Monon, IN 47959, Tel: 1-800-558-7297, 219-253-6666; Empl.: 100; *Sls. Mgr.:* Joseph Rogers; *Dist. Mgr.:* Duane Nagel ..... **C•1081-1089**

Local Sales Offices & Reps

CA	Saratoga, Edward King & Assocs.	408-741-0434
CT	Old Saybrook, FJS Assocs.	203-388-5374
MI	Livonia, Amtech Reps.	313-474-8300
FL	Orlando, Aurora-Schmitt Assoc.	800-232-9005
IL	Cary, Bob Burns & Assocs.	708-516-3322
MA	Burlington, FJS Assocs.	617-273-5959
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NY	Hauppauge, Schmitt Mktg. Corp.	516-434-1313
OR	Portland, Caruso & Co.	503-620-0375
TX	Austin, S.W. Mktg. Assoc.	512-255-8010
TX	Dallas, S.W. Mktg. Assocs.	214-341-8631
TX	Houston, S.W. Mktg. Assocs.	713-537-8166
WA	Bellevue, Caruso & Co.	206-455-8811
WI	Colgate, Rep One & Assocs.	414-628-4016
WI	Madison, Rep One & Assoc.	608-246-8889

Local Distributors

CA	Chatsworth, Marshall Inds.	818-407-4150
CA	Costa Mesa, Marvac Elctrns.	714-540-3280
CA	Irvine, Marshall Inds.	714-458-5394
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Clara, Context Engrg.	408-748-8676
IL	Champaign, Klaus Radio	217-356-1896
MD	Rockville, Capitol Radio	301-881-2270
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Northboro, Papi Supp.	508-393-8564
MI	Grand Rapids, S F Elctrn. Supp.	616-459-0216
MI	Livonia, LWC Distributors	313-464-7700
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	New York City, Martin Audio	212-541-5900
OR	Portland, Radar Elec.	503-232-8353
TX	Austin, Altex Elctrns.	512-832-9131
TX	Fort Worth, Allied Elctrns.	817-595-3500
TX	San Antonio, Altex Elctrns.	512-828-0503
VA	Annandale, Arcade Elctrns.	703-256-4610
VA	Richmond, Norfolk Wire	804-355-1100
VA	Virginia Beach, Norfolk Wire	804-449-3449
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, NEP Elctrns.	414-785-9100

PRECISION FILTERS, INC.

FAX: 607-277-4466

PRECISION FILTERS, 240 Cherry St., Ithaca, NY 14850, Tel: 607-277-3550, TELEX: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 95; *Sls. Mgr.:* D. F. Chandler ..... **A•1650, 1706-1707; D•1015, 1192-1193**

Local Sales Offices & Reps

AZ	Tempe, Hannah-Hill	602-431-1771
CA	Chatsworth, Technologies West	818-349-2001
IL	Matteson, Instrumentation Sls. Inc.	708-720-0705
CA	Pleasonton, SECCO Sales, INc.	415-484-1030
CO	Denver, Hannah-Hill, Inc.	303-424-5390
AZ	Tempe, Hannah-Hill, Inc.	602-431-1771
DC	Arlington, Gans & Pugh	703-527-3262
FL	Orlando, Microspec	407-898-3504
GA	Lilburn, Microspec	404-921-3840
IL	Matteson, Instrumentation Sales. Inc.	708-720-0705
IN	Indianapolis, RDP Corp.	317-243-8788
MD	W. Friendship, Gans & Pugh Assocs.	301-442-2189
MA	Boston, Ellis Assocs.	617-367-2170
MI	Farmington Hills, RDP Corp.	313-471-0685
NH	Manchester, Ellis Assocs.	603-623-0185
NM	Albequerque, Hannah-Hill, Inc.	505-268-0950
NY	Amherst, Reliable Measurement	716-892-9484
NY	Port Chester, Radiation Elctrns.	914-937-2300
OH	Dayton, RDP Corp.	513-253-6175
OH	Richfield, RDP Corp.	216-659-3138
OK	Oklahoma City, Abcor, Inc.	405-749-1600
PA	North Wales, Gans & Pugh Associates, Inc.	215-699-6655
PA	Pittsburg, RDP Corp.	412-487-2217
SC	Rock Hill, Microspec	803-366-3015
TN	Nashville, Microspec	615-383-4064
TX	Houston, ABCOR, Inc.	713-486-9251
UT	West Valley City, Hannah-Hill, Inc.	801-364-0606
VA	Herndon, Gans & Pugh Assocs.	703-709-0305
WA	Bellevue, Syntek	206-462-7700

PRECISION GRAPHICS INC., 59 La Grange St., Raritan, NJ 08869, Tel: 908-707-8880, FAX: 908-707-8884; Empl.: 36; *Sls. Mgr.:* David K. Weissman

PRECISION IMAGE CORPORATION, 501 Chesapeake Dr., Redwood City, CA 94063, Tel: 415-366-8900, 1-800-338-3377, FAX: 415-366-2149; Empl.: 70; *Sls. Mgr.:* Mr. Rene Carillo; *Dist. Mgr.:* Mr. Rene Carillo

PRECISION INTERCONNECT, 16640 SW 72nd Ave., Portland, OR 97224, Tel: 503-620-9400, TELEX: 36-0963; FSC No.: 60381; Empl.: 295; *Sls. Mgr.:* Alex Guletsky

PRECISION LAMP, INC., 681 Portal St., Cotati, CA 94931, Tel: 707-792-0333, FAX: 707-792-2738; FSC No.: FSCM 58451; Empl.: 65

PRECISION MECHANISMS, 50 Bond St., Westbury, NY 11590, Tel: 516-ED3-5955, FAX: 516-333-5956; FSC No.: 08127; Empl.: 25; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODUCTS CO., Centennial Indl. Pk., Peabody, MA 01961-6026, Tel: 508-532-5500, FAX: 508-532-9403; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert A. Degnan

PRECISION MONOLITHICS INC. SUBSIDIARY OF BOURNS INC., 1500 Space Park Dr. PO Box 58020, Santa Clara, CA 95052-8020, Tel: 408-727-1500, 800-843-1515, TELEX: 71-371-9541, ESYLNK: 408-727-1550; Empl.: 1000; *Sls. Mgr.:* Peter Smyth; *Dist. Mgr.:* Cindy Joyce

PRECISION PAPER TUBE CO., 1033 South Noel Ave, Wheeling, IL 60090, Tel: 708-537-4250, FAX: 708-537-5777; Empl.: 250

PRECISION POWER SYSTEMS, 1840 Industrial Circle, Longmont, CO 80501, Tel: 303-443-6250, FAX: 303-678-8360; Empl.: 110; *Sls. Mgr.:* Linda Tholen

FAX: 319-394-9280

PRECISION RESISTIVE PRODUCTS, INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131; Empl.: 65; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline ..... **A•1976-1977**

Local Sales Offices & Reps

AL	Huntsville, Hughes & Assocs.	205-533-9108
CA	Burbank, Darco	818-504-2425
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	San Diego, Darco	714-639-5698
CO	Grand Junction, Krebil Comp. Sls.	303-243-8220
MA	Lexington, Jesco, Inc.	617-893-1598
MN	Minneapolis, Intl. Sls. Co.	612-831-8423
TX	Rowlett, Campion Sls. Co.	214-475-8313

FAX: 813-546-9515

PRECISION RESISTOR CO., INC., 10601 75 St. N., Largo, FL 34647-1421, Tel: 813-541-5771, TELEX: 821788; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* Arleen Reid ..... **A•1978-1981**

PRECISION SPECIALTIES, INC., 19414 Londelius St, Northridge, CA 91324, Tel: 818-349-9774, FAX: 818-349-4367; FSC No.: 66785; Empl.: 10

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128, FAX: 415-856-1638

PRECISION TUBE, Church Rd. & Wissahickon, N. Wales, PA 19454, Tel: 215-699-5801, FAX: 215-699-0761; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

PREFERRED ELECTRONICS, INC., Main Line Dr., P.O. Box 248, Westfield, MA 01086, Tel: 413-568-2301, 1-800-553-6374, TELEX: 955-329, FAX: 413-562-7275; Empl.: 225

PREH ELECTRONIC INDUSTRIES, INC., 470 E. Main St., Lake Zurich, IL 60047-2578, Tel: 708-438-4000, FAX: 708-438-5522; FSC No.: 36-3193682; Empl.: 7; *Sls. Mgr.:* Ken Wood; *Dist. Mgr.:* Bob Van Orden ..... **B•1765, 1827-1829; C•1508-1509**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, More Sls., Inc.	602-788-9181
CA	Irvine, Balzer/Wolf Assocs.	714-261-6877
CA	Mtn. View, Bart Budge Assocs.	415-961-0940
CO	Arvada, Arrowhead CSI/ Sls.	303-423-5597
CT	Cheshire, MacInnis	203-272-8877
FL	Miami, Indl. Comps.	305-477-0387
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Des Plaines, Essco Assocs.	708-298-5310
MD	Columbia, L. D. Lowery, Inc.	301-381-0225
MA	Norwood, MacInnis Co.	617-762-8090
MI	Farmington Hills, R.C. Merchant	313-476-4600
MN	Bloomington, Electronic Sls. Agy.	612-884-8291
MS	Corinth, Hughes Assocs.	601-287-2915
MO	St. Louis, Jim Amberg	314-946-5777
NJ	Berkley Heights, Cambridge/Allen	201-464-0203
NC	Cary, Hughes Assocs.	919-467-7029
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
OR	Portland, SPS Elctrns.	503-297-6919
PA	Broomall, L.D. Lowery Inc.	215-356-5300
TN	Jonesboro, Hughes Assocs.	615-753-2719
TX	Round Rock, Encore Tech. Comps.	214-418-0188
UT	Salt Lake City, Arrowhead CSI/Sls.	801-268-8440
WA	Redmond, SPS Elctrns.	206-885-5257
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
CA	Belmont, LoDan Elctrns. Inc.	415-592-4600
CA	Compton, Harper S.I.D.	213-979-5090
CA	Gardena, California Switch & Signal	213-770-2330
CA	San Carlos, LoDan Elctrns.	415-592-4600
CA	San Diego, California Switch	619-231-6740
CA	San Diego, Harper S.I.D.	619-578-2500
CA	San Jose, Harper S.I.D.	408-943-9490
CO	Arvada, Denver Beta Wintronic	303-431-7161
CT	Norwalk, Cobra Comps.	203-847-6442
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Largo, LoDan Elctrns., Inc.	813-586-2851
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, Hammond Elctrns.	404-449-1996
IL	Arlington Hgts., LoDan Elctrns.	312-398-5311
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Indianapolis, P.E.I. Genesis	317-879-0700
MA	Hingham, Sager Elctrl. Supp. Co.	617-749-6700
MA	Westborough, In Stock Prods. Co.	617-870-5750
MN	New Brighton, Parts 1	612-633-8079
MO	Jackson, Rapco Inds.	314-243-1433
NJ	Camden, Gen. Radio Supp. Co.	609-964-8560
NY	Bohemia, Key Comps.	516-567-7500
NY	Hempstead, Elctrn. Equip.	516-538-5510
NY	Rochester, Whirlwind Music Distrs.	716-663-8820
NC	Greensboro, Hammond Elctrns.	919-275-6391
OR	Beaverton, Component Resources	503-641-8488
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Philidelphia, P.E.I. Genesis	215-673-0400
SC	Greenville, Hammond Elctrns.	803-232-0872
TX	Richardson, Off The Shelf Comps.	214-238-0808
WA	Seattle, Radar Elec.	206-282-2511
Can	London, Ont., C. M. Peterson Co. Ltd.	519-434-3204
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-9999
Can	Willowdale, Ont., Electrosonic Inc.	416-494-1666

PREMA PRECISION ELECTRONICS, INC., 4650 Arrow Hwy. Suite E-5, Montclair, CA 91763, Tel: 714-621-7292, FAX: 714-625-2098

FAX: 212-993-9211

PREMIER METAL PRODS. CO., 381 Canal Pl, Bronx, NY 10451, Tel: 212-993-9200; Empl.: 75; *Sls. Mgr.:* Anthony E. Bozza ..... **C•1090-1091**

Local Sales Offices & Reps

AZ	Tempe, Scientific Dvcs.	602-730-9774
CA	Fontana, Premier Metal	714-829-3089
CA	Huntington Bch., Scientific Dvcs.	714-840-3501
CA	San Jose, Scientific Dvcs.	408-554-0455
CO	Denver, AKI Enterprises	303-338-4488
CT	East Haven, Eagle Assocs.	203-467-6542
GA	Marietta, Adams & Assocs.	404-973-0853
IL	W. Chicago, May Assocs.	708-293-7763
KS	Kansas City, Delltron Co.	816-436-6445
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Eagle Assocs.	617-444-3446
MI	Brighton, Electronic Sources	313-227-3598
MN	Minneapolis, J.E.M. Anderson Co.	612-823-6459
MO	Florissant, Delltron Co.	314-839-0033
NM	Albuquerque, Brytec-Scientific Devices	505-883-3668

NY New Hyde Park, Harris & Aldrich Sls. 516-488-2622
NY Yonkers, Sonkin Assocs. 914-968-8282
NC Greenboro, Adams & Assocs. 919-272-6838
OH Cleveland, Del Steffen & Assoc. 216-461-8333
PA Penndel, Delta Mktg. 215-750-1440
TX Richardson, Spectra Sls. Corp. 214-234-3600
WA Redmond, Scientific Dvcs 206-885-0004
EXP FL, Ft. Lauderdale, GM Intl. 305-434-6617

Local Distributors

AZ Phoenix, Dalis Elctrns. 602-275-2885
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Jose, Quement Elctrns. 408-998-5900
CA San Jose, Rose Elctrns. 408-943-0255
CT Wallingford, Sager Elctrl. Supp. 203-265-4600
ID Boise, Radar Elec. 208-336-2227
IL Skokie, Anixter 708-677-2600
LA Baton Rouge, Menard Elctrns. 504-355-0323
MD Baltimore, Resco 301-823-0070
MA Hingham, Sager Electrical Supp. 617-749-6700
MI Ann Arbor, Purchase Radio Supp. 313-668-8696
MO St. Louis, Gateway Elctrn. Supp. 314-427-6116
NJ Cranford, Garden State Indl. Elec. 201-272-6400
NY Buffalo, Summit Distrs. 716-884-3450
NY Hauppauge, Broadline Elec. Dist. 516-231-4100
NY Hempstead, Davis Elctrn. Corp. 516-483-9200
NY LIC, H. L. Dalis Inc. 212-361-1100
NY New York, Martin Audio/Video Corp. 212-541-5900
NY Portchester, Wise Comps. 914-939-8600
NY Rochester, Simcona Elctrn. Corp. 716-328-3230
NY Rochester, Summit Elctrns. 716-334-8110
NC Raleigh, Southeastern Radio 919-828-2311
OH Warren, Rem Elctrns. 216-248-1636
OR Portland, Radar Elec. 503-232-3404
PA Horsham, Toner Cable Equip. 215-675-2053
PA West Chester, West Chester Elec. Supp. 215-696-7500
SC Charleston, Wholesale Indl. Elec. 803-722-2634
TN Clarksville, Randolph Hale & Matthews 615-647-2325
TN Cookeville, Randolph & Parks 615-526-6184
TN Nashville, Randolph & Rice 615-255-5601
TN Tullahoma, Randolph Rice & Williams 615-455-4531
TX Ft. Worth, Swieco Inc. 817-335-6521
TX Houston, Lenert Co. 713-225-1465
VA Arlington, Arlington Elctrns. 703-524-2412
WA Richland, Radar Elec. 509-943-8336
WA Seattle, Radar Elec. Co. 206-282-2511

PREMIER MICROWAVE, 35 New Broad St, Port Chester, NY 10573, Tel: 914-939-8900, FAX: 914-939-9239; FSC No.: 15870; Empl.: 65; *Sls. Mgr.:* Mel Radner

PREM

FAX: 815-385-8578

PREM MAGNETICS, INC., 3521 N. Chapel Hill Rd., McHenry, IL 60050, Tel: 815-385-2700; FSC No.: 20462; Empl.: 180; *Sls. Mgr.:* D. Hertel ..... **A•1250-1253, 2372-2383**

PRES-AIR-TROL CORP., 1009 Boston Post Rd., Mamaroneck, NY 10543, Tel: 914-698-2026, 800-431-2625 (outside NY), FAX: 914-698-9456; Empl.: 25; *Sls. Mgr.:* Doug Robinson ..... **B•1766**

PRESCO, INC., 8 Lunar Drive, Woodbridge, CT 06525, Tel: 203-397-8722, FAX: 203-389-1129; Empl.: 11

PRESIDIO COMPONENTS, INC., 7185 Construction Ct., San Diego, CA 92121, Tel: 619-578-9390, FAX: 619-578-6225; FSC No.: 60212

PRESS-ON PRODUCTS, 21 Factory Rd., Addison, IL 60101, Tel: 708-628-2255, FAX: 708-543-4414; Empl.: 20; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 406 Cortlandt St, Belleville, NJ 07109, Tel: 201-751-5002, FAX: 201-751-9653; FSC No.: 52193; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYSTEMS, INC., 34 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, TELEX: 901406, FAX: 804-766-2644; Empl.: 98; *Sls. Mgr.:* J. S. Yakshe

PRIMELINE, Soltec Corporation, P. O. Box 670, San Fernando, CA 91341-0670, Tel: 818-365-0101, TELEX: 494-3094 SOLTEC UI, FAX: 818-365-7839; *Sls. Mgr.:* Byron McIntire

PRIME POWER, A Prime Technology Co., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; *Sls. Mgr.:* J. L. Jamieson

PRIME TECHNOLOGY, INC., See General Resistance, A Prime Technology Co.

PRIMO COMPANY LIMITED, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan 181, Tel: 0422-43-3121; FSC No.: 0422 49 8865; Empl.: 391; *Sls. Mgr.:* H. Ikoma; *Dist. Mgr.:* S. Mizutani

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 908-687-1750, FAX: 908-687-1755; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELECTRONIC PRODUCTS, 2549 U.S. Highway 1, North Brunswick, NJ 08902, Tel: 908-297-4448, FAX: 908-821-5950; Empl.: 29; *Sls. Mgr.:* H. Center; *Dist. Mgr.:* H. Center

PRINCO INSTRUMENTS, INC., 1020 Industrial Hwy., Southampton, PA 18966; FSC No.: 48620; Empl.: 70; *Sls. Mgr.:* G. G. Pfaff

PRINTER PRODUCTS, 25 Denby Road, Boston, MA 02134, Tel: 617-254-1200, FAX: 617-254-6848; Empl.: 200; *Sls. Mgr.:* Bruce Burgess; *Dist. Mgr.:* Bruce Burgess

PRO BATTERY, INC., 3941 Oakcliff Indl. Ct., Atlanta, GA 30340, Tel: 800-451-7171, FAX: 404-449-5457; Empl.: 35; *Sls. Mgr.:* Neal A. Zucker

PROBE MASTER, INC., 4898 Ronson Ct, San Diego, CA 92111, Tel: 619-560-9676, 800-772-1519, FAX: 619-560-7354; *Sls. Mgr.:* Dick Press

PROBE-RITE, INC., P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-243-7219; *Sls. Mgr.:* Frank J. Ardezzone

PRO COM TECHNOLOGY INC., 28 Commerce Dr., Farmingdale, NY 11735, Tel: 516-293-4443, 800-762-3785, FAX: 516-293-4456; Empl.: 11; *Sls. Mgr.:* Alan Spiegel

PRODELIN CORPORATION, P.O. Box 368, Conover, NC 28613, Tel: 704-464-4141, FAX: 704-464-5725; Empl.: 100; *Sls. Mgr.:* Dan Johnson

PRODIGIT ELECTRONICS, 9301-101 Jordan Ave., Chatsworth, CA 91311, Tel: 818-341-6987, FAX: 818-341-5726; Empl.: 100; *Sls. Mgr.:* Daniel Erb ..... **D•2003**

PRODUCTION AUTOMATION, INC., 3160 De la Cruz Blvd. Ste. 210, Santa Clara, CA 95054, Tel: 408-980-9880, FAX: 408-980-8018; Empl.: 4; *Sls. Mgr.:* Bill Minnick; *Dist. Mgr.:* Bill Minnick

PRODUCTRONICS INC., 7616 Disalle Blvd., Fort Wayne, IN 46825, Tel: 219-489-8201, FAX: 219-489-6573; Empl.: 4; *Sls. Mgr.:* Bernard James

PRODUCTS ENGRG. CORP., 503 S. Vincent Ave., Azusa, CA 91702, Tel: 818-969-5879, TELEX: 910-587-1559, FAX: 818-969-9381; FSC No.: CAGE 3S621; Empl.: 45; *Sls. Mgr.:* Richard Mitchell

PRODUCTS FOR RESEARCH, 88 Holten St, Danvers, MA 01923, Tel: 508-774-3250, FAX: 617-245-1628; Empl.: 17; *Sls. Mgr.:* Skip Moccia

PTI PRODUCT TECHNOLOGY INC.

FAX: 714-474-1340

PRODUCT TECHNOLOGY, INC., 2811-B McGaw Avenue, Irvine, CA 92714, Tel: 714-474-8998; FSC No.: 1Z295; Empl.: 45 ..... **C•1661, 1684**

Local Sales Offices & Reps

AL Huntsville, Mec-Elec 205-881-1522
AZ Tempe, Integrated Tech. Sls. 602-968-5118
CA San Diego, Qualtronics 619-695-0118
OH Cincinnati, Bob Gilbert & Assocs. 513-574-1932
TX Dallas, Passive Comps. Assocs. 214-824-6162
UT Salt Lake City, Sierra Tech. Sls. 801-566-9719

Local Distributors

AZ Scottsdale, Added Value 602-951-9788
CA San Diego, Added Value 619-558-8890
CA Tustin, Added Value 714-259-8258
CA Visalia, Added Value 209-734-8861
CA Westlake Village, Added Value 818-889-2861
CO Wheat Ridge, Added Value 303-422-1701
TX Austin, Added Value 512-454-8845
TX Dallas, Added Value 214-404-1144
UT West Valley City, Added Value 801-975-9500

PROF. A/V & SPECIALTY PROD. DIV., 223-5N-01, St. Paul, MN 55144-1000, Tel: 612-733-7644, FAX: 612-737-5583; Empl.: 38,351

PROFESSIONAL ENGINEERING SYSTEMS, 425 Parkway Dr., Erie, PA 16511-1051, Tel: 814-453-5452

PROGRAMMABLE DEVICES, INC., 155-T New Boston St., Woburn, MA 01801, Tel: 617-935-9530, FAX: 617-935-3654; Empl.: 10

PTS FREQUENCY SYNTHESIZERS

FAX: 508-486-4495

PROGRAMMED TEST SOURCES, 9 Beaver Brook Road, P.O. Box 517, Littleton, MA 01460, Tel: 508-486-3008; FSC No.: 66381; Empl.: 30 ..... **D•1312**

PRB LINE®

FAX: 1-800-635-8101

PROJECTOR RECORDER BELT CORP., Route 3 Highway 59 P.O. Box 176, Whitewater, WI 53190, Tel: 1-800-533-9654; Empl.: 30; *Sls. Mgr.:* Ed Wetzel; *Dist. Mgr.:* Nancy Smith ..... **C•1597**

Local Sales Offices & Reps

CA Burlington, William Purdy Co. 415-347-7701
CA Santa Ana, Mike Roth Sls. 714-647-0606
CO Colorado Springs, Norris & Co. 303-576-8697
FL Maitland, Hawkins-Frederickson Assocs., Inc. 407-831-2474
GA Roswell, HW Phillips 404-992-3070
IL Addison, Elctrn. Specialists 708-250-9080
IA W. Des Moines, Nevco 515-225-9866
MA Milford, Jonel Sls. Assoc. 508-478-4650
MI Southfield, Robert Milsk Co. 313-354-3310
MN Excelsior, Procon 612-937-6024
NY Victor, Imco 716-924-3671
OH Stow, J.W. Lehner Co. 216-686-1965
OR Beaverton, Pacific Mktg. Grp. 503-641-9373
TX Rowlett, Campion Sls. 214-475-8313
VA Charlottesville, Crown Assocs. 804-293-6373
Can Dorval, Quebec, ECG Canada 514-685-5800

PROJECT RESOURCES INC., 16 Kendrick Rd., Wareham, MA 02571, Tel: 508-295-7444, FAX: 508-295-7497; FSC No.: OEF11; Empl.: 18; *Sls. Mgr.:* T.R.Egan

PROJECTS UNLIMITED, 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, FAX: 513-890-4911; Empl.: 61; *Sls. Mgr.:* Greg Kimpton ..... **D•1050-1052**

Local Sales Offices & Reps

AL Huntsville, ElectroSales, Inc. 205-830-2715
AZ Scottsdale, Williams Assocs. 602-947-4297
CA Irvine, Cal Rep 714-250-0567
CA San Jose, Comtech Mktg. 408-294-3330
CO Commerce City, Williams Assocs. 303-289-5647
CT Seymour, Sturdy Corp. 203-888-1480
FL Lakeland, Munday Sls. Co. 813-858-5606
GA Atlanta, ElectroSales, Inc. 404-394-1122
IL Downers Grove, Golten Assocs. Inc. .. 708-512-0093
IN Indianapolis, The J. C. Hofstetter Co. .. 317-897-7914
KS Overland Park, Thomas L. Dowell 913-599-1100
MA Wellesley Hills, Sturdy Corp. 617-235-2330
MN Edina, G.P. Sls. 612-831-2362
MO St. Louis, Thomas L. Dowell 314-849-4234
NM Albuquerque, Williams Assocs. 505-255-1638
NY Patchogue, Optimum Sls. 516-758-0644
NC Raleigh, Tingen Tech. Sls., Inc. 919-870-6670
OH Dayton, J.C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
PA Hickory, J. C. Hofstetter Co. 412-356-2305
PA Valley Forge, Providence Mktg. 215-935-3300
TX Richardson, Eagle Mktg. 214-238-5383

IA Cedar Rapids, Thomas L. Dowell & Assocs. 319-364-3880
WA Redmond, Doran Sls. Assocs., Inc. 206-885-1885
Can Islington, Ont., D.T. Shaw Co., Ltd. 416-231-3494
Can Montreal, Que., D.T. Shaw Co. Ltd. 514-332-1163
Can Vancouver,B.C., F.D. Bolton, Ltd. 604-736-0351
Can Winnipeg, Man., F.D. Bolton, Ltd. 204-774-5708

Local Distributors

CA San Jose, Speakers Unlimited 408-453-5698
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Torrance, Pyramid Elctrns. 213-320-2700
CO Commerce City, Waco Elctrns. 303-289-4743
FL Lakeland, A-A Elec. 813-665-6941
GA Norcross, A-A Elec. 404-449-8670
IL Bensonville, Voyager Elctrns. Corp. 708-860-1300
MA Hingham, Hingham Bay 617-740-1900
MO St. Louis, Beckwith Elctrns. 314-343-6463
NY Rochester, Ray Baker Elctrns. 716-586-9164
MN Fridley, Voyager Elctrns. Corp. 612-571-7766
OH Dayton, Electro Supp. 513-299-5020
PA McKean, Advacom 814-476-7774
TX Austin, Southwest Elctrns. 512-837-8971
TX Stafford, Southwest Elctrns. 713-240-4000
TX Dallas, S.W. Elctrns. 214-234-3050
WA Redmond, Pyramid Elctrns. 206-883-7200
Can Willowdale, Ont., Electro Sonic 416-494-1666

PRO-LOG CORP., 2555 Garden Road, Monterey, CA 93940, Tel: 408-372-4593, TWX: 910-360-7082; Empl.: 120; *Sls. Mgr.:* Dick Thomas; *Dist. Mgr.:* Pat Laughlin

PROLOGIC SYSTEMS, 557-0 Burbank St., Broomfield, CO 80020, Tel: 303-460-0103, FAX: 303-469-5565; Empl.: 9

PROMAX-JOHNTON ELECTRONIC CORP., 17935 Sky Park Circle, Ste. H, Irvine, CA 92714, Tel: 714-975-1245, FAX: 714-975-1390; Empl.: 12; *Sls. Mgr.:* Dave Cooper

PROTEK INC., P.O. Box 59, Norwood, NJ 07648, Tel: 201-767-7242, FAX: 201-767-7343; *Sls. Mgr.:* Alex Orloff

PROTO STAMPING CORP., 811 Kaynyne St., Redwood City, CA 94063, Tel: 415-365-0498, FAX: 415-366-6329; Empl.: 35; *Sls. Mgr.:* Dave Anstead

PROTO SYSTEMS, 625 Sims Industrial Blvd., Alpharetta, GA 30201, Tel: 404-475-1330, 800-331-1797, FAX: 404-442-9751; FSC No.: FU 718; Empl.: 155; *Sls. Mgr.:* Keith Koehle

PROTOTEK, INC., 25 Standen Dr., Hamilton, OH 45015, Tel: 513-874-5094, FAX: 513-874-2252; FSC No.: 60813; Empl.: 45; *Sls. Mgr.:* Ron Nabors

PTC INDUSTRIES, INC., 5721 Research Drive, Huntington Beach, CA 92649, Tel: 213-598-9547, 714-891-7561, FAX: 714-373-0269; Empl.: 14; *Sls. Mgr.:* Steve Varonka

PTC TRANSFORMERS, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505, Tel: 609-298-8200, FAX: 609-298-8235; FSC No.: 05853; Empl.: 30; *Sls. Mgr.:* C. W. Harrison

PTS CORPORATION, Box 272, Bloomington, IN 47401, Tel: 812-824-9331; Empl.: 350; *Sls. Mgr.:* Jeff Hamilton; *Dist. Mgr.:* David Melwid

PTX-PENTRONIX INC., 1737 Cicotte, Lincoln Park, MI 48146, Tel: 313-388-3100, TELEX: 23-0398, FAX: 313-388-9171; Empl.: 21; *Sls. Mgr.:* J. Schultz

Z-LINE®

FAX: 714-641-9062

PULIZZI ENGINEERING, INC., 3240 S. Susan St., Santa Ana, CA 92704-6865, Tel: 714-540-4229; FSC No.: 70513; Empl.: 35; *Sls. Mgr.:* Roger A. Lea; *Dist. Mgr.:* Roger A. Lea ..... **D•2224-2228**

Local Sales Offices & Reps

CA Anaheim, Alpha Elctrn. Sls. 714-665-6580
CA Los Angeles, Power Partners 213-215-0800
CA Los Gatos, Norwest Elctrns. 408-395-1190
CA Santa Ana, Pulizzi Engrg., Inc. 714-540-4229
CT Westford, I.C.S. Assocs., Inc. 508-692-3545
IL Bensenville, E.S.I. 708-766-3667
IL Bensenville, R.L. Lang & Assoc. 312-766-3667
MD Columbia, L.G. White & Co., Inc. 301-290-8880
MD Silver Spring, L. G. White & Co., Inc. 301-792-0660
MA Westford, ICS Assocs., Inc. 508-692-3545
MO Bridgeton, BC Elctrn. Sls., Inc. 314-739-6683
MD Silver Spring, L.G. White 301-792-0660
OR Beaverton, Temper Tech. Mktg. 503-292-8201
PA Valley Forge, J.E. Cuesta & Co. 215-935-0400
Can Lac-Carre, Que., V.V.M. REG. 514-766-9270

Local Distributors

CA San Jose, Dansco Comp. Sls., Inc. 408-292-9740

PULNIX AMERICA, INC., 770 Lucerne Dr., Sunnyvale, CA 94086, Tel: 408-733-1560, TELEX: 172541 Pulnix America; *Sls. Mgr.:* Richard Hofmeister

PULSE INSTRUMENTS CO., 1234 Francisco, Torrance, CA 90502, Tel: 213-515-5330, FAX: 213-515-0068; Empl.: 30; *Sls. Mgr.:* Ron Perry

PUREDATA, 180 West Beaver Creek Rd., Richmond Hill, Ont., Canada L4B 1B4, Tel: 416-731-6444, FAX: 416-731-7017; Empl.: 150; *Sls. Mgr.:* Alex Kosarow, Cdn. Sls.; *Dist. Mgr.:* Dennis Robinson, US Sls.

PYLE INDUSTRIES, INC., 501 Center St, P.O. Box 620, Huntington, IN 46750, Tel: 219-356-1200, FAX: 219-356-2830; Empl.: 375; *Sls. Mgr.:* Tom Pyle; *Dist. Mgr.:* Mark Pyle, Natl. Sls. Mgr.

PYLE-NATIONAL, INC. LPL CO., 1334 N. Kostner Ave., Chicago, IL 60651, Tel: 312-342-6300 x210, TELEX: 25251, TWX: 910-221-0335, FAX: 312-342-0872; FSC No.: 49367; Empl.: 650; *Sls. Mgr.:* Mike Carroccia, V.P. Sls./Mktg.

PYLON CO., See Augat/Pylon Corp., Inc.

PYLON ELEX DEVELOPMENT CO. LTD., 2300 Victoria, Lachine, PQ, Canada H8S 1Z3, Tel: 514-637-1186, FAX: 514-636-1970; Empl.: 50; *Sls. Mgr.:* J. Guay

PYROCOM CO., 924 N. 143rd St., Seattle, WA 98133, Tel: 206-365-3535, FAX: 206-365-0402; *Sls. Mgr.:* Bill Kurtz

PYROFERRIC INTERNATIONAL, INC., 200 Madison St., Toledo, IL 62468, Tel: 217-849-3300, TWX: 910-663-0616, FAX: 217-849-2544; Empl.: 50; *Sls. Mgr.:* S. John Horner

Local Sales Offices & Reps

AZ Phoenix, Charles T. Fink & Assocs., Ltd. 602-992-9884
CA Alhambra, Deniston/JDA, Inc. 818-289-2844
CA Santa Clara, C. B. King Assocs. 408-988-7551
NY Commack, Marvin Scheck 516-864-9676
OH Shaker Hgts., Don Gype Co. 216-291-0103
TX Dallas, S.W. Elctrn. Ind., Inc. 214-690-9881
VA Roanoke, A.B. Kreger Co. 703-989-4738

PYROFILM RESISTOR CO., See KDI Electronics

PYROHM, INC., 24268 Indoplex Circle, Farmington Hills, MI 48018, Tel: 313-478-5060; *Sls. Mgr.:* Charles R. Berry

Q-CARD, INC., 2 Chellis Ct., Owings Mills, MD 21117-1634, Tel: 410-581-0112; *Sls. Mgr.:* Larry Nickel

QMI/NIEC, 12900 Rolling Oaks Rd., Twin Oaks, CA 93518, Tel: 805-867-2555, FAX: 805-867-2698 ..... **A•2126**

Local Sales Offices & Reps

AL Huntsville, EMA, Inc. 205-830-4030
CA Laguna Hills, 4-Star Elctrn. Comp. Sls. 714-583-9781
CA San Jose, Ruppert Sls. & Engrg., Inc. 408-998-8717
FL Boca Raton, Tech Sls. Specialists, Inc. 407-391-3718
GA Roswell, EMA, Inc. 404-992-7240
IL Rolling Meadows, Eagle Tech. Sls. Inc. 708-991-0700
MI Livonia, Leading Edge Sls. Corp. 313-478-6700
MN Prior Lake, Gleason Assoc., Inc. 612-447-7020
NJ No. Fairfield, Metro Logic Corp. 201-575-5585
NJ So. Medford, CEF Assocs. 609-953-3417
NY Syracuse, Murcan Sls. Corp. 315-455-8807
NC Raleigh, EMA, Inc. 919-846-6888
OH Columbus, The Tom Mulligan Co., Inc. 614-457-2242
TX Dallas, Electra Reps., Inc. 214-248-3852
WA Bellevue, N R Schultz Co. 206-746-1890

QSI CORPORATION, 2212 So. W. Temple No. 46, Salt Lake City, UT 84115, Tel: 801-466-8770, FAX: 801-466-8792; Empl.: 10; *Sls. Mgr.:* Gerri Mackey

Local Sales Offices & Reps

CT Orange, Isdale Assocs. 203-387-2704

Q-TECH CORP., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, Tel: 213-836-7900, TELEX: 69-6140, FAX: 213-836-2157; FSC No.: 51774; Empl.: 140; *Sls. Mgr.:* Sandra Rappaport ..... **A•1444-1447**

Local Sales Offices & Reps

AZ Tempe, Piper Sls. Co. 602-949-0048
CA Hermosa Beach, Quattro Sls. Assoc., Inc. 213-372-4221
CA Moorpark, Quattro Sls. Assoc., Inc. 805-523-2978
CA San Diego, Quattro Sls. Assoc., Inc. 619-581-3093
CA San Jose, Blue Elctrn. Sls. 408-345-0260
CA San Juan Capistrano, Quattro Sls. Assoc., Inc. 800-735-4510
CO Parker, Howard Assoc. 303-841-5755
CT Canterbury, The Cygnus Sls. Co., Inc. 203-546-6322
IL Northbrook, Allied Comp. Reps., Inc. 708-498-6658
IN Fort Wayne, TX Sales Inc. 219-489-4447
MD Baltimore, R.A. Wafer Assocs. 602-949-0048
MA Tewksbury, The Cygnus Sls. Co., Inc. 508-640-0001
MO St. Louis, Abrams & Assoc. 314-569-0447
NJ Glen Gardner, F & M Tech. Sls. 201-537-7888
NJ Paramus, Eltech Sls. 201-967-1309
NM Albuquerque, Piper Sls. Co. 505-828-1300
TN Winchester, C.J. Sls. 615-967-2156
TX Austin, Texoma Technical Sales, Inc. 512-441-1771
TX Houston, Texoma Technical Sales, Inc. 713-462-1432
VT So. Burlington, The Cygnus Sls. Co., Inc. 802-862-7754

QUAD DESIGN TECHNOLOGY, INC., 1385 Del Norte Road, Camarillo, CA 93010, Tel: 805-988-8250, FAX: 805-988-8259; Empl.: 16; *Sls. Mgr.:* Ron Lee; *Dist. Mgr.:* Jack Weaver

QUALCOMM, INC., 10555 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-587-1121, FAX: 619-452-9096; Empl.: 400; *Sls. Mgr.:* James Madsen; *Dist. Mgr.:* James Madsen

Qualidyne

FAX: 619-429-1011

QUALIDYNE SYSTEMS, INC., Lambda Group of Unitech, plc, 3055 Del Sol Blvd., San Diego, CA 92154, Tel: 619-575-1100; Empl.: 400; *Sls. Mgr.:* Barry A. Chenes ..... **D•2014-2019**

QUALITEC TECHNOLOGIES, INC., 43064 Christy St., Fremont, CA 94538, Tel: 415-498-1046, FAX: 415-498-5938; Empl.: 130; *Sls. Mgr.:* Kevin Daniels ..... **D•1313**

QUALITY AUTOMATION, INC., 1600 E. South Anaheim Blvd., Anaheim, CA 92805, Tel: 714-491-8535, FAX: 714-491-0417; Empl.: 22; *Sls. Mgr.:* Joe George; *Dist. Mgr.:* Joe George

QUALITY COMPONENTS, INC., P.O. Box 113, St. Marys, PA 15857, Tel: 814-834-2817, FAX: 814-834-9141; Empl.: 95; *Sls. Mgr.:* Michael Renaud, Mktg. Mgr.

QUALITY MICROWAVE INTERCONNECTS, INC., 301 Ballardvale St., Wilmington, MA 01887, Tel: 508-988-9090, FAX: 508-988-9393; FSC No.: 64023; Empl.: 30; *Sls. Mgr.:* Paul M. Tusini ..... **A•1624-1826**

Local Sales Offices & Reps

AL Huntsville, Bolton Assoc. 205-880-1164
AZ Tempe, Cain Technlg. 602-966-4322
CA Cupertino, Dura Sls. 408-255-2084
CA Van Nuys, Cain Technlg. 818-904-9392
CO Englewood, Cain Technlg. 303-220-8118
FL Orlando, Bolton Assoc. 407-856-0612
FL Pompano Beach, Bolton Assoc. 305-975-7245
FL St. Petersburg, Bolton Assoc. 813-864-2294
IN Park Ridge, Probe Elctrns. 708-696-2828
MD Laurel, Elec. Mktg. Assoc. 301-953-7800
MA Teskwbury, Sequel Assoc. 508-851-4010
MN New Hope, Baltz Assoc. 612-546-8520
NJ Deptford, Elec. Mktg. Assoc. 609-227-0925
NJ Linden, El-Tech Sls. 201-925-6162
NJ Paramus, El-Tech Sls. 201-967-1309
NY Syracuse, Em-Tech Assocs. 315-437-6410
SC Greenwood, Bolton Assoc. 803-223-4018
TX Garland, Cary McMahill Assoc. 214-681-1414
VA Abingdon, Bolton Assoc. 703-676-0500
WA Seattle, Data Com 206-285-2525
EXP Stamford, Dage Corp. 203-324-3123
Can Montreal, Que., Solid State Engrg. 514-481-3313

Local Distributors

CA Westlake Village, Sertek, Inc. 818-707-2872
MA Tewksbury, Sequel Sls. 508-851-4010

QUALITY POWER SYSTEMS, INC., 2400 S. Texas Ave., Pearland, TX 77581, Tel: 713-997-1700, 800-992-1701, FAX: 713-997-1907; Empl.: 20; *Sls. Mgr.:* Clarence Oliver

QUALITY RESEARCH COMPANY, North 11424 Judkins Lane, Spokane, WA 99207-9632, Tel: 509-924-6895; Empl.: 6; *Sls. Mgr.:* Jon Roath

QUALITY TECHNOLOGIES, 3400 Hillview Ave., Palo Alto, CA 93404, Tel: 415-493-0400, FAX: 415-493-7055; Empl.: 2000; *Sls. Mgr.:* Bob Taber; *Dist. Mgr.:* Candace Johnson

QUALITY THERMISTOR, 2147 Centurion Pl, Boise, ID 83709, Tel: 208-377-3373, FAX: 208-376-4754; FSC No.: 56866; Empl.: 45; *Sls. Mgr.:* John Mahoney ..... **B•1830, 1858-1859**

Local Sales Offices & Reps

EXP Oradell, NJ, Sylvan Ginsbury Ltd. 201-261-3200

QUALOGY INC., 109 Bonaventura Dr., San Jose, CA 95134, Tel: 408-434-5200, FAX: 408-434-5242; Empl.: 25; *Sls. Mgr.:* Mike Sills

QUALISTAR CORP., 9621 Irondale Ave., Chatsworth, CA 91311, Tel: 818-882-5822, TELEX: 510-600-2569, ESYLNK: 6289-9796, FAX: 818-882-4081; Empl.: 50

QUALTEK ELECTRONICS CORP., 7158 Industrial Pk. Blvd., Mentor, OH 44060, Tel: 216-951-3300, TELEX: 985319, FAX: 216-951-7252; Empl.: 75; *Sls. Mgr.:* Laura Yano/Regional Sls. Mgr.; *Dist. Mgr.:* Laura Yano/Regional Sls. Mgr.

QUAM-NICHOLS CO., 234 E. Marquette Rd., Chicago, IL 60637, Tel: 312-488-5800, FAX: 312-488-6944; Empl.: 200; *Sls. Mgr.:* William G. Little; *Dist. Mgr.:* Greg Johns ..... **D•1054-1055**

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AZ Mesa, Yocum Mktg. 602-834-3334
CA Belmont, Brian Trankle & Assocs. 415-595-4004
CA Gardena, Bidwell-Schwartz Assocs. ... 213-770-0300
UT Salt Lake City, Pro Tech Mktg. 801-943-8331
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GA Norcross, Cartwright & Bean of GA ... 404-368-0160
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KS Prairie Village, R. W. Kunz & Assocs., Inc. 913-648-3535
MA Chicopee, Repworks, Inc. 413-533-0845
MN Edina, Mel Foster Techn. Sls. Inv. 612-941-9790
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NY Roslyn Hgts., Hudson Mktg. Inc. 516-625-0002
NY Syracruse, The Lewis & Dunnigan Co., Inc. 315-446-5522
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PA Broomall, Lowery Assocs. Co. 215-356-5300
TN Menphis, Cartwright & Bean of TN 901-362-8345
TX Dallas, J. Y. Schoonmaker CO., Inc. ... 214-349-4650
WA Seattle, Vector Manufacturers' Rep. ... 206-368-8400
EXP Yonkers, NY, Roburn Agencies, Inc. ... 914-968-1016
Can Waterloo, Ont., McBride Loudspeaker Source, Ltd. 519-884-3500
MI Southfield, Robert Milsk Co. 313-354-3310

QUAN-TECH, Stansbury Industries Inc., P.O. Box 28, Rte. 206, Flanders, NJ 07836, Tel: 201-927-1766, TWX: 710-987-7500; FSC No.: 63921; *Sls. Mgr.:* Richard A. Stansbury

QUANTRONIX, 49 Wireless Blvd., P.O. Box 9014, Smithtown, NY 11788, Tel: 516-273-6900, TELEX: 685-2167, FAX: 516-273-6958; Empl.: 175; *Sls. Mgr.:* R. J. Bruno; *Dist. Mgr.:* R. J. Bruno

QUANTUM BATTERIES, INC., 2772 Loker Ave. West, Carlsbad, CA 92008, Tel: 619-438-2202, TELEX: 01830, FAX: 619-438-0694; FSC No.: 01830; Empl.: 30; *Sls. Mgr.:* Gregg Kuehn; *Dist. Mgr.:* Terry Nielsen

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QUATECH INC., 662 Wolf Ledges Pkwy., Akron, OH 44311, Tel: 216-434-3154, TELEX: 5101012726, FAX: 216-434-1409; Empl.: 25; *Sls. Mgr.:* Michael Cenker; *Dist. Mgr.:* Michael Cenker

Q.V.S., INC., 20 North 15th St, East Orange, NJ 07017, Tel: 201-673-3996, FAX: 201-673-3997; FSC No.: 89820; Empl.: 45

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RACAL-MILGO, 1601 N. Harrison Parkway, Sunrise, FL 33323-2899, Tel: 305-846-1601, 800-327-4440, TWX: 510-955-4145, FAX: 305-846-4942; Empl.: 2800; *Sls. Mgr.:* H. Cheli

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RACORE COMPUTER PRODUCTS, INC., 170 Knowles Drive., Los Gatos, CA 95030, Tel: 408-374-8290, FAX: 408-374-6653; *Sls. Mgr.:* Joseph W. Rooney; *Dist. Mgr.:* Joseph W. Rooney

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RADIOMETRICS MIDWEST CORP., 2200 S. Main St., Lombard, IL 60148, Tel: 708-932-7262; FSC No.: Cage Code 1Z075 SIC Code 8748 Ext. 0021; Empl.: 5

RADIO RESEARCH INSTRUMENT CO., INC., 584 North Main Street, Waterbury, CT 06704-3506, Tel: 203-753-5840, TELEX: 962444 RADAR DURY, FAX: 203-754-2567; FSC No.: 57174; *Sls. Mgr.:* E. B. Doyle

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RAF ELECTRONIC HARDWARE, 95 Silvermine Rd., Seymour, CT 06483, Tel: 203-888-2133, FAX: 203-888-9860; FSC No.: 55566; Empl.: 120; *Sls. Mgr.:* William R. Bailey, Jr.; *Dist. Mgr.:* Dave Granger/John Capece

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RAGEN CORP., Systems Div., 9 Porete Ave., N. Arlington, NJ 07032, Tel: 201-997-1000, FAX: 201-997-6948; Empl.: 400

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FL Orlando, Holmes & Assocs. 407-281-0067
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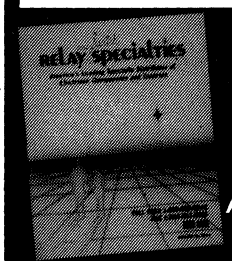
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MA Natick, Wayland Engrg. Sls. 508-655-6080

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RASTER GRAPHICS, INC., P. O. Box 5157, Bend, OR 97701, Tel: 503-388-2584, FAX: 503-389-8249

RATELCO, Power Systems, 1260 Mercer, Dept. EEM, Seattle, WA 98109-5589, Tel: 206-624-7770, FAX: 206-382-5447; FSC No.: 14259; Empl.: 160; *Sls. Mgr.:* D. Terpstra

RAULAND-ZENITH ELECTRONICS CORP., 2407 W. North Ave., Melrose Pk, IL 60160, Tel: 708-450-8992, TELEX: 72-1488, FAX: 708-450-8393; Empl.: 2300

RAYOVAC CORPORATION, 601 Rayovac Drive, Madison, WI 53711-0960, Tel: 608-275-4692, TELEX: 190428, FAX: 608-275-4994; FSC No.: 6135; Empl.: 2000; *Sls. Mgr.:* Jeff Heberlein

RAY PROOF, Shielding Systems Corp., 50 Keeler Ave., P.O. Box 5060, Norwalk, CT 06856-5060, Tel: 800-243-5704, TELEX: 96-5812; *Sls. Mgr.:* Brian F. Lawrence, V.P. Mktg. & Sls.

RAYTEK, INC., Box 1820, Santa Cruz, CA 95060-1820, Tel: 408-458-1110, FAX: 408-458-1239; *Sls. Mgr.:* S. Brager; *Dist. Mgr.:* Stuart Brager

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RAYTHEON CO., Laser Products, 465 Centre St., Quincy, MA 02169, Tel: 617-479-5300, TELEX: 92-3455, TWX: 710-324-6568, FAX: 617-479-5300 (ext. 2359); Empl.: 1000; *Sls. Mgr.:* B. Werschler

RAYTHEON CO., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02254, Tel: 617-899-8400, TWX: 710-324-8400, FAX: 617-899-5451; *Sls. Mgr.:* J. Hieber

RAYTHEON SEMICONDUCTOR, 350 Ellis St., Mountain View, CA 94043, Tel: 415-966-7639, TWX: 910-379-6484, FAX: 415-966-7620; FSC No.: 07933; Empl.: 1,000; *Sls. Mgr.:* R. Johnson, Natl. Sls. Mgr.; *Dist. Mgr.:* R. Johnson, Natl. Sls. Mgr.

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AZ	Scottsdale, TC Electrns.	602-944-5153
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CA	Laguna Hills, 4-Star	714-583-9781
CO	Denver, Purdy Co.	303-790-2211
FL	Palm Beach Gdns., Graham & Assocs.	407-622-4049
IL	Downers Grove, Golten & Assocs.	708-512-0093
MA	Needham, Ray Perron Co.	617-449-6162
MI	Brighton, A/P Assoc.	313-229-6650
MN	Plymouth, Twist Co.	612-550-0922
MO	Florissant, Delltron	314-839-0033
NJ	Leonia, Peter E. Schmitt	201-944-1096
OH	Cincinnati, Campisano	513-574-7111
NY	N. Syracuse, Advance Comps.	315-699-2671
TX	Richardson, Pro Comp. Sls.	214-669-1500
WA	Kirkland, Northwest	206-828-2104
WI	Colgate, Rep One	414-628-4016
Can	Ontario, Haltronics	416-844-2121

Local Distributors

CA	Fountain Valley, Component Ctr.	714-979-0433
CA	San Diego, Mock III	619-693-8230
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Southland Comp.	619-673-3800
CA	San Jose, Centrex	408-379-0800
CA	San Jose, Compass Comps.	408-432-7575
CO	Englewood, Indelco	303-694-9756
CT	Danbury, Heiland	203-265-9900
CT	Wallingford, Greene Shaw	203-265-3333
CT	Wallingford, Midstate	800-243-1043
FL	Melbourne, Pridmore	407-727-2491
FL	Tampa, Reptron	813-855-4656
FL	W. Palm Beach, Atlantic Elctrns.	813-531-5900
IL	Lisle, Components, Inc.	708-852-7707
IL	Schaumberg, Reptron	708-882-1700
IL	Franklin Pk., Stetco	708-671-4208
IN	Wakarusa, Earlynn	219-862-2425
IA	Cedar Rapids, DEE	319-365-7551
MD	Gaithersburg, Axis Electronics	301-840-9640
MA	Billerica, Baldwin	800-645-5608
MN	Eitzen, Capacitors Assoc.	507-495-3306
MA	Newton, Greeneshaw	617-969-8900
MA	Wilmington, Heilind Elctrns.	508-657-4870
MA	Wilmington, North Star Elctrns.	508-657-5155
MI	Livonia, Reptron	313-525-2700
MN	Roseville, Parts One	612-633-8079
NC	Raleigh, Sager	919-850-9550
NH	Nashua, Brevan Elctrns.	603-889-7230
NY	Bohemia, Key Comps. Inc.	516-567-7500
NY	Bohemia, RBD Elctrns.	516-589-7717
NY	Ronkonkoma, Baldwin	800-645-5600
NY	Ronkonkoma, Compucon	516-981-8810
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OH	Worthington, Reptron	614-436-6675
PA	McKean, Advacom	814-476-7774
PA	Reading, Barbey Elctrns.	215-376-7451
TX	Ft. Worth, Allied Elctrns.	800-433-5700
WA	Redmond, Priebe Elctrns.	206-881-2363
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Can	Ontario, Paltronics	416-844-2121

R. C. ELECTRONICS INC., 6464 Hollister Ave, Goleta, CA 93116, Tel: 805-685-7770, FAX: 805-685-5853; Empl.: 20; *Sls. Mgr.:* Chao-Sun Pang; *Dist. Mgr.:* Chao-Sun Pang

RCL-SHALLCROSS, INC., U.S. Hwy. 70 East, Smithfield, NC 27577, Tel: 919-934-5181, TWX: 510-939-1463, FAX: 919-934-5186; FSC No.: 54294; Empl.: 150; *Sls. Mgr.:* Steve Wade

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R-COLUMBIA PRODS. CO., INC., 2008 St. Johns Ave., Highland Park, IL 60035, Tel: 708-432-7915, FAX: 708-432-9181; Empl.: 20

RDI ELECTRONICS

FAX: 914-632-7464

RDI ELCTRNS., INC., 56 Harrison St., New Rochelle, NY 10801, Tel: 914-632-7274; Empl.: 9; *Sls. Mgr.:* Barry Miller ..... **A•2063; B•1767; C•1510-1511, 1815; D•1057**

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CA	Newport Beach, SPA	714-863-1193
CA	San Jose, Comtech Mktg.	408-249-3330
FL	Longwood, M & H Assocs.	407-332-7912
MD	Baltimore, L.H. Kolman & Co. Inc.	301-828-0212
MA	S. Easton, Intek Sls.	508-238-9283
MI	Adrian, Elctrnc. Salesmasters, Inc.	216-831-9555
MN	Minneapolis, OEM Elctrl. Sls., Inc.	612-884-7509
MO	Kansas City, Weisler & Assocs.	816-421-1703
NY	Hicksville, J. Square Mktg., Inc.	516-935-3200
OH	Beachwood, Elctrnc. Salesmasters, Inc.	216-831-9555
OR	Vancouver, Elctrnc. Mktg. Grp., Inc.	503-684-5935
WA	Redmond, Elctrnc. Mktg. Grp., Inc.	206-882-0962

REACTEL, INC., 687-K Lofstrand Ln., Rockville, MD 20850, Tel: 301-279-5535, FAX: 301-340-7304; FSC No.: 60458; Empl.: 30; *Sls. Mgr.:* Manny Assurian

READE ADVANCED MATERIALS, PO Drawer 15039, Riverside, RI 02915-0039, Tel: 401-433-7000, FAX: 401-433-7001; FSC No.: OA9E1; Empl.: 30; *Sls. Mgr.:* Charles Reade; *Dist. Mgr.:* Bethany Cochran

RECOGNITION CONCEPTS,INC., P.O. Box 8510, Incline Village, NV 89450, Tel: 702-831-0473, TELEX: 753168, FAX: 702-831-8035; Empl.: 48

THE RECORDER COMPANY, P.O. Box 8, San Marcos, TX 78667, Tel: 512-629-1400, FAX: 512-353-5333; Empl.: 11; *Sls. Mgr.:* Floyd Mackenzie; *Dist. Mgr.:* Floyd Mackenzie

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RECORTEC, INC., 1290 Lawrence Station Road, Sunnyvale, CA 94089, Tel: 408-734-1290, FAX: 408-734-2140; *Sls. Mgr.:* S. Giacomo

RECOTON CORP., 46-23 Crane St., Long Island City, NY 11101, Tel: 718-392-6442, TELEX: 236047 RCTN, FAX: 718-784-1080; Empl.: 300; *Sls. Mgr.:* Peter Dayton, VP, Sls.

REDCO, 3000 Arrowhead Dr., Carson City, NV 89706, Tel: 702-882-3100, FAX: 702-882-8385; Empl.: 45; *Sls. Mgr.:* Mitch Watts

REDINGTON COUNTERS, 130 Addison Rd., Windsor, CT 06095, Tel: 203-688-6205, FAX: 203-688-1591; *Sls. Mgr.:* Dennis O'Shea; *Dist. Mgr.:* Dennis O'Shea

REDLAKE CORP., 15005 Concord Circle, Morgan Hill, CA 95037, Tel: 408-779-6464, FAX: 408-778-6256; Empl.: 22; *Sls. Mgr.:* J. Stephen Wood

RED SQUARE COMPANY, 11770 Warner Ave., Ste. 226, Fountain Valley, CA 92708, Tel: 714-751-1373; *Sls. Mgr.:* Ed Burg

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REEVES-HOFFMAN
DIVISION DYNAMICS CORPORATION OF AMERICA

FAX: 717-243-0079

REEVES-HOFFMAN DIV., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, Tel: 717-243-5929; Empl.: 340; *Sls. Mgr.:* Mark Laser ..... **A•1448-1451, 1740-1741**

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IL	Des Plaines, ESCO Assocs.	708-298-5310
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	Wakefield, H. Jappe Co.	617-245-9359
MN	Minneapolis, Intl. Elctrns.	612-571-0000
NJ	Flanders, K&R Engrg. Corp.	201-584-5235
OH	Cincinnati, Tri-State Mktg.	513-761-7993
PA	Hatboro, AQS Electro	215-674-4421
TX	Irving, Kite Elctrns. Sls.	214-986-0321
EXP	London, England, Reeves-Hoffman U.K.	4484442848
Can	Rexdale, Ont., Myelco, Inc.	416-674-1636

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REGDON SOLENOID, INC., 401 Plaza Drive, Westmont, IL 60559, Tel: 708-789-0600; FSC No.: 27190; Empl.: 65; *Sls. Mgr.:* David K. Conroy ..... **B•1634-1637**

Local Sales Offices & Reps

AZ	Phoenix, Wistech Controls	602-243-4361
CA	Los Altos, J. W. Wilhoit	415-961-3660
CA	Valencia, DJM Elctrns. Inc.	805-254-2677
CO	Denver, Neil Binge & Assocs.	303-698-1481
CT	Woodbury, Mark-Rep Assocs.	203-263-3047
FL	Maitland, EIR, Inc.	305-660-9600
IL	Downers Grove, Richmar Elect. Corp.	312-968-0118
IL	Westmont, Regdon Solenoid, Inc.	708-789-0600
IN	Indianapolis, Richmar Elctrns.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
MA	Mattapoisett, Mark-Rep Assocs.	508-758-2318
MI	Ada, Erin Engrg.	616-676-0665
MN	Hopkins, S. J. Collins & Assocs.	612-933-7661
NH	Plaistow, Mark-Rep Assocs.	603-382-9563
NJ	Red Bank, Varrelman-Gorman Co.	201-219-0088
NY	E. Rochester, William Kreger Assocs.,Inc.	716-381-4430
OH	New Lebanon, J.N. Bailey & Assocs.	513-687-1325
OR	Portland, D.A. Sullivan Co.	503-292-2448
PA	Huntingdon Valley, Edwin Leiby & Assocs.	215-659-8938
TX	Plano, K & H Sales	214-423-6520
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

CA	San Carlos, Logan Elctrn. Supp.	415-594-0700
MA	Lynn, Land Elctrns.	617-592-2220
NJ	Oakland, Relay Specialties	201-337-1000

REGENT CONTROLS, INC., 39 Fanny St., P.O. Box 767, Shelton, CT 06484-0767, Tel: 203-924-2924, FAX: 203-924-2928; Empl.: 35; *Sls. Mgr.:* Lora C. Murphy

REGULUS SYSTEMS, 859 Canis Lane, Foster City, CA 94404, Tel: 415-593-4197

REICH ASSOCIATES, INC., Rt. 4, Box 4620, Lakehills, TX 78063, Tel: 512-751-3220, FAX: 512-751-3054; FSC No.: 55916; Empl.: 20; *Sls. Mgr.:* W. Reich

RE INSTRUMENTS CORP., 31029 Center Ridge Rd., Westlake, OH 44145, Tel: 216-871-7617, FAX: 216-871-4303; Empl.: 15; *Sls. Mgr.:* P. A. Bosworth

REKCO, INC., See LEM/Rekco

RELAY SERVICE CO., 1300 N. Pulaski Rd., Chicago, IL 60651, Tel: 312-252-2700, FAX: 312-252-0300; Empl.: 25; *Sls. Mgr.:* Chas. H. Badger

Local Sales Offices & Reps

AZ	Glendale, Sunbird Inds., Inc.	602-439-0134
CA	Vista, Sado Sls.	714-672-4521
CO	Monument, Sunbird Inds., Inc.	719-481-2900
CT	Bethany, Reps. Corp.	203-393-0024
IL	Downers Grove, Golten Assocs.	708-512-0093
IN	Ft. Wayne, Naunas Sls.	219-432-4792
MA	Wellesley, Reps. Corp.	617-237-6476
NY	New Rochelle, Repco Assocs.	914-235-6405
OH	Cleveland, John O. Olsen	216-838-0510
OR	Beaverton, Cascade Sls. Co.	503-626-7978
PA	Glenside, Shelmar Elctrns. Corp.	215-885-0800
PA	Pittsburgh, John O. Olsen	412-381-4254
TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772
UT	Ogden, Sunbird Inds., Inc.	801-479-8602

Distributor

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RELAY SPECIALTIES, 17 Raritan Rd., Oakland, NJ 07436, Tel: 201-337-1000, TELEX: 642751; Empl.: 48; *Sls. Mgr.:* S. R. Gershberg ..... **B•1566**
.....611, 617, 619, 635 636, 641, 650, 652, 689, 692, 700, 736, 738, 763, 772, 803

Local Sales Offices & Reps

CA	Los Alamitos, The Rep House	213-598-3379
CT	Manchester, Vin-Tech, Inc.	203-646-3007
MD	Glen Burnie, Faion Lott & Co., Inc.	301-744-4611
MI	Dearborn, Pitcher Poulin Inc.	313-582-5450
MN	Minneapolis, Engrg. Prods. Assocs.	612-835-9022
NJ	Haddon Hgts., Walt Woodward	609-547-5000

RELCO PRODUCTS, 5594 E. Jefferson Ave., Denver, CO 80237, Tel: 303-756-1143; FSC No.: 14454; Empl.: 7

RELIABILITY, INCORPORATED, P. O. Box 218370, Houston, TX 77218, Tel: 713-492-0550, FAX: 713-492-0615; *Sls. Mgr.:* Len Moscovitz; *Dist. Mgr.:* Mike Tenore/Steve Popst

RELIANCE COMM/TEC, Reliance Electric, P.O. Box 17438, Cleveland, OH 44117, Tel: 800-245-4501

RELIANCE ELECTRIC CO., Marketing Info Center, P.O. Box 17438, Cleveland, OH 44117, Tel: 800-245-4501

RELIANCE PLASTICS & PACKAGING, 217 Brook Ave., Passaic, NJ 07055, Tel: 201-473-7200, FAX: 201-473-1023; Empl.: 60; *Sls. Mgr.:* Hale Smith

RELM COMMUNICATIONS, INC., 7707 Records Street, Indianapolis, IN 46226, Tel: 317-545-4281, FAX: 317-545-2170; Empl.: 300; *Sls. Mgr.:* John Biljan

REMEE PRODUCTS CORP., 186 North Main Street, Florida, NY 10921, Tel: 914-651-4431, FAX: 914-651-4160; FSC No.: 4R362; Empl.: 135; *Sls. Mgr.:* Ken Pimental; *Dist. Mgr.:* Ken Pimental

REMTEK CORPORATION, 46107 Landing Parkway, Fremont, CA 94538, Tel: 415-490-3999, FAX: 415-659-1849; Empl.: 40; *Sls. Mgr.:* Lynne Deegan; *Dist. Mgr.:* Robert T. Collins

RENARD MANUFACTURING COMPANY, INC., 3305 N.W. 79th Ave., Miami, FL 33122-1015, Tel: 305-592-1500, TELEX: 989326, ESYLNK: 62929141, FAX: 305-593-9990; *Sls. Mgr.:* S. Simerly

RENATA U. S., 2263-C Valdina Street, Dallas, TX 75207, Tel: 214-630-2563,800-527-0719, FAX: 214-630-2568; Empl.: 300; *Sls. Mgr.:* Joseph M. Ensminger Sls. Mgr.

RENCO ENCODERS INC., 26 Coromar Dr., Goleta, CA 93117-3094, Tel: 805-968-1525, FAX: 805-685-7965; FSC No.: 34479; Empl.: 100; *Sls. Mgr.:* Sid Russell; *Dist. Mgr.:* Sid Russell

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Local Sales Offices & Reps

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AZ	Phoenix, Moss Mktg.	602-433-9349
CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	La Jolla, Coastal Elctrn. Sls.	619-459-4148
CA	Santa Clara, Cummings & Assoc.	408-247-8656
CO	Aurora, Moss Mktg.	303-340-8535
CT	East Hampton, Apex Assocs.	203-269-8401
GA	Norcross, Spears & Assocs.	404-270-5661
MA	Needham, Apex Assocs.	617-444-8070
NY	Commack, Mars Engrg.	516-864-8676
NC	Raleigh, Spears & Assocs.	919-790-7606
UT	Salt Lake City, Moss Mktg.	801-363-5875
FL	Indian Harbor Bch., Post Mktg.	407-777-0994
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Baltimore, Eltron Sls. Ltd.	301-426-6637
MI	Grosse Point Pk., Greiner Assocs.	313-499-0188
OH	Westlake, Baehr Greenleaf & Assocs.	216-892-1770
OR	Hillsboro, Temco Northwest	503-645-2030
PA	Warrendale, Baehr Greenleaf & Assocs.	412-934-3088
TX	Dallas, Electra Reps	214-248-3852
VA	Front Royal, Eltron Sls. Ltd.	703-635-7201
WA	Bothell, Temco Nortwest	206-481-6150
WI	Milwaukee, Bert Wartchow Assocs.	414-964-0942
Can	Montreal, Que, Eli Manis, Inc.	514-484-2923

REN ELECTRONICS CORPORATION, C.C.G., An Insico Co., 755 New Ludlow Rd., S. Hadley, MA 01075, Tel: 413-536-1800, TELEX: 315617, FAX: 413-536-8425; FSC No.: 70143; Empl.: 75; *Sls. Mgr.:* S. W. Pai, Div. Mgr.

REPRODUCTION TECHNOLOGIES INC., P.O. Box 790, Bristol, IN 46507-0518, Tel: 219-848-5233, TELEX: 510 600 2378 R T I, FAX: 219-848-5333; Empl.: 10; *Sls. Mgr.:* Maxine Beasey

REPUBLIC ELECTRONICS CO., 200 Wireless Blvd., Hauppauge, NY 11788, Tel: 516-273-9800, FAX: 516-273-9820; FSC No.: 95750; Empl.: 145; *Sls. Mgr.:* Sy Newman, Mktg. Mgr.

RESEARCH DEVICES, INC., 121 Ethel Rd., Piscataway, NJ 08854, Tel: 908-572-4800, TELEX: 467058, FAX: 908-572-4808; Empl.: 25; *Sls. Mgr.:* Michael Schneider

RESEARCH SPECIALISTS, 1816 Settlers Oval, Cleveland, OH 44145, Tel: 216-871-8909; Empl.: 10; *Sls. Mgr.:* Tim Howard

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770, FAX: 612-636-8944; *Sls. Mgr.:* Roger H. Falde

FAX: 708-863-4272

RESISTORS, INC., 5226 W. 26th St, Chicago, IL 60650, Tel: 708-652-7555; Empl.: 35; *Sls. Mgr.:* Theresa McGraw

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RESONANT POWER TECHNOLOGY, 3350 Scott Boulevard, Bldg.5302, Santa Clara, CA 95054, Tel: 408-982-0200; FSC No.: 0BZ13; Empl.: 10; *Sls. Mgr.:* Dan H. Burgoon ..... D•2024-2025

Local Sales Offices & Reps

FL	Land O Lakes, AJ'S Power Source	813-996-2583
NH	Salem, OEM Marketing & Sales	603-893-0009
TX	Richardson, Jim Gray & Associates	214-699-9976

R.F. ELECTRONICS, INC., 1091 Duryea Ave., Irvine, CA 92714-5517, Tel: 714-263-0661, FAX: 714-263-0662; Empl.: 18; *Sls. Mgr.:* Michael Welter; *Dist. Mgr.:* Michael Welter

RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, TWX: 510-227-6233, FAX: 516-231-6465; FSC No.: 13619; Empl.: 140; *Sls. Mgr.:* Dave Radford ..... A•1633

Local Sales Offices & Reps

CA	Alhambra, M.W. Riedel Co.	213-283-7694
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
FL	Clearwater, Tech-Rep Assocs.	813-572-9900
FL	Ft. Lauderdale, Tech Rep Assocs.	305-791-2708
FL	Merritt Island, Tech-Rep Assocs.	407-453-3313
FL	Winter Springs, Tech-Rep Assocs.	407-699-4010
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
MD	Rockville, Mechtronics Sls.	301-340-2130
MA	Burlington, Tritek, Inc.	617-272-4550
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NM	Albuquerque, M.G. Elctrns.	505-255-1638
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Great Neck, Trionic Assocs.	516-466-2300
NY	Rochester, Upstate Engrg.Sls.	716-225-2383
NY	Ronkonkoma, Compucon Distrs., Inc.	516-981-8810
NY	Utica, Upstate Engrg.Sls.	315-797-6721
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Glenside, Koebert Assocs.,Inc.	215-887-2310
TX	Garland, McBride Sci. Sls.	214-494-5000
Can	Bedford, N.S., Norgay Entprs. Ltd.	902-835•8530
Can	Neapean, Ontario, Norgay Entprs. Ltd.	613-745-4051
Can	Richmond B.C., Norgay Entprs. Ltd.	604-275-1121
Can	Toronto, Ontario, Norgay Entprs. Ltd.	416-234-8966
Can	Westmount, Quebec, Norgay Entprs. Ltd.	514-932-3233

Local Distributors

IL	Des Plaines, Compucon Distrs., Inc.	312-827-9444
MA	Reading, Compucon Distrs., Inc.	617-944-6875

RF INDUSTRIES, Celltronics, 10040 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-587-0656, FAX: 619-587-0049

RFL INDS., INC., (DBA) Dowty Elctrns. Co., PO Box 250 Prospect St., Brandon, VT 05733, Tel: 802-247-6811, FAX: 802-247-3946; Empl.: 130; *Sls. Mgr.:* Dan Boutin; *Dist. Mgr.:* Dan Boutin

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75244, Tel: 214-233-2903, TELEX: 463-0088, FAX: 214-387-8148; FSC No.: 2U874; Empl.: 120; *Sls. Mgr.:* C. Baker

R.F. POWER LABS., INC., Kalmus Engrg. Labs., Inc., 21820 -87th S.E., Woodinville, WA 98072, Tel: 206-481-8833, FAX: 206-486-1002; FSC No.: 057143; Empl.: 17; *Sls. Mgr.:* Jeannie Olson

RGB SPECTRUM, 2550 Ninth St., Berkeley, CA 94710, Tel: 415-848-0180, FAX: 415-848-0971; Empl.: 30; *Sls. Mgr.:* Lucien E. Long; *Dist. Mgr.:* Lucien E. Long

RHETOREX, INC., 1671 Deli Ave. No. 208, Campbell, CA 95008, Tel: 408-370-0881, FAX: 408-370-1171; Empl.: 15; *Sls. Mgr.:* Michael Ross

RHG ELECTRONICS LABORATORY, INC., 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, FAX: 516-242-1222; Empl.: 205; *Sls. Mgr.:* David E. Krautheimer

RHOMBUS INDUSTRIES, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, TWX: 910-596-1826, FAX: 714-896-0971; FSC No.: 16714; Empl.: 60; *Sls. Mgr.:* Jim Earley; *Dist. Mgr.:* Jim Earley

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RICHARD-LEE CO., 3 Quine St., Cranford, NJ 07016, Tel: 201-276-0710, FAX: 201-276-6179; Empl.: 13

RICHARDS, ARKLAY S., CO., INC., 72 Winchester St., Newton Highlands, MA 02161-1796, Tel: 617-527-4385, FAX: 617-964-3746; *Sls. Mgr.:* L. K. Richards

RICHARDSON ELECTRONICS, LTD., 40W267 Keslinger Rd., LaFox, IL 60147, Tel: 800-323-1770, 708-208-2200, FAX: 708-208-2550; FSC No.: 5L804; Empl.: 625; *Sls. Mgr.:* Chris Cane; *Dist. Mgr.:* Chris Cane

RICHCO PLASTIC CO., P.O. Box 804238, Chicago, IL 60680, Tel: 312-539-4060, FAX: 312-539-6770; FSC No.: 06915; Empl.: 400; *Sls. Mgr.:* Ted E. Pavoris; *Dist. Mgr.:* Ted Pavoris

RIDGE TOOL CO., Sub. Emerson Elec. Co., 400 Clark St., Elyria, OH 44036, Tel: 216-323-5581, TELEX: 0243420, FAX: 216-323-5204; *Dist. Mgr.:* John Drew

RITTAL CORP., 3100 Upper Valley Pike, Springfield, OH 45504-9807, Tel: 800-477-4000, TELEX: 513-390-5599; Empl.: 150

RITZ ELECTRONICS/RELCO, 196 Queen St. N., New Dundee, Ont., Canada NOB 2EO, Tel: 519-696-2616, FAX: 519-696-2670; Empl.: 30; *Sls. Mgr.:* Leonard Snow; *Dist. Mgr.:* Leonard Snow ..... C•1092; D•2027

Local Sales Offices & Reps

CA	Torrance, U.S. Power Converting Co.	213-316-9984
KS	Wichita, US Power/Relco Midwest	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

Local Distributors

CA	Torrance, Leonard Snow & Assocs./U.S. Power	213-316-9984
KS	Wichita, US Power/Relco Midwest	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

RJF INTERANTIONAL CORP., 3875 Embassy Pkwy., Fairlawn, OH 44333, Tel: 216-668-7689, FAX: 216-668-7701

R-K ELECTRONICS, 11560 Goldcoast Dr., Cincinnati, OH 45249, Tel: 513-489-4060

RLC ELECTRONICS, INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, TWX: 710-571-2103, FAX: 914-241-1753; FSC No.: 12598; Empl.: 75; *Sls. Mgr.:* Joseph Norelli; *Dist. Mgr.:* Joseph Norelli

RMF PRODUCTS, INC., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, Tel: 708-879-0020, FAX: 708-879-6749; Empl.: 11; *Sls. Mgr.:* R. Frieders ..... C•1593

RMS COMPANY, Connector Division, 980 Osborne Rd., Minneapolis, MN 55432, Tel: 612-786-1520, FAX: 612-786-1771; Empl.: 50; *Sls. Mgr.:* Jack M. Lundeen

RMS TECHN., 11833 Canon Blvd., Ste 100, Newport News, VA 23606, Tel: 804-873-0100, FAX: 804-873-1512; FSC No.: 59606; Empl.: 42

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, TWX: 710-581-6555, FAX: 212-989-3285; FSC No.: 82872; Empl.: 80; *Sls. Mgr.:* Ray Lefebvre; *Dist. Mgr.:* Ray Lefebvre

RO ASSOCIATES

FAX: 408-744-1521

RO ASSOCIATES, INC., 246 Caspian Dr., Box 61419, Sunnyvale, CA 94088, Tel: 408-744-1450; FSC No.: 24230; Empl.: 47; *Sls. Mgr.:* R. D. Okada ..... D•2028-2033

Local Sales Offices & Reps

AL	JSI Inc.	205-883-4163
AL	Huntsville, JSI, Inc.	205-883-4163
AZ	Phoenix, Tech. Sls. Inc.	602-246-1614

CA Los Angeles, West Coast Reps. 213-690-9960
CA San Diego, W. Coast Rep 619-581-2406
CA San Jose, P & M Elctrns. 408-287-0402
CO Denver, F.G. Mktg. 303-795-9176
CT Woodbury, Power Factor 203-264-9812
DC Washington, Gans & Pugh 703-709-0305
FL Ft. Lauderdale, Panamtech 305-587-3769
FL Orlando, Panamtech 407-679-5506
IL Chicago, Mar-con Assocs. Inc. 708-675-6450
KS Kansas City, Midtec 913-541-0505
MD Baltimore, Gans & Pugh 301-442-2189
MA Boston, Power Factor 508-234-6415
MN Minneapolis, R J Inc. 612-866-3661
MO St. Louis, Midtec 314-275-8666
NM Albuquerque, Fry-Gates, Inc. 505-262-1525
NY Buffalo, NRM Mktg. 716-634-4300
NY Great Neck, M.O.S. Mktg. 516-487-3966
NY Rochester, NRM Mktg. 716-352-9166
NY Syracuse, NRM Mktg. 315-685-8991
OH Centerville, Omega Sls., Inc. 513-434-5507
PA Philadelphia, Gans & Pugh 215-699-6655
TX Houston, Barry Sls. 713-784-5860
TX Richardson, Barry Sls. 214-234-0255
WA Seattle, West Coast Reps. 206-483-5300
Can Vancouver, BC, Tracan Elctrn. Western Ltd. 604-984-4141

ROBBINS & MYERS/ELECTRO-CRAFT, 6950 Washington Ave. So., Eden Prairie, MN 55344, Tel: 612-942-3600, FAX: 612-942-3636; *Sls. Mgr.:* Terry McDonald; *Dist. Mgr.:* Brad Nelson

ROBINSON NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-948-0564, TWX: 810-540-4082, FAX: 812-945-0804; Empl.: 567; *Sls. Mgr.:* Terry Johnson; *Dist. Mgr.:* Vic Siccone

Local Sales Offices & Reps
IN New Albany, Robinson Nugent, Inc. ... 812-948-0564

ROBISON ELECTRONICS, P.O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-8000, FAX: 805-544-8091; FSC No.: 19080; Empl.: 83

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103, FAX: 914-947-1712; FSC No.: 12111

ROCKLAND SCIENTIFIC CORPORATION, P.O. Box 3135, Princeton, NJ 08543, Tel: 609-896-2255, FAX: 609-895-9726; Empl.: 60; *Sls. Mgr.:* M. Classen

ROCKWELL INTERNATIONAL, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532 COLLINS CSMA., FAX: 714-641-5320; Empl.: 60; *Sls. Mgr.:* Robert A. Johnson

ROCKWELL INT'L:SEMICONDUCTOR PRODUCTS DIVISION, 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 714-833-4600, TWX: 910-591-1698; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* Ernie Raper, Dir. of Sls.; *Dist. Mgr.:* K. Reutemann

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RODALE TECHNICAL SALES INC., 577 Main Street, Islip, NY 11751, Tel: 516-277-5454, TELEX: 5106007812, ESYLNK: T8003254112; Empl.: 10; *Sls. Mgr.:* Gene Lipman ..... **B•1182, 1388; C•1662-1663, 1816-1817**

Local Sales Offices & Reps
CA Yorba Linda, Rodale Tech. Sls., Inc. ... 714-283-3140
KS Prairie Village, Crosslink Elctrl./Elctrns. 913-432-6100
NY Islip, Rodale Tech. Sls., Inc. 516-277-5454
OH Bedford Hgts., P.H.P. 515-472-5984

Local Distributors
AZ Phoenix, Storm Prods. 602-269-3485
CA Inglewood, Storm Prods. 213-776-8141
CA Sacramento, AVAC Sunset 1-800-AVAC-DIV
CA Santa Ana, BDS Elctrns., Inc. 714-662-1050
CO Broomfield, Storm Prods. 303-466-1991
MN St. Paul, AVAC Mid-America 1-800-AVAC-DIV
NJ Edison, AVAC National 1-800-AVAC-DIV
TN Nashville, AVAC Pioneer Tenn. 1-800-AVAC-DIV
TX Dallas, Storm Prods. 214-330-1381
WA Woodinville, Storm Prods. 206-488-7400

RODANN ELECTRONICS MFG. CO., 133 S. Brea Blvd, Brea, CA 92621, Tel: 714-529-1301, 800-366-7010, FAX: 714-529-9564; *Sls. Mgr.:* Alex Skarbek

RODELCO ELECTRONICS CORP., 111 Haynes Ct, Ronkonkoma, NY 11779, Tel: 516-981-0900, FAX: 516-981-1792; Empl.: 44

ROD-L
ELECTRONICS, INC.

FAX: 415-326-1993

ROD-L ELECTRONICS, INC., 923 Hamilton Ave., Menlo Park, CA 94025, Tel: 415-322-0711, 1-800-548-6305, TWX: 296210; *Sls. Mgr.:* Tom Cooke .... **D•1316-1317**

Local Sales Offices & Reps
CA Menlo Park, ROD-L (factory) 415-322-0711
CO Conifer, Energy Equip. Sls. 303-972-3335
IL Elk Grove, Loren Green Assocs. 312-593-0282
IN Indianapolis, Loren Green Assocs. 317-293-9827
KS Lenexa, Midtec Assocs. 913-541-0505
MD Cockeysville, Sci. Reps. 301-321-1411
MA Reading, Scheinfein Assocs. 617-944-2304
MI Detroit, Micro Sls 313-464-4520
MN Minneapolis, Hei-Lite Sls 612-861-6051
MO St. Louis, Midtec Assocs. 314-275-8666
NJ Fairfield, Addem Sls. 201-882-0993
NJ Pennsauken, Sci. Reps. 609-662-5222
NY De Witt, DB Assocs. 315-446-0220
OH Centerville, Micro Sls. 513-433-8171
OH N. Olmsted, Micro Sls 216-734-3080
OK Tulsa, Spectra Sls 918-663-7188
OR Beaverton, Core II Mktg 503-641-0877
TX El Paso, Venturesearch 915-594-4094
TX Houston, Spectra Sls. 713-270-8212
TX Richardson, Spectra Sls. 214-234-3600
VA Fairfax, Sci. Reps. 703-385-0600
WA Redmond, Core II Mktg 206-885-4344
WA Spokane, Core II Mktg 509-922-2971
WV Pittsburg, Micro Sls 412-471-0105
Can Ontario, Webster Instrs. Ltd. 416-625-0600

Local Distributors
CA Menlo Park, Rod-L (Factory) 415-322-0711
Can Ontario, Webster Instrs. Ltd. 416-625-0600

ROEAN INDUSTRIES, INC., 12970 Branford, Ste. C, Pacoima, CA 91331, Tel: 818-767-7047, FAX: 818-768-4974; Empl.: 8

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 708-498-2300, FAX: 708-498-2334; FSC No.: 86797; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier

ROGERS CORP. DIV. POWER DISTBN.DIV., 5750 East McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-830-3370

ROGERS CORPORATION, Circuit Components Div., 2400 S. Roosevelt St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-967-9385

ROGERS CORPORATION, Circuit Materials Div., Box 4000, Chandler, AZ 85244, Tel: 602-963-4584, FAX: 602-732-9381

ROGERS CORPORATION, Flexible Interconnections Div., Box 700, Chandler, AZ 85244, Tel: 602-963-4584, TELEX: 140-223, TWX: 910-950-1961, FAX: 602-786-8490; *Sls. Mgr.:* Darrel Brasch

ROGERS CORPORATION, Microwave & Circuit Matls. Div., 100 S. Roosevelt Ave., Chandler, AZ 85226, Tel: 602-961-1382, FAX: 602-961-4533

ROGERS CORPORATION, Molding Materials Div., P.O. Box 550, Manchester, CT 06040, Tel: 203-646-5500, FAX: 203-646-5503

ROGERS CORPORATION, Power Distribution Div., 5750 E. McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-396-6401

ROGERS CORPORATION, Soladyne Div., 7447 Convoy Ct., San Diego, CA 92111, Tel: 619-279-7872, FAX: 619-277-9105; FSC No.: 55655; *Sls. Mgr.:* Dale Reed; *Dist. Mgr.:* Rick Jansen

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500

ROH, Portland Instrument, 6120 San Fernando Rd., Glendale, CA 91201, Tel: 818-500-0137, FAX: 818-240-1828; Empl.: 10; *Sls. Mgr.:* Dick Herbert

Local Distributors
CA Los Angeles, Hoffman Video Sys. 213-749-3311
FL Miami, Midwest Communications 305-592-5355
KY Hebron, TV One 606-689-4515

ROHDE & SCHWARZ, INC., 4425 Nicole Drive, Lanham, MD 20706, Tel: 301-459-8800, FAX: 301-459-2810; FSC No.: 82199; Empl.: 65

ROHM

FAX: 615-641-2022

ROHM CORPORATION, Rohm Electronics Division, 3034 Owen Drive, Antioch, TN 37013, Tel: 615-641-2020; Empl.: 115; *Sls. Mgr.:* Mike DelGrippo; *Dist. Mgr.:* Steve Bishop .... **A•1742, 1984-1985, 2120-2121; B•1183**

Local Sales Offices & Reps
AL Huntsville, Strategic Mktg. 205-464-0490
AZ Tucson, Clemick & Assocs. 602-749-4003
CA Camarillo, Eltec Entprs. 805-484-8298
CA Cupertino, GetSales 408-725-8384
CA Dana Point, Eltec Entprs. 714-493-7003
CA Diamond Bar, Eltec Entprs. 714-861-4779
CA San Diego, C.K. Assocs. 619-279-0420
CO Parker, A5 Company 303-841-3651
FL Altamonte Springs, Sales Engrg. Concepts 407-682-4800
FL Deerfield Bch., Sales Engrg. Concepts 305-426-4601
IL Lake Bluff, Hopewell Assocs. 708-234-3310
IN Kokomo, Schillinger Assocs., Inc. 317-455-2708
IA Cedar Rapids, Electromec Sls., Inc. ... 319-393-1637
KS Kansas City, B.C. Elctrn. Sls. 913-342-1211
MD Westminster, Chesapeake Technlgs. .. 301-876-4318
MA Harvard, Cycle Sls. 508-456-6868
MI Grosse Pointe Pk., Greiner Assocs., Inc. 313-499-0188
MN Burnsville, Electromec Sls., Inc. 612-894-8200
MO Bridgeton, B.C. Elctrn. Sls., Inc. 314-739-6683
NJ Springfield, Radix, Inc. 201-467-4970
NY Buffalo, Quality Comps., Inc. 716-837-5430
NY Manlius, Quality Comps., Inc. 315-682-8885
NY Rochester, Quality Comps., Inc. 716-342-7229
NC Cary, Rohm Corporation 919-460-5959
OR Tigard, Comps. West, Inc. 503-684-1671
PA Prospect Park, ELF Sls. Co. 215-534-3340
TN Jonesboro, Strategic Mktg. 615-753-5518
TN Nashville, Strategic Mktg. 615-883-7882
TX Austin, Sage Mktg. 512-335-0300
TX Bedford, Sage Mktg. 817-267-7781
TX Denton, Rohm Corporation 817-383-3931
WA Redmond, Comps. West, Inc. 206-885-5880
WA Spokane, Comps. West, Inc. 509-922-2412
PR Puerto Rico, Sales Engrg. Concepts ..... 809-250-0140 x 5321
Can Hamilton, Ont., Cartwright-Southall Assocs. 416-528-0294
Can Nepean, Ont., Cartwright-Southall Assocs. 613-723-6733

ROLYN OPTICS CO., 706 Arrowgrand Circle, Covina, CA 91722-2199, Tel: 818-915-5707/5717, TELEX: 67-0380, FAX: 818-915-1379

ROSE ELECTRONICS, INC., Energy Products Group, 1991 Concourse Dr., San Jose, CA 95131, Tel: 408-943-0440, FAX: 408-943-0360; Empl.: 13; *Sls. Mgr.:* Bob Burres; *Dist. Mgr.:* Bob Burres

ROSE ENCLOSURES SYS., INC., 7330 Executive Way, Frederick, MD 21701, Tel: 301-696-9800, FAX: 301-696-9494; FSC No.: 4Y520/C0242; Empl.: 45; *Sls. Mgr.:* Warren Hudacek ..... **C•1093**

Local Sales Offices & Reps
CA Irvine, Comp. Mktg. 714-951-5950
FL Tampa, Florida Comp. Sls. 813-960-7044
MA Needham, Todino Eng. Sls. 617-444-7925
IL Chicago, Paddock Mktg. 312-452-7852
IA Cedar Rapids, Tech. Elctrns. 319-366-5443
NY Rochester, Tech. Comp. Sls. 716-342-2406
NC Kernersville, Heritage Sls. 919-996-4374
OH Dayton, J.C. Hofstetter Co. 216-241-4880
PA Frazer, ICI 215-889-0650
TX Dallas, D.J. Sls. & Assoc. 214-783-8876
WA Federal Way, K. R. Jensen Sls. 206-874-2772

Local Distributors
Can Vancouver, BC, Memco 604-590-1553

ROSEMONT-NASHVILLE, INC., See Chromalox Instrs. & Controls

ROSEMOUNT®

FAX: 201-857-9403

ROSEMOUNT ANALYTICAL INC., 89 Commerce Rd., Cedar Grove, NJ 07009, Tel: 800-367-7242 .... **D•1318**

Local Sales Offices & Reps

AL	Birmingham	205-988-5759
AL	Mobile	205-343-9403
AZ	Phoenix	602-867-9374
CA	Concord	415-674-9799
CA	Laguna Hills, Kendall Mktg.	714-581-9951
CA	LaHabra	213-694-5504
CO	Lakewood	303-935-1524
FL	Maitland	407-740-0170
GA	Marietta	404-426-1300
HI	Honolulu	808-842-4484
IL	Lombard	708-495-8383
IN	Indianapolis	317-247-4613
KS	Shawnee Mission	913-642-8560
LA	Baton Rouge	504-756-7000
LA	Lake Charles	318-436-1828
TX	Stafford	713-274-0500
MD	Hunt Valley	301-527-1030
MA	Westborough	508-898-2444
MI	Brighton	313-227-3622
MN	Bloomington	612-832-5001
MO	Bridgeton	314-739-1540
NJ	Fairfield	201-808-9168
NY	Fairport	716-223-0400
NC	Charlotte	704-523-2223
NC	Raleigh	919-783-6730
OH	Cincinnati	513-381-5343
OH	Independence	216-661-9800
OK	Tulsa	918-663-6025
PA	King of Prussia	215-768-6900
PA	Pittsburgh	412-787-7340
TN	Knoxville	615-588-0014
TN	Memphis	901-365-9906
TX	Dallas	214-869-1461,62
TX	Round Rock	713-274-0500
VA	Midlothian	804-739-0660
WA	Bellevue	206-451-1111
WI	Appleton	414-731-8757

ROSENBERGER-MICRO COAX, (Formerly Micro-Coax Components, Inc.), Box E, Collegeville, PA 19426, Tel: 215-489-3700, FAX: 215-489-1103; Empl.: 50; *Sls. Mgr.:* Lloyd Deery

ROSS ENGINEERING CORP., 540 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621, FAX: 408-377-5182; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Jim Ross; *Dist. Mgr.:* Jim Ross ..... **B•1230, 1567-1569; D•1319**

ROTEK INSTRUMENT CORP., 390 Main St, Waltham, MA 02254, Tel: 617-899-4611, TELEX: 928034; FSC No.: 06678; *Sls. Mgr.:* Eliot Warner

ROTORK CONTROLS, INC., 19 Jetview Drive, Rochester, NY 14624, Tel: 716-328-1550, FAX: 716-328-5848; Empl.: 65; *Sls. Mgr.:* Chris Warnett; *Dist. Mgr.:* Chris Warnett

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761, FAX: 419-729-1794; FSC No.: 82878; Empl.: 89 ..... **C•1513-1515, 1819**

Local Sales Offices & Reps

AL	Huntsville, South Design & Mktg.	205-880-3623
AZ	Phoenix, Blackhart Assocs.	602-893-3488
CA	Morgan Hill, Val. C. Robinson	408-778-6210
FL	Maitland, EIR, Inc.	407-660-9600
IL	Lisle, Connect-Plus	708-355-6363
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Burlington, Don C. Richard	617-273-3888
MN	Stillwater, Kits, Co.	612-439-8088
PA	Glenside, Koebert Assocs.	215-887-2310
TX	Roanoke, CMR	817-379-6540
WA	Bellevue, Advanced Power Comps.	206-747-9127
WV	Inwood, Koebert Assocs.	304-229-8401

Local Distributors

MN	Bloomington, Triad Wire & Cable	612-884-7390

MILTON ROY CO., Environmental, 1238 W. Grove Ave., Orange, CA 92665-4134, Tel: 714-974-5560, FAX: 714-921-2531; Empl.: 60; *Sls. Mgr.:* Harold Peper

ROYONIC INC., 25345 Ave. Stanford, Ste. 201, Valencia, CA 91355, Tel: 805-257-0303, TELEX: 315672, ESYLNK: 62840158, FAX: 805-257-0802; Empl.: 11; *Sls. Mgr.:* Rory Stoner

RTRON CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-679-7180, FAX: 708-675-3709; FSC No.: 19130; *Sls. Mgr.:* R. McLean

RTS SYSTEMS, TELEX COMMUNICATIONS, INC., 1100 W. Chestnut St., Burbank, CA 91506, Tel: 818-566-6700, TELEX: 194855, FAX: 818-843-7953; FSC No.: 60572; Empl.: 45; *Sls. Mgr.:* Shelley Brown Harrison; *Dist. Mgr.:* Shelley Brown Harrison

RUBYCON AMERICA, INC., 4293 Lee Ave., Gurnee, IL 60031, Tel: 708-249-3450, FAX: 708-578-1300; Empl.: 8; *Sls. Mgr.:* Jeffrey W. Swanson; *Dist. Mgr.:* Jeffrey W. Swanson

RUNDEL PRODUCTS, Allied Controls Incorporated, 562 Captain Neville Drive, Waterbury, CT 06705, Tel: 203-757-4200, FAX: 203-757-4204; FSC No.: 02288; *Sls. Mgr.:* J. T. Kryjak; *Dist. Mgr.:* D. Varga ..... **B•1768-1769**

Local Sales Offices & Reps

AZ	Phoenix, BLS Comms.	602-841-6613
CA	Irvine, Component Mktg. Assoc.	714-727-0688
CA	Tarzana, Comp. Mktg. Assoc.	818-708-8058
CT	Waterbury, Allied Controls, Inc.	203-757-4200
FL	Lakeland, Munday Sls. Co.	813-858-5606
IL	Skokie, Indl. Reps.	312-967-8430
IN	Indianapolis, M & L Elctrn. Sls., Inc.	317-359-4742
MD	Burtonsville, Chesapeake Technlg.	301-236-0530
MN	Bloomington, Indl. Reps. Inc.	612-854-8027
NJ	Englewood, Gray Assocs., Inc.	201-894-0894
NJ	Kenvil, Gray Assocs., Inc.	201-927-6662
OH	Beachwood, Elctrn. Salesmasters Inc.	216-831-9555
TX	Austin, Comp. Technlg.	512-250-2450
TX	Dallas, Component Technlgy.	214-783-8831
TX	Houston, Comp. Technlg.	713-961-1262
WI	Brookfield, Indl. Reps. Inc.	414-789-9393

RUSH ENTERPRISES INC.:A HEICO COMPANY, 20 Hampshire Drive, Hudson, NH 03051, Tel: 603-886-9460, FAX: 603-886-0372; Empl.: 14; *Sls. Mgr.:* William A. Walsh

RUSSTECH ENGINEERING COMPANY, INC., 23322 (D) Madero Road, Mission Viejo, CA 92691, Tel: 714-472-0880, FAX: 714-472-1081; FSC No.: 01EG24; *Sls. Mgr.:* David Zoscak

RUSTRAK INSTRUMENTS, Mark IV Company, Rte. 2 & Middle Rd., E. Greenwich, RI 02818, Tel: 401-884-6800, 800-332-3202, TWX: 710-387-1500; Empl.: 250; *Sls. Mgr.:* John Olobri; *Dist. Mgr.:* John Olobri ..... **D•1423**

Local Distributors

AZ	Tempe, CMI Metermaster	602-431-0015
CA	Fullerton, Rustrak	714-879-6384
CA	Hayward, Coast Inst.	415-786-9300
CA	San Marcos, Mitchell Inst.	619-744-2690
CO	Commerce City, WACO Elctrns.	303-289-4743
CT	Middletown, EIL Instrs.	203-346-6646
FL	Lakeland, AA Elec.	813-665-6941
GA	Forest Park, Brownell Electro	404-362-9009
IL	Des Plaines, Rustrak	312-803-5390
MD	Sparks, EIL Instrs.	301-771-4800
MA	Burlington, EIL Instrs.	617-272-9450
MI	Grand Rapids, Smith Inst.	616-245-1195
MI	Royal Oak, George Inst.	313-280-1111
MO	St. Louis, Indl. Svc. Labs	314-423-3141
NJ	Newark, Norman Bragar Prods.	201-344-1100
NC	Charlotte, Brownell Electro	704-597-1270
OH	Cincinnati, Schlemmer Assocs.	513-522-8340
OH	Cleveland, M.A. Blankenberg	216-251-7010
PA	Philadelphia, Sunshine Scientific	215-673-5600
RI	E. Greenwich, Rustrak	800-332-3202
TX	Dallas, Inotek Corp.	214-243-8370
TX	Houston, American Analog	713-941-7265
WA	Seattle, Branom Inst.	206-762-6050
WI	Waukesha, Wisconsin Control Corp.	414-796-0290
Can	Mississauga, Ont., Webster Inst.	416-625-0600

RUTHERFORD RESEARCH, Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

R X D INC., Relm Communications, 806 Custer Ave., Norfolk, NE 68701, Tel: 402-379-0012, 800-228-8108, FAX: 402-379-3074 ..... **A•1452-1454**

RYAN INTERNATIONAL CORP., 4800 Evanswood Dr., Columbus, OH 43229-6207, Tel: 614-885-3303, FAX: 614-885-8307; Empl.: 30

RYE INDUSTRIES, INC., 3337 Air Park Rd, Fuquay-Varina, NC 27526, Tel: 919-557-0511, TELEX: 919-557-0510; Empl.: 5

S A B NIFE, INC., Div. of Sonesson, P.O. Box 7366, 251 Industrial Blvd, Greenville, NC 27834, Tel: 919-830-1600, TELEX: 92-9407; Empl.: 150; *Sls. Mgr.:* Alan Feo; *Dist. Mgr.:* Alan Feo

SABRE COMMUNICATIONS CORP., 3400 Hwy 75 N, P.O. Box 536, Sioux City, IA 51102, Tel: 712-258-6690, FAX: 712-258-8250; FSC No.: 60348; *Sls. Mgr.:* Jerry W. Audus; *Dist. Mgr.:* Larry D. Vaydich

SABRITEC, 1733 Kaiser Ave., Irvine, CA 92714, Tel: 714-660-1970, TELEX: 678401; FAX: 714-660-9136; FSC No.: 58795; Empl.: 49

SACO CONTROLS INC., 9700 Trans Canada Hwy., Montreal,Qc., Canada H4S 1V9, Tel: 514-745-0310, TELEX: 055-62171, FAX: 514-745-0315; Empl.: 36; *Sls. Mgr.:* Pat Argento

SAFE POWER, Acme Electric Corporation, 5416 Amelia Earhart Dr., Salt Lake City, UT 84116, Tel: 801-539-0227, 1-800-325-5848, FAX: 801-539-0237; *Sls. Mgr.:* Rod Pullen; *Dist. Mgr.:* Jim Heidenreich

SAFT AMERICA INC., Power Sources Div., 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547620, TWX: 810-786-5866, FAX: 912-247-6680; Empl.: 200 ..... **D•1426, 1486-1488**

SAFT AMERICA INC., Advanced Battery Systems Div., 107 Beaver Ct, Cockeysville, MD 21030, Tel: 301-771-3200, FAX: 301-771-1144 ..... **D•1426**

SAFT

FAX: 912-247-6680

SAFT AMERICA, INC., Portable Battery Division, 711 Industrial Blvd, Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547-620; Empl.: 600; *Sls. Mgr.:* Michael Marcoux ..... **D•1426, 1486-1488**

Local Sales Offices & Reps

CA	Camarillo, SAFT America, Inc.	805-482-4101
CA	Granada Hills, SAFT America, Inc.	818-360-1853
CA	Redwood City, SAFT America Inc.	415-365-4539
FL	Boca Raton, SAFT America, Inc.	407-338-7730
GA	Kennesaw, SAFT America Inc.	404-429-4938
GA	Marietta, SAFT America, Inc.	404-992-6950
IL	Naperville, SAFT America, Inc.	708-355-8990
IL	Oak Forest, SAFT America, Inc.	708-687-6690
TX	Dallas, SAFT America, Inc.	214-239-3935
MN	Inver Grove Hgts., SAFT America Inc.	612-552-0121
OH	Brownsville, SAFT America, Inc.	216-861-1877
PA	McKean, Advacom	814-476-7774

Local Distributors

AZ	Phoenix, Lynntronics	602-433-0288
CA	Carlsbad, Quantum Batteries	619-438-2202
CA	Chatsworth, Mill Comm. Distrs., Inc.	818-998-3111
CA	Costa Mesa, House of Batteries	714-548-3968
CA	Hawthorne, Kent Elctrns.	213-970-0997
CA	Mountain View, Energy Sls.	415-969-0800
CA	N. Hollywood, C.H. & M	818-982-3150
CA	San Rafael, Elctrns. Plus	415-457-0466
CO	Littleton, AVT	303-798-1958
FL	Altamonte Springs, TNR Tech.	407-682-4311
FL	Hialeah, Pro Battery	305-884-4040
GA	Decatur, ELS Prods.	800-334-5066
IL	Downers Grove, Telecomms. Dvcs., Inc.	708-971-3460
IL	Lisle, Jabro Batteries	708-964-9358
IL	Rosemont, Advent Elctrns.	708-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MA	Andover, Generation Elctrns.	508-683-1177
MA	Billerica, A. W. Mayer Co., Inc.	617-229-2255
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Sharon, Adcour	617-784-8123
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, R. S. Elctrns.	313-525-1155
MI	Livonia, Vidcom	313-462-9400
MN	St. Paul, D. C. Battery Prods. Inc.	612-646-7478
NY	Farmingdale, Delta Concepts	516-845-1294
NY	Flushing, W & W Assocs.	718-961-2103
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Charlotte, Electro Sys., Inc.	704-525-2421

PA Bensalem, Avex Elctrns. Corp. 215-638-3300
PA McKean, Advacom 814-476-7774
TN Mt. Juliet, Batteries Unlimited 615-754-8179
TX Austin, Kent Elctrns. 512-834-1900
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Lone Star Mktg. 713-589-0853
TX Richardson, Kent Elctrns. 214-669-2600
TX Spring, Jabro Batteries, S.W. 713-367-9393
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Falls Church, Perrott Engrg. Labs, Inc. 703-532-0700
WA Redmond, Energy Sls. 206-883-2343

SAGE LABORATORIES, INC., 11 Huron Dr., Natick, MA 01760, Tel: 508-653-0844, TWX: 710-346-0390, FAX: 508-653-5671; FSC No.: 07180; Empl.: 43; *Sls. Mgr.:* Tony Cieri

SAINT SWITCH, INC., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174, Tel: 708-377-3779, FAX: 708-377-7438; FSC No.: 60198; Empl.: 30

SAMARIUS PRECISION INSTRUMENTS, INC., 562 Captain Neville Drive, Waterbury, CT 06705, Tel: 203-756-7030, FAX: 203-757-4204; FSC No.: 18065; Empl.: 25; *Sls. Mgr.:* Isabella Dobbins

SAMATIC WINDING MACHINE, Jenlor Ltd., 200 Highbridge St., Fayetteville, NY 13066, Tel: 315-637-9080, FAX: 315-637-9149; Empl.: 15; *Sls. Mgr.:* Jim Philips; *Dist. Mgr.:* Jim Phillips

SAMHWA

FAX: 805-584-9498

SAMHWA U.S.A. INC., 709 E. Cochran St. Bldg. 1A, 1B, Simi Valley, CA 93065, Tel: 805-584-9494, 800-800-0069; Empl.: 8; *Sls. Mgr.:* Joseph Buckle

SAMSUNG ELECTRON DEVICES, See Samtron Displays, Inc.

SAMTEC, INC., 810 Progress Blvd., P.O. Box 1147, New Albany, IN 47150, Tel: 812-944-6733, TWX: 810-540-4095, FAX: 812-948-5047; FSC No.: 55322; Empl.: 200; *Sls. Mgr.:* Mike Hynes

SAMTRON DISPLAYS, INC., SAMSUNG Electron Devices, 14251 E. Firestone Bl. No. 101, La Mirada, CA 90638, Tel: 213-802-8425, TWX: 183423 SEDLA; *Sls. Mgr.:* Myung Bang ..... **B•1114-1116**

Local Sales Offices & Reps

AL Huntsville, SCSI 205-533-6500
AZ Phoenix, Moss Mktg. 602-433-9349
CA Solana Beach, D2 619-481-9310
CT Torrington, Phoenix Sls. Co. 203-496-7709
GA Roswell, SCSI 404-594-7557
IL Arlington Heights, Coombs Assocs. 708-439-9810
IN Ft. Wayne, Gen II 219-436-4485
IN Louisville, Gen II 502-491-5250
KS Lenexa, A & M 913-888-0022
KY Indianapolis, Gen II 317-848-3083
MA Peabody, Orion Grp. 508-532-6266
MI Troy, C.B. Jensen 313-643-0506
MN Eden Prairie, Comtek 612-941-7181
NM Albuquerque, Moss Mktg. 505-292-7505
NC Raleigh, Zucker Assocs. 919-782-8433
OH Dayton, Midwest Mktg. 513-433-2511
OH Lyndhurst, Midwest Mktg. 216-381-8575
OR Beaverton, ATMI 503-643-8307
PA W. Conshohocken, Eastern Comp. 215-825-8610
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NY Hauppauge, Jaco Elctrns.,Inc. 516-273-5500, FAX:516-273-5799
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SCHENCK PEGASUS CORP., 2890 John R, Troy, MI 48083, Tel: 313-689-9000, TWX: 810-232-1529, FAX: 313-689-8578; Empl.: 130; *Sls. Mgr.:* David Sallberg

SCHLEGEL CORP., P.O. Box 23197, Rochester, NY 14692, Tel: 716-427-7200, TELEX: 6854121, FAX: 716-427-9993; Empl.: 500; *Sls. Mgr.:* Duncan Tyrrel

SCHLEUNIGER USA INC., 150 Dow St. Tower Four, Manchester, MI 03101, Tel: 603-668-8117, FAX: 603-668-8119; Empl.: 11; *Sls. Mgr.:* Charles C. S. Burns

SCHLUMBERGER INDUSTRIES, Tranducers Div., 11321 Richmond, M-102, Houston, TX 77082, Tel: 713-558-2587, TELEX: 791209, FAX: 713-558-8954; *Sls. Mgr.:* Robinson Ord

SCHLUMBERGER INSTRUMENTS, Schlumberger Technlgs., 829 Middlesex Turnpike, Billerica, MA 01821, Tel: 508-671-9700, 1-800-225-5765, FAX: 508-671-9704; Empl.: 70

SCHLUMBERGER INSTRUMENTS, Schlumberger Technologies, 20 North Avenue, Burlington, MA 01803, Tel: 617-229-4825, FAX: 617-229-4885; FSC No.: 1T316; Empl.: 50; *Sls. Mgr.:* Michael Milona

SCHNEIDER CORP. OF AMERICA, 400 Crossways Park Drive, Woodbury, NY 11797, Tel: 516-496-8500, FAX: 516-496-8524; Empl.: 13; *Sls. Mgr.:* Dwight Lindsey; *Dist. Mgr.:* Dwight Lindsey

SCHONSTEDT INSTRUMENT CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, FAX: 703-471-1795; Empl.: 45; *Sls. Mgr.:* O. K. Davis

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, FAX: 612-475-1786; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* A. Schmitt

Local Sales Offices & Reps
MA Needham, Hatch Assocs. 617-963-3306

SCHOTT ELECTRONICS, 42 Silvermine Road, Seymour, CT 06483, Tel: 203-881-0102, TWX: 710-451-8911, FAX: 203-881-0098; Empl.: 150; *Sls. Mgr.:* Ross Wieringa

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535, FAX: 717-457-6960; FSC No.: 23-169-1403; Empl.: 500; *Sls. Mgr.:* J. Nimmerfroh

SCHRACK NORTH AMERICA CORP., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, Tel: 516-737-0099, FAX: 516-737-2550; Empl.: 10; *Sls. Mgr.:* John Walsh; *Dist. Mgr.:* Christopher Meza ..... **B•1570-1576**

Local Sales Offices & Reps
AL Huntsville, DHR Mktg. 205-533-5165
AZ Phoenix, CPS Assoc. 602-246-1097
CA Arcadia, Van Gott & Assocs. 818-445-9728
CO Boulder, Stratford Grp. 303-530-3194
FL Miami, Omnitron 305-448-0050
FL Tampa, SRT Mktg. 813-884-4805
IN Mishawaka, Power Comp. 219-256-6630
MO Hazelwood, Acorn Elctrns. 314-731-2002
MD Hunt Valley, Eagle 301-666-3930
MA Swansea, Poisson & Assoc. 508-677-3655
MI Ypsilanti, Tech Rep 313-572-1950
MN Roseville, TLC 612-483-2226
NJ Lawrenceville, DVS Co. 609-896-1112
NJ Matawan, Sheppard 201-566-0095
NY Liverpool, Lynn 315-457-6859
NC Raleigh, Spears 919-790-7606
OH Highland Hts., KT/Depco 216-442-6200
PA Gibsonia, Lynn 412-443-3670
TX Dallas, Pro Sls. 214-387-0344
WA Bellevue, Caruso & Co. 206-454-1261
Can Ontario, Honeywell Ltd. 416-293-8111

Local Distributors
AL Birmingham, ACK Ind. 205-322-0588
AZ Tempe, Control Des. Supp. 602-829-7981
CA City of Industry, ITAL 818-968-8515
CA San Rafael, Elctrns. Plus 415-457-0466
CO Denver, CSID 303-292-9594
CT Middlefield, Control Des. Supp. 203-349-0200
FL Ft. Lauderdale, Southeastern Elctrns. 305-563-4131
GA Stone Mountain, Control Des. Supp. 404-979-3500
ID Boise, Bolen's Control House 208-363-5280
IL Carol Stream, Lectro Comps. 708-690-0520
IN Indianapolis, Control Des. Supp. 317-788-4559
IA Marion, Control Des. Supp. 319-373-2923
KS Kansas City, Control Des. Supp. 913-362-4248
ME Gray, Longhill Electro. Tech. 207-657-2183
MD Gaithersburg, Axis Elec. 301-840-9640
MA Norwood, Emtel 617-769-9500
MI Ypsilanti, Tech Rep 313-229-2961
MN Minneapolis, Control Des. Supp. 612-721-1628
MO St. Louis, Control Des. Supp. 314-426-3150
NJ Lodi, Nidisco 201-773-1771
NJ Paramus, Electro Control Supp. 201-836-2112
NJ Pennsauken, IMS Distbn. 609-662-1770
NY Newburgh, Electro 914-561-5330
NY Ronkonkoma, All American 516-981-3935
NC Charlotte, C.P.S. 704-588-4410
NC Pineville, Control Des. Supp. 704-588-4410
OR Portland, Dunn Elctrns. 503-285-0214
OR Portland, O4 Controls, Inc. 503-231-8058
PA Malvern, Control Des. Supp. 215-296-0150
TX Dallas, Control Des. Supp. 214-358-1441
TX Houston, Wofford Elec. 713-847-3583
WA Boseman, C.E.D. 509-535-8891
WA Seattle, Stusser Elec. Co. 206-624-8770
Can Scarborough, Honeywell 514-337-1104

SCHROFF INCORPORATED, 170 Commerce Dr., Warwick, RI 02886, Tel: 401-732-3770, FAX: 401-738-7988; Empl.: 120; *Sls. Mgr.:* William Bottis

SCHUMACHER ELECT. CORP., 7474 N. Rogers Ave., Chicago, IL 60626, Tel: 312-973-1600, FAX: 312-973-7781; Empl.: 700; *Sls. Mgr.:* Norman Patinka

SCHURTER

FAX: 707-778-6401

SCHURTER, INC., 1016 Clegg Ct., Petaluma, CA 94952, Tel: 707-778-6311; FSC No.: 61935; *Sls. Mgr.:* Bruno H. Schurter ... **A•1638-1639; B•1389, 1771; C•1516-1520**

Local Sales Offices & Reps
AL Madison, Benchmark Tech. Sls. Inc. 205-464-0033
AZ Scottsdale, JK & Assos. 602-990-8804
AR Little Rock, Doby Assoc. 501-221-0326
CA La Habra, Cygnus Sls. Engrg. Corp. 213-691-2993
CA San Jose, Arnold Tech. Sls., Inc. 408-954-0400
CO Broomfield, Summit West Mktg., Inc. 303-460-9600
FL Pompano Bch., IMR, Inc. 305-942-2449
IN Carmel, Newton & Assocs. 317-577-5895
GA Norcross, Benchmark Tech. Sls. Inc. 404-446-1711
IL Arlington Hgts., MJ Petersen & Assoc., Ltd. 708-577-8200
MN Shorewood, Frank Anthony Mktg. 612-474-2850
MS Jackson, Doby Assocs. 601-981-1138
MO St. Louis, Acorn Elctrns. Inc. 314-421-1751
NH Nashua, Bell Controls 603-882-6984
NJ Ho-Ho-Kus, D. J. Fisher Co. 201-652-0090
NJ Medford, Champion Elctrn. Sls. Co. 609-983-0932
NY Fairport, TAC Sls, Inc. 716-377-2250
NC Raleigh, Benchmark Tech. Sls. Inc. 919-850-0633
OH Beachwood, Electronic Salesmasters 216-831-9555
OR Hillsboro, Doran Sls. 503-640-4500
TX Dallas, Reese & Assocs. 214-224-1000
UT Salt Lake City, Prorep Mktg. 801-268-3434
WA Redmond, Doran Sls. 206-885-1885

Local Distributors
CA Irvine, Kensington Elctrns., Inc. 714-588-0575
CA Livermore, Quail Elctrns. 415-373-6700
CT Wallingford, Sager Elctrns. 203-265-4600
FL Orlando, Sager 407-240-3114
GA Norcross, NRC-Jarco Dixie, Inc. 404-729-0411
IL Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc. 708-437-7120
MD Columbia, Sager Elctrns. 301-995-6580
MD Rockville, FIC Corp. 800-638-6594
MA Hingham, Sager Elctrns. 617-749-7600
MA Sandwich, JV ELctrns. 508-833-0700
MN Plymouth, Leeds Electro Comps., Inc. 612-557-1277
NH Salem, Sager Elctrns. 603-898-1348
NY Hauppauge, Sager Elctrns. 516-348-1300
NC Raleigh, Sager Elctrns. 919-850-9550
OH Strongsville, Fuse World 216-238-1330
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
PA Harrisburg, Ad-Tech Elctrns., Inc. 717-561-9905
PA Mars, Sager Elctrns. 412-772-2233
PA McKean, Advacom 814-476-7774
PA Philadelphia, Sager Elctrns. 215-464-4336
TX Dallas, Fuses, Inc. 214-341-6407
WI Oconomowoc, GW Elctrns. Ltd. 414-567-9445
Can Markham, Ont., Birde Mktg. 416-477-7722

SCHUSTER ELECTRONICS, 8 Beattie Court, Huntington, NY 11530, Tel: 516-271-0590; *Sls. Mgr.:* Max Schuster

SCIENCE ACCESSORIES CORP., 200 Watson Blvd, Stratford, CT 06497, Tel: 203-386-9978, FAX: 203-381-9270; Empl.: 40; *Sls. Mgr.:* H. A. Cleveland

SCIENCE & ENGRG. CONSULTANTS, INC., 1820 Discovery St, Ste. 300, Reston, VA 22090, Tel: 703-471-1600, FAX: 703-281-9778; Empl.: 2; *Sls. Mgr.:* Dr. Joseph T. Siewick

SCIENCE/ELECTRONICS, P. O. Box 986, Dayton, OH 45401-0986, Tel: 513-859-5555, FAX: 513-859-7930; Empl.: 25; *Sls. Mgr.:* E. E. Pohl; *Dist. Mgr.:* J. Tanksley

SCIENTECH, INC., 5649 Arapahoe Ave., Boulder, CO 80303, Tel: 303-444-1361, 800-525-0522, TWX: 910-940-0994, FAX: 303-444-9229; Empl.: 35

SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

SCIENTIFIC INSTRUMENTS, 4400 W. Tiffany Dr., West Palm Beach, FL 33407, Tel: 407-881-8500, FAX: 407-881-8556; FSC No.: 591197614; Empl.: 52; *Sls. Mgr.:* Mike Capers; *Dist. Mgr.:* Mike Capers

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

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FAX: 415-471-9752

SCIENTIFIC TECHNOLOGIES INC., Control Components Div., 31069 Genstar Rd., Hayward, CA 94544-7831, Tel: 415-471-9717, 800-221-7060; FSC No.: 52797; Empl.: 25; *Sls. Mgr.:* Paul N. Dreiseszun ..... **B•1578-1579**

SCIENTIFIC TECHNOLOGIES INC., Optical Sensor Div., 31069 Genstar Rd., Hayward, CA 94544, Tel: 415-471-9717, FAX: 415-471-9752; Empl.: 120

SCITEQ ELECTRONICS, INC., 8401 Aero Dr., San Diego, CA 92123, Tel: 619-292-0500, TELEX: 882008, FAX: 619-292-9120; FSC No.: 70561; Empl.: 40; *Sls. Mgr.:* Phil Feinberg

SCOPE INCORPORATED, 1860 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-5600, FAX: 703-471-1715; Empl.: 150; *Sls. Mgr.:* J. Tietge, Dir. PD

SC TECHNOLOGY, INC., 368 Earhart Way, Livermore, CA 94550, Tel: 415-373-9230, FAX: 415-373-9416; *Sls. Mgr.:* Susan L. Karl

SCREENPRINT DOW, See Dow Switch, Div. of Screenprint Dow

SEABOARD ELECTRONICS, 70 Church St., New Rochelle, NY 10805, Tel: 914-235-8073, TELEX: 646289; Empl.: 40; *Sls. Mgr.:* Bernie Klempner; *Dist. Mgr.:* Subhash Grandhi

SEACOR INC.

FAX: 201-664-8544

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600; Empl.: 20 ..... **A•1137**

Local Sales Offices & Reps

AL	Huntsville, Summit Mktg.	205-721-1701
AZ	Tempe, FP Sls.	602-894-5303
CA	San Jose, H. W. Assocs.	408-996-9940
CO	Denver, Hi-Level Mktg.	303-660-9685
FL	Melbourne, R-Rep Co.	407-242-9800
GA	Norcross, Summit Mktg. Assoc.	404-498-4530
IL	Inverness, Heartland Tech. Mktg.	708-358-6622
MD	Bel Air, Freedman/Malta Assoc.	301-879-3148
MA	Sudbury, KSA of New England	508-443-5881
MN	St. Paul, The Johnson Co.	612-641-1878
MO	St. Louis, Acorn Elctrns.	314-421-1751
NJ	Parlin, JMR Sls. Inc.	908-525-8000
NM	Albuquerque, FP Sls.	505-345-5553
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NC	New Hill, Tom Santel Assocs.	919-362-4091
OH	Powell, Val-Skol Sls.	614-889-0174
OH	Willoughby, Val-Skol Sls.	216-942-6021
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
TX	Richardson, Eagle Mktg.	214-238-5383
WI	Brookfield, Heartland Tech. Mktg.	414-792-0920

Local Distributors

CA	Garden Grove, Natl. Cap. Supp.	714-892-7744
CA	San Jose, Compass Comps.	408-432-7575
CT	Wallingford, Mid-State Elctrns.	203-265-9900
FL	Ft. Lauderdale, Brothers Elec.	305-561-6700
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
IL	Bensenville, Voyager Elec.	312-860-1300
IL	Schaumburg, Q.P.S.	312-884-6620
MA	Burlington, T.L.C.	617-273-0140
MA	Framingham, Now Elctrns.	617-235-9501
MA	N. Chelmsford, Pilgrim Elec.	617-454-9889
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	Fridley, Voyager Elctrns.	612-571-7766
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NJ	Rockaway, Tonar Inds.	201-586-9000
NY	Melville, S.A.I.	516-293-2710
NY	Ronkonkoma, Spectrum Comp.	516-737-6900
TX	Dallas, Off-the-Shelf Comps.	214-238-0808
TX	Ft. Worth, C & W Supp.	817-831-0395
WA	Seattle, Vesco Elctrns.	206-575-3607

SEAFAB, INC., 14648 N.E. 95th St., Redmond, WA 98052, Tel: 206-881-2778, FAX: 206-882-0707; Empl.: 80; *Sls. Mgr.:* Bruce Murray

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400, FAX: 513-733-0131; FSC No.: 3678; Empl.: 140; *Sls. Mgr.:* James Dawson

SEASTROM MANUFACTURING CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 213-245-9121, FAX: 818-246-6803; FSC No.: 86928; Empl.: 80; *Sls. Mgr.:* Dave Buddecke

SECMA, INC., Secme, 17752 Skypark Circle No. 200, Irvine, CA 92714, Tel: 714-261-0610, FAX: 714-261-8390; Empl.: 400

SECTOR MICROWAVE IND. INC., 999 Grand Blvd, Deer Park, NY 11729, Tel: 516-242-2300, TWX: 510-227-6075, FAX: 516-242-8158; Empl.: 45; *Sls. Mgr.:* Thomas Nelson

SECTOR SYSTEMS CO., INC., 416 Ocean Ave., Marblehead, MA 01945, Tel: 617-639-2625; Empl.: 10

SECURITY PLASTICS, INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, FAX: 305-557-1431; Empl.: 400; *Sls. Mgr.:* Nelson Rodriguez

SEEQ TECHNOLOGY, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-432-7400, 1-800-333-7706, TELEX: 296609, TWX: 9103382313, FAX: 408-432-9549; Empl.: 370; *Sls. Mgr.:* Phil Ortiz, V.P Worldwide Sls.; *Dist. Mgr.:* Pat Bringuel

Seiko Instruments

FAX: 213-517-7792

SEIKO INSTRUMENTS U.S.A., INC. ELECTRONIC COMPONENTS, 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7770; *Sls. Mgr.:* D. Brooks ..... **A•1461; B•1117; D•1108, 1490**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tucson, Fred Board Assocs.	602-299-1508
CA	Irvine, Groh Assoc.	714-837-9871
CA	San Diego, Groh Assocs.	619-673-4321
CA	San Jose, H-Technical Sls.	408-453-2111
CO	Aurora, Electrodyne	303-695-8903
CT	Madison, Focus Elctrn. Sls.	203-245-4314
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Elk Grove Village, TriStar Grp., Inc.	708-593-0200
IN	Ft. Wayne, Electro Rep Inc.	219-489-8205
IN	Indianapolis, Electro Rep Inc.	317-842-7202
IA	Cedar Rapids, J.R. Sls. Engrg., Inc.	319-393-2232
KS	Overland Park, Electri-Rep	913-649-2168
MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
MD	Burtonsville, Glasscock Assocs.	301-384-5213
MA	Taunton, Focus Elctrns. Sls.	508-824-3840
MI	Detroit, R.P. Urban & Assoc.	313-535-2355
MN	Eden Prairie, Stan Clothier Co.	612-944-3456
MO	St. Louis, Electri-Rep	314-993-4421
NJ	E. Brunswick, Shepard & Assoc.	908-254-5757
NY	E. Syracuse, Nycom, Inc.	315-437-8343
PA	Apollo, J.N. Bailey & Assoc.	412-568-1392
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4132
OH	Brunswick, J. N. Bailey & Assocs.	216-273-3798
OH	Columbus, J.N. Bailey & Assocs.	614-262-7274
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
OR	Tigard, Electronic Comp. Sls.	503-245-2342
PA	Frazer, Industrial Comps., Inc.	215-889-0650
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
Can	Markham, Ont., Birde Mktg.	416-477-7722
TX	Austin, TI Mktg. Inc.	512-837-7272
TX	Dallas, TL Mktg. Inc.	214-484-6800
TX	Houston, TL Mktg. Inc.	713-587-8100
UT	Salt Lake City, Electrodyne	801-264-8050
VA	Ashland, Glasscock Assocs.	804-798-2125
WA	Mercer Island, Electronic Comp. Sls.	206-232-9301
WA	Spokane, Electronic Comp. Sls.	509-456-0100
WI	Menomonee, TriStar Grp., Inc.	800-654-4105
Can	Kanata, Ontario, Birde Mktg.	613-592-5411
Can	St. Laurent, Quebec, Birde Mktg.	514-335-4050
Can	Vancouver, B.C., Birde Mktg.	604-431-0427

Local Distributors

AL	Huntsville, Cypress Elctrns.	205-533-0783
AZ	Phoenix, Aerospace S.W.	602-582-2779
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Buena Pk., Cypress Elctrns.	714-404-0445
CA	Chatsworth, Sterling Elctrns.	818-407-8850
MD	Columbia, Sterling Elctrns.	301-290-3800
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Sterling Elctrns.	619-560-8097
CA	San Jose, Electro Alliance, Inc.	408-280-0221
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Sunrise, All American	305-572-7999
CA	Tustin, OBI	714-258-1411
CA	Tustin, Sterling Elctrns.	714-259-0900
CA	Woodland Hills, Cypress Elctrns.	818-710-7780
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Melbourne, Greene-Shaw Co. Inc.	407-951-3636
GA	Norcross, Applied Power Inc.	404-263-0421
IL	Bensenville, Cypress Elctrns.	708-350-2005
IL	Bensenville, Goold Elctrns. Corp.	708-860-7171
IL	Northbrook, Classic Comps.	708-272-9650
IL	Rosemont, Advent Elctrns., Inc.(printers only)	708-297-6200
IN	Indianapolis, Advent Elctrns., Inc.(printers only)	317-872-4910
IN	Indianapolis, RM Elctrns.	317-843-9403
IA	Cedar Rapids, Advent Elctrns., Inc.(printers only)	319-363-0221
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
KS	Lenexa, Sterling Elctrns.	913-492-5406
LA	West Wego, Sterling Elctrns.	504-436-1418
MD	Middletown, Current Comps.	301-473-5333
MA	Norwood, Emtel	617-769-9500
MI	Southfield, RM Elctrns.	313-262-1582
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Farmington Hills, Advent Elctrns., Inc.(printers only)	313-477-1650
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Aerospace Computer Supps.	612-884-4725
MN	Minneapolis, Sterling Elctrns.	612-831-2666
NJ	Edison, Sterling Elctrns.	908-417-1000
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Hewlett, Metropolitan Sls.	516-599-7900
NY	Mt. Vernon, QAR Elctrns.	914-699-2224
NC	Raleigh, Century Elctrns.	919-782-2116
NY	Ronkonkoma, All American	516-981-3935
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Portland, Cypress Elctrns.	503-223-8900
OR	Tualatin, Moore Elctrns.	503-692-5333
OR	Beaverton, Micropower (Batteries Only)	503-626-7086
PA	Norristown, Century Elctrns.	215-631-5404
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Dallas, Cypress Elctrns.	214-869-1435
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-623-6600
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Kent, Moore Elctrns., Inc.	206-251-8090
WI	New Berlin, Classic Comps.	414-786-5300
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
Can	Burnaby, B.C., ITT/RAE Multicomps.	604-291-8866
Can	Concord, Ont., ITT Multicomps.	416-736-1144
Can	Markham, Ont., Semad Elctrns./DGW Elctrns.	416-475-8500
Can	Nepean, Ont., Carsten Elctrns. Ltd.	613-726-9250
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-7703

Can St. Laurent, Que., Carsten Elctrns. Ltd. 514-334-8321

SEIKO INSTS. USA, INC., Graphic Devices & Systems Div., 1130 Ringwood Ct., San Jose, CA 95131, Tel: 408-922-5800, FAX: 408-922-5840; *Sls. Mgr.:* Steve Dodds; *Dist. Mgr.:* Ralph Kosoff

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7850, FAX: 213-517-7793; Empl.: 250; *Sls. Mgr.:* K. Curtis; *Dist. Mgr.:* P. Simpson

SEKAI ELECTRONICS OF AMERICA, INC., 14700 E. Firestone Blvd., Suite 122, La Mirada, CA 90638, Tel: 714-670-1854, FAX: 714-670-1855; FSC No.: 8V398; Empl.: 6; *Sls. Mgr.:* Larry Klementowski

selco

FAX: 714-739-1507

SELCO PRODUCTS CO., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673; Empl.: 18; *Sls. Mgr.:* Bill Wilkinson; *Dist. Mgr.:* Ray Anton ..... **B•1861; C•1594; D•1370-1371**

Local Sales Offices & Reps

AR	Hot Springs, ASI	501-767-5444
CA	Arcadia, HMC, Inc.	818-447-0958
CA	Mission Viejo, Summit Sls.	800-457-6525
CA	Sunnyvale, Pass Assocs.	408-735-9040
FL	Sarasota, Rep-USA	813-923-2897
IL	Downers Grove, Golten Assocs.	708-512-0093
IN	Indianapolis, S & M Sls. & Mktgs.	317-843-5519
MA	Andover, Crawford Assocs.	617-470-2122
MS	Horn Lake, ASI	601-342-4989
NY	Hauppauge, Sticom	516-366-4221
NY	Naples, LMS Sls. Assoc.	716-374-2626
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Hatboro, AQS	215-674-3562
TX	Dallas, Titan- Hill Co.	214-241-1398
WA	Bellevue, Luscombe Engrg.	206-223-1541

Local Distributors

CA	Arcadia, Parco	818-447-0958
FL	Largo, Elctrn. Precepts	813-544-3636
IL	Wheeling, Hawk Elctrns.	312-459-4091
MA	Sandwich, JV Elctrns.	508-833-0700
NY	New York City, Martin Audio/Video	212-541-5900

SELECO, INC., P.O. Box 68809, Indianapolis, IN 46268, Tel: 317-872-4181, FAX: 317-872-0248; Empl.: 30

SELECT CONTROLS INC., 350 I Central Ave., Bohemia, NY 11716, Tel: 516-467-8577, FAX: 516-567-9013; Empl.: 14

SEL-REX DIV., OMI Intl. Corp., 75 River Rd., Nutley, NJ 07110, Tel: 201-667-5200, TELEX: 133-320, TWX: 710-989-1423; Empl.: 250; *Sls. Mgr.:* R. Berg

SEMICOA, 333 McCormick Ave., Costa Mesa, CA 92626, Tel: 714-979-1900, TELEX: 678-315, TWX: 910-595-1961, FAX: 714-557-4541; FSC No.: 34156; Empl.: 85; *Sls. Mgr.:* Don Felder

SEMICONDUCTOR CIRCUITS, INC., Astec America, Inc., 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, FAX: 603-893-6280; Empl.: 1004; *Sls. Mgr.:* Dale Raveney, VP Mktg. & Sls.

SEMICONDUCTOR PACKAGING MATERIALS CO., 431 Fayette Ave., Mamaroneck, NY 10543, Tel: 914-698-5353, FAX: 914-698-5386; Empl.: 30; *Sls. Mgr.:* Ken Huth

SEMICONDUCTOR TECHNOLOGY, INC., 3131 S.E. Jay St., Stuart, FL 34997, Tel: 407-283-4500, FAX: 407-286-8914; FSC No.: 50891; Empl.: 45

Local Sales Offices & Reps

AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tucson, Fred Board Assocs.	602-299-1508
CA	Costa Mesa, Solid State Sls.	714-650-8414
CA	Mountain View, Leddy Assocs.	415-969-6313
CO	Englewood, Component Sls.	303-779-8060
FL	Singer Island, KDI	407-848-7313
IL	Downers Grove, Nextek	708-719-0099
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Park, Lorenz Sls.	913-469-1312
MD	Towson, Arbotek	301-825-0775
MA	Burlington, Conti-Younger	617-273-1582
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
MO	St. Louis, Lorenz Sls.	314-997-4558
NE	Lincoln, Lorenz Sls.	402-474-7094
NV	Henderson, Fred Board Assoc.	702-564-5528
NJ	Hasbrouck Heights, Comp Tech Sls.	201-288-7400
NM	Albuquerque, Q.A. Elctrns.	505-888-1121
NY	New Hyde Park, Comp Tech Sls.	516-593-2628
NY	Rochester, Electra Sls.	716-427-7860
NY	Syracuse, Electra Sls.	315-463-1248
OH	Tipp City, Cleary Sls.	513-667-7703
OR	Portland, Index Inc.	503-297-3364
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-Rep	713-988-7613
UT	Midvale, Arrowhead Sls.	801-561-5688
WA	Bellevue, Index Inc.	206-451-9635
Can	Montreal, Que., Solid State Engrg.	514-481-3313

SEMIKRON, INC., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066, Tel: 603-883-8102, 1-800-258-1308, FAX: 603-883-8021; FSC No.: 58687; Empl.: 74; *Sls. Mgr.:* Frank Haase; *Dist. Mgr.:* John Flannery

SEMTECH, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-498-2111, TWX: 910-336-1264; FSC No.: 14099;Multiple; Empl.: 200; *Sls. Mgr.:* Bud Hultz; *Dist. Mgr.:* Bud Hultz

SEMTECH CORPUS CHRISTI, Semtech Corporation, 121 International Dr., Corpus Christi, TX 78410, Tel: 512-289-0403, FAX: 512-289-0472; Empl.: 200

SEMTRONICS CORP., 211 Prospect Pk., P.O. Box 2248, Peachtree City, GA 30269, Tel: 404-487-6681, FAX: 404-487-1128; Empl.: 30; *Sls. Mgr.:* Art Cowart

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 1-800-736-2673, 605-339-0100, FAX: 605-339-0317; FSC No.: 33347; Empl.: 230; *Sls. Mgr.:* George Gonds

SENIOR INDS., INC., 610 Pond Dr., Wood Dale, IL 60191, Tel: 312-350-1600, FAX: 312-350-1654

SENSIDYNE, INC., 16333 Bay Vista Drive, Clearwater, FL 34620, Tel: 813-530-3602, 1-800-451-9444; Empl.: 70; *Sls. Mgr.:* Joe Gilberti; *Dist. Mgr.:* Bob Bottini

SENSITEK CORPORATION, See Biddle Instruments

SENSITIVE RESEARCH INSTRUMENTS, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1322-1324**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CO	Commerce City, Williams Assocs.	303-289-5647
IL	Lincolnwood, Saffro & Assocs.	708-677-9722
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Columbus, Comtel Instrs. Co.	614-876-8305
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-954-5020
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WI	Lake Mills, Saffro & Assocs.	1-800-327-0312
Can	Baconsfield, Que., Mesurina Ltee /Ltd.	514-630-5990

SENSITRON SEMICONDUCTOR, RSM Electron Power Div., 221 W. Industry Ct., Deer Park, NY 11729, Tel: 516-586-7600, FAX: 516-242-9798; FSC No.: 13409; Empl.: 150; *Sls. Mgr.:* Bryan Rogers; *Dist. Mgr.:* Bryan Rogers

SENSORAY CORP., 44160 Old Warm Springs Blvd., Fremont, CA 94538, Tel: 415-657-7290; Empl.: 6; *Sls. Mgr.:* Richard Soundy

SENSOR CORP., Box 140, Scottdale, PA 15683, Tel: 412-887-4080, FAX: 412-887-0383; Empl.: 6

SENSOR DEVELOPMENTS INC., PO Box 290, Lake Orion, MI 48361, Tel: 313-391-3000, FAX: 313-391-0107; Empl.: 45; *Sls. Mgr.:* James J. Babiarz

SENSOR PRODUCTS, INC., 71 W 23rd St., Ste. 1500, New York, NY 10010, Tel: 212-675-0201, FAX: 212-645-8436; Empl.: 2

Sensor Scientific, inc.

FAX: 201-227-8063

SENSOR SCIENTIFIC, INC., 6 Kingsbridge Rd., Fairfield, NJ 07006, Tel: 201-227-7790, 800-524-1610; FSC No.: 0AES7; Empl.: 125; *Sls. Mgr.:* Donna Caputo ..... **B•1862-1863**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrn. Assoc.	714-551-4004
CA	Mountain View, Shaw Tech Inc.	415-961-4775
CA	Van Nuys, Vale Elctrns.	818-705-0283
CO	Ft. Collins, Rep. Sls.	303-226-1504
FL	Boca Raton, Tech Sls. Spec.	407-391-3718
IL	Des Plaines, ESCO Assocs.	312-298-5310
KS	Overland Pk., Markline Technlgs.	913-681-8880
MA	Lexington, Jodan Technlg.	617-863-8898
NY	Syracuse, ADCON	315-432-4409
NY	Williamsville, CEF Tech. Sls.	716-633-7324
OH	Medina, J.C. Hofstetter	216-241-4880
PA	Harlysville, Thomas Jackson Assoc.	215-256-8877
TX	Dallas, Allied Comps. Inc.	214-238-0408
TX	Houston, Allied Comps. Inc.	713-988-1600

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, TELEX: 69-1583, FAX: 818-341-9059; *Sls. Mgr.:* E. Schneider

SENSOTEC, INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188, FAX: 614-486-0506; FSC No.: 29927; *Sls. Mgr.:* Jack Feil

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, FAX: 408-734-0407; FSC No.: 5955; Empl.: 150; *Sls. Mgr.:* Fred Jones; *Dist. Mgr.:* Fred Jones

SENTECH, INC., 518 Ryers Ave., Cheltenham, PA 19012, Tel: 215-663-0422, FAX: 215-663-0461; Empl.: 4

SENTRY MANUFACTURING COMPANY, Crystal Park, Chickasha, OK 73018, Tel: 405-224-6780, FAX: 405-224-8808; FSC No.: 5955; Empl.: 30; *Sls. Mgr.:* Barbara Maberry

SERCO PRODUCTS DIVISION:SERCO MOLD, INC., 612 Commercial Ave., Covina, CA 91723, Tel: 818-331-0517, 800-843-8172(Calif.), FAX: 818-331-8584; Empl.: 45; *Sls. Mgr.:* Neil Reckon ..... **C•1100-1101**

Local Sales Offices & Reps

CA	Covina, Serco Prods.	818-331-0517
CA	Valencia, Lessing & Assocs.	805-295-0225
GA	Norcross, Hollingsworth & Still, Inc.	404-447-1700
IL	Cary, Ellinger Sls. Corp.	708-639-1850
MA	Burlington, Gerber Sls. Corp.	617-229-1150
MO	Florissant, Delltron Co., Inc.	314-839-0033
NY	Latham, L-Tron Corp.	518-785-5032
NY	Pt. Washington, Ashtec, Inc.	516-767-0336
PA	Ft. Washington, Simon Mktg. Consultants	215-628-3394
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447
Can	Ontario, Avotronics Ltd.	416-475-2024

Local Distributors

AL	Montgomery, Handey's Elctrn. Ctr. Inc.	205-262-4885
AZ	Phoenix, Capital Elctrns.	602-252-5897
AZ	Phoenix, Elctrn. Emporium Inc.	602-437-8633
AZ	Tucson, Electronic City	602-622-1173
CA	Canoga Park, Sandy's Elctrns.	818-346-0510
CA	Costa Mesa, Mar Vac Elctrns.	714-650-2001
CA	Cucamonga, Abletronics	714-944-4952
CA	Culver City, DOW Elctrns.	213-391-6763
CA	El Monte, Marshall Ind.	800-522-0084
CA	Fremont, Fry's Elctrns.	415-770-3797
CA	Goleta, DOW Elctrns.	805-968-7272
CA	Hawiian Gardens, DOW Elctrns.	213-421-3786
CA	Hollywood, Pacific Radio Exchange	213-462-1393
CA	Inglewood, Inglewood Elctrns.	213-674-2366
CA	Oxnard, DOW Elctrns.	805-486-6353
CA	Palo Alto, Fry's Elctrns.	415-496-6100
CA	Pasadena, DOW Elctrns.	818-793-1195
CA	Pomona, DOW Elctrns.	818-966-8461
CA	Sacramento, Mar Vac California Radio	916-922-6531
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Maria, Elctrn. Parts Supermart	805-925-8604
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Orlando, Atlantic Comps. FL	407-354-0435
FL	Tampa, Sunex Elctrn. Supp. Inc.	813-885-4074

FL West Palm Beach, Dolphin Elctrn. Supp. Inc. 305-659-7166
IL So. Holland, Union Elctrns. Dist. 312-333-4100
MA Burlington, Atlantic Comps. 617-270-0051
MA Lynn, Land Elctrns. Inc. 617-592-2220
MI Detroit, Elctrn. Parts Co. 313-891-7400
MN S. Minneapolis, Tortec Corp. 612-866-3662
NV Las Vegas, Sandy's Elctrns. 702-383-8353
NJ Lodi, Nidisco Inc. 201-773-1771
NY Woodside, Switches Unlimited 718-478-5000
NC Durham, Southeastern Elctrns. 919-638-8204
NC Greensboro, Guilford Elctrn. Supp. Inc. 919-275-1385
NC Raleigh, Southeastern Elctrns. 919-828-2311
NC Winston-Salem, Elctrn. Distrbg. Inc. ... 919-723-1097
TN Clarksville, Randolph, Hale & Matthews Inc. 615-647-2325
TX Austin, Electrotex, Inc. 512-454-0318
TX Dallas, Electrotex, Inc. 214-234-0433
TX Ft. Worth, Allied Elctrns. 800-433-5700
TX Houston, Electrotex, Inc. 713-526-3456
WI Fond du Lac, Fedco Elctrns. Inc. 414-922-6490
WI Milwaukee, Marsh Elctrns. Inc. 414-475-6000
Can Kingston, Ont., Electronic Packaging Sys. Ltd. 613-384-1142
Can Markham, Ont., Arma Elctrns. 416-475-1858
Can Montreal, Future Elctrns. 800-388-8731

SERIAL LAB PRODS., INC., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752, Tel: 617-481-1684, TELEX: 955318 Attn: SERIAL LAB; Empl.: 12; *Sls. Mgr.:* R. L. Wiedeman; *Dist. Mgr.:* D. Kreck

SERVOBYTE INC., P.O. Box 112, Millbury, MA 01527, Tel: 508-865-0225, FAX: 508-865-0295; Empl.: 5; *Sls. Mgr.:* C. Harris

servo
SERVO CORPORATION OF AMERICA

FAX: 516-938-9644

SERVO CORPORATION OF AMERICA, 111 New South Rd., Hicksville, NY 11802-9907, Tel: 516-938-9700; FSC No.: 92110 & 05627; Empl.: 220; *Sls. Mgr.:* G. Immerso ..... **A•1827; D•1077**

Local Sales Offices & Reps
CA Dana Point, EBA Microwave 714-240-8181
CA Del Mar, Servo Western Reg. Off. 619-792-8672
CA Los Angeles, EBA Microwave 213-822-7510

Local Distributors
VA Fairfax, Servo Eastern Reg. Off. 703-591-4331

SERVOMEX COMPANY, 90 Kerry Pl., Norwood, MA 02062, Tel: 617-769-7710, TELEX: 4430161, FAX: 617-769-2834

SERVO-TEK®

FAX: 201-427-4249

SERVO-TEK PRODUCTS CO., 1086 Goffle Rd., Hawthorne, NJ 07506, Tel: 201-427-3100; Empl.: 60; *Sls. Mgr.:* T. J. Daly ..... **B•1310**

SESCOM, INC., 2100 Ward Dr., Henderson, NV 89015-4249, Tel: 702-565-3400, FAX: 702-565-4828; FSC No.: 7Z174; Empl.: 12; *Sls. Mgr.:* Franklin J. Miller ... **C•1102**

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 508-263-1400, 1-800-25-SETRA, TELEX: 4430243, FAX: 508-264-0292; FSC No.: 53367; Empl.: 110; *Sls. Mgr.:* Ed Cope ..... **B•1948-1949**

Local Sales Offices & Reps
AL Huntsville, Burnette Techno Metrics .. 205-830-2832
AK Anchorage, Unit Process 907-522-1010
CA Concord, QCon, Inc. 415-682-2020
CA Downey, Dynasales Co. 213-806-1400
CO Westminster, RMS Sls. 303-429-1111
FL Tampa, Quantum Measurements Corp. 813-933-8078
GA Atlanta, Craft Assocs. 404-256-0420
HI Honolulu, Unit Process 808-834-7195
IL Carpentersville, Precision Meas. Prods. 708-426-4446
IN Ft. Wayne, Domino, Inc. 219-456-5512
IN Indianapolis, Domino, Inc. 317-841-6159
KY Louisville, Domino, Inc. 502-425-2848
MD Columbia, Stein Instrs. 301-596-3748
MA Ashland, NEDT, Inc. 508-881-3265
MI Hazel Park, Tiby Co. 313-547-3550
MN Minneapolis, The Mark Co. 612-933-3026
MO St. Louis, Adelphi, Inc. 314-821-1232
MT Billings, Unit Process 406-252-0455
NJ Little Falls, KLS Assocs. 201-785-4450
NM Albuquerque, TMA, Inc. 505-345-8921
NY Rochester, Ritec Entprs., Inc. 716-271-3170
OH Cleveland, Tiby Co. 216-371-5335
OH Dayton, Tiby Co. 513-277-3822
OK Tulsa, Inotek Corp. 918-627-1500
PA Cheltenham, Stein Instrm. 215-379-1990
TX Richardson, ADI Instrs. 214-680-2222
WA Kirkland, Unit Process 206-827-0433
WI Waukesha, Ray Knitter Assocs. 414-544-1976
Can Ontario, Alpha Controls & Instr. 416-477-2133

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559, FAX: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFE TECHNOLOGIES, 1501 1st St., San Fernando, CA 91340, Tel: 818-365-9411, TWX: 910-496-1535, FAX: 818-365-5117; FSC No.: 96733; Empl.: 800; *Sls. Mgr.:* Michael Rosenberg

S. F. PRODUCTS CORPORATION, 1021 Parker Road, Chester, NJ 07930, Tel: 201-271-4009; Empl.: 8; *Sls. Mgr.:* Norman W. Johanson; *Dist. Mgr.:* R. S. Johanson

SGS-THOMSON MICROELECTRONICS, INC., 1310 Electronics, Carrollton, TX 75006, Tel: 214-466-6000, FAX: 214-466-7602; FSC No.: 7X328; Empl.: 1700; *Sls. Mgr.:* Garth Nash; *Dist. Mgr.:* Jack Dauber

Shallco

FAX: 919-934-3298

SHALLCO, INC., Box 1089, Smithfield, NC 27577, Tel: 919-934-3135, 1-800-876-3135; Empl.: 35; *Sls. Mgr.:* M. D. Sutton ..... **B•1772-1777**

Local Sales Offices & Reps
MN St. Paul, Kencotronics, Inc. 612-645-7717

SHALLTRONIX

FAX: 919-965-6620

SHALLTRONIX CORP., Preston St., P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346; FSC No.: 58258; *Sls. Mgr.:* Joe Deans ..... **D•1325**

Local Sales Offices & Reps
TX Arlington, Electronic Prod. Reps. 817-467-0377

SHAMROCK PLASTICS & RUBBER, INC., 5330 E. 25th St., Indianapolis, IN 46218, Tel: 317-543-3540, 800-382-4635, FAX: 317-543-3553; Empl.: 25; *Sls. Mgr.:* Bill Crispen

SHAPE ELECTRONICS, INC., 901 DuPage Ave., Lombard, IL 60148, Tel: 708-620-8394, FAX: 708-620-0784; Empl.: 110; *Sls. Mgr.:* Judy M. Ardolino; *Dist. Mgr.:* Judy M. Ardolino

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024, FAX: 714-675-9063; Empl.: 7

SHARP

FAX: 206-834-8903

SHARP ELECTRONICS CORP., Microelectronics Grp., 5700 NW Pacific Rim Blvd., Ste.20, Camas, WA 98706, Tel: 206-834-2500; *Sls. Mgr.:* Terry Manton; *Dist. Mgr.:* Dave Mathews ..... **A•1743-1745; B•1119-1121, 1184, 1339-1341, 1581**

Local Sales Offices & Reps
AL Daphne, Interep Assocs. 205-621-1036
AL Huntsville, Interep Assocs. 205-881-1096
AZ Tempe, Electronic Tech. Sls. 602-921-7122
CA Newport Bch., Plustronics 714-476-8009
CA San Diego, Mesa Comps. 619-278-8021
CA San Jose, Sharp Elctrns. Corp. 408-436-4900, FAX:408-436-0924
CA Sherman Oaks, Plustronics 818-995-8908
CO Denver, Seale & Assocs., Inc. 303-695-1980
FL Orlando, Component Design Mktg. Co. 407-240-3903
GA Norcross, Interep Assocs. 404-449-8680
IL Glendale Hgts., Synergistic Sls. 708-858-8686
IN Leo, Mohrfield Mktg. 219-627-5355
KS Wichita, Baka Corp. 316-682-8411
MD Towson, Advanced Technlg. Sls., Inc. 301-296-9360
MA Burlington, Sharp Elctrns. Corp. 617-270-7979, FAX:617-229-9117
MI Madison Hgts., DEM Sls., Inc. 313-583-1500
MN Minneapolis, Reptek 612-331-1212
NJ Allendale, Eastec Assocs. 201-934-7135
NY N. Syracuse, Micro-Tech Mktg. Inc. ... 315-458-5254
NY Rochester, Micro-Tech Mktg. Inc. 716-426-0808
NC Raleigh, WLA & Assocs. 919-231-9939
OH Dayton, Five Star Elctrns., Inc. 513-299-1718
OH Solon, Five Star Elctrns., Inc. 216-349-1611
OR Beaverton, Blair Hirsh 503-641-1875
PA Erdenheim, Omni Sls. 215-233-4600
TN Greenville, Interep Assocs. 615-639-3491
TX Dallas, Sharp Elctrns. Corp. 214-991-5185
VA Richmond, Advanced Technlgy. Sls. .. 804-320-8756
WA Lynwood, Blair Hirsh 206-774-8151
WI Brookfield, Synergistic Sls. 414-821-1516
Can Dollard des Ormeaux, Indigo Elctrns. Ltd. 514-696-6104
Can Kanata, Ont., Indigo Elctrns. Ltd. 613-831-3106
Can Mississauga, Ont., Indigo Elctrns. Ltd. 416-670-0284
Can Richmond, BC, Enerlec Sls. 604-273-0882

Local Distributors
CA El Monte, Marshall Inds. 818-459-5574
CA Saratoga, Western Micro Technlgy. ... 408-725-1660
CA Tustin, Added Value Elctrns. 714-259-8259
NY Farmingdale, Milgray 516-420-9800
Can Montreal, Que., Space Elctrns. 514-694-7710

SHATTUCK INDUSTRIES, 238 Eleana Dr., Ben Lomond, CA 95005, Tel: 408-336-5145, FAX: 408-336-3376; *Sls. Mgr.:* Bruce Shattuck

SHELDAHL, INC., 1150 Sheldahl Rd., Northfield, MN 55057, Tel: 507-663-8000, TWX: 910-565-2180, FAX: 507-663-8545; Empl.: 1,257; *Sls. Mgr.:* Ed Lundstrom

SHELLY

FAX: 714-669-1081

SHELLY ASSOCIATES, INC., 14811 Myford Rd., Tustin, CA 92680, Tel: 714-669-9850, TELEX: 85-2263; FSC No.: 00303; Empl.: 30 ..... **B•1122-1124, 1185**

Local Sales Offices & Reps
AZ Tempe, Spectrum Assocs., S.W. 602-966-1788
CA Mountain View, Leddy Assocs. 415-969-6313
CA San Diego, O'Donnell Assocs., Inc. 619-578-1645
CA Torrance, O'Donnell Assocs., Inc. 213-539-9664
CO Englewood, Romulus Elec., Inc. 303-770-4888
FL Charlotte, Q Rep, Inc. 813-379-8431
GA Norcross, Intronics 404-973-6605
IL Skokie, Electro Tech Mktg. 312-676-3151
IN Ft. Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. Inc. 317-841-0010
MA Sudbury, KSA of New England 508-443-5881
MI Ypsilanti, Techrep, Inc. 313-572-1950
MN Hopkins, Steve Forsythe & Assocs. ... 612-933-8267
MO Grandview, R. R. Burton & Assocs. 816-763-5385
MO Kirkwood, R. R. Burton & Assocs. 314-965-0451
NJ Boonton, TMA 201-263-2946
NJ Cherry Hill, Metz Benham Assocs., Inc. 609-424-0404
NY N. Syracuse, R. F. Roux Co. 315-458-9169
NY Port Washington, TMA 516-883-2432
NC Charlotte, Hollingsworth & Still, Inc. ... 800-241-5712
NC Kernersville, Hollingsworth & Still, Inc. 800-241-5712
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. Inc. 216-473-5050
OH Kettering, Scott Elctrns., Inc. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281

OR Beaverton, Luscombe Engrg. Co. 503-636-6664
OR Portland, Temper Tech. Mktg. 503-292-8201
PA Pittsburgh, Scott Elctrns. 412-963-6116
TX Dallas, de Forest Sls. Co. 214-349-3290
WA Bellevue, Luscombe Engrg. Co. 206-223-1541
WI Brookfield, Electro-Tech Mktg. Assocs. 414-785-9554
Can Scarborough, Ont., Banke Elctrns. 416-292-5152

Local Distributors

AR Ft. Smith, Radio, Inc. 501-646-5200
CA Anaheim, Bisco Inds. Inc. 714-635-0380
CA Fremont, VIC/TAL Sls. 415-651-6420
CA San Jose, Bisco Inds. Inc. 408-435-8980
CT Wallingford, Midstate Elctrns. Co. 203-265-9900
IL Franklin Park, Bisco Inds. Inc. 312-451-1230
IA Cedar Rapids, Iowa Radio Supp. Co. .. 319-393-4510
IA Cedar Rapids, Iowa Radio Supp. Co. .. 313-393-4510
MA Woburn, Bisco Inds. 617-938-8590
NJ Cranford, Garden State Indl. Elctrns. .. 201-272-6400
NJ Fair Lawn, Relay Specialties 201-797-3313
NJ Oakland, Relay Specialties 201-337-1000
NY Elmsford, White Plains Elctrl. 914-592-9555
NY Huntington, Energy Elctrl. Supp. 516-549-2722
NC Raleigh, Svc. Plus Elctrns. 919-850-9550
OH Strongsville, Roberts Elctrns. Co., Inc. 216-238-1711
OH Twinsburg, Advacom, Inc. 216-425-8477
OK Tulsa, Radio, Inc. 918-587-9123
PA McKean, Advacom 814-476-7774
TX Arlington, Bisco Inds. 817-640-7046
TX Austin, Wofford Elctrns. 512-339-1131
TX Houston, Wofford Elctrns. 713-847-3583
TX Midland, ESI Supp. 915-694-9657
WI Mequon, Lakeview Elctrns. 414-377-8250
Can Calgary, Alberta, Memco 403-258-3399
Can Surrey, B.C., Memco 604-590-1553

SKC

FAX: 818-764-6845

SHINANO KENSHI CORP. (SKC), 7525 Ethel Ave., N. Hollywood, CA 91605, Tel: 818-764-4266; Empl.: 7; *Sls. Mgr.:* Dale Dowis ..... **B•1311**

Local Sales Offices & Reps

AL Madison, Benchmark 205-464-0033
CA Cupertino, PEI Sls. Assoc. 408-253-1960
CA North Hollywood, Shinano Kenshi Corp. 818-764-4266
CO Denver, Tech Rep Sls. Co. 303-758-7031
CT Bloomfield, SIR Assocs. 203-243-9343
FL Melbourne, Phoenix Comps. 407-723-4414
GA Norcross, Benchmark 404-446-1711
MA Westford, SIR Assocs. 508-692-2500
MI Brighton, A.P. Assoc. 313-229-6550
NY Albertson, DOL Engrg. 516-747-3944
NY Pittsford, KLM Garner 716-381-8350
NC Raleigh, Benchmark 919-850-0633
OH Columbus, A.P. Assocs. 614-882-1110
OR Portland, Intertech Sls. 503-775-7885
TX Dallas, Theodore Borek Assoc. 214-985-7702
UT Salt Lake City, Sierra Tech Sls. 801-566-9719

Local Distributors

CA N. Hollywood, Digilog Devices Inc. 818-764-9777

Shindengen America, Inc.

FAX: 805-373-3710

SHINDENGEN AMERICA INC., 2649 Townsgate Road, Ste. 200, Westlake Vl., CA 91361, Tel: 800-634-3654; Empl.: 10; *Sls. Mgr.:* Peter Gajewski; *Dist. Mgr.:* Peter Gajewski ..... **D•2034-2035**

Local Sales Offices & Reps

AZ Phoenix, Hartland Sls. 602-492-0012
CA Murrieta, Mil-Com Sls., Inc. 714-677-2097
CA San Diego, Power Assocs. 619-275-0641
CA Santa Clara, Integrated Tech. Sls. 408-727-3408
CO Arvada, Arrowhead/CSI 303-423-5597
FL Land O' Lakes, A.J.'s Power Source, Inc. 813-996-2583
GA Duluth, AJ's Power Source 404-441-7927
IL Rolling Meadows, Eagle Tech. Sls., Inc. 312-991-0700
AZ Scottsdale, Bill Earl Assocs. 602-994-3813
KS Lenexa, Midtec Assocs. 913-541-0505
MD Baltimore, Chesapeake Indl. Mktg. 301-653-0476
MI Lathrup Vl., R. C. Nordstrom & Co. 313-559-7373
MO St. Louis, Midtec Assocs. 314-275-8666
NH Nashua, Bell Controls, Inc. 603-882-6984
NY Hauppauge, Aurora-Schmitt 516-434-1313
NY Pittsford, Franklin Sls. Corp. 716-248-8251
OR Beaverton, Olsen Tech. Sls. Corp. 503-643-9488
PA Blue Bell, Delatronics Inc. 215-641-9930
MN Mancata, E. I. Sls. 507-345-5786
TX Richardson, Jim Gray & Assocs. 214-699-9976
TX Richmond, Jim Gray & Assocs. 713-342-1710
UT Midvale, Arrowhead/CSI 801-561-5688
WA Bellevue, Olsen Tech. Sls. Corp. 206-883-7792
WI Waukesha, Eagle Tech. Sls. 414-549-3622
Can Mississauga, Ont., Techrep 416-890-2903
Can Nepean, Ont., Techrep 613-225-9186
Can St. Laubert, Que., Techrep 514-337-6046

Local Distributors

AZ Phoenix, Dalis Elctrn. Supply 602-275-2626
AZ Tucson, Dalis Elctrn Supply 602-294-2628
CO Littleton, Dusplays Plus, Inc. 303-730-7333
CT Danbury, Aved Elctrn. Dist., Inc. 203-744-7838
IL Schaumburg, QPS Elctrns. 312-884-6620
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Andover, Aved Elctrn. Dist., Inc. 508-688-3800
MI St. Clair Shores, Spemco 313-771-2700
NJ Pennsauken, Alta Elctrns. 609-488-1442
NM Albuquerque, Summit Elec. Supp. Co. 505-884-4400
NM Albuquerque, Walker Elctrn. Supply ... 505-883-2992
OH Cleveland, Major Elctrns. 216-442-6200
TX Austin, Wofford Elctrns. 512-339-1131
TX Dallas, Wofford Elctrns. 214-320-0294
TX El Paso, Midland Wintronic Co. 915-779-8391
TX Houston, Wofford Elctrns. 713-847-3583

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SHIN-ETSU POLYMER AMERICA, INC., 34135 7th St., Union City, CA 94587, Tel: 415-475-9000, TWX: 910-338-2229; *Sls. Mgr.:* Doug Hall ..... **C•1521**

Local Sales Offices & Reps

FL Clearwater, Tech-Rep Assocs. 813-572-9900
IL Crystal Lake, Mid America Reps. 815-455-5310
IN Carmel, Technology Mktg. Corp. 317-844-8462
MA Lexington, Jodan Technlg. 617-863-8898
MO St. Louis, G.M. Brown & Assocs. 314-741-4424
NJ Matawan, SP America, Inc. 201-583-7070
NJ Princeton, Siemens Comps., Inc. 609-987-0083
NM Albuquerque, F-P Sls. 505-345-5553
NY Liverpool, Gen-Tech 315-451-3480
NC Smithfield, ADI, Inc. 919-934-8136
OH Columbus, Siemens Comps., Inc. 614-433-7500
OH Strongfield, Dolfuss-Root & Co., Inc. ... 216-238-0300
PA Bridgeville, Dolfuss Root & Co. 412-221-4420
PA Broomall, TCA Assoc. 215-353-2022
PA Westchester, TCA Assocs. 215-692-6853
TN Greenville, Interep 615-639-3491
TN Greenville, Lamons Sls. Co. 615-639-8711
TX Arlington, CompTech Sls., Inc. 817-265-6007
TX Austin, CompTech Sls., Inc. 512-331-8922
TX Dallas, THT Sls. 214-783-1501
CA Irvine, Interconn Tech. Mktg. 714-733-1879
UT Salt Lake City, Lange Sls. 801-487-0843
UT Salt Lake City, Lange Sls., Inc. 801-487-0843
WA Bellevue, Micro Sls. 206-451-0568
PR Rio Piedras, Klamco Elec. 809-752-6169

Local Distributors

MI Farmington Hills, J.L. Montgomery Assoc., Inc. 313-489-0099

SHOGYO

FAX: 516-466-0922

SHOGYO INTERNATIONAL CORP., 287 Northern Blvd., Great Neck, NY 11021, Tel: 516-466-0911, TELEX: 4758024, TWX: 12218 ..... **A•2391; B•1186, 1778; C•1523-1525, 1820-1821; D•1058-1059, 1491, 2037**

SHOKAI

FAX: 914-736-3656

SHOKAI FAR EAST LTD., 9 Elena Court, Peekskill, NY 10566, Tel: 914-736-3500, TELEX: 224219; Empl.: 362; *Sls. Mgr.:* Shirlee Serber; *Dist. Mgr.:* Robert Craig ..... **A•2069; B•1187; D•1060**

SHURE BROTHERS INC., 222 Hartrey Ave., Evanston, IL 60202-3696, Tel: 708-866-2200, TELEX: 4330191, FAX: 708-886-2279; *Sls. Mgr.:* L.Z. Morgan, VP Sls.

SHURITE METERS, A Prime Technology Co., P.O. Box 185, Twin Lakes Rd., North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 82239; Empl.: 15; *Sls. Mgr.:* James L. Jamieson ..... **D•1373**

Local Sales Offices & Reps

AK Please Consult Factory, Please Consult Factory 203-481-5721
CA Burbank, Modco Co. 818-848-2215
CA San Diego, Qualtronics 619-873-0118
CA So. San Francisco, Carelli-EMA 415-873-3365
CO Denver, Nelson Co. Inc. 303-295-1017
CT Gilman, Adams McGregor Inc. 203-537-3033
FL Lakeland, Munday Sls. Co. 813-858-5606
IL Cary, Bob Burns Assocs. 708-516-3322
IN Indianapolis, John Sukup Inc. 317-253-5501
IA Des Moines, The Beams Co. 515-255-1148
KS Shawnee Mission, The Beams Co. 913-631-0300
MI E. Detroit, Jack M. Thorpe Co. 313-779-6363
MO St. Louis, The Beams Co. 314-434-8448
NJ Franklin, D. F. Tobias & Co. 201-751-8680
NJ Lawrenceville, DVS Co. 609-896-1112
NY Rochester, D. F. Tobias 201-751-8680
NC Raleigh, B.T. Funderburk Inc. 919-846-2373
OH Cleveland, John Olsen Co. 216-838-0510
PA Glenshaw, DVS Co. 609-896-1112
SC Landrum, B.T. Funderburk Inc. 919-846-2373
TX Dallas, The Crockett Sls. Co. 214-350-3377
Can Thornhill, Ont., R. C. Kahnert Sls. Ltd. 416-764-2596
Can Winnipeg, Manitoba, Smith-Patterson & Assocs. 204-885-1376

Local Distributors

AL Birmingham, ACK Radio Supply 205-322-0588
AZ Phoenix, Capital Elctrns. Supp. 602-252-5897
AR Little Rock, Carlton-Bates 501-562-9100
CA San Francisco, Zack Elctrns. 415-624-1444
CA San Jose, Quements Elctrns. 408-998-5900
CA San Rafael, Electronics Plus 415-457-0466
CO Denver, Fistells Elec. Supp. 303-629-1312
CT New Haven, Hatry Elctrns. 203-787-5921
IN East Chicago, Acro Elctrns. 219-397-8681
IA Des Moines, Radio Trade Supp. 515-288-7237
KY Louisville, Peerless Elctrn.Eqpt. 502-637-7677
LA Baton Rouge, Ralph's Elctrn. Supp. ... 504-344-3761
MO Kansas City, Elctrn. Supp. Co. 816-931-0250
MO Kansas City, Walters Indl. Elect. Inc. 1-800-821-5248
NM Los Cruces, Elctrn. Parts Co. 505-523-4578
OH Akron, Akron Elctrn. Supp. 216-762-8818
OH Lima, Hutch & Sons 419-229-8751
OK Tulsa, Radio Inc. 918-587-9123
PA Reading, Barbey Elctrns. Corp. 215-376-7451
RI Pawtucket, Jabbour Elctrns. 401-728-4600
TX Fort Worth, Allied Elctrns. 1-800-433-5700
TX Houston, City Elctrns. Supp. 713-621-1060
TX Houston, Elctrn. Prts. Outlet 713-784-0140
WI Milwaukee, E.M. Instrs. Inc. 414-272-7799
Can Willowdale, Ontario, Electro Sonic Inc. 416-494-1666

SIEMENS-B C L MAGNETICS, Siemens Automotive Ltd., 5045 North Service Rd., Burlington, Ont., Canada L7L 5H6, Tel: 416-335-2530, FAX: 416-335-8474; Empl.: 160; *Sls. Mgr.:* Dave Dore

SIEMENS COMPONENTS, INC., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014, Tel: 408-257-7910, TELEX: 352084, TWX: 910-338-0022; FSC No.: 50579; Empl.: 1100; *Sls. Mgr.:* Chuck Berghoff; *Dist. Mgr.:* Regina Walls

SIEMENS COMPONENTS, INC., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, Tel: 201-321-3400, TWX: 710-998-0588/0529, FAX: 201-321-3961; Empl.: 800; *Sls. Mgr.:* Curt Hozian; *Dist. Mgr.:* Dick Robert

SIERRACIN/MAGNEDYNE, 2258 Rutherford Rd., Carlsbad, CA 92008, Tel: 619-438-3321, FAX: 619-438-4987; Empl.: 150

SIERRACIN POWER SYSTEMS, See Sierra Power Systems

SIERRA MONITOR CORP., 1991 Tarob Ct., Milpitas, CA 95035, Tel: 408-262-6611, TELEX: 17-1618; FSC No.: MSGSNDR; Empl.: 23; *Sls. Mgr.:* Robert Dunkle; *Dist. Mgr.:* Gordon Arnold

SIERRA POWER SYSTEMS, See Valor Power Sys. Div., Valor Elctrns.

SIERRA SEMICONDUCTOR CORP., 2075 N. Capitol Ave., San Jose, CA 95132, Tel: 408-263-9300, FAX: 408-263-3337

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Irvine, Strong & Assocs.	714-261-7233
CA	Mountain View, Brooks Tech. Grp.	415-960-3880
CA	San Diego, Pathfinder Elctrns. Reps.	619-578-2555
CO	Wheat Ridge, Wescom Mktg.	303-422-8957
CT	Woodbury, Lindco Assocs., Inc.	203-266-0728
FL	Altamonte Springs, Sls. Engrg. Concepts	407-830-8444
FL	Deerfield Bch., Sls. Engrg. Concepts	305-426-4601
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
ID	Boise, Wescom Mktg., Inc.	208-226-6654
IL	Rolling Meadows, Eagle Tech. Sls.	708-991-0700
IN	Indianapolis, Elctrn. Sls. & Engineering	317-849-4260
MD	Columbia, Chesapeake Technlg.	301-236-0530
MA	Burlington, New Tech Solutions	617-229-8888
MI	Farmington, Tri-Tech Sls., Inc.	313-442-1200
MN	Minneapolis, P.S.I.	612-944-8545
NJ	E. Hanover, Emtec Sls., Inc.	201-428-0600
NJ	Medford, The McCoy Grp., Inc.	609-953-0770
NM	Albuquerque, Summit Sls.	505-345-5003
NY	Syracuse, PITronics (Upstate)	315-455-7346
NC	Raleigh, Montgomery Mktg.	919-851-0010
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Beaverton, L-Squared	503-629-8555
PA	Exton (East), The McCoy Grp.	215-363-0350
PA	Pittsburgh (West), Arthur Baier Co.	412-367-7799
TX	Houston, Logic 1 Sls.	713-444-7594
TX	Richardson, Logic 1 Sls.	214-234-0765
UT	Salt Lake City, Wescom Mktg., Inc.	801-269-0419
WA	Kirkland, L-Squared, Ltd.	206-827-8555
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
Can	Ottawa, Ont., Cantec Reps.	613-725-3704

Local Distributors

CA	Irvine, ITT Multicomponents	714-727-4001
CA	San Jose, ITT Multicomponents	408-453-1404
CO	Westminster, ITT Multicomponents	303-451-8740
CT	Milford, Milgray	203-878-5538
FL	Winter Pk., Milgray	305-647-5747
GA	Norcross, Milgray	404-446-9777
IL	Arlington Hgts., Milgray	312-253-1212
KS	Overland Pk., Milgray	913-236-8800
MD	Columbia, Milgray	301-621-8169
MA	Wilmington, Milgray	508-657-5900
NJ	Marlton, Milgray	609-983-5010
NY	Farmingdale, Milgray	516-391-3000
NY	N. Lindenhurst, Phase 1 Technlg.	516-957-4900
NY	Pittsford (Upstate), Milgray	716-381-9700
OH	Cleveland, Milgray	216-447-1520
TX	Dallas, Milgray	214-248-1603
UT	Salt Lake City, Milgray	801-272-4999
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SIGMA ELECTRONICS INC., 10830 Kinghurst Dr., Houston, TX 77099, Tel: 713-933-4700, 800-874-7121, FAX: 713-933-9067; FSC No.: 60767; Empl.: 87; *Sls. Mgr.:* K. Johnson

SIGMA PLASTRONICS, INC., P.O. Box 649, Whitmore Lake, MI 48189, Tel: 313-231-2871, FAX: 313-231-2960; Empl.: 3

SIGMAPOWER, INC., 20790 Leapwood Ave., Carson, CA 90746, Tel: 213-32-Sigma, FAX: 213-769-0172; FSC No.: 55196; Empl.: 145; *Sls. Mgr.:* Carl J. Marquardt

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FAX: 619-283-6526

SIGMA SYSTEMS CORP., 3163 Adams Ave., San Diego, CA 92116, Tel: 619-283-3193; Empl.: 21; *Sls. Mgr.:* T. Stewart ..... **D•1201**

Local Sales Offices & Reps

CA	Albany, B/P Assocs.	415-525-7605
CA	San Carlos, Electronic Engrg. Assoc.	415-593-2189
CA	San Carlos, Electronic Engrg. Assocs.	415-593-2189
IL	Elgin, R.K. Elctrns., Inc.	312-695-8552
IL	So. Elgin, RK Elctrns., Inc.	312-695-8552
MN	Edina, Dytec Instrs., Inc.	612-831-7169
NJ	Parsippany, Creative Tech. Sls.	201-335-7881
Intl	Palaiseau, France, Salies S.A.	920-40-10

SIGNAL PROCESSING TECHNOLOGIES, 1510 Quail Lake Loop, Colorado Springs, CO 80906, Tel: 719-540-3900, FAX: 719-540-3970; Empl.: 68; *Sls. Mgr.:* Rick Mintle

SIGNAL RESEARCH INC., River Road, P.O. Box 357, Titusville, NJ 08560, Tel: 609-737-1917 ..... **D•1109**

SIGNAL SYSTEMS INTERNATIONAL, P.O. Box 470, Lavalette, NJ 08735, Tel: 201-793-4668, FAX: 201-793-4679; Empl.: 7; *Sls. Mgr.:* W. Kinney ..... **B•1779**

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Local Sales Offices & Reps

Can	Toronto, Ont., Calbrooke Mktg.	416-346-2551

SIGNATEC, INC., 357 N. Sheridan-Ste. 119, Corona, CA 91720, Tel: 714-734-3001, FAX: 714-734-4356; Empl.: 4; *Sls. Mgr.:* Belinda Hunt

SIGNATRON, A Subsidiary of Meteor Communications Corp., 110 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-1500, TELEX: 299551 (RCA GLOBCOM), FAX: 617-863-8039; FSC No.: 59371; Empl.: 25; *Sls. Mgr.:* Joseph T. McNamara

SIGNETICS COMPANY, Sub. of North American Philips, 811 E. Arques Ave., P.O. Box 3409, Sunnyvale, CA 94088-3409, Tel: 408-991-2000, FAX: 408-991-2311; FSC No.: 1CH66; Empl.: 7,000; *Sls. Mgr.:* Steve Pletcher; *Dist. Mgr.:* Vinnie Bonanno

SIGNUM, INC., 600 W. Cummings Park, Woburn, MA 01801, Tel: 617-933-4780, TELEX: 948263, FAX: 617-938-1757; *Sls. Mgr.:* Thomas DiGennaro

SIGNUM SYSTEMS CORP., 171 E. Thousand Oaks Blvd. No. 202, Thousand Oaks, CA 91360, Tel: 805-371-4608, TELEX: 36-24-39, FAX: 805-371-4610; Empl.: 12; *Sls. Mgr.:* Don Mull; *Dist. Mgr.:* K. Kristensen ... **D•1326**

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CA	San Jose, C.M.S.	415-487-2118

SIKAMA INTERNATIONAL, INC., 301 B Donaldson Place, Santa Barbara, CA 93117, Tel: 805-683-6379, FAX: 805-683-6740; Empl.: 25; *Sls. Mgr.:* Theresa Roberts; *Dist. Mgr.:* Theresa Roberts

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FAX: 805-484-9935

SILICON DETECTOR CORP., 1240 Avenida Acaso, Camarillo, CA 93012, Tel: 805-484-2884; Empl.: 60; *Sls. Mgr.:* David Tingley, William Bandel ..... **B•1342-1344**

Local Sales Offices & Reps

AL	Huntsville, Reynolds & Assocs., Inc.	407-259-7000, FAX:205-534-1015
CA	Santa Clara, Electec	408-496-0706, FAX:408-727-9617
CA	Tarzana, Royal Shillah	818-342-1848, FAX:818-342-2601
CO	Littleton, Simpson Assocs.	303-794-8381, FAX:303-794-2409
CT	Madison, Conti-Younger	203-245-1136
FL	New Port Richey, Reynolds & Assocs., Inc.	407-259-7000,FAX:813-372-7204
GA	Lilburn, Reynolds & Assocs., Inc.	407-259-7000, FAX:404-905-4116
IN	Fishers, Carter, McCormic & Pierce, Inc.	317-842-9277,FAX:317-577-2741
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505, FAX:913-541-1729
MD	Randallstown, Beacon North	703-478-2480
MA	Burlington, Conti-Younger	617-273-1582, FAX:617-270-0310
MI	Farmington Hills, Carter, McCormic & Pierce, Inc.	313-477-7700,FAX:313-477-4149
MN	Eden Prarie, Electronic Innovators, Inc.	612-922-2745,FAX:612-922-3914
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666, FAX:314-275-8859
NJ	Huwitt, Aurora Schmitt Assocs.	201-853-5253
NY	Albany, L-Tron Corp.	518-489-7810, FAX:518-489-7810
NY	Hauppauge, Aurora Schmitt Assocs.	516-434-1313,FAX:516-434-1572
NY	Pittsford, L-Tron Corp.	716-383-0050, FAX:716-383-0701
NC	Raleigh, Reynolds & Assocs., Inc.	407-259-7000
OH	Englewood, Carter, McCormic & Pierce, Inc.	513-836-0951,FAX:513-836-2358
OH	Parma, Carter, McCormic & Pierce, Inc.	216-398-0400,FAX:216-398-0766
OK	Tulsa, Advanced Tech. Sls.	918-664-0482, FAX:918-664-5467
OR	Portland, Venture Elctrns.	503-624-0617, FAX:503-620-4632
PA	Collegeville, Beacon North	703-478-2480
PA	Langhorne, Beacon North	215-752-4429
PA	Pittsburgh, Carter, McCormic & Pierce, Inc.	412-826-3800,FAX:412-826-3803
SC	Greenville, Reynolds & Assocs., Inc.	407-259-7000
TX	Austin, Advanced Tech. Sls.	512-467-9209, FAX:512-467-9405
TX	Dallas, Advanced Tech. Sls.	713-440-3888, FAX:713-440-4439
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SILICON GENERAL, 11861 Western Ave., Garden Grove, CA 92641, Tel: 714-898-8121, TELEX: 692-411, TWX: 910-596-1804, FAX: 714-893-2570; FSC No.: 34333; Empl.: 250; *Sls. Mgr.:* Roger Holliday; *Dist. Mgr.:* Louise Toussaint

SILICONIX, INC., 2201 Laurelwood Rd., Santa Clara, CA 95054, Tel: 408-988-8000, TWX: 910-338-0227; Empl.: 2300; *Sls. Mgr.:* Walter Senges, VP of Sls.; *Dist. Mgr.:* Richard O Tuska, Dist. Sls. Dir.

FAX: 213-630-5338

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Local Distributors

AL	Huntsville, Hamilton/Avnet	205-837-7210
AZ	Chandler, Hamilton/Avnet	602-961-1211
CA	Costa Mesa, Hamilton/Avnet	714-641-4100
CA	Gardena, Hamilton/Avnet	213-516-8600
CA	Long Beach, Amps Abundant	213-634-0187
CA	Sacramento, Hamilton/Avnet	916-925-2216
CA	San Diego, Hamilton/Avnet	619-571-1900
CA	Sunnyvale, Hamilton/Avnet	408-743-3300
CA	Woodland Hills, Hamilton/Avnet	818-594-0404
CO	Englewood, Hamilton Avnet	303-799-7800
CT	Danbury, Hamilton/Avnet	203-748-6077
FL	Ft. Lauderdale, Hamilton/Avnet	305-767-6377
FL	St. Petersburg, Hamilton/Avnet	813-576-3930
FL	Winter Pk., Hamilton/Avnet	407-657-3300
IL	Bensenville, Hamilton/Avnet	708-860-7700
IN	Carmel, Hamilton/Avnet	317-844-9333
IA	Cedar Rapids, Hamilton/Avnet	319-362-4757
KS	Overland Pk., Hamilton/Avnet	913-888-8900
MD	Columbia, Hamilton/Avnet	301-995-3500
MA	Peabody, Hamilton/Avnet	508-531-7430
MI	Grand Rapids, Hamilton/Avnet	616-243-8805
MI	Livonia, Hamilton/Avnet	313-347-4270
MN	Minnetonka, Hamilton/Avnet	612-932-0600
MO	Earth City, Hamilton/Avnet	314-537-1600
NJ	Cherry Hill, Hamilton/Avnet	609-424-0100
NJ	Fairfield, Hamilton/Avnet	201-575-3390
NM	Albuquerque, Hamilton/Avnet	505-345-0001
NY	Hauppauge, Hamilton/Avnet	516-231-9800
NY	Rochester, Hamilton/Avnet	716-292-0810
NY	Syracuse, Hamilton/Avnet	315-437-2641
NC	Raleigh, Hamilton/Avnet	919-878-0810
OH	Dayton, Hamilton/Avnet	513-439-6700
OH	Solon, Hamilton/Avnet	216-242-6610
OH	Westerville, Hamilton/Avnet	614-882-7004
OK	Tulsa, Hamilton/Avnet	918-664-0444
OR	Lake Oswego, Hamilton/Avnet	503-627-0201
PA	Pittsburgh, Hamilton/Avnet	412-281-4150
TX	Austin, Hamilton/Avnet	512-837-8911
TX	Irving, Hamilton/Avnet	214-308-8111
TX	Stafford, Hamilton/Avnet	713-240-7733
UT	Salt Lake City, Hamilton/Avnet	801-972-2800
WA	Bellevue, Hamilton/Avnet	206-241-8555
WI	New Berlin, Hamilton/Avnet	414-784-4510
Can	Burnaby, BC, Hamilton/Avnet	604-420-4101
Can	Mississauga, Ont., Hamilton/Avnet	416-677-7432
Can	Mississauga,Ont., R-Theta	416-890-0221
Can	Nepean, Ont., Hamilton/Avnet	613-226-1700
Can	St. Laurent, Que., Hamilton/Avnet	514-335-1000

SILICON SENSORS, Old Hwy. 18 East, Dodgeville, WI 53533, Tel: 608-935-2707, TWX: 910-997-0072, FAX: 608-935-2775; FSC No.: 54822; Empl.: 30

SILICON TRANSISTOR CORP., Katrina Rd., Chelmsford, MA 01824, Tel: 508-256-3321, FAX: 508-250-1046; FSC No.: 07256; Empl.: 200; *Sls. Mgr.:* John J. Flynn; *Dist. Mgr.:* Fred Wheaton

SILONEX INC., 331 Cornelia St., Plattsburgh, NY 12901, Tel: 518-561-3160, FAX: 514-747-3906; Empl.: 110; *Sls. Mgr.:* Carol Larsen ..... **B•1345**

Local Sales Offices & Reps

CT	Branford, LJM Assocs.	203-488-4244
IL	Crystal Lake, Komac Entprs. Inc.	815-459-7456
MA	Topsfield, RFC Assocs.	508-887-8545
MI	Livonia, Amtech Reps.	313-474-8300
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NJ	Denville, T. J. Sls., Inc.	201-361-5352
WA	Seattle, Harry Levinson Co.	206-382-1300

SILTRONICS LTD., P.O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 110; *Sls. Mgr.:* G. Urban

SIMCO, 21401 SW 127 Ave., Miami, FL 33177, Tel: 305-233-9900, 800-780-9090, FAX: 305-233-1990; Empl.: 15 ..... **C•1103-1105**

Local Sales Offices & Reps

CA	San Diego, Qualtronics, Inc.	619-695-0118
CT	Bethel, Instr. Dynamics	203-743-5045
GA	Atlanta, Electro Sls. Inc.	404-394-1122
IL	Cary, Bob Burns & Assocs.	708-516-3322
MA	Wakefield, Instr. Dynamics Inc.	617-245-5100
NY	F & F Metro Inc.	516-482-4080
TX	Dallas, Southwest Elctrn. Ind. Inc.	214-690-9881
WI	Wauwatosa, Larsen Assocs. Inc.	414-258-0529
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

SIMCO CO., 2257 North Penn Rd., Hatfield, PA 19440, Tel: 215-822-2171, FAX: 215-822-3795; Empl.: 150; *Sls. Mgr.:* Bob Heacock

SIMMONDS PRECISION ENGINE SYSTEMS, BF Goodrich Aerospace, P.O. Box 310, Norwich, NY 13815, Tel: 607-335-5000, TWX: 510-261-7776; Empl.: 650; *Sls. Mgr.:* G. D. Cummings

SIMPSON ELECTRIC CO., 853 Dundee Ave., Elgin, IL 60120, Tel: 708-697-2260, TELEX: 72-2416, FAX: 708-697-2272; Empl.: 550; *Dist. Mgr.:* George Oskandy, Sls. Admin. Mgr.

SIMTEK CORP., 1465 Kelly Johnson Blvd., Colorado Springs, CO 80920, Tel: 719-531-9444, FAX: 719-531-9481; Empl.: 40; *Sls. Mgr.:* David Bowers; *Dist. Mgr.:* David Bowers

SIMULASER CORP., 15251 E. Don Julian Rd., City of Industry, CA 91746, Tel: 818-369-1355, FAX: 818-336-8694; FSC No.: 8T239; Empl.: 26

SIMULEX CORPORATION, 2832-C Walnut Avenue, Tustin, CA 92680, Tel: 714-730-1500, FAX: 714-730-7176; *Sls. Mgr.:* Dave Guss

SINCLAIR RADIO LABORATORIES LTD., 85 Mary St., Aurora, Ont., Canada L4G 3G9, Tel: 416-727-0165, FAX: 416-727-0861; Empl.: 100; *Sls. Mgr.:* R.F. Jonkman

FAX: 708-860-3672

SINGER DATA PRODUCTS, INC., 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6500, TELEX: 210-230; Empl.: 40; *Sls. Mgr.:* Ken Krohmer ..... **D•1111**

Local Sales Offices & Reps

NJ	Haddonfield, Singer Data	609-429-6927

SINOTECH, Technology Communications Group, Inc., 23590 Stafford Hill Drive, West Linn, OR 97068, Tel: 503-638-1000, FAX: 503-638-1002; Empl.: 45; *Sls. Mgr.:* John Vezmar

SIPEX CORP., Custom Monolithic Prods. Div., Six Fortune Dr., Billerica, MA 01821, Tel: 508-667-8700, FAX: 508-670-9001; Empl.: 90; *Sls. Mgr.:* Bill Dennehy

SITCO ANTENNAS DIV.OF SIMPLICITY TOOL CORP., 10330 N.E. Marx St., Portland, OR 97220, Tel: 503-253-2000, TELEX: 200 479, FAX: 503-253-2009; Empl.: 18; *Sls. Mgr.:* M. Bureker

Local Distributors

CO	Englewood, Mega Hertz	303-779-1717
MN	Shakopee, Comms. Supp. Grp.	612-445-8424
IL	Elk Grove, Anxiter	800-554-5368
MN	St. Paul, D.F. Coutryman	800-328-6820
NY	Wharton, Anxiter	516-293-7788
OK	Tulsa, Tulsat Corp./DRK Entrps.	918-836-8348
TX	Bedford, Spectrum	817-267-2288
WA	Redmond, Glade Comms.	206-869-4116

S.I. TECH, 901 N. Batavia Ave., Batavia, IL 60510, Tel: 708-232-8640, FAX: 708-232-8677; Empl.: 17; *Sls. Mgr.:* Ramesh Sheth; *Dist. Mgr.:* Kay Brabec ..... **B•1231**

Local Sales Offices & Reps

MA	Holliston, Olson Mktg.	508-429-8066
MN	Hibbing, Minntech Ec.	218-262-5228
NJ	E. Brunswick, EAC Assocs.	908-254-6624
NM	Albuquerque, Fry-Gates Co.	505-262-1525
TN	Memphis, Professional Technlg.	901-458-1228
TX	Ingram, Davis-Hallmark Prods.	512-367-4919
WA	Bellevue, Interconnect Tech.	206-462-9508

Local Distributors

AL	Birmingham, Newark Ec.	205-942-4044
AK	Anchorage, Potelcom Supp.	907-274-8525
AR	Little Rock, Carlton Bates	817-293-5558
CA	Los Angeles, Anixter	213-625-7828
CA	San Francisco, Anixter	415-543-6070
CO	Denver, Newark Ec.	303-373-4540
FL	Miami, Newark Ec.	800-631-4608
IL	Chicago, Newark	312-792-8233
IL	Skokie, Anixter	800-243-8344
LA	Baton Rouge, Anixter	504-922-7755
MA	Boston, Anixter	508-682-8870
MI	Detroit, Anixter	313-478-3900
MO	St. Louis, Newark Ec.	314-821-7466
NY	Hauppauge, Manchester Equip. Co.	516-294-5351
OH	Columbus, Hughes-Peters	614-294-6215
PA	Pittsburgh, South-Mills Ec.	800-245-6215
TN	Chattanooga, Horizon Ec.	615-899-8585
TN	Clarksville, Randolph, Hale, Matthews	615-647-2325
TX	Houston, Anixter	713-460-9473
VA	Chantilly, Newark Ec.	703-471-7447
WA	Bellevue, Newark Ec.	206-641-9800
WI	Milwaukee, Anixter	414-355-0222
Can	London, Newark Ec.	519-685-4280
Can	Toronto, Anixter	416-568-8999

SIVERS IMA AB, 11520 Jefferson Blvd., Culver City, CA 90230, Tel: 213-306-4248, FAX: 213-390-4350; Empl.: 300; *Sls. Mgr.:* Marshall Cleland

SJOBERG, C., & SON, INC., 415 Station St., P.O. Box 3583, Cranston, RI 02910, Tel: 401-461-8220, FAX: 401-467-5446; Empl.: 20

SKB COPORATION, 434 W. Levers Place, Orange, CA 92667, Tel: 714-637-1252, FAX: 714-637-0491; FSC No.: 61302; Empl.: 170; *Sls. Mgr.:* Allan Evavold

SKF CONDITION MONITORING, 4141 Ruffin Rd., San Diego, CA 92123-1841, Tel: 619-496-3400, FAX: 619-496-3546; Empl.: 150; *Sls. Mgr.:* Rich Gabel

SKO-DIE, INC., 8050 Austin Ave., Morton Grove, IL 60053, Tel: 708-965-1130, FAX: 708-966-0322; FSC No.: 7P145; Empl.: 50; *Sls. Mgr.:* Ralph H. Hoffmann

SKY COMPUTER, INC., 27 Industrial Ave., Chelmsford, MA 01824, Tel: 508-250-1920, TELEX: 499-1331, FAX: 508-250-0036

SKYDYNE DIV., AAR MFG., 21 River Rd., Port Jervis, NY 12771, Tel: 914-856-6655, 800-428-CASE, FAX: 914-856-8378; Empl.: 110; *Sls. Mgr.:* M. Timney ..... **C•1106-1107**

SKYNET ELECTRONICS, 1474 Gladding Ct., Milpitas, CA 95035, Tel: 408-945-6355, FAX: 408-945-6357; Empl.: 20

SKYWAY MAGNETICS, 35372 Hwy 79, Warner Springs, CA 92086, Tel: 619-782-3342; FSC No.: 3612; Empl.: 12; *Sls. Mgr.:* John Grudziadz

SLAUGHTER CO., 801 Hailey St., P.O. Box 1805, Ardmore, OK 73402, Tel: 405-223-4773, TELEX: 697-5577, FAX: 405-226-5757; FSC No.: 05611; *Sls. Mgr.:* T. Medrick ..... **D•1327**

SL CORPORATION, 240 Tamal Vista Blvd. No. 110, Corte Madera, CA 94925, Tel: 415-927-1724, FAX: 415-927-2931; Empl.: 26; *Sls. Mgr.:* Christopher Wilson; *Dist. Mgr.:* Christopher Wilson

The Sloan Company
"THE TOUCH OF BRILLIANCE IN PANEL DESIGN"

FAX: 818-768-8326

SLOAN CO., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, Tel: 213-875-1123, TWX: 910-498-2250; FSC No.: 08717; Empl.: 25 ..... **B•1188-1195**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
CA	Montrose, Signal Entprs. Inc.	818-957-0640
CA	Mtn. View, Francisco & Assocs.	415-962-1717
RI	Warwick, Schumacher & Yarrington	401-884-5671
IL	Wheaton, CS Tech Sls.	708-653-8126
MD	Glen Burnie, Macrotech Assoc.	301-766-1111
MN	Minneapolis, Loren Green Assoc. of Minn.	612-571-6666
MO	Shawnee Mission, Microtronics	913-262-1444
NJ	Cherry Hill, Quality Comps.	609-428-6226
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NY	Rochester, Tech. Comps.	716-342-2406
OH	Cleveland, Allan Scraga	216-232-4946
TX	Dallas, IBL Engrg. & Sls.	214-363-2921
WA	Bellevue, Olson Tech Sls.	206-883-7792

Local Distributors

AL	Huntsville, Powell Elctrns.	205-529-2731
CA	Anaheim, Deco Elctrns.	714-630-8252

CA	Canoga Park, AMC Radio Hardware	818-998-2584
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Torrance, Kent Elctrns.	213-320-2700
CT	W. Hartford, Signal Ctr. Inc.	203-236-6005
FL	Ft. Lauderdale, Peerless Radio Corp.	305-973-4141
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
CA	Los Angeles, Trebor Elctrns.	213-641-8304
FL	Pompano Beach, Peerless Radio	305-973-4141
KS	Wichita, Lee Prods.	316-264-2172
MD	Annapolis, Powell Elctrns.	301-880-3355
IL	Arlington, Mar'Lyn Elctrns.	312-364-7880
MA	Westborough, Powell Elctrns.	617-366-6100
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NJ	Englewood, Powell Elctrns.	201-568-5600
OH	Cleveland, Acorn Inds.	216-289-2531
OH	Dayton, D & D Packaging Co., Inc.	513-233-8585
OH	Solon, Repco	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
PA	Philadelphia, Powell Elctrns.	215-365-1900
TN	Memphis, GFI Sls.	901-683-6252
TX	Austin, The Altair Co.	512-837-4490
NC	Cary, Powell Elctrns.	919-467-1212
TX	Houston, Altair Co.	713-462-3029
TX	Irving, Powell Elctrns.	214-258-6841
TX	Richardson, Altair Co.	214-231-5166

SLOAN TECHNOLOGY CORPORATION, Veeco Instruments Inc., 602 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-963-4431, TWX: 910-334-4901, FAX: 805-965-0522; Empl.: 75; *Sls. Mgr.:* Mel Lipton

SL WABER, INC., 520 Fellowship Rd. Ste. 306, Mt. Laurel, NJ 08054, Tel: 609-866-8888, 800-257-8384, FAX: 609-866-1945; Empl.: 125; *Sls. Mgr.:* Scott Hammill

SMERT COMPTER AIDED DESIGN & PROTOTYPE, DIV. OF SME (MONACO), P.O. Box 13280, Kanata, Ont., Canada K2K 1X4, Tel: 613-839-5588, FAX: 613-839-5582; Empl.: 14; *Sls. Mgr.:* Raymond Fourastier

H H SMITH, NT-T Inc., 632 Arch St, Meadville, PA 16335, Tel: 814-724-6440, FAX: 814-333-1912; Empl.: 300; *Sls. Mgr.:* Larry Zeiser; *Dist. Mgr.:* Larry Zeiser

BRILL ELECTRONICS
(415) 834-5888
610 E 10th St . Oakland. CA 94606
HHSMITH
(213) 452-8002
1220 Olympic Bl Santa Monica. CA 90404

BRILL ELECTRONICS
(415) 834-5888
610 E 10th St . Oakland. CA 94606
A UNIT OF GENERAL SIGNAL
SOLA ELECTRIC
(213) 452-8002
1220 Olympic Bl Santa Monica. CA 90404

SMK ELECTRONICS CORPORATION, U.S.A., 1901 Nancita Cir., Placentia, CA 92670, Tel: 714-996-0960, TELEX: 18-3081, FAX: 714-779-2790; FSC No.: 637-7400; Empl.: 219; *Sls. Mgr.:* Gary Redman/ T. Klymenko

SMT EAST CORPORATION, 378 Page St., Deerfield Corp. Ctr., Stoughton, MA 02072-1141, Tel: 800-888-SMT1, FAX: 617-344-0480; Empl.: 50

SNAPTITE/ALLIED, 6424 W. Ridge Rd., P.O. Box 8550, Erie, PA 16505, Tel: 814-833-6131, FAX: 814-838-7503; Empl.: 75

SOFREL, INC., 7685 Commerce Way No. 105, Eden Prairie, MN 55344, Tel: 612-937-8835, 1-800-8-SOFREL, FAX: 612-937-9086; Empl.: 8; *Sls. Mgr.:* Scott Henstein; *Dist. Mgr.:* Scott Henstein

SOFTAID, INC., 8930 Route 108, Columbia, MD 21045, Tel: 301-964-8455, FAX: 301-596-1852; Empl.: 9; *Sls. Mgr.:* Tammie Adams

SOFTWARE COMPONENTS GROUP, 1731 Technology Dr., San Jose, CA 95110, Tel: 408-437-0700, FAX: 408-437-0711; Empl.: 35; *Sls. Mgr.:* Dennis O Donel

THE SOFTWARE LINK, INC., 3577 Parkway Lane, Norcross, GA 30092, Tel: 404-448-5465, TELEX: 4996147SWLINK, FAX: 404-263-6474; Empl.: 55

SOHIO ENGINEERED MATERIALS CO., See Standard Engineered Materials Co.

SOKOL CRYSTAL PRODUCTS, INC., 121 Water St, Mineral Point, WI 53565, Tel: 608-987-3363, FAX: 608-987-3882; FSC No.: 56187; Empl.: 150; *Sls. Mgr.:* Steven M. Sokol

SOLA, A Unit of General Sign., 1717 Busse Rd., Elk Grove Village, IL 60007-5666, Tel: 708-439-2800, TELEX: 6871106 SOLAE, FAX: 800-626-6269; *Sls. Mgr.:* James Kimball; *Dist. Mgr.:* Brian Crowe

SOLARCOM TECHNOLOGY, INC., P.O. Box 4715, Hayward, CA 94544, Tel: 415-489-3141; Empl.: 9; *Sls. Mgr.:* Rose Ferguson

SOLAR ELECTRONICS CO., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038, Tel: 213-462-0806, TWX: 910-997-1921, FAX: 213-462-3721; FSC No.: 13222; Empl.: 17; *Sls. Mgr.:* Roy Talley

SOLATRON ENTERPRISES, 421 E. Beach Ave., Inglewood, CA 90302, Tel: 213-678-4981; Empl.: 20

SOLDER ABSORBING TECHNOLOGY (SAT), A Spirig Co., 144 Oakland St, Springfield, MA 01108, Tel: 800-628-8862, FAX: 413-788-0490; Empl.: 8; *Sls. Mgr.:* Joyce White

SOLDER REMOVAL, P.O. Box 1678, Covina, CA 91722, Tel: 818-967-3681, TWX: 910-584-1820; FSC No.: 34605; Empl.: 57

SOLID STATE, INC., 46 Farrand St., Bloomfield, NJ 07003, Tel: 201-429-8700, FAX: 201-429-8683; Empl.: 110; *Sls. Mgr.:* T. King

SOLID STATE DEVICES, 14830 Valley View Ave., La Mirada, CA 90638, Tel: 213-921-9660, FAX: 213-921-2396; FSC No.: 30043; Empl.: 200

SOLID STATE ELECTRONICS CORP., 18646 Parthenia St., Northridge, CA 91324, Tel: 818-993-8257, FAX: 818-993-8259; FSC No.: 11911; Empl.: 15

SOLID STATE RELAYS, 71 Regent, Oak Brook, IL 60521, Tel: 708-932-1660, FAX: 708-887-9522

SOLID STATE SYSTEMS, 1300 Shiloh Rd., N.W., Kennesaw, GA 30144, Tel: 404-423-2200, FAX: 404-423-2228; Empl.: 150; *Sls. Mgr.:* Max Biller; *Dist. Mgr.:* Max Biller

SOLID STATE TESTING, INC., 56 Middlesex Tpke., Burlington, MA 01803, Tel: 617-272-0972, FAX: 617-273-4896; Empl.: 150; *Sls. Mgr.:* James Roberts; *Dist. Mgr.:* James DiGiacomo

SOLITRON DEVICES, INC., Semiconductor Group, 1177 Blue Heron Blvd., Bldg. No.1, Riviera Beach, FL 33404-9978, Tel: 407-848-4311, 800-888-8763, FAX: 407-863-5946; FSC No.: 21845; Empl.: 800; *Sls. Mgr.:* Margaret McNutt; *Dist. Mgr.:* Abe Lincoln

SOLITRON/MICROWAVE, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk.,Bldg. No. 2, Riviera Bch., FL 33404-9978, Tel: 407-848-4311, 800-888-8763, FAX: 407-848-4311, Ext.116; FSC No.: 95077; Empl.: 200; *Sls. Mgr.:* Ray Sulzer; *Dist. Mgr.:* Deloris Martinez

SOLTEC CORP., 12977 Arroyo Street, San Fernando, CA 91340-1597, Tel: 818-365-0800, 800-423-2344, TELEX: 365-7089, FAX: 818-365-7839; Empl.: 80; *Sls. Mgr.:* Byron G. McIntire

SONICALL, INC., 3288 E. Willow Street, Signal Hill, CA 90806, Tel: 213-490-2143, FAX: 213-490-2145; *Sls. Mgr.:* Frank Handler ..... **D•1061**

Local Sales Offices & Reps

CA	Mountain View, Francisco & Assocs.	415-962-1717
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Park Ridge, Synmark Sls., Inc.	708-390-9696
FL	Margate, EPM, Inc.	305-977-0331
MD	Severna, Jenco Sls.	301-544-8652
MI	Lathrup Vlg., R.C. Nordstrom	313-559-7373
MN	St. Louis Park, Elctrn. Innovators	612-922-2945
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NY	Great Neck, F&F Metro Inc.	516-482-4080
NC	Raleigh, Micro Sls. Inc.	919-881-0007
OH	Centerville, EMA, Inc.	513-433-3147
OR	Hillsboro, TAC Assocs.	503-648-6110
PA	West Chester, TCA Inc.	215-692-6853
RI	Warwick, Ertronics, Inc.	401-732-3567
TX	Dallas, REM Comps. Corp.	214-234-1069

Local Distributors

MA	Sharon, ADCOUR	800-232-3557

SONICOR INSTRUMENT CORP., 100 Wartburg Ave., Copiague, NY 11726, Tel: 516-842-3344, TELEX: 649494, FAX: 516-842-3389; FSC No.: 31605; *Sls. Mgr.:* Arthur Liers; *Dist. Mgr.:* Arthur Liers

SONNENSCHEIN BATTERIES INC., See East Penn Manufacturing

SONOBOND ULTRASONICS INC., Inductotherm Industries, 887 S. Matlack St, West Chester, PA 19382, Tel: 215-696-4710, 800-323-1269, FAX: 215-692-0674; FSC No.: 15882; Empl.: 35; *Sls. Mgr.:* P. C. Krause

SONY COMPONENT PRODUCTS CO, Semiconductor Division, 108333 Valley View St, Cypress, CA 90630, Tel: 714-229-4197, FAX: 714-229-4271; Empl.: 120; *Sls. Mgr.:* Chuck Schouw, V.P.; *Dist. Mgr.:* Mark Marrietta

SOPHIA SYSTEMS & TECHNOLOGY, 777 California Avenue, Palo Alto, CA 94304, Tel: 415-493-6700, 800-824-9294, FAX: 415-493-4648

Sorensen

FAX: 312-792-2129

SORENSEN COMPANY, 5555 N. Elston Ave., Chicago, IL 60630, Tel: 312-775-0843, 1-800-525-2024; Empl.: 200; *Sls. Mgr.:* Ed Larrabee ..... **D•2038-2046**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier, Inc.	205-536-1506,FAX:205-551-0558
AZ	Tempe, Trembly Assocs.	602-967-2058, FAX:602-967-2878
CA	Cupertino, Costar	408-446-9339, FAX:408-446-4885
CA	LaCanada Flintridge, Trimarco Synertek	818-952-7106,FAX:818-952-8859
CA	Los Altos, Jay Stone & Assocs.	415-948-4563, FAX:415-948-2714
CA	San Jose, Jay Stone & Assocs.	408-435-1010
CO	Wheat Ridge, Trembly Assocs.	303-421-8900, FAX:303-421-1020
FL	Melbourne, Currie, Peak & Frazier, Inc.	407-724-6795,FAX:407-951-9717
FL	Orlando, Currie, Peak & Frazier, Inc.	407-855-0843, FAX:407-851-1464
FL	Pensacola, Currie, Peak & Frazier, Inc.	904-994-0599
FL	Tampa, Currie, Peak & Frazier, Inc.	813-963-1076, FAX:813-968-2480
GA	Duluth, Currie, Peak & Frazier, Inc.	404-497-9404, FAX:404-497-9412
IL	Arlington Heights, Dytec/Midwest, Inc.	708-255-3200,FAX:708-394-0270

IL Palatine, Vine Sls., Inc. 708-934-5476, FAX:708-934-1290
IN Indianapolis, Dytec/Midwest, Inc. 317-297-5988, FAX:317-297-0355
KS Lenexa, Dytec/South, Inc. 913-888-0215, FAX:913-894-1039
KS Wichita, Dytec/South, Inc. 316-263-7090, FAX:316-262-3189
LA Lafayette, Kemp Instruments, Inc. 318-269-9452, FAX:318-269-1073
MD Baltimore, Sci-Rep, Inc. 410-321-1411
MA Westford, ICS Assocs. 508-692-3545, FAX:508-692-0227
MI Southfield, Comtel Instruments Co. 313-358-2505, FAX:313-352-2324
MN Edina, Dytec Instruments, Inc. 612-831-7169, FAX:612-831-5114
MO Maryland Heights, Dytec/South, Inc. 314-739-0665,FAX:314-739-1405
NV Las Vegas, Trembly Assocs. 702-739-9770, FAX:702-739-0331
NH Salem, Advanced Elctrn. Sls. 603-894-6414, FAX:603-894-7111
NJ Cherry Hill, Sci-Rep, Inc. 609-662-5222
NM Albuquerque, Trembly Assocs. 505-266-8616, FAX:505-255-0635
NY Elmont, Crane & Egert Corp. 516-872-0800, FAX:516-872-9074
NY Rochester, TAE-REP, Inc. 716-586-8710, FAX:716-586-8719
NY Whitney Point, TAE-REP, Inc. 607-692-3705, FAX:607-692-3709
NC Charlotte, Currie, Peak & Frazier, Inc. 704-846-1702
NC Greensboro, Currie, Peak & Frazier, Inc. 919-373-0380,FAX:919-273-6308
OH Cleveland, Comtel Instrument Co. 216-442-8080, FAX:216-442-6009
OH Columbus, Comtel Instruments Co. 614-876-8305, FAX:614-876-1445
OH Dayton, Comtel Instruments Co. 513-426-5310, FAX:513-426-1048
OK Tulsa, Kemp Instruments, Inc. 918-663-4501, FAX:918-665-7362
OR Beaverton, Northwest Test & Measurement, Inc. 503-645-9000,FAX:503-645-5186
PA Huntingdon Valley, Sci-Rep, Inc. 215-322-6500, FAX:215-322-9907
PA Pittsburgh, Comtel Instruments Co. 412-922-5720, FAX:412-922-8454
TN Smyrna, Currie, Peak & Frazier, Inc. ... 615-459-0743
TX Austin, Kemp Instruments, Inc. 512-263-3322, FAX:512-263-9700
TX Dallas, Kemp Instruments, Inc. 214-931-7100, FAX:214-250-2493
TX Houston, Kemp Instruments, Inc. 713-466-1465, FAX:713-466-7821
UT No. Salt Lake, Trembly Assocs. 801-295-4703, FAX:801-295-8676
VA Fairfax, Sci-Rep, Inc. 703-385-0660, FAX:703-359-7341
VA Newport News, Sci-Rep, Inc. 301-321-0200
VA Richmond, Sci-Rep, Inc. 804-282-0220
WA Redmond, Northwest Test & Measurement, Inc. 206-881-8857,206-867-0742
WI Brookfield, Dytec/Midwest, Inc. 414-792-0320, FAX:414-792-0311
Can Mississauga, Ont., Allan Crawford Assocs., Ltd. 416-890-2010,FAX:416-890-1959
Can No. Vancouver, BC, Allan Crawford Assocs., Ltd. 604-988-2195,FAX:604-980-5892
Can Ottawa, Ont., Allan Crawford Assocs., Ltd. 613-596-9300,FAX:613-596-3081
Can St. Laurent, Quebec, Allan Crawford Assocs., Ltd. 514-747-7878,FAX:514-747-5673

SoLiCo/mec

FAX: 1-800-331-1184

FAX: 203-527-6047

SORENSON LIGHTED CONTROLS, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092, 1-800-243-0240; Empl.: 100; *Sls. Mgr.:* Ted Ogorzalek ..... **B•1787**

Local Sales Offices & Reps

CA Tustin, Schoenbachler-Dobson Co. ... 714-544-1888
AZ Scottsdale, Advent Comp. Corp. 602-481-0044
CA San Rafael, Wright Assocs. 415-457-9940
CO Boulder, The Stratford Grp. 303-530-3194
FL Deerfield Bch., Jack Krutek & Assoc. .. 305-427-4202
IL Schiller Park, W.R.B. Inc. 708-678-7888
IN Fort Wayne, Menze Sls. 219-747-5616
KS Shawnee Mission, The Mertens Co. ... 913-432-9323
MD Gaithersburg, Naudian Assoc. Southern, Inc. 301-258-5040
MA Hopkinton, Berkshire Elctrns. 508-435-9356
MI Dearborn, Pitcher-Poulin, Inc. 313-582-5450
MN Minneapolis, Tech. Comps. Grp. 612-536-9512
MO Clayton, Mertens Co. 314-993-6600
NJ Burlington, VDE Elctrns. 609-387-9331
NJ Eatontown, Pacent Engrg. 201-389-1409
NY Great Neck, Pacent Eng. Co. 516-482-4678
NC Siler City, Crossroads Elctrns. 919-742-2372
WA Bothell, Evergreen Mktg. Grp. 206-485-8063
WI Mequon, WM Bolles Assoc., Inc. 414-241-3320

Local Distributors

AZ Phoenix, Minarik Elec. Co. 602-233-3000
CA Anaheim, Electro Comps. Dist. 213-628-2844
CA Covina, Selecta Switch 818-967-4123
CA Freemont, KEA Elctrns. 415-651-2600
CA Gardena, California Switch & Signal .. 213-538-9830
CA Glendale, Minarik Elec. Co. 818-507-6445
CA Irvin, J & J Elctrns. 714-455-0104
CA Los Angeles, Electric Switches 213-660-1310
CA San Diego, Minarik Elec. Co. 619-560-6632
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CA Tustin, Western Switches 714-259-8144
CA Van Nuys, Wes-Garde Comps. Grp. ... 818-786-3724
CO Commerce City, Minarik Elec. Co. 303-289-5800
CT Hartford, Wes-Garde Comp. Grp. 203-527-7705
FL Lakeland, Wes-Garde Comp. Grp. 813-644-7564
GA Tucker, CID, Inc. 404-491-3143
IL Carol Stream, Wes-Garde Comp. Grp. 708-653-1460
KS Overland Pk., Wes-Garde Comps. 913-262-2718
MA Canton, Xenell 617-828-2948
MI St. Clair Shores, Specialities Mfg. 313-771-2700
MN Minneapolis, Carl Bergquist 612-835-2322
MO St. Louis, Wes-Garde Comp. Grp. 314-567-7776
NH Nashua, Wes-Garde Comp. Grp. 603-880-1971
NJ Mt. Laurel, Wes-Garde Comp. Grp. 609-778-8190
NY Woodside, Switches Unltd. 718-478-5000
OH Westerville, Wes-Garde Comps. Grp. 614-885-0319
OR Portland, Minarik Elec. 503-253-3402
SC Columbia, Dixie Elctrns. 803-779-5332
TX Dallas, Wes-Garde Comp. Grp. 214-357-1768
TX San Antonio, Minarik Elec. 512-822-7097
WI Grafton, Lake-View Elctrns. 414-377-8250
WI Milwaukee, Progressive Image 414-321-4722
Can Edmonton, Deskin Sls. 403-466-2106
Can Montreal, Deskin Sls. 514-331-2860
Can Ottawa, Deskin Sls. 613-228-1201
Can Richmond, Vancouver, Deskin Sls. 604-324-8343
Can Toronto, Deskin Sls. 416-475-1412
Can Winnipeg, Deskin Sls. 403-466-2106

SOR, INC., 14685 W. 105th St., Lenexa, KS 66215, Tel: 913-888-2630, TELEX: 4992783, FAX: 913-888-0767; Empl.: 200; *Sls. Mgr.:* Steve Spelman

SOSHIN ELECTRIC CO., LTD., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 3775-9111, TELEX: 246-6377, FAX: (03) 3775-7092; Empl.: 1150; *Sls. Mgr.:* Z. Uehara, Overseas Dept. ..... **A•1655-1657**

Local Sales Offices & Reps

CA Chatsworth, Arco Elctrns. 818-882-8707

SOUNDCOAT CO., INC., 1 Burt Dr., Deer Park, NY 11729-5701, Tel: 516-242-2200, TELEX: 12-5514, FAX: 516-242-2246; Empl.: 100; *Sls. Mgr.:* Mr. Carl Wolaver

SOURIAU, INC., 28309 N. Avenue Crocker, Valencia, CA 91355, Tel: 805-257-4830, TELEX: 4720328, TWX: 910-336-1553, FAX: 805-257-2383; Empl.: 79; *Sls. Mgr.:* Keith L. Olsen

SOUTH AMERICAN DEVELOPMENT CORP., 29 Noxon Rd., Poughkeepsie, NY 12590, Tel: 914-452-1305, FAX: 914-452-2526; Empl.: 80; *Sls. Mgr.:* C. Healy

SOUTHCO, INC., 210 N. Brinton Lake Rd., Concordville, PA 19331, Tel: 215-459-4000, FAX: 215-459-4012; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342, Tel: 404-252-3340, FAX: 404-252-8929; *Sls. Mgr.:* Ray Manley

SOUTHERN ELECTRONICS, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 818-845-2458, FAX: 818-845-6348; Empl.: 100; *Sls. Mgr.:* Wayne Melvin

SOUTHTRONICS, INC., 1265 Kennestone Circle, Marietta, GA 30066-6029, Tel: 404-429-1000, FAX: 404-424-2000

SOUTHWESTERN NAMEPLATE & MFG. CO., INC., P.O. Box 35, Fourth St., Anna, TX 75003, Tel: 214-231-6663, 214-924-3289, 1-800-331-6600, FAX: 214-924-3090; Empl.: 14

SPACE ELECTRONICS, INC., 81 Fuller Way, Berlin, CT 06037, Tel: 203-829-0001, FAX: 203-829-0005; Empl.: 26; *Sls. Mgr.:* Richard Boynton

SPECIAL ELECTRIC CO., INC., 3628 W. Pierce St., Milwaukee, WI 53215, Tel: 414-383-6370, TELEX: 910-262-3106, FAX: 414-383-6725; Empl.: 40; *Sls. Mgr.:* F. James Heider

SPECIALIZED PRODUCTS COMPANY, 3131 Premier Dr., Irving, TX 75063, Tel: 214-550-1923, TELEX: 732764, FAX: 214-550-1386; Empl.: 39; *Sls. Mgr.:* Paul Jones

SPECIALTY CABLE CORPORATION, P.O. Box 50, Wallingford, CT 06492, Tel: 800-456-SPEC, FAX: 203-269-5293; Empl.: 72

SPECIALTY CONNECTOR CO., 2100 Earlywood Dr., Franklin, IN 46131, Tel: 317-738-2800, TELEX: 217084, FAX: 317-738-2858; *Sls. Mgr.:* Thomas L. Lynn; *Dist. Mgr.:* 234

SPECIALITY ELECTRONICS, INC., 19200 Asheville Hwy., Landrum, SC 29356, Tel: 803-457-3824, FAX: 803-457-2535; Empl.: 30; *Sls. Mgr.:* John Galli ..... **C•1526-1532**

SPECO DIV., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, 800-645-5516, TELEX: 96-7754, FAX: 516-957-9142; FSC No.: 516-957-9142; Empl.: 29; *Sls. Mgr.:* Eric Forman; *Dist. Mgr.:* Mel Hulkower

SPECTRACOM CORPORATION, 101 Despatch Drive, East Rochester, NY 14445-1484, Tel: 716-381-4827, TELEX: 9103509587, FAX: 716-381-4998; *Sls. Mgr.:* Edward F. O'Connor

SPECTRAGRAPHICS CORP., 9125 Rehco Rd., San Diego, CA 92121, Tel: 619-450-0611, TELEX: 295439; Empl.: 250; *Sls. Mgr.:* Ray Barger, VP Sls.; *Dist. Mgr.:* Elliot Shev

SPECTRAL INNOVATIONS, 4633 Old Ironsides Dr., Ste. 401, Santa Clara, CA 95054-1807, Tel: 408-727-1314, FAX: 408-727-1423

Local Sales Offices & Reps

OH Columbus, ACQsys Solutions 614-486-6401

SPECTRA LUX CORP., 11825 120th Ave. NE, Kirkland, WA 98034, Tel: 206-747-0560, FAX: 206-821-3193; FSC No.: 51896; Empl.: 120; *Sls. Mgr.:* Woody Hertzog

SPECTRAN CORP., 50 Hall Road, Sturbridge, MA 01566, Tel: 508-347-2261, FAX: 508-347-2747; FSC No.: 6V569; Empl.: 80

SPECTRA-PHYSICS LASERS INC., 1330 Terra Bella Ave.,P.O. Box 7013, Mountain View, CA 94039-7013, Tel: 415-961-2550, 800-227-8054, TELEX: 348-488, FAX: 415-969-4084; *Sls. Mgr.:* Bob Turcotte

SPECTRASCAN, INC., 1110A Elkton Drive, Colorado Springs, CO 80907, Tel: 719-599-9254, FAX: 719-599-0815; Empl.: 15; *Sls. Mgr.:* Jim Stathis

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84405, Tel: 801-392-7531; Empl.: 35

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SPECTROL ELECTRONICS CORP., 4051 Greystone Dr., Ontario, CA 91761, Tel: 714-923-3313; FSC No.: 02111; Empl.: 200; *Sls. Mgr.:* Joseph L. Lucia; *Dist. Mgr.:* Gene Stauffer, Mgr. OEM Prods. ..... **A•2066-2068**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-722-0440
AZ	Phoenix, Deskin Sls.	602-268-2121
AZ	Scottsdale, JK Assocs.	602-990-8804
CA	San Diego, Hadden & Assoc.	619-565-9444
CA	San Jose, Silicon Valley	408-432-1967
CO	Denver, West, Inc.	303-477-8180
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, DHR Mktg.	407-331-1199
IL	Naperville, Lancastle Sls.	708-717-9494
IA	Cedar Rapids, Lowell-Kangas	319-362-9290
KS	Shawnee Mission, Lowell-Kangas	913-631-3515
GA	Duluth, DHR Mktg.	404-564-0529
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, Lowell-Kangas	314-821-4050
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NM	Scottsdale, AZ, J.K. Assocs.	602-990-8804
NY	Commack, E.R.A.	516-543-0510
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, DHR Mktg.	919-829-2510
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls.	513-294-0426
OR	Beaverton, Westmark Elctrn., Inc.	503-641-8780
PA	Pittsburgh, Luebbe Sls.	412-364-0490
TX	Richardson, Pro Comp. Sls. Co.	214-669-1500
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Lancastle, Lancastle	414-796-2723

Local Distributors

AL	Mobile, Newark Elctrns.	205-471-6500
AZ	Phoenix, Newark Elctrs.	602-864-9905
AZ	Phoenix, Sterling Elctrns.	602-268-2121
AZ	Tempe, Shelley-Ragon	602-894-2058
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Fountain Valley, Component Center	714-979-0433
CA	Orange, Newark Elctrs.	714-634-8224
CA	San Diego, Shelley/Ragon	619-453-7133
CA	San Jose, Shelley/Ragon	408-432-0600
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Shelley/Ragon	303-762-0670
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Cronin Elctrns.	203-265-3134
GA	Norcross, Newark Elctrns.	404-448-1300
IL	Bensenville, Voyager	312-860-1300
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Ft. Wayne, Newark Elctrns.	219-484-0766
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Lenexa, Sterling Elctrns.	913-492-5406
MD	Columbia, Newark Elctrns.	301-964-4482
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Waltham, Newark Elctrns.	617-894-8050
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Farmington Hills, Advent Elctrns.	313-967-0600
MI	Oakpark, Newark Elctrns.	313-967-0957
MN	Bloomington, Sterling Elctrns.	612-831-2666
MN	Fridley, Voyager	612-571-7766
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	St. Paul, Shelley/Ragon	612-642-2828
MN	St.Paul, Gopher Elctrns.	612-483-3322
MO	Independence, Newark Elctrns.	816-478-0561
MO	Maryland Heights, Chelsea Inds.	314-997-7709
NJ	South Plainfield, Sterling Elctrns.	201-769-7000
NJ	Union, Newark Elctrns	201-851-2290
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Buffalo, Summit Distrs.	716-887-2800
NC	Charlotte, Newark Elctrns.	704-535-5650
OH	Akron, Akron Elctrns. Supp.	216-762-8818
OH	Cincinnati, Newark Elctrns.	513-722-8181
OH	Columbus, Electronics Mktg.	614-299-4161
OK	Tulsa, Altair	918-252-5781
OR	Portland, Radar Elec.	503-232-3401
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	Philadelphia, Shap Elctrns.	215-969-3300
PA	Pittsburg, Newark Elctrns.	412-367-2790
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Knoxville, Newark Elctrns.	615-588-6493
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-623-6600
TX	Mansfield, Mouser Elctrns.	817-483-0165
TX	Richardson, Altair	214-231-5166
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Newark Elctrns.	206-641-9800
WA	Redmond, Shelley/Ragon	206-883-2220
WA	Seattle, Radar Electrns.	206-282-2511
WV	Charleston, Newark Elctrns.	304-744-9022
WI	Milwaukee, Newark Elctrns.	414-453-9100

SPECTRON GLASS & ELECTRONICS, INC., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788, Tel: 516-582-5600, TELEX: 968296; FSC No.: 57349; Empl.: 70; *Sls. Mgr.:* Bob Marshall

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840/1-800-274-8888, TWX: 510-222-5877, FAX: 516-333-4859; Empl.: 125; *Sls. Mgr.:* Gary Naftaly

SPECTRUM CONTROL, INC., 2185 W. 8th St., Erie, PA 16505, Tel: 814-455-0966, FAX: 814-455-2550; FSC No.: 33095;5733; Empl.: 450; *Sls. Mgr.:* D. Reynolds; *Dist. Mgr.:* D. Zaday

SPECTRUM CORP., 10048 Easthaven, Houston, TX 77075, Tel: 713-944-6200, 1-800-392-5050(Sls), FAX: 713-944-1290; Empl.: 35; *Sls. Mgr.:* Gary W. Liddell; *Dist. Mgr.:* Jim B. Bishop

SPECTRUM DEVICES, 13706 Larkway Dr., Sugar Land, TX 77478-2420, Tel: 713-242-6417, FAX: 713-242-6415; Empl.: 7; *Sls. Mgr.:* Sajid Rafique

SPECTRUM SIGNAL PROC., 250 H st, P.O. Box 8110-25, Blaine, WA 98230, Tel: 1-800-663-8986 (US), 604-438-7266 (Can.), FAX: 604-438-3046; Empl.: 25; *Sls. Mgr.:* Rod Jensen; *Dist. Mgr.:* Al Rana

Local Distributors

CA	Mountainview, Thorson West	415-964-9300
CA	Riverside, Innovation Prods.	714-682-8570

SPECTRUM TECHNOLOGY, INC., DATUM, Incorporated, 749 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-7791, TWX: 910-334-1163, FAX: 805-683-3481; FSC No.: 32464; Empl.: 90; *Sls. Mgr.:* Manny Fernandez, Jr. ..... **A•1462-1467**

Local Sales Offices & Reps

AZ	Phoenix, Sedco Sls.	602-461-9069
CA	Los Angeles, The Thorson Co.	213-595-0361
CA	San Diego, Thorson Co.	619-292-8525
CA	San Francisco, Frequency Control	408-252-5250
HI	Santa Barbara, Spectrum Technlg.	805-964-7791
CA	Santa Barbara, Thorson Co.	805-964-8751
CO	Englewood, Advanced Technology Mktg.	303-789-2606
FL	Ocala, Felcomp	904-288-2365
FL	Orlando, Felcomp	407-282-3554
IL	Elgin, R.K. Elctrns.	312-695-8552
MA	Needham Hgts., Todino Engrg. Sls.	617-444-7925
PA	Glenside, Kobert Assocs.	215-887-2310
TX	Dallas, Caton Sls.	214-243-4716
TX	Dallas, Caton Sls.	214-350-1612

Local Distributors

MD	Kensington, Koebert Assocs.	301-493-8924

SPEEDY CIRCUITS, PJC Technologies, Inc., 5332 Commerical Dr., Huntington Bch., CA 92649, Tel: 714-898-4901, FAX: 714-891-0607; Empl.: 36; *Sls. Mgr.:* Jon P. Herkins

Spellman
High Voltage Electronics Corp

FAX: 516-349-8699

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 150; *Sls. Mgr.:* Eric Marko; *Dist. Mgr.:* Eric Marko ..... **D•2047-2055**

Local Sales Offices & Reps

WA	Kirkland, Syntek	206-488-0394
Can	British Columbia, Broman Engrg.	604-254-6311

SPEMCO SWITCHES, 23425 Harper, Box 386, St. Clair Shores, MI 48080, Tel: 800-482-2828, FAX: 313-771-3491; Empl.: 12; *Sls. Mgr.:* Andrew Richardson

SPERRY, A. W. INSTRUMENTS, P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, 800-645-5398, TELEX: 645104, FAX: 516-434-3128; Empl.: 50; *Sls. Mgr.:* Dennis W. Carroll

SPIRA MANUFACTURING CORP., 12721 Saticoy Street South, North Hollywood, CA 91605, Tel: 818-764-8222, FAX: 818-764-9880; FSC No.: 60050; Empl.: 18; *Sls. Mgr.:* Lisa A Panzich

SPIRICON, INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729, TELEX: 296-465 SPIR UR, FAX: 801-735-5231; Empl.: 15; *Sls. Mgr.:* Ed Danahy

SPRAGUE ELECTRIC COMPANY, Sprague Technologies, Inc., 4 Stamford Forum P.O. Box 120007, Stamford, CT 06901-0007, Tel: 203-964-8600, FAX: 203-964-8668; Empl.: 5,500

SPRAGUE ELECTRIC COMPANY, Distribution Division, 41 Hampden Rd. P.O. Box 9102, Mansfield, MA 02048-9102, Tel: 508-339-8900, FAX: 508-339-5063 ..... **A•1138**

SPRAGUE ELECTRIC COMPANY, Solid Tantalum Capacitors, Lower Main St., P.O. Box 231, Sanford, ME 04073-0231, Tel: 207-324-4140, FAX: 207-324-7223

SPRAGUE ELECTRIC COMPANY, Aluminum Capacitors, 9800 Kincey Ave., Suite 100, Huntersville, NC 28078, Tel: 704-875-8070, FAX: 704-875-8541

SPRAGUE ELECTRIC COMPANY, Wet & Foil Tantalum Capacitors, MIL Filters, 1600 Curran Hwy., North Adams, MA 01247-3987, Tel: 413-664-4431, FAX: 413-663-5079

SPRAGUE ELECTRIC COMPANY, Film Capacitors, 1221 W. Hwy 17/92, Longwood, FL 32750, Tel: 407-695-6562, FAX: 407-695-6889

SPRAGUE ELECTRIC COMPANY, Thick Film Networks and Hybrids Div., 267 Lowell Rd., Hudson, NH 03051, Tel: 603-881-7200, 603-883-9774 (Mktg), FAX: 603-880-1910

SPRAGUE FIL-MAG, 4787 Cardin Street, San Diego, CA 92111-1416, Tel: 619-569-6577, FAX: 619-569-6073; Empl.: 500; *Sls. Mgr.:* Linda Sorrentino

SPRAGUE GOODMAN

FAX: 516-746-1396

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385, TELEX: 14-4533; FSC No.: 52769; Empl.: 80; *Sls. Mgr.:* Martin D. Markson ..... **A•1140-1141**

Local Sales Offices & Reps

AL	Huntsville, Electramark Inc.	205-830-4400
AZ	Mesa, System Sls. of Arizona	602-464-9989
CA	Cupertino, Dura Elctrn. Sls.	408-255-2084
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
CO	Denver, West Inc.	303-477-8180
CT	Milford, KSA Connecticut	203-524-5849
FL	Orlando, TMA	407-857-3760
GA	Norcross, Electramark Inc.	404-446-7915
ID	Meridian, WEST Inc.	208-888-6227
IL	Chicago, B.N.I. Elctrns.	312-775-1717
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665
IA	Marion, M.S.B. Assocs.	319-377-6261
KS	Shawnee Mission, M.S.B. Assocs.	913-432-2131
MD	Monkton, Imagitron Sls.	301-374-5600
MA	Sudbury, KSA of New England	508-443-5881
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
MO	St. Charles, M.S.B. Assocs.	314-946-5577
NJ	Monkton, Imagitron Sls. Co., Inc.	800-638-3592
NM	Albuquerque, SSA of New Mexico	505-889-2901
NY	Melville, R F Elctrns. Sls. Co. Inc.	516-420-8890
NY	Utica, Upstate Engrg. Sls.	315-797-6721
NC	Raleigh, Micro Sls. Inc.	919-881-0007
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OR	Portland, Harry Levinson Co.	503-690-1312
PA	Maple Glen, Imagitron/Pennsylvania	800-638-3592
TX	Seagoville, Delta Comps.	214-287-6333
UT	Centerville, West/Utah	801-292-8787
WA	Seattle, Harry Levinson Co.	206-382-1300
PR	Rio Piedras, Elctrn. Sls. Assocs.	809-762-6459
Can	Toronto, Ont., Norgay Entprs.	416-259-9663

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Garden Grove, Natl. Elctrns.	714-892-7749
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Milpitas, TTI, Inc.	408-946-5577
CA	Mission Hills, TTI, Inc.	818-892-4669
CA	Mission Hills, TTI, Inc.	818-891-8850
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Projections Unltd.	619-453-7900

CA San Diego, TTI, Inc. 619-748-2025
CA Santa Ana, TTI, Inc. 714-641-9393
CA Tustin, Projections Unltd. 714-544-2700
CO Denver, TTI, Inc. 303-429-6806
CT Wallingford, TTI, Inc. 203-284-7474
FL Ft. Lauderdale, Bros. Elctrns. of FL 305-561-6700
FL Melbourne, New Yorker Elctrns. 407-727-0955
FL Orlando, TTI, Inc. 407-859-1000
GA Norcross, TTI, Inc. 404-662-0911
MD Columbia, TTI, Inc. 301-995-1331
MD Savage, Pyttronic Inds. 301-953-9650
MA Wilmington, TTI, Inc. 508-658-4700
MN Eden Prairie, TTI, Inc. 612-944-5080
NJ Fairfield, Tri Start Elctrns. 201-227-3500
NJ Mt. Laurel, TTI, Inc. 609-234-6400
NY Mamaroneck, New Yorker Elctrns. 914-698-7600
NY Ronkonkoma, Tri-Start Elctrns. 516-737-2200
NY Ronkonkoma, TTI, Inc. 516-737-2000
NC Charlotte, TTI, Inc. 704-522-0277
OH Columbus, TTI, Inc. 614-848-5770
PA Harrisburg, Adtech 717-561-9905
PA Montgomeryville, Pyttronic Inds. 215-855-0925
TX Ft. Worth, TTI, Inc. 817-595-3100
TX Garland, J & S Elctrns. Inc. 214-487-8808
WA Redmond, TTI, Inc. 206-882-0291
WA Seattle, Kam Elctrns. 206-382-1300
Can Toronto, Ont., Norgay Entprs. Ltd. 416-234-8966

S-PRODUCTS INC., 35 Kings Highway East, Fairfield, CT 06430, Tel: 203-331-9546, FAX: 203-335-2723; Empl.: 4

SPS SOFTWARE PRODUCTS & SERVICES, INC., 14 E. 38th Street, 14th Fl., New York, NY 10016, Tel: 212-686-3790, TELEX: 852616, FAX: 212-481-7464; *Sls. Mgr.:* Peter Voletsky

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 708-397-2600, FAX: 708-397-8814; Empl.: 19,000; *Sls. Mgr.:* J. Glore, VP Sls.; *Dist. Mgr.:* E.P. Mazzetta

SQUARE D. COMPANY, Control Products, Hwy 64 East, Knightdale, NC 27545, Tel: 919-266-3671, FAX: 919-266-8393; Empl.: 900

SQUARE D CO. POWER PROTECTION SYSTEMS, 9192 Topaz Way, San Diego, CA 92123-1165, Tel: 619-279-0831, TWX: 910-335-1556, FAX: 619-569-8427; FSC No.: 06049; Empl.: 200; *Sls. Mgr.:* Dan Mathews, Dir. of Sls.; *Dist. Mgr.:* Dan Mathews, Dir. of Sls.

Please refer to Topaz' sales representatives for distributor information.

SQUARE D. DATA ENTRY PRODUCTS FORMERLY K.B. DENVER, See MGR Industries

SR ENGINEERING, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200, TELEX: 364412INTR-871, FAX: 714-265-0856; FSC No.: 21441; *Sls. Mgr.:* Mel Hitchcock

SSAC INCORPORATED, P.O. Box 1000, Baldwinsville, NY 13027, Tel: 315-638-1300, FAX: 315-638-0333; FSC No.: 16-0985719; Empl.: 250; *Sls. Mgr.:* D. Carroll

S SQUARED ELECTRONICS, formerly ComTech Systems, Inc., 10 Halyard Rd., Valley Stream, NY 11581-2813, Tel: 516-791-1175; Empl.: 10

STACKBIN CORP., Albion Road, P.O. Box 397, Lincoln, RI 02865, Tel: 401-333-1600, 800-333-1603, FAX: 401-333-1952; Empl.: 50; *Sls. Mgr.:* Valerie Baxter; *Dist. Mgr.:* Timothy J. O'Leary

STACKPOLE CARBON COMPANY, 201 Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, FAX: 814-781-8570; *Sls. Mgr.:* R.A. Williams

STACKPOLE COMPONENTS CO., See Ark-les Special Products Grp., Div. of Stackpole Switches

STACKPOLE, MAGNET DIV., 700 Elk Ave., Kane, PA 16735, Tel: 814-837-0272, FAX: 814-837-0277; *Sls. Mgr.:* G.A. Olson, Mgr. Sls. & Mktg.

STACO, INC., See Staco Transpower

STACO ENERGY PRODUCTS CO.

FAX: 513-253-1723

STACO ENERGY PRODUCTS CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191, TELEX: 288-032; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Robert Simpson ..... **A•2412-2413**

Local Sales Offices & Reps
CA Laguna Hills, South Rep 714-951-1084
CO Wheat Ridge, Cluff 303-425-6604
FL Maitland, H & H 305-831-2474
GA Atlanta, Millar 404-634-3350
IL Chicago, Saffro 312-677-9720
IN Indianapolis, EMCI 317-921-3452
MA Lexington, Hathaway 617-861-1010
MI Detroit, Shalco 313-547-4771
MN St. Paul, Kencotronics 612-645-7717
MO St. Louis, Dowell 314-849-4234
NM Albuquerque, Carlberg 505-836-1448
NY Northport, LSC 516-266-5020
NC Raleigh, Millar 919-828-8840
OH Cleveland, Rockford 216-725-3705
OR Hillsboro, Turn-A-Round 503-640-4661
PA Philadelphia, ECSC 215-825-8610
TX Dallas, B & R 214-985-0028
Can Scarborough, Decade 416-439-9921

Local Distributors
AL Birmingham, JLS 205-322-2486
CO Arvada, Denver Beta Wintronics 303-431-7161
CO San Francisco, Stevens Engrg. 415-588-9200
CT Wallingford, Sager Elctrns. 203-265-4600
FL Miami, Elctrn. Equip. 305-871-3500
GA Atlanta, Cleveland Elec. 404-696-4550
HI Honolulu, Victor Kim 808-841-6266
IL Chicago, Newark Elctrns. 312-784-5100
IN Indianapolis, Bell Elctrns. 317-875-8200
KY Louisville, Peerless 502-637-7674
LA Lafayette, Ralph's 318-234-4507
MA Somerville, Electro Sls. 617-666-0500
MI Madison Hgts., Galco 313-542-9090
MN Minneapolis, Elctrn. Center 612-378-2442
MS Jackson, Ellington Elctrns. 601-355-0561
MO St. Louis, Chelsea Elctrns. 314-997-7709
NJ Kenilworth, Federated Purchaser 201-272-0505
NY Hauppauge, Broadline Elctrns. 516-231-4100
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Dayton, Stotts Friedman Elctrns. 513-298-5555
PA Drexel Hill, Kass Elctrns. 215-449-2300
SC Charleston, Wholesale Elctrns. 803-722-2634
TN Knoxville, Indl. Elctrns. 615-573-7135
TX Ft. Worth, Allied Elctrns. 817-336-5401
VA Charlottesville, VA Elctrns. 804-296-4184
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Scarborough, Decade Elctrns. 416-439-9921

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, TWX: 910-595-1507, FAX: 714-549-0930; FSC No.: 12522;Multiple; Empl.: 115; *Sls. Mgr.:* D. Sugg

STACO TRANSPOWER, Components Corp. of America, 610 W. 6th St., Mt. Carmel, IL 62863, Tel: 618-262-5555, FAX: 618-263-3150; FSC No.: 83008; Empl.: 75; *Sls. Mgr.:* Bill Chidester

STAFFALL INC., 1468 Elmwood Ave., Cranston, RI 02910, Tel: 401-461-5554, TWX: 710-381-6964; Empl.: 25

STAG MICROSYSTEMS INC., 1600 Wyatt Drive, Santa Clara, CA 95054, Tel: 408-988-1118, 1-800-227-8836, FAX: 408-988-1232; Empl.: 150; *Sls. Mgr.:* Phil Holden; *Dist. Mgr.:* Phil Holden

STAINLESS, INC., 210 S. 3rd St., N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097, FAX: 215-699-9597; Empl.: 80; *Sls. Mgr.:* Owen F. Ulmer

STANCOR

FAX: 219-722-5189

STANCOR, White-Rodgers, 131 Godfrey St., Logansport, IN 46947, Tel: 219-722-2244; FSC No.: 80089; Empl.: 400; *Sls. Mgr.:* Steve Fisher; *Dist. Mgr.:* Stephanie Starbuck, Prod. Mgr. ..... **A•2414-2419; B•1584-1587**

Local Sales Offices & Reps
AL Athens, E.M.F. 205-233-2947
AZ Contact Factory 219-722-2244
CA Campbell, Shur Sls. 408-374-5577
CA Irvine, Groh Assocs. 714-837-9871
CO Denver, West, Inc. 303-477-8180
CT Waterbury, Cannon Assocs. 203-597-0240
FL Tampa, Uni-Rep 813-831-6083
GA Atlanta, E.M.F. 404-944-9216
IL Chicago, Joel Wasserman Assocs. 708-256-3566
IN Ft. Wayne, K & D Sls. 219-436-2221
KS Shawnee, Lowell Kangas 913-631-3515
MD Sykesville, D.J.C. 301-795-7020
MA Chelmsford, Cannon Assocs., Inc. 508-649-3809
MN Bloomington, Murnco 612-854-4161
MO St. Louis, Lowell Kangas 314-821-4050
NM Contact Factory 219-722-2244
NY Rochester, A.J. Electromarketing 716-426-3598
NC Raleigh, E.M.F. 919-867-6221
OH Beachwood, Elctrn. SalesMasters 216-831-9555
OR Portland, Temper Tech. 503-292-8201
PA Philadelphia, D.J.C. 215-334-4533
RI Warwick, Cannon Assocs. 401-732-1570
TX Richardson, Pro-Comp Sls. 214-669-1500
VT Isle La Motte, Cannon Assocs. 802-928-3041

STANDARD CONDENSER CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-675-3133, FAX: 708-675-3709; FSC No.: 97419; *Sls. Mgr.:* B. P. McLean

STANDARD CRYSTAL CORPORATION, 9940 E. Baldwin Pl., El Monte, CA 91731, Tel: 818-443-2121, TELEX: 4998755, FAX: 818-443-9049; FSC No.: 30149; *Sls. Mgr.:* Tom Valasek/Gus Jimenez; *Dist. Mgr.:* Betty Longwell ..... **A•1469**

Local Sales Offices & Reps
AZ Phoenix, CPS Assocs., Inc. 602-246-1097
AZ Scottsdale, Az Tech-CPS Inc. 602-991-6300
CA Milpitas, Ward Elctrn. Packaging Sls. .. 408-945-0420
GA Norcross, Spar Tech Assocs. 404-446-7300
IL Berkeley, ESA Tech. Mktg. 312-544-0120
IL Northbrook, Allied Comp. Reps., Inc. .. 312-498-6658
MI Grand Rapids, R.P. Urban & Assocs. .. 616-245-0511
MA Sherborn, Barlow Engrg. Assoc., Inc. .. 508-655-6751
TX Dallas, Allied Comps., Inc. 214-238-0408
UT Salt Lake City, Sage Sls. 801-467-5451
WA Bellevue, Caruso and Company 206-455-8811

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, FAX: 201-256-2820; Empl.: 42

STANDARD GRIGSBY, INC., FLINT INDUSTRIES, See OakGrigsby, Inc.

STANDARD GRIGSBY INC., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: 0911-65521, TELEX: 622351, FAX: 0911/6552-239

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STANDARD INSERT CO., Penn Engrg. & Mfg. Corp., 419 Sargon Way, Horsham, PA 19044, Tel: 215-956-0350, FAX: 215-956-0366; Empl.: 7; *Sls. Mgr.:* Christopher O'Connell

STANDARD MAGNETIC CORP., 3000 E. Coronado St, Anaheim, CA 92806, Tel: 714-630-9751, FAX: 714-630-1601; Empl.: 15; *Sls. Mgr.:* Satish Jain

STANDARD MICROSYSTEMS, 35 Marcus Blvd, Hauppauge, NY 11788, Tel: 516-273-3100, FAX: 516-273-3123; FSC No.: 53848; Empl.: 500

STANDARD REFERENCE LABS, INC., See Koep Precision Standards, Inc.

STANDARD WIRE & CABLE CO., 1959 E. Cashdan St, Rancho Dominguez, CA 90220, Tel: 213-609-1811, 800-326-0006, TELEX: 65-3423, ESYLNK: 62931655, FAX: 213-609-1862; Empl.: 50; *Sls. Mgr.:* Dan Varvais; *Dist. Mgr.:* Jerry Gaither

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FAX: 513-871-3779

STANDEX ELECTRONICS, Standex International, 4538 Camberwell Rd, Cincinnati, OH 45209, Tel: 513-871-3777; FSC No.: 56402; Empl.: 450; *Sls. Mgr.:* Charles C. Johnson, VP Sls. .... **A•1262-1267; B•1782-1783**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-464-0792
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Cupertino, Codella Mktg. Grp., Inc.	408-257-2561
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
CO	Longmont, Butler Tech. Sls.	303-651-7703
FL	Boca Raton, R. W. Mitscher Co.	305-368-3841
FL	Tequesta, R.W. Mitscher Co.	407-575-4485
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Granger, Gregory Sls. Co.	219-272-9626
MD	Edina, Jay Borman Sls. Co.	612-922-5525
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Sudbury, KSA of New England	617-443-5881
MI	Detroit, R.P. Urban & Assoc.	313-535-2355
MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
MO	Kansas City, EPI Inc.	816-523-8911
MO	St. Louis, EPI Inc.	314-962-1411
NJ	Woodbridge, Jade Mktg.	201-750-2998
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	Red Hook, R. W. Mitscher Co., Inc.	914-758-8375
NY	Rochester, R. W. Mitscher Co., Inc.	716-227-0839
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Portland, Components Technlg.	503-292-1518
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Houston, B & R Elctrn. Sls. Corp.	713-682-5448
TX	Plano, B & R Elctrn. Sls. Corp.	214-985-0028
VA	Richmond, R. W. Mitscher Co., Inc.	804-320-7350
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940

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Local Sales Offices & Reps

AZ	Chandler, Lindberg Co.	602-786-9115
CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Boulder, R-G Entprs.	303-447-9211
CT	Branford, Coakley, Boyd & Abbett, Inc.	800-225-8402,203-481-2218
FL	Palm Harbor, Bob Dean, Inc.	813-789-1233
GA	Atlanta, Wallace Elctrn. Sls.	404-634-3159
IL	Skokie, Indl. Rep.	708-967-8430
IN	Carmel, TMC	317-844-8462
IN	Ft. Wayne, TMC	219-432-5553
KY	Louisville, TMC	502-893-1377
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	Blue Springs, Palatine Sls.	816-229-4007
MO	Florissant, Palatine Sls.	314-839-0800
NJ	Hackensack, Coakley, Boyd, Abbett, Metro	201-440-4114
NJ	Marlton, Naudain Assoc.	609-983-5300
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Centerville, Bear Mktg.	513-436-2061
OH	Richfield, Bear Mktg.	216-659-3131
TX	Austin, Allied Comps.	512-331-4494
TX	Dallas, Allied Comps.	214-238-0408
TX	Hurst, Allied Comps.	817-589-0456
WI	Brookfield, Indl. Rep.	414-789-9393
Can	Mississauga, Ont., Indigo Elctrs. Ltd.	416-670-0284

Local Distributors

AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Buena Park, Cypress Elctrns.	213-744-0355
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-945-8400
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Englewood, Indelco	303-694-9444
CT	Danbury, Heilind Elctrns.	203-797-8600
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrn.	407-849-6060
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Gaithersburg, Pioneer/Wash.	301-921-0660
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Fridley, Voyager Elctrns.	612-571-7766
NJ	W. Berlin, General Comps., Inc.	609-768-6767
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Distr.	716-887-2800
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rome, Rome Elctrns.	315-337-5400
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Dayton, Bell Inds.	513-435-8660
OH	Solon, Repco	216-248-8900
OH	Stow, Advacom	216-688-5311
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Radar Elec.	503-233-3404
PA	McKean, Advacom	814-476-7774
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Stafford, Harrison Equip.	713-879-2727
TX	Stafford, Southwest Elctrns.	713-240-4000
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Mequon, Taylor Elec.	414-241-4321
Can	Burnaby, B.C., Semad Elctrns.	604-420-9889
Can	Calgary, Alberta, ITT Multicomponents	403-273-2780
Can	Concord, Ont., ITT Multicomponents	416-736-1144
Can	Edmonton, Alberta, ITT Multicomponents	403-436-9555
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Ottawa, Ont., Semad Elctrns.	613-727-8325
Can	Surrey, B.C., Memco Elctrn. Mkts.	604-590-1553
Can	Ville St. Laurent, Quebec, ITT Multicomponents	514-335-7697
Can	Winnipeg, Manitoba, ITT MultiComponents	204-697-2300
WA	Bellevue, Testco, Inc.	206-454-7422

STANFORD RESCH. SYS., INC., 1290 D. Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-9040, TELEX: 706891 SRS UD, FAX: 408-744-9049; *Sls. Mgr.:* Daniel R. Melick

STANFORD TELECOMMUNICATIONS, INC., 2421 Mission College Blvd., Santa Clara, CA 95056, Tel: 408-748-1010, TWX: 910-339-9531, FAX: 408-980-1066; FSC No.: 61362; Empl.: 900; *Sls. Mgr.:* Chuck Frank

STANGENES INDUSTRIES, INC., 1052 East Meadow Circle, Palo Alto, CA 94303, Tel: 415-493-0814, FAX: 415-855-9926; FSC No.: 62709; Empl.: 61; *Sls. Mgr.:* Magne Stangenes

STANLEY ELECTRONICS DIV., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000; FSC No.: 61544; Empl.: 12

STANLEY

FAX: 714-222-0777

I I STANLEY CO. INC., Stanley Electric Co. LTD., 2661 Gates Avenue, Suite 2000, Irvine, CA 92714, Tel: 1-800-LED-LCD1; Empl.: 390; *Sls. Mgr.:* Bill Roth; *Dist. Mgr.:* Al Kile ..... **B•1134, 1196-1201**

Local Sales Offices & Reps

AZ	Scottsdale, B.S.E.	602-483-0373
CA	Laguna Hills, Bart Budge Assoc.	714-582-8720
CO	Boulder, Stratford Grp.	303-530-3194
FL	Lighthouse Pt., Jack Krutek Assoc.	305-783-2501
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IN	Indianapolis, EMCI	317-921-3450
KS	Overland Park, Mink Assoc.	913-341-8309
MA	N. Reading, Alpha-Omega Sls.	508-664-1118
MN	Minneapolis, Holmgren Assoc.	612-574-9983
MO	Bridgeton, Mink Assoc.	314-291-5454
NY	Port Washington, ASHTEC	516-767-0336
OH	Dayton, K W Elctrns.	513-899-2150
PA	Horsham, Jacobsen Assoc.	215-674-2937
TX	Dallas, TESCO	214-553-1200
WA	Kirkland, Northwest Comp. Sls.	206-828-2104
WY	Jackson, TETONICS	307-733-1077
Can	Markham, Ontario, Deskin Sls.	416-475-1412

Local Distributors

AL	Huntsville, Future Elctrns.	205-830-2322
AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Littleton, Indelcc, Inc.	303-796-3461
CT	Hartford, Wesgarde Comps. Grp.	203-527-7705
FL	Lakeland, Wesgarde Comps. Grp.	813-644-7564
IL	Woodale, NEP Elctrns.	708-595-8500
IA	Cedar Rapids, DEE Elctrns. Inc.	319-365-7551
MD	Columbia, Future Elctrns.	301-290-0600
MA	Westborough, Future Elctrns.	508-366-2400
MI	Livonia, Future Elctrns.	313-261-5290
MN	New Brighton, CHRIS Elctrns.	612-631-2647
MO	St. Louis, Wesgarde Comps. Grp.	314-567-7776
NH	Nashua, Wesgarde Comps. Grp.	603-880-1971
NJ	Mt. Laurel, Wesgarde Comps. Grp.	609-778-8190
NY	Rochester, Future Elctrns.	716-272-1120
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Meafield Heights, Future Elctrns.	216-449-6996
PA	N. Versailles, CMD Elctrns.	412-678-6020
TX	Houston, Kent Elctrns.	713-780-7770
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	New Berlin, NEP Elctrns.	414-785-9100

STANLEY-VIDMAR, Stanley Works, 11 Grammes Rd., Allentown, PA 18103, Tel: 215-797-6600, TELEX: 847-345; Empl.: 5000; *Sls. Mgr.:* Ernie Gitlin, Vic Joliat; *Dist. Mgr.:* Frank Casey

STANPAT PRODS., 100 Goldstein Drive, Woonsocket, RI 02895, Tel: 401-766-8400, FAX: 401-767-0244; Empl.: 35; *Sls. Mgr.:* Mark Barbone

STANTON MAGNETICS, INC., Terminal Dr., Plainview, NY 11803-1511, Tel: 516-349-0235, TWX: 510-221-1845, FAX: 516-349-0230; Empl.: 300; *Dist. Mgr.:* Jack O'Donnell, Natl. Sls. Mgr.

STANTRON, Unit of Zero Corporation, 6900-6918 Beck Ave., P. O. Box 9156, N. Hollywood, CA 91605, Tel: 818-841-1825, FAX: 818-841-8892; FSC No.: 06514; Empl.: 125; *Sls. Mgr.:* G. A. Tessier

STAR CASE MANUFACTURING CO., INC., 648 Superior Avenue, Munster, IN 46321, Tel: 219-922-4440, 800-822-STAR (outside IN), 800-782-CASE (inside IN), FAX: 219-922-4442; Empl.: 75; *Sls. Mgr.:* Veronica Stadden ..... **C•1097**



FAX: 908-572-5095

STAR MICRONICS, INC., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, Tel: 908-572-9512; Empl.: 120; *Sls. Mgr.:* Georgia Lombardi; *Dist. Mgr.:* Chris Duffy ..... **D•1062-1065, 1112-1115**

Local Sales Offices & Reps

CA	Irvine, Star Micronics	714-768-7203
IL	Itasca, Star Micronics	312-773-3717

Local Distributors

CA	Los Angeles, Elec. Switches, Inc.	213-660-1310
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Stanton, MS Cash Drawer	818-792-2111
CA	Sunnyvale, Penstock / Waltronics	408-730-0300
CO	Englewood, NEP Elctrns.	303-799-9898
FL	Davie, Arco Dist., Inc.	305-473-2550
GA	Norcross, Applied Power	404-263-0421
IL	Wood Dale, NEP Elctrns.	708-595-8500
IL	Wheeling, Hawk Elctrns.	708-459-4030
MD	Middletown, Current Comps.	301-473-5333
MA	Sharon, Adcour	617-784-8123
MI	Brighton, Applied Power	313-227-3604
MI	Grand Rapids, S. F. Elec. Supp., Inc.	616-459-0216
NJ	Sparta, Instrument & Equip.	201-729-4293
NY	Hewlett, Metropolitan Sls.	516-599-7900
OH	Cincinnati, U.R.I. Elctrns.	513-761-4030
TX	Channelview, R. T. Henry Elctrns.	713-452-4451
TX	Dallas, Foxfire	214-353-9543
CA	Tustin, OBI Dists.	714-250-9003
WI	New Berlin, NEP Elctrns.	414-785-9100
EXP	Markham, Ont., Birde Mktg.	416-477-7722

STAR PORCELAIN, 71 Muirhead Ave., Trenton, NJ 08638, Tel: 609-392-3154; Empl.: 70; *Sls. Mgr.:* Art Weigold

STAR-TRON CORPORATION, 58 Curtis St., Providence, RI 02909, Tel: 401-274-5090, FAX: 401-274-3936; Empl.: 50; *Sls. Mgr.:* Debra Chandronet-Christy



FAX: 714-997-1256

STATEK CORP., 512 N. Main St., Orange, CA 92668, Tel: 714-639-7810, TELEX: 67-8394; FSC No.: 51791; Empl.: 200; *Sls. Mgr.:* Bob Goodwin; *Dist. Mgr.:* S. Schaefer ..... **A•1470-1471**

Local Sales Offices & Reps

AL	Huntsville, L & D	205-837-1469
AZ	Phoenix, Eltron	602-266-2164
CA	Fallbrook, Chilcote Assoc.	619-728-7678
CA	Mission Viejo, Jay Mktg.	714-768-7519
CO	Englewood, Comp. Sls.	303-779-8060
FL	Palm Habor, Sigma Tech	813-789-5522
GA	Atlanta, L & D	404-395-7079
IL	Rolling Meadows, Eagle Tech. Sls.	312-991-0700
IN	Fort Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Des Moines, SPS Assocs.	515-225-0607
KS	Olathe, SPS Assocs.	913-764-4460
MA	Woburn, Radian Assocs.	617-933-7386
MI	Brighton, AP Assoc.	313-229-6550
MN	Bloomington, Murnco Inc.	612-854-4161
MO	Earth City, SPS Assocs.	314-291-0520
NJ	Bellmawr, TAI Corp.	609-778-5353
NY	New Rochelle, Robert Diamond Inc.	914-632-2828
NC	Charlotte, Prime Comps.	704-522-1150
NC	Raleigh, Prime Comps.	919-850-9866
OH	Centerville, Omega Sls. Inc.	513-434-5507
OH	Cleveland, Omega Sls. Inc.	216-360-9400
OR	Oregon City, Halbar Assoc.	503-656-3714
TX	Austin, Norcom	512-451-2757
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-778-0392
UT	Midvale, Comp. Sls.	801-561-5688
WA	Redmond, Halbar Assocs.	206-882-0990

Local Distributors

CA	Orange, Western Micro	714-637-0200
CA	San Diego, Western Micro	619-453-8430
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Littleton, Indelco	303-795-3431
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Palatine, OHM Elctrns.	708-359-5500
IL	Schaumberg, Reptron Elctrns.	708-882-1700
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
MA	Woburn, First Frequency	617-935-3885
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Maryland Hgts., RS Elctrns.	314-997-7709
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Mt. Vernon, All American	914-699-2224
OH	Solon, Reptron Elctrns.	216-349-1415
OH	Worthington, Reptron Elctrns.	614-436-6675
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
WA	Redmond, Kent Elect	206-883-7200

STATE OF THE ART, INC., 2470 Fox Hill Rd., State College, PA 16803-1797, Tel: 814-355-8004, TELEX: 866633, FAX: 814-355-2714; Empl.: 100; *Sls. Mgr.:* Joseph J. Curcio ..... **A•1986-1991**

Local Sales Offices & Reps

AZ	Phoenix, Eltron, Inc.	602-266-2164
CA	La Miranda, Select Elctrns.	714-739-8891
CA	Saratoga, EMS	408-446-3833
CT	New Haven, Masten-Wright, Inc.	203-288-1638
FL	Melbourne, Graham Assoc., Inc.	407-773-6631
FL	Palm Bch. Gdns., Graham Assoc., Inc.	407-662-4049
IL	Glenview, Crimson Engrg. Sls., Inc.	312-470-0024
IN	Indianapolis, Hi-Tech Sls.	317-887-2564
MA	Newton, NormellAssocs.,Inc.	617-969-5478
MN	Edina, Peterson Sls. & Assocs.	612-944-0030
NY	Huntington, Compar NY, Inc.	516-423-5660
NY	Lewistown, Watmet, Inc.	716-285-3595
PA	Colmar, E.L. Assocs.	215-822-2510
TX	Dallas, Merino Sls. Co.	214-233-6002
WA	Bellevue, Mars	206-747-3292
Can	Niagara Falls, Waters Metal Prods., Ltd.	416-356-4925

Local Distributors

CA	Los Alamitos, Semi Dice, Inc.	213-594-4631
FL	Tampa, Impala Elctrns.	813-885-4747
NJ	Fairfield, CHPS, Inc.	201-882-0997
NJ	Fairfield, Micross Comps.	201-227-8007
NY	Melville, Semi Dice	516-753-0050
NY	Port Chester, Zeus Comps.	914-937-7400



FAX: 516-666-8039

STAVER CO., INC., P.O. Box 220M 41 Saxon Ave., Bay Shore, NY 11706, Tel: 516-666-8000, TELEX: 6711657 STAVER; Empl.: 80; *Sls. Mgr.:* Arnold Lazarus ..... **B•1127-1131**

Local Sales Offices & Reps

CA	Ventura, R D Sls. Corp.	805-650-0111
IL	Wheaton, RMP McBride Corp.	708-462-2500
IN	Sugar Grove, The Manx Co.	708-466-4200
MI	Jackson, Jordan-Elliott Sls.	517-788-8353
MN	St. Paul, Proud Inds.	612-646-9428
NH	Hancock, Eisenbeis Sls.	603-525-4417
NY	East Northport, Levison Sls. Co.	516-266-5020
NC	New Hill, Tom G. Santel	919-362-4091
OK	Tulsa, Jerry Robison & Assocs.	918-665-3562
OR	Beaverton, Quest Mkgt.	503-641-7377
PA	Montgomeryville, Eastern Scientific Mktg.	215-368-4570
SC	Mauldin, Carl Hart Assocs.	803-288-2323
TX	Dallas, Innovative Tech. Sls.	214-669-3485
TX	Houston, Innovative Tech. Sls.	713-468-3882
WA	Bellevue, Quest Mkgt.	206-747-9424
WI	Colgate, RMP McBride Sls. Corp.	414-628-4016

STEMCO INSTRUMENTS, Colt Industries, P.O. Box 8047, Longview, TX 75607, Tel: 214-643-3236, TWX: 710-730-5236, FAX: 214-643-3339; FSC No.: 07446; Empl.: 100; *Sls. Mgr.:* Bob Halpin

STENNING INSTRMENTS, INC., 671 Enchanted Way, Pacific Palisades, CA 90272, Tel: 213-459-2930, FAX: 213-459-4983; *Sls. Mgr.:* Charles Stenning

STEP ENGINEERING, P.O. Box 3166, Sunnyvale, CA 94088, Tel: 408-733-7837, TWX: 910-339-9506, FAX: 408-773-1073; Empl.: 50; *Sls. Mgr.:* Robert C. Davi

STEPHENS ANALYTICAL, INC., 2750 Brabant-Marineau, Montreal, Que., CA H4S 1L1, Tel: 514-332-1230, FAX: 514-331-2084; Empl.: 8; *Sls. Mgr.:* Mr. Alan Lee

STERLING INSTRUMENTS, 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 150

STETCO, INC., 3344 Schierhorn Ct., Franklin Pk., IL 60131, Tel: 708-671-4208, FAX: 708-671-5270; FSC No.: 52763; Empl.: 41; *Sls. Mgr.:* Saul A. Gusaras

STETRON INTERNATIONAL, INC., 90 Broadway, Buffalo, NY 14203, Tel: 716-854-3443, FAX: 716-854-3448; Empl.: 70

STEVENS-ARNOLD DIV., Computer Prods./Stevens-Arnold, 7 Elkins St., So. Boston, MA 02127, Tel: 617-268-1170, TELEX: 95-1456 STEARCO, TWX: 710-339-0855, FAX: 617-268-0300; FSC No.: 80640; Empl.: 260; *Sls. Mgr.:* John T. Parent

Refer to Computer Products, Inc., Fremont, CA for sls. offices and reps. and for distrs. listings. Refer to Computer Products, Inc., Pompano Beach, FL for sls. offices and reps. and for distrs. listings.

STEVENS PRODUCTS, INC., 128 N. Park St., E. Orange, NJ 07019, Tel: 201-672-2140, FAX: 201-672-2837; Empl: 50; *Sls. Mgr.:* Robert Cantilina

STEWARD, D. M., MFG. CO., E 36th st., P.O. Box 510, Chattanooga, TN 37401, Tel: 615-867-4100, FAX: 615-867-4102; Empl.: 250; *Sls. Mgr.:* Don Lepard

STEWART CONNECTOR SYS., INC., Insilco, R.D. No. 2 Box 2020, Glen Rock, PA 17327, Tel: 717-235-7512, TELEX: 4977105, FAX: 717-235-7954; Empl.: 187; *Sls. Mgr.:* Ed Cavanaugh; *Dist. Mgr.:* Ed Cavanaugh ..... **C•1533**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assoc., Inc.	205-533-9108
CA	Dana-Point, PCA	714-493-9822
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Boulder, Component Prod. Sls. Co., Inc.	303-530-2800
CT	Madison, Focus	203-245-4314
FL	Tamarac, Hughes Assoc., Inc.	305-720-1674
GA	Norcross, Hughes Assoc., Inc.	404-662-1561
IL	St. Charles, XYZ Mktg.	708-584-3001
IN	Columbus, Connect 21, Inc.	812-378-4361
KS	Parker, S.W. Assocs., Inc.	913-898-6552
KY	Louisville, Connect 21, Inc.	502-426-8955
MA	Tauton, Focus	508-824-3840
MI	Southfield, Carl H. Schmidt	313-353-6000
MN	Brooklin Center, Combined Sls.	612-566-2724
MS	Corinth, Hughes Assoc.	601-287-2915
NJ	Paramus, Atlantic Tech. Comps., Inc.	201-261-0542
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Charlotte, Quantum	704-523-8822
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter	216-725-6422
OK	Tulsa, Blair Engrg., Inc.	918-622-3100
OR	Beaverton, Elctrns. Northwest,Inc.	503-629-9241
PA	Glen Rock, SCS	717-235-7512
TX	Dallas, Blaire Engrg., Inc.	214-241-5655
UT	Salt Lake City, Component Prod. Sls., Inc.	801-531-7672
WA	Redmond, Elctrns. Northwest, Inc.	206-883-1959
Can	Bellevue, Ont., Quest	206-747-9424
Can	Campden, Ont., Magden	416-563-5408

Local Distributors

CA	Irvine, Kensington Elctrns.	714-588-0575

STIMPSON COMPANY, INC., 900 Sylvan Ave., Bayport, NY 11705-1097, Tel: 516-472-2000, TELEX: ITT 4972370, FAX: 516-472-2425; Empl.: 900; *Sls. Mgr.:* Edward J. Dewalters



ST MICROWAVE CORP., Sub. of Signal Technlg. Corp., 955 Benecia Ave., Sunnyvale, CA 94086, Tel: 408-730-6300, FAX: 408-245-3396,408-733-0254; FSC No.: 27338; Empl.: 237; *Sls. Mgr.:* Phillip B. Cox-VP

STOCK DRIVE PRODUCTS, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-0200, 328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 228; *Sls. Mgr.:* Murray Ores ..... **B•1312**

Local Sales Offices & Reps

AL	Huntsville, Par Marketing, Inc.	205-859-5702
CA	Chatsworth, Western Comp. Sls.	818-882-6226
CA	San Carlos, SDP West	415-594-0700
CA	San Carlos, Western Comp. Sls. N.	415-594-1222
CO	Denver, Manufacturer's Mktg.	303-985-2008
CO	Wheatridge, Manufacturers Mktg.	303-425-9569
CT	Wethersfield, Underwood Sls.	203-563-3046
FL	Clearwater, Tech-Rep Assoc., Inc.	813-576-9900
IL	Downers Grove, Rockford Controls Co.	312-960-2046
IN	Indianapolis, Rockford Controls Ohio	317-251-2866
MD	Upperco, Imagitron Sls. Co.	301-374-5600
MA	Lowell, Underwood Sls.	617-256-8191
MA	Topsfield, Liberty Electro	508-887-6655
MI	Southfield, R.C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Northstar Motion & Control	612-770-5311
NJ	Paramus, Design Elctrns.	201-845-6224
NY	Clark Mills, KLM-Garner, Inc.	315-853-6126
NY	New Hyde Park, SDP	516-328-3300
NY	Pittsford, KLM-Garner	716-381-8350
OH	Euclid, Rockford Controls Ohio, Inc.	216-731-5250
OH	Medina, Rockford Controls Ohio	216-725-3705
TX	Houston, Zonk & Assoc.	713-579-7777
TX	Richardson, Zonk & Associates	214-238-7651
WA	Seattle, Northmar Inc.	206-524-5170
WI	Madison, Rockford Controls	608-233-8750

Local Distributors

CA	San Carlos, SDP West	415-594-1222

STOCK MODEL PARTS, Designatronics Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-3300, FAX: 516-326-8827

STOCKO CONNECTORS, Stocko Corporation, 495 Industrial Road, Carlstadt, NJ 07072, Tel: 201-933-4452, FAX: 201-933-4522; Empl.: 34

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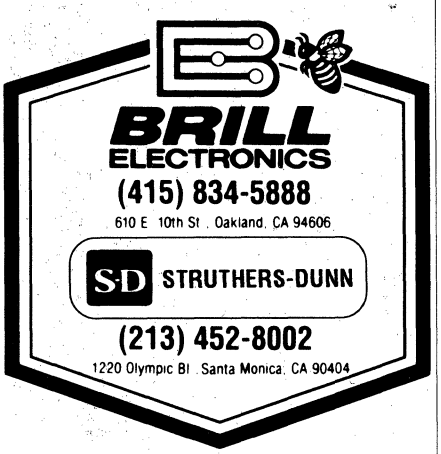
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STOLZBERG RESEARCH, INC., 3 Seabrook Court, Stony Brook, NY 11790, Tel: 516-751-4277, FAX: 516-689-6671; Empl.: 4; *Sls. Mgr.:* Bruce Davis; *Dist. Mgr.:* Bruce Davis

STORM PRODUCTS CO., 116 Shore Drive, Hinsdale, IL 60521, Tel: 708-323-9121, TWX: 910-651-0850, FAX: 708-323-9398; FSC No.: 57500; Empl.: 68; *Sls. Mgr.:* Brian J. Holland

STRATOS PRODUCT DEVELOPMENT GROUP, 2025 First Ave. 830 Market Pl. Tower, Seattle, WA 98121, Tel: 206-448-1388, FAX: 206-448-7830; Empl.: 14

STRAWBERRY TREE, INC., 160 S. Wolfe Rd., Sunnyvale, CA 94086, Tel: 408-736-8800, TELEX: 650 3172834 MCI, FAX: 408-736-1041; Empl.: 25

STREET ELECTRONICS CORP., 6420 Via Real, Carpinteria, CA 93013, Tel: 805-684-4593, FAX: 805-684-6628; *Dist. Mgr.:* Mark Pfeffer

ST RESEARCH CORPORATION, 8419 Terminal Road, Newington, VA 22122, Tel: 703-550-7000, FAX: 703-550-7470; FSC No.: 50406; Empl.: 160

STRONGBOX, P.O. Box 2726, Culver City, CA 90231-2726, Tel: 213-305-8288; FSC No.: 2T043; Empl.: 5; *Sls. Mgr.:* Larry Martinek ..... **C•1108-1109**



FAX: 609-589-2619

STRUTHERS-DUNN, INC. AND HI-G CO., INC., Lambs Rd., Pitman, NJ 08071-0901, Tel: 609-589-7500, ESYLNK: 622-87939; FSC No.: 78290; Empl.: 467 ..... **B•1588-1603**

Local Sales Offices & Reps

AZ	Scottsdale, BSE, Inc.	602-483-0373
CA	RD & D	
CA	Los Angeles, RD & D	213-666-1611
CA	Palo Alto, Innovative Sls.	415-961-0456
CO	Englewood, Omega	303-762-1921
CT	Bloomfield, Friedman	203-242-7781
FL	Orlando, Comp. Design Mktg.	407-352-5480
IL	Downers Grove, Bob Burns & Assoc.	312-960-2046
IN	Ft. Wayne, TX Sls.	219-423-3422
IA	Cedar Rapids, Pattison	319-365-3150
KS	Olathe, Advanced Tech. Sls.	913-782-8702
LA	Lafayette, Fralia	318-269-9452
MD	Columbia, Imagitron	301-381-0225
MI	Southfield, TX Sls.	313-353-8210
MN	Minneapolis, Jay Borman	612-888-2122
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NM	Albuquerque, B.S.E.	505-293-2582
NY	Buffalo, Tri-Tech	716-877-3677
OH	Cincinnati, Elctrn Comps.	513-729-1969
PA	Broomall, Imagitron Sls.	215-356-5300
PA	Pittsburgh, Elctrn. Comps.	412-242-9500
TX	Euless, W. Pat Fralia Co.	817-354-1144
WA	Bellevue, Eltech, Inc.	206-643-4330

Local Distributors

CA	Santa Ana, Norstan Elctrns., Inc.	714-540-4165
MO	Maryland Hgts., L Comp. Inc.	314-291-6200
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Plainview, A.C.I. Elctrns.	516-293-6630
PA	Philadelphia, PEI/Genesis	215-673-0400
TX	Dallas, Associated Aircraft	214-331-4381

ST-SEMICONDUCTORS OF INDIANA, INC., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609, Tel: 812-332-1435, FAX: 812-331-8706; Empl.: 100; *Sls. Mgr.:* Jim Davis; *Dist. Mgr.:* Jim Davis

SUBMARINE SIGNAL DIVISION, Raytheon Company, 1847 W. Main Road, Portsmouth, RI 02871, Tel: 401-847-8000, TELEX: 71-6817111, FAX: 401-847-2364; Empl.: 2,300

SUCKLE CORP., 733 Davis St., Dept. EM, Scranton, PA 18505, Tel: 717-346-3871, FAX: 717-346-1612; Empl.: 220; *Sls. Mgr.:* James J. Castellino

SULLINS ELECTRONICS CORP., P.O. Box 189, 801 E. Mission Rd., San Marcos, CA 92069, Tel: 619-744-0125, TWX: 910-322-1472, ESYLNK: 62912413, FAX: 619-744-6081; Empl.: 75 ..... **C•1534-1535**

Local Sales Offices & Reps

AZ	Phoenix, TM Entprs.	602-759-5057
AL	Athens, Effective Mktg. Force	205-233-2947
CT	Bethel, Cycle Sls.	203-621-2131
CA	Newport Beach, Qual Conn	714-851-6465
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CO	Wheatridge, Cluff & Assocs.	303-425-6604
FL	Palm Harbor, Bob DEan, Inc.	813-789-1233
GA	Lithia Springs, Effective Mktg. Force	404-948-6023
IL	Mt. Prospect, Dombrow Co.	708-253-3326
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assoc.	913-432-2131
MD	Randallstown, Chesapeake Inds. Mktg.	301-653-0476
MA	Harvard, Cycle Sls.	617-456-6868
MI	Southfield, Comp. Assocs.	313-355-4110
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Louis, M-S-B Assocs., Inc.	314-772-2166
NJ	Medford, Comp. Consultants	609-654-5300
NY	E. Rockaway, HLJ Comp-Tech	516-599-2999
NC	Fayettville, Effective Mktg. Force	919-867-6221
OH	Centerville, Omega Sls., Inc.	513-434-5507
OH	Dublin, Sls. Plus	216-942-7811
PA	Ft. Washington, SMC Inc.	215-628-3394
TX	Allen, Bozman & Assocs.	214-727-3719
TX	Richardson, Comp. Partners	214-644-1288
TX	Richardson, Off The Shelf Comp.	214-238-0808
TX	Round Rock, Bozman & Assocs.	512-255-2444
WA	Chattaroy, Elctrn. Mktg. Grp.	509-922-2718
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WA	Vancouver, Elctrn. Mktg. Grp.	206-254-4572
WI	Oconomowoc, Artmor Ltd.	414-367-8789
Can	Carlsbad, QualConn	714-851-6465
Can	La Canada, KCP Entprs.	818-790-1365

Local Distributors

AL	Birmingham, American Elctrn. Supp.	205-942-4656
AL	Huntsville, Cypress Elctrns.	205-533-0783
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Buena Park, Cypress Elctrns.	213-404-0445
CA	Burbank, Atwater Elctrns.	818-841-9050
CA	City of Industry, Ital Elect Sls. Inc.	818-968-8515
CA	Pasadena, Empire Elctrns.	213-681-2711
CA	San Diego, Cypress/RPS Elect.	619-535-0011
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Sierra W. Elctrns.	408-435-7477
CA	Santa Ana, Sigma Elctrns.	714-558-8600
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Simi Valley, Lee Johnson Sls.	818-346-5412
CA	Woodland Hills, Cypress Elctrns.	818-710-7780
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CO	Engelwood, Cypress Elctrns.	303-792-5829
CO	Englewood, NEP Elect. of Co.	303-799-9898
CO	Littleton, Indelco Inc.	303-795-8298
CT	Bridgeport, Millenium Elctrn. Sls.	203-372-2037
FL	Davie, Arco Distrs., Inc.	305-473-2550
FL	Miami, Electronic Equip. Co.	305-871-3500
FL	Winter Park, Deanco	417-671-5100
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GA	Marietta, Deanco	404-429-0126
IL	Addison, Belford Elctrns.	312-691-1100
IL	Carol Stream, Lectro Comps.	708-690-0520
IL	Chicago, NEP Elctrns.	312-625-8400
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IN	Evansville, Excalibur Elctrns.	812-464-0079
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Advent Elctrns.	312-872-4910
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
IA	Cedar Rapids, DEE Electrns.	319-365-7551
IA	Cedar Springs, Barton Digital	319-474-2247
MD	Beltsville, Petricko Sls.	301-937-4960
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Gaithersburg, Deanco	301-948-5444
MD	Timonium, M X 4 Elctrns., Inc.	301-252-1192
MA	Canton, EPC Elctrns. Inc.	617-821-2111
MA	Canton, Richey/Impact Elect.	617-821-1500
MA	Wilmington, EPC Elctrns.	508-657-6523
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, Caider Elctrns.	616-698-7400
MI	St. Claire Shore, Spemco	313-771-2700
MN	Bloomington, Bergquist Co.	612-835-2322
MN	Eden Prarie, Cypress Elctrns.	612-934-2104
MN	St. Paul, Shelley Ragon Inc.	612-642-2828
MN	Thief River Fls., Digi-Key Corp.	218-681-6674
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NH	Atkinson, Astrum Elctrns.	603-898-3399
NH	Hampstead, Astrum Elctrns.	603-329-9640
NJ	Bellmawr, Mid-Atlantic Elect.	609-931-5303
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NJ	Union, Meridian Supp.	201-687-6220
NM	Albuquerque, Electronic Parts	505-293-6161

NM Las Cruces, Electronic Parts 505-523-4578
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NY E. Rockaway, Forejay Assocs. 516-599-2999
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NC Hickory, Southeastern Elctrns., Inc. 919-828-2311
OH Cincinnati, Schuster Elec. Co. 513-489-1400
OH Solon, REH Elctrns. 216-248-1636
OH Twinsburg, Schuster Elec. Co. 216-425-8134
OR Portland, Cypress Electrns. 503-641-2233
OR Portland, Dunn Elctrns. 503-285-0214
PA McKean, Advacom 814-476-7774
PA Wayne, Peak Elctrns. 215-293-9000
RI Warwick, Cal-Greg Comps., Inc. 401-738-6170
TN Knoxville, Indl. Elctrns., Inc. 615-573-7135
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TX Carrollton, Connec/Tek Inc. 214-245-1266
TX Corpus Christi, Douglas Elctrns. 512-883-5103
TX Dallas, Cypress Elctrns. 214-869-1435
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TX Garland, J & S Elctrns. 214-487-8808
TX Pflugerville, RSI 512-251-1161
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TX Richardson, Off The Shelf 214-238-0808
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UT Salt Lake City, Standard Supp. Co. 801-486-3371
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VA Annandale, Arcade Elect. Inc. 703-256-4610
VA Charlottesville, Virginia Radio Supp. 804-296-4184
VA Virginia Bch., Deanco 804-499-3322
WA Bothel, Cypress Elctrns. 206-483-1144
WA Seattle, Radar Elec. 206-282-2611
WA Tukwila, Carlye 206-251-0700
WI Grafton, Lake-View Elect. Inc. 414-377-8250
WI Milwaukee, Indl. Elctrns. 414-276-1212
WI New Berlin, NEP Elctrns. 414-785-9100
WI Oconomowoc, G.W. Elctrns., Ltd. 414-367-6003
Can Burnaby, Intek 604-294-8100
Can Pointe Claire, Que., A. R. Gray & Assocs. 514-694-6378
Can Victoria, Pacific Coast Elect. 604-385-5111

SUMMAGRAPHICS CORP., 60 Silvermine Rd., Seymour, CT 06483, Tel: 203-881-5400, TELEX: 964348, FAX: 203-881-5367; FSC No.: ;;;203-881-5367; Empl.: 185; *Sls. Mgr.:* Jim Whitney; *Dist. Mgr.:* Randy Ringer

SUMMIT ELECTRONICS, DIVISION OF BASLER ELECTRIC, See Basler Electric, Electronic Product Group

SUMTAK ELECTRONICS, Daido Corporation, 615 Pierce St., Somerset, NJ 08875, Tel: 908-805-0008, FAX: 908-805-0122; *Sls. Mgr.:* Phillip Giannini, Nat. Sls. Mgr. ..... **B•1950-1951**

SUNBANK ELECTRONICS, 1740 Commerce Way, Paso Robles, CA 93446, Tel: 805-238-2840, FAX: 805-238-0241; FSC No.: 07418; Empl.: 260; *Sls. Mgr.:* Jack White; *Dist. Mgr.:* Robert Haldeman

SUNDSTRAND DATA CONTROL INC., Sundstrand Corporation, P. O. Box 97001, Redmond, WA 98073-9701, Tel: 206-885-3711, TELEX: RCA 286144; Empl.: 1800; *Dist. Mgr.:* R. Heilman

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FAX: 305-587-0450

SUN ELECTRONIC SYSTEMS, INC., 1601 NW 38th Ave., Ft. Lauderdale, FL 33311, Tel: 305-587-5577; Empl.: 10; *Sls. Mgr.:* Veronica L. Pasqua ..... **D•1202-1203**

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SUNRISE ELECTRONICS, INC.

FAX: 818-914-1583

SUNRISE ELECTRONICS, INC., 524 S. Vermont Ave., Glendora, CA 91740, Tel: 818-914-1926; FSC No.: 64908; Empl.: 10; *Sls. Mgr.:* Allan V. Carey; *Dist. Mgr.:* Allan V. Carey ..... **D•1329**

SUNSHINE INSTRUMENTS, 1810 Grant Ave., Philadelphia, PA 19115, Tel: 215-673-5600, 800-343-1199, FAX: 215-673-5609; Empl.: 30; *Sls. Mgr.:* M.L. Norton

SUNX SENSORS/IMPORTED BY RAMCO ELECT., 1207 Maple St., West Des Moines, IA 50265, Tel: 515-225-6933, FAX: 515-225-0063; Empl.: 25; *Sls. Mgr.:* Mike Reelitz; *Dist. Mgr.:* Mike Reelitz

SUPERIOR CARBON PRODUCTS, INC., 101 HWY 35, Superior Pl., Walnut Grove, MS 39189, Tel: 601-253-2442, FAX: 601-253-2430; FSC No.: 68256; Empl.: 71

SUPERIOR ELECTRIC, 383 Middle St., Bristol, CT 06010, Tel: 203-582-9561, FAX: 203-589-2136; FSC No.: 58474; Empl.: 550; *Sls. Mgr.:* Harold Lorenson/James Hayden; *Dist. Mgr.:* Cheryl Tokarski/Michael Miga ..... **A•2421; B•1314-1315; C•1537**

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MS Jackson, Doby Assocs. 601-981-1138
NM Albuquerque, Fry Gates, Inc. 505-262-1525

SUPERIOR FLUX & MFG. CO., 95 Alpha Park, Cleveland, OH 44143, Tel: 216-461-3315, FAX: 216-461-6846; FSC No.: 3439; Empl.: 10; *Sls. Mgr.:* Linda Cohen

SUPERTEK ELECTRONICS, INC., 543 W. Algonquin Rd., Arlington Heights, IL 60005, Tel: 312-981-5655, TELEX: 910-687-2847, FAX: 312-981-9076; Empl.: 10; *Sls. Mgr.:* Fred Kluth

SUPPORT SYSTEMS INTL. CORP., 150 South Second St., Richmond, CA 94804, Tel: 415-234-9090, TWX: 910-382-8130, FAX: 415-233-8888; Empl.: 105; *Sls. Mgr.:* Nola Sanders; *Dist. Mgr.:* Nola Sanders

SURGEONICS LIMITED, One Sullivan Parkway, Fort Edward, NY 12828, Tel: 518-747-2156, FAX: 518-747-2607; Empl.: 20; *Sls. Mgr.:* R. Thomas

SURON MAAGAN MICHAEL, Kibbutz Maagan-Michael, D.N. Menashe 37805, Israel, Tel: 06-394211, TELEX: 471468 SURON IL, FAX: 063-90296; Empl.: 38; *Sls. Mgr.:* Gershon Peleg

SUSCO ELCTRNS., 70D Carolyn Blvd., Farmingdale, NY 11735, Tel: 516-249-4848, FAX: 516-249-4865

SUTTON DESIGNS, INC., 215 N. Cayuga Street, Ithaca, NY 14850, Tel: 800-326-8119, FAX: 607-277-6983; FSC No.: 6625; Empl.: 24; *Sls. Mgr.:* Chris Hebner

SWAN ASSOCIATES, P.O. Box 9424, New Haven, CT 06534, Tel: 203-387-3917, FAX: 203-397-5306; Empl.: 2

SWEDLOW, INC., Liberty Mirror Products, 851 Third Ave., Brackenridge, PA 15014, Tel: 412-224-1800, FAX: 412-224-8754; Empl.: 90; *Sls. Mgr.:* Steve Williams

SWISS JEWEL COMPANY, 613 Lafayette Building, Philadelphia, PA 19106, Tel: 215-925-2867, 800-922-0118, FAX: 215-922-3055; Empl.: 6; *Sls. Mgr.:* P. N. Steel, Jr.

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CA San Diego, Wiley Co. 619-453-9018
CA Santa Clara, Ross Mktg. Assoc. 408-988-8111
CO Denver, Moss Mktg. 303-455-7205
MA Merrimac, Switchcraft, Inc. New England Sls. 603-424-4423
GA Atlanta, DHR Mktg. Inc. 404-451-9848
IL Chicago, Switchcraft Inc. 312-792-2700
KS Overland Park, Thomas L. Dowell & Assoc. 913-648-7373
MA Taunton, Switchcraft, Inc. New England Sls. 508-880-0027
MI Royal Oak, Switchcraft, Inc. Michigan Sls. 313-549-4848
MN Edina, Mel Foster Tech. Sls. 612-941-9790
MS Jackson, Doby Elctrns. 601-981-1138
MO St. Louis, Thomas L. Dowell & Assoc. 314-849-4234
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NM Albuquerque, Moss Mktg. 505-292-7505
NY Hauppauge, Masin-Esco 516-273-3500
NY Rochester, Apex Assocs. 716-272-7040
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OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
OR Milwaukee, Comtec 503-654-6626
SC Greenville, DHR Mktg. Inc. 803-235-3594
TN Memphis, Doby Elctrns. 901-365-9575
TX Austin, J. Y. Schoonmaker Co. 512-327-5274
TX Dallas, J. Y. Schoonmaker Co. 214-349-1650
TX Houston, J. Y. Schoonmaker Co. 713-738-2427
UT Salt Lake City, Moss Mktg. 801-363-5875
WA Bellevue, Comtec 206-453-1188
WI Burlington, Switchcraft 414-763-2100
Can Toronto, Atlas 416-789-7761

SWITCHES UNLIMITED, INC., 34-11 56th St., Woodside, NY 11377, Tel: 718-478-5000, 800-221-0487, FAX: 718-672-6370; Empl.: 20; *Sls. Mgr.:* Douglas King

SWITCHING POWER INC., 3601 Veterans Hwy, Ronkonkoma, NY 11779, Tel: 516-981-7231, TWX: 510-220-1528, FAX: 516-981-7266; Empl.: 200

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FAX: 714-996-2753

SWITCHING SYSTEMS INTERNATIONAL, 500 Porter Way, Placentia, CA 92670, Tel: 714-996-0909; Empl.: 85; *Sls. Mgr.:* Guy Lacerte ..... **D•2056-2057**

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CA Los Alamitos, Power Specialists 213-594-9418
CA Placentia, Switching Sys. Intl. 714-996-0909

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CT Meriden, Power Conversion Sys. 203-235-4886
FL Orlando, Mackay, Smith & Assoc. 407-423-4353
GA Tucker, Mackay, Smith & Assoc. 404-496-9913
IL Chicago, Utronix 312-834-1100
IL Elmhurst, Utronix 312-834-1100
MD Randallstown, Beacon North Inc. 800-877-3747
VA Sterling, Beacon North, Inc. 703-478-2480
MI Ann Arbor, Lintott & Assoc. 313-662-1611
MN Minneapolis, Electro-Serv 612-338-3475
NH Londonderry, Power Conversion Sys. 603-434-2371
NJ Marlton, Beacon North Inc. 609-596-9456
NM Albuquerque, Holder Hauer 505-888-9614
NY Spring Valley, Powertronics 914-735-3775
NC Raleigh, Mackay, Smith & Assoc. 919-847-2277
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TX Garland, Carey, McMahill & Assoc. 214-681-1414
UT Salt Lake City, Holder Hauer 801-532-2111

SYGENEX INC., 15446 Bel-Red Rd. Ste. 450, Redmond, WA 98052, Tel: 206-881-5500, FAX: 206-869-2837; Empl.: 8; *Sls. Mgr.:* Mary J. Grubic, Business Mgr.

SYLVANIA GTE CONTROL DEVICES, Rte. 35, Standish, ME 04084, Tel: 207-642-4535, TWX: 710-365-0145; Empl.: Over 1,000; *Sls. Mgr.:* M. L. Lyons; *Dist. Mgr.:* M. L. Lyons

SYLVANIA ELECTRONIC COMPONENTS, See Philips ECG, Amperex Electronics Corp., A North American Philips Co.

SYLVANIA LIGHTING DIVISION-U.S., Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923, Tel: 1-800-544-4828; *Sls. Mgr.:* Melvin Moehring

SYLVANIA MINIATURE LIGHTING, GTE Corporation, W. Main St., Hillsboro, NH 03244, Tel: 603-464-5533, TWX: 710-366-0387, FAX: 603-464-0259; FSC No.: 88204; Empl.: 850 ..... **B•1202-1207**

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FL Tampa, Hutto, Hawkins, Assocs., Inc. .. 813-251-2970
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KS Prairie Village, R.W. Kunz 913-648-3535
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NJ Long Valley, Paul A. Sweeney 201-852-1434
NY Rochester, Electra Sls. 716-427-7860
NY Syracuse, Electra Sls. 315-463-1248
NC Raleigh, Millar Elctrns. 919-828-8840
OH Cincinnati, R.O. Whitesell & Assocs. 513-521-2290
OH Cleveland, R.O. Whitesell & Assocs. .. 216-447-9020
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CO Wheatridge, Cluff & Assocs. 303-423-9354
WA Bellevue, Electronic Sources Inc. 206-451-3500
WI Milwaukee, F.C. DuBois & Assocs. 414-774-3100

SYMBICON ASSOC. INC., P.O. Box 896, Amherst, NH 03031, Tel: 603-673-8898, FAX: 603-673-1372; *Sls. Mgr.:* S. Harrington; *Dist. Mgr.:* S. Buzzell

SYM-TEK SYS., INC., 3912 Calle Fortunada, San Diego, CA 92123, Tel: 619-569-6800, TELEX: 249036, FAX: 619-569-8296; Empl.: 350; *Sls. Mgr.:* Roger Hopkins

SYMTRON CORP. DIV. DICEON ELCTRNS., 2415 E. Charleston Rd., Mountain View, CA 94043, Tel: 415-965-4500, TWX: 910-379-5002; Empl.: 350; *Sls. Mgr.:* Don Atkins

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FAX: 508-481-5769

SYNTEST CORP., 40 Locke Dr., Marlboro, MA 01752-9973, Tel: 508-481-7827; Empl.: 26; *Sls. Mgr.:* Mitchell Corrigan ..... **D•1116**

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CA Los Gatos, Mil-Com Sales, Inc. 408-356-2968
CA San Diego, Mil-Com Sales, Inc. 619-275-0641
CO Franktown, M R C, Inc. 303-794-4684
CT Orange, Isdale Assocs. 203-389-8583
FL Altamonte Springs, Carter Assocs. 407-260-5566
IL Arlington Hgts., Coombs Assocs., Inc. 708-439-9810
MN St Louis Park, Elctrn. Innovators, Inc. .. 612-922-2945
NJ Butler, General Technlgs. 201-492-1292
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OH Aurora, EMA, Inc. 216-562-6104
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OH Centerville, EMA, Inc. 513-433-2800
OR Beavertown, Seltech 503-629-9254
TX Austin, C & L Assocs. 512-263-3334
PA Montgomeryville, Eastern Sci. Mktg. 215-368-4570
TX Missouri City, C & L Assocs. 713-499-5541
WA Beaverton, Seltech Elctrns. 503-629-9254
WA Bellevue, Seltech 206-746-7970
WA Richland, Seltech 509-943-5288
WI Milwaukee, Coombs Assocs. 414-351-6123

Local Distributors
WV Ravenswood, Valtronics, Inc. 304-273-5356

SYSCON INTL., INC., 1108 So. High St., So. Bend, IN 46601-3796, Tel: 219-232-3900, FAX: 219-287-5916; Empl.: 80; *Sls. Mgr.:* Phil Barney

SYSTEM GENERAL CORPORATION, 244 South Hillview Drive, Milpitas, CA 95035, Tel: 408-263-6667, FAX: 408-262-9220; Empl.: 52; *Sls. Mgr.:* Gary Delucchi; *Dist. Mgr.:* Gary Delucchi

SYSTEMS DATA, INC., 2830 Copley Road, P.O. Box 4297, Akron, OH 44321, Tel: 216-666-0085, FAX: 216-666-7183; Empl.: 12; *Sls. Mgr.:* John C. Hall

SYSTEMS RESEARCH LABOROTORIES, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440, Tel: 513-426-6000, FAX: 513-426-1984; FSC No.: 14590; Empl.: 1000; *Sls. Mgr.:* Frank Balogh Sr.

SYSTEMS TESTING, INC., PO Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, TWX: 910-338-0260; Empl.: 4; *Sls. Mgr.:* Frank J. Ardezzone

SYSTRON-DONNER INERTIAL DIV., 2700 Systron Dr., Concord, CA 94518, Tel: 415-671-6400, TWX: 910-481-9478, FAX: 415-671-6590; Empl.: 370; *Sls. Mgr.:* G. W. Felsing

SYSTRON-DONNER INSTRUMENT DIV., 2727 Systron Dr., Concord, CA 94518, Tel: 415-676-5000, TELEX: 171996, TWX: 910-481-9479; FSC No.: 52542; Empl.: 100; *Sls. Mgr.:* N. J. Susner, Gen. Mgr.

SYSTRON-DONNER MICROWAVE DIV., 13100 Telfair Ave., Sylmar, CA 91342, Tel: 818-362-9900, FAX: 818-362-1035; Empl.: 160; *Sls. Mgr.:* Ashvin K. Sheth

SYSTRONIX INC., 754 E. Roosevelt Ave., P.O Box 526398, Salt Lake City, UT 84152-6398, Tel: 801-487-7412, FAX: 801-487-3130; Empl.: 2; *Sls. Mgr.:* Bruce Boyes

3-D VISIONS, 412 S. Pacific Coast Hwy., Redondo Beach, CA 90277, Tel: 213-540-8818, 800-SAY-GRAF, FAX: 213-540-3492; Empl.: 8

TAB/MCGRAW-HILL, McGraw-Hill Inc., Blue Ridge Summit, PA 17294-0850, Tel: 717-794-2191, TELEX: 820562, FAX: 717-794-2080; Empl.: 400; *Sls. Mgr.:* Tim Higgins

TACC INTERNATIONAL CORP. FORMULATED RESINS GRP., Air Station Inds. Pk., Rockland, RI 02370, Tel: 617-878-7015, TELEX: 952123, ESYLNK: 5106015650(TACC INTL CORP), FAX: 617-871-6727; Empl.: 70; *Sls. Mgr.:* Norman G. Harrington

FAX: 516-621-4517

TADIRAN ELECTRONIC INDUSTRIES, INC., 40 Seaview Blvd., Port Washington, NY 11050, Tel: 516-621-4980; Empl.: 6300; *Dist. Mgr.:* Avi Timor, Sls. Mgr. ..... **D•1493**

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AL Huntsville, Montgomery Mktg. 205-830-0498
AZ Tempe, Reptronix Ltd. 602-345-4580
CA Cameron Pk., Parsons Tech. Mktg. 916-676-2025
CA San Jose, Tritech Sls. 408-925-9409

CA Santa Ana, Technlg. Solutions 714-558-9562
CT Bloomfield, Friedman Sls. Inc. 203-243-3122
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GA Norcross, Montgomery Mktg. 404-447-6124
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MI Grand Rapids, R.P. Urban & Assocs. .. 616-245-0511
MN St. Louis Pk., Elctrn. Innovators 612-922-2945
MO Florissant, G.M. Brown & Assoc. 314-839-3600
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Can Markham, Ont., Designtronics 416-513-8760
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CA San Diego, Tauber Elctrns. 619-274-7242
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PA Richboro, Power Comps. 800-628-7029
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TX Houston, Bar-Tec 713-957-4717
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TAIYO YUDEN (USA) INC., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493, Tel: 708-364-6104, FAX: 708-870-7828; Empl.: 63; *Sls. Mgr.:* Ken Keim

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FAX: 314-265-3350

TALEMA ELECTRONIC, INC., P.O. Box 306, Saint James, MO 65559, Tel: 314-265-5500; Empl.: 44; *Sls. Mgr.:* Jeff Goff ..... **A•2422-2426**

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Can Markham, Ont., Avotronics, Ltd. 416-475-2024
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CO Grand Junction, Krebill Comp. Sls. 303-293-8220
IL Wheaton, EMTronics, Inc. 312-665-6222
MO Kansas City, Buckman & Assocs. 816-356-5515
MN Minneapolis, RK Sls. Assocs., Inc. 612-571-1001
MO St. Charles, Buckman & Assocs. 314-946-6201
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WA Bellevue, Luscombe Engrg. 206-643-1463
Can Markham, Ont., Avotronics Ltd. 416-475-2024

TALIQ CORP., 1277 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-745-0750, FAX: 408-745-1820; Empl.: 100; *Sls. Mgr.:* Bob Simpson

TAMA ELECTRIC CO., LTD., See Raltron Electronics Corp.

tamura

FAX: 213-638-9956

TAMURA CORPORATION OF AMERICA, 1150 Dominguez St., Carson, CA 90746-3518, Tel: 213-638-1790; Empl.: 5000 ..... **A•1269-1272, 1641-1643, 2427, 2429-2436; D•1494-1495, 2058-2068**

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IA Davenport, Rush & West Assocs, Inc. 319-388-9494
KS Olathe, Rush & West Assocs., Inc. 913-764-2700
MA Westborough, Anchor Engrg. Corp. ... 508-898-2724
KY Lexington, Elctrn. Rep. 606-273-8425
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MD Livonia, Lowell-Wendt Mktg. Co. 313-464-2722
MI Wyoming, Lowell-Wendt Mktg. Co. 616-791-7370
MN Edina, Grayden & Flemmer, Inc. 612-941-1120
SC Greenville, Electronic Mktg. Assoc. 803-233-4637
MO St. Louis, Rush & West Assocs., Inc. .. 314-965-3322
FL Deerfield Bch., Micro-Elect. Comps. Corp. 305-426-8944
NJ Lodi, TRC Elctrns., Inc. 201-779-8282
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NY Utica, Tech-Mark 315-733-0575
NC Raleigh, Elctrn. Mktg. Assoc. 919-847-8800
NC Raleigh, Robert Elctrn. Sls. 919-878-4465
NC Sapphire, Robert Elctrn. Sls. 704-877-3280
OH Centerville, Dolfuss-Root & Co. 513-433-6776
OH Dayton, Dolfuss-Root & Co. 513-433-6776
OH Westlake, Dolfuss-Root & Co. 216-899-9370
OH Worthington, Dolfuss-Root & Co. 614-855-4844
PA Allentown, TRC Elctrns., Inc. 215-391-8977
TX Austin, B-P Sls. 512-346-9186
TX Houston, B-P Sls. 713-782-4144
TX Richardson, B-P Sls. 214-234-8438
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WA Redmond, S.E.A. (Sls. & Engrg. Assoc.) 206-883-4999
WA Vancouver, S.E.A. (Sls. & Engrg. Assoc.) 206-573-5161
FL Largo, Micro-Elect. Comps. Corp. 813-393-5011
WI West Allis, Metcom Assoc., Corp. 414-476-1300
Can Pointe Claire, Que., A.R. Gray & Assoc. 514-694-6378

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AL Huntsville, Comp. Distrs. Inc. 205-851-7800
AZ Tempe, On-Shore Technlg. 602-921-3000
CA Manhattan Beach, Prime Electro Prods. Co. 213-379-3642
CA Sacramento, Power & Data Technlg. .. 415-792-5087
CA San Jose, Foresight Elctrns. 408-453-0490
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CA Van Nuys, Nesco/Natl. Electro-Sls. ... 818-781-0505
CO Englewood, Comp. Distrs., Inc. 303-799-4916
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CO Littleton, Displays Plus, Inc. 303-730-7333
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FL Deerfield Bch., Vantage Comps. 305-429-1001
FL Oldsmar, Applied Power Inc. 813-854-4004
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GA Norcross, Applied Power Inc. 404-263-0421
GA Norcross, Comp. Distrs., Inc. 404-441-3320
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IN Carmel, Altex Elctrns. 317-848-1323
MD Columbia, Sager Elec. Supp. 301-995-6580
MD Columbia, Vantage Comps. 301-720-5100
MA Andover, Vantage Comps. 508-887-3900
MA Hingham, Sager Elec. Supp. 617-749-6700
MA Sharon, Adcour, Inc. 617-784-8123
MI Brighton, Applied Power Inc. 313-227-3604
MI Livonia, LWC Distrs. 313-464-7700
MN Minneapolis, Bergquist Co. 612-835-2322
MN Minneapolis, Tortec Corp. 612-866-3662
NH Salem, Sager Elec. Supp. 603-898-1348
NJ Lodi, TRC Elec. Inc. 201-779-8282
NM Albuquerque, H.E.R. Elctrns. 505-265-8609
NY Hauppauge, Sager Elec. Supp. 516-348-1300
NY Syracuse, ADR Technlgs. Inc. 315-437-7087
NC Raleigh, Sager Elec. Supp. 919-850-9550
OH Aurora, Indl. Prods. Distbg., Inc. 216-562-8113
OH Centerville, Indl. Prods. Distbg., Inc. ... 513-435-2086
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OH Twinsburg, Schuster Elctrns., Inc. 216-425-8134
OK Tulsa, The Altair Co. 918-252-5781
OR Beaverton, Micro Power Elctrns. 503-626-7086
OR West Linn, Power Factor & Assocs. ... 503-657-6969
PA Allentown, TRC Elec. Inc. 215-391-8977
PA Mars, Sager Elec. Supp. 412-772-2233
PA Philadelphia, Sager Elec. Supp. 215-464-4336
TX Austin, The Altair Co. 512-837-4970
TX Carrollton, LCD Elctrns. 214-245-0600
TX Dallas, Comp. Distrs., Inc. 214-644-0373
TX El Paso, Power & Data Technlg. 505-589-0052
TX Houston, The Altair Co. 713-462-3029
TX Richardson, The Altair Co. 214-231-5166
TX Round Rock, LCD Elctrns. 512-388-1339
TX Stafford, Southwest Elctrns. 713-240-4000
WA Edmonds, Prime Source 206-743-6641
WA Redmond, Priebe Elctrns. 206-881-2363
WI Mequon, Taylor Elec. Co. 414-241-4321
WI Milwaukee, Progressive Image, Inc. ... 414-321-4722
WI Sullivan, Bergquist Co. 414-593-2020

T&W SYSTEMS, INC., See Versacad Corp.

TANE ALARM PRODUCTS, 247-40 Jericho Tpke., Floral Park, NY 11001, Tel: 516-328-3351, FAX: 516-326-9125; Empl.: 10; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Sam Lurie

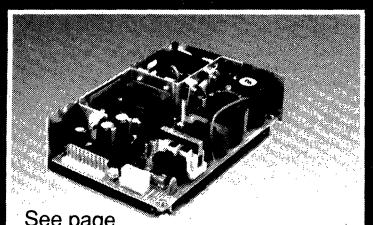
TANSITOR ELECTRONICS, West Rd., P.O. Box 230, Bennington, VT 05201, Tel: 802-442-5473, TELEX: 954007, FAX: 802-447-1297; FSC No.: 030266626; Empl.: 183; *Sls. Mgr.:* David Latchum; *Dist. Mgr.:* 225 ..... **A•1143**

Local Sales Offices & Reps

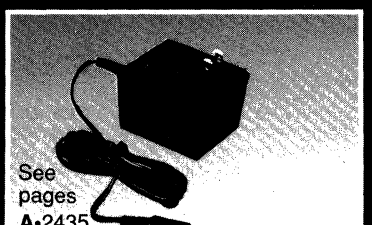
AL Huntsville, Elctrn. Mktg. Assocs. Inc. 205-880-8050, FAX:205-880-8054
AZ Tempe, Piper Sls. 602-949-0048, FAX:602-894-1032
CA Chatsworth, Wes-K Assocs. 818-770-0933, FAX:818-709-9832
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CO Grand Junction, Krebill Comp. Sls. 303-243-8220, FAX:303-243-7939
CT Farmington, Ray Perron & Co., Inc. 203-673-4825, FAX:203-675-7345
FL Boca Raton, So. Atlantic Comp. Sls. ... 407-391-1034
FL Orlando, So. Atlantic Comp. Sls. 407-857-3650, FAX:407-857-3298
FL St. Petersburg, So. Atlantic Comp. Sls. 813-324-0953
GA Atlanta, Elctrns. Mktg. Assocs. Inc. 404-448-1215, FAX:404-446-9363
IL Itasca, Circuit Sls. 708-773-0200, FAX:708-773-2721
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IN Indianapolis, Electro Reps. 317-842-7202, FAX:317-841-0230
IA Cedar Rapids, R. F. Welch Co. 319-362-6824, FAX:319-362-7734
KS Olathe, Rush & West Assocs. Inc. 913-764-2700, FAX:913-764-0096
ME Yarmouth, Memar, Inc. 207-846-3791, FAX:207-846-6488
MD Annapolis, Elctrn. Engrg. 301-269-6573, FAX:301-269-6476
MA Needham, Ray Perron & Co., Inc. 617-449-6162, FAX:617-444-1074
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NY Cazenovia, S/T Woolard Co. 315-655-8145
NY Great Neck, M.O.S. Assocs. 516-487-3966, FAX:516-487-3989

TAMURA

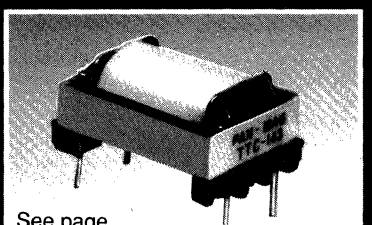
DELIVERS FROM STOCK



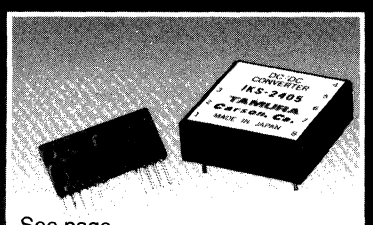
See page D•2062 — **SINGLE AND MULTI–OUTPUT SWITCHERS**



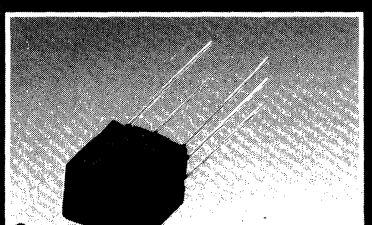
See pages A•2435, D•1495, D•2066 — **WALL PLUG–IN, AC & DC POWER**



See page A•2428 — **FCC PART 68 TELCOM LINE COUPLING**



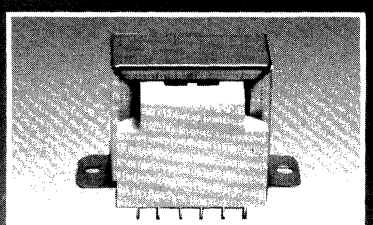
See page D•2059 — **DC/DC CONVERTERS SIP & DIP PKG**



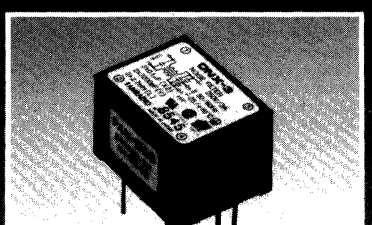
See page A•2430 — **MINIATURE AUDIO & PART 68 COUPLING**



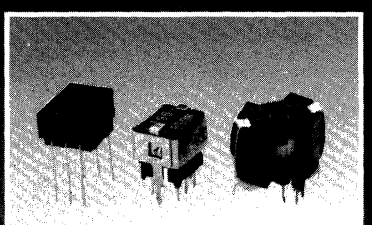
CONTACT FACTORY — **COMPUTER NETWORKING BALUNS**



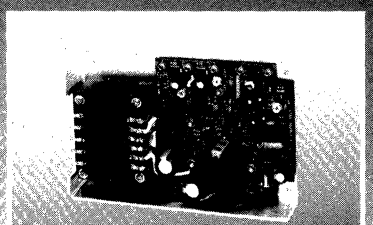
A•2432 — **INT'L PCB POWER– UL 1411, IEC, VDE, & CSA**



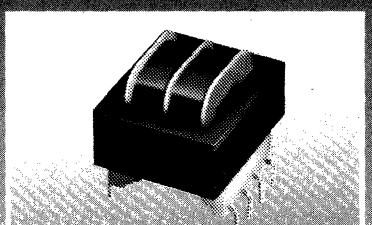
A•1643 — **EMI LINE FILTERS**



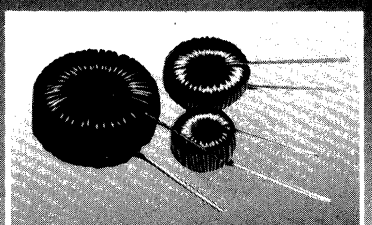
A•2431 — **WIDE BAND PULSE– T1 & DIGITAL**



D•2064 — **LINEAR POWER SUPPLIES**



A•2433 — **UL/CSA PCB POWER**



A•1270 — **NOISE, COMMON MODE & POWER COILS**

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OH Burton, Elctrn. Comps., Inc. 216-834-0011
OH Cleveland, Elctrn. Comps., Inc. 216-331-5330, FAX:513-866-3371
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OH Miamisburg (Dayton), Elctrn. Comps., Inc. 513-866-3340,FAX:513-866-3371
OH Miamisburg (Dayton), Foxtronix, Inc. ... 513-866-2112, FAX:513-866-3371
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SC Greenville, Elctrn. Mktg. Assocs., Inc. 803-233-4637,FAX:803-242-3089
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VA Richmond, Elctrn. Engrg. & Sls, Inc. 804-794-8939, FAX:804-794-6090
WA Kirkland, ES/Chase Co., Inc. 206-823-9535, FAX:206-821-7257
WI Brookfield, Circuit Sls., Inc. 414-784-7773, FAX:414-784-4528
Can Mississauga, Ont., Gidden Morton Assoc., Inc. 416-671-8111,FAX:416-671-2422
Can Richmond, Gidden Morton Assoc., Inc. 613-838-4480,FAX:613-838-4479
Can St. Laurent, Que., Gidden Morton Assoc., Inc. 514-335-9572,FAX:514-335-9573

Local Distributors

AZ Tempe, Shelly-Ragon Elec. 602-894-2058
CA Chatsworth, Passive Comps., Inc. 818-700-8838
CA Garden Grove, Natl. Capacitor Corp. 213-598-9611,FAX:714-898-6769
CA Irvine, I.E.C. Elctrns., Inc. 714-837-9960, FAX:714-837-8308
CA San Jose, Natl. Elctrns. 408-922-0500, FAX:408-922-0448
CA Yorba Linda, Zeus Comps. 714-921-9000, FAX:714-921-2715
CO Denver, IEC Elec. 303-292-5537, FAX:303-292-0114
FL Melbourne, New Yorker Elctrns. Co., Inc. 407-727-0955,FAX:407-727-1844
FL Oviedo, Zeus Comps. 407-365-3000, FAX:407-365-2365
FL Tampa, Jaco Elctrns. Inc. 813-628-4665, FAX:813-626-8185
MD Columbia, Jaco Elctrns. Inc. 301-995-6620, FAX:301-995-6032
MA Woburn, ACI Elec. 617-935-7230
MI Livonia, R.S./Chelsea Elctrns. 313-525-1155, FAX:313-525-1184
MN St. Paul, Shelley-Ragon Elctrns. 800-328-9427, FAX:612-642-1990
MO Maryland Hts., R.S./Chelsea Elctrns. .. 314-997-7709
NJ Voorhees, Partec Comps. 609-795-4884
NY Hauppauge, Jaco Elec. 516-273-5500, FAX:516-273-5528
NY Mamaroneck, New Yorker Elctrns. Co., Inc. 914-698-7600,FAX:914-698-7026
OH Cincinnati, R.S./Chelsea Elctrns. 513-793-2450, FAX:800-582-1607
OH Dayton, Yankee Distrs., Inc. 513-890-1700, FAX:513-890-2082
OH Solon, Targetronix Corp. 216-248-7930
OR Beaverton, Shelley-Ragon Elctrns. 503-641-1691, FAX:503-646-4927
TX Addison, Jaco Elec. 214-733-4300, FAX:214-733-4604
UT Valley City, Aved 801-975-9500, FAX:801-977-0245
WA Redmond, Jaco Elctrns., Inc. 206-881-9700, FAX:206-881-9777

TAPECON, INC., 10 Latta Rd., Rochester, NY 14612, Tel: 716-621-8400; Empl.: 120; *Sls. Mgr.:* Joseph C. Pallone

TAPESWITCH CORP. OF AMERICA, 100 Schmitt Blvd., Farmingdale, NY 11735, Tel: 516-694-6312, FAX: 516-694-6304; Empl.: 100; *Sls. Mgr.:* Ed Duhon

TAPPAN WIRE & CABLE, 256 Oak Tree Rd., Tappan, NY 10983, Tel: 914-359-9300, FAX: 914-359-9369; FSC No.: 2G330; Empl.: 27; *Sls. Mgr.:* Mike Ressa

TAUBER

FAX: 619-274-2220

TAUBER ELCTRNS. INC., 4901 Morena Blvd., Bldg. 314, San Diego, CA 92117, Tel: 619-274-7242; Empl.: 38; *Sls. Mgr.:* Bob Tauber; *Dist. Mgr.:* Ed Hoscoe ..... **D•1496**

Local Sales Offices & Reps

AL Huntsville, Macro-Marketing 205-883-9630
AL Huntsville, Macro-Mktg. 205-883-9630
AZ Scottsville, Mactronix 602-998-1848
CA Fullerton, Tauber Elctrns. 1-800-829-4747
CA Los Angeles, Berman Sls. 213-556-3358
CA Santa Ana, Berman Sls. 1-800-829-4747
FL Land O'Lakes, AJ'S Power Source 813-996-2583
FL Land-O-Lakes, AJ'S Power Source ... 813-996-2583
GA Norcross, Marco Mktg. 404-662-5580
IL Wheeling, Ed Joyner 312-520-1200
IL Wheeling, Ed Joyner & Co. 312-520-1200
IA Des Moines, Beams Co. 515-255-1148
KS Shawnee Mission, Beams Co. 913-631-0300

TAURUS COMPUTER PRODUCTS, DY-4 Systems Inc., 21 Fitzgerald Rd., Nepean, Ont., Canada K2H 9J4, Tel: 613-596-9911, FAX: 613-596-0574; Empl.: 13; *Sls. Mgr.:* David Murray; *Dist. Mgr.:* David Murray

TAURUS CORPORATION, See Signal Research Inc.

TAYLOR ELECTRONICS, INC., 401 West Orion, Tempe, AZ 85283, Tel: 602-838-4523, FAX: 602-838-7456; Empl.: 25; *Sls. Mgr.:* Sharon F. Hansen

TAYLOR INDUSTRIAL SOFTWARE, , Edmonton, Alberta, Canada T5K 2M5, Tel: 403-482-7547, FAX: 403-488-8032; Empl.: 65; *Sls. Mgr.:* Glenn Saunders

INCORPORATED
Tbar®
A DATA SWITCH COMPANY

FAX: 203-929-6408

T-BAR DATA SWITCH CORP., 1 Enterprise Dr., Shelton, CT 06484, Tel: 203-926-1801, TWX: 710-463-3210; Empl.: 140; *Sls. Mgr.:* Gerard F. Ryan .... **B•1788**

Local Sales Offices & Reps

CA Arcadia, Van Gott & Assocs. 818-445-9728
FL Clearwater, Tech-Rep Assocs. 813-577-9370
IL Barrington, Perhats Assocs. 312-381-6360
KS Lenexa, MIDTEC Assocs. 913-541-0505
MD Gaithersburg, Carwithen Assocs. 301-921-9545
MO St. Louis, MIDTEC Assocs. 314-275-8666
TX Richardson, McCoy Assocs. Co. 214-864-1838

Local Distributors

IL Chicago, Newark Elctrns. 312-784-5100
CT Wallingford, Sager Elctrl. Supp. Co. 203-265-4600

TCA, 7733 Telegraph Rd., Montebello, CA 90640, Tel: 213-726-0303, FAX: 213-727-7621; Empl.: 200; *Sls. Mgr.:* Jay Giles

T.D.I. BATTERIES, 2852 Hitchcock Ave., Downers Grove, IL 60515, Tel: 708-971-3460, FAX: 708-971-3903; Empl.: 160; *Sls. Mgr.:* Kurt Padera; *Dist. Mgr.:* Theresa Kanaga

TDJ CO., INC., 1154 Morena Blvd., San Diego, CA 92110, Tel: 619-276-5920, FAX: 619-276-5960; FSC No.: 60382; Empl.: 7; *Sls. Mgr.:* R. Scherr ..... **C•1110-1111**

TDK

FAX: 708-803-6296

TDK CORPORATION OF AMERICA, Electronic Components & Material, 1600 Feehanville Drive, Mount Prospect, IL 60056, Tel: 708-803-6100; Empl.: 7,800; *Sls. Mgr.:* Tadashi Enami; *Dist. Mgr.:* Tadashi Enami (TDK Corp. of America) .... **A•1144-1147, 1273, 1294-1299, 1597, 1644-1645; D•1066, 2069**

Local Sales Offices & Reps

AL Huntsville, TDK Corp. of America 205-464-0222
CA San Jose, TDK Corp. of America 408-437-9585
CA Torrance, TDK Corp. of America 213-539-6631
IL Mt. Prospect, TDK Corp. of America ... 708-803-6100
IN Indianapolis, TDK Corp. of America ... 317-872-0370
MA Southborough, TDK Corp. of America 508-624-4262
MI Livonia, TDK Corp. of America 313-462-1210
NJ New Jersey, MH & W Intl. Corp. 201-891-8800
NJ West Orange, TDK Corp. of America .. 201-736-0023
NY Port Washington, TDK Corp. of America 516-625-0151
NC Greensboro, TDK Corp. of America ... 919-292-0012
TX Irving, TDK Corp. of America 214-506-9800
Can Ontario, MH & W Intl. Corp. 416-676-9401

TDS, Tang Ind., 1965 Pratt Blvd., Elk Grove Village, IL 60007, Tel: 1-800-323-6648, 312-806-7240, FAX: 312-806-7222

TEAL ELECTRONICS CORPORATION, 9190 Camino Santa Fe, San Diego, CA 92121, Tel: 619-693-6000, 800-888-8325, FAX: 619-693-8325; Empl.: 50; *Sls. Mgr.:* Stephanie Kaupp

TEAM SYSTEMS, Div. of Toyo Spectrum, 2934 Corvin Dr., Santa Clara, CA 95051, Tel: 408-720-8877, TELEX: 297584 TEAM UR, FAX: 408-720-9643; Empl.: 6; *Sls. Mgr.:* Bill Nicklin

TEAPO ELECTRONIC CORP. OF AMERICA, 5550 Peachtree Inds. Blvd., Norcross, GA 30071, Tel: 404-449-6220, FAX: 404-447-1109,404-448-8584; Empl.: 1000; *Sls. Mgr.:* Michael Lin

TECA, THERMOELECTRIC COOLING AMERICA CORP., 448 N. Halsted St., Chicago, IL 60622, Tel: 312-666-1600, FAX: 312-666-3964; Empl.: 50 ..... **C•1664-1665**

Local Distributors

EXP Hamburg, Germany, BWD Automotive, GMBH 040-24-67-54
Can Sudbury, Ont., Avad Indl. Sls. 705-897-2584

TECCOR ELECTRONICS, INC.
A SIEBE COMPANY

FAX: 214-550-1309

TECCOR ELECTRONICS, INC., 1801 Hurd Dr., Irving, TX 75038, Tel: 214-580-1515, TELEX: 79-1600; Empl.: 1250; *Sls. Mgr.:* Gerry Wiley ..... **A•2122-2125**

Local Sales Offices & Reps

AL Daphne, Interep Assocs. 205-478-1036
AL Huntsville, Interep Assocs. 205-881-1096
AZ Mesa, System Sls. of Az.(SSA) 602-464-9989
CA San Diego, O'Donnell Assocs. 619-578-1645
CA San Jose, O'Donnell North 408-456-2950
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Littleton, Harthun Assocs. 303-795-5545
CT Bridgeport, Advanced Comp. Sls. (ACS) 203-332-1124
FL Boca Raton, Perrott Assocs. 407-362-0191
FL Casselberry, Perrott Assocs. 407-830-0094
FL Clearwater, Perrott Assocs. 813-530-5779
FL Melbourne, Perrott Assocs. Inc. 407-676-0305
GA Norcross, Interep Assocs. 404-449-8680
IL Itasca, Micro Sls.(MSI) 708-285-1000
IN Huntington, Elctrn. Rep, Inc. 219-356-3513
IN Indianapolis, Elctrn. Rep, Inc. 317-894-1414
IA West Des Moines, SPS Assocs. Ltd. .. 515-225-0607
KS Olathe, SPS Assocs. Ltd. 913-764-4460
KS Wichita, SPS Assocs. Ltd. 316-733-4415
KY Lexington, Elctrn. REP, Inc. 606-273-8425
MA Still Water, JEF Comps. 508-456-3369
MA Walpole, JEF Components 508-668-6695
MI Farmington Hills, Rathsburg Assocs. .. 313-489-1500
MN Minneapolis, Electric Comp. Sls. 612-933-2594
MO Earth City, SPS Assocs. Ltd. 314-291-0520
NJ Mt. Laurel, S-J South Assocs. 609-866-1234
NM Albuquerque, Sys. Sls. of NM (SSA) .. 505-889-2901
NY Canandaigua, Bensman/Upstate Assocs. 716-396-2498
NY Lewiston, Bensman/Upstate Assocs. 716-754-9155
NY Rockville Centre, S-J Assocs. Inc. 516-536-4242
NC Raleigh, Godwin Assocs. 919-878-8000
OH Cleveland, Del Steffen & Assocs. 216-461-8333
OH Dayton, Del Steffen & Assocs. 513-293-3145
OH Lexington, Del Steffen & Assocs. 419-884-2313
PA Carnegie, Del Steffen & Assocs. 412-276-7366
TN Greenville, Interep Assocs. Inc. 615-639-3491
TX Irving, Mike Farrar 214-580-1515
NE Panama, SPS Assocs. Ltd. 402-477-7227
VA Falls Church, S-J Chesapeake 703-533-2233
NC Charlotte, Godwin Assocs. 704-549-8500
WA Lynnwood, Quadra Sls. 206-743-2633
WI Wauwatosa, Larsen Assocs. 414-258-0529
Can Concord, Ont., Astec Comps. 416-669-4022
Can Pierrefonds, Que., Astec Comps. 514-683-5473

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Hayward, Electro Comp. Distrs.	415-783-5800
CA	Santee, Mouser Elctrns.	619-449-2220
CA	Tustin, Added Value Elect.	714-259-8258
CT	East Haven, JV Elctrns.	203-469-2321
CT	Killingsworth, ACI Elctrns.	203-663-3311
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, Hammond Elctrns.	404-449-1996
CO	Wheat Ridge, Added Value Rcky. Mtns.	303-422-1701
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
LA	Baton Rouge, Indl. Elctrns. Supp.	504-357-4249
LA	Shreveport, Indl. Elctrns. Supp.	318-222-9459
MD	Savage, Pyttronic Inds.	301-953-9650
MA	Woburn, ACI Elctrns.	617-935-7230
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	St. Paul, Gopher Elctrns.	612-483-3322
MN	Thief River Falls, Digi-Key	800-344-4539
NE	Lincoln, Scott Elctrns.	402-466-8221
NJ	Bloomfield, Solid State Inc.	201-429-8700
NJ	Randolph, Mouser Elctrns	201-328-3322
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Penn Yan, Advacom	315-536-7221
NY	Plainview, ACI Elctrns.	516-293-6630
NC	Greensboro, Hammond Elctrns.	919-275-6391
OR	Portland, Radar Elec.	503-232-3404
PA	Export, Advacom Inc.	412-325-7551
PA	McKean, Advacom Inc.	814-476-7774
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Dallas, Omni Pro Intl. Inc.	214-233-9368
TX	Mansfield, Mouser Elctrns.	817-483-4422
UT	West Valley City, Added Value (AVED)	801-975-9500
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Burnaby, BC, RAE Indl. Elctrns. Ltd.	604-291-8866
Can	Calgary, Alberta, Cardinal Ind Elctrns.	403-259-6817
Can	Edmonton, Alberta, Cardinal IND Elctrns.	403-483-6266
Can	London, Ont., Peterson Co., CM	519-434-3204
Can	Montreal, Que, Electronic Wholesalers	514-769-8861
Can	Saskatoon, Sask., Cardinal Ind. Elctrns.	306-934-3443
Can	Willowdale, Ont., Electro Sonic Inc.	416-494-1666

TECHDYNE, INC., Lance Wire & Cable Div., 380 Treadwell St., Hamden, CT 06514, Tel: 203-288-5571, TWX: 510-601-0470, FAX: 203-248-0256; Empl.: 50; *Sls. Mgr.:* Bill Kahler

TECH-ETCH, INC., 45 Aldrin Rd., Plymouth, MA 02360, Tel: 508-747-0300, TELEX: 989997, FAX: 508-746-9639; Empl.: 280; *Sls. Mgr.:* P. A. Thomas

TECH LABORATORIES INC., 500 10th St., Palisades Pk., NJ 07650, Tel: 201-944-2221, FAX: 201-944-1653; FSC No.: 83332; Empl.: 25; *Sls. Mgr.:* Nino M. Vlacich ..... **B•1789**

Local Sales Offices & Reps

CA	Canoga Park, C & W Compents Sls.	818-700-2684
CA	Mtn. View, Bridge Mktg.	415-965-8045
IL	Glenview, Crimson Engrg. Co.	312-470-0024
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Norwood, Components Mktg. Svc.	617-762-4339
MI	Jackson, N. Scroggs Co.	517-750-1170
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Whippany, Ken L. Love Assocs.	201-540-0204
NY	Fairport, Net Sls.	716-223-1030
NY	Hempstead, Ken L. Love Assocs.	516-681-3155
OH	Cincinnati, Patco	513-931-3311
SC	Myrtle Beach, Candor Co. Inc.	803-448-8361
TX	Dallas, Southwest Elctrns.	214-690-9881
TX	Houston, Southwest Elctrns.	713-729-1670

TECHLAND BLUELYNX, P.O. Box 877, Cumberland, MD 21502, Tel: 800-832-4526, TELEX: 961-134, FAX: 301-777-3307; *Sls. Mgr.:* Janine Filion

FAX: 213-827-2572

TECHMAR CORP., 5420 McConnell Ave., Los Angeles, CA 90066, Tel: 213-827-8897, 1-800-TECHMAR; FSC No.: 32597; Empl.: 12; *Sls. Mgr.:* Jeff Wilson ... **C•1113-1115**

TECHMATION, INC., 2730 South Hardy, Ste. 5, Tempe, AZ 85282, Tel: 602-968-9946, FAX: 602-968-1849

TECHNAR, INC., See TRW Technar, Inc.

TECHNIC, INC., Box 9650, Providence, RI 02940-9650, Tel: 401-781-6100, TELEX: 927514, FAX: 401-781-2890; Empl.: 125; *Sls. Mgr.:* Andrew T. Ferris

TECHNICAL DEVICES, 560 Alaska Ave., Torrance, CA 90503, Tel: 213-618-8437, FAX: 213-618-1543; FSC No.: 04772; Empl.: 45; *Sls. Mgr.:* D. Murrin; *Dist. Mgr.:* D. Murrin

TECHNICAL MARKING SYS., See Autoroll Machine Corp.

TECHNICAL PANELS, INC., 9162 La Rosa Dr., Temple City, CA 91780, Tel: 800-343-1170, 818-285-3105, FAX: 818-287-0420; Empl.: 14

Local Sales Offices & Reps

CA	San Jose, McFarland Assocs. Corp.	408-993-0200
CA	Carlsbad, Zerimar Sls.	619-436-3379
IL	Mundelein, Northpoint Technlgs.	708-566-7999
NJ	Pt. Pleasant, Jade Mktg.	201-899-7265
MN	Wayzata, Cardinal Sls.	612-475-0042
RI	Warwick, Schumacher & Yarrington	401-884-5671
OH	Chagrin, Crest Comp. Sls.	216-543-9808

TECHNICAL RESEARCH & MFG., INC., See TRM, Inc.

TECHNICAL SERVICES LABORATORY INC., 95 Ready Ave., Ft. Walton Beach, FL 32548, Tel: 904-243-3722, FAX: 904-244-6653; FSC No.: 51283; Empl.: 24; *Sls. Mgr.:* Andrew J. Corbin

TECHNIPOWER, A PENRIL CO., P.O. Box 222, Commerce Pk., Danbury, CT 06813, Tel: 203-748-7001, TELEX: 710-456-9280, FAX: 203-797-9285; FSC No.: 13850; Empl.: 135; *Sls. Mgr.:* L. Carbone; *Dist. Mgr.:* Larry Carbone

TECHNIQUES, INC., 235 Jackson St., Englewood, NJ 07631, Tel: 201-569-5900, FAX: 201-569-5615; Empl.: 60

TECHNI-TOOL, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462, Tel: 215-825-4990, TELEX: 834-763, FAX: 215-828-5623; FSC No.: 30239; Empl.: 80; *Sls. Mgr.:* W. Bezar

TECHNITROL, 1952 E. Allegheny Ave., Philadelphia, PA 19134, Tel: 215-426-9105, FAX: 215-426-2836; FSC No.: 90095; Empl.: 900; *Sls. Mgr.:* G. Shilling ..... **A•1598-1605; B•1028-1029**

Local Sales Offices & Reps

CA	Livermore, United Techn. Mktg.	415-449-7644
AZ	Phoenix, Detomasi & Grupp	602-947-3724
CA	Mission Hills, Detomasi & Grupp	818-365-8285
CA	San Diego, Detomasi & Grupp	619-277-0178
CA	Torrance, Detomasi & Grupp, Inc.	213-618-8898
AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
GA	Norcross, Advanced Comps.Mktg.	404-448-7025
IL	Wauconda, Cudahy Sls.	708-526-2484
MD	Baltimore, Callas Elctrns.	301-744-7711
NY	Fairport, TAC Sls.	716-377-2250
NY	Jericho, J. Square Mktg.	516-935-3200
OH	Akron, Augnat Assocs.	216-239-2499
FL	Seminole, Q-Rep	813-397-8431
PA	Easton, The Kendon Co.	215-253-3100
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-Rep	713-988-7613
Can	Quebec, Elcom GbM, Inc.	514-668-3361

TECHNO DIVISION, DALE ELECTRONICS, INC., 7803 Lemona Avenue, Van Nuys, CA 91405-1139, Tel: 818-781-1642, FAX: 818-781-8647; FSC No.: 69274; Empl.: 140; *Sls. Mgr.:* Danny Jagirdar; *Dist. Mgr.:* Jon Trabert ..... **A•2037**

Refer to Dale Electronics, Inc., Columbus, NE for sale offices and distributor information.

TECHNO-ISEL USA DIVISION, Designatronics, 2101 Jericho Tunpike, New Hyde Park, NY 11040, Tel: 516-328-3970, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 85; *Sls. Mgr.:* Sam Singer

TECHNOLOGY DESIGN INC., 10838 Main St., Bellevue, WA 98006, Tel: 206-455-9822, FAX: 206-455-3449; Empl.: 16; *Sls. Mgr.:* Robert Hamilton

TECHNOLOGY DYNAMICS inc.

FAX: 201-385-0702

TECHNOLOGY DYNAMICS INC., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70; *Sls. Mgr.:* Mark S.Jacobus

TECHNOLOGY 80, INC., 658 Mendelssohn Ave. N., Minneapolis, MN 55427, Tel: 612-542-9545, FAX: 612-542-9785; Empl.: 25; *Sls. Mgr.:* James Burkett

TECHRAND CORP. OF AMERICA, 6520 Schamber Dr., Muskegon, MI 49444, Tel: 616-798-2930, FAX: 616-798-2934; Empl.: 40; *Sls. Mgr.:* James Arter

TECHRON

FAX: 1-219-294-8329

TECHRON DIV., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-8300, TWX: 810-294-2160; FSC No.: 06306; Empl.: 490 ..... **D•1017-1019**

Local Sales Offices & Reps

IL	Arlington Hgts., Berndt Assocs., Inc.	312-632-0900
CA	Milpitas, IFM Inc.	408-945-5920
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Woodbridge, Electronic Marketing Assoc.	203-397-1461
FL	Melbourne, Reynolds & Assocs., Inc.	305-259-7000
IL	Chicago, Berndt Assocs.	312-283-0713
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
NY	Syracuse, Labtronics Inc.	315-455-7314
OH	Brecksville, Audio Mktg. Assoc.	216-526-2426
PA	Montgomeryville, Eastern Sci-Mktg.	215-368-4570

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, TELEX: 738450, FAX: 806-372-8750; Empl.: 58; *Sls. Mgr.:* Richard C. Johnson; *Dist. Mgr.:* Rich Johnson

TECHTROL CYCLONETICS, INC., 815 Market St., New Cumberland, PA 17070, Tel: 717-774-2746, FAX: 717-774-6799; FSC No.: 58792; Empl.: 15; *Sls. Mgr.:* James M. Griffith

TECKNIT (EASTERN FACILITY), 129 Dermody St., Cranford, NJ 07016, Tel: 908-272-5500, TELEX: 6853079 TCKNT, FAX: 908-272-2741; FSC No.: 07700; Empl.: 300; *Sls. Mgr.:* Thomas McCreery

TECLAB, Kalamazoo Technical Furniture, P.O. Box 1165, Kalamazoo, MI 49005, Tel: 616-372-6000, 800-832-5227, FAX: 616-372-6116; Empl.: 42; *Sls. Mgr.:* B. Smith ..... **C•1117-1119**

TECNETICS, See Computer Products, Inc.

TECNETICS INC., Computer Products, 6287 Arapahoe Ave., Boulder, CO 80303, Tel: 303-442-3837, FAX: 303-444-9437; Empl.: 135; *Sls. Mgr.:* Cliff Payne

Refer to Tecnetics Inc. 6287 Arapaho Ave. Boulder, CO 80303

TECO CORP., Bay Rd., P. O. Box A, Winnisquam, NH 03289, Tel: 603-524-1998, FAX: 603-524-1899; Empl.: 30; *Sls. Mgr.:* Sandra Murphy

TECOM INDUSTRIES, INC., 9324 Topanga Canyon Blvd., Chatsworth, CA 91311, Tel: 818-341-4010, TELEX: 69 8476, FAX: 818-718-1402; FSC No.: 59850001; Empl.: 134

TECTROL INC
SWITCHING POWER PRODUCTS

FAX: 416-638-0553

TECTROL, INC., 39 Kodiak Cres., Downsview, Ontario, Canada M3J 3E5, Tel: 416-630-8108; Empl.: 450; *Sls. Mgr.:* Paul Carroll ..... **D•2071-2074**

Local Sales Offices & Reps

CA	San Diego, Mesa Comps.	619-278-8021
CA	Cupertino, PEI Sls. Assoc.	408-253-1960
IL	Chicago, Century Elctrns. Corp.	312-777-9700
CT	Bloomfield, Zaslow Sls.	203-242-7781
MA	Natick, Zaslow Sls.	508-393-8150
MN	S.St. Paul, Northport Engrg., Inc.	612-457-8000
NJ	Ho-Ho-Kus, Alto Assocs.	201-447-1770
NY	Buffalo, Lynn Assocs.	716-631-0054
OH	Dayton	513-890-6811
OR	Tigard, Rep-West	503-639-0325
PA	Pittsburgh, Lynn Assocs.	412-443-3670
TX	Richardson, Interactive Comp. Sls.	214-669-2277
WA	Seattle, Rep-West	206-283-8351
WI	Wauwatosa, Larsen Assocs., Inc.	414-258-0529
Can	Downsview, Ont., Tectrol Inc.	416-630-8108

Local Distributors

CA	San Jose, Delta Lu Research	408-453-0490

TEGAL SCIENTIFIC, INC., Box 5905, Concord, CA 94524, Tel: 415-827-1054, TELEX: 380053, FAX: 415-827-1189; *Sls. Mgr.:* L. Rigali

TEGAM, INC., 7230 North Ridge Rd., Madison, OH 44057, Tel: 800-666-1010, TELEX: 205188, FAX: 216-428-7505; Empl.: 30; *Sls. Mgr.:* Gerry Hubbard

TEKA an Interplex Industries company
INTERCONNECTION SYSTEMS, INC.

FAX: 401-461-2310

TEKA INTERCONNECTION SYSTEMS, 45 Salem Dr., Providence, RI 02907, Tel: 401-785-4110; Empl.: 89; *Sls. Mgr.:* Barry Manchester; *Dist. Mgr.:* Barry Manchester ..... **C•1544-1549**

Local Sales Offices & Reps

OH	Dayton, Shamrock Elctrns.	513-258-1227
AL	Huntsville, Total Circuits	205-881-4000
MO	Blue Springs, Atronics	816-224-2131
AZ	Tempe, Spectrum Assocs. S.W. Inc.	602-966-1788
CA	Downey, Management Mktg. & Sls.	213-560-5584
CA	San Diego, Qualtronics	619-695-0118
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CO	Boulder, R.G. Entprs., Inc.	303-447-9211
IL	Arlington Hgts., Russell Elctrns.	708-394-5560
MA	Danvers, C.H. Burnham Assoc.	508-774-0111
MN	Wayzata, Cardinal Sls.	612-475-0041
NY	Hauppauge, Sticom Sls. & Mktg.	516-366-4221
NC	Matthews, R.G. Sls.	704-847-0049
OR	Aloha, Norwest Interconnect Sys.	503-649-7714
PA	Mt. Laurel, Wyck Mkt. Inc.	215-677-7790
TX	Houston, Mil-Rep Assocs.	713-444-2557
EXP	Huntington Beach, Intercation Inc.	714-636-3722
Can	St. Laurent, Que., HHR	514-739-7054

Local Distributors

CA	Hayward, KEA Elctrns.	415-887-2900
CA	Irvine, Mann Southwest	714-380-4170
CA	San Jose, Compass Comp.	408-432-7575
CA	San Jose, Spectra Elec.	1-800-252-1590
CA	Santa Ana, Norstan Elctrns.	800-854-8344
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Kent Elec.	408-727-9810
MA	Andover, Aved Elctrns.	617-688-3800
MA	Canton, E.P.C., Inc.	617-821-2111
MI	Roseville, Madsion Elctrns.	313-778-7640
MN	St. Paul, Shelley-Ragon, Inc.	612-642-2844
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Ronkonkoma, Conco Elctrns.	516-467-8200
NC	Raleigh, Resco Raleigh	919-781-5700
OH	Centerville, I.P.D., Inc.	513-435-2086
RI	Warwick, AL Greg Comp. Inc.	401-738-6170
TX	Allen, Prime Distbn.	214-231-0170
TX	Dallas, Cypress Elctrns.	214-869-1435
WA	Seattle, Shelley Ragon, Inc.	206-241-1980
Can	Burlington, Ont., Alternate Source Comp.	416-335-6385

TEK-COM /PRENTICE CORP., 2343 Bering Dr., San Jose, CA 95131, Tel: 408-435-9515, TELEX: 277216, FAX: 408-435-9514; FSC No.: 72242; Empl.: 23; *Sls. Mgr.:* Garry Stoddard

TEKNATIONAL INDS., INC., 430 S. Clinton Ave., Rochester, NY 14620-1103, Tel: 716-232-1291, FAX: 716-232-1295; FSC No.: 24227; Empl.: 15; *Sls. Mgr.:* J. D. Hochheimer

TEKTONE SOUND & SIGNAL, 1331 S. Killian Dr., Lake Park, FL 33403, Tel: 407-844-2383, FAX: 407-845-1587; FSC No.: 59-1500771; Empl.: 70; *Sls. Mgr.:* Carlos Mira; *Dist. Mgr.:* Carlos Mira

TEKTRONIX, INC., P.O. Box 500, Beaverton, OR 97077, Tel: 800-835-9433, TWX: 910-467-8708; FSC No.: 80009; Empl.: 12,500

TEKTRONIX, INC., Display Products, P.O. Box 500 M/S 46-943, Beaverton, OR 97077, Tel: 503-627-5000, FAX: 503-627-1070

TEKTRONIX-SIGNAL ANALYSIS UNIT, 1350 Dell Ave., No. 104, Campbell, CA 95008, Tel: 408-374-6464, FAX: 408-374-6467; *Sls. Mgr.:* Jim Searles

TEKWORKS, INC., 72 Redner Rd., Morristown, NJ 07960, Tel: 201-540-1096, FAX: 201-540-9412; Empl.: 2; *Sls. Mgr.:* David A.H. Robinson

TELCO INTERCONTINENTAL, 9812 Whithorn Dr., Houston, TX 77095, Tel: 713-855-2218, FAX: 713-859-8825; Empl.: 12; *Sls. Mgr.:* Ruth Haber

TELCOM INTERNATIONAL, INC., See Hadron, Inc.

TELEBYTE TECHNOLOGY, INC., 270 East Pulaski Road, Greenlawn, NY 11740, Tel: 516-423-3232, 800-835-3298, FAX: 516-385-8184; Empl.: 48; *Sls. Mgr.:* J. Kramer; *Dist. Mgr.:* R. Nazario

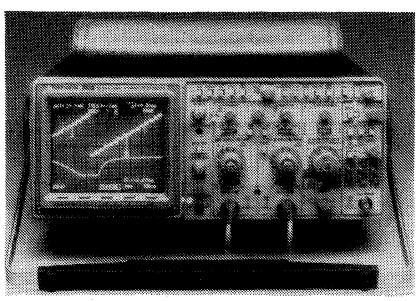
TELECOMMUNICATIONS TECHNIQUES CORP., 20410 Observation Drive, Germantown, MD 20876, Tel: 301-353-1550, FAX: 301-353-0734

TELECTRO SYSTEMS CORP., 96-18 43rd Ave., Corona, NY 11368, Tel: 718-651-8900, TWX: 510-601-8607 TELECTRO, FAX: 718-651-4103; FSC No.: 30040; Empl.: 50; *Sls. Mgr.:* Harry Sussman

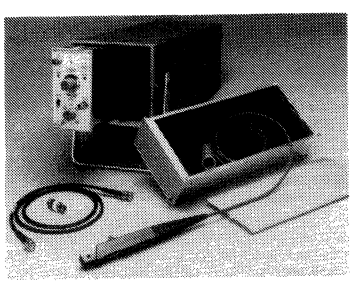
TELE-DENKEN RESOURCES, INC., 7702 FM 1960 East, Ste. 300, Humble, TX 77346, Tel: 713-852-5366, TELEX: 4949653, FAX: 713-852-3869; *Sls. Mgr.:* Gary Killian; *Dist. Mgr.:* Gary Killian

TELEDYNE AEROSPACE SYS., 1007 E. 10th St., Fairmont, MN 56031, Tel: 507-235-3355, FAX: 507-235-6088; FSC No.: 24600; Empl.: 230; *Sls. Mgr.:* Robert L. Johnson

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TELEDYNE COMPONENTS, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267, Tel: 415-968-9241, TWX: 910-379-6494, FAX: 415-967-1590; FSC No.: 15818; Empl.: 200; *Sls. Mgr.:* Thurston Awalt; *Dist. Mgr.:* Nancye R. Beck, Worldwide Distr. Sls. Mgr.

TELEDYNE CRYSTALONICS, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140, Tel: 617-491-1670, TWX: 710-320-1196, FAX: 617-547-6119; FSC No.: 12498;Multiple; *Dist. Mgr.:* W. J. Kilgarriff

TELEDYNE GURLEY, 514 Fulton St., P.O. Box 88, Troy, NY 12181, Tel: 518-272-6300, 800-759-1844, TWX: 710-443-8156, FAX: 518-274-3660; *Sls. Mgr.:* G. S. Gordon

TELEDYNE INET, Teledyne, Inc., 2750 W. Lomita Blvd., Torrance, CA 90506, Tel: 213-325-5040, TELEX: 67-7228, FAX: 213-534-2274; FSC No.: 90911; *Sls. Mgr.:* Fred Tamjidi

TELEDYNE KINETICS, Div. of Teledyne, Inc., 410 S. Cedros Ave., Solana Beach, CA 92075, Tel: 619-755-1181, TELEX: 62877770; FSC No.: 06928; Empl.: 100; *Sls. Mgr.:* John Schuler

TELEDYNE MICROELECTRONICS, 12964 Panama St., Los Angeles, CA 90066, Tel: 213-822-8229, 213-870-9831, TWX: 910-343-7436, FAX: 213-305-0248; FSC No.: 16170; Empl.: 950; *Sls. Mgr.:* W. Kennedy

TELEDYNE MICROWAVE, 1290 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-968-2211, FAX: 415-966-1521; FSC No.: 24022; Empl.: 350; *Sls. Mgr.:* M. Lee

TELEDYNE RELAYS

FAX: 213-779-9161

TELEDYNE RELAYS, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077, TWX: 910-321-4610; FSC No.: 11532; *Sls. Mgr.:* Tom Garland ..... **B•1604-1612**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	San Jose, Teledyne Relays	408-978-8899
CT	Stratford, VISTAssociates, Inc.	203-375-5456
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
FL	Longwood, Teledyne Relays	407-682-9044
FL	Winter Pk., HHP Assocs., Inc.	407-740-0320
GA	Norcross, Advanced Comps. Mktg.	404-448-7025
IL	Bloomingdale, Teledyne Relays	708-529-1060
IA	Cedar Rapids, Stan Clothier Co.	319-365-1717
KS	Olathe, Stan Clothier Co.	913-829-0073
MD	Towson, Arbotek Assocs.	301-825-0775
MA	Marlborough, VISTAssociates	508-481-9277
MN	Eden Prairie, Stan Clothier Co.	612-944-3456
MO	St. Louis, Rothkoph & Assocs.	314-961-4485
NJ	Cranford, Teledyne Relays	201-272-0020
NM	Albuquerque, Reptronix	505-292-1718
NY	Mount Vernon, Friedman-Smith Elctrns.	914-664-4866
NY	Syracuse, Hotze & Murcan Assoc.	315-455-8807
Can	Truro, Nova Scotia, Deskin Sls.	902-893-9228
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter Co.	216-241-4880
NJ	Cherry Hill, Vantage Sls.	609-424-6777
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
TX	Austin, Kruvand Assocs.	512-346-8579
TX	Dallas, Kruvand Asso.	214-437-3355
WA	Houston, Kruvand Assocs.	713-956-6741
UT	Salt Lake City, Thorson Rocky Mtn.	801-973-7969
WA	Seattle, TEKREP	206-286-2047
Can	Calgary, Alb., Deskin Sls.	403-270-4440
Can	Edmonton, Alb., Deskin Sls.	403-466-2106
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Nepean, Deskin Sls.	613-228-1201
Can	St. Laurent, Que., Deskin Sls.	514-331-2860
Can	Transcona, Man., Deskin Sls.	403-466-2106
Can	Vancouver, Deskin Sls.	604-324-8343

Local Distributors

AL	Huntsville, Time Elctrns.	205-721-1133
CT	Norwalk, Pioneer/CT	203-853-1515
AL	Huntsville, Pioneer/Alabama	205-837-9300
AZ	Tempe, Time-Arizona	602-967-2000
CA	Camarillo, Milgray/Los Angeles	805-484-4055
CA	Chatsworth, Time Elctrns.	818-998-7200
FL	Clearwater, Pioneer/Clearwater	813-536-0445
FL	Deerfield Bch., Pioneer/Deerfield Bch.	305-428-8877
CA	Irvine, Milgray/Orange County	714-753-1282
CA	San Diego, Time Elctrns.	619-586-0129
CA	San Jose, Pioneer/San Jose	408-495-9100
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Tustin, Time Elctrns.	714-669-0100
CO	Englewood, Time Elctrns.	303-799-8851
CT	Norwalk, Pioneer/Connecticut	203-853-1515
CT	Milford, Milgray/Conn.	203-878-5538
FL	Altamonte Springs, Pioneer/Altamonte Spgs.	407-834-9090
WI	Brookfield, Pioneer Wisconsin	414-784-3480
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Orlando, Time Elctrns.	407-841-6565
FL	Winter Pk., Milgray/Fla.	407-647-5747
NY	Woodbury, Pioneer Woodbury	516-921-8700
GA	Atlanta, Electro-Air-Georgia	404-351-3545
GA	Atlanta, Milgray/Atlanta	404-446-9777
NY	Binghamton, Pioneer Binghamton	607-772-9300
GA	Norcross, Pioneer/Norcross	404-448-1711
GA	Norcross, Time Elctrns.	404-368-0969
IL	Addison, Pioneer/Chicago	708-495-9680
IL	Palatine, Milgray/Chicago	708-202-1900
IL	Schaumburg, Time Elctrns.	708-303-3000
IN	Indianapolis, Pioneer/Indianapolis	317-573-0880
KS	Overland Pk., Milgray/Kansas City	913-236-8800
MD	Columbia, Milgray/Wash.	301-621-8169
MD	Columbia, Time Elctrns.	301-964-3090
MA	Lexington, Pioneer/Mass.	617-861-9200
MA	Peabody, Time Elctrns.	508-532-9900
MA	Wilmington, Milgray/New England	508-657-5900
MI	Grand Rapids, Pioneer Western Mich.	616-698-1800
MI	Livonia, Pioneer/Mich.	313-525-1800
MN	Eden Prairie, Pioneer Twin Cities	612-944-3355
MN	Edina, Time Elctrns.	612-835-1250
MO	Manchester, Time Elctrns.	314-391-6444
MO	St. Louis, Pioneer St. Louis	314-432-4350
NJ	Fairfield, Pioneer NJ	201-575-3510
NJ	Marlton, Milgray/Delaware Valley	609-983-5010
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Parsippany, Milgray/New Jersey	201-335-1766
NY	Buffalo, Summit Dist.	716-887-2800
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Farmingdale, Milgray Elctrns.	516-391-3000
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Pittsford, Milgray/Rochester	716-381-9700
NY	Rochester, Summit Dist.	716-334-8110
NY	Fairport, Pioneer Rochester	716-381-7070
OH	Cleveland, Milgray/Cleveland	216-447-1520
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Columbus, Time Elctrns.	614-794-3301
OH	Dayton, Pioneer/Dayton	513-236-9900
OR	Portland, Time Elctrns.	503-684-3780
PA	Horsham, Pioneer/Delaware Valley	215-674-4000
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
TX	Austin, Pioneer	512-835-4000
TX	Austin, Time Elctrns.	512-346-7346
TX	Austin, Wyle	512-834-9957
TX	Dallas, Milgray/Dallas	214-248-1603
TX	Dallas, Pioneer/Dallas	214-386-7300
TX	Houston, Pioneer/Houston	713-495-4700
TX	Richardson, Time Elctrns.	214-644-4644
TX	Stafford, Milgray/Houston	713-240-5360
UT	Salt Lake City, Milgray/Utah	801-272-4999
UT	W. Valley City, Time Elctrns.	801-973-8494
Can	Pointe Claire, Que., Milgray/Montreal	514-426-5900
WA	Redmond, Time Elctrns.	206-882-1600
Can	Calgary, Alb., Deskin Sls.	403-270-4440
Can	Edmonton, Alb., Deskin Sls.	403-466-2106
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Mississauga, Ont., Time Elctrns. of Can., Inc.	416-572-5300
Can	Nepean, Deskin Sls.	613-228-1201
Can	St. Laurent, Que., Deskin Sls.	514-331-2860
Can	Transcona, Man., Deskin Sls.	204-224-1321
Can	Truro, Nova Scotia, Deskin Sls.	902-893-9228
Can	Vancouver, BC, Deskin Sls.	604-324-8343
Can	Willowdale, Ont., Milgray Elctrns.	416-756-4481

TELEDYNE ROTOLITE, P.O. Box 398, Owen, WI 54460, Tel: 800-524-0105, TWX: 710-986-3017; *Sls. Mgr.:* J. F. Stickel

TELEDYNE RYAN ELECTRONICS, 8650 Balboa Ave., San Diego, CA 92123, Tel: 619-560-6400, TELEX: 695-028, TWX: 910-335-1174, FAX: 619-560-1147; Empl.: 400; *Sls. Mgr.:* J.E. Wallin

FAX: 213-779-9161

TELEDYNE SOLID STATE, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077, TWX: 910-321-4610; FSC No.: 63745; *Sls. Mgr.:* Tom Garland ..... **B•1604-1612**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	San Jose, Teledyne Solid State	408-978-8899
CO	Englewood, Thorson Rocky Mtn.	303-799-3435
CT	Stratford, VISTAssociates	203-375-5456
FL	Longwood, Teledyne Relays/Teledyne Solid State	407-682-9044
FL	Winter Pk., HHP Assocs., Inc.	407-740-0320
GA	Norcross, Advanced Comps. Mktg.	404-448-7025
IL	Bloomingdale, Teledyne Solid State	708-529-1060
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Stan Clothier Co.	319-365-1717
KS	Olathe, Stan Clothier Co.	913-829-0073
MD	Towson, Arbotek Assocs.	301-825-0775
MA	Marlborough, VISTAssociates	508-481-9277
MN	Eden Prairie, Stan Clothier Co.	612-944-3456
MO	St. Louis, RothKopf & Assocs.	314-961-4485
NJ	Cranford, Teledyne Solid State	201-272-0020
NM	Albuquerque, Reptronix	505-292-1718
NY	Mount Vernon, Friedman-Smith Elctrns.	914-664-4866
NY	Syracuse, Hotze & Murcan Associates	315-455-8807
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
NJ	Cherry Hill, Vantage Sls.	609-424-6777
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
TX	Austin, Kruvand Assocs.	512-346-8579
TX	Dallas, Kruvand Assocs.	214-437-3355
TX	Houston, Kruvand Assocs.	713-956-6741
UT	Salt Lake City, Thorson Rocky Mtn.	801-942-1683
WA	Seattle, Tekrep Elec.	206-286-2047
Can	Calgary, Alb., Deskin Sls.	403-290-4440
Can	Edmonton, Alb., Deskin Sls.	403-466-2106
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Nepean, Deskin Sls.	613-228-1201
Can	St. Laurent, Que., Deskin Sls.	514-331-2860
Can	Transcona, Man., Deskin Sls.	204-224-1321
Can	Truro, Nova Scotia, Deskin Sls.	902-893-9228
Can	Vancouver, Deskin Sls.	604-324-8343

Local Distributors

AL	Huntsville, Pioneer/Alabama	205-837-9300
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Camarillo, Milgray/Los Angeles	805-484-4055
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Irvine, Milgray/Orange Ctny	714-753-1282
CA	San Diego, Time Elctrns.	619-586-0129
CA	San Jose, Pioneer/San Jose	408-954-9100
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CO	Englewood, Time Elctrns.	303-799-8851
CT	Milford, Milgray/Conn.	203-878-5538
CT	Norwalk, Pioneer/CT	203-853-1515
FL	Altamonte Spgs., Pioneer/Altamonte Spgs.	407-834-9090
FL	Clearwater, Pioneer/Clearwater	813-536-0445
FL	Deerfield Bch., Pioneer/Deerfield Bch.	305-428-8877
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Orlando, Time Elctrns.	407-841-6565
FL	Winter Pk., Milgray/Fla.	407-647-5747
GA	Atlanta, Electro-Air/Georgia	404-351-3545
GA	Duluth, Pioneer/Norcross	404-623-1003
GA	Norcross, Milgray/Atlanta	404-446-9777
GA	Norcross, Time Elctrns.	404-448-4448
GA	Norcross, Time Elctrns.	404-368-0969
IL	Addison, Pioneer/Chicago	708-495-9680
IL	Palatine, Milgray/Chicago	708-202-1900
IL	Schaumburg, Time Elctrns.	708-303-3000
IN	Indianapolis, Pioneer/Indiana	317-573-0880
KS	Overland Pk., Milgray/Kansas City	913-236-8800
MD	Columbia, Milgray/Wash.	301-621-8169
MD	Columbia, Time Elctrns.	301-964-3090
MD	Gaithersburg, Pioneer/Gaithersburg	301-921-0660
MA	Lexington, Pioneer/Mass.	617-861-9200
MA	Peabody, Time Elctrns.	508-532-9900
MA	Wilmington, Milgray/New England	508-657-5900
MI	Grand Rapids, Pioneer Western Michigan	616-698-1800
MI	Livonia, Pioneer/Mich.	313-525-1800
MN	Eden Prairie, Pioneer/Twin Cities	612-944-3355
MN	Edina, Time Elctrns.	612-835-1250
MO	Manchester, Time Elctrns.	314-391-6444
MO	St.Louis, Pioneer St. Louis	314-432-4350
NJ	Fairfield, Pioneer New Jersey	201-575-3510
NJ	Marlton, Milgray/Delaware Valley	609-983-5010
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Parsippany, Milgray/New Jersey	201-335-1766
NY	Birmingham, Pioneer/Binghamton	607-722-9300

NY Buffalo, Summit Dist. 716-887-2800
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Fairport, Pioneer/Rochester 716-381-7070
NY Farmingdale, Milgray/New York 516-391-3000
NY Haupauge, Time Elctrns. 516-273-0100
NY Pittsford, Milgray/Upstate New York .. 716-381-9700
NY Rochester, Summit Dist. 716-334-8110
NC Charlotte, Pioneer/Charlotte 704-527-8188
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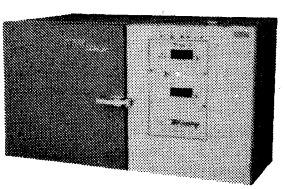
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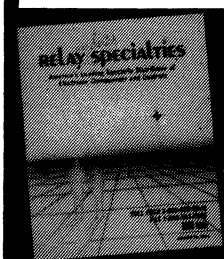
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GA	Norcross, Glen White Assocs.	404-441-1447
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MD	Towson, Glen White Assocs.	301-321-7235
MA	Hingham, Northeast Reps.	617-749-8700
MI	Livonia, Electro Mktg.	313-421-7590
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MN	Minneapolis, R. K. Sales Assocs.	612-571-1001
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MO	St. Louis, Harris-Hanson Co.	314-432-3611
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NY	Syracuse, Labtronics	315-455-7314
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OH	Dayton, Electro Mktg.	513-890-8322
OH	No. Royalton, Electro Mktg.	215-582-0075
OR	Portland, Venture Mktg.	503-624-0617
PA	Pittsburgh, Electro Mktg.	412-823-5400
TN	Gray, Glen White Assocs.	615-477-8850
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VA	Lynchburg, Glen White Assocs.	804-385-6110
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IL	Brookfield, Synmark	414-781-4775
IL	Palatine, Vine Sls., Inc.	708-934-5476
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
IA	Cedar Rapids, Complete Sls.	315-393-7610
MD	Ellicott City, Technology Sls.	301-461-7802
MA	Marlboro, JDS Reps.	508-460-0187
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Oakdale, Complete Sls.	612-731-2923
NJ	Kenvil, Compoments for Elctrns.	201-927-6662
NY	Albany, Lynn Assocs.	518-459-1239
NY	Buffalo, Lynn Assocs.	716-631-0054
NC	King, The Phillip- Matthew Corp.	919-983-9790
OR	Portland, Index, Inc.	503-297-3364
PA	Gibsonia, Lynn Assocs.	412-443-3670
TX	Dallas, Rem Components	214-234-1069
UT	Salt Lake City, WEST Inc.	801-292-8787
WA	Bellevue, Inex, Inc.	206-451-9635
WA	Lynnwood, Blair Hirsh Co.	206-774-8151
WI	Appleton, Vine Sls.	414-731-9873
Can	Mississauga, RFM Electro Sls. Inc.	416-677-0027

Local Distributors

FL	Orlando, Rainbow Sls.	305-658-1082
GA	Norcross, GMT Dist.	404-263-0421
MA	Framingham, JDS Reps.	508-872-5876
MA	Marlboro, Now/JDS Reps.	508-460-0187
MI	Brighton, Applied Power Inc.	312-227-3604
PA	Reading, Barbey Elctrns.	215-376-7451
TX	Houston, Wofford	713-847-3583
TX	Richardson, Off the Shelf	214-238-0808

TOTAL TEMPERATURE INSTRUMENTATION, INC., PO Box 1073, 30 Krupp Dr., Williston, VT 05495, Tel: 802-863-0085, FAX: 802-863-1193; Empl.: 5; *Sls. Mgr.:* Bob Berman; *Dist. Mgr.:* Bob Berman

TOWER ELECTRONICS, INC., 281 S. Commerce Circle, Fridley, MN 55432, Tel: 612-571-3737, FAX: 612-571-5605

TOYOCOM USA INC., 617 E. Golf Rd., Ste. 112, Arlington Heights, IL 60005, Tel: 708-593-8780/1-800-TOYOCOM, FAX: 708-593-5678; Empl.: 10; *Sls. Mgr.:* Seiichi Omoto **A•1472-1482**

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls.	602-345-1276
CA	Irvine, English/Damco	714-753-1950
MI	Livonia, Giesting & Assoc.	313-478-8106
CA	Santa Clara, Pinnacle Sls.	408-249-7400
CO	Denver, West	303-477-8180
FL	Maitland, EIR	407-660-9600
GA	Norcross, Electramark	404-446-7915
IL	Arlington Hgts., MB Sls.	312-392-9499
IN	Carmel, Giesting & Assoc.	317-844-5222
IA	Cedar Rapids, ATS	319-393-8280
MD	Rockville, CEtech	301-590-0111
MD	Timonium, CEtech	301-666-0315
MA	Randolph, Hatch	617-963-3306
MI	Coloma, Giesting & Assoc.	616-468-4200
MI	Livonia, Giesting & Assoc.	313-478-8106
MN	Minneapolis, Scott Elctrn.	612-929-2985
NJ	Mountainside, Henry G. Richter	201-233-4615
NM	Alburquerque, Cantec Sls.	505-889-9165
NY	Fayetteville, Henry G. Richter	315-637-6713
NC	Raleigh, L & D Inc.	919-876-5301
OH	Cincinnati, Giesting & Assoc.	513-385-1105
OH	Cleveland, Giesting & Assoc.	216-261-9705
OK	Tulsa, Hugh J. Daley	918-494-7711
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Phoenixville, Henry G. Richter	215-495-6176
PA	Pittsburg, Giesting & Assoc.	412-828-3553
TX	Austin (xtal), Rice Entpr.	512-355-2296
TX	Austin (SIMM), Gardin-Moore	512-244-2859
TX	Ft. Worth (xtal), Rice Entpr.	817-497-5284
TX	Plano (SIMM), Gardin-Moore	214-985-1193
UT	Salt Lake City, West	801-292-8787
WA	Bellevue, Quest Mktg.	206-747-9424
Intl	San German, Digit-Tech Sls.	809-892-4317
Can	Mississauga,Ont., Canadian Mktg. Technlgs., Inc.	416-612-0900

TOYO SPECTRUM CORP., 2934 Corvin Drive, Santa Clara, CA 95051, Tel: 408-720-8877, 800-338-1981, TELEX: 297584 TEAM UR, FAX: 408-720-9643; *Sls. Mgr.:* Bill Nicklin

TRACEWELL ENCLOSURES, INC., 567 Enterprise Dr., Westerville, OH 43081, Tel: 614-846-6175, 800-848-4525, FAX: 614-846-4450; Empl.: 50; *Sls. Mgr.:* Walter G. Waldron **C•1120-1125**

TRA-CON, INC., 55 North St., Medford, MA 02155, Tel: 617-391-5550; Empl.: 55; *Sls. Mgr.:* Dan Romanow

TRACOR FLIGHT SYSTEMS, INC., Tracor, Inc., A Westmark Co., 1241 E. Dyer Rd., Santa Ana, CA 92705, Tel: 714-662-0333, TWX: 510-601-1467 FSI HDQT; FSC No.: 6B468; Empl.: 550; *Sls. Mgr.:* A. Mallamo



FAX: 813-886-2794

TRAK MICROWAVE CORP., 4726 Eisenhower Blvd., Dept. E-1, Tampa, FL 33634, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 12855; *Sls. Mgr.:* Thomas L. Roberts; *Dist. Mgr.:* Sharon Altimari **A•1829-1833; D•1078, 1194**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Granada Hills, S & S Technlg., Inc.	818-366-2866
CA	Mountain View, Disman Bakner	415-969-3010
CA	Redondo Bch., S & S Techlg, Inc.	213-379-9335
CA	San Diego, S & S Technlg. Inc.	619-484-2996
CO	Parker, Howard Assocs.	303-841-5755
FL	Melbourne, Jerry Williams, Inc.	407-259-7700
FL	Tampa, M. Lader Co.	813-264-1444
WA	Bellevue, Arva Hudson	206-455-0773
GA	Lawrenceville, M. Lader Co.	404-985-8057
IL	Mt. Prospect, Cain-Forlaw	708-253-3578
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MD	Columbia, M. Lader Co.	301-381-1550
MD	Conowingo, M. Lader Co.	301-378-3449
MA	Andover, Bee Assoc.	508-475-2124
MO	Florissant, Blair Engrg.	314-831-4069
NM	Albuquerque, Thorson Desert States, Inc.	505-293-8555
NY	Liverpool, R&D Assocs.	315-457-0100
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NC	Greensboro, M. Lader Co.	919-674-8970
PA	Conshohocken, M. Lader Co.	215-825-3177
TX	Austin, Thorson Co.	512-345-1985
TX	Dallas, Thorson Co.	214-233-5744
TX	Houston, Thorson Co.	713-558-8205
Can	Ottawa, Giga Tron Assocs. Ltd.	613-225-4090

Local Distributors

AZ	Scottsdale, Spirit Elctrns.	602-998-1533
CA	Mtn. View, Cornstock Distrs., Inc.	415-969-3010
NY	Ronkonkoma, Compucon Distr., Inc.	516-981-8810
PA	Conshohocken, MLC Distrs., Ltd.	215-825-3177
TX	Dallas, Thorson Co.	214-233-5744

TRAK MICROWAVE LTD., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, FAX: 44-382-562643; Empl.: 30



FAX: 813-886-2794

TRAK SYSTEMS, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E-1, Tampa, FL 33634-6391, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 11165; *Sls. Mgr.:* Thomas L. Roberts **D•1078, 1194-1195**

Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Phoenix, J. Smith Assocs.	602-267-0981
CA	Huntington Beach, Scientific Dvcs. West	714-840-3501
CA	San Diego, Scientific Dvcs. West	619-268-9635
CA	San Jose, Scientific Dvcs. West	408-554-0455
CO	Parker, Howard Assocs.	303-841-5755
FL	Sarasota, Bass Assocs.	813-378-1405
GA	Atlanta, Magaro & Assocs.	404-451-8862
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
MD	Andover, Saret Assocs.	508-475-9332
MD	Annapolis, Blackwood Assocs.	301-268-3669
NM	Albuquerque, J. Smith Assocs.	505-345-6501
NC	Greensboro, Magaro & Assocs.	919-282-4424
OR	Portland, Scientific Dvcs. West	503-248-6340
PA	Philadelphia, Rabal Assocs.	215-922-6914
TX	Arlington, J. T. Houston Assocs.	817-265-2931
WA	Bellevue, Scientific Dvcs. West	206-637-0945
Can	Ottawa, Giga Tron Assocs., Ltd.	613-225-4090

TRANSAMERICA DELAVAL, INC., See IMO Delaval, Inc., CEC Instruments Div.

TRANSAMERICA DELAVAL, See IMO Delaval, Inc., Gems Sensors Div.

Trans American Transformer, Inc.

FAX: 516-928-0852

TRANS AMERICAN TRANSFORMER, 26 Hulse Rd., E. Setauket, NY 11733, Tel: 516-928-0762; FSC No.: 61619; Empl.: 30 **A•2452**

TRANSCO PRODUCTS, INC., Subsidiary of Datron Systems Inc., Vard Newport, Camarillo, CA 93012, Tel: 805-987-8007, TELEX: 857579, FAX: 805-484-0830; FSC No.: 82152; Empl.: 300; *Sls. Mgr.:* A. Kwon, V.P. of Mktg.

TRANSDUCERS & SYSTEMS, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson **B•1947**

All states not listed consult factory, N. Branford, CT

Local Sales Offices & Reps

CT	Suffield, Digital & Analog Sls.	203-668-1664
IN	Indianapolis, Rixan Assoc.	513-278-4216
OH	Dayton, RIXAN Assocs.	513-278-4216
PA	Bensalem, Rixan Assoc.	513-278-4216
SC	Greer, Trask Instrumentation	803-292-8900
TX	Humble, Talon Tech. Sls.	713-852-3962

TRANSDUKTOR, INC., See Ulveco, Inc.

TRANSENE, Rte. 1, Rowley, MA 01969, Tel: 508-948-2501, FAX: 508-948-2206; Empl.: 21; *Sls. Mgr.:* H. Femino

TRANSFORMER DESIGN , MTE Corporation, W147 N9525 Held Drive, Menomonee Falls, WI 53051, Tel: 414-253-8200, FAX: 414-253-8222; Empl.: 120; *Sls. Mgr.:* John A. Houdek

TRANSFORMER TECHNOLOGIES, INC., 52 Putnam St., Mt. Vernon, NY 10550, Tel: 914-668-1600, FAX: 914-668-4794; Empl.: 15; *Sls. Mgr.:* Thomas Quaglieri ..... **A•2453**

Local Sales Offices & Reps

IL Highland Pk., Mid-Tek Mktg. 708-831-1130
NJ Brunswick, Synergy Sls. 201-828-5090
VA Ashland, Glasscock Assocs. 804-798-2125

TRANSICOIL, INC., Eagle-Picher, P.O. Box 9011, Valley Forge, PA 19485, Tel: 215-539-4400, FAX: 215-539-3400; FSC No.: 82686; Empl.: 290

TRANSICOIL INC., Penn Airborne Products, 950 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-3400, TELEX: 834-759, FAX: 215-322-2194; FSC No.: 25805; Empl.: 41; *Sls. Mgr.:* Claude Mercier

TRANSICOIL INC., Robinson-Halpern Products, 2560 General Armistead Blvd., Trooper, PA 19403, Tel: 215-539-4400, FAX: 215-539-3400; Empl.: 300; *Sls. Mgr.:* Francis Mashintonio

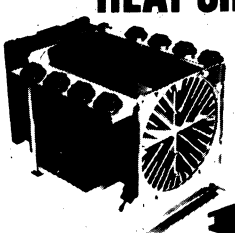
TRANSISTOR DEVICES, INC., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-361-6622, FAX: 201-361-7665; FSC No.: 09004; Empl.: 650; *Sls. Mgr.:* Don Fedderly ..... **D•1331, 2108-2109**

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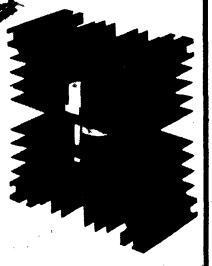
AL Huntsville, Reynolds & Assocs., Inc. 205-539-1485
AZ Scottsdale, Dave Menegay & Assocs. 602-994-9519
AR El Dorado, Kemp Instrs. 501-862-5869
CA Bakersfield, FLW, Inc. 805-398-0720
CA Campbell, SMA 408-370-6900
CA Canoga Pk., FLW, Inc. 818-719-0037
CA Carlsbad, FLW, Inc. 619-434-5251
CA Costa Mesa, FLW Inc. 714-751-7512
CO Denver, Elcom, Inc. 303-337-2300
CT Watertown, May Technlg., Inc. 203-274-3777
FL Coral Spring, Reynolds Assocs., Inc. .. 305-344-4536
FL Melbourne, Reynolds Assocs., Inc. 407-259-7000
FL Newport Richey, Reynolds Assocs., Inc. 813-372-8369
GA Duluth, Reynolds Assocs., Inc. 404-476-4992
IL Wheeling, Ed Joyner & Co. 312-520-1200
KS Overland Pk., WEB Assocs./Elctrns. .. 913-381-7986
MA Lexington, E. F. Delfino, Inc. 617-862-1118

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MO Florissant, WEB Assocs./Elctrns. 314-921-5720
NJ Comp-Tech Sls. 201-697-1961
NJ Hasbrouck Hgts., Comp-Tech Sls. 201-288-7400
NY E. Syracuse, Advance Components ... 315-437-6700
NY Endicott, Advanced Comps. Corp. 607-785-3191
NY Hicksville, Comp-Tech Sls. 516-593-2628
NY Kingston, Advanced Comp. Corp. 914-339-1730
NY New York, Roburn Agencies, Inc. 914-968-1016
NY Rochester, Advanced Comps. Corp. ... 716-544-7017
NY Scottsville, Advanced Comps. Corp. ... 716-889-1429
NC Raleigh, Reynolds & Assocs., Inc. 919-876-0282
OH Arcanum, Ashby Assocs., Inc. 513-692-8713
OH Cleveland, Ashby Assocs., Inc. 216-461-0826
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Pittsburgh, Ashby Assocs. 412-343-5105
PA Southampton, Campbell Assoc. 215-322-6630
TX Lewisville, Jim Hughes Co. 214-221-1536, 214-221-1538
UT Murray, Elcom 801-262-2400, 801-262-2472
VA Alexandria, Dyna-Rep Co. 703-354-1222
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
Can Weston Ont., Duncan Instrs. Canada Ltd. 416-742-4448

TRANSKINETIC SYS., 110 Shawmut Rd., Canton, MA 02021, Tel: 617-828-3000; Empl.: 17; *Sls. Mgr.:* D. Pettijohn

TRANSMAGNETICS, 210 Adams Blvd., Farmingdale, NY 11735, Tel: 516-293-3100, TWX: 510-224-6420, FAX: 516-293-3793; FSC No.: 17755; Empl.: 44; *Sls. Mgr.:* Fred Haber ..... **D•1196-1199**

TRANS METRICS, INC., 5325 Naiman Pkwy Ste.E , Solon, OH 44139, Tel: 216-248-2229, FAX: 216-248-7780; FSC No.: 6685; Empl.: 20; *Sls. Mgr.:* James N. Dietrich

TRANSONIC SYSTEMS INC., 34 Dutch Mill Road, Ithaca, NY 14850, Tel: 607-257-5300, TELEX: 413523, ESYLNK: 62050974; Empl.: 40

TRANSTECHNOLOGY ELECTRONICS, Transtechnology Corporation, 8800 Allen Rd., Peoria, IL 61615-1584, Tel: 309-693-3300, TWX: 510-390-3691, FAX: 309-693-3308; FSC No.: 30463; Empl.: 280; *Sls. Mgr.:* Arthur J. Mallamo, Jr.; *Dist. Mgr.:* Arthur J. Mallamo, Jr.

Local Sales Offices & Reps

CA San Jose, B.J. White 415-837-7201
CA Woodland Hills, Cal Ward Sls. 818-883-2202
FL Altamonte Springs, Krebs Myton Assoc. 407-788-9333
GA Atlanta, Krebs Myton Assoc. 404-399-7895
IL Hillside, Cadre Tech. Rep., Inc. 708-449-3900
IA Blue Grass, Rothkopf & Assocs. 319-381-4396
KS Olathe, Rothkopf & Assocs. 913-829-8898
MD Baltimore, Hagy Assocs. 301-931-2022
MA St. Louis, Rothkopf & Assocs., Inc. 508-851-4010
NM Albuqerque, H & H Elctrns. 505-889-3300
NY Setauket, Smith Engrg. Sls. 516-689-6514
OH TippCity, Cleary Sls. Co. 513-667-7703
PA Newtown Square, Hagy Assocs. 215-459-0504
TX Centerville, MC2 801-298-3388
TX Colleyville, DeArmond Entprs. 817-267-2048
TX Dallas, M-Rep 214-484-5711
VA Charlottesville, Pdg Sls. 804-979-7085
WA Bellevue, Lehr Assocs. 206-453-9993

Local Distributors

CA Brea, Aeroflite 714-773-4251
CA Van Nuys, Air Electro 818-988-4400
WA Auburn, West Air Intl. 206-631-1000

TRANSTECTOR SYSTEMS, INC., P.O. Box 300, Hayden Lake, ID 83835, Tel: 800-829-2901, TELEX: 150-077TRANSTECPFLS, FAX: 208-772-9016; FSC No.: 30992; Empl.: 150; *Sls. Mgr.:* Mary Munger; *Dist. Mgr.:* Mike Sweeney

TRANS-TEK, P.O. Box 338, Rte. 83, Ellington, CT 06029, Tel: 203-872-8351, TELEX: 99207, FAX: 203-872-4211; FSC No.: 27109; Empl.: 40; *Sls. Mgr.:* William R. Padin

TRAN-TEC CORP., Box 1044, Columbus, NE 68601, Tel: 402-564-2748, FAX: 402-564-4946; Empl.: 46; *Sls. Mgr.:* Cliff Schroeder

Local Sales Offices & Reps

CA Redwood City, Woodworth Co. 415-365-0252
CA Tustin, Sierra-Pacific Engrg. Co. 714-731-3411
CO Lafayette, Pierce-Robbins Assocs. 303-665-3296
FL Palm Bch. Gardens, Russell Assocs. .. 305-627-1503
GA Atlanta, Russell Assocs. 404-255-8422
IN Ft. Wayne, Scott Elctrns, Inc. 219-489-5690
IA Hiawatha, Ard Sls. Co. 319-393-6392
MD Bel Air, Russell Assocs. 301-879-9180
MA Wakefield, H.C. Jappe Co. 617-245-9359
PA Westchester, Russell Assocs. 215-696-0700
NY Bay Shore, Russell Assocs. 516-666-6500
NY Morrisville, Naylor Elec. Co. 315-684-9620
OH Cleveland, D. Steffen & Assocs. 216-461-8333
TX Dallas, Russell Assocs. 214-699-0383
WA Bellevue, Russell Assocs. 206-455-3694

TRATEC OF CALIFORNIA, INC., 3802 Main St. Ste. 3, Chula Vista, CA 91911, Tel: 619-476-1155, ESYLNK: 619-476-1176; Empl.: 250; *Sls. Mgr.:* Dale Fox

TREE TECHNOLOGIES CORPORATION, Baird Research Pk., 1576 Sweet Home Rd., Buffalo, NY 14228, Tel: 716-688-4640, FAX: 716-636-3630; Empl.: 8; *Sls. Mgr.:* Victor Demjanenko, PH.D.

TREK, INCORPORATED, 3932 Salt Works Road, Medina, NY 14103-0231, Tel: 716-798-3140, FAX: 716-798-3106; Empl.: 141; *Sls. Mgr.:* Peter R. Bossard, Ph.D.; *Dist. Mgr.:* Mark J. Delucia

TREMETRICS INC., Baker Hughes Incorporated, 6500 Tracor La., Bldg. 27, Austin, TX 78725-2100, Tel: 512-929-2051, TWX: 910-874-1366, FAX: 512-929-2747; FSC No.: 63409; Empl.: 160; *Sls. Mgr.:* William R. Murphy; *Dist. Mgr.:* Will Hoover

TREND CIRCUITS, 44358 Old Warm Springs Blvd., Fremont, CA 94538-6148, Tel: 415-651-1150, FAX: 415-651-5763; Empl.: 142; *Sls. Mgr.:* Colleen Frisz

TREND DLC, Card Technology, 70 Eisenhower Dr., Paramus, NJ 07652, Tel: 201-845-7373, FAX: 201-845-3337; Empl.: 60; *Sls. Mgr.:* Joseph R. La Manna

TRENT, INC., 201 Leverington Ave., Philadelphia, PA 19127, Tel: 215-482-5000, FAX: 215-482-9389; Empl.: 55

TRIAC ELECTRONIC SYSTEMS, INC., 87-27 Myrtle Ave., Glendale, NY 11385, Tel: 718-441-4759, TWX: 221500 ASAS ATT TRIAC; Empl.: 35; *Sls. Mgr.:* Victor Botnick

TRIAD POWER SYSTEMS, See Behlman Engineering

THE TRIANGLE TOOL GROUP, INC., Cameron Rd., P.O. Box 1807, Orangeburg, SC 29115, Tel: 803-534-7010, FAX: 803-536-6632; FSC No.: 30106; *Sls. Mgr.:* Herbert L. Tait

TRICONEX CORP., 15091 Bake Parkway, Irvine, CA 92718, Tel: 714-768-3709, 800-325-2128 (outside Ca), FAX: 714-768-6601; Empl.: 60; *Sls. Mgr.:* Peter B. Robinson; *Dist. Mgr.:* Paul Hamilton

TRICON INDUSTRIES, INC., Brazing Alloys & Chemical Products Div., 5000 Chase St, Downers Grove, IL 60515-4012, Tel: 708-963-0220, FAX: 708-963-0269; Empl.: 19; *Sls. Mgr.:* T. R. Boedeker

TRICON INDUSTRIES, INC., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076, Tel: 708-964-2330, FAX: 708-964-5179; Empl.: 289; *Sls. Mgr.:* Robert Stevens

TRIDAK, 1120 Federal Rd., Brookfield, CT 06804, Tel: 203-775-1287, TELEX: 62009593, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* Frank Barbera

TRIDYNE PROCESS SYSTEMS, DBI Industries, 80 Allen Rd., So. Burlington, VT 05403, Tel: 802-863-6873, FAX: 802-860-1591; Empl.: 35; *Sls. Mgr.:* Bonnie Rousseau

TRIGON/ADCOTECH, Dynatech, 100 S. Milpitas Blvd., Milpitas, CA 95035, Tel: 408-946-4300, FAX: 408-263-9217; Empl.: 50; *Sls. Mgr.:* Gary Dotzler

TRILITHIC, INC., 9202 E. 33rd St., Indianapolis, IN 46236, Tel: 800-344-2412, FAX: 317-895-3613; FSC No.: 23042; Empl.: 120; *Sls. Mgr.:* D. Distler

TRILOBYTE COMPUTER CORPORATION, 14477 Catalina St., San Leandro, CA 94577, Tel: 415-895-1100, TWX: 910-350-0171, FAX: 415-895-2244; Empl.: 15

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TRI-MAG, INC., 1601 N. Clancy Ct., Visalia, CA 93291, Tel: 209-651-2222, TELEX: (ITT) 4994462; FSC No.: 64771; Empl.: 80 ..... **A•1646-1648; D•2110-2113**

Local Sales Offices & Reps

AL Huntsville, EPI, Inc. 205-534-3747
CA Burlingame, William J. Purdy Co. 415-347-7701
CA Laguna Hills, Electro-Venture 714-581-9244
FL Land O'Lakes, AJ's Power Source, Inc. 813-996-2583
IL Arlington Hgts., Coombs Assocs., Inc. 312-439-9810
KS Overland Pk., EPI, Inc. 913-642-9118
MD Ambler, W.R. Hartmaier Assoc., Inc. ... 301-788-7128
MS Jackson, EPI, Inc. 601-856-6251
MO St. Louis, EPI, Inc. 314-962-1411
MA Southboro, Sullivan Tech. Sls. 508-485-2215
NJ Ridgewood, Ballou, Inc. 201-444-6990
NY Rochester, R.M. Scanlon & Assoc., Inc. 716-924-7450
NY Syracuse, R.M. Scanlon & Assoc., Inc. 315-463-7682
OH Mentor, Sales Plus, Inc. 216-942-7811
OK Tulsa, Cunningham Comps. 918-665-3562
OR Beaverton, Pacific Mktg. Spec. 503-641-9373
PA Ambler, W.R. Hartmaier Assoc. Inc. 215-643-6691
PA Ambler, W.R. Hartmaier Assocs., Inc. .. 215-643-6691
TX Austin, Cunningham Comps. 512-255-1510
TX Dallas, Cunningham Comps. 214-699-3485
TX Houston, Cunningham Comps. 713-461-4197
WA Redmond, Pacific Mktg. Spec. 206-882-3144
WI Milwaukee, Coombs Assocs., Inc. 414-351-6123

Local Distributors

MA Needman, Power Electro Supp. Co. ... 718-767-1447

TRIMM INC., Newton Instr. Co., 400 W. Lake St., Box 489, Libertyville, IL 60048, Tel: 708-362-3700, FAX: 708-680-3888; FSC No.: 81812; Empl.: 50; *Sls. Mgr.:* Howard Zarch

TRIM-TRONICS, INC., 2763 Route 20 East, Cazenovia, NY 13035, Tel: 315-655-9528, FAX: 315-655-2149; Empl.: 20; *Sls. Mgr.:* James E. Dowd

TRINETICS INC., 55807 Currant Rd., Mishawaka, IN 46545-4899, Tel: 219-259-8535, FAX: 219-259-8552; FSC No.: 3677; Empl.: 100; *Sls. Mgr.:* P. L. Kamerer

TRIO LABORATORIES, INC., 80 Dupont St., Plainview, NY 11803, Tel: 516-349-0400, FAX: 516-349-0442; FSC No.: 00638; Empl.: 60; *Sls. Mgr.:* Richard Frerking, Dir. of Sls. & Mktg.

TRIONICS, INC., P.O. Box 225, St. Charles, IL 60174, Tel: 312-232-9117, FAX: 312-232-0820; Empl.: 50

TRIO-TECH INTERNATIONAL, 355 Parkside Dr., San Fernando, CA 91340, Tel: 818-365-9200, TELEX: 194811(TTI INTL SFDO), FAX: 818-365-8210; Empl.: 266; *Sls. Mgr.:* Jon Easterson

TRIPLE I, See PHI Technologies, Inc.

TRIPLETT CORPORATION, One Triplett Dr., Bluffton, OH 45817-9987, Tel: 419-358-5015, TWX: 810-490-2400, FAX: 419-358-7956; *Sls. Mgr.:* Joel Weldy; *Dist. Mgr.:* Tony Augsburger

TRIPP-LITE, 500 No. Orleans, Chicago, IL 60610-4188, Tel: 312-329-1777, FAX: 312-644-6505; Empl.: 150; *Sls. Mgr.:* Ray Foster

TRIRIDGE

FAX: 904-728-6799

TRIRIDGE CORPORATION, P.O. Box 2130, Leesburg, FL 34749-2130, Tel: 904-728-0799/1-800-537-3529; Empl.: 45

TRIRIDGE CORP., P.O. Box 12420, Pittsburgh, PA 15231, Tel: 412-899-2288, 800-537-3529, FAX: 412-899-2284; FSC No.: 31951; Empl.: 48; *Sls. Mgr.:* Michael Minich ..... **B•1613**

Local Sales Offices & Reps

AL Huntsville, Hughes & Assoc. 205-533-4664
CA Seal Beach, Texel 213-596-9411
FL Maitland, EIR Inc. 407-660-9600
GA Norcross, Hughes Assocs. 404-662-1587
IL Downers Grove, Golten Assocs. 708-512-0093
MA Chelmsford, Interstate Sls. Assocs. 508-256-2287
MN Stillwater, Kits Co. 612-439-8088
MS Corinth, Hughes Assocs. 601-287-2915
NY Manhasset, Win-Cor Elctrn.Sls. 516-627-9474
NC Cary, Hughes Assocs. 919-467-7029
TN Knoxville, Hughes Assocs. 615-558-0283

Local Distributors

CA Los Angeles, Masters Distrs. 213-452-1229
OH Warren, Rem Elctrn. Supp. Co. 216-373-1300
PA McKean, Advacom Inc. 814-476-7774

TRM, INC., 401 Kelly Ave., Grenier Field, Manchester, NH 03103, Tel: 603-627-6000, FAX: 603-627-6025; Empl.: 40; *Sls. Mgr.:* A. Butts

FAX: 818-706-1040

TROMPETER ELECTRONICS, INC., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91362-4047, Tel: 818-707-2020; FSC No.: 14949; Empl.: 180; *Sls. Mgr.:* Dick Coleman; *Dist. Mgr.:* Raymond Calvin .... **C•1556-1561**

Local Sales Offices & Reps

AL Huntsville, Currie, Peak and Frazier ... 205-536-1506
AZ Tempe, Aztec Entprs. 602-431-8401
CA Los Angeles, Knight Co. 213-670-2833
CA Santa Clara, ISG 408-980-1166
CA Temecula, Knight Co. 619-452-7196
CO Denver, Aztec Entprs. 303-779-5285
CT Wethersfield, Underwood Sls. 203-563-3046
FL Orlando, Currie, Peak & Frazier 407-855-0843
FL Pace, Currie, Peak & Frazier 904-994-0599
FL Tampa, Currie,Peak, & Frazier 813-963-1076
FL W.Melbourne, Currie, Peak & Frazier .. 407-724-6795
GA Duluth, Currie, Peak & Frazier 404-497-9404
IL Arlington Heights, Berndt Assocs. 312-632-0900
IN Carmel, Berndt Assocs. 317-844-0114
KS Overland Pk., Baka 913-432-5252
KS Wichita, Baka 316-682-8411
MD Landover, Sel-Tronics 301-341-2700
MA Lowell, Underwood Sls. 508-256-8191
MI Sterling Hgts., Geotronix 313-254-0520
MN EPA (Bortech Sls.), EPA (Bortech Sls.) 612-835-9002
MO St. Johns, Baka 314-429-2252
NJ Elmwood Park, L & M Assoc. Eng. Rep. 201-797-0441
NM Albuquerque, Aztec Entprs. 505-262-1688
NY Buffalo, T.A.E. Reps. 716-688-5008
NY Clifton Park, T.A.E. Reps. 518-371-3117
NY New York, L & M Assocs. Eng. Rep. .. 212-243-6155
NY Rochester, T A E Reps. 716-586-8710
NY Whitney Point, T.A.E. Reps. 607-692-3705
NC Charlotte, Currie, Peak & Frazier 704-846-1702
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
OH Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-854-5939
PA Allison Park, Geotronix 412-487-1770
PA Festerville, L & M Assocs. 215-953-9808
TN Smyrna, Currie, Peak & Frazier 615-459-0743
TX Grand Prairie, ION Assocs. 214-647-8225
UT Salt Lake City, Aztec Entprs. 801-467-4675
WA Bothell, Evergreen Mktg. 206-485-8063
WI Milwaukee, Berndt Assocs. 414-545-8400
Can Markham, Ont., Components, Ltd. 416-479-7200
Can St. Laurent, Que., Componetics, Ltd. ... 514-331-9930

TRONTECH, INC., 38 Industrial Way E., Eatontown, NJ 07724, Tel: 908-542-1133; Empl.: 70; *Sls. Mgr.:* Albert E. Arbuckle

TRUEVISION, 7340 Shadeland Station, Indpls., IN 46256, Tel: 317-841-0332, FAX: 317-576-7700; Empl.: 64; *Sls. Mgr.:* Greg Vandendries

TRULINE CORPORATION, 909 W. Visalia Rd., Farmersville, CA 93223, Tel: 209-747-1261, FAX: 209-747-0280; Empl.: 85; *Sls. Mgr.:* R. W. Aubery

TRUMETER COMPANY, INC., 38 West 32nd St., New York, NY 10001, Tel: 212-564-0666, 800-537-2261, FAX: 212-268-0432; Empl.: 9; *Sls. Mgr.:* Rene Jacobus

TRW LSI PRODUCTS INC., PO Box 2472, La Jolla, CA 92038, Tel: 619-457-1000, FAX: 619-455-6314; FSC No.: 59621; Empl.: 290; *Sls. Mgr.:* Al Jonas, Dir. Sls.

TRW MICROWAVE, See FEI Microwave

TRW RESISTIVE PRODUCTS DIV., See International Resistive Co.

TRW TECHNAR, INC., TRW, Inc., 5462 Irwindale Ave., Irwindale, CA 91706, Tel: 818-334-0250, FAX: 818-969-4781; Empl.: 750; *Sls. Mgr.:* George R. Downs

TS PRODUCTS, INC., 12455 Branford St., Bldg. 22, Arleta, CA 91331-3429, Tel: 818-896-6676, FAX: 818-896-2816; Empl.: 6; *Sls. Mgr.:* James T. Thomasson; *Dist. Mgr.:* James T. Thomasson ..... **D•2245**

Local Sales Offices & Reps

CA Corona Del Mar, Motion Control, Inc. .. 714-675-0211
CA Los Angeles, TS Products, Inc. 818-896-6676
CA Montebello, TUCUL Engrg. 818-791-1364

TSSI, 8205 S.W. Creekside Place, Beaverton, OR 97005, Tel: 503-643-9281, FAX: 503-646-4954; Empl.: 50; *Sls. Mgr.:* Dean Turnbaugh, V.P., N.A. Sls.; *Dist. Mgr.:* David Flaningam, V.P., Intl. Sls.

TTE

FAX: 213-445-2791

TTE, INCORPORATED, 2251 Barry Ave., W. Los Angeles, CA 90064, Tel: 213-478-8224; FSC No.: 07766; Empl.: 30; *Sls. Mgr.:* S. J. Sodaro ..... **A•1708-1717**

T T I TESTRON INC., 41 Century Drive, Woonsocket, RI 02895, Tel: 401-766-9100, FAX: 401-766-9017; Empl.: 250; *Sls. Mgr.:* Carl Reed

TUCKER ELECTRONICS, Box 551419, Dallas, TX 75355-1419, Tel: 214-348-8800, 800-527-4642, TELEX: 79-1726, TWX: 62812862, FAX: 214-348-0367; Empl.: 43; *Sls. Mgr.:* Don Stabeno

TUMBLER CORP. CABLE DIV., 175 Kootenai Drive, Fremont, CA 94539, Tel: 415-657-3002, FAX: 415-770-1933; Empl.: 86; *Sls. Mgr.:* Vincent P. Lin

TUNGSTONE BATTERIES, INC., 18 Billings St., Sharon, MA 02067, Tel: 617-784-2000, FAX: 617-784-5563; Empl.: 23; *Sls. Mgr.:* William O'Connell





TURCK INC., 3000 Campus Drive, Minneapolis, MN 55441-2656, Tel: 612-553-9224, 1-800-328-0580, 1-800-544-PROX, FAX: 612-553-0708; Empl.: 75; *Sls. Mgr.:* Jerald L. Moser, Dir.of Sls.; *Dist. Mgr.:* Daniel P. Cina, Eastern Reg'l Sls. Mgr., Brad Nielson, Western Reg'l Sls. Mgr.

TUSONIX, INC., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, Tel: 602-744-0400, TELEX: 102-299640, TWX: 310-299640, FAX: 602-744-6155; FSC No.: 59660; Empl.: 800; *Sls. Mgr.:* Robert H. Jones; *Dist. Mgr.:* John H. Ohlrich

TUSTIN ELECTRONICS CO., 1580 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-5800, FAX: 714-777-5814; FSC No.: 7025-0010; *Sls. Mgr.:* Saul Tunkelrott

TWO TECHNOLOGIES,INC., 419 Sargon Way, Horsham, PA 19044, Tel: 215-441-5305, FAX: 215-441-0423; Empl.: 10; *Sls. Mgr.:* Joan Rickards

TWP, INC., 2133 4th St, Berkeley, CA 94710, Tel: 415-548-4434, TELEX: 171-267, FAX: 415-548-3073; Empl.: 10; *Sls. Mgr.:* C. Donahue

TYCO INSTR. DIV., See Data Instrs.

TYCOR INTERNATIONAL INC., 6107-6 Street S.E., Calgary, Alberta, Canada T2H 1L9, Tel: 403-259-3200, FAX: 403-253-0663; *Sls. Mgr.:* Scott Lee, Canadian

TYTON CORP., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223, Tel: 414-355-1130, 800-535-5552, TWX: 910-262-3094, FAX: 414-355-7341; *Sls. Mgr.:* Jim Campion, VP Sls.; *Dist. Mgr.:* Terry Tuttle

UCE, INC., 35 Rockland Rd., Norwalk, CT 06854, Tel: 203-838-7509, FAX: 203-838-2566; Empl.: 20; *Sls. Mgr.:* Greg Borstelmann

U. E. SYSTEMS, INC., 12 West Main St., Elmsford, NY 10523, Tel: 914-592-1220, 800-223-1325, TELEX: 229676, FAX: 914-347-2181; Empl.: 20

ULTRAN LABORATORIES, 139R North Gill St., State College, PA 16801, Tel: 814-238-9083, TELEX: 82-0978, FAX: 814-234-3367; FSC No.: 6625, 6635; Empl.: 20

ULTRA VOLT, CS9002, Ronkonkoma, NY 11779, Tel: 800-876-POWER, FAX: 516-363-2423; Empl.: 11; *Sls. Mgr.:* Jim Morrison ..... **D•2115**

ULTRONIX, INC., A Company of Vishay, P.O. Box 1090, Grand Junction, CO 81502, Tel: 303-242-0810, FAX: 303-242-5917; FSC No.: 05347; Empl.: 250; *Sls. Mgr.:* Rai Warzecha; *Dist. Mgr.:* Linda Million, Sls. Coord. ..... **A•1992-1995**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
AZ	Tempe, Dale Elctrns.	602-966-0291
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, V.E.C. San Diego	619-690-5112
CA	Tustin, V.E.C. Los Angeles	714-544-7024
CO	Loveland, V.E.C. Rockey Mtns.	303-667-7500
FL	Altamonte Springs, Semtronic Assocs.	407-831-8233
GA	Roswell, JWL Assocs.	404-993-0100
IL	Skokie, I.R.I. of IL	312-967-8430
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
KS	Olathe, Tech Sls.	913-829-2800
MD	Glen Burnie, Tri-Mark, Inc.	301-761-6000
MD	Lutherville, J.A. Dougherty Sls., Inc.	301-321-7890
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MA	Westwood, Comp Rep Assocs.	617-329-3454
MI	Plymouth, Jay Mktg.	313-459-1200
MN	Bloomington, I.R.I. of MN	612-854-8027
MO	St. Louis, Tech Sls.	314-521-2044
NJ	Flanders, K & R. Eng.	201-584-5235
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	E. Rochester, L-Mar Assocs.	716-381-9100
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Centerville, EMA, Inc.	513-433-2800
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5000
OH	Dayton, Scott Elctrns.	513-294-0539
OH	Reynoldsburg, Scott Elctrns.	614-863-1281
OR	Beaverton, L D Elctrns.	503-684-8221
PA	Horsham, T M I	215-441-4300
TX	Dallas, Edward F. Aymond Co.	214-826-7620
TX	Houston, Edward F. Aymond	713-943-3149
WA	Bellevue, UniComp, Inc.	206-869-5124
WA	Snohomish, L D Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Brooksfield, I.R.I. of Wisconsin	414-789-9393
Can	British Columbia, Kaytronics, Inc.	604-294-2000
Can	Concord, Ont., Kaytronics	416-669-2262
Can	Kanata, Ont., Kaytronics	613-564-0080
Can	Ville St. Laurent, Ont., Kaytronics	514-745-5800

ULVAC NORTH AMERICA CORPORATION, P.O. Box 799, 105 York Street, Kennebunk, ME 04043, Tel: 207-985-2973, TELEX: 46-9045, FAX: 207-985-4459; Empl.: 50; *Sls. Mgr.:* Susan Zilaro; *Dist. Mgr.:* Harold Baum

Ulveco

FAX: 713-977-5031

ULVECO, INC., 10401 West Office Dr., Houston, TX 77042, Tel: 1-800-527-7042; Empl.: 50; *Sls. Mgr.:* Ron Schneider ..... **A•2454-2457**

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Escondido, Van Gott & Assocs.	619-489-0893
CA	Santa Clara, Gagner-Toomey Assocs., Inc.	408-244-2200
CO	Franktown, MRC	303-660-8750
CT	Avon, Tom Maguire Assocs.	203-673-3019
FL	Maitland, E I R, Inc.	407-660-9600
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MN	Minneapolis, Electro-Serv Co.	612-338-3475
NH	Windham, Tom Maguire Assocs.	603-432-0363
NY	Plainview, Robert Smith Assocs.	516-681-3155
PA	Exton, Linear Sls.	215-524-8080
WA	Seattle, Northmar, Inc.	206-524-5170
WI	Thiensville, TFL Assocs. Inc	414-242-6800
Can	Toronto, Cana Reps.	416-250-6683

UNADILLA ANTENNA MFG. CO., Ballardvale Station, P.O. Box 4215, Andover, MA 01810, Tel: 508-475-7831, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* P. Jannini

FAX: 619-744-7320

UNDERWATER KINETICS, 1020 Linda Vista Dr., San Marcos, CA 92069, Tel: 619-744-7560; Empl.: 85; *Sls. Mgr.:* Greg Sippel ..... **C•1127-1129**

UNDERWOOD INDUSTRIES OF N.Y., INC., d/b/a Viking Products, 456 Broad St., P.O. Box 269, Waverly, NY 14892, Tel: 607-565-4551, FAX: 607-565-9650; Empl.: 7; *Sls. Mgr.:* Robert Pichette

UNGAR, Div. Eldon Inds., Inc., 5620 Knott Ave., Buena Park, CA 90621, Tel: 714-994-2510, TELEX: 4720750 Eldon, FAX: 714-523-7790; FSC No.: 78976; Empl.: 140; *Sls. Mgr.:* Richard Shivers; *Dist. Mgr.:* Dianna Maes

Local Sales Offices & Reps

AZ	Tempe, Rich Sls. Co.	602-968-7787
CA	Gardena, Ungar Sls. Assocs.	213-532-6837
CA	Mountain View, Production Innovation	415-968-0380
CA	San Clemente, Diversitech Reps.	714-366-1496
CO	Boulder, Intersys	303-443-5897
FL	Coral Springs, PSR Technlgs. Inc.	305-753-5732
GA	Lithia Springs, Effective Mktg. Force	404-948-6023
IL	Itsaca, LTD Technlgs.	708-773-2900
IN	Fishers, Rathsburg Assoc.	317-577-4500
MA	N. Reading, Yankee Tech	508-664-0865
MI	Farmington Hills, Rathsburg Assoc.	313-489-1500
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	St. Louis, Thomas L. Dowell & Assocs.	314-849-4234
NY	Orchard Park, Davis-Callahan Co.	716-662-5988
OH	Franklin, Wiethe & Young Assoc.	513-422-5959
OR	Tualitin, Weaver & Assocs. Inc.	503-691-0665
PA	Spring City, Classen & Doolittle Assocs.	215-948-5958
TX	Dallas, Rich Sls.	214-257-0761
TX	Round Rock, Rich Sls.	512-244-0205
EXP	Inglewood, Eldon Industries, Inc.	213-642-7716

UNHOLTZ-DICKIE CORP., 6 Brookside Dr., Wallingford, CT 06492, Tel: 203-265-3929, FAX: 203-265-2690; Empl.: 45

UNIBOX, Div. of Amerex, P.O. Box 2815, Riverside, CA 92516, Tel: 714-686-1400; *Sls. Mgr.:* Kim Dabe

UNICO, 3725 Nicholson Rd., Franksville, WI 53126-0505, Tel: 414-886-5678, TWX: 910-271-2385, FAX: 414-886-8396; Empl.: 250; *Sls. Mgr.:* Joseph Glover

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FAX: 201-674-3803

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700, 800-526-1389; FSC No.: 04729; Empl.: 82; *Sls. Mgr.:* B. Levine ..... **C•1598-1599**

Local Sales Offices & Reps

CA	Irvine, The Hapco Group	714-474-8474
CO	Wheatridge, Skip Jutze Assoc.	303-231-0900
CT	Lyme, Gerard M. Blaney Assoc.	203-434-9497
IL	Addison, Houlihan Sls. Co.	708-543-7200
NJ	Ramsey, R.W. Rundle Assocs.	201-327-4151
PA	Doylestown, George Recentio Assocs.	215-348-7577

UNIMAX SWITCH CORP., See C & K/Unimax, Inc.

UNIMEASURE, INC., 7055 N.W. Grandview Dr., Corvallis, OR 97330, Tel: 503-757-3158, FAX: 503-757-0858

UNION CARBIDE CHEMICALS & PLASTICS COMPANY INC., Industrial Chemicals Div., Crystal, 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123, Tel: 619-279-4500, FAX: 619-565-8926; Empl.: 125; *Sls. Mgr.:* L R Rothrock

UNIPLEX CORP., 221 E. Little Canada Rd., St. Paul, MN 55117, Tel: 612-490-1936, FAX: 612-490-0495; Empl.: 8; *Sls. Mgr.:* M. Bryan

UNIPOWER CORPORATION

FAX: 305-971-1837

UNIPOWER CORPORATION, 2981 Gateway Dr., Pompano Bch., FL 33069-4803, Tel: 305-974-2442; FSC No.: 62125; Empl.: 65; *Sls. Mgr.:* Warren Peters, Mgr. Tech. Sls. ..... **D•2116-2130**

Local Sales Offices & Reps

AL	Huntsville, Marco Mktg.	205-883-9630
AZ	Phoenix, Shefler-Kahn	602-257-0884
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	Santa Clara, Gagner-Toomey	408-244-2200
CO	Denver, AKI Enterprises	303-388-4488
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	407-425-6149
IL	Itasca, Beta Technlg. Sls.	708-250-9586
IA	Cedar Rapids, Stan Clothier	319-393-1576
KS	Olathe, Stan Clothier	913-829-0073
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MO St. Charles, Stan Clothier 314-928-8078
NY Great Neck, F & F Metro 516-482-4080
NY Rochester, Elcom Sls. Inc. 716-385-1400
NY Syracuse, Elcom Sls. Inc. 315-685-8967
NC Charlotte, RG Sls. 704-531-0096
OH Columbus, McFadden Sls. 614-761-3177
PA Blue Bell, Deltatronics 215-641-9930
TX Houston, Jim D. Gray Assocs. 713-342-1710
TX Richardson, Jim D. Gray Assocs. 214-699-9976
VA Pohaton, Deltatronics 804-492-9027
Can Mississauga, Andy Bauman Assocs. .. 416-828-2600
Can W. Vancouver, Leister Blake Entprs. ... 604-926-6127

Local Distributors

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CA San Jose, ForeSight Elctrns. 408-453-0219

UNI-POWER HYBRIDS INTERNATIONAL, See Hybrids Intl. Ltd., Thick Film Div., and Hi-Q Crystals, Hybrids Intl. Ltd.

UNIT DESIGN, 1811 N. Case St., Orange, CA 92665, Tel: 714-282-8100, TWX: 910-250-0136, FAX: 714-526-0119; Empl.: 15; *Sls. Mgr.:* Bill Potter

UNITED CHEMI-CON

FAX: 708-640-6341

UNITED CHEMI-CON INC., 9801 W. Higgins Rd., Rosemont, IL 60018, Tel: 708-696-2000; Empl.: 65; *Sls. Mgr.:* R. Donham ..... **A•1148-1149**

Local Sales Offices & Reps

PA Spring House, Hartmaier, Assoc. 215-643-6691
AL Huntsville, R. O. Whitesell 205-883-5110
CA Irvine, English/Damco Sls. 714-753-1950
CT Plainville, Northeast Reps 203-866-6030
GA Norcross, R. O. Whitesell 404-449-9190
IL Chicago, M. Gottlieb Assocs. 312-775-1151
IN Indianapolis, R. O. Whitesell 317-876-9000
KS Overland Pk., Spectrum Sls. 913-648-6811
KY Versailles, R. O. Whitesell 606-873-1182
MA Hingham, Northeast Reps. 617-749-8700
MI Grand Rapids, R. O. Whitesell 616-942-5420
MI Southfield, R. O. Whitesell 313-559-5454
MI St. Joseph, R. O. Whitesell 616-983-7337
MN Plymouth, Twist Co. 612-550-0922
NH Mt. Vernon, Northeast Reps 603-880-8199
NJ Englewood Cliffs, Caravan Sls., Corp. 201-567-7600
NY Hauppauge, Aurora Mktg. 516-434-1313
NY Pittsford, Franklin Sls. Corp. 716-248-8251
NC Greensboro, Caravan Sls. 919-271-2668
NC Raleigh, Tingen Tech Sls., Inc. 919-870-7123
OH Cincinnati, R. O. Whitesell 513-521-2290
OH Cleveland, R. O. Whitesell 216-447-9020
OH Columbus, R. O. Whitesell 614-888-9396
OH Dayton, R. O. Whitesell 513-298-9546
OR Beaverton, Earl & Brown 503-639-2100
PA Ambler, W.R. Hartmaier 215-643-6691
PA Pittsburgh, R. O. Whitesell 412-963-6161
TN Knoxville, R. O. Whitesell 615-694-9476
TX Austin, Mil-Rep 512-346-6331
TX Houston, Mil-Rep 713-444-2557
TX Richardson, Mil-Rep 214-644-6731
WA Redmond, Earl & Brown 206-885-5064
Can Richmond Hill, Renmark Elctrns. 416-881-8844

Local Distributors

AL Huntsville, Hammond Elctrns 205-830-4764
AL Huntsville, Resistacap 205-883-4270
AZ Phoenix, Arizona Comps. 602-269-5655
AZ Tempe, Bell Inds. 602-269-5655
AZ Tempe, Future Elctrn. 602-968-7140
AZ Tempe, Time Elctrns. 602-967-2000
CA Agoura Hills, Bell Inds. 818-706-2608
CA Agoura Hills, Time Elctrns. 818-707-2890
CA Anaheim, Time Elctrns. 714-937-0911
CA Camarillo, Milgray Elctrns. 800-635-7812, 805-484-4055
CA Chatsworth, Future Elctrns. 818-700-0914
CA Chatsworth, Passive Comps. 818-700-8838
CA Fountain Valley, Components Ctr. 714-979-0433
CA Irvine, Kelex Elctrns. 714-863-1230
CA Irvine, Milgray Elctrns. 714-753-1282
CA Irvine, S.A.I. 213-376-0861
CA Riverside, Elctrn. Supp. 714-683-7300
CA San Diego, Elctrn. Supp. 619-693-8222
CA Santa Clara, Components Ctr. 408-988-6931
CA Sunnyvale, Capsco Sls., Inc. 408-734-3020
CA Tustin, Capstone Elctrns. 713-730-0349
CA Tustin, Projections Unltd. 714-544-2700
CO Denver, Capstone Elctrns. 303-375-1300
CO Englewood, Nep Elctrns. 303-799-9898
CO Englewood, Time Elctrns. 303-799-8851
CO Westminster, Future Elctrns. 303-650-0123
CO Wheatridge, Bell Inds. 303-424-1985
CT Bethel, Future Elctrns. 203-743-9594
CT Cheshire, Time Elctrns. 203-271-3200
CT East Haven, JV Elctrns. 203-469-2321
CT Milford, Milgray 800-922-6911
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Altamonte Springs, Bell Inds. 407-339-0078
FL Altamonte Springs, Future Elctrns. 407-767-8414
FL Altamonte SPrings, S.A.I. 407-831-6201
FL Clearwater, Future Elctrns. 813-578-2770
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112
FL Ft. Lauderdale, Time Elctrns. 305-974-4800
FL Longwood, RM Elctrns. 407-862-9191
FL Tampa, Reptron Elctrns. 813-855-4656
FL Winter Pk., Milgray Elctrns. 800-241-5523
GA Atlanta, Time Elctrns. 404-984-0923
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Future Elctrns. 404-441-7676
GA Norcross, Hammond Elctrns. 404-449-1996
GA Norcross, Milgray Elctrns. 800-241-5523
GA Norcross, Reptron Elctrns. 404-446-1300
IL Arlington Hgts., Milgray Elctrns. 800-322-6271
IL Elk Grove Vlg., Bell Inds. 708-640-1910
IL Itasca, Capstone Elctrns. 708-250-0300
IL Northbrook, Classic Comps. 708-272-9650
IL Rolling Meadows, RM Elctrns. 708-358-0300
IL Schaumburg, Future Elctrns. 708-882-1255
IL Schaumburg, Reptron Elctrns. 708-882-1700
IL Schaumburg, Time Elctrns. 708-303-3000
IL Wood Dale, Nep Elctrns. 708-595-8500
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Classic Comps. 317-872-4777
IN Indianapolis, RM Elctrns. 317-291-7110
KS Overland Pk., Milgray Elctrns. 800-255-6576, 913-236-8800
MD Columbia, Future Elctrns. 301-290-0600
MD Columbia, Milgray Elctrns. 800-638-6656
MD Columbia, Time Elctrns. 301-964-3090
MA Andover, Bell Inds. 508-474-8880
MA Chelmsford, TLC/Shelly-Ragon 508-250-9666
MA Hopkinton, Interface Elctrns. 508-435-6858
MA Peabody, Time Elctrns. 508-532-9756
MA Sandwich, JV Elctrns. 508-833-0700
MA Sutton, EAC 508-865-0722
MA Westborough, Future Elctrns. 508-366-2400
MA Wilmington, Capstone Elctrns. 508-657-5874
MA Wilmington, Milgray Elctrns. 800-334-6941
MA Wilmington, North Star Elctrns. 508-657-5155
MA Wilmington, S.A.I. 617-938-5460
MI Ann Arbor, Bell Inds. 313-971-9093
MI Grand Rapids, RM Elctrns. 616-531-9300
MI Livonia, Reptron Elctrns. 313-525-2700
MN Chanhassen, G&F Distbn. 612-934-8225
MN Eden Prairie, Future Elctrns. 612-944-2200
MN Eitzen, Capacitor Assocs. 507-495-3306
MN Minnetonka, Reptron Elctrns. 612-938-0000
MN New Brighton, Parts One 612-633-8079
MO St. Louis, Time Elctrns. 314-391-6444
NH Nashua, Brevan Elctrns. 603-889-7230
NJ Marlton, Milgray Elctrns. 800-257-7111
NJ Mt. Laurel, Capstone Elctrns. 609-727-7800
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NJ Parsippany, Milgray Elctrns. 800-622-0291
NJ Rockaway, Tonar Inds. 201-586-9000
NJ Teterboro, EAC 201-288-4477
NM Albuquerque, Bell Inds. 505-292-2700
NY Brooklyn, Chip Technlg. 718-251-8300
NY Canandiaga, Advacom, Inc. 716-396-9050
NY E. Syracuse, ADR Technlgs. 315-437-7087
NY Farmingdale, Milgray Elctrns. 800-645-4729
NY Hauppauge, Time Elctrns. 516-273-0100
NY Liverpool, Future Elctrns. 315-451-2371
NY Melville, S.A.I. 516-293-2710
NY Penn Yan, Advacom 315-536-2221
NY Rochester, Masline Elctrns. 716-546-5373
NC Charlotte, Time Elctrns. 704-522-7600
NC Charolette, Elctrn. Mktg. Corp. 704-394-6195
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Capstone Elctrns. 919-954-0600
NC Raleigh, Century Elctrn. Comps. 919-782-2116
NC Raleigh, EAC 919-970-9700
NC Raleigh, Milgray Elctrns. 800-562-3118
NC Raleigh, Sager Elctrns. 919-850-9550
OH Cleveland, Milgray Elctrns. 800-321-0006
OH Columbus, Elctrn. Mktg. Corp. 614-299-4161
OH Dayton, Bell Inds. (Indl.) 513-435-8660
OH Dayton, Elctrn. Mktg. Corp. 513-439-4711
OH Dublin, Time Elctrns. 614-761-1100
OH Highlands Hills, Elctrn. Mktg. Corp. 216-442-3441
OH Solon, Reptron Elctrns. 216-349-1415
OR Beaverton, Future Elctrns. 503-645-9454
OR Lake Oswego, Bell Inds. 503-635-6500
PA Exton, VSH 215-363-2250
PA King of Prussia, Time Elctrns. 215-337-0900
PA Malvern, Interface Elctrns. 215-889-2060
PA McKean, Advacom 814-476-7774
PA McKean, Advacom, Inc. 814-476-7774
PA Norristown, Century Elctrn. Comps. ... 215-631-5400
PA Philadelphia, Future Elctrns. 609-778-7600
PA York, E.C.I. 717-846-5334
SC Greensville, Hammond Elctrns. 803-233-4121
TX Austin, Kent Elctrns. 512-834-1900
TX Carrollton, Capstone Elctrns. 214-380-9049
TX Dallas, Milgray Elctrns. 800-637-7227
TX Houston, Time Elctrns. 713-530-0800
TX Irving, HArper, S.I.D. 214-621-0500
TX Richardson, Bell Inds. 214-690-0466
TX Richardson, S.A.I. 214-231-6330
UT Midvale, Bell Inds. 801-255-9611
UT Salt Lake City, Future Elctrns. 801-972-8489
UT Salt Lake City, Milgray Elctrns. 800-537-9739
UT Salt Lake City, Standard Supp. Co. 801-486-3371
UT W. Valley, Time Elctrns. 801-973-8181
VT Rutland, S.A.I. 802-775-7126
WA Bothell, Projections Unltd. 206 485-2147
WA Redmond, Capsco Sls., Inc. 206-869-7400
WA Redmond, Future Elctrns. 206-881-8199
WA Redmond, Time Elctrns. 206-882-1600
WI New Berlin, Classic Comps. 414-786-5300
WI New Berlin, Nep Elctrns. 414-785-9100
WI Waukesha, Bell Inds. 414-547-8879
Can Calgary, Zentronics 403-295-8838
Can Mississauga, Time Elctrns. 416-672-5300
Can Mississauga, Zentronics 416-564-9600
Can Nepean, Carsten Elctrns. 613-726-9250
Can Ottawa, Future Elctrns. 613-820-8313
Can Richmond, Electrosonics, Inc. 604-273-2911
Can Richmond, Zentronics 604-273-5575
Can Scarborough, Carsten Elctrns. 416-495-7705
Can Willowdale, Milgray Elctrns. 800-268-3315, 416-756-4481

UNITED ELECTRIC CONTROLS, P. O. Box 9143, Watertown, MA 02272-9143, Tel: 617-926-1000, TELEX: 92 2445, FAX: 617-926-2568; Empl.: 420; *Sls. Mgr.:* Dave Williams; *Dist. Mgr.:* George Miller

UNITED FOAM PLASTICS, 172-Q E. Main St., Georgetown, MA 01833, Tel: 508-352-2200, TWX: 710-347-0315, FAX: 508-352-7169; FSC No.: 55900; Empl.: 200; *Sls. Mgr.:* R.L. Bailly

Local Sales Offices & Reps

AL Decatur, United Foam Plastics Corp. .. 205-351-0800
CT Pawcatuck, United Foam Plastics 203-599-1242
FL Kissimee, United Foam Plastics Corp. 407-933-4880
GA Fairburn, United Foam Plastics 404-964-5888
NJ Somerset, United Foam Plastics 201-560-9550
PA Bridgeport, United Foam Plastics 215-272-5430

UNITED PRICING REPORTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

UNITED SOLDER WRAP INC., See Vector Elctrn. Co., Solderwrap of CA, Inc.

UNITED STATES CRYSTAL CORP., 3605 McCart St., Fort Worth, TX 76110, Tel: 817-921-3014, TWX: 910-893-4084, FAX: 817-923-0424; FSC No.: 52847; Empl.: 75; *Sls. Mgr.:* Jan Henderson

UNITED STATES ELECTRONICS, 60 Brown Ave., Springfield, NJ 07081, Tel: 201-912-0111, FAX: 201-912-0015; Empl.: 20

UNITED SUPERTEK, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0730, FAX: 408-922-0534; Empl.: 55; *Sls. Mgr.:* Roger Meade

UNITED TECHNOLOGIES CONTROL SYSTEMS, 131 Godfrey St., Logansport, IN 47401, Tel: 219-747-6142, TWX: 810-295-0699; Empl.: 3,700; *Sls. Mgr.:* Terry Smith

UNITED TECHNOLOGIES MICROELECTRONICS CENTER, United Technologies Corp., 1575 Garden of The Gods Rd., Colorado Springs, CO 80907, Tel: 719-594-8000, 1-800-MIL-UTMC, FAX: 719-594-8032; Empl.: 485; *Sls. Mgr.:* Dwight Deem

UNITED WIRE & CABLE CORP., 425 Shrewsbury St., Worcester, MA 01604, Tel: 508-757-3872, FAX: 508-753-2173; FSC No.: 51348; Empl.: 10; *Sls. Mgr.:* T. P. Andrews

UNIT INDUSTRIES, 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-4161, FAX: 714-871-4164; FSC No.: 0AMM9; Empl.: 40; *Sls. Mgr.:* D. Molby

UNITRACK INDUSTRIES, INC., 1372 Enterprise Dr., Goshen Corp. Pk., P.O. Box 1927, West Chester, PA 19380, Tel: 215-692-0800; *Sls. Mgr.:* Anna Orcutt

UNITREK CORPORATION, 3000 Lewis & Clark Hwy., Ste.2, Vancouver, WA 98661, Tel: 206-699-7277, FAX: 206-694-6930; Empl.: 40; *Sls. Mgr.:* John Sailer

UNITRODE CORP., 580 Pleasant St., Watertown, MA 02172, Tel: 617-926-0404, FAX: 617-924-1235; Empl.: 2,000; *Sls. Mgr.:* Leslie Wallace; *Dist. Mgr.:* Ron Myers

UNITRON INC., 10925 Miller Rd., Dept. EE, Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511, FAX: 214-341-2099; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* James Baker

UNIVERSAL AD-YU/D-F INC., 2517 E. Norwich St., Milwaukee, WI 53207, Tel: 414-482-4100; FSC No.: 90101; Empl.: 10; *Sls. Mgr.:* Ronald Tessmer

UNIVERSAL DATA SYSTEMS, INC., Motorola Information Systems Group, 5000 Bradford Dr., Huntsville, AL 35805-1993, Tel: 205-430-8000, TELEX: 752602 UDS HTV, FAX: 205-830-5657; Empl.: 950; *Sls. Mgr.:* Tony Zalenski

UNIVERSAL INSTRS. CORP., MECHANIZED ELCTRN. ASSEMBLY (MEA) DIV., See Mechanized Elctrn. Assembly Div., Universa

UNIVERSAL MFG., CO. INC., 1168 Grove St., Irvington, NJ 07111, Tel: 201-374-9800, TELEX: 710-995-4647, FAX: 201-374-2265; Empl.: 60; *Sls. Mgr.:* Martin Mayer; *Dist. Mgr.:* Martin Mayer

FAX: 914-241-3129

UNIVERSAL VOLTRONICS CORP, Thermedics Inc./ThermoElctron Corp., 27 Radio Circle Dr., Mt. Kisco, NY 10549, Tel: 914-241-1300, TWX: 710-571-2142; FSC No.: 14225; Empl.: 85 ..... **D•2131-2133**

Local Sales Offices & Reps

FL	Satellite Beach, BWS Microwave Marktg.	407-773-6170
MA	Whitinsville, Power Factor & Assocs.	617-234-6415
NV	Las Vegas, Trembly Assoc., Inc.	702-739-9770
NM	Albuquerque, Trembly Assoc., Inc.	505-266-8616
PA	Audubon, Holmes Assocs.	215-666-0636
PA	Audubon, Holmes Assocs., Inc.	215-666-0636
TX	El Paso, Trembly Assocs., Inc.	915-533-9380
UT	No. Salt Lake City, Trembly Assocs., Inc.	801-295-4703
Can	Nepean, Ont., Datacomp Elctrns.	613-723-8825
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

Local Distributors

AZ	Phoenix, Trembly Assoc. Inc.	602-967-2058
CO	Wheat Ridge, Trembly Assoc. Inc.	303-421-8900
NV	Las Vegas, Trembly Assoc. Inc.	702-739-9770
NM	Albuquerque, Trembly Assoc. Inc.	505-266-8616
TX	El Paso, Trembly Assoc. Inc.	915-533-9380
UT	North Salt Lake, Trembly Assoc. Inc.	801-295-4703
EXP	London, England, Stansberry Assoc. Int'l, Inc.	01-467-0535
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

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UPSYSTEMS, INC., Subsidiary of Chloride Power Elec., One Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, FAX: 716-538-6345; FSC No.: 3698; *Sls. Mgr.:* Steve Olson

URBAN ELECTRONICS, P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 50; *Sls. Mgr.:* G. Urban

USAR SYSTEMS, INC., 568 Broadway Ste. 405, New York, NY 10012, Tel: 212-226-2042, FAX: 212-226-3215; Empl.: 3; *Sls. Mgr.:* Yannis Milios

FAX: 206-576-0515

U. S. DIGITAL CORP., 8409 N.W. 15th Court, Vancouver, WA 98665, Tel: 206-576-0514, 800-736-0194 (Sales); *Sls. Mgr.:* David Madore ..... **B•1952-1955**

Local Sales Offices & Reps

VA	Roanoke, Engrg. & Mktg. Corp. of VA	703-562-0726

Local Distributors

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USD PRODUCTS , Div. of Bussmann, 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-4600, FAX: 708-867-2211; Empl.: 200; *Sls. Mgr.:* Mr. Chris Osmun

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 818-786-6381, FAX: 818-902-4516; FSC No.: 88245; Empl.: 100; *Sls. Mgr.:* Peggy Slattery

U.S. ELCO,INC., 2930 Scott Blvd., Santa Clara, CA 95054, Tel: 1-800-888-ELCO, FAX: 408-980-9754; *Sls. Mgr.:* Douglas Hemingway

U.S. INSTRUMENT RENTALS, INC., AT&T Capital Corp., 1830 West Airfield Drive, D/FW Airport, TX 75261, Tel: 800-874-7123; Empl.: 500; *Sls. Mgr.:* Greg Lapham

U. S. LASER CORP., 825 Windham Court North, Wyckoff, NJ 07481, Tel: 201-848-9200, FAX: 201-848-9006; Empl.: 25; *Sls. Mgr.:* James F. Golden

U.S. POWER/RELCO MIDWEST, U.S. Power Converting Co., 8830 West 61st North, Wichita, KS 67205, Tel: 316-722-6440; Empl.: 12; *Dist. Mgr.:* Jonathan P. Snow ..... **C•1092; D•2027**

U.S. POWER CONVERTING COMPANY/RELCO, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, Tel: 213-316-9984, FAX: 213-316-9050; Empl.: 8; *Sls. Mgr.:* Van Snow; *Dist. Mgr.:* Tom Clark ..... **C•1092; D•2027**

Local Sales Offices & Reps

KS	Wichita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616
Can	Torrance, U.S. Power Conv. Co.	213-316-9984

Local Distributors

CA	Torrance, U.S. Power Converting/L. Snow & Assocs.	213-316-9984
KS	Witchita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

U.S. SENSOR CORP., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000, FAX: 714-639-1220; Empl.: 25 ..... **B•1871**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls. Inc.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls. Inc.	602-577-5146
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Englewood, Compass Mktg. & Sls., Inc.	303-721-9663
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
IL	Downers Grove, Richmar Elctrns. Corp.	708-968-0118
IN	Indianapolis, Richmar Elctrns. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
MA	Canton, John Ferrari Co.	617-821-4599
MI	Farmington, J.P.Bergin Assocs.	313-471-7940
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-344-9990
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
WI	Butler, Richmar Elctrns. Corp.	414-781-1730

U.S. TERMINALS INC., 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, FAX: 513-561-8755; FSC No.: 12615; Empl.: 45; *Sls. Mgr.:* George L.Stepp ..... **C•1563**

Local Sales Offices & Reps

AZ	Phoenix, Gramer & Co.	602-942-1415
FL	Melbourne, Jerry Williams, Inc.	407-259-7700
IL	Chicago, LTD Technologies	708-773-2900
IL	Itasca, LTD Technologies	708-773-2900
IA	Cedar Rapids, J.R. Sls. Engrg, Inc.	319-393-2232
IA	Cedar Rapids, J.R. Sls.Engrg,Inc.	319-393-2232

FAX: 818-287-7350

U.S. TOYO FAN CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-5297; Empl.: 20; *Sls. Mgr.:* Peter Jeanseau; *Dist. Mgr.:* Peter Jeanseau ..... **C•1668-1669**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Oceanside, Noo Rep Tech Sls.	619-941-0558
CA	San Gabriel, U.S. Toyo Fan Corp.	818-287-5297
CA	Santa Clara, U.S. Toyo Fan Corp.	408-988-1260
FL	Winter Springs, Sunland Assocs.	407-365-9533
IL	Downers Grove, Golten Assoc.	708-512-0093
IA	Cedar Rapids, Stan Clothier Co.	319-393-1576
KS	Olathe, Stan Clothier Co.	913-829-0013
MD	Cockeysville, Dalbrook Corp.	301-666-2212
MI	Farmington Hills, W. R. Hummon	313-474-0661
MN	St. Paul, Innovate Sls.	612-225-9772
MO	St. Charles, Stan Clothier Co.	314-928-8078
NJ	Fort Lee, Nepture Elec.	201-461-2789
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NY	Plainview, Neptune Elec.	516-349-1600
NC	Matthews, Arthur, Harris & Assoc.	704-845-1085
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix	513-252-6700
OR	Beaverton, Unicomp, Inc.	503-643-1645
PA	Allison Pk., Geotronix Inc.	412-487-1770
PA	Colmar, Dalbrook Corp.	215-997-2770
TX	Richardson, Zonk Assocs.	214-238-7651
TX	Stafford, Zonk & Assocs.	713-561-7777
WA	Snohomish, Unicomp, Inc.	206-568-0511
PR	Santruce, SISCO	809-726-3137
Can	Islington, Ont., Pipe-Thompson Ltd.	416-236-2355

Local Distributors

AZ	Phoenix, Aero-Space Southwest	602-269-5655
CA	Anaheim, Almo/Pacesetter	714-777-4711
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CA	Tustin, Added Value Elctrns. Distr.	714-259-8258
MN	Fridley, Voyager Elect.	612-571-7766
UT	Salt Lake City, Added Value Elect.	801-975-9500
IL	Elk Grove, Martec Assocs.	708-956-8090
MD	Beltsville, Petricko Sls.	301-937-4960
MA	Haverhill, Cord Elctrns.	617-374-0100
MI	Farmington Hills, Versatron	313-474-0667
MN	Fridley, Voyager Elec.	612-571-7766
NV	Las Vegas, Kiesub Corp.	702-733-3888
NJ	Corbin City, Index	609-628-4040
NM	Albuquerque, Betatron	505-821-1122
NY	Elmsford, Multimeterics	914-347-3666
NY	Endwell, Pryme-Line Distr.	607-748-5200
OH	Richfield, Alpha Distr. Corp.	216-659-7100
OR	Beaverton, Hansen Elctrns.	503-642-4455
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
TX	Richardson, Zec Sls.	214-669-0895
Can	Mississauga, Ont., Rush Elex. Ltd.	416-677-7280

UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 908-922-1009, TELEX: 13-2461, FAX: 908-922-0848; FSC No.: 23261; Empl.: 35

UTI INSTRUMENTS CO., 2030 Fortune Drive, San Jose, CA 95131, Tel: 408-428-9400, FAX: 408-428-0823; Empl.: 80; *Sls. Mgr.:* Clyde Madsen

UVP, INC., 5100 Walnut Grove Ave., P.O. Box 1500, San Gabriel, CA 91778, Tel: 818-285-3123, TELEX: 371 6381, FAX: 818-285-2940; Empl.: 100

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FAX: 619-457-0127

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CA	San Jose, ARC Tech. Resources	408-263-6486
CA	Sunnyvale, ARC Technical Resources	408-773-8871
CA	Torrance, Cutlass Elctrns.	213-324-7360
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GA	Duluth, Currie, Peak & Frazier	404-497-9404
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MA	Hopkinton, Eastern Sys.	508-435-2151
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MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co., Inc.	816-436-6445
NY	Rochester, Eastern Systems	716-292-1460
NC	Charlotte, Currie, Peak & Frazier	704-846-1702
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Englewood, Carter, McCormic & Peirce (CMP)	513-836-0951
OH	Parma, Carter, McCormic & Peirce (CMP)	216-398-0400
OK	Tulsa, AIREP Elctrns.	918-592-7711
OR	Portland, Westcon, Inc.	503-283-0132
PA	Philadelphia, Robert Meyers Assocs.	215-224-1663
PA	Pittsburg, Carter, McCormic & Peirce (CMP)	412-826-3800
TX	Austin, AIREP Elctrns.	512-327-0778
TX	Dallas, AIREP Elctrns.	214-349-4360
TX	Tomball, AIREP Elctrns.	713-255-2828
VA	Hampton, Sel-Tronics	804-827-6308
WI	New Berlin, Comtel Midwest Co.	414-544-6042

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MD	Sparks, EIL Instruments	301-771-4800
NY	Rochester, Transcat	716-458-4801
NC	Charlotte, EIS	704-392-7366

VALIDYNE ENGINEERING CORPORATION, 8626 Wilbur Ave., Northridge, CA 91324, Tel: 818-886-2057, TELEX: 65-1303, FAX: 818-886-6512; Empl.: 200

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VALOR

FAX: 619-458-0875

VALOR ELECTRONICS, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, Tel: 619-458-1471, TELEX: 653406 VALORSD; FSC No.: 15003; Empl.: 2000; *Sls. Mgr.:* Brad Rogers; *Dist. Mgr.:* Bill Karlicek ..... **A•1606-1607; D•2134**

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AZ	Scottsdale, American Mktg., Inc.	602-948-2778, FAX:602-860-4455
CA	Garden Grove, Elsco Elctrns.	714-891-4621, FAX:714-891-1251
CA	Santa Clara, Fahrner-Miller Assocs.	408-727-9800, FAX:408-496-6952
CO	Englewood, Comp. Sls.	303-779-8060, FAX:303-779-8357
FL	Orlando, So. Atlantic Comp.	407-857-3650, FAX:407-857-3298
FL	Seminole, So. Atlantic Comp.	813-595-6397, FAX:407-857-3298
GA	Norcross, Benchmark	404-446-1711, FAX:404-448-2854
IL	Arlington Hgts., KMA	708-398-5300, FAX:708-398-5708
MD	Annapolis, Electronic Eng.	301-249-0616, FAX:301-249-0617
MA	Topsfield, Whitehead Assocs. Inc.	617-887-8050, FAX:617-887-5434
MI	Canton, Techrep Inc.	313-981-1950, FAX:313-981-2006
MN	Minneapolis, DeBeck-Hays Assocs. Inc.	612-835-3610,FAX:612-835-0515
NJ	Kinnelon, Ashtec, Inc.	201-838-3467, FAX:201-838-5773
NJ	Marlton, BGR Assocs.	609-983-1020, FAX:609-983-1879
NY	Port Washington, Ashtec Inc.	516-767-0336, FAX:516-767-0981
OH	Dayton, KW Elctrn. Sls.	513-890-2150, FAX:513-890-5408
OH	Shaker Hgts., KW Elctrn. Sls.	216-491-9177, FAX:216-491-9102
TX	Austin, Kruvand	512-219-9441,FAX:512-219-1932
TX	Dallas, Kruvand	214-437-3355,FAX:214-680-8854
UT	Midvale, Comp. Sls.	801-561-5099, FAX:801-561-6016
VA	Midlothian, Elctrns. Engr.	804-794-8939, FAX:804-794-6090
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WI	Milwaukee, KMA	414-259-1771,FAX:414-259-0246
PR	Rio Piedras, D.K. Mktg.	809-765-5380, FAX:809-758-5380

Local Distributors

AL	Huntsville, Hall-Mark Elctrns. Corp.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns. Corp.	602-437-1200
CA	Chatsworth, Hall-Mark Elctrns. Corp.	818-773-4560
CA	Duluth, Hall-Mark Elctrns. Corp.	404-623-4400
CA	Irvine, Hall-Mark Elctrns. Corp.	714-727-6000
CA	Rocklin, Hall-Mark	916-624-9781
CA	San Diego, Hall-Mark Elctrns. Corp.	619-268-1201
CA	San Jose, Hall-Mark Elctrns. Corp.	408-432-4000
CO	Englewood, Hall-Mark Elctrns. Corp.	303-790-1662
CT	Cheshire, Hall-Mark Elctrns. Corp.	203-271-2844
FL	Casselberry, Hall-Mark Elctrns. Corp.	407-830-5855
FL	Largo, Hall-Mark Elctrns. Corp.	813-541-7440
FL	Pompano Bch., Hall-Mark Elctrns. Corp.	305-971-9280
IL	Wood Dale, Hall-Mark Elctrns. Corp.	708-860-3800
IN	Indianapolis, Hall-Mark Elctrns. Corp.	317-872-8875
KS	Lenexa, Hall-Mark Elctrns. Corp.	913-888-4747
MD	Columbia, Hall-Mark Elctrns. Corp.	301-988-9800
MA	Billerica, Hall-Mark Elctrns. Corp.	508-667-0902
MA	Needham, Cronin Elect.	617-449-5000
MI	Livonia, Hall-Mark Elctrns. Corp.	313-462-1205
MN	Eden Prairie, Hall-Mark Elctrns. Corp.	612-941-2600
MN	Roseville, Parts 1	612-633-8079
MO	Earth City, Hall-Mark Elctrns. Corp.	314-291-5350
NJ	Mt. Laurel, Hall-Mark Elctrns. Corp.	609-235-1900
NJ	Parsippany, Hall-Mark Elctrns. Corp.	201-515-3000
NY	Fairport, Hall-Mark Elctrns. Corp.	716-425-3300
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OH	Worthington, Hall-Mark Elctrns. Corp.	614-888-3313
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WI	New Berlin, Hall-Mark Elctrns. Corp.	414-797-7844

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VANN INSTRUMENTS, 1046 Vassar N.E., Albuquerque, NM 87106, Tel: 505-265-2498, FAX: 505-265-1030; *Sls. Mgr.:* Michael E. Vann

VARIAN ASSOCIATES, Electron Device Business, 3100 Hansen Way, Palo Alto, CA 94304, Tel: 415-493-4000, 800-544-4636, TELEX: 34 8476, FAX: 415-424-6276; FSC No.: 02845; Empl.: 10,700; *Sls. Mgr.:* John Beighley

VARIAN MICROWAVE EQUIP. DIV., Varian Assocs., Inc., 3200 Patrick Henry, Santa Clara, CA 95054, Tel: 408-496-6273, TELEX: 510-601-5674 MEDSC, TWX: 348476, FAX: 408-496-6235; FSC No.: 59782; Empl.: 300

VARIAN TEMPE ELCTRNS. DIV., Varian Assocs., 615 S. River Rd., Tempe, AZ 82581, Tel: 602-968-6790, FAX: 602-894-5381; Empl.: 265; *Sls. Mgr.:* Douglas Kim

VARITRONIX, See VL Electronics

VARTA BATTERIES, INC., 300 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-2500, 800-431-2154, TELEX: 996-548, FAX: 914-592-2667; *Sls. Mgr.:* Randy Nelson ..... **D•1497**

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PA	West Chester, TCA Assocs.	215-353-2022
TX	Richardson, Comp. Technlg.	214-783-8831
Can	Mississauga, Ont., K.C. Sls. & Mktg.	416-826-5435
Can	Mississauga, Ont., Nica Power Battery Corp.	416-828-7100

Local Distributors

AZ	Phoenix, Specific Energy Corp.	602-433-0288
CA	Escondido, Alexander Battery Co., West	619-480-4445
CA	Long Beach, Battery Specialties	213-437-1809
CA	Mtn. View, Energy Sls.	415-969-0800
CA	San Diego, Tauber Electronics	619-274-7242
CA	San Jose, Rose Elctrns.	408-943-0200
CO	Castle Rock, Access Battery	800-526-1020
CO	Denver, Car-Go Battery	303-296-8763
CO	Englewood, AVT	303-798-1958
FL	Altamonte Springs, TNR Tech., Inc.	407-682-4311
FL	Boca Raton, D & R Assocs.	407-997-8751
GA	Marietta, Synergistic Batteries	404-973-2220
GA	Norcross, Applied Power, Inc.	404-263-0421
HI	Honolulu, Pacific Energy Dvcs.	808-737-2021
IL	Donwers Grove, Telecommunications Dvcs.	312-971-3460
IL	Morton Grove, Power-pak, Inc.	708-966-6000
MD	Beltsville, Mark Elctrns.	301-595-5040
MA	Andover, Generation Elctrns.	508-683-1177
MA	Sharon, Adcour	800-232-3557
MI	Livonia, LWC Dists., Inc.	313-464-7700
MN	St. Paul, DC Battery	612-646-7478
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WA Redmond, Energy Sls., Inc. 206-883-2343
Can Burnaby, B.C., Enercell Technlgs., Inc. 604-435-2284
Can Mississauga, Ont., NICA Power Battery Corp. 416-828-7100

VASAK INDS., INC., 211 Eucalyptus Drive, El Segundo, CA 90245, Tel: 1-800-67-VASAK; Empl.: 10; *Sls. Mgr.:* John Vasak

VA-TRAN SYSTEMS INC., 677 Anita St. Ste. A , Chula Vista, CA 91911, Tel: 619-423-4555, FAX: 619-423-4604; Empl.: 10; *Sls. Mgr.:* J.E. Sloan

VECTOR ELECTRONIC CO., INC., 12460 Gladstone Ave., Sylmar, CA 91342, Tel: 818-365-9661, 800-423-5659, 800-426-4652, FAX: 818-365-5718; FSC No.: 82893; Empl.: 95; *Sls. Mgr.:* Greg Littler; *Dist. Mgr.:* J. Forman

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FL Clearwater, CM Mktg. 813-443-6390
GA Lilburn, Intl. Computer Specialists 404-381-5130
IN Ft. Wayne, M/S Sls. & Assocs., Inc. ... 219-436-3023
MA Hingham, Northeast Reps. Inc. 617-749-8700
MI Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
NJ Woodbridge, Jade Mktg., Inc. 201-750-2998
NM Albuquerque, Reptronix, Ltd. 505-292-1718
NY Mendon, Tech-Mark, Inc. 716-624-3840
PA Trevose, Omega Elctrn. Sls., Inc. 215-244-4000
TX Dallas, Norcom, Inc. 214-386-4888

National Distributors

Local Distributors

IL Chicago, Newark Elctrns. 312-784-5100
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
OH Cleveland, Pioneer Stand. Elec. 216-587-3600
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TX Ft. Worth, Allied Elctrns. 817-336-5401

VECTOR ELECTRONICS CO., Specialties Division, 3901 East La Palma Ave., Anaheim, CA 92807, Tel: 714-632-9842, 800-326-9888, FAX: 714-632-9779; Empl.: 95

VECTOR-VIZ INSTRUMENT DIV. OF THE VECTOR GRP., INC., 180 Liberty Street, Newburgh, NY 12550, Tel: 800-627-0943, FAX: 914-565-0597; Empl.: 14; *Sls. Mgr.:* Frank Menichello; *Dist. Mgr.:* Bill Quinn

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VECTRON LABORATORIES, INC., 166 Glover Ave., Norwalk, CT 06850, Tel: 203-853-4433, TWX: 710-468-3796, FAX: 203-849-1423; FSC No.: 27802; Empl.: 340; *Sls. Mgr.:* Larry Jawitz ..... **A•1484-1489**

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AL Huntsville, Saber Assocs. 800-327-0853
AZ Phoenix, J. Smith & Assoc. 602-267-0981
CA Mountain View, Schoenduve Corp. 415-962-8330
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CA Tarzana, Midwin & Olifson, Inc. 818-996-9093
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UT Salt Lake City, Techn. Mktg. Assocs. .. 801-483-1009
WA Seattle, Datacom 206-285-2525
Can Quebec, Microvolt Elctrns. 514-421-4164

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VEEDER-ROOT, 125 Powder Forest Dr., Simsbury, CT 06070-2003, Tel: 203-651-2700, FAX: 203-651-2750; Empl.: 1200; *Sls. Mgr.:* James Appelgren; *Dist. Mgr.:* Stephan Rosenthal

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VEETRONIX, INC., Box 480, Lexington, NE 68850, Tel: 308-324-4600; Empl.: 25; *Sls. Mgr.:* Eddie Howerter ..... **B•1790-1791**

VEGA PRECISION LABS., 800 Follin La., Vienna, VA 22180, Tel: 703-938-6300, FAX: 703-938-6311; FSC No.: 23115; Empl.: 180; *Sls. Mgr.:* Joe E. Bennett

VEKTREX ELECTRONIC SYSTEMS, INC., 7915 Silverton Ave.-Ste. 309, San Diego, CA 92126, Tel: 619-578-6787; FSC No.: 0BV42; Empl.: 5

VELMEX, INC., P. O. Box 38, East Bloomfield, NY 14443, Tel: 716-657-6151, 800-642-6446, FAX: 716-657-6153; Empl.: 30; *Sls. Mgr.:* R. Yurick

VELONEX, 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, FAX: 408-727-0389; Empl.: 25; *Sls. Mgr.:* Kevin M. Coffey

VELONEX, 6551 Loisdale Ct., Ste. 322, Springfield, VA 22150, Tel: 703-922-8005, FAX: 703-922-8007

VENABLE INDUSTRIES, INC., 3555 Lomita Blvd., Torrance, CA 90505, Tel: 213-539-2522, FAX: 213-539-4139; Empl.: 20; *Sls. Mgr.:* Shelley Ely

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CA Van Nuys, Halbar Assocs. 818-906-3941
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FL Largo, Labrant Tech. Sls. 813-536-8480
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MD Monkton, Imagitron Sls. Co., Inc. 301-374-5600
MA Burlington, Kitchen & Kutchen Inc. 617-229-2660
MI Royal Oak, Elctrl. Sys. Co. 313-542-1747
MN Minneapolis, PSI 612-944-8545
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NY Jericho, Metro Tech. Sls. 516-935-3330
NY Syracuse, T-Squared Elctrn. Sls. 315-463-8592
NY Victor, T-Squared 716-924-9101
NC Raleigh, DHR Mktg. Inc. 919-829-1970
OH Beachwood, Electronic Salesmasters, Inc. 216-831-9565
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AZ Tempe, TTI 602-431-1191
CA Agoura Hills, Zeus 818-889-3838
CA San Diego, Shelley-Ragon 619-453-7133
CA San Jose, Future 408-945-9100
CA San Jose, Shelley-Ragon 408-942-9111
CA Thousand Oaks, Bell Inds. 818-340-1940
CO Denver, TTI 303-429-6806
CT Bethel, Future 203-847-6442
CA Los Angeles, TTI 818-891-8885
CT Wallingford, TTI 203-284-7474
FL Clearwater, Future 813-441-4771
FL Orlando, TTI Inc. 305-849-1000
CA San Diego, TTI 619-748-2025
CA San Jose, TTI 408-946-5577
GA Norcross, TTI 404-662-0911
IL Lombard, Shelley Ragon 312-595-6633
CA San Jose, Zeus 408-629-4789
MA Lexington, Zeus 617-863-8800

MA	Wilmington, TTI Inc.	508-658-4700
MD	Columbia, TTI	301-995-1331
FL	Oviedo, Zeus	407-365-3000
MD	Columbia, Zeus	301-997-1118
MA	Westboro, Future	617-366-2400
MA	Tewksbury, JACO	508-640-0755
MN	Eden Prarie, TTI	612-944-5080
MN	St. Pauls, Shelley Ragon	612-642-2823
MO	St. Louis, Chelsea	314-426-4500
MD	Columbia, Jaco	301-995-6620
NJ	Mt. Carmel, TTI	609-234-6400
NJ	Mt. Laurel, Future	609-778-7600
FL	Tampa, JACO	813-628-8185
FL	Totowa, JACO	201-942-4000
NM	Albuquerque, Sterling	505-884-1900
NY	Hauppauge, Fairmont Elec. Sls.	516-231-3313
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Liverpool, Future	315-451-2371
NY	Port Chester, Zeus	914-937-7400
NY	Ronkonkoma, TTI Inc.	516-737-2000
NY	Ronkonkoma, Zeus	516-737-4500
NY	Valley Stream, L & S Elctrns.	516-561-2474
NC	Charlotte, TTI	704-522-0277
OH	Dayton, Zeus	513-293-6182
OH	Columbus, TTI	614-848-5757
OH	Dayton, Bell Micro-Mil	513-434-8231
TX	Richardson, JACO	214-235-9575
TX	Ft. Worth, TTI Inc.	817-595-3100
TX	Houston, Sterling	713-627-9800
TX	Richardson, Zeus	214-783-7010
UT	Salt Lake City, Future	801-972-8489
EXP	TX Ft. Worth, TTI	817-847-6666
WA	Bellevue, Future	206-881-8199
WA	Redmond, TTI	206-883-3776
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710

VERNITRON CONTROLS, Vernitron Corporation, See Magtech Controls, Vernitron Corporation

VERNITRON ELEC. COMPS., See Beau Prods. Div.

VERN KIEBLER ELECTRONICS, INC., 201 N. Gables, Wheaton, IL 60187, Tel: 708-668-5407, FAX: 708-462-7590; Empl.: 200; *Sls. Mgr.:* Wm. Archbold

VERSACAD COMPUTERVISION PERSONAL CAD/CAM, 2124 Main St., Huntington Bch., CA 92648, Tel: 714-960-7720, TWX: 510-101-1759 TWINC UD; Empl.: 50; *Sls. Mgr.:* John Towart; *Dist. Mgr.:* Giwes Guignat

VERSADATA INC., 790 Maple Lane, Bensenville, IL 60106, Tel: 708-766-6755, FAX: 708-860-3672; Empl.: 5; *Sls. Mgr.:* Ken Krohmer

VERSALOGIC CORP., 3888 Stewart Rd., Eugene, OR 97402, Tel: 800-824-3163, FAX: 503-485-5712

VERTEK INTL. INC., 9465 Customhouse Plaza, Ste. D, San Diego, CA 92173, Tel: 619-661-6868, FAX: 706-686-3444(Mexico); Empl.: 225

VERTEX INDUSTRIES, INC., P. O. Box 996, 23 Carol St., Clifton, NJ 07014, Tel: 201-472-1331, FAX: 201-472-0814; Empl.: 85; *Sls. Mgr.:* Carlo Pastore

VERTOX CO., 10022 Imperial Ave. E , Garden Grove, CA 92643, Tel: 714-530-4541, FAX: 714-530-0143; FSC No.: 53688; Empl.: 12; *Sls. Mgr.:* Steve Hacker; *Dist. Mgr.:* Steve Hacker

VESTA TECHNOLOGY, INC., 7100 W. 44th Ave. Ste 101, Wheat Ridge, CO 80033, Tel: 303-422-8088, FAX: 303-422-9800; Empl.: 9

VETRA SYSTEMS CORP., 27 Newtown Rd., Plainview, NY 11803, Tel: 516-454-6469, FAX: 516-454-1648; Empl.: 10; *Sls. Mgr.:* Jim Del Rossi

VG CONTROLS, INC., 34 Jenkins Road, Hewitt, NJ 07421, Tel: 201-853-4600, TELEX: 201-853-7913; Empl.: 3

VGI, INC., Vikay Industrial Pte. Ltd., 1800 Vernon St, Roseville, CA 95661, Tel: 916-783-7878, FAX: 916-783-7845; Empl.: 14; *Sls. Mgr.:* Gary Johnson

VIABLE SYSTEMS INC., Box 369, Sherborn, MA 01770, Tel: 508-653-7665, TELEX: 922 495 VIABLEUS, FAX: 508-653-6645; Empl.: 30

VIATRAN CORPORATION, 300 Industrial Drive, Grand Isl. 14072, Tel: 716-773-1700, TELEX: 710-260-1353, ESYLNK: 716-773-2488; Empl.: 110

VIA WEST INTERFACE, INC., 534 N. Stone Ave., Tucson, AZ 85705, Tel: 602-623-5716, 1-800-266-5716, FAX: 1-602-623-5718; Empl.: 4; *Sls. Mgr.:* Robert S. Bos

VIBRAC, 16 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777, TELEX: 312698 VIBRAC, FAX: 603-886-3857; Empl.: 50; *Sls. Mgr.:* R. Searle

Vibra• Metrics INC.

FAX: 203-288-4937

VIBRA-METRICS, INC., 1014 Sherman Ave., Hamden, CT 06514, Tel: 203-288-6158, 1-800-8-SENS-IT; Empl.: 25; *Sls. Mgr.:* William McClain ..... **B•1957**

Local Sales Offices & Reps

AK	Anchorage, Amerom Assoc.	907-338-0894
CA	Laguna Hills, Elotek Sys.	714-830-4856
CO	Longmont, Weaver & Assocs.	303-772-1999
CA	Pleasanton, Secco Sls. Inc.	415-484-1030
IL	Palos Hills, James L. Griffin Co., Inc.	708-974-1770
GA	Tunnel Hill, Pump & Vibration Consits.	404-935-5851
MI	Troy, Satullo Assoc., Inc.	313-585-4811
IL	Carpentersville, Precision Meas. Prods.	708-426-4446
LA	Baton Rouge, Data Signal Sys., Inc.	504-927-4953
MD	Columbia, Stein Instrumn. Corp.	301-596-3748
RI	Narragansett, Pat Assoc.	401-783-9565
MO	St. Louis, Precision Meas. Prods.	314-394-4403
NM	Albuquerque, Mesa Tech. Corp.	505-883-8833
NY	Baldwinsville, Oshex Assoc.	315-635-6027
OH	Cleveland, Abitec	216-531-9122
OK	Data Signal Sys., Inc.	918-866-2450
PA	Philadelphia, Metrasystems	215-247-7347
TN	Chattanooga, Pump & Vibation Consits.	404-935-5851
TX	Friendswood, Data Signal	713-482-9653
UT	West Amercan Fork, Highland Tech. Mktg.	801-756-2634
WI	Mequon, James L. Griffin Co. Inc.	414-241-4451
EXP	Hamden, CT, Vibra-Metrics, Inc.	203-288-6158
Can	Mississauga, Ont., SRP Control Sys. Ltd.	416-238-2880

VIBRO-METER CORP., P.O. Box 5058, Billerica, MA 01822-5058, Tel: 508-663-7322, TELEX: 948145, TWX: 710-320-1872, FAX: 508-667-1944; Empl.: 50; *Sls. Mgr.:* Joe Micali

VICOM SYSTEMS, INC., 46360 Fremont Blvd., Fremont, CA 94538, Tel: 415-498-3200, FAX: 415-498-3325; Empl.: 77; *Sls. Mgr.:* Ernie Pope

VICOR CORP., 23 Frontage Rd., Andover, MA 01810, Tel: 508-470-2900, TELEX: 910-380-5144, ESYLNK: 508-475-6715; Empl.: 400; *Sls. Mgr.:* D. Nesbitt; *Dist. Mgr.:* L. Cavanaugh

V.I. CORPORATION, 47 Pleasant St., Northampton, MA 01060, Tel: 413-586-4144, FAX: 413-586-3805; Empl.: 75; *Sls. Mgr.:* Paul Maguire, VP Nat. Sls.

VICTOREEN

FAX: 216-248-9301

VICTOREEN, INC., 6000 Cochran Rd., Solon, OH 44139-3395, Tel: 216-248-9300, 216-248-9043, TWX: 810-421-8287; Empl.: 350; *Sls. Mgr.:* Glenn Whiteley ..... **A•1996-1999**

VICTOR ELEC. WIRE & CABLE, 618 Main St., W. Warwick, RI 02893, Tel: 401-821-1700, SALES 401-821-7800, TELEX: 952122, TWX: 710-382-1534, FAX: 401-828-0441; Empl.: 500; *Sls. Mgr.:* E. M. Colasanto

VICTOR WIRE & CABLE CORP., 3601 Holdrege Ave., Los Angeles, CA 90016, Tel: 213-870-9933, FAX: 213-559-4167; Empl.: 30

VICTORY ENGINEERING CORP., Victory Rd., Springfield, NJ 07081, Tel: 201-379-5900, TELEX: 710-983-4430, FAX: 201-379-5982; Empl.: 150; *Sls. Mgr.:* P. Foley

VIDCO, INC., 8039 S.W. Cirrus Dr., Beaverton, OR 97005, Tel: 503-641-1804, FAX: 503-641-1806; Empl.: 10; *Sls. Mgr.:* Bradley Cohen

VIDEO AUTOMATION SYSTEMS, Upper Shad Rd., Pound Ridge, NY 10576, Tel: 914-764-4613, FAX: 914-764-4613; Empl.: 5

VIDEO DISPLAY CORP., 1868 Tucker Industrial Dr., Tucker, GA 30084, Tel: 404-938-2080,800241-5005, FAX: 404-493-3903; Empl.: 300; *Sls. Mgr.:* Robert (Bob) Liss; *Dist. Mgr.:* Randy Russell

VIDEO MONITORS, INC., Dotronix, Inc., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-7785, TELEX: 510-100-1880, FAX: 715-834-5672; Empl.: 190; *Sls. Mgr.:* L. Stewart

VIEWLOGIC SYSTEMS, INC., 293 Boston Post Rd. West, Marlboro, MA 01752, Tel: 508-480-0881, FAX: 508-480-0882; Empl.: 200; *Sls. Mgr.:* Harvey Ford

VIKING CASES, 10480 Oak St. N.E., St. Petersburg, FL 33716, Tel: 813-577-1216, FAX: 813-577-2082; *Sls. Mgr.:* Bill Strickland

VIKING ELECTRONICS, 1531 Ind. St. PO Box 448, Hudson, WI 54016, Tel: 715-386-8861; Empl.: 26; *Sls. Mgr.:* Roy Crist

VIKING ELECTRONICS, INC., 21001 Nordhoff St., P.O. Box 2379, Chatsworth, CA 91311, Tel: 818-341-4330, FAX: 818-882-5713; FSC No.: 05574; Empl.: 150; *Sls. Mgr.:* William Vockerath; *Dist. Mgr.:* Karen Claybaugh

VIKING INDUSTRIAL PRODUCTS, 729 Farm Rd., Marlboro, MA 01752, Tel: 508-481-4600; Empl.: 25; *Sls. Mgr.:* Aubrey Elms

VIRGINIA PANEL CORPORATION, 1400 New Hope Rd., Waynesboro, VA 22980, Tel: 703-949-8376, FAX: 703-942-2856; FSC No.: 18117; Empl.: 130; *Sls. Mgr.:* Norman D. Wood

FAX: 703-375-0135

VIRGINIA PLASTICS CO., P.O. Box 4577, Roanoke, VA 24015-0577, Tel: 703-375-0100; FSC No.: 59608; Empl.: 130; *Sls. Mgr.:* Barry D. Lee ..... **C•1564-1567, 1822-1824**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Arcadia, H M C Inc.	818-447-0958
CA	San Diego, HMC, Inc.	619-484-8921
CA	Santa Clara, Penmark Sls. Co.	408-980-1303
CO	Denver, Lindberg Co.	303-758-9033
CT	Middletown, Gerber Sls.	203-347-3000
IL	Wheaton, CS Tech. Sls., Inc.	708-653-8126
IN	Kokomo, John McKenzie	317-452-7390
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Burlington, Gerber Sls.	617-229-1150
MI	Livonia, Engrg. & Mktg. Svcs. Co.	313-522-9465
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594

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NJ Englewood, Sprung/Nussbaum 201-569-5666
NM Albuquerque, Lindberg Co. 505-881-1006
NY Buffalo, NRM Mktg. Grp. 716-634-4300
NY Skaneateles, NRM Mktg. Grp. 315-685-8991
NC Raleigh, Spears & Assocs. 919-790-7606
OK Bixby, MGR Elctrns. 918-369-5186
OH Cincinnati, Makin & Assocs. 513-871-2424
OH Cleveland, Makin & Assocs. 216-248-7370
OH Dublin, Makin & Assocs. 614-793-9545
OR Lake Oswego, SPS Elctrns. 503-697-7768
PA Harrisburg, All-Tech. Mktg. 717-540-1204
PA West Chester, All-Tech Mktg., Inc. 215-344-0134
KS Overlook Pk, Markline Technlgs. 913-681-8880
TX Dallas, MGR Elctrns., Inc. 214-238-5246
UT Salt Lake City, Lindberg Co. 801-484-8689
WA Snohomish, SPS Elctrns. 206-794-0154
Can Downsview, Ont., Tienkay, Inc. 416-736-1221

Local Distributors

CA Canoga Park, Acort Inds. 818-700-2991
NH Manchester, Yankee Elctrn. Supp. Co. 800-365-9720
Can Downsview, Ont., P.S. Comps. 416-665-9546

VIRTIS CO., Rte. 208, Gardiner, NY 12525, Tel: 914-255-5000, 800-431-8232, TELEX: 926474, FAX: 914-255-5338; Empl.: 92; *Sls. Mgr.:* J. D. Schmidt

VISHAY-MANN SYSTEM, See Vishay Resistive Systems Group

VISHAY RESISTIVE SYSTEMS, 63 Lincoln Hwy., Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-5812; Empl.: 500
..... **A•1844-1845, 1914-1915, 1965-1967, 1992-1995, 2001-2009, 2015, 2076; D•1335**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
AZ Phoenix, Howe & Howe 602-264-7971
CA Loveland, VEC 303-667-7500
CA Redwood City, James S. Heaton Co. .. 415-367-9000
CA San Diego, VEC 619-690-5112
CA Tustin, VEC 714-544-7024
CT Yalesville, Comp Rep Assocs. 407-269-1145
FL Altamonte Springs, Semtronic Assocs. 305-831-8233
FL Clearwater, Semtronic Assocs. 813-461-4675
FL Ft. Lauderdale, Semtronic Assocs. 305-731-2484
GA Atlanta, JWL Assocs. 404-993-0100
IN Ft. Wayne, Scott Elctrns. 219-489-5690
IL Skokie, IRI-Illinois 312-967-8430
IN Indianapolis, Scott Elctrns. 317-841-0010
KS Olathe, Technical Sls. Assocs. 913-829-2800
MD Lutherville, J. A. Dougherty Sls. Co. ... 301-321-7890
MA Westwood, Comp Rep Assocs. 617-329-3454
MI Plymouth, Jay Mktg. Assocs. 313-459-1200
MN Bloomington, IRI of Minnesota 612-854-8027
MO St. Louis, Technical Sls. Assocs. 314-521-2044
NJ Flanders, K & R Engrg. Sls. Co. 201-584-5235
NM Albuquerque, Nelco Electronix 505-293-1399
NY Rochester, L-Mar Assocs. 716-381-9100
NC Charlotte, JWL Assocs. 704-541-5750
NC Raleigh, JWL Assocs. 919-787-4826
OH Aurora, EMA, Inc. 216-562-6104
OH Centerville, EMA, Inc. 513-433-2800
OR Beaverton, N. R. Schultz Co. 503-643-1644
PA Horsham, TMI 215-441-4300
PA Malvern, Vishay Resistive Sys. Grp. ... 215-644-1300
TX Dallas, Edward F. Aymond Co. 214-826-7620
TX Houston, Edward F. Aymond Co. 713-943-3149
WI Milwaukee, IRI-Wisconsin 414-789-9393
WA Bellevue, N. R. Schultz Co. 206-746-1890
PR Caguas, Comp Rep Assocs. 809-746-6550
Can Burnaby, B.C., Kaytronics, Inc. 604-294-2000
Can Concord, Ont., Kaytronics, Inc. 416-669-2262
Can Kanata, Ont., Kaytronics, Inc. 613-564-0080
Can Ville St. Laurent, Que., Kaytronics, Inc. 514-745-5800

Local Distributors

AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
AZ Tempe, TTI, Inc. 602-431-1191
CA Chatsworth, Passive Comps. Inc. 818-700-8838
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Milipitas, TTI, Inc. 408-946-5577
CA Mission Hill, TTI, Inc. 818-891-8885
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Diego, TTI, Inc. 619-748-2025
CA San Jose, Passive Comps. 408-441-1441
CA San Jose, Shelley-Ragon, Inc. 408-432-0600
CA Santa Ana, TTI, Inc. 714-641-9393
CO Denver, TTI, Inc. 303-429-6806
FL Orlando, TTI, Inc. 407-859-1000
FL Pinellas Pk, MMG Elec./L&S 813-545-1700
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
CT Wallingford, TTI, Inc. 203-284-7474
GA Norcross, TTI, Inc. 404-662-0911
MA Chelmsford, Shelley-Ragon, Inc. 508-250-9666
IL Glendale Hgts., Shelley-Ragon, Inc. ... 708-529-9977
IA Cedar Rapids, Shelley-Ragon, Inc. 319-373-0525
MD Baltimore, RESCO/Baltimore 301-931-8200
MD Beltsville, RESCO/Washington 301-937-9100
MA Wilmington, TTI, Inc. 508-658-4700
MN Minnetonka, TTI, Inc. 612-933-8555
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828
MO Hazlewood, Shelley-Ragon, Inc. 314-895-1515
MO Independence, Shelley-Ragon, Inc. 816-254-3410
NJ Mt. Laurel, TTI Inc. 609-234-6400
NY Farmingdale, Command Elctrns. Corp. 516-293-1212
NY Medford, Shelley-Ragon, Inc. 516-447-2000
NY Ronkonkoma, Mast Distrs., Inc. 516-471-4422
NY Ronkonkoma, TTI, Inc. 516-737-2000
NY Valley Stream, L & S Elctrns. 516-561-2474
SC Charleston, L & S 803-720-4242
OH Dayton, Micro Mil Div. 513-434-8231
OH Worthington, TTI, Inc. 614-848-5770
PA Malvern, Vishay Resistive Sys. Grp. 215-644-1300
TX Fort Worth, TTI, Inc. 817-595-3100
TX Ft. Worth, TTI, Inc. 817-831-8300
TX Houston, Texas Comp. Corp. 713-468-3882
WA Redmond, Shelley-Ragon 206-883-2220
WA Redmond, TTI, Inc. 206-882-0291
Can Burnaby, B.C., Kaytronics 604-294-2000
Can Concord, Ont., Kaytronics 416-669-2262
Can Kanata, Ont., Kaytronics 613-564-0080
Can Que., Kaytronics, Inc. 514-745-5800

VISIONARY ELECTRONICS, 141 Parker Avenue, San Francisco, CA 94118, Tel: 415-751-8811

VISION ENGINEERING, INC., 570 Danbury Rd., New Milford, CT 06776, Tel: 203-355-3776, TELEX: 643769, FAX: 203-355-0712; Empl.: 15; *Sls. Mgr.:* Bill Johnson

VISIONICS CORPORATION, 3032 Bunker Hill Ln.-Ste. 201, Santa Clara, CA 95054, Tel: 408-492-1440, FAX: 408-492-1380; *Sls. Mgr.:* Mary Leasure

VISTA SYSTEMS, INC., 2 Centennial Drive, Peabody, MA 01960, Tel: 508-532-1971, FAX: 508-532-2068; Empl.: 4; *Sls. Mgr.:* Jim Atwood

VISUAL COMMUNICATIONS CO., INC., 7920 Arjons Dr., Ste. G, San Diego, CA 92126, Tel: 619-549-6900, FAX: 619-549-3520; Empl.: 9; *Sls. Mgr.:* P. Loudon ..... **B•1208-1209**

Local Sales Offices & Reps

EXP CT, Litchfield, Intrade 203-567-5901

Local Distributors

AL Huntsville, Component Dist. Inc. 205-881-7800
AZ Phoenix, Keystone Electro 602-995-3005
CA Costa Mesa, Orange County Comp. ... 714-979-3597
CA Los Angeles, Electric Switch Inc. 213-660-1310
CA San Diego, Orange County Comps. ... 619-549-2511
CA San Jose, Spectra Elctrns. 408-452-1590
CA Sunnyvale, PSC Elctrns. 408-737-1333
CO Englewood, Component Dist. Inc. 303-770-6214
FL Clearwater, Component Distrs. 813-796-0466
FL Ft. Lauderdale, Component Distrs. 305-973-6650
FL Melbourne, Component Dist. Inc. 407-724-9910
GA Norcross, Component Dist. Inc. 404-441-3320
IL Palatine, OHM Elctrns. 708-359-5500
MA Lynn, Land Elctrns. 617-592-2220
MI Grand Rapids, S F Elctrn. Supp. 616-459-0216
MN New Brighton, Chris Elctrns. 612-631-2647
NJ Bellmawr, Mid Atlantic 609-931-5303
OH Aurora, Industrial Prods. 216-562-8113
OH Centerville, Industrial Prod. Dist. 513-435-2086
TX Dallas, Component Dist. Inc. 214-644-0373
WA Kent, Shannon Indl. 206-575-8600

VISUAL INFORMATION INSTITUTE, Box 33, Xenia, OH 45385-0033, Tel: 513-376-4361, TELEX: 501031 VIS INFO INST, FAX: 513-376-2802; FSC No.: 27432; Empl.: 45

VISUAL INFORMATION TECHNOLOGIES, INC.(UITEC), 3460 Lotus Dr., Plano, TX 75075, Tel: 214-596-5600, 800-325-6467, FAX: 214-867-4489; Empl.: 90; *Sls. Mgr.:* Ken Hilton, VP Sls., Mktg.; *Dist. Mgr.:* Ken Hilton, VP Sls., Mktg.

VITEC

FAX: 209-651-1538

VITEC ELECTRONICS CORP., 8530 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1535; *Sls. Mgr.:* Ed Green ..... **A•2459-2463**

Local Sales Offices & Reps

AZ Phoenix, O'Donnell Assoc.,S.W. 602-944-9542
AR Little Rock, Doby-Morse Assocs. 501-221-0326
CA Northern, Comtech Mktg. 408-249-3330
CA San Diego, VanGott & Assocs., Inc. ... 714-698-7774
CA Southern, Van Gott & Assocs. Inc. 818-445-9728
CO Englewood, Harthun Assocs., Inc. 303-795-5545
DC McLean, Jin Sung Hsia 703-734-1739
FL Longwood, SAM Reps. Inc. 407-869-9565
CT Plainville, Northeast Reps., Inc. 203-866-6030
IL WoodDALE, BNI Elctrns., Inc. 708-595-9210
IN Kokomo, Schillinger Assocs., Inc. 317-455-2708
MA Hingham, Northeast Reps., Inc. 617-749-8700
MI Bloomington, RK Elctrn. Sls. & Assocs. 612-888-2757
MS Jackson, EPI Inc. 601-362-5045
MO Kansas City, EPI Inc.-West 816-523-8911
MO St. Louis, EPI Inc. 314-962-1411
NH Mt. Vernon, Northeast Reps., Inc. 603-880-8199
NY Penfield, Upstate Comps 716-381-6070
NY Huntington, Andrews & Andrews 516-692-8686
OH Beachwood, Elctrn. Sls. Master Inc. ... 216-831-9555
OR Beaverton, Evergreen Mktg. Inc. 502-643-8020
PA Willow Grove, Edwin Leiby & Assocs. 215-659-8938
TX Plano, Meg-Tech Mktg., Inc. 214-423-6342
TX Austin, Mega-Tech Mktg. Inc. 512-440-0258
TX Houston, Mega-Tech Mktg. Inc. 713-894-2335
WA Bothell, Evergreen Mktg. Grp., Inc. 206-485-8063
WI Brookfield, BNI Elctrns. 414-781-4775
Can Nepean, Electromate Indl. Sls.,Ltd. 613-829-6561

Local Distributors

CA Costa Mesa, E.E.P. Corp. 714-549-2275
CA Fremont, Kea Elctrns. 415-651-2600
CA Irvine, Schweber Elctrns. 714-863-0261
IA Cedar Rapids, Advent Elctrns. 319-363-0221
FL Melbourne, New Yorker Elctrns. 407-727-0955
GA Augusta, Dixie Elctrns. 404-722-2055
IL Northbrook, Classic Comps. Supp., Inc. 708-272-9650
IL Palatine, OHM Elctrns. 708-359-5500
IL Rosemont, Advent Elctrns. 708-297-6200
IL Schaumberg, Marsh Elctrns. 708-240-9290
IN Indianapolis, AdventElctrns. 317-872-4910
IN Indianapolis, Bell Inds. 317-875-8200
IA Cedar Rapids, Dee Elctrns., Inc. 319-365-7551
MD Columbia, Aztech Elctrns. 301-995-6800
MA N. Adams, ICO-Rally Corp. 413-664-4951
MI Farmington Hills, Advent Elctrns. 313-477-1650
MA Hingham, Sager Electl. Supply, Inc. 617-749-6700
MA N. Adams, Elctrn. Supp. Ctr. 413-664-1086
NJ Kenilworth, Federated Purchaser, Inc. 201-272-0505
NY Binghamton, Pioneer-Standard Elctrns., Inc. 607-722-9300
NY Buffalo, Summit Dists., Inc. 716-887-2800
NY Elmsford, Ancar Elctrns. 914-592-7100
IN Indianapolis, Bell Inds.-JIT 317-299-5487
NY Mamaroneck, New Yorker Elctrns. 914-698-7600
NY Penn Yan, Advacom 315-536-2221
NY Rome, Rome Elctrns. 315-337-5400
NC Charlotte, Dixie Elctrns. 704-377-5413
NC Winston-Salem, Dixie Elctrns. 919-724-5961
OH Cleveland, Pioneer-Standard Elctrns., Inc. 216-587-3600
TX Dallas, Wallace Elctrns. 214-340-0400
OK Tulsa, Radio, Inc. 918-587-9123
PA Bristol, Aim Elctrns. 215-785-3500
PA McKean, Advacom, Inc. 814-476-7774
SC Columbia, Dixie Elctrns. 803-779-5332
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Classic Comps. Supp. Inc. 414-786-5300
PA Export, Advacom, Inc. 412-325-7551

VITEQ CORP., 1000 Aerospace Rd., Lanham, MD 20706, Tel: 301-731-0400, FAX: 301-731-5995; Empl.: 120; *Sls. Mgr.:* Edward Bone

VIZ METEOROLOGICAL INSTRUMENTS, 335 E. Price St, Philadelphia, PA 19144-5782, Tel: 215-844-2626, TWX: 710-670-2626; FSC No.: 41226; Empl.: 325; *Sls. Mgr.:* Tom Curran; *Dist. Mgr.:* Tom Curran

VL

FAX: 213-738-5340

VL ELECTRONICS, INC., 3250 Wilshire Blvd., Ste. 1301, Los Angeles, CA 90010-1603, Tel: 213-738-8700; FSC No.: 95-3896380; Empl.: 10; *Sls. Mgr.:* C. Kreslake; *Dist. Mgr.:* C. Kreslake ..... **B•1132**

Local Sales Offices & Reps

CO	Denver, MRC	303-660-8750
DC	D.C./Baltimore, Eastern Elctrns.	919-876-7591
IN	Indianapolis, J-C Hofstetter	317-897-7914
IA	Marion, A.E.M. Assocs.	319-377-1129
KS	Olathe, A.E.M. Assocs.	913-888-0022
MA	Canton, New England Elctrn. Sls.	617-828-4835
MO	St. Louis, A.E.M. Assocs.	314-298-9900
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, Hoftstetter	216-241-4880
PA	Philadelphia, HB Sys.	215-489-3256
PA	Pittsburgh, J. C. Hoffsetter	412-356-2305
NY	E. Chester, WDS Sls.	914-779-8738
MN	St. Paul, Proud Inds.	612-646-9428
WI	Colgate, Rep One	414-628-4016
WI	Madison, Rep 1 & Assocs.	608-246-8889
Can	Toronto, Ont., Norgay Entprs., Ltd.	416-234-8966
Can	Vancouver, Norgay Ltd.	604-275-1121

Local Distributors

CA	Los Angeles, VL Elctrns Inc.	213-661-8883
NC	Raleigh, Eastern Elctrns.	919-876-7591

VLSI TECHNOLOGY, INC., 1109 McKay Dr., San Jose, CA 95131, Tel: 408-434-7673, FAX: 408-434-7931; Empl.: 2000; *Dist. Mgr.:* Frank Reynolds

VME MICROSYSTEMS INTL CORP., 12090 South Memorial Pkwy., Huntsville, AL 35803-3308, Tel: 205-880-0444, FAX: 205-882-0859; FSC No.: OBPH5; Empl.: 90; *Sls. Mgr.:* Al Casteleyn

VMETRO, INC., VMETRO as, 2500 Witcrest Ave., Ste. 550, Houston, TX 77042, Tel: 713-266-6430, FAX: 713-266-6919; Empl.: 15; *Sls. Mgr.:* Gunnar Ostgaard; *Dist. Mgr.:* Jim Williams

VOICE CONNEXION, 17835 Skypark Circle, Ste. C, Irvine, CA 92714, Tel: 714-261-2366, FAX: 714-261-8563; *Sls. Mgr.:* Shirlee Runge

VOICE IDENTIFICATION, Box 714, Somerville, NJ 08876, Tel: 908-526-3408, FAX: 908-526-5714; Empl.: 7

VOICE PROCESSING CORP., 1 Main St., Cambridge, MA 02142, Tel: 617-494-0100, FAX: 617-494-4970; Empl.: 19

VOLGEN AMERICA, INC., Volgen Electric Co., Ltd., Tokyo, 39650 Liberty St., Suite 325, Fremont, CA 94538, Tel: 415-498-5950, FAX: 415-498-5940; Empl.: 7; *Sls. Mgr.:* Ron Wild; *Dist. Mgr.:* Brian Hagino

VOLPI-MFG-USA, 26 Aurelius Ave., Auburn, NY 13021-1289, Tel: 315-255-1737, FAX: 315-255-1202; Empl.: 25; *Dist. Mgr.:* Stephanie Dunner

FAX: 209-651-0740

VOLTAGE MULTIPLIERS, INC., 8711 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1402, TELEX: 530484; FSC No.: 60211; Empl.: 85; *Sls. Mgr.:* Karen Spano ..... **A•2127**

VOLTAMPERE CORP., 146 Horton Ave., Lynbrook, NY 11563, Tel: 516-887-9443, FAX: 516-887-9869; FSC No.: 64196; Empl.: 30; *Sls. Mgr.:* Robert Pampin

VOLTARC TECHNOLOGIES, INC., 186 Linwood Ave., P.O. Box 688, Fairfield, CT 06430, Tel: 203-255-2633, TELEX: 96-4337, FAX: 203-259-1194; Empl.: 180; *Sls. Mgr.:* Albert H. Katz

Voltech

FAX: 508-879-8669

VOLTECH, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7329; Empl.: 10; *Sls. Mgr.:* Louise Hall ..... **D•1336**

Local Sales Offices & Reps

AL	Huntsville, Teqspec	205-830-1797
CA	Laguna Hills, Electro Venture-South	714-581-9244
CA	Santa Clara, Electro Venture-North	408-727-1553
FL	Cape Canaveral, Teqspec	407-783-3444
GA	Snellville, Teqspec	404-972-7955
IL	Arlington Hgts., Berndt Assoc., Inc.	708-632-0900
IN	Carmel, Berndt Assoc., Inc.	317-844-0114
MA	Burlington, Intersell	617-273-3844
MI	Plymouth, E Q S Sys.	313-455-7920
NJ	Cherry Hill, SCI Rep, Inc.	609-662-2068
NY	East Burne, Northeast Tech. Sls.	518-872-2062
NY	Wantagh, Bytec	516-781-7400
NC	Winston Salem, Teqspec	919-765-5553
OH	Chesterland, E Q S Sys.	216-729-2222
OH	Dayton, E Q S Sys.	513-236-7676
MN	Minneapolis, Berndt Assoc., Inc.	612-546-2021
OR	Portland, Power Factor & Assoc.	503-233-6969
PA	Huntington Valley, Sci Rep, Inc.	215-322-6500
PA	Wexford, E Q S Sys.	412-935-0678
UT	Ogden, Taylor Mktg.	801-546-9570
VA	Fairfax, SCI Rep, Inc.	703-385-0600
WI	Milwaukee, Berndt Assoc., Inc.	414-545-8400

VOLTEX

FAX: 516-842-2991

VOLTEX, 3460 Great Neck Rd., Amityville, NY 11701, Tel: 516-842-2772; Empl.: 55; *Sls. Mgr.:* S. Vogel ... **D•2135**

Local Sales Offices & Reps

CA	San Clemente, 3-J Prods.	714-361-7727
CA	Santa Clara, W-J Elctrns. Sls.	408-982-9222
CT	Washington, Tri-Com Assocs.	203-868-7027
FL	Boca Raton, Tech Sls. Specialties	407-391-3718
GA	Atlanta, Electro Sls.	404-394-1122
MD	Churchtown, Dawn Assocs.	301-261-5001
MA	Burlington, Tri-Com Assocs.	617-272-8163
NJ	Fairfield, Astrorep, Inc.	201-808-0025
NY	Babylon, Astrorep, Inc.	516-422-2504
PA	Norristown, Rivco January Inc.(RJI)	215-631-1414

VOLTRONICS CORPORATION, West St., P.O. Box 476, E. Hanover, NJ 07936, Tel: 201-887-1517, FAX: 201-887-3349; FSC No.: 18736;Multiple; Empl.: 70; *Sls. Mgr.:* Nicholas J. Perrella

VORNE INDUSTRIES, INC., 5831 Northwest Highway, Chicago, IL 60631, Tel: 312-775-9440, FAX: 312-775-3854; *Sls. Mgr.:* Bob Benedict

VTC, INCORPORATED, Control Data Corp., 2401 E. 86th St., Bloomington, MN 55425, Tel: 612-851-5200, 800-882-2667, TELEX: 857113, FAX: 612-851-5199; Empl.: 400; *Sls. Mgr.:* Dan Griffith, VP Sls.; *Dist. Mgr.:* Sue Mansk

V-TRON ELECTRONICS CORP., 10 Venus Way, P.O. Box 3297, S. Attleboro, MA 02703, Tel: 508-761-9100, FAX: 508-761-4727; Empl.: 150; *Sls. Mgr.:* Richard E. French

Local Sales Offices & Reps

MA	Needham, Com-Sale	617-444-8071
NJ	Englewood, Sprung Nussbaum, Inc.	201-569-5666
TX	Ft. Worth, Diversified Comps.	817-244-7704
VA	Manassas, F.B.D. Sls. Corp.	703-369-7212

VU-DATA CORPORATION, 9180 Brown Deer Rd., San Diego, CA 92121, Tel: 619-452-7670, FAX: 619-452-2543; FSC No.: 34160; Empl.: 20; *Sls. Mgr.:* M. Knapp

VYNCKIER, INC., 4 Skyline Dr., Hawthorne, NY 10532, Tel: 714-896-0772, FAX: 714-891-0749; Empl.: 50

WABASH MAGNETICS, Kearney-National Inc., 1375 Swan Street, Huntington, IN 46750, Tel: 219-356-8300, TWX: 510-100-2867, FAX: 219-356-3846; Empl.: 1000; *Sls. Mgr.:* Stanley P. Bickhart

WABASH MAGNETICS, First & Webster Streets, P.O. Box 708, Wabash, IN 46992, Tel: 219-563-2191, TWX: 810-290-2722, FAX: 219-563-1652; Empl.: 250; *Sls. Mgr.:* Bob Lunn

WAFERSCALE INTEGRATION, INC., 47280 Kato Rd., Fremont, CA 94538, Tel: 415-656-5400, 800-451-5970 (USA), TELEX: 289255, FAX: 415-657-5916; Empl.: 125; *Sls. Mgr.:* Bob Hoard; *Dist. Mgr.:* Mike Speckman

WAGO CORP., 9085 N. Deerbrook Trail, Brown Deer, WI 53223, Tel: 414-354-5511, FAX: 414-354-1268; FSC No.: 65996; *Sls. Mgr.:* Thomas J. Artmann

WALDMANN LIGHTING CO., 9 W. Century Dr., Wheeling, IL 60090, Tel: 708-520-1060, FAX: 708-520-1730; *Sls. Mgr.:* Gary Cardoza

WALKER POWER, INC., 18 Mill St., Warner, NH 03278, Tel: 603-456-3111, FAX: 603-456-2498; Empl.: 115; *Sls. Mgr.:* Paul D. Iverson

WALKER SCIENTIFIC, Rockdale St., Worcester, MA 01606, Tel: 508-852-3674, 508-853-3232, 800-962-4638, FAX: 508-856-9931; Empl.: 83; *Sls. Mgr.:* B. Langley ..... **D•1337**

Local Sales Offices & Reps

AL	Birmingham, Levand Sci. Co.	800-222-2595
CA	San Marcos, Mitchell Instrs.	619-744-2690
CA	Santa Barbara, Abbeon Cal, Inc.	805-966-0810
CT	Westport, A.J. Abrams Co.	203-226-3010
IL	Chicago, McMaster Carr Supp. Co.	312-834-9600
MA	Gardner, MR Resources	508-632-7000
MD	Baltimore, Davis Instrs.	301-243-4301
NY	Rochester, Transcat	716-458-4801
TX	Garland, Tucker Elctrns.	214-348-8800

Local Distributors

AL	Birmingham, Levand Sci. Co.	800-222-2595
CA	San Marcos, Mitchell Instrs.	619-744-2690
CA	Santa Barbara, Abbeon Cal, Inc.	805-966-0810
CT	Westport, A.J. Abrams	203-226-3010
IL	Chicago, McMaster Carr Supp. Co.	312-834-9600
MA	Gardner, MR Resources	508-632-7000
MD	Baltimore, Davis Instrs.	301-243-4301
TX	Garland, Tucker Elctrns.	214-348-8800
NY	Rochester, Transcat	716-458-4801

WALL, A. T., CO., 55 Service Ave., Warwick, RI 02886, Tel: 401-739-0740, TWX: 710-382-1535, FAX: 401-732-5784; Empl.: 75; *Sls. Mgr.:* Jim Matzen; *Dist. Mgr.:* R. Huntsman

WALL INDUSTRIES, 5 Watson Brook Rd., Exeter, NH 03833, Tel: 603-778-2300, 800-321-WALL, FAX: 603-778-9797; Empl.: 50; *Sls. Mgr.:* Bill Elswick

WALL LENK CORPORATION, Box 3349, Kinston, NC 28502-3349, Tel: 919-527-4186, FAX: 919-527-4189; FSC No.: 79165; Empl.: 60; *Sls. Mgr.:* Richard B. Davis

WAMCO, INC., 11555-A Coley River Cir., Fountain Valley, CA 92708, Tel: 714-545-5560, TELEX: 678-459, FAX: 714-545-6093; FSC No.: 58774; Empl.: 20; *Sls. Mgr.:* Gordon R. Calvert; *Dist. Mgr.:* Sheila A. Sherman .... **B•1180-1181**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comp. Corp.	602-481-0044
FL	Melbourne, Jerry Williams Inc.	407-259-7700
IL	Elmhurst, Utronix Sls., Inc.	312-834-1100
IN	Kokomo, (SAI)Schillinger Assoc. Inc.	317-455-2708
KS	Parker, S. W. Wollard Co.	913-898-6552
NY	Bayshore, Richard McGrath Inc.	516-968-8448
NY	Jericho, Metro Tech. Sls., Inc.	516-935-3330
TN	Nashville, INSUL-REPS Inc.	615-383-0524
WA	Seattle, Repwest	206-283-8351

WARREN COMMUNICATIONS, See Fiskars Electronics Corporation

WARREN G-V, GENERAL SIGNAL CORP., 1 APOLLO DRIVE, WHIPPANY, NJ 07981, Tel: 201-386-1200, FAX: 201-386-9311; FSC No.: 93929; Empl.: 140; *Sls. Mgr.:* William J. Vandertulip; *Dist. Mgr.:* William J. Vandertulip ..... **B•1870**

Local Sales Offices & Reps

AZ	Phoenix, Dorton Entprs. Inc.	602-944-2957
CA	Brea, Masco Inc.	714-529-0866
CA	Foster City, Polach and Bensinger Inc.	415-578-8200
CO	Golden, James Hurlburt Co.	303-279-7796
IL	S. Elgin, R.K. Elctrns.	708-695-8552
KS	Lenexa, Midtech Inc.	913-541-0505
MA	Norwood, Comp. Mktg. Svcs.	617-762-4339
MN	Eden Praire, PWC Inc.	612-934-1409
NY	Hauppauge, Sticom	516-366-4221
NY	Rochester, Lamb Comps. Inc.	716-328-6350
PA	Hatboro, AQS Inc.	215-674-3562
TX	Carrollton, Seaton Corp.	214-980-9860

WARREN-KNIGHT INSTRUMENT CO., Warren Industries, Inc., 2045 Bennett Rd., Philadelphia, PA 19116, Tel: 215-464-9300; Empl.: 50; *Sls. Mgr.:* Richard M. Marron

WASATCH HIGH VOLTAGE, P.O. Box 15457, Salt Lake City, UT 84115, Tel: 801-265-9561; Empl.: 75; *Sls. Mgr.:* Gary I. Tobian

WATERS MANUFACTURING, INC. | Talley Industries

FAX: 508-358-5649

WATERS MANUFACTURING, INC., Talley Industries, Longfellow Ctr., Wayland, MA 01778, Tel: 508-358-2777; FSC No.: ;Multiple; Empl.: 125; *Sls. Mgr.:* James Dyne ..... **A•2078-2079**

Local Sales Offices & Reps

AZ Paradise Valley, Techrep-Don Epand 602-443-8288
CA Alameda, Liaison, Inc. 415-769-1991
CA Lomita, Techrep 213-539-9070
CT Bloomfield, Sir Assocs. 203-243-9343
FL Melbourne, R-Rep Co. 407-242-9800
IL Chicago, Bierhaus Sls. 312-751-8088
KS Overland Park, Acorn Elctrns. 913-649-6402
MA Westford, Sir Assocs. 508-692-2500
MO St. Louis, Acorn Electronics 314-421-1751
NJ Union, SSAI 201-687-6363
NY Le Roy, SSAI 716-768-7213
OH Dayton, INH Comp. Sls. 513-434-8808
TX Dallas, Allied Comps. 214-238-0408
WI Milwaukee, Bierhaus Sls. 414-963-0318

WATKINS-JOHNSON CO., 3333 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-4141, TELEX: 34-8415, TWX: 910-373-1253; FSC No.: 14482; Empl.: 3000

WAVETEK, (Western Area Sales Office), 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-565-9234

WAVETEK, (Central Area Sales Office), 5808 Churchman Bypass, Indianapolis, IN 46203, Tel: 317-782-4619

WAVETEK, Southeast Area Sales Office, 2085 U.S. 19 North, Ste. 102, Clearwater, FL 34623, Tel: 813-797-1792

WAVETEK DATRON, See Datron Instruments (or call area sales offices)

WAVETEK MICROWAVE, INC., (Formerly Pacific Measurement, Inc.), 488 Tasman Dr., Sunnyvale, CA 94089, Tel: 408-734-5780, FAX: 408-747-1265

For sales offices and representatives, see Wavetek San Diego, Inc.

WAVETEK RF PRODUCTS, INC., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203-6109, Tel: 317-788-9351, FAX: 317-788-5999; FSC No.: 34280; Empl.: 303; *Sls. Mgr.:* Sara Mussmann; *Dist. Mgr.:* Ben Constantini

For Sls. Ofcs. & Reps. 9145 Balboa Ave, San Diego, CA 92123

WAVETEK SAN DIEGO, INC. , Wavetek Corp., 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-279-2200, FAX: 619-565-9558; *Sls. Mgr.:* Bob Hynes

WEBER, Inmark Corporation-Importer, 4 Byington Place, Norwalk, CT 06850, Tel: 203-866-8474, FAX: 1-203-866-0918

WEBER U.S., INC., Weber AG, 291 Great Valley Parkway, Malvern, PA 19355, Tel: 215-651-0770, FAX: 215-651-0775; Empl.: 7; *Sls. Mgr.:* Theo Notaras

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FAX: 518-298-5938

WECO ELECTRICAL CONNECTORS, INC., Trimex Bldg., Rte. 11, Mooers, NY 12958, Tel: 518-298-4810; FSC No.: 5935, 5963, 5940; Empl.: 52; *Sls. Mgr.:* John T. Meikle; *Dist. Mgr.:* John T. Meikle ..... **C•1568-1577**

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CA San Diego, SPA Inc. 619-530-0209
CA San Jose, Silicon Valley Sls. 408-432-1967
CO Littleton, Chinook Tech Sls. 303-933-9007
FL Apopka, Cartwright & Bean Inc. 407-889-9100
GA Norcross, Cartwright & Bean Inc. 404-368-0160
IL Palatine, Key Entprs. Inc. 708-991-2144
IN Indianapolis, MEI (Mktg. Engrs.) 317-872-5665
IA Davenport, Rush & West Assocs. Inc. 319-388-9494
KS Overland Park, Rush & West Assocs.,Inc. 913-764-2700
KY Louisville, M E I 502-267-7093
MD Rising Sun, LHR Assocs. Inc. 301-658-4058
MA Scituate, Olsen Tech Sls. Inc. 617-545-5101
MN Edina, Engrg. Prods. Assocs. 612-835-9022
MS Jackson, Cartwright & Bean Inc. 601-981-1170
MO St. Louis, Rush & West Assocs.,Inc. ... 314-965-3322
NH Nashua, Olsen Tech. Sls. Inc. 603-888-3619
NJ Woodbridge, Riser Sls.Inc. 201-634-0954
NY Buffalo, NRM Mktg. Inc. 916-634-4300
NY Skaneateles, NRM Mktg. Inc. 315-685-8991
NY Spencerport, NRM Mktg. Inc. 716-352-9166
NC Charlotte, Cartwright & Bean Inc. 704-536-0303
NY Mooers, WECO Elctrl. Connectors Inc. 518-298-4810
OH Cleveland, Marlow Assocs. 216-831-8232
OH Dayton, Marlow Assocs., Inc. 513-274-9666
OR Lake Oswego, SPS Elctrns. 503-697-7768
PA Harrisburg, Beil & Whitaker 717-564-6900
PA Pittsburg, Marlow Assocs., Inc. 412-343-5050
SC Raleigh, Cartwright & Bean Inc. 919-876-4130
TN Memphis, Cartwright & Bean Inc. 901-362-8345
TX Irvine, Aid Elctrns., Inc. 214-790-4761
UT Riverton, Chinook Tech Sls. 801-254-7166
WA Snohomish, SPS Elctrns. 206-323-4140
WI Milwaukee, Key Entprs. Inc. 414-762-2323

Local Distributors

AL Mobile, Control Design Supply Inc. 205-666-6693
AZ Tempe, Control Design Supp. Inc. 602-829-7981
CA Anaheim, Control Design Supp. Inc. 213-802-1371, 714-821-1516
CA Anaheim, DECO Elctrns. Inc. 714-630-8252
CA Fountain Valley, Comp. Ctr. 714-979-0433
CA Fremont, Terminal Sls. Corp. 415-656-7722, 800-972-5932
CA Fullerton, I.S.I. Mktg. Co. 714-773-0411
CA Orange, Wes-Garde Comps. Grp. 714-953-1254, 800-624-1516
CA San Carlos, Control Design Supp. Inc. 415-592-4806
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Diego, Wes-Garde Comps. Grp. .. 619-264-6117
CA Van Nuys, Wes-Garde Comps. Grp. ... 213-873-4802
CT Wallingford, Control Design Supp. Inc. 203-269-9955
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Altamonte Springs, Control Design Supp. 407-788-3220,800-432-5895
FL Davie, ARCO Dists. Inc. 305-473-2550, 305-940-3295
CO Denver, Control Dseign Supply Inc. ... 303-296-1922
FL Largo, Electronic Precepts of FL Inc. .. 813-544-3636
FL Pompano Bch., Control Design Supp. Inc. 305-782-1311
CA San Jose, Spectra Elctrns. Inc. 408-452-1590
CA Santa Ana, BDS Elctrns. Inc. 714-662-1050
CA Santa Clara, Component Ctr. 408-988-3751
GA Fayetteville, Frankland Inc. 404-461-4026
GA Stone Mtn., Control Design Supp. Inc. 404-979-3500
IL Carol Stream, Lectro Comps. Inc. 708-690-0520, 800-323-2282
IL Schaumburg, Control Design Supp. Inc. 708-307-8900,800-882-7232
IN Indianapolis, Control Design Supp. Inc. 317-788-4559
IA Marion, Control Design Supp. Inc. 319-373-2923
KS Kansas City, Control Design Supp. Inc. 913-362-4248
KS Wichita, RSC Elctrns. Inc. 316-267-5213, 800-362-2077
KY Owensboro, Ohio Valley Sound 502-683-6727
MD Gaithersburg, Axis Elctrns. Inc. 301-840-9640, 800-492-3190
MA Middleboro, Glynn Elctrns. Inc. 508-947-4262, 800-427-4262
MA Woburn, Control Design Supp. Inc. 617-932-9404
MI Farmington Hills, Control Design Supp., Inc. 313-473-0220
MN Minneapolis, Control Design Supp. Inc. 612-721-1628,800-328-8222
MO St. louis, Control Design 314-426-3150
MO St. Louis, Franklin Elctrns. 314-429-3111, 800-821-6344
NH Manchester, Glynn Elctrns. 603-622-8131
OH Dayton, Scotts-Friedman Co. Inc. 513-298-5555
NJ Kenliworth, Federated Purchaser Inc. 201-272-0505
NY Bohemia, Key Comps. Inc. 516-567-7500
NY Rome, Rome Elctrn. 315-337-5400
NY Syracuse, ADR Tech. 315-437-7087
NC Charlotte, Control Design 704-588-4410, 800-334-3726
OH Akron, Aesco Elctrns. Inc. 216-494-8572, 800-362-0022
OH Canton, Aesco Elctrns., Inc. 216-494-8572
OH Cleveland, Aesco Elctrns., Inc. 216-621-5835, 800-362-0022
OH Cleveland, Roberts Elec. Co. Inc. 216-238-1711
OH Columbus, Aesco Elctrns. Inc. 614-882-6762
OH Columbus, Thompson Elctrn. Supp. ... 614-228-6191
OK Oklahoma City, RSC Elctrns. Inc. 405-631-7729, 800-522-8401
OR Portland, Dunn Elctrns. Inc. 503-285-0214
PA Malvern, Control Design Supp. Inc. 215-296-0150
PA McKean, Advacom 814-476-7774
PA Wilkes Barre, Wallco Inc. 717-823-6181
PA York, Elctrn. Comp. for Inds. 717-846-5334
PA Allentown, Lighting Fixture & Supply Co. Inc. 215-435-9691
TX Austin, Wofford Elctrns., Inc. 512-339-1131
TX Dallas, Control Design .. 214-358-1441,512-448-1919
TX Ft. Worth, Allied Elctrns. Inc. 817-595-3500
TX Houston, Control Design Supply INc. 713-880-9418
TX Richardson, RSC Elctrns., Inc. 214-644-3444
UT Nephi, Control Design Supply Inc. 801-623-2908
TX Richardson, Off The Shelf 214-238-0808, 800-648-5387
WA Seattle, H.D. Campbell 206-433-1900
TX Austin, Control Design Supp. Inc. 512-448-1919
WI New Berlin, Control Design 414-784-1016, 800-242-4395

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FAX: 514-694-0956

WECO ELECTRICAL CONNECTORS, INC., 16805 Hymus Blvd., Kirkland, Quebec, Canada H9H 3L4, Tel: 514-694-9136; FSC No.: 5935, 5963, 5940; Empl.: 52; *Sls. Mgr.:* Ramy Badawy; *Dist. Mgr.:* Ramy Badawy ..... **C•1568-1577**

Local Sales Offices & Reps

Can Calgary, Alb., Deskin Sls. 403-270-4440
Can Edmondton, Sas., Deskin Sls. 403-466-2106
Can Kirkland, Que., WECO Elctrl. Connectors Inc. 514-694-9136
Can Rexdale, Ont., WECO Elctrl. Connectors Inc. 416-674-1084
Can Transcona,Man., Deskin Sls. 800-661-1935
Can Vancouver, B.C., Deskin Sls. 604-324-8343

Local Distributors

Can Calgary,Alb., Deskin Sls. 403-270-4440
Can Concord, Ont., Zierick Canada Corp. .. 416-669-1429
Can Dartmouth, N.S., Arcom Elctrns. 902-464-1600
Can Dorval, Que., Bentin Elctrl. 514-631-2061
Can Drummondville, Que., Marnel Intl., Inc. 819-478-3128
Can Edmonton, Deskin Sls. 403-466-2106
Can Islington, Ont., D.T. Shaw Co. Ltd. 416-231-2706
Can Mississauga, Ont., Sayal Elctrns. 416-238-8640
Can Montreal, Que., Cite Electronique 514-526-9184
Can Montreal, Que., D.T. Shaw Co. Ltd. 514-332-1163
Can Montreal, Que., Versatech Elctrns. Inc. 514-481-0196
Can Nepean, Carsten Elctrns. Ltd. 613-726-9250
Can Oakville, Ont., Cantwell Cullen & Co. .. 416-842-8470
Can Quebec, Que., Crobel Ltee Electronique 418-687-1171
Can Quebec, Que., Pro Technique Que. Inc. 418-529-5774
Can Scarborough, Ont., Sayal Elctrns. 416-494-8999
Can Scarborough,Ont., Carsten Elctrns. Ltd. 416-495-9999
Can Sherbrooke, Que., Cite Electronique .. 819-822-9908
Can St Laurent, Que., Carsten Elctrns. Ltd. 514-334-8321
Can Transcona, Man., Deskin Sls. 800-661-1935
Can Vancouver,B.C., Deskin Sls. 604-324-8343
Can Ville Laval, Que., Montcalm Electronique 514-663-3102
Can Winnipeg, Man., WES Elctrns. Ltd. 204-632-1260

WECO ELECTRICAL CONNECTORS, INC., 151 Carlingview Dr., Unit 5, Rexdale, Ontario, Canada M9W 5S4, Tel: 416-674-1084, TELEX: 06-989100 POS TOR, FAX: 416-675-0057 ..... **C•1568-1577**

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Can Kirkland, Que, Weco Electrical Connectors 514-694-9136
Can Rexdale, N.B., Weco Electrical Connectors 416-674-1084
Can Rexdale, N.S., Weco Electrical Connectors 416-674-1084
Can Rexdale, N.W.T., Weco Electrical Connectors 416-674-1084
Can Rexdale, Nfld., Weco Electrical Connectors 416-674-1084
Can Rexdale, Ont., Weco Electrical Connectors 416-674-1084
Can Rexdale, P.E.I., Weco Electrical Connectors 416-674-1084
Can Rexdale, Yukon, Weco Electrical Connectors 416-674-1084
Can Transconia, B.C., Deskin Sls. 1-800-661-1935
Can Vancouver, B.C., Deskin Sls. 1-800-663-5969, 604-324-8343

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Can Edmonton, Alta., Deskin Sls. 403-466-2106
Can Islington, Ont., D. T. Shaw Ltd. 416-231-3494
Can Kanata, Ont., Prelco Ltd. 613-592-3636
Can Longueuil, Que., Lumen Inc. 514-679-3460
Can Mississauga, Ont., Prelco Ltd. 416-678-0401, 1-800-387-38
Can Mississauga, Ont., Sayal Elctrns. 416-238-8440
Can Montreal , Que, Versatech Elctrns. Inc. 541-481-0196
Can Montreal, Que., D. T. Shaw Ltd. 514-332-1163
Can Montreal, Que., Prelco Ltd. 514-389-8051
Can Nepean, Ont., Carsten Electrns. Ltd. ... 613-726-9250
Can Oakville, Ont., Cantwell & Co. 416-842-8470
Can Ottawa, Ont., Cantwell Cullen & Co. Inc. 613-744-4516
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Can Quebec, Que., Crobel Llee Electronique 418-687-1171
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999,1-800-268-34
Can Scarborough, Ont., Sayal Elctrns. 416-494-8999
Can Sherbrooke, Que., Lumen Inc. 819-566-0966
Can St Laurent, Que., Carsten Elctrns. Ltd. 514-334-8321
Can St Laurent, Que., Zierick 514-331-7460
Can Surrey, B. C., Carsten Elctrns. Ltd. 604-590-6877
Can Transcona, Man., Deskin Sls. 1-800-661-1935
Can Vancouver, B.C., Deskin Sls. 604-324-8343
Can Ville Laval, Que., Montcalm Elctrns. ... 514-663-3102
Can Winnipeg, Man., Wes Elctrns. Ltd. 204-632-1260

WEED FIBER OPTICS INC., Weed Instrument Co., 1702-D Ponderosa, College Station, TX 77845, Tel: 409-693-5397, FAX: 409-693-1205; Empl.: 15; *Sls. Mgr.:* Chuck Landis; *Dist. Mgr.:* Chuck Landis

WEED INSTRUMENT CO., INC., 707 Jeffrey Way, P.O. Box 300, Round Rock, TX 78680-0300, Tel: 512-255-7043, FAX: 512-388-4362; Empl.: 123; *Sls. Mgr.:* Jim Robertson

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FAX: 516-254-2099

WEICO WIRE & CABLE, INC., 161 Rodeo Dr., Edgewood, NY 11717, Tel: 516-254-2970; FSC No.: 7R617; *Sls. Mgr.:* Theodore Weill ..... **C•1826-1863**

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WEIDMULLER INC., 821 Southlake Blvd., Richmond, VA 23236, Tel: 804-794-2877, TELEX: 828376; Empl.: 98; *Sls. Mgr.:* Peter Anest ..... **C•1578-1581**

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CA Montrose, Luscombe Engrg. Co. 818-249-9000
CO Littleton, Con-Tek Mktg. 303-973-8490
CT Simsbury, Larry Kingsley-Reg. Mgr. 203-658-1522
FL Tampa, Flordia Comp. Sls., Inc. 813-873-3622
GA Marietta, Bill Ibsen 404-924-2829
IL Machesney Park, David Brownley 815-654-2815
LA Harvey, Power Sys. Spec. 504-340-7340
IN Indianapolis, Elctrnc. Rep. 317-894-1414
MN Hopkins, S. J. Collins 612-933-7661
MO St. Louis, Thomas Dowell & Assocs. .. 314-849-4234
NY Fairport, Belltronics 716-377-6790
OH Mentor, Dan Rowe 216-257-2211
OK Tulsa, Lynn Elliott Co., Inc. 918-663-4616
OR Portland, Elect. Eng. Sls. 503-639-3978
NY Pt. Washington, Ashtec, Inc. 516-767-0336
PA Willow Grove, Jacobson-Rodger 215-657-4300
RI Warwick, Greg Jacobson 401-738-6454
SC Greer, Jim Hall 803-322-6016
TN Memphis, Byron Carson Co. 901-276-0614
TX Missouri City, Jack Guinn 713-437-2011

WEIR ELECTRONICS, INC., Weir Elctrns., Ltd., 418 3rd St., Annapolis, MD 21403, Tel: 301-268-0122, FAX: 301-268-7909; Empl.: 2; *Sls. Mgr.:* Barbara Bunting

WEIR ELCTRNS. LTD., Durban Rd., Bognor Regis, West Sussex, ENG PO 22 9RW, Tel: 0243-865991, TELEX: 86543, FAX: 0243-868613; Empl.: 500; *Sls. Mgr.:* Peter Cole (Exp.)

WEITEK CORP., 1060 E. Arques, Sunnyvale, CA 94086, Tel: 408-738-8400; Empl.: 220

WEITZ ELECTRONICS/MARVWA USA, Tel: 718-523-3688, FAX: 718-657-6938; Empl.: 49; *Sls. Mgr.:* Greg Weitz

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AZ Scottsdale, Kaye C.R. 602-948-8433
CA Santa Clara, Amelox, Inc. 408-970-9366
CO Thornton, Kaye C.R. 303-426-7951
FL Longwood, EAB Inc. 407-339-4986
GA Atlanta, EAB Inc. 404-975-3660
MN Edina, Orrin Eames Tech. Sls. 612-944-3494
RI Warwick, Ertronics 401-732-3567
TX Dallas, Passive Component Assocs. .. 214-824-6162

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IL Lemont, Trend Tronics 708-972-1166
NJ Roselle, Lectron Inds. 201-245-5858
NY Bohemia, Edge Elctrns. 516-567-6300

WELCH ALLYN, INC., Data Collection Div., 4619 Jordan Rd., Skaneateles Falls, NY 13153-0187, Tel: 315-685-8945, FAX: 315-685-3172; *Sls. Mgr.:* Richard Kraetz; *Dist. Mgr.:* Andy Adams

WELLEX CORPORATION, 44141 S. Grimmer Blvd., Fremont, CA 94538, Tel: 415-490-3263, TELEX: 3717647, FAX: 415-490-5531; Empl.: 356; *Sls. Mgr.:* John E. Soares

WELLS ELECTRONICS, INC., 1701 S. Main St., South Bend, IN 46613, Tel: 219-287-5941, TELEX: 4937960, FAX: 219-287-0356; FSC No.: 219-287-0356; Empl.: 200; *Sls. Mgr.:* Mike Myers

WELLS-GARDNER ELCTRNS. CORP., 2701 N. Kildare Ave., Chicago, IL 60639, Tel: 312-252-8220, FAX: 312-252-8072; Empl.: 282; *Sls. Mgr.:* Lawrence J. Brady ..... **B•1133**

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IL Inverness, James Inds. 1-708-358-8000
MA Action, Boston Elctrns. 508-264-4456
NJ Mountainside, Henry G. Richter, Inc. .. 201-233-4615
NY Fayetteville, Henry G. Richter, Inc. 315-637-6713
OH Cincinnati, JMK Elctrns. 513-271-3860
PA Phoenixville, Henry G. Richter, Inc. 215-495-6176

WENZEL ASSOCIATES, INC., 14050 Summit Dr., Austin, TX 78728, Tel: 512-244-7741, FAX: 512-244-9338; FSC No.: 62821; Empl.: 32; *Sls. Mgr.:* Liz Ronchetti

WERLATONE, INC., P. O. Box 47, Rte. 22, Brewster, NY 10509, Tel: 914-279-6187, FAX: 914-279-7404; FSC No.: 28812; Empl.: 11; *Sls. Mgr.:* G. Werlau

WESCHLER INSTRUMENTS

FAX: 216-238-0660

WESCHLER INSTRUMENTS, 16900 Foltz Parkway, Cleveland, OH 44136, Tel: 216-238-2550; Empl.: 125; *Sls. Mgr.:* Jim Tatalick ..... **D•1395-1405**

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GA Cascade Controls 404-998-1027
IL Ray Knitter Assoc. 708-690-6363
IN IN North, Jacks Margis 219-374-5905
IN IN South, Ray Knitter Assoc. 317-862-2788
LA Mid South Sls. 504-641-7480
MA Eastern Systems 508-435-2151
MI G&D Assoc. 313-684-5233
MN Waltam Sales 612-781-2778
MO Controls Midwest 816-842-4290
NV Vegas, Kachina Ctrls. 702-741-5666
NJ RJM Sales 908-322-7880
NM Kachina Controls 505-260-1741
NY NY (East), Expert Ind. 518-869-3355
NC Sunbelt Instruments 704-375-3132
OH OH (North), Contact Weschler 216-238-2550
OH OH (South), Annett Ind. 513-831-2800
OR McLaren Inc. 503-627-0757
PA PA (East), RJM Sales 215-643-6610
PA PA (West), Contact Weschler 216-238-2550
TX Northern TX, Seaton Corp. 214-980-9860
TX Southern TX, Lynn Elliott 713-499-1571
UT Anderson Controls 801-566-5864
VA Martin Control Equip. 804-321-7143
WA McLaren Inc. 206-827-9400
WV Contact Weschler 216-238-2550
WI WI (East), Knitter Assoc. 414-544-1976

WESCO ELECTRICAL CO., 201 Munson St., Greenfield, MA 01301, Tel: 413-774-4358, FAX: 413-774-4562; FSC No.: 12673; Empl.: 150; *Sls. Mgr.:* James R. DeSanty ..... **A•1150-1151**

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AZ Tempe, ACS of AZ 602-731-9711
CT Milford, Cuming Assoc. 203-878-3946
FL Maitland, EIR, Inc. 305-660-9600
IL Palatine, Houlihan Sls. 708-543-7200
IN Indianapolis, John H. Weaver Co. 317-257-7661
MD Severna Park, Jenco Sls. 301-544-8652
MA Framingham, Bengal Assocs. 617-877-2639
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OH Novelty, Spectro-Corn 216-338-5226
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WESCORP ANTISTATIC PRODUCTS, 144 S. Whisman Rd., Mountain View, CA 94041, Tel: 415-969-7717, TELEX: 345507; FAX: 415-969-6130; Empl.: 15; *Sls. Mgr.:* Thelma Paxton

WES-GARDE COMPONENTS GROUP, INC., 190 Elliott St., Hartford, CT 06114, Tel: 203-525-6907

WESTAMP, 1542 15th St., Santa Monica, CA 90404, Tel: 213-393-0401, TELEX: 3720078, FAX: 213-451-1058; FSC No.: 12745; Empl.: 100; *Sls. Mgr.:* Michael Mula

WESTBERG MANUFACTURING INC. (WESTACH), 3400 Westach Way, Sonoma, CA 95476, Tel: 707-938-2121; Empl.: 20; *Sls. Mgr.:* R. R. Westberg

WEST COAST ELEC. MFG., 14045 Garfield Ave, Paramount, CA 90723, Tel: 213-633-1010, FAX: 213-633-1018; FSC No.: 81823; Empl.: 25; *Sls. Mgr.:* W. E. Seal

WESTCON, 959 Cheney Ave., Marion, OH 43302, Tel: 614-382-5771, TELEX: 3775688; Empl.: 50

WESTCON, INC., 5101 N. Interstate Ave., Portland, OR 97217, Tel: 503-283-0132, FAX: 503-283-0137; Empl.: 15; *Sls. Mgr.:* Jan M. Rundquist; *Dist. Mgr.:* Jan M. Rundquist

WESTCOR CORPORATION, 485-100 Alberto Way, Los Gatos, CA 95032, Tel: 408-395-7050, FAX: 408-395-1518; *Sls. Mgr.:* Nancy Pepper

WEST ELECTRONIC SALES TEAM, 14340 Bolsa Chica Rd.G , Westminster, CA 92683, Tel: 714-898-0120, 213-495-5569, FAX: 714-894-6544; Empl.: 14; *Sls. Mgr.:* Mark Wickham; *Dist. Mgr.:* Jack Carrigan

WESTERN CASE, INC., 14351 Chambers Rd., Tustin, CA 92680, Tel: 714-838-8460, FAX: 714-838-3039; *Sls. Mgr.:* David B. Horne

WESTERN DIGITAL CORP., 8105 Irvine Center Drive, Irvine, CA 92718, Tel: 714-932-6000, FAX: 714-932-6498; Empl.: 6500; *Sls. Mgr.:* Tom DeMarchi

WESTERN ELECTRO-MECHANICAL CO., INC., 300 Broadway, Oakland, CA 94607, Tel: 415-452-1936, FAX: 415-452-1939; Empl.: 9; *Sls. Mgr.:* Hal Johnson

WESTERN ELCTRN. COMPS. CORP., 1250-A Avenida Acaso, Camarillo, CA 93010, Tel: 805-482-8002, TELEX: 401076, FAX: 805-482-8675; Empl.: 15; *Sls. Mgr.:* Russ Geary

WESTERN ELECTRONIC PRODUCTS CO., 915-G Calle Amanecer, San Clemente, CA 92672, Tel: 714-492-4677, FAX: 714-492-5952; Empl.: 6; *Sls. Mgr.:* Tony English; *Dist. Mgr.:* Shaun Ramsey

GRAPHTEC

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WESTERN GRAPHTEC, 11 Vanderbilt, Irvine, CA 92718-2067, Tel: 714-770-6010, 800-854-8385; Empl.: 72 ..... **D•1425**

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AL Huntsville, W. A. Brown Instrs. 205-830-9224
AK Anchorage, Alaska Science & Tech. .. 907-562-2482
AZ Chandler, Vic Myers Assocs. 602-241-9324
CA Irvine, Western Graphtec 714-770-6010
CO Aurora, Mark Myers Assocs. 303-629-9676
CO Colorado Springs, Western Graphtec 719-576-8858
FL Boca Raton, Western Graphtec 407-392-4550
FL Ft. Lauderdale, W. A. Brown 305-776-6661
FL Melbourne, W. A. Brown Instrs. 407-723-0766
FL Orlando, W. A. Brown Instrs. 407-648-9660
GA Norcross, W. A. Brown Instrs. 404-449-7194
IL Arlington Hgts., Comtel Midwest 312-392-4040
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MD Landover, Sel-Tronics 301-341-2700
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MA Hopkinton, Eastern Sys. 508-435-2151
MI Milford, T.M.S. 313-360-1514
MN Wayzata, Comtel Midwest 612-476-1551
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OH Westlake, T.M.S. 216-327-3527
OK Tulsa, J. Wisdom & Assocs. 918-665-8899
PA Bridgeville, T.M.S. 412-221-2338
TX Richardson, J. Wisdom & Assocs. 214-470-9093
TX Round Rock, J. Wisdom & Assocs. 512-255-1167
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VA Hampton, Sel-Tronics 804-827-6308
WA Bellevue, Western Instrs. 206-881-5110
WI New Berlin, Comtel Midwest 414-544-6042

WESTERN MULTIPLEX CORP., 310 Harbor Blvd., Belmont, CA 94002, Tel: 415-592-8832, TELEX: 295114 VIA RCA, FAX: 415-592-4249; FSC No.: 94-2620670; Empl.: 33; *Sls. Mgr.:* Graham Barnes

WESTERN RESERVE ELECTRONICS, 2150 Highland Rd., Twinsburg, OH 44087, Tel: 216-425-4951, FAX: 216-425-4956; Empl.: 100; *Sls. Mgr.:* Robert Rhodes

WESTINGHOUSE ELECTRIC CORP., Control Division, P.O. Box 819, Oldsmar, FL 34667, Tel: 813-855-4621, TELEX: 358713; Empl.: 200; *Sls. Mgr.:* E.A. Schiff

WEST INSTRUMENT, A Mark IV Company, 2101 Oxford Road, Des Plaines, IL 60018-1919, Tel: 708-390-7711, FAX: 708-390-7234; Empl.: 150; *Sls. Mgr.:* W. J. Bell, Jr.; *Dist. Mgr.:* W. J. Bell, Jr.

WESTLAKE COMPONENTS INTERNATIONAL, 30961 Agoura Rd., Ste. 309, Westlake Village, CA 91361, Tel: 800-228-1097, FAX: 818-717-1754; *Sls. Mgr.:* Rick Odorfer

WESTON INSTRUMENTS, Electrical Instrument Service, Inc., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590; Empl.: 35; *Sls. Mgr.:* Gerald D. Frank; *Dist. Mgr.:* Gerald D. Frank ..... **D•1338-1339**

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AL Birmingham, Brownell Instrs. & Controls Co. 205-323-4761
AL Mobile, Brownell Instrs. & Controls Co. 205-479-8581
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FL Palm Bay, EIL Instrs., Inc. 407-725-8300
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IL Bridgeview, EIL Instrs. 708-430-2292
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NY Farmingdale, Brownell Instrs. & Controls Co. 516-420-5990
NY Hauppauge, EIL Instrs., Inc. 516-231-6333
NY New York, Brownell Instrs. & Controls Co. 212-691-1171
NY New York, Nilsson Labs. 212-675-7944
NY Pittsford, EIL Instrs., Inc. 716-586-8251
NC Charlotte, Brownell Instrs. & Controls Co. 704-597-1270
NC Charlotte, EIL Instrs., Inc. 704-376-2237
OH Hilliard, Comtel Instrs. Co. 614-872-8305
NC Raleigh, Brownell Instrs. & Controls Co. 919-876-6524
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OH Dayton, Comtel Instruments co. 513-426-5310
OH Dayton, EIL Instrs., Inc. 513-435-2134
OK Tulsa, Tri-State Instr. Lab 918-836-0286
OR Portland, Brownell Electro, Inc. 502-226-3286
PA Bridgeville, Brownell Electro, Inc. 412-221-0074
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TN Nashville, Brownell Instrs. & Controls Co. 615-885-1302
TX Dallas, Butler & Land, Inc. 214-343-8800
TX Dallas, EIL Instrs., Inc. 214-357-0297
TX Garland, Crompton Metermaster 214-271-5671
TX Harlingen, Bush Supply Co. 512-428-1613
TX Houston, Brownell Instrs. & Controls Co. 713-699-1981
TX Houston, Butler & Land, Inc. 713-896-0808
TX Houston, CMI Meters & Instr. 713-644-1631
TX Houston, EIL Instrs., Inc. 713-271-3100
UT Salt Lake City, Brownell Electro, Inc. .. 801-262-8498
VA Bluefield, Brownell Electro, Inc. 703-322-3402
VA Norfolk, Brownell Electro, Inc. 804-855-2400
VA Norfolk, EIL Instrs., Inc. 804-885-9553
VA Richmond, Metermetrics 804-275-1431
TX Lubbock, Brownell Electro, Inc. 806-747-0211
WA Redmond, EIL Instrs., Inc. 206-882-3222
WI Milwaukee, E-M Instrs. 414-272-7799
Can Mississauga, Ont., EIL Instrs., Inc. 416-624-6660

WESTREX PRODUCTS, 25 Denby Rd., Boston, MA 02134, Tel: 617-254-1200, FAX: 617-254-6848; Empl.: 200; *Sls. Mgr.:* Bruce Burgess; *Dist. Mgr.:* Bruce Burgess

WESTRONICS INC. OF TEXAS, A Baker Hughes Co., 5001 Blue Mound Rd., Box 961003, Ft. Worth, TX 76161, Tel: 817-625-2311, FAX: 817-625-1068; Empl.: 180; *Sls. Mgr.:* Jim Bittikoffer

WHEELOCK, INC., 273 Branchport Ave., Long Branch, NJ 07740, Tel: 201-222-6880, FAX: 201-222-8707; Empl.: 200; *Sls. Mgr.:* William L. Goldstein, Sls./Mktg. VP

BRIAN R. WHITE CO., INC., 313 Henry Station Rd., Ukiah, CA 95482, Tel: 707-462-9795, FAX: 707-462-4800; *Sls. Mgr.:* Larry Richmond

WHITE-RODGERS LOGANSPORT DIV., See Stancor/ White Rodgers

S.S WHITE TECHNOLOGIES INC., 151 Old New Brunswick Rd, Piscataway, NJ 08854-3761, Tel: 908-752-8300; FSC No.: 0KZS2; Empl.: 100; *Sls. Mgr.:* Rich Henriksen; *Dist. Mgr.:* Pam Barnhard

WHITE TECHNOLOGY, INC., Bowmar Instrument Corp., 4246 E. Wood St., Phoenix, AZ 85040, Tel: 602-437-1520, FAX: 602-437-9120; FSC No.: 54230; Empl.: 105; *Sls. Mgr.:* Dan Hurd, Steve McComb

WHITMOR WIRE & CABLE, 27737 Ave. Hopkins, Valencia, CA 91355, Tel: 805-257-2400, FAX: 805-257-2495; FSC No.: 15851; Empl.: 29; *Sls. Mgr.:* Mark Lee; *Dist. Mgr.:* Mark Lee

WHITSO, 9326 Byron St., Schiller Pk., IL 60176, Tel: 708-678-5200, FAX: 708-678-0711; Empl.: 170

WHITTAKER CORP., Electronic Resources Div., 1955 N. Surveyor Ave., Simi Valley, CA 93063, Tel: 805-584-4100, TWX: 910-498-2751, FAX: 805-584-9157; FSC No.: 72152; Empl.: 200

WHITTAKER CORP., Providence Chemicals Div., King Philip Rd., P.O. Box 16069, E. Providence, RI 02916, Tel: 401-434-1770, TELEX: 92-7652, FAX: 401-434-8090; Empl.: 25

WICKMANN USA, INC., Wickmann-Werke GmbH, 3800 Camp Creek Pkwy.,Bldg. 2600,Suite 120, Atlanta, GA 30331, Tel: 404-699-7820, TELEX: 269 115 JIC UR, FAX: 404-691-2843; Empl.: 600-650; *Sls. Mgr.:* Michael V. Nagle; *Dist. Mgr.:* Michael V. Nagle ..... **B•1392-1394**

Local Sales Offices & Reps

AL	Athens, WLA & Assocs., Inc.	205-233-7894
CA	Laguna Hills, Bart Budge Assocs.	714-582-8720
CA	San Jose, Kottmeier Assocs., Inc.	408-371-8700
CO	Denver, West Inc.	303-477-8180
IL	Palatine, Goldbeck & Milota Assoc., Inc.	708-705-0602
MD	Baltimore, Manay Sls. Assocs.	301-484-6376
MA	Needham Hgts., Rosen & Assocs.	617-449-4700
MI	Grand Rapids, R.P.Urban & Assocs.	616-245-0511
MN	Minneapolis, RK Sls.	612-571-1001
TX	Dallas, Rem Comps.	214-234-1069

Local Distributors

CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Van Nuys, Fuses Unlimited/ Fusecom	818-786-8111
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
IL	Cary, Gama Elctrns.	708-639-3424
MA	Hingham, Sager Elctrns.	617-749-6700
MN	Roseville, Parts 1	612-633-8079
NH	Salem, Sager Elctrns.	603-898-1348
NY	Hauppauge, Sager Elctrns.	516-348-1300
OH	Twinsburg, Schuster Elctrns.	216-425-8134
TX	Dallas, Fuses Inc.	214-341-6407
WI	Milwaukee, Progressive Image, Inc.	414-321-4722
Can	Ontario, PS Comps., Inc.	416-665-9546

WIDE BAND ENGINEERING CO., INC., Box 21652, Phoenix, AZ 85036, Tel: 602-254-1570; FSC No.: 58907; Empl.: 10

WIDE RANGE ELCTRNS. CORP., 174 Chesterfield Indl. Blvd., Chesterfield, Missouri 63005, Tel: 314-532-5887, FAX: 314-532-5492; Empl.: 11; *Sls. Mgr.:* Donald Toone

WIELAND INC., 466 Main Street, New Rochelle, NY 10801, Tel: 914-633-0222, TELEX: 646-186, FAX: 1-800-572-0057; *Sls. Mgr.:* Carl Gruenberg, V.P. Sls. & Mktg.; *Dist. Mgr.:* Steve Vineis

WILBRECHT ELECTRONICS

FAX: 612-222-7639

WILBRECHT ELECTRONICS, 346 Chester St., St. Paul, MN 55107, Tel: 612-222-2791; Empl.: 200; *Sls. Mgr.:* Laurie Wilbrecht ..... **A•2077; B•1211-1213, 1793**

Local Sales Offices & Reps

AL	Huntsville, DTM Inc.	205-539-1485
AZ	Phoenix, Toward Engr. Assoc., Inc.	602-955-3193
CA	Chatsworth, Wes K/ Raltech Inc.	818-700-0933
CA	Milpitas, Advanced Tech., Sls., Inc.	408-946-3208
CO	Broomfield, Connors Co.	303-466-9628
FL	St. Petersburg, JCS Assoc.	813-343-2679
GA	Duluth, DTM Inc.	404-381-5592
IL	Arlington Hgts., Dytec/Central	708-394-3380
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MA	Sudbury, KSA of New England	617-443-5881
MN	St. Paul, Wilbrecht Elctrns.	612-222-2791
NJ	Morristown, Andrews & Andrews Inc.	201-569-8800
NY	Huntington, Andrews & Andrews	516-692-8686
WA	Bellevue, Caruso & Co.	206-455-8811
NC	Raleigh, DTM Inc.	919-781-7004
OH	Cincinnati, Stegman Blaine	513-729-1969
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Austin, THT Sls. Co.	512-835-2796
Can	Thornhill, Ont., EMX Entprs. Ltd.	416-889-1204

WILCO

FAX: 317-293-9462

WILCO CORP., 6451 Saguaro Court, Indianapolis, IN 46268, Tel: 317-293-9300 ..... **A•1280-1283, 2464**

Local Sales Offices & Reps

CA	San Jose, The Mktg. Co.	408-272-6836
IL	Arlington Heights, M.B. Sls.	708-392-9499
MI	Madison Heights, DEM Elctrn. Sls.	313-583-1500

WILCO WIRE & CABLE CO., INC., 1921 Las Plumas Ave., San Jose, CA 95133, Tel: 408-926-8880, FAX: 408-251-0508; Empl.: 52; *Sls. Mgr.:* Joe Shepherd; *Dist. Mgr.:* Sylvia Neal

WILCOXON RESEARCH, 2096 Gaither Rd., Rockville, MD 20850, Tel: 301-330-8811, FAX: 301-330-8873; Empl.: 90; *Sls. Mgr.:* Bob Haggerson ..... **B•1959**

WILKINSON, P.O. Box 4558, Westlake Village, CA 91359, Tel: 818-889-0050, 800-822-4653, FAX: 818-889-3810; Empl.: 40; *Sls. Mgr.:* R. Cook; *Dist. Mgr.:* R. Cook

W.L. WILLIAMSON & ASSOC., LTD., 528 S. Extension Rd., Mesa, AZ 85210, Tel: 602-833-5202; Empl.: 3

WILLIAMSON CORPORATION, 70 Domino Dr., Concord, MA 01742, Tel: 508-369-9607, FAX: 508-369-5485; FSC No.: 92-3343 WILIAMSON WCRD; Empl.: 25; *Sls. Mgr.:* William R. Barron

WILMAR ELECTRONICS, INC., 2430 Amsler St, Torrance, CA 90505, Tel: 213-326-6668, FAX: 213-326-9147; FSC No.: 25248; Empl.: 25; *Sls. Mgr.:* Zev Heifetz

WILMINGTON RESEARCH & DEVELOPMENT, 461-Boston Road B-3, Topsfield, MA 01983, Tel: 508-887-2501, FAX: 508-887-3249; Empl.: 6

WILMORE ELECTRONICS CO., INC., Box 1329, Hillsborough, NC 27278, Tel: 919-732-9351, TELEX: 292617, FAX: 919-732-9359; Empl.: 48; *Sls. Mgr.:* J. L. Harris ..... **D•2136-2139, 2230-2231**

WILSON COMPANY-SYSTEMS DIVISION, 16301 Addison Road, Dallas, TX 75248, Tel: 214-931-8666, 800-325-4436, FAX: 214-248-1177; Empl.: 9; *Sls. Mgr.:* Dave Pellerin; *Dist. Mgr.:* Dave Pellerin

WILSON, H. F., ENGINEERING CO., 475 Taft Ave., Glen Ellyn, IL 60137, Tel: 708-469-7473, FAX: 708-469-8663; Empl.: 21; *Sls. Mgr.:* Robert W. Carroll

WILSON ELECTRONICS, See Regency Land Mobile, Inc.

WILTRON, 490 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-778-2000, TELEX: 285227 WILTRON MH, FAX: 408-778-0239; FSC No.: 20944; Empl.: 800; *Sls. Mgr.:* W. Baxter

THE WINATIC CORP., Electro-Technik Industries, Inc., 409 Commerce Rd., Vestal, NY 13850, Tel: 607-729-6318, FAX: 607-729-6446; Empl.: 125; *Sls. Mgr.:* Ted Zaparzynski

WINSYSTEMS, INC., 715 Stadium DR.,Ste. 100, Arlington, TX 76011, Tel: 817-274-7553, FAX: 817-548-1358; FSC No.: 1AU87

WINTEK CORP., 1801 South St., Lafayette, IN 47904-2993, Tel: 317-448-1903, 800-742-6809, TELEX: 15-624-6480 Wintek, FAX: 317-448-4823; Empl.: 13 ..... **D•1122-1123**

WIREBENDERS, INC., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021-2824, Tel: 602-861-1856, FAX: 602-870-9242; FSC No.: 5950;FSCS/CAGE 1DA26; Empl.: 22; *Sls. Mgr.:* Charles Middleton

THE WIREMOLD COMPANY, 60 Woodlawn Street, W. Hartford, CT 06110, Tel: 203-233-6251, FAX: 203-232-2062; Empl.: 900; *Sls. Mgr.:* F. D. Casteel

WIRE-PRO, INC., 23 Front Street, Salem, NJ 08079, Tel: 609-935-7601, 609-935-7651, TWX: 510-680-4750, FAX: 609-935-0102; FSC No.: FSCN 50738; Empl.: 225; *Sls. Mgr.:* Russell Morgan, Sls. & Svc. Mgr.; *Dist. Mgr.:* Phil Negrin, Mktg. Mgr.

WIRING ANALYZERS, INC., P.O. Box 417, Edmonds, WA 98020-0417, Tel: 800-221-5979 (excl. CA); Empl.: 15; *Sls. Mgr.:* Norman Wartell

WOLFRAM RESEARCH, INC., 100 Trade Center Drive, Champaign, IL 61820-7237, Tel: 217-398-0700, FAX: 217-398-0747; Empl.: 1000; *Sls. Mgr.:* Stuart Ariewitz

WONTRONICS, 3048 N. Coolidge Ave., Los Angeles, CA 90039, Tel: 213-660-6230, FAX: 213-913-2299; *Sls. Mgr.:* Frank Phillips

WORLDNET MARKETING INC., 3187 F Airway Ave., Costa Mesa, CA 92626, Tel: 714-545-7118, TELEX: 3781824, FAX: 714-540-9138; Empl.: 7; *Sls. Mgr.:* Frank Buday; *Dist. Mgr.:* Frank Buday

WP®

FAX: 707-996-3380

WORLD PRODUCTS INC., 19654 8th St. East, Sonoma, CA 95476, Tel: 707-996-5201, TELEX: Worldpro snom 171715, FAX: 707-996-3380; FSC No.: 410966309; Empl.: 445; *Sls. Mgr.:* Mark Beynon; *Dist. Mgr.:* Jim Corbett ..... **A•1153, 2011, 2128-2129; B•1030**

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.	205-534-0044
AZ	Scottsdale, American Mktg.	602-948-2778
CA	Mission Viejo, Jay Mktg.	714-581-1211
CA	Mt. View, Straube Assocs. Inc.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
FL	Tampa, Electramark Florida Inc.	813-889-7775
GA	Norcross, The Novus Grp., Inc.	404-263-0320
IL	Arlington Heights, KMA Sls. Co.	708-398-5300
IA	Marion, Associated Elctrn. Mktg., Inc.	319-377-1129
MA	Burlington, Bob Dean Inc.	617-229-6800
MI	Holland, Comtek Sls. Inc.	616-392-7100
MN	Minneapolis, Tecteam Sls. Inc.	612-854-6616
MO	St. Louis, AEM, Inc.	314-298-9900
NJ	West Caldwell, Grimm. Siegel Assoc.	201-575-9300
NM	Albuquerque, Suntech	505-266-7951
NC	Cary, The Novus Grp., Inc.	919-460-7771
OH	Cincinnati, F.J. Campisano Co.	513-574-7111
OR	Portland, Caruso & Assocs.	503-246-5439
PA	Broomhall, L.D. Lowery	215-356-5300
PA	Coraopolis, F.J Campisano Co.	412-264-5151
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Bellevue, Caruso & Assocs.	206-455-8811
WI	Milwaukee, KMA Sls. Co.	414-259-1771

Local Distributors

AL	Huntsville, Reptron Elctrns. Inc.	205-722-9500
CA	Anaheim, Compumech Elctrns.	714-939-9100
CA	Del Mar, Compumech Elctrns.	619-792-7800
CA	Milpitas, Compumech Elctrns.	408-945-9100
CA	San Diego, All American	619-268-1505
CA	San Diego, Neuman	619-695-3005
CA	San Jose, All American Semiconductor Inc.	408-943-1200
CA	Santa Clara, Trinity Elctrns.	408-980-9011
CA	Torrance, All American Semiconductor Inc.	213-320-0240
CA	Yorba Linda, Target Elctrns.	714-692-1630
FL	Melbourne, Pridmore	407-727-2491
FL	Miami, All American Semiconductor Inc.	305-621-8282
FL	Sunrise, All American Semiconductor Inc.	305-572-7999
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Augusta, Dixie Elctrns.	404-722-2055
GA	Norcross, Reptron Elctrns.	404-446-1300
ID	Boise, Radar Elctrn.	208-336-2227
IL	Lisle, Comps. Inc.	708-852-7707
IL	Schaumburg, Reptron Elctrns.	708-882-1700
MD	Rockville, All American Semiconductor Inc.	800-426-0420,301-251-1205
MA	Norwood, Emtel	617-769-9500
MA	Wakefield, All American Semiconductor Inc.	617-246-2300
MI	Livonia, Reptron Elctrns.	313-525-3209
MN	Eden Prairie, All American Semiconductor Inc.	800-342-7364
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Fenton, Beckwith Elctrns.	314-343-6463
NM	Albuquerque, Betatron	505-821-1122
NY	Canadaigua, Advacom Technlg.	716-396-9050
NY	Ronkonkoma, All American Semiconductor	800-874-2830
NC	Charlotte, Dixie Elctrns.	704-377-4348
NC	Raleigh, Reptron Elctrns.	919-870-5189
NC	Winston-Salem, Dixie Elctrns.	919-727-5961
OH	Columbus, Reptron Elctrns.	614-436-6675
OH	Solon, Reptron Elctrns.	216-349-1415
OH	Stow, Advacom, Inc.	216-688-5311
OR	Portland, Radar Elctrns.	503-232-3404
PA	Harrisburg, Cumberland Elctrns.	717-238-5999
PA	McKean, Advacom Inc.	800-678-0512
SC	Columbia, Dixie Elctrns.	800-868-2236
SC	Greensville, Dixie Elctrns.	800-868-2260
SC	No. Charleston, Dixie Elctrns.	803-868-3336
TN	Gray, Dixie Elctrns.	615-477-3838

TN	Oakridge, Dixie Elctrns.	615-481-3393
TX	Austin, Omni Pro Elctrns.	512-794-9200
TX	Dallas, All American Semiconductor Inc.	800-541-1435
TX	Dallas, Omni Pro Elctrns.	214-233-0500
TX	Houston, Omni Pro Elctrns.	713-270-1700
VA	Charlottesville, Virginia Elctrn. Comp.	804-296-4184
WA	Richland, Radar Elctrns.	509-943-8336
WA	Seattle, Radar Elctrns.	206-282-2511
WA	Spokane, Radar Elctrns.	509-747-3053
Can	Calgary, Alb., Zentronics	403-295-8838
Can	Missisuga, Ont., Zentronics	613-226-8840
Can	Nepean, Ont., Zanin Elctrns.	613-596-2911
Can	Nepean, Ont., Zentronics	613-226-8840
Can	Richmond, B.C., Zentronics	604-273-5575
Can	St. Foy, Que., Zanin Elctrns.	418-681-1262
Can	St. Laurent, Que., Zanin Elctrns.	514-342-6211
Can	St. Laurent, Que., Zentronics	514-737-9700
Can	Toronto, Ont., Zanin Elctrns.	416-695-6850
KS	Lenexa, Associated Elctrn. Mktg., Inc.	913-888-0022

WORLD PRODUCTS INC., Systems Devices Grp., 19654 8th St. E., Sonoma 95476, Tel: 707-996-5201; Empl.: 50 ..... **A•1153, 2010-2011, 2128-2129; B•1030**

Local Sales Offices & Reps

AZ	Tempe, Spectrum Assocs.	602-966-1788
CA	Los Angeles, SPA Elctrn. Sls.	714-863-1193
CA	San Jose, Signet Tech. Sls.	408-453-0611
CO	Denver, Donohue Sls., Co.	303-455-1719
FL	Melbourne, R-Rep Co., Inc.	407-242-9800
IL	Arlington, KMA Sls. Co.	312-398-5300
IN	Fort Wayne, Berberich Assoc.	219-486-0673
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NJ	Livingston, Avemark Tech. Mktg.	201-992-5331
OH	Dayton, Berberich Assocs. Inc.	513-433-0342
OR	Beaverton, Luscombe Engrg./N.W.	503-636-6664
PA	Hatboro, AQS Electro	215-674-4421
TX	Dallas, Southwestern Tech. Sls.	214-369-0977
VA	Herndon, Stinson Assocs.	703-620-1332
WA	Bellevue, Luscombe Engrg./N.E.	206-643-1463
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Montreal, ELI Manis Inc.	514-484-2923

'WORLD' TEST SYSTEMS, INC., P. O. Drawer 1428, Waynesboro, VA 22980, Tel: 703-949-6753, FAX: 703-943-3826; *Sls. Mgr.:* Buford H. Baber

WOVEN ELECTRONICS, Woven Electronics Corporation, 1001 Old Stage Rd., Simpsonville, SC 29681, Tel: 803-963-5131, TWX: 810-963-5131, FAX: 803-963-1761; Empl.: 400; *Sls. Mgr.:* Tommy Little

WYLE LABS, See Electronic Enclosures

XCEL CORPORATION, See Digitran and Computron Display Sys. Divs.

XCEL CONTROLS INC., 1600 W. 6th, Mishawaka, IN 46544, Tel: 219-259-7804, FAX: 219-259-5769; Empl.: 40; *Sls. Mgr.:* Bruce Shepard

XCP, INC., 40 Elm St., P.O. Box 819, Dryden, NY 13053, Tel: 607-844-9143; *Sls. Mgr.:* Diane Rademacher

XEDAR CORP., 2500 Central Ave., Boulder, CO 80301, Tel: 303-443-6441, FAX: 303-443-6444; *Sls. Mgr.:* Andy Zeidler

XELTEK, 764 San Aleso Ave., Sunnyvale, CA 94086, Tel: 408-745-7974, FAX: 408-745-1401; Empl.: 17; *Sls. Mgr.:* Andrew Choi; *Dist. Mgr.:* John Kim

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XENON CORP., 20 Commerce Way, Woburn, MA 01801, Tel: 617-938-3594, FAX: 617-933-8804; Empl.: 45; *Sls. Mgr.:* Louis R. Panico

XENOTRONIX INC., 26074 Ave., Hall No. 10, Valencia, CA 91355, Tel: 805-257-4793, FAX: 805-257-1093; *Sls. Mgr.:* Jeffrey Frotton; *Dist. Mgr.:* Loria Geery

Xentek

FAX: 619-727-8926

XENTEK, INC., Taiyo Yuden USA, Inc., 760 Shadowridge Drive, Vista, CA 92083, Tel: 619-727-0940, TELEX: 910-322-1155; FSC No.: 53279; Empl.: 220; *Sls. Mgr.:* Chuck Henry ..... **D•2140-2143, 2232-2233**

Local Sales Offices & Reps

AL	Madison, Lamons Sls. Co.	205-461-7886
CA	Glendale, Halbar Assocs.	818-246-8263
CA	Huntington Bch., Regan/Munro Sls., Inc.	714-841-1411
CA	San Jose, Richards Assocs.	408-452-8171
CA	San Jose, Ruppert Sls. & Eng.	408-998-8717
FL	Casselberry, Symco, Inc.	407-695-6010
FL	Indian Harbor Bch., Post Mktg.	407-777-0994
GA	Norcross, Lamons Sls. Co.	404-242-2610
IL	Itasca, LTD Technlgs., Inc.	312-773-2900
IA	Cedar Rapids, Midtec Assocs.	319-395-0028
KS	Lenexa, Midtec Assoc.	913-541-0505
NJ	Medford, Mech-Elec. Sls.	609-654-8209
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Nashua, Bell Controls	603-882-6984
NC	Raleigh, Lamons Sls. Co.	919-846-1652
UT	Salt Lake City, Pro Rep Mktg.	801-268-3434
NY	Syracuse, M. M. Hare	315-457-6859
OH	Cincinnati, Tri-State Mktg.	513-761-7993
OR	Oregon City, Halbar, PNW	503-656-3714
TN	Greenville, Lamins Sls. Co.	615-639-8711
TX	Austin, Allied Comps.	512-331-4494
TX	Dallas, Allied Comps.	214-238-0408
TX	Houston, Allied Comps.	713-974-1903
TX	Hurst, Allied Comps. Co.	817-589-0456
VA	Richmond, Mech-Elec Sls.	804-231-4006
WA	Redmond, Halbar PNW, Inc.	206-882-0990
WI	Milwaukee, LTD Technlgs.	414-774-1000
Can	Mississauga, Altus Technlgs.	416-858-8509

XERCON, INC., P.O. Box 554, Portland, OR 97207, Tel: 503-292-8682, FAX: 503-292-8697; Empl.: 6; *Sls. Mgr.:* G. Osgood

XEROX CORPORATION, Xerox Square, 0-5, Rochester, NY 14644, Tel: 800-832-6979; Empl.: 100,367

XEROX IMAGING SYSTEMS, INC., Xerox Corp., 535 Oakmead Parkway, Sunnyvale, CA 94086, Tel: 408-245-7900, 800-248-6550, TELEX: 701994 DATACOPY UO, FAX: 415-965-3474; Empl.: 235; *Sls. Mgr.:* Joe Burroughs

XERTEX CORP., See Rosemont Corp., Sensall National Sonics

XETEL CORPORATION, 8100 Cameron Rd., Austin, TX 78753, Tel: 512-834-2266, FAX: 512-834-9250; Empl.: 300; *Sls. Mgr.:* Mark Trutna

XICO

FAX: 818-709-5235

XICO, INC., 9737 Eton Ave., Chatsworth, CA 91311, Tel: 818-709-4403, TELEX: 709577, ESYLNK: 62253150; Empl.: 21; *Sls. Mgr.:* Ralph Reccia ..... **D•1118**

XICON CAPACITORS, P.O. Box 170537, Arlington, TX 76003, Tel: 800-628-0544, FAX: 817-561-1480; *Sls. Mgr.:* Drey Hayford; *Dist. Mgr.:* A.T. White

XICOR, INC., 851 Buckeye Court, Milpitas, CA 95035, Tel: 408-432-8888, TWX: 910-379-0033, FAX: 408-432-0640; FSC No.: 60395; Empl.: 1010; *Sls. Mgr.:* Bruce Mattern,VP Sls.; *Dist. Mgr.:* Bruce Mattern

XITRON TECHNOLOGIES, 10225 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-458-9852, FAX: 619-458-9213; Empl.: 10; *Sls. Mgr.:* Stephen Merrill

XKD CORPORATION, 101 Cooper Court, Los Gatos, CA 95030, Tel: 408-395-3700, TELEX: 171946, FAX: 408-354-2606; *Sls. Mgr.:* Skip McLaughlin

XL MICROWAVE, 5811 Racine St., Oakland, CA 94609, Tel: 415-428-9488, FAX: 415-428-9469; Empl.: 6; *Sls. Mgr.:* William J. Artz

XSIS ELECTRONICS, INC., 12620 W. 63rd St., Shawnee, KS 66216, Tel: 913-631-0448, TELEX: 437227, FAX: 913-631-1170; FSC No.: 57051; *Sls. Mgr.:* Jerry Dehnert ..... **A•1491**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Western High Tech. Mktg.	602-266-2070
CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CA	Mission Viejo, Chaparrah Elctrn. Sls.	714-582-2950
CT	Cheshire, Ashworth Assocs.	203-968-0656
IL	Schaumberg, Sieger Assocs.	312-310-8844
KS	Lenexa, Midtec Assoc. Inc.	913-541-0505
KY	Ft. Mitchell, G. W. Thelen Co.	606-341-8181
MD	Ellicott City, VPI, Inc.	301-461-2525
MA	Shrewsbury, Ashworth Assocs.	617-845-9688
MN	Eden Prairie, Aldridge Assocs., Inc.	612-944-8433
MO	St. Louis, Midtec Assoc., Inc.	314-275-8666
NJ	Wayne, Ramar Assoc.	201-942-0480
NM	Albuquerque, Western High Tech Mktg.	505-884-2256
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Montgomeryville, Rufo Sys. Comps.	215-368-8495
TX	Sherman, Repmaster	214-247-6236
EXP	NY, Great Neck, Ad Auriema	516-487-0700

XYLOG CORP., 83 Hobart St., Hackensack, NJ 07601, Tel: 201-489-4040, FAX: 201-489-6745; Empl.: 30; *Sls. Mgr.:* Milton Frank

XYLOGICS, INC., 53 Third Ave., Burlington, MA 01803, Tel: 800-225-3317, FAX: 617-273-5392; Empl.: 200; *Sls. Mgr.:* David Padley; *Dist. Mgr.:* Joe Twardy

XYZ ELECTRONICS, 4700 N. 600 W, McCordsville, IN 46055, Tel: 317-335-2128, FAX: 317-335-2128; Empl.: 5; *Sls. Mgr.:* Gary Bannister

YAMAICHI ELECTRONICS, INC., Yamaichi Electronics Co., Ltd., 1420 Koll Circle, Ste.B, San Jose, CA 95112, Tel: 408-452-0797, FAX: 408-452-0799; Empl.: 19; *Sls. Mgr.:* Bob Million; *Dist. Mgr.:* Jim Bennett

YARDNEY TECHNICAL PRODUCTS, INC., 82 Mechanic St., Pawcatuck, CT 06379, Tel: 203-599-1100, TELEX: 6813114, TWX: 710-470-0260; FSC No.: 87362; Empl.: 250; *Sls. Mgr.:* Rene DuBois

YELLOW SPRINGS INSTRUMENT CO., Box 279, Yellow Springs, OH 45387, Tel: , , , 800-343-4357, TELEX: 205437, FAX: 513-767-9353; Empl.: 359; *Sls. Mgr.:* Michael Flora

YEW CORP., See Yokogawa Corp. of America

YORK METAL PRODUCTS, INC., 34-20 12th St., Long Island City, NY 11106, Tel: 718-932-3660, FAX: 718-932-0007; Empl.: 45

YORK TECHNOLOGY, INC., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502, Tel: 818-955-8927, TELEX: 990-968 York CA, FAX: 818-955-9728; *Sls. Mgr.:* Bradley E. Sousa

YSI INCORPORATED, P.O. Box 279, Yellow Springs, OH 45387, Tel: 513-767-7241, TELEX: 205437, FAX: 513-767-9353; Empl.: 300; *Sls. Mgr.:* Michael Flora; *Dist. Mgr.:* Michael Flora

YUASA BATTERY

FAX: 213-949-5527

YUASA BATTERY (AMERICA), INC., 9728 Alburtis Ave., Santa Fe Springs, CA 90670, Tel: 213-949-4266; Empl.: 5,000; *Sls. Mgr.:* Ron Alonso, Ed Stone; *Dist. Mgr.:* Greg Rapp ..... **D•1499**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Chandler, Lindberg	602-786-9115
AZ	Tempe, Westrep	602-820-9932
CA	San Diego, West Elctrns.	619-233-0236
CA	Santa Clara, Novatronix	408-727-9530
CA	Westminster, West Elctrns.	714-898-0120
CO	Denver, Lindberg Co.	303-758-9033
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, Over & Over	407-332-1222
FL	Coral Springs, Over & Over	305-753-7050
FL	Tampa, Over and Over	813-626-9100
GA	Norcross, Over & Over	404-449-6205
GA	Norcross, Over and Over	404-449-6205
IL	Arlington Heights, Brainard Nielsen	708-437-2700
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IA	Cedar Rapids, R.W. Kunz & Assocs.	319-396-5386
KS	Prairie Vlg., R.W. Kunz & Assocs.	913-648-3535
MD	Lisbon, Samual K. MacDonald	301-982-1088
MN	St. Louis Park, Elctrn. Innovators	612-922-2945
MO	St. Louis, R.W. Kunz & Assocs.	314-966-4977
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Cherry Hill, Samuel K. MacDonald	609-482-2666
NM	Albuquerque, Lindberg	505-881-1006
NC	Charlotte, Over and Over	704-542-9111
NC	Raleigh, Over & Over	919-876-7338
OH	Columbus, McFadden Sls.	614-761-3177
OR	Beaverton, Westmark Elctrns.	503-641-8780
PA	Monroeville, Samuel K. MacDonald	412-373-1723
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Lindberg	801-484-8689
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Waukesha, Brainard Nielsen	414-797-7940
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Mississauga, Ont., Tech-Trek Ltd.	416-238-0366
Can	Nepean, Ont., Tech-Trek Ltd.	613-225-5161
Can	Richmond, B.C., Tech-Trek Ltd.	604-276-8735
Can	St. Laurent, Que., Tech-Trek Ltd.	514-337-7540

Local Distributors

AZ	Glendale, Lynntronics	602-931-5981
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Costa Mesa, House of Batteries	714-642-8222
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Norcross, Applied Power	404-263-0421
HI	Honolulu, Elctrl. Equip.	808-533-3881
IL	Downers Grove, Jarbo Battery	312-964-9358
MD	Beltsville, Mark Elctrns.	301-595-5040
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Brighton, Applied Power	313-229-6550
MN	Minneapolis, Bergquist Co.	612-835-2322
NH	Salem, Cronin Elctrns.	603-898-4440
NJ	Clifton, Engrd. Assemblies	201-340-0600
NY	Farmingdale, Battery Expeditors	516-752-0111
NY	Flushing, W & W Assocs.	718-961-2103
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Engrd. Assemblies	919-790-9700
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Solon, Repco Elctrns.	216-248-8900
OR	Portland, Standard Batteries of Portland	503-234-7251
TX	Allen, Prime Distrbg.	214-231-0170
WA	Redmond, Priebe Elctrns.	206-881-2363
EXP	National & Canada, Newark Elctrns.	800-367-3573
Can	Brampton, Ont., Zentronics	416-451-8445

YUASA BATTERY (AMERICA) INC., Eastern Regional Office, 131 Industrial Ave., Hasbrouck Hgts., NJ 07604, Tel: 201-641-5900, FAX: 201-641-8720; *Sls. Mgr.:* Ed Stone/Cindy Werts; *Dist. Mgr.:* Toshio Hirai

ZAKI CORPORATION, 420 Maple St, Marlboro, MA 01752, Tel: 508-480-0201, FAX: 508-481-0595; *Sls. Mgr.:* Steven Sotsky

ZAMBRE CO., INC., 2134 Old Middlefield Way, Mountain View, CA 94043, Tel: 415-968-9176, FAX: 415-968-4851; FSC No.: 58758; 5950; Empl.: 20 Average

ZAX CORP., 2572 White Road, Irvine, CA 92714, Tel: 800-233-9817, 800-421-0982, FAX: 714-474-0159; Empl.: 25; *Sls. Mgr.:* Robert J. Parente, Dir. of Sls. & Mktg.

Z COMMUNICATIONS, INC., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, Tel: 305-735-1000, FAX: 305-735-1094; FSC No.: 1564A; Empl.: 20; *Sls. Mgr.:* Devang Patel

ZEBRA TECHNOLOGIES CORPORATION, 333 Corporate Woods Pkwy., Vernon Hills, IL 60061-3109, Tel: 708-634-6700, TELEX: 206230, FAX: 708-913-8766; Empl.: 175; *Sls. Mgr.:* Kevin O'Donnell

ZEHNTEL SYSTEMS, Div.of Teradyne Inc., 2625 Shadelands Dr., Walnut Creek, CA 94598, Tel: 415-932-6900, FAX: 415-934-0540; Empl.: 350; *Sls. Mgr.:* David Bernstein

CARL ZEISS, INC., One Zeiss Drive, Thornwood, NY 10594, Tel: 914-747-1800, TELEX: RCA 221834, TWX: WV64-6928

ZENDEX CORP., 6780 Sierra Court, Ste. A, Dublin, CA 94568, Tel: 415-828-3000, TWX: 910-389-4009, FAX: 415-828-1574; Empl.: 50; *Sls. Mgr.:* John Marceca

ZENITH

FAX: 708-391-7078

ZENITH MAGNETICS, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025-2493, Tel: 708-391-7733; *Sls. Mgr.:* Bob Cunningham; *Dist. Mgr.:* Allan Parker ..... **D•2145**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg. Assoc., Inc.	205-883-9630
AL	Huntsville, Pen-Tech Assoc.	205-881-9298
AZ	Phoenix, Howe & Howe Sls, Inc.	602-264-7971
CA	Laguna Hills, Electro Venture-s	714-581-9244
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Tech Rep Sls.	303-758-7031
CT	Cheshire, Nesco	203-272-0368
FL	West Palm Bch., Pen-Tech Assoc.	407-640-0800
IL	Arlington Hts., Hill Sls. Corp.	708-255-4400
KS	Roeland Pk., MSB Assocs. Inc.	913-432-2131
MA	Franklin, OEM Mktg. & Sls.	508-528-4983
MI	Ann Arbor, S-Tek	313-572-0516
MN	Minneapolis, Comstrand Inc.	612-788-9234
NH	Salem, OEM Mktg. & Sls.	603-893-1197
NJ	Fairfield, Metro Logic Corp.	201-575-5585
NY	Rochester, Micro-Tech Mktg. Inc.	716-426-0806
NC	Raleigh, Prime Components, Inc.	919-850-9866
OH	Cleveland, S-Tek	216-468-0413
OR	Portland, Jos. V. Beluski CO.	503-222-4279
PA	Willow Grove, Tech Sls. Assoc.	215-784-0170
TX	Dallas, REM Comps.	214-234-1069
TX	Houston, REM Comps.	713-589-9721
VA	Front Royal, Eltron Sls.	703-635-7201

ZERCOM CORPORATION, P.O. Box 84, Zercom Drive, Merrifield, MN 56465-0084, Tel: 218-765-3151, FAX: 218-765-3900; *Sls. Mgr.:* Jeff Zernov

ZERO CORPORATION

FAX: 818-841-5618

ZERO ENCLOSURES, Zero Corp., 777 Front St, Burbank, CA 91503, Tel: 818-846-4191, 818-841-1825; Empl.: 1400; *Sls. Mgr.:* Doug Griffith, V.P. ..... **C•1130-1144**

Local Sales Offices & Reps

AL	Huntsville, BJR Mfrs. Reps.	205-881-3569
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
AZ	Phoenix, Shefler/Kahn	602-581-0884
CA	Burbank, Zero-West Div.	818-846-4191
CA	Los Angeles, Landa & Assocs., Inc.	213-879-0770
CA	San Diego, Luscombe Engrg. Co.	619-292-4337
CO	Boulder, Component Prod. Sls. Co. Inc.	303-530-2800
FL	Maitland/Pompano Beach, Hutto Hawkins Assocs., Inc.	407-831-2474
FL	Pinellas Park, P & M Tech. Sls.	813-546-4175
GA	Norcross, Hollingsworth & Still, Inc.	404-447-1700
IL	Elk Grove Village, Carlson Elctrns. Sls.	708-956-8240
IN	Indianapolis, L.M. DeVoe Co.	317-842-3245
IA	Cedar Rapids, Carlson Elctrns. Sls.	319-378-1450
MD	Baltimore, Marktron	301-628-1111
MA	Monson, Zero-East Div.	413-267-5561
MN	Bloomington, Elctrn. Sls. Agcy.	612-884-8291
MS	Jackson, S. L. Welch	601-856-5471
MO	St. Louis, Cadon Techn. Sls.	314-645-8670
NY	Commack, MTR, Inc.	516-462-9580
NM	Albuquerque, Fry-Gates	505-262-1525
NY	East Syracuse, Fountain Young & Co.	315-437-7733
NC	Apex, Engineering Reps Assoc.	703-632-2365
OH	Cincinnati, K.C. Hoffman Co.	513-931-1686
OR	Tigard, RTS, Inc.	503-244-4123
PA	Boswell, B.E. Gibson	814-629-6772
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
SC	Greenville, Engineering Reps Assoc.	703-632-2365
TX	Austin, Tesco, Inc.	512-834-8374
TX	Dallas, Tesco Inc.	214-553-1200
TX	Houston, Tesco, Inc.	703-690-4909
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Salt Lake City, Effective Sls.	801-266-9617
MD	Rockville, Marktron	301-251-8990
WA	Vashon, RTS, Inc.	206-285-1363
Can	Iberville, Que., Lhotellier Canada Inds.	514-358-4376

ZERO CORP., Zero East Div., 288 Main St., Monson, MA 01057, Tel: 413-267-5561, FAX: 413-267-5569; FSC No.: 19178; Empl.: 380; *Sls. Mgr.:* Roger St. Martin ..... **C•1130**

Local Sales Offices & Reps

AL	Huntsville, BJR Mfg. Reps.	205-881-3569
CT	Monson, Zero-East Div.	413-267-5561
IN	Indianapolis, C.C. Electro Sls.	317-355-1508
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
MD	Rockville, Marktron, Inc.	301-251-8990
MA	Monson, Zero-East Div.	413-267-5561
MA	Palmer, Benoit-Senecal Co.	413-283-8384
MI	Grosse Pointe Pk., Greiner Assocs., Inc.	313-499-0188
MS	Jackson, S. L. Welch & Assocs.	601-932-5534
NY	Commack, MTR, Inc.	516-462-9580
NY	Syracuse, Fountain Young Co.	315-437-7733
NC	Martinsville, Engrg. Reps Assocs.	703-632-2365
OH	Columbus, Tom Mulligan & Assoc.	614-457-2242
PA	Boswell, B. E. Gibson	814-629-6772
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
SC	Martinsville W. VA, Engrg. Reps Assocs.	703-632-2365
Can	Islington, Ont., Pipe-Thompson Ltd.	416-236-2355

ZERO PLASTICS, A UNIT OF ZERO CORP., 672 Fuller Rd., Chicopee, MA 01020, Tel: 413-267-5561 Ext. 432, FAX: 413-592-5018; Empl.: 100; *Sls. Mgr.:* Brian Nichols

ZETA GRAPHICS CORP., 777 Arnold Drive, Martinez, CA 94553, Tel: 415-372-7568; Empl.: 138; *Sls. Mgr.:* Richard Howell, Natl. Sls. Mgr.

ZETEX, INC., Zetex plc., 87 Modular Avenue, Commack, NY 11725, Tel: 516-543-7100, FAX: 516-864-7630; *Sls. Mgr.:* Joseph M. DeBlasio

ZEUS INDL. PRODS. INC., P.O. Box 2167, Orangeburg, SC 29116, Tel: 803-531-2174, 800-526-3842, TWX: 710-480-9346, FAX: 803-533-5694; FSC No.: 32039; Empl.: 280; *Sls. Mgr.:* Wally Bernardo, OEM Sls. Mgr.; *Dist. Mgr.:* Heather Bernardo, Distr. Sls. Mgr.

ZEVATECH, INC., 2700 Gateway Centre Blvd. Ste., Morrisville, NC 27560, Tel: 919-460-0111, FAX: 919-469-0480; Empl.: 110; *Sls. Mgr.:* Bob Black; *Dist. Mgr.:* Bob Black

ZEXCO, 5526 Murietta Ave., Van Nuys, CA 91401, Tel: 818-997-7895

ZIATECH, 3433 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-0488, FAX: 805-541-5088; Empl.: 65; *Sls. Mgr.:* Ron Giovannelli

ZIERICK MANUFACTURING CORP., 56 Radio Circle, Mt. Kisco, NY 10549, Tel: 914-666-2911, 800-882-8020, TWX: 710-571-2143, FAX: 914-666-0216; Empl.: 120; *Sls. Mgr.:* L. T. Noyes; *Dist. Mgr.:* Jack Becker

ZIPPERTUBING CO., Box 61129, Los Angeles, CA 90061, Tel: 213-321-3901, FAX: 213-321-3086; Empl.: 60; *Sls. Mgr.:* Mike Sullivan

ZIRMEX, See Degussa Electronics, Hybrid Div.

ZI-TECH INSTRUMENT CORP., P.O. Box 391567, Mountain View, CA 94039-1567, Tel: 415-966-8484, TELEX: 334-447, FAX: 415-966-8201; Empl.: 15; *Sls. Mgr.:* J. Ziman

zitel

FAX: 408-262-6754

ZITEL CORPORATION, 630 Alder Drive, Milpitas, CA 95035, Tel: 408-946-9600, 800-622-5020, TELEX: 171607, TWX: 910-338-0567; Empl.: 145; *Sls. Mgr.:* Don Olker; *Dist. Mgr.:* Don Olker ..... **D•1119, 2239**

Local Sales Offices & Reps

CA	Granada Hills, West Coast Reps.	818-368-7385
CA	La Habra, West Coast Reps.	213-690-9960
CA	Meadow Vista, West Coast Reps.	916-878-7454
CA	Milpitas, Zitel	408-946-9600
CA	Norco, West Coast Reps.	714-261-5313
CA	Palo Alto, West Coast Reps.	415-325-6097
CA	San Diego, West Coast Reps.	619-581-2406
CT	Wallingford, Northern Computer Sales, Inc.	203-294-1004
FL	Cocoa Beach, Zitel	407-799-1000
IL	Hoffman Estates, Panatek	708-519-0867
MA	Canton, Northern Computer Sls, Inc.	617-821-2180
MI	Warren, Dietrich & Assocs.	313-751-4990
MN	Plymouth, James R. Johnson & Assocs.	612-478-9442
MO	St. Louis, Panatek Tech. Sls.	314-993-5088
NY	Elmont, Crane & Egert, Inc.	516-872-0800
NY	Fairport, Northern Computer Sls, Inc.	716-377-2650
OH	Cincinnati, Dietrich & Assocs.	513-984-8924
OH	Independence, Dietrich & Assocs.	216-642-7965
OK	Tulsa, Milco Mktg. Inc.	918-664-2188
PA	New Kensington, Zitel	412-795-0900
PA	Pittsburgh, Dietrich & Assocs.	412-892-2992
TX	Austin, Milco Mktg, Inc.	512-835-5359
TX	Houston, Milco Mktg, Inc.	713-469-5156
TX	Plano, Milco Mktg, Inc.	214-578-1996
WA	Snohomish, West Coast Reps.	206-483-5300

Z-LINE POWER CONTROLLERS, See Pulizzi Engineering, Inc.

ZMAN MAGNETICS, 7633 South 180th, Kent, WA 98032, Tel: 206-251-8064, FAX: 206-251-6264; Empl.: 35; *Sls. Mgr.:* Mark Mennella

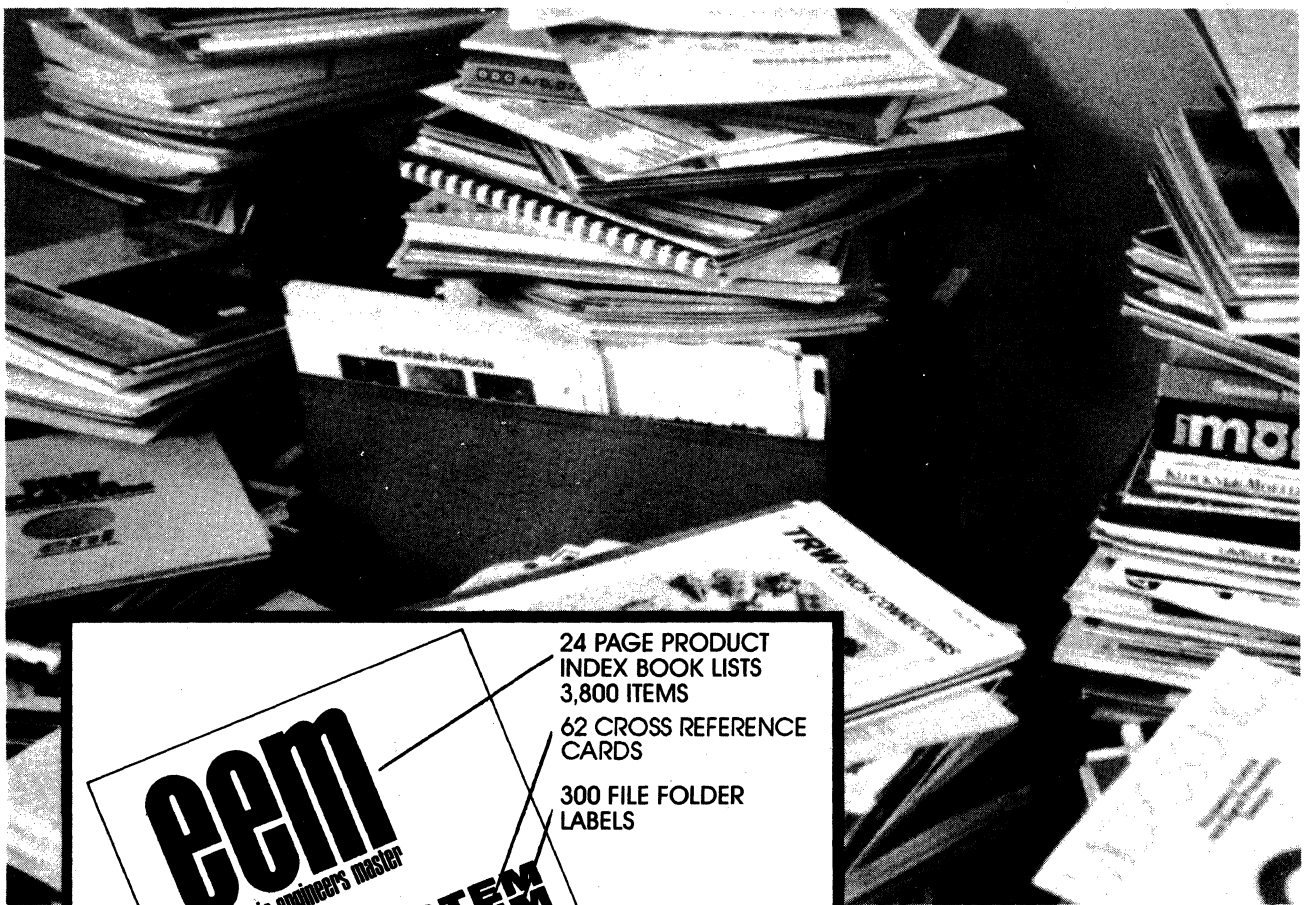
Z-WORLD ENGINEERING, 1340 Covell Blvd. 101, Davis, CA 95616, Tel: 916-753-3722, FAX: 916-753-5141; Empl.: 9; *Sls. Mgr.:* Carrie Evanoff

ZYLAB CORPORATION, 100 Lexington Dr., Buffalo Grove, IL 60089, Tel: 708-459-8000, FAX: 708-459-8054; Empl.: 21; *Sls. Mgr.:* Beth Harvey

ZYTRON, Zytronics, 70 Tirrell Hill Road, Bedford, NH 03102, Tel: 603-623-8888, FAX: 603-623-4009; Empl.: 100; *Sls. Mgr.:* Jan St. Pierre

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CODES
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SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

ABNT **Brazil (ABNT)** Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

TGL **Germany, Democratic Republic of (East) (ASMW)** Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

ELOT **Greece (ELOT)** The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

SII **Indonesia** Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

SII **Israel (SII)** Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

KEMA KEUR **Netherlands (NEC)** Nederlands Elektrotechnisch Comite

SANZ **New Zealand (SANZ)** Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

STAS **Romania** Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

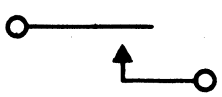
United States Underwriters Laboratories Inc.

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

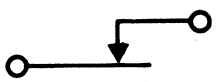
Yugoslavia Federal Institute of Standardization

MINIGLOSSARY
RELAY CONTACT FORMS

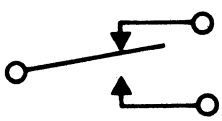
A
Make
SPST-NO



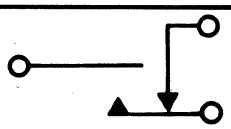
B
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SPST-NC



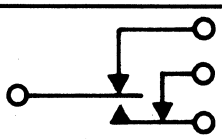
C
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(Transfer)
SPDT



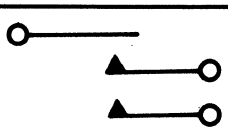
D
Make, Break
(Continuity
Transfer)



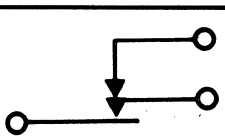
E
Break,
Make,
Break



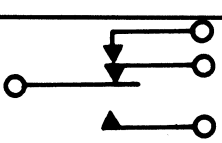
F
Make,
Make



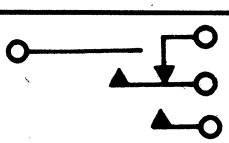
G
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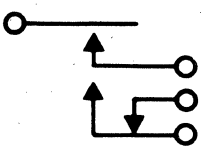
H
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Break,
Make



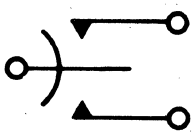
I
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Make



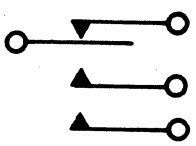
J
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Break



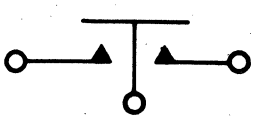
K
Center off
SPDT



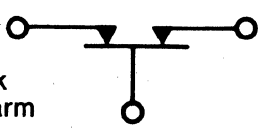
L
Break,
Make,
Make



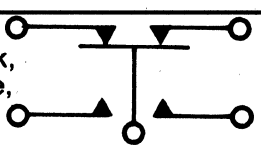
U
Double
make
Contact
on arm



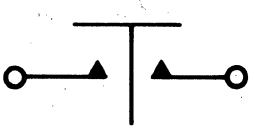
V
Double break
Contact on arm



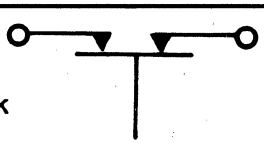
W
Double break,
Double make,
Contact
on arm



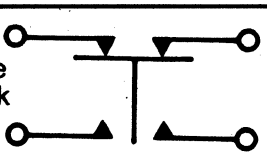
X
Double
make



Y
Double break



Z
Double make
Double break
SPDT-DB



CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-temperature	NA	S	2.1	685	1.8	200	[h]
	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

eem MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

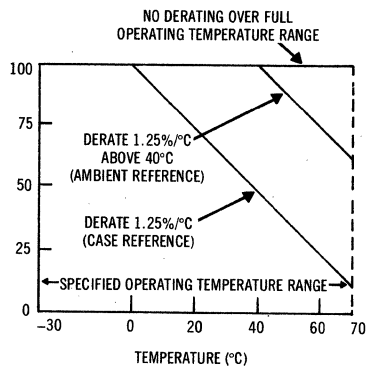


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

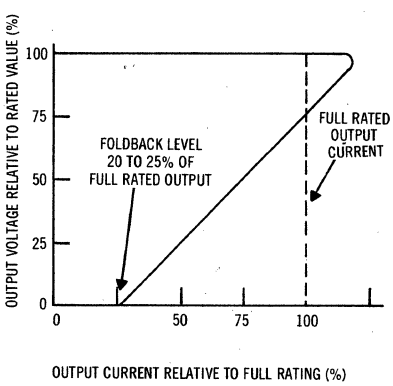


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

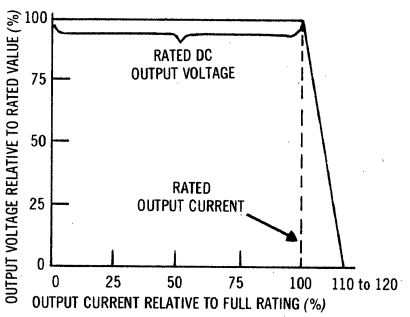


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE

Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al_2O_3	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1,\varphi_1,\alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

eem SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

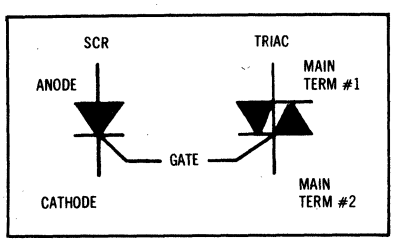
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

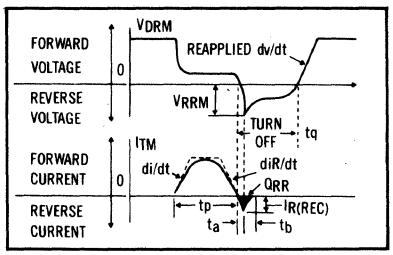


Fig. 1. Concurrent voltage and current waveforms

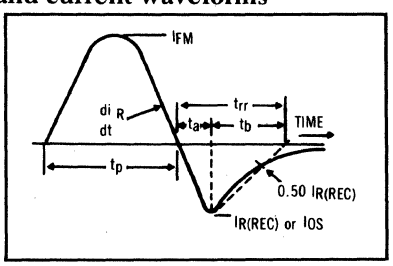


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature.*

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

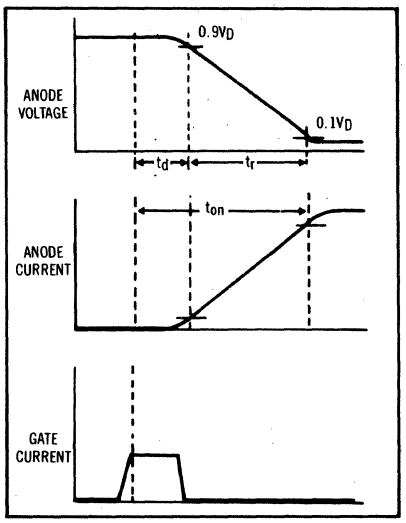


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time*. Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

eem MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

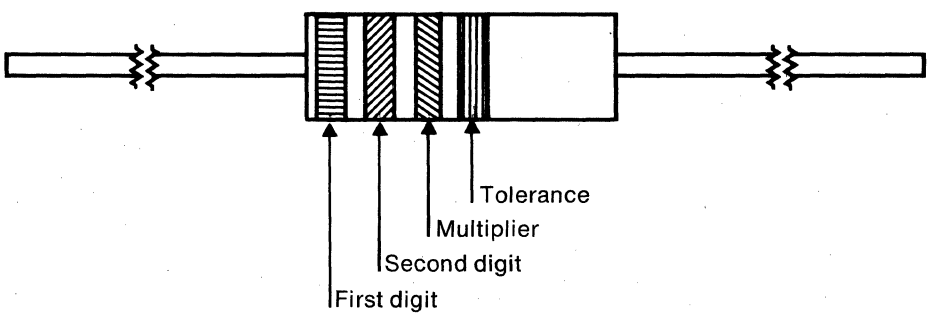
Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

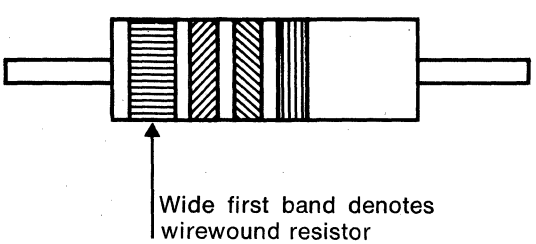
Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

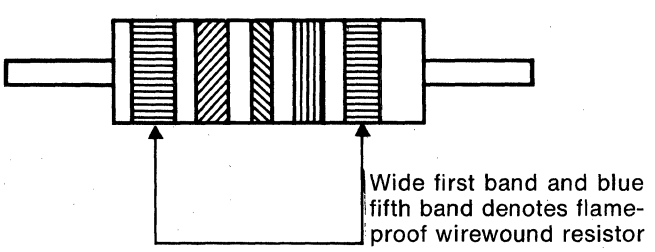
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

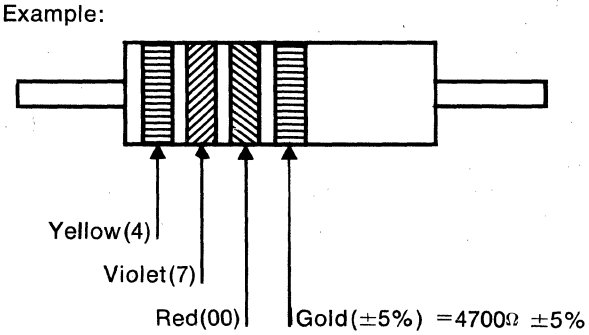




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



MINIGLOSSARY TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer
(Delay-On-Operate/Interval Timer)
The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)
The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time
(Delay-On-Operate or Interval Timer)
The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)
The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.
Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

Trip Point
The predetermined point at which a sensing device is set to change the output state.

Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

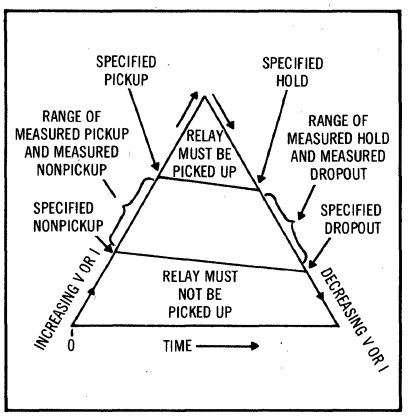
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.



Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

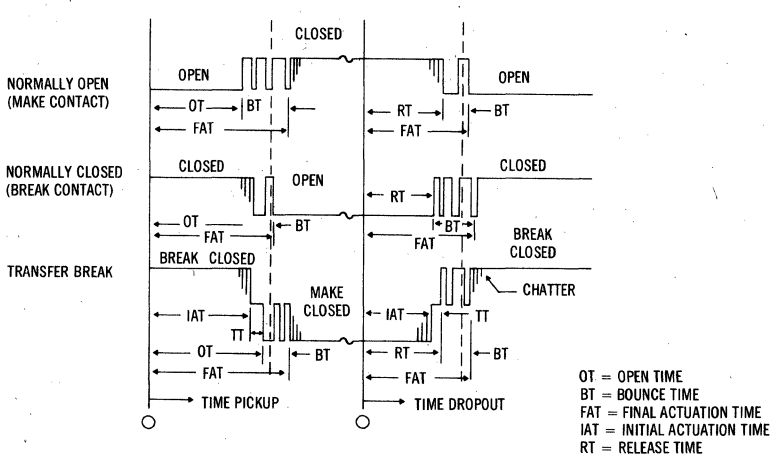


Fig. 2. Typical time vs. current (noninductive load)

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

eem MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

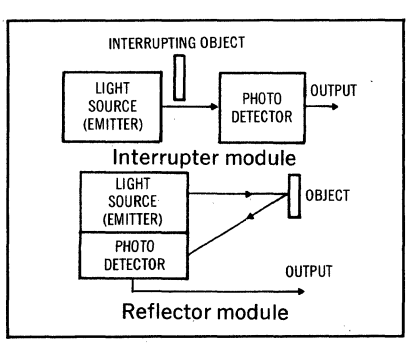
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

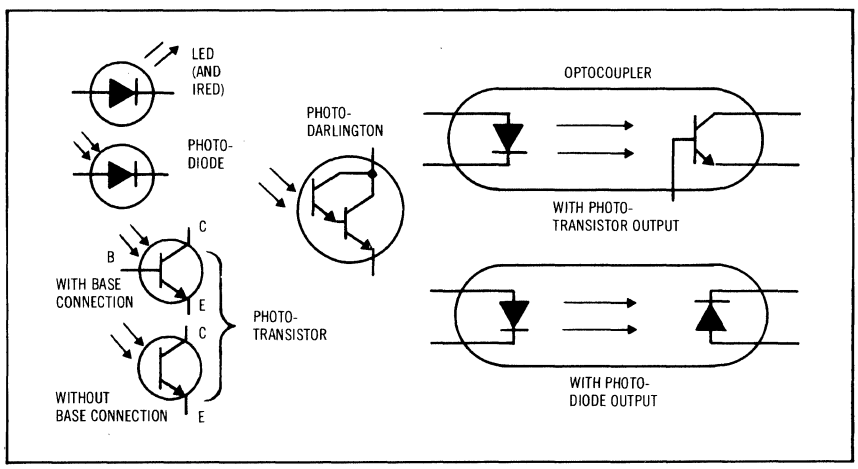
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

eem

MINIGLOSSARY
BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon
<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
_	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

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EEM/Electronic Engineers Master is **user**-named, **user**-driven, and **user**-sensitive.

You, the electronic engineer, are the individual the thousands of manufacturers represented in EEM are trying to reach. **You** are the reason hundreds of manufacturers place their data pages in EEM—so that **you can specify their product in your project.**

EEM wants to know:

- what's new
- what products you are looking for
- what you call them
- what are their basic parameters
- where do they belong in the EEM Product Sections

What kind of reference material/engineering aids will help you make your electronic component choices:

- glossaries
- nomographs
- charts
- product selection guides

Write to the editor: The Editor
EEM/Electronic Engineers Master
645 Stewart Ave.
Garden City, NY 11530

eem

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

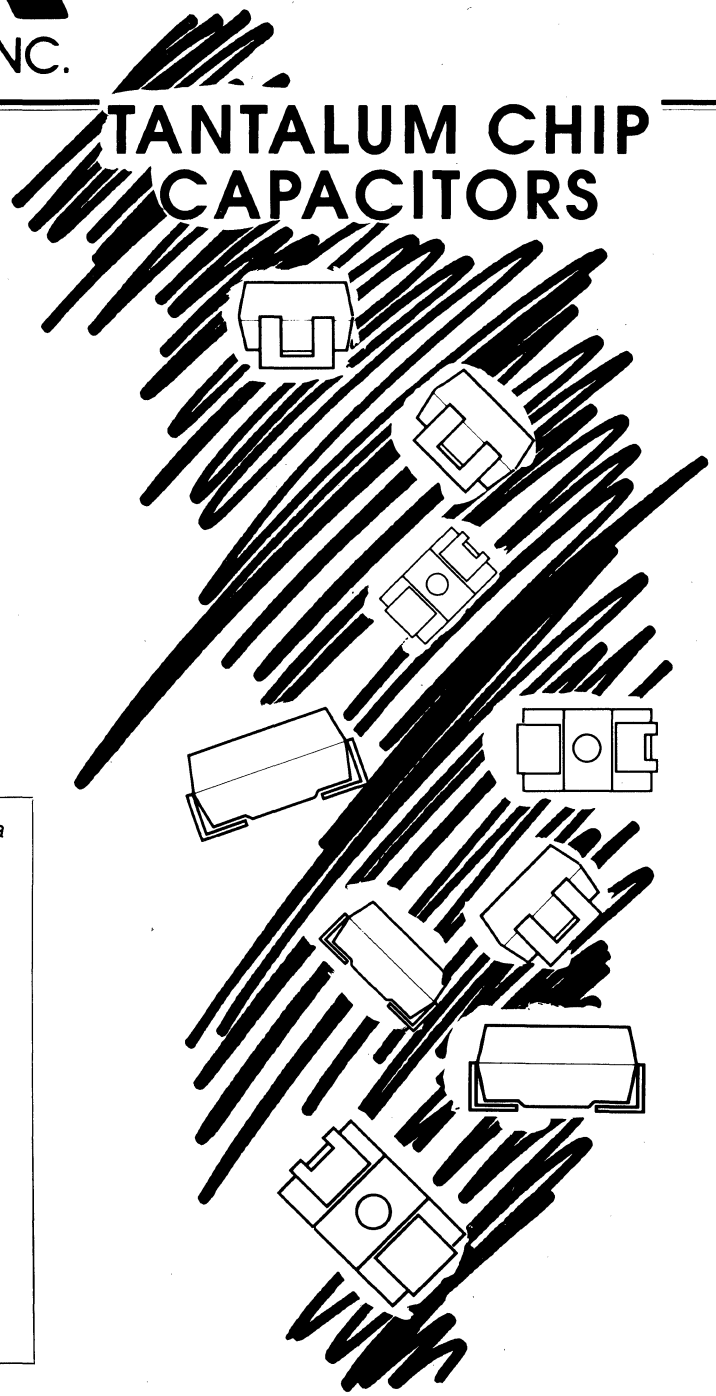
WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

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ASCII Code **D**•1086
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Batteries & Fuel Cells, Characteristics **D**•1468
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CAPACITORS, FIXED, ELECTROLYTIC

ALUMINUM

Manufacturer	Starting EEM Page No.	Subminiature Tubular				Standard Tubular				Small Can		Large Can	Plastic	AC Motor
		Axial Leads		Single End		Axial Leads		Single End		Single	Multi-			
		Polar	Nonpol.	Polar	Nonpol.	Polar	Nonpol.	Polar	Nonpol.	Section	Section	Storage	Cases	Start
Robert G. Allen Co. Inc.	A•1008	√	√	√	√	√	√	√	√	√	√	√	√	√
Del Electronics	A•1056									√	√			
Armbar	A•1011	√		√										
Illinois Capacitor Inc.	A•1066					√	√	√	√	√		√		
Metuchen Capacitors	A•1098	√		√										
M.P. Capar	A•1107	√	√	√	√	√	√	√	√	√				
Philips Components	A•1124					√		√				√		√
Sprague Electric	A•1138	√	√	√	√	√	√	√		√		√*		
Tansistor Electronics	A•1143	√		√		√		√		√				
United Chemicon Inc.	A•1148	√	√	√	√	√	√	√	√	√	√	√		√

* MIL Spec. § Surface Mount

TANTALUM

Manufacturer	Starting EEM Page No.	Solid Electrolyte						Wet Slug		Foil	
		Dipped Radial	Molded Axial	Molded Radial	DIP	Chip	Metal Case	Tubular Case	Large Case	Polar	Nonpolar
Robert G. Allen Co. Inc.	A•1008	√	√	√	√	√					
Arm Bar Industries, Inc.	A•1011						√*	√*		√	
Kemet Electronics Corp.	A•1082	√*	√*	√	√	√§	√*				
KOA Speer	A•1085	√	√	√	√	√		√	√		
Matsuo Electronics of America	A•1092	√		√	√	√	√	√			
Metuchen Capacitors	A•1098						√	√		√	
M.P. Capar	A•1107	√				√					
NEC Electronics	A•1115					√					
Philips Components	A•1124		√	√		√		√		√	√
Sprague Electric	A•1138	√§*	√§*		√§*	√§*	√§*	√	√	√	√
Tansistor Electronics	A•1143	√			√	√		√		√	√

* MIL Spec. § Surface Mount

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CAPACITORS,FIXED, ELECTROSTATIC

CERAMIC

Manufacturer	Starting EEM Page No.	General Purposes (Z5U)		Special Purpose (C0G etc.)				Monolithic						
										Encapsulated				
		Axial	Disc/ Radial	Axial	Disc/ Radial	DIP	Chip	Chip	DIP	Axial	Dipped Radial	Molded Radial	Feed Thru	High Voltage/ Power
Robert G. Allen Co. Inc.	A•1008	√	√	√	√	√	√	√	√	√	√	√		
Arm Bar Industries Inc.	A•1011	√*	√*	√*	√*	√*	√*§	√*§	√*	√*	√*	√*	√*	√*
Component Research Co. Inc.	A•1021		√		√									
Illinois Capacitor Inc.	A•1066		√		√									
Jennings	A•1079	√	√	√	√	√	√							√
Johanson Dialectrics Inc.	A•1081	√	√	√	√	√	√	√		√				√
Kemet Electronics Corp.	A•1082	√	√	√*	√	√	√	√*§	√	√	√	√		√
Maida Development Co.	A•1086	√	√	√	√								√	√
Metuchen Capacitors Inc.	A•1098	√	√	√	√	√	√	√	√	√	√	√	√	√
M. P. Capar	A•1107	√	√	√	√	√	√	√	√	√	√			
Murata Erie N. A.	A•1109	√	√	√	√		√	√		√	√			√
Philips Components	A•1124	√	√	√	√	√		√						
Sprague Electric	A•1138		√*§		√	√	√*	√*	√		√		√	
TDK Corp. of America	A•1144	√	√	√	√	√	√	√	√	√	√	√	√	√

* MIL Spec. § Surface Mount

CAPACITORS, FIXED, ELECTROSTATIC

FILM/FOIL (NONMETALLIZED)

Manufacturer	Starting EEM Page No.	Polyester		Polystyrene		Polycarbonate		Polypropylene		Teflon	Paralene		Combi-nations
		Axial	Radial	Axial	Radial	Axial	Radial	Axial	Radial	Axial	Axial	Radial	
Robert G. Allen Co. Inc.	A•1008	√	√	√	√			√	√				
Armbar	A•1011	√*	√*			√*	√*				√	√	
Chicago Condenser Corp.	A•1019	√	√			√	√	√	√	√			
Component Research Co.	A•1021	√	√	√	√	√	√	√	√	√			
Condenser Products Corp.	A•1051	√	√					√	√	√			
Del Electronics	A•1056	√	√			√		√	√				
Electronic Concepts Inc.	A•1058	√	√	√	√	√	√	√	√				
Elpac Components	A•1065	√	√	√	√	√	√	√	√	√			
Illinois Capacitor Inc.	A•1066		√										
Inter-Technical Group	A•1071		√				√		√				
ISKRA Electronics	A•1075		√	√	√		√		√				
ITW Paktron	A•1076							√	√				
Matsuo Electronics	A•1092	√	√					√	√				
Metuchen Capacitors	A•1098	√	√			√	√						
M.P. Capar	A•1107	√	√	√	√	√	√	√	√				
Multi-Comp, Inc.	A•1108	√		√		√		√					
NWL Transformers	A•1120	√		√		√		√			√		
Philips Components	A•1124	√		√	√			√		√			
PPD Inc.	A•1130							√	√				
Seacor Inc.	A•1137	√	√	√	√	√	√	√	√				
Sprague Electric	A•1138	√	√	√	√	√	√	√	√				
Wesco Electrical Co.	A•1150	√	√	√	√	√	√	√	√				

* MIL Spec. § Surface Mount

METALLIZED FILM

Manufacturer	Starting EEM Page No.	Polyester		Polysulfone		Polycarbonate			Polypropylene		AC & Motor Run	Teflon Axial	Combi-nations
		Axial	Radial	Axial	Radial	Axial	Radial	Chip	Axial	Radial			
Robert G. Allen Co. Inc.	A•1008	√	√						√	√	√		
Armbar	A•1011	√	√	√	√	√	√	√	√	√	√	√	
ASC Capacitors	A•1012	√	√										
Chicago Condenser	A•1019	√	√						√	√			
Component Research Co. Inc.	A•1021			√	√	√	√	√	√	√	√	√	√
CSI Capacitors	A•1055	√	√	√	√	√	√	√	√	√	√		
Del Electronics	A•1056	√		√		√			√	√			
Electronic Concepts Inc.	A•1058	√	√	√	√	√	√		√	√	√		√
Elpac Components	A•1065	√	√	√	√	√	√		√	√		√	
Illinois Capacitor Inc.	A•1066	√	√			√			√	√			
Inter-Technical Group	A•1071		√				√			√			
ISKRA Electronics	A•1075	√	√			√	√			√	√		
ITW Paktron	A•1076	√	√			√	√						
Kemet Electronics Corp.	A•1082					√*	√						
Matsuo Electronics of America	A•1092	√	√			√			√	√			√
Metuchen Capacitors	A•1098	√	√	√	√	√	√	√	√	√	√	√	
M.P. Capar	A•1107	√	√			√	√		√	√			
Multi-Comp., Inc.	A•1108	√				√			√				√
NWL Transformers	A•1120	√				√			√		√		
Philips Components	A•1124	√				√	√			√			√
PPD Inc.	A•1130	√	√						√	√	√		
Seacor Inc.	A•1137	√	√			√	√		√	√	√		√
Sprague Electric	A•1138	√*	√*	√	√	√	√*		√*	√*	√*		
Wesco Electrical Co.	A•1150	√	√			√	√		√	√	√		

* MIL Spec. § Surface Mount

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CAPACITORS, FIXED, ELECTROSTATIC

MICA

Manufacturer	Starting EEM Page No.	Dipped	Chip	Button	Transmitting	Reconstituted
Robert G. Allen Co., Inc.	A•1008	√				
Arm Bar	A•1011	√	√			
Del Electronics	A•1056					√
Metuchen Capacitors	A•1098	√	√			
M.P. Capar	A•1107	√	√			
NWL Transformer	A•1120				√	√

* MIL Spec. § Surface Mount

PAPER & PAPER/FILM

Manufacturer	Starting EEM Page No.	Paper Foil (Dry)			Paper Foil (Impregnated)		Metallized Paper			Paper/ Film (Axial)
		Axial	Single End	Herm. Sealed	Energy Store	Motor Run	Axial	Single Ended	Herm. Sealed	
Chicago Condenser	A•1019				√*					√
Component Research	A•1021	√	√	√			√	√	√	√
CSI Capacitors	A•1055	√	√	√	√	√	√	√	√	√
Condenser Products	A•1051				√					
Del Electronics	A•1056	√	√	√	√	√	√		√	
Inter-Technical Group	A•1071			√					√	
ISKRA	A•1075							√		
NWL Transformers	A•1120	√	√	√	√		√		√	√
Philips Components	A•1124									
Seacor	A•1137	√	√		√	√	√	√		
Sprague Electric	A•1138	√*		√*	√*	√*	√*		√*	√

* MIL Spec. § Surface Mount

CAPACITORS, VARIABLE

Manufacturer	Starting EEM Page No.	AIR				CERAMIC		Gas Filled	GLASS		Mica	PLASTIC		Sapphire	Vacuum
		Single Turn	Multi-turn	Ball Bearing	Ganged	Tubular	Disk		Piston	Non-magnetic		Single Turn	Multi-turn		
Arm Bar Industries, Inc.	A•1011					√	√*				√	√	√		
Jennings	A•1079	√	√	√	√	√	√		√	√		√			
Johanson Dielectric	A•1081	√	√	√	√	√									
Johanson Mfg. Corp.	A•1080							√			√	√			
Maida Development	A•1086					√									
Metuchen Capacitors Inc.	A•1098					√	√				√	√	√		
Murata Erie/KSA	A•1109	√		√							√	√			
Sprague Goodman Elctrns. Inc.	A•1140	√					√*		√	√	√*	√*		√	

* MIL Spec. § Surface Mount

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

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Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

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Radial—Wide Temperature
Radial—Low Profile (5mm Height Max)
Radial—Low Leakage
Radial—Low Leakage, Wide Temperature
Radial—Super Subminiature, Low Leakage, Tantalum Replacement
Radial—Non-Polarized
Radial—Low ESR for Switching Regulators
Snap-in Terminal
Snap-in Terminal, Low Profile
Snap-in Terminal, Wide Temperature
Snap-in Terminal, Low Profile, Wide Temperature

TANTALUM CAPACITORS
Radial—Resin Dipped
Chip type, Surface Mounted

FILM CAPACITORS
Radial, Inductive Dipped Polyester
Radial, Non-Inductive Dipped Polyester
Axial, Wrap and Fill Polyester, Non-Inductive
Radial, Metalized Polyester, Dipped
Axial, Metalized Polyester, Wrap and Fill, Flat Oval
Axial, Metalized Polyester, Wrap and Fill, Tubular
Radial Metalized Polypropylene, Dipped
Axial Metalized Polypropylene, Wrap and Fill, Flat Oval
Axial Metalized Polypropylene, Wrap and Fill, Tubular
Radial Polypropylene
Axial Polypropylene
Axial Polystyrene, Film Foil

CERAMIC CAPACITORS
Radial Disc, HI-K Type Y5F, Y5P, Z5U, Z5V
Radial Disc, Temperature Compensating Type NPO, SL, N750, N1500
Radial Disc, Semi-Conductive Type Y5S, Y5T, Y5V
Radial, Multi-Layer, Epoxy Dip NPO, X7R, Z5U
Chip Type Multi-Layer NPO, X7R, Y5V, Z5U
Axial Single Layer

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- *Snap in Terminals*
- *High Temperature*
- *Chip*

Ceramics
- *Chip*
- *Hi-K Type*
- *NPO, X7R*
- *Semiconductive Type*
- *Monolythic*

Tantalum
- *Dipped Type*
- *Molded Types*
- *Solid*
- *Wet Slug*
- *Chip*

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- *Polycarbonate*
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- *Chip*

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TANTALUM SOLID ELECTROLYTIC CAPACITORS

SUPERMINIATURE MOLDED CHIP TANTALUM CAPACITORS

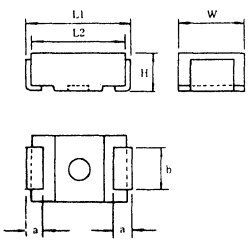
TCM SERIES

Miniaturization of electronics products requires less space for components. TCM Series Molded Chip Tantalum Capacitors are designed for use in thick film hybrid circuits and for direct mounting on printed on circuit boards. Fully-molded construction has good resistance to mechanical stress and moisture. They are supplied on Carrier Tape for automatic assembly.

SPECIFICATIONS

Operating Temperature Range		−55°C – +125°C
Maximum Operating Temperature at Rated Voltage		+85°C
Capacitance Range		0.047μF – 100μF
Rated Voltage Range		4.0V – 35V DC
Capacitance Tolerance		±20% (at 20°C, 120Hz)
Leakage Current		0.01CV or 0.5μA max.
Dissipation Factor at 20°C and 120Hz		Cap. ≦1.0 .umF less than 4% Cap. ≧1.5μF less than 6%
Humidity Test	Test Condition	Temp.: 60°C, humidity: 90 – 95% RH, duration: 500 hrs.
	Capacitance Change	Within 5% of the value before test
	Leakage Current	Not to exceed the value specified above
	Dissipation Factor	Not to exceed 125% of the value specified above
High Temp. Load Test	Test Condition	Temp.: 85°C at rated voltage duration: 1,000 hrs.
	Capacitance Change	Within 10% of the value before test
	Leakage Current	Not to exceed 125% of the value specified above
	Dissipation Factor	Not to exceed 125% of the value specified above
Reliability		Failure rate: Less than 1%/1,000 hours (60% CL)

DIMENSIONS

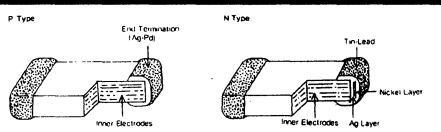


(Unit: mm)

	L1±0.2	L2±0.2	W±0.2	H±0.2	a±0.2	b±0.2
Case A	3.2	2.9	1.6	1.7	0.8	1.2
Case B	5.1	4.8	3.2	1.8	0.8	2.0
Case B1	3.4	3.1	2.8	1.9	0.8	1.8
Case C	6.7	6.4	4.8	1.8	1.2	2.5
Case C1	5.8	5.5	3.2	2.5	1.2	2.0
Case D	6.7	6.4	4.8	2.5	1.2	2.5
Case D1	5.8	5.5	4.6	3.2	1.3	2.4
Case E	7.3	7.0	4.3	2.9	1.3	2.4

CHIP CAPACITOR

Construction



COG

Ultra Stable class I dielectric,with negligible dependance of electrical properties on temperature, voltage, frequency or time. Used in circuits requiring stable performance.

X7R

Stable class II dielectric, with predictable change of properties with temperature, voltage, frequency and time. Used as blocking, coupling, by-pass and frequency discriminating elements. This dielectric is ferroelectric and offers higher capacitance ranges than class I.

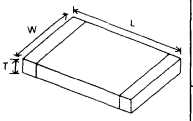
Y5V (Z5U)

General purpose class II dielectric with higher dielectric constant and greater variation of properties with temperature and test conditions. Very high capacitance per unit volume is attainable for general purpose applications.

STANDARD RATINGS AND CASE CODES

Cap. (μF) \ W.V.	4.0	6.3	10	16	20	25	35
0.047							A
0.068							A
0.1							A
0.15							A
0.22							A
0.33							A
0.47						A	B, B1
0.68					A		B, B1
1.0				A			B, B1
1.5			A			B, B1	C, C1
2.2		A			B, B1	C, C1	C, C1
3.3	A			B, B1	C, C1	C, C1	C, C1
4.7	A		B, B1	C, C1	C, C1	C, C1	D, D1, E
6.8		B, B1	C, C1	C, C1	C, C1	D, D1, E	D, D1, E
10	B, B1	C, C1	C, C1	C, C1	D, D1, E	D, D1, E	E
15	C, C1	C, C1	C, C1	D, D1, E	D, D1, E		
22	C, C1	C, C1	D, D1, E	D, D1, E			
33	C, C1	D, D1, E	D, D1, E				
47	D, D1, E	D, D1, E	D, D1, E				
68	D, D1, E	D, D1, E					
100	D, D1, E						

SIZE & CAPACITANCE VALUE RANGE

SIZE	CONSTRUCTION	DIMENSION L	DIMENSION W	DIMENSION T
0805		2.0±0.15	1.25±0.15	$0.7\pm^{0.}_{0.2}$
				$1.0\pm^{0.}_{0.4}$
				$1.25\pm^{0.}_{0.4}$
1206		3.2±0.15	1.6±0.15	$0.7\pm^{0.}_{0.2}$
				$1.0\pm^{0.}_{0.4}$
				$1.25\pm^{0.}_{0.4}$

CAPACITANCE VALUE RANGE OBTAINABLE FOR EACH SIZE

SIZE	THICKNESS (mm)	COG (pF)	X7R (pF) 50V	X7R (pF) 25V	Y5V (Z5U) (pF) 50V	Y5V (Z5U) (pF) 25V
0805	$0.7\pm^{0.}_{0.2}$	10-330	470-8200	10000-12000	1000-2200	33000-68000
	$1.0\pm^{0.}_{0.4}$	360-510	10000-15000	15000-22000	33000-47000	100000
	$1.25\pm^{0.}_{0.4}$	560-820	18000-27000	27000-39000	68000	-
1206	$0.7\pm^{0.}_{0.2}$	20-750	1000-15000	39000-47000	1000-47000	68000-100000
	$1.0\pm^{0.}_{0.4}$	820-1000	18000-27000	56000-100000	8000	150000
	$1.25\pm^{0.}_{0.4}$	1100-2200	33000-68000		100000	220000

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EEM COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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CERAMIC CHIP CAPACITORS FOR SURFACE MOUNTED TECHNOLOGY

CHIP PACKAGING INFORMATION—CERAMIC

CoPS (Component Placement System) Reeling

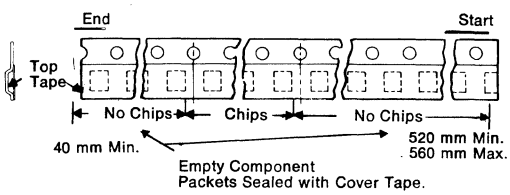
Armbar Industries is offering KEMET's CoPS (Component Placement System), Multilayer Ceramic Chip Capacitors in carrier tape form for automatic placement on printed circuit boards. They are available in nine sizes.

KEMET CoPS capacitors conform to the Electronic Industries Association specification RS-481A for Automated Compoennt Processing and insertion.

FIGURE 1
KEMET CoPS Capacitors are wound on a standard 178.0 mm (7.00″) or 330.0 mm (13.0″) diameter 8 mm reel. Seven-inch diameter reels contain 2,500 chips and for 13.0″ diameter reels, 12,500 chips.

FIGURE 2
Figure 2 shows carrier leader and ending amounts of KEMET Multilayer Ceramic Chips on CoPS reels.

Figure 2 — CoPS Carrier Chips



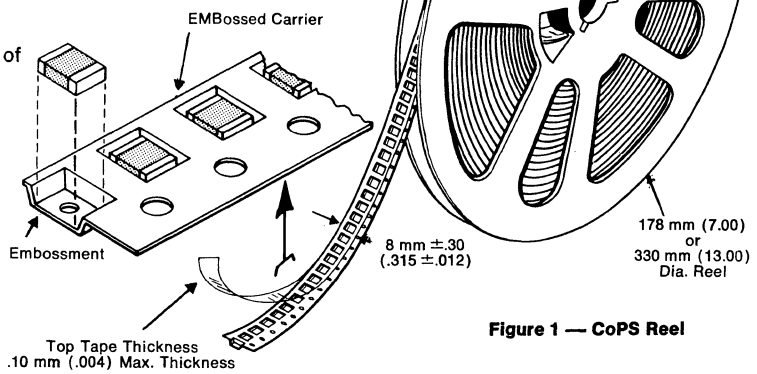


Figure 1 — CoPS Reel

Armbar stocks the following chip sizes and values on reel for immediate shipping.
Additional sizes and value will be made available on reels — consult Armbar for delivery.

NPO DIELECTRIC

CAP pF	SIZE C0805
1.0	C0805C109D5GAC
1.5	C0805C159D5GAC
2.2	C0805C229D5GAC
3.3	C0805C339D5GAC
4.7	C0805C479D5GAC
6.8	C0805C689D5GAC
10.0	C0805C100J5GAC
15.0	C0805C150J5GAC
22.0	C0805C220J5GAC
33.0	C0805C330J5GAC
47.0	C0805C470J5GAC
68.0	C0805C680J5GAC
100.0	C0805C101J5GAC
150.0	C0805C151J5GAC
220.0	C0805C221J5GAC
330.0	C0805C331J5GAC

C1206C

CAP pF	SIZE C1206
1.0	C1206C109D5GAC
4.7	C1206C479D5GAC
10.0	C1206C100J5GAC
15.0	C1206C150J5GAC
22.0	C1206C220J5GAC

C1206C (Cont.)

CAP pF	SIZE C1206
33.0	C1206C330J5GAC
47.0	C1206C470J5GAC
68.0	C1206C680J5GAC
100.0	C1206C101J5GAC
150.0	C1206C151J5GAC
220.0	C1206C221J5GAC
330.0	C1206C331J5GAC
470.0	C1206C471J5GAC
680.0	C1206C681J5GAC
1,000.0	C1206C102J5GAC
1,500.0	C1206C152J5GAC

X7R DIELECTRIC

CAP pF	SIZE C0805
470	C0805C471K5RAC
680	C0805C681K5RAC
1,000	C0805C102K5RAC
1,500	C0805C152K5RAC
2,200	C0805C222K5RAC
3,300	C0805C332K5RAC
4,700	C0805C472K5RAC
6,800	C0805C682K5RAC
10,000	C0805C103K5RAC
15,000	C0805C153K5RAC

C1206

Cap pF	SIZE C1206
1,000	C1206C102K5RAC
2,200	C1206C222K5RAC
3,300	C1206C332K5RAC
4,700	C1206C472K5RAC
6,800	C1206C682K5RAC
10,000	C1206C103K5RAC
15,000	C1206C153K5RAC
22,000	C1206C223K5RAC
33,000	C1206C333K5RAC
47,000	C1206C473K5RAC
68,000	C1206C683K5RAC
100,000	C1206C104K5RAC
100,000	C1206C104M5UAC
150,000	C1206C154M5UAC

Z5U

CAP pF	SIZE C1206
100,000	C1206C104M5UAC
150,000	C1206C154M5UAC

Chip Size	Capacitance Range			Chip Quantities Per Reel*		
	NPO	X7R	Z5U	178 mm Dia. (7 inches)	330 mm Dia. (13 inches)	Tape Width (mm)
C0805	1 — 470 PF	470 — .015 MF	.6800 — .033 MF	2,500	12,500	8
C1005	1 — 1000 PF	680 — 39,000 PF	.018 — .082 MF	2,500	12,500	8
C1206	1 — 2,200 PF	1000 — .1 MF	.033 — .15 MF	2,500	12,500	8
C1210	1000 — 4700 PF	.01 — .15 MF	.047 — .27 MF	2,500	12,500	8
C1805	470 — 2700 PF	.0033 — .1 MF	.033 — .15 MF	2,500	12,500	12
C1808	470 — 4700 PF	.0056 — .18 MF	.068 — .33 MF	2,500	12,500	12
C1812	470 — 10,000 PF	.01 — .33 MF	.082 — .68 MF	1,300	7,500	12
C1825	5600 — 10,000 PF	.12 — .68 MF	.18 — 1.5 MF	1,300	7,500	12
C2225	2200 — 27,000 PF	.27 — .015 MF	.33 — 2.2 MF	1,300	7,500	12

& Minimum shipping quantity is quantity contained on one reel.

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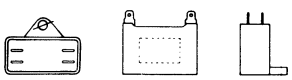
Ogallala, Nebraska, America's new "film capital", is the site of ASC's 170,000 square foot manufacturing facility. This is just one of our state-of-the-art facilities, where ASC manufactures one of the most complete lines of high quality film capacitors in the world.

ASC's broad range of product offerings, combined with strong engineering know-how and a total commitment to customer service means you now have a single domestic source for all your film capacitor requirements.

Ogallala, Nebraska, Engineering and Production Facility.

AC CAPACITORS

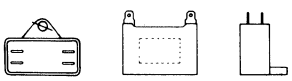
METALLIZED POLYESTER (Dry type)



UL810 listed styles available

APPLICATIONS: Motor run, fans/appliances/pumps/business machines, electric tools.

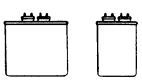
METALLIZED POLYPROPYLENE (Dry type)



UL810 listed styles available

APPLICATIONS: Motor run, fans/appliances, electric tools, lighting ballasts.

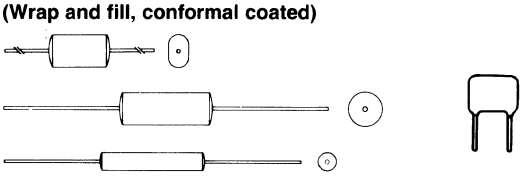
METALLIZED POLYPROPYLENE (Oil filled)



UL810 listed styles available

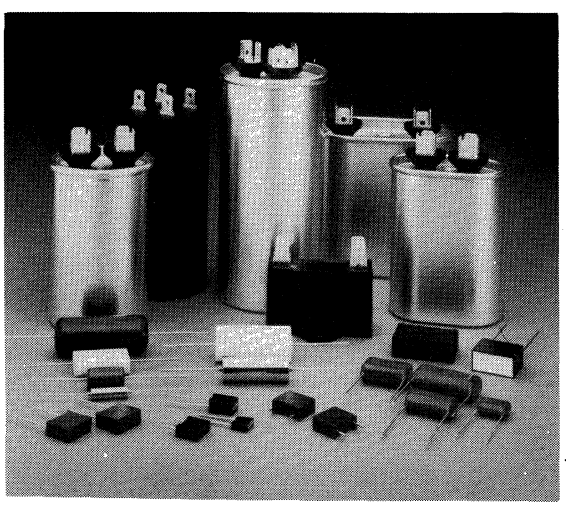
APPLICATIONS: HVAC, HID lighting, power factor correction, UPS.

METALLIZED POLYESTER
(Wrap and fill, conformal coated)



APPLICATIONS: Fans/ventilators/air conditioners/business machines, electric tools, power factor correction, small motors, noise filtering.

CUSTOM CONFIGURATIONS
ASSEMBLIES
FILTERS
RC NETWORKS



AC & DC CAPACITORS.
ASC is unique in its ability to manufacture and deliver a full range of film capacitor products, for both AC and DC applications. ASC has the experience and production capacity to satisfy the demands of nearly every market-medical or test instrumentation, computer products, switch mode power supplies, heating and air-conditioning, lighting, automotive sensors and controls or appliances.

ASC's sizeable Engineering Staff stands ready to assist you in making the proper capacitor selection for your application and answer any technical questions you might have.

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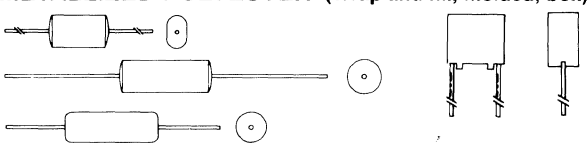
CUSTOM & MILITARY EXPERTISE.
With over 45 years of engineering experience, ASC has all the resources necessary to serve the Aerospace and Military markets with quality capacitors and RC networks.

It is the kind of experience you can rely on for custom solutions to a wide range of application specific problems. These include critical electrical parameters, unusually high voltage or low E.S.R. applications, all sizes and types of packages, tape wraps, hermetically sealed enclosures, potted boxes, multi-pin DIP packages and surface mount devices. The film capacitors shown represent only a small sampling of our overall custom and Hi-Rel capabilities.

ASC's facilities include a NASA approved test laboratory, a Hi-Rel production room and a Mil.Q-9858A Approved quality system.

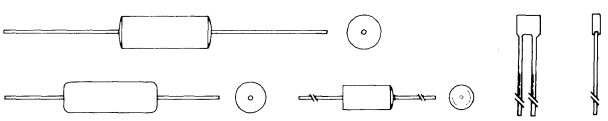
DC CAPACITORS

METALLIZED POLYESTER (Wrap and fill, molded, box)



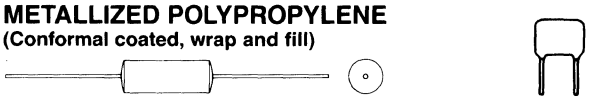
APPLICATIONS: Military, airborne, instruments, power supplies, auto-insertion, analog and digital circuitry, decoupling, high volume applications in consumer, automotive and industrial markets.

METALLIZED POLYCARBONATE
(Wrap and fill, molded, box, hermetically sealed)



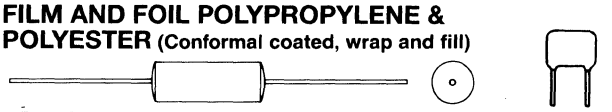
APPLICATIONS: Military and space, high volume applications in consumer, automotive and industrial markets.

METALLIZED POLYPROPYLENE
(Conformal coated, wrap and fill)



APPLICATIONS: Instrumentation, switching power supplies, AC/DC/RMS current applications.

FILM AND FOIL POLYPROPYLENE & POLYESTER (Conformal coated, wrap and fill)



APPLICATIONS: Snubbers, CRT monitors, power supplies, RF generators, test equipment, pulse forming, deflection.

ALSO FEATURING THE FOLLOWING FOR YOUR SPECIFIC APPLICATIONS REQUIRING:

X & Y FUNCTION: AC types for appliances and DC types for power supplies. UL, CSA, VDE, SEV & TUV approvals.

HERMETICALLY SEALED: Available in metallized dielectrics, metallized polyester, and film/foil for applications in instrumentation and high reliability.

SMT: Surface mount capacitors for hybrid and chip-on-board applications (in development; consult factory).

ASC's COMPETITIVE POLYESTER BOX CAPACITORS - TYPE X678

In our X678 series you will find direct replacements for the Mallory/Westlake 160/167 series and the Thomson MC series of metallized polyester box capacitors. These components are price competitive and are available from stock to eight weeks A.R.O. Call for information and samples today.

X678



- .300" & up lead space
- 100 to 630 Vdc
- Values up to 10 MFD

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ASC® CAPACITORS **FILM CAPACITORS**

TYPE X335 - SUPERIOR TO OTHER DIELECTRICS FOR SOME VERY POWERFUL REASONS
SWITCH-MODE POWER SUPPLY CAPACITORS

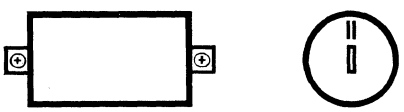
SUPERIOR TO OTHER DIELECTRICS FOR SOME VERY POWERFUL REASONS

- Low Dielectric Absorbtion
- Long Term Stability
- Good Retrace
- High Insulation Resistance

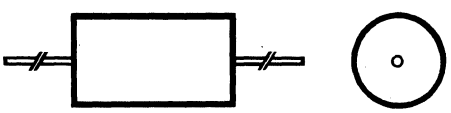
ASC's X335 series (formerly TRW-35) is among the most recognized, and most respected, series of film capacitors designed specifically for the power supply industry. The metallized polypropylene capacitors are designed and manufactured to achieve the optimum characteristics for high current and low ESR applications.

The X335 and X335L series outperform electrolytic capacitors, as well as capacitors utilizing other film dielectrics. ASC capacitors are second to none. Let us prove it to you.

X335 "L"



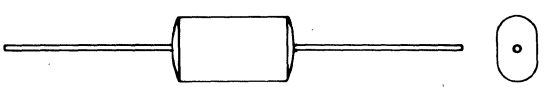
X335



TYPE X661 - METALLIZED POLYESTER CAPACITORS
SWITCH-MODE POWER SUPPLY CAPACITORS

- Designed for 20-60KHz Usage
- High Current—Up to 4 A rms
- Special High Current Termination
- Low ESR Values
- Capacitance Tolerances to ±5%

X661



100% tested for ESR

PERFORMANCE

The X661 is designed specifically for switching power supply applications where current and low ESR values are important. The metallized polyester X661 shows negligible shift in capacitance under long exposure to humidity, operating life and temperature cycling. Insulation resistance, dielectric absorption and dissipation factor properties are all superior to those of electrolytic capacitors presently used by switching power supply manufacturers.

These features, plus size and weight savings in SPS designs, make the X661 the logical capacitor for performance and design of switching power supplies.

Operating Temperature	-55° to +85°C at full rated voltage
Rated Voltage	250 and 400 Vdc
Dielectric Strength	200% of rated voltage for one minute
Capacitance Range	1.0 - 4.7 MFD
Standard Capacitance Tolerance	±5%, ±10% and ±20%

ASC® CAPACITORS

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ASC® CAPACITORS FILM CAPACITORS

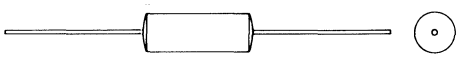
TYPE X665 - X667 - METALLIZED POLYESTER

NEW

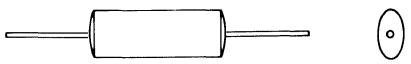
- Miniature Size & Weight
- Cost Effective
- Distributor Item
- Self-Healing

Applications:
Used in circuits for coupling, bypass or line isolation applications requiring surge protection. Lightweight and small size make it ideally suited for small portable equipment applications.

X665



X667



The X665-X667 Series features axial wrap & fill construction. Lead are solder coated on tinned solid wire.

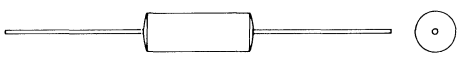
Operating Temperature	
Rated Voltage	63, 100, 250 & 400 Vdc
Dielectric Strength	160% at rated voltage for one minute
Capacitance Range	.01-10.0 MFD
Standard Tolerances	5%, 10% & 20%

TYPE X465 - X467 METALLIZED POLYCARBONATE

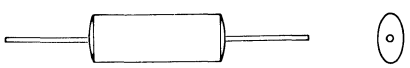
NEW WHITE WRAPPER SERIES

- Miniaturized Sizes
- Cost Effective
- Stocked Locally

X465



X467



The X465 - X467 series features axial wrap and fill construction. Leads are solder coated or tinned solid wire.

DESIGN FEATURES
Non-inductive wound metallized polycarbonate.
Polyester tape wrap & epoxy filled case.
Capable of withstanding a five (5) pound pull force on lead axis.

APPLICATIONS
Military
Temperature Compensating Circuits
Precision Testing Equipment
Telecommunications

Operating Temperature	-55° to +125° C at full rated voltage
Rated Voltage	50, 100, 200 & 400 Vdc
Dielectric Strength	200% of rated voltage for one minute
Capacitance Range	.001-10 MFD
Standard Capacitance Tolerance	±1%(F), ±2%(G), ±5%(J), ±10% (K)

ASC® CAPACITORS

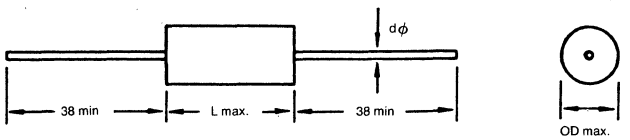
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ASC® CAPACITORS FILM CAPACITORS

TYPE X637 - DESIGNED FOR 220-250 VAC APPLICATIONS

- Flame Retardant Encapsulation
- 400Vdc-500 Vdc Dielectric Strength
- High Durability
- Unimpregnated

X637



APPLICATIONS:

The X637 series of metallized polyester capacitors combine high capacitance and small size, making it ideal for use in motors, fans, appliances, pumps, business machines, electric tools and other general purpose AC applications. The proven durability and self-healing characteristics of the X637 make it an excellent alternative to other AC rated capacitors.

Custom Terminations: Special terminations such as stranded insulated leads or quick disconnects are available for the X640 on a customized basis. Consult the factory for details.

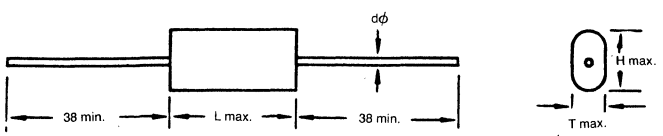
X637 Provides Corona-Free Performance

Operating Temperature	– 55° to + 85° at full rated voltage
Rated Voltage	220 Vac 50/60 Hz 250 Vac 50/60 Hz
Capacitance Range	.50 - 25.0 MFD
Standard Capacitance Tolerance	± 20%, ± 10%, ± 5%

TYPE X640 - DESIGNED FOR CORONA-FREE PERFORMANCE

- Flame Retardant Encapsulation
- 900Vdc-2100Vdc Dielectric Strength
- High Durability
- Unimpregnated and Self-Healing
- Metallized Polyester Dielectric

X640



Small Motor Applications:

The X640's impedance and physical characteristics make it a superior alternative to other passive or active devices for motor start, motor run or speed control applications with small motors. It eliminates the heat generation problems of resistance controls. It is an effective impedance device for various commercial and household electrical products; motors, fans and blowers; computer peripherals, such as terminals, printers and disc drives; and other small motor applications.

Custom Terminations: Special terminations such as stranded insulated leads or quick disconnects are available for the X640 on a customized basis. Consult the factory for details.

330-460VAC

Operating Temperature	– 55 to + 85° at full rated voltage
Rated Voltages	330, 370 and 460 Vac 50/60 Hz
Capacitance Range	.010 - 2.0 MFD
Standard Capacitance Tolerance	± 20%, ± 10%, ± 5%

ASC® CAPACITORS

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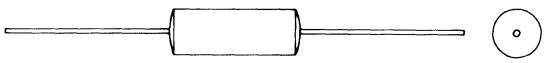
ASC® FILM CAPACITORS

ASC CAPACITORS

TYPE X675 - FOR HIGH VOLTAGE APPLICATIONS

- Small Size, Lightweight
- Self Healing
- Long Life
- Fully Rated to 65°C
- VDC to 16 KV
- Capacitance Tolerances to ±5%

X675



PERFORMANCE

The X675 capacitor is a high voltage capacitor designed to meet the needs of voltage multipliers and high voltage filters required in today's high density, high voltage power supplies. Uses are found in CRT displays of all types, copiers, laboratory instruments and power supplies.

In keeping with the state of the art in construction of silicon high voltage rectifiers, the physical design of the X675 lends itself to this demanding application. The dry winding and skin tight polyester case offer considerable size and weight reductions from former high voltage designs.

A long term matrix testing program shows that when applications are within the X675 ratings, a high standard of reliability is maintained.

Operating Temperature	-55° to +65°C at full rated voltage, to 85°C with 25% derating
Rated Voltage	2000 Vdc to 16000 Vdc
Capacitance Range	.001-.68 MFD
Standard Capacitance Tolerance	±5%, ±10% and ±20%

TYPE 315 - POLYPROPYLENE & FOIL CAPACITORS TO 1600 VDC

- Polypropylene film and aluminum foil construction
- Low DF losses
- Stable characteristics
- Ideal for high frequency and pulse applications
- Low ESR

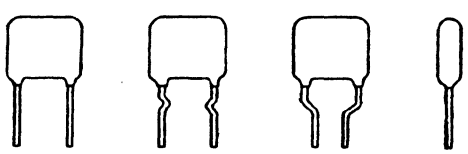
APPLICATIONS:

Instrumentation: Excellent stability plus outstanding electrical properties make the 315 ideal for use in timing and integrating circuitry.

Close Tolerance: Where close tolerance capacitors are required, this series is ideal because of inherent stability with service conditions and life.

Pulse and High Frequency: Low DF and ESR make the 315 ideal for these applications.

315



Straight STYLE A | Hairpin STYLE B | Hockey STYLE C

Operating Temperature	−40° to +85°C.
Rated Voltage	1000, 1250, 1600 VDC
Capacitance Range	.001-.47 uF
Standard Capacitance Tolerance	±2%, ±5%, ±10%, and ±20%

ASC® CAPACITORS

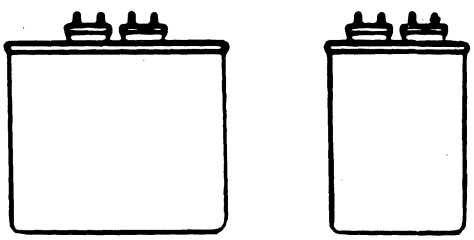
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ASC® CAPACITORS **FILM CAPACITORS**

TYPES X386, X387, X388 and X389 - METALLIZED POLYPROPYLENE OIL FILLED/METAL ENC

- 50% Size and Weight Reduction over Conventional Designs
- Extremely Low Losses and Heat Dissipation
- Non-PCB SPEARINOL III™ Oil Filled
- Self-Healing Ability for Enhanced Reliability and Life
- Round Aluminum or Oval Terne-Plated Steel Cases
- −40°C to +70°C Operating Temperature Range (to +90°C for types X388-X389 only)
- UL Approved Internal Protective Device
- Mounting Brackets and Terminal Caps Available
- 2, 3, or 4 Tine Terminal Configurations
- Painted or Unpainted Cases
- Exceeds EIA 456 Standards
- 240 VAC to 440 VAC Ratings
- Types X386/X387: CSA approved File No. LR68147 and LR68148. Types X388/X389: CSA pending

ROUND STYLE **OVAL STYLE**



INTERNAL PROTECTIVE DEVICE:
Type X386/7 capacitors have an internal protective device designed to prevent case rupturing. This unique patented device is recognized by Underwriter's Laboratories under file number E83671. A minimum of 1/2″ additional space is required above the terminals for proper operation of this protector.

TYPES X345, X347, X349 & X647—CAPACITORS FOR MOTOR RUN APPLICATIONS

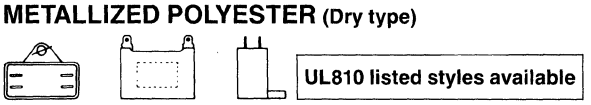
- Self-Healing Dielectric
- Plastic Case, Flame Retardant to UL 94V-O
- Mounting Brackets
- Dry Construction
- X345 and X349 UL Recognized File No. E83671 to 10,000 Amp Fault Current

APPLICATIONS:

Ideal for Use in Motors, Fans, Appliances, Pumps, Business Machines, & Electric Tools Requiring High Capacitance & Small Size.

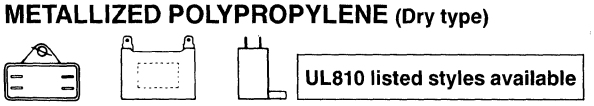
AC CAPACITORS

METALLIZED POLYESTER (Dry type)



APPLICATIONS: Motor run, fans/appliances/pumps/business machines, electric tools.

METALLIZED POLYPROPYLENE (Dry type)



APPLICATIONS: Motor run, fans/appliances, electric tools, lighting ballasts.

Rated Voltage	200-500 VAC
Capacitance Range	Up to 25 MFD in lower voltages
Terminals	or stranded wire leads available.
Standard Tolerances	±5%, ±10%, +10%/−5%

ASC® CAPACITORS

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HIGH VOLTAGE CAPACITORS



Over 40 Years of Manufacturing Quality Capacitors

OUR PRODUCTS

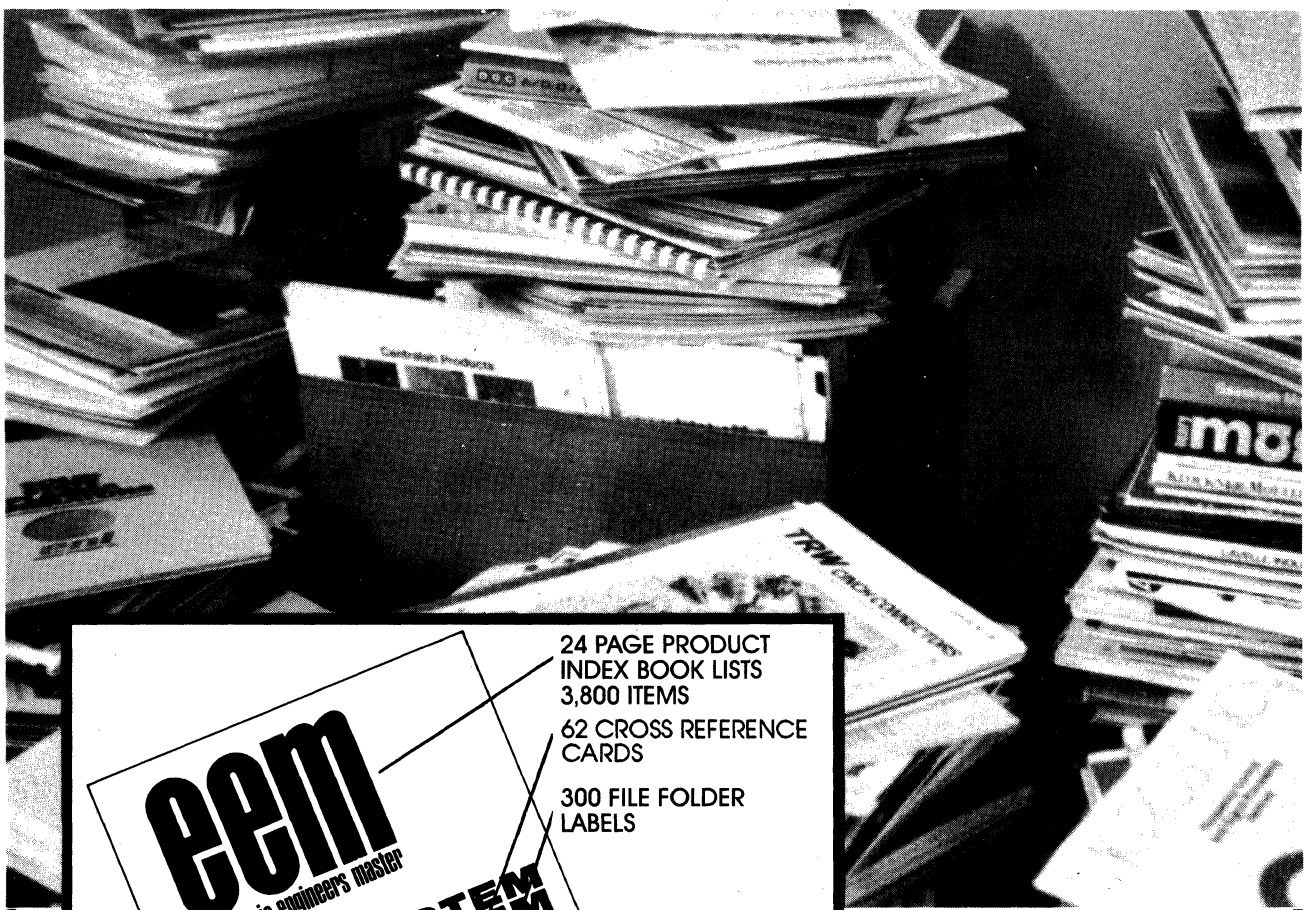
- Oil-filled High Voltage Capacitors
- Metallized Film Capacitors
- Capacitor Bypass Feedthroughs
- Pulse Discharge Capacitors
- MIL-C-19978
  Style CQ72
- MIL-C-25
  Style CP 53, 54, 55
  Style CP 61, 63, 65, 67, 69, 70,72

OUR SERVICE

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ALL NEW with this edition of EEM

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The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with the System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

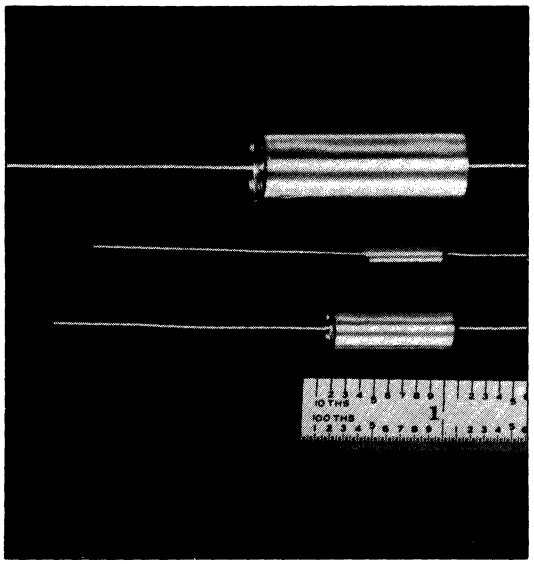
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Component Research High Reliability Film Capacitors



Component Research Company is recognized as the leader in hermetically sealed high reliability plastic film capacitors. These capacitors see large usage in military, aerospace, space, medical and oil well logging industries. Established in 1959, Component Research Company has gained industry wide recognition for outstanding technical expertise, unsurpassed quality and excellent service.

Since the early sixties, Component Research Company capacitors have been used in every U.S. space program. Many of the innovations developed and produced by Component Research have resulted in new military specifications such as MIL-C-83421, MIL-C-39022/9 and MIL-C-87217.

Quality is assured by the strictest adherence to all specification requirements and state-of-the-art manufacturing and testing methods. To this end, Component Research maintains a complete military approved environmental testing laboratory with capabilities for vibration, shock, acceleration, thermal shock, burn-in, moisture resistance, barometric pressure, solderability, resistance to solvents, hermeticity and radiographic testing. This quality system is approved to MIL-Q-9858 and MIL-STD-790. A calibration laboratory complying to MIL-STD-45662 is also maintained.

In addition to the standard line of hermetically sealed film capacitors, Component Research Company designs and manufactures capacitor networks, high current capacitors, feedthrough capacitors and other custom capacitors.

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Component Research CRC

ORDERING INFORMATION

MILITARY APPROVALS

Component Research Company is qualified to the following Military specifications:

- ☐ MIL-C-83421/1
- ☐ MIL-C-83421/2
- ☐ MIL-C-39022/7
- ☐ MIL-C-39022/9
- ☐ MIL-C-39022/10
- ☐ MIL-C-87217/1

SALES INFORMATION

Standard products listed in the catalog may be ordered by contacting our sales office.

PHONE: (213) 829-3615

TELEFAX: (213) 829-9584

MAIL: 1655 26th Street
Santa Monica
CA 90404-4090
Attention: Sales

TERMS

Net 30 upon approval by our credit dept. Minimum order is $40, $20 per line item. All shipments are FOB Santa Monica.

PATENT INFORMATION

Component Research capacitors are exclusively manufactured under one or more of the following patents: 3,238,428; 3,260,906; 3,920,063; 3,506,895; 3,539,886; 3,603,849; 4,587,144. Additional patents pending.

APPLICATIONS ASSISTANCE

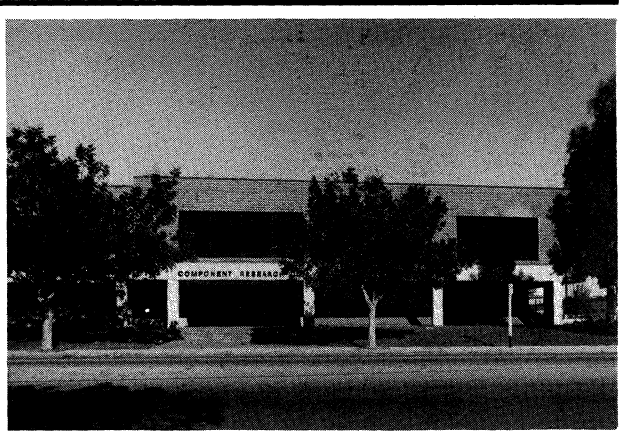
Our applications engineers are recognized as the most knowledgeable in the industry. Please call our applications department for any requirement that is not covered in our catalog.

CUSTOM CAPACITORS

Component Research designs and manufactures thousands of custom capacitors for special applications. These custom designs include:

- Capacitor networks
- Capacitor standards
- Feedthrough capacitors
- Matched sets
- Special Temperature Coefficient capacitors
- High temperature capacitors
- Special hermetic packages for high vibration
- High current capacitors tested at high frequencies





COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research CRC

A12 METALLIZED POLYCARBONATE CAPACITOR

PRODUCT FEATURES

1.0 μF 30VDC ACTUAL SIZE CAPACITOR



QUALIFIED TO MIL-C-83421/01 FAILURE RATE S.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE APPLICATIONS.

AC RATED FROM 22VRMS TO 240VRMS AT FREQUENCIES FROM 0 TO 400Hz. RATINGS TO 40KHz AT LOWER VOLTAGE RATINGS, −65°C TO +100°C WITH DERATED OPERATION AT 125°C, DC RATED 30VDC TO 400VDC.

100% RELIABILITY SCREENING, INCLUDES BURN-IN, TEMPERATURE CYCLING, FINE LEAK TESTS, AND AC SQUARE WAVE TESTS.

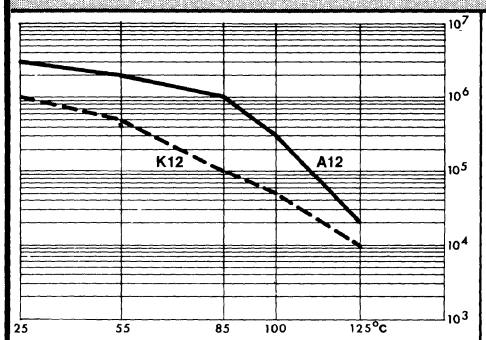
LOW LOSS, RUGGED INTERNAL TERMINATIONS QUALIFIED FOR ALL HI-REL PROGRAMS (CRC PATENTED CONSTRUCTION).

CAPACITORS HAVE BEEN THERMAL SHOCK TESTED FOR 1000 CYCLES FROM −65°C to +125°C, AIR TO AIR AND LIQUID TO LIQUID, SEE THERMAL SHOCK TEST PAGE.

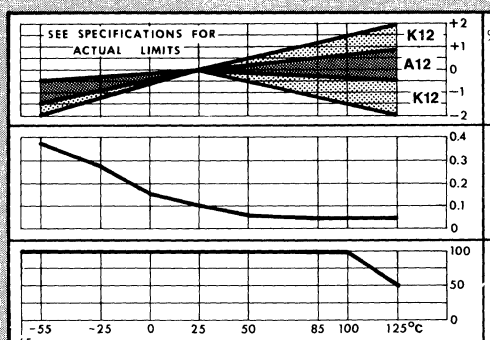
CAPACITORS OF SAME DESIGN AND CONSTRUCTION HAVE BEEN LIFE TESTED TO 40,000 HOURS, SEE 40,000 HOUR LIFE TEST DATA PAGE.

AVAILABLE IN STANDARD TOLERANCES: 0.25%, 0.5%, 1%, 2%, 5%, 10%. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



% CAPACITANCE CHANGE WITH TEMPERATURE

% DISSIPATION FACTOR WITH TEMPERATURE

% VOLTAGE RATING WITH TEMPERATURE

TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #77TR116

TEST RESULTS FOR SERIES A12 CAPACITORS LIFE TESTED FOR 2000 HOURS AT 100°C AT 140% OF RATED DC VOLTAGE.

THERE WERE NO FAILURES FOR THIS TEST.

LIST OF CAPACITORS SUBMITTED TO LIFE TEST			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
A12A	.1	20	$1x10^6$	$3x10^6$	$4x10^6$	±2.0	0.00	+.40	.25	.07	.08
A12A	.001	20	$1x10^6$	$1x10^7$	$30x10^6$	±2.0	−.38	+.06	.25	.05	.05
A12B	1.0	20	$1x10^5$	$8x10^5$	$1x10^6$	±2.0	−.03	+.18	.25	.04	.05
A12B	.018	20	$1x10^6$	$1.2x10^7$	$2.5x10^7$	±2.0	−.33	−.16	.25	.07	.08
A12C	4.7	20	$2x10^4$	$1.1x10^5$	$5x10^5$	±2.0	−.13	−.06	.25	.04	.05
A12C	.039	20	$1x10^6$	$1.4x10^7$	$2x10^7$	±2.0	−.07	+.05	.25	.08	.08
A12D	.56	30	$1.8x10^5$	$1.6x10^6$	$1.8x10^6$	±2.0	−.03	+.05	.25	.05	.06
A12E	.01	30	$1x10^6$	$4x10^7$	$6.6x10^7$	±2.0	+.02	−.16	.25	.07	.07

Component Research CRC

A12 METALLIZED POLYCARBONATE CAPACITOR

A12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements and are qualified to MIL-C-83421/1.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated DC voltage	At 25°C from terminal to terminal and terminal to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT (IN % CAPACITANCE)	−1.0% to +1.2%	From +25°C to +125°C
	−0% to −2.5%	From −55°C to 25°C
CAPACITANCE STABILITY (IN % CAPACITANCE)	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See Insulation Resistance Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R.
EXAMPLE: A 0.5uF, SERIES A12 CAPACITOR AT 25°C IS 300,000 ÷ 0.5 = 600,000 MEGOHMS.

RANGE	STYLE	25°C	55°C	85°C	100°C	125°C
.001 TO 0.1uF	A12	3,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	300,000 Megohms	20,000 Megohms
GREATER THAN 0.1uF	A12	300,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	30,000 Megohms-uF	2,000 Megohms-uF

A12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL A12
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6} atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8.	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research (CRC)

A12 METALLIZED POLYCARBONATE CAPACITOR

uF	CASE DIMENSIONS														
	30 VDC			50 VDC			100 VDC			200 VDC			400 VDC		
	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C
.001	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0012	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0015	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0018	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.002	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0022	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0027	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0033	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0039	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0047	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.005	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0056	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0068	.170	.500	.600	.170	.500	.600	.170	.562	.662	.170	.562	.662	.235	.687	.787
.0075	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787
.0082	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787
.01	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787
.012	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787
.015	.170	.500	.600	.170	.562	.662	.170	.687	.787	.235	.562	.662	.235	.813	.913
.018	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.02	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.022	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.027	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913
.033	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913
.039	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913
.047	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913
.05	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913
.056	.170	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	.813	.913
.068	.170	.687	.787	.193	.687	.787	.235	.813	.913	.312	.813	.913	.400	.813	.913
.075	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.082	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.1	.193	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.12	.193	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.15	.235	.562	.662	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.400	1.375	1.475
.18	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.2	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.22	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.27	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475
.33	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475
.39	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.47	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.5	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.56	.312	.687	.787	.400	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.68	.312	.687	.787	.400	.813	.913	.500	1.125	1.225	.562	1.375	1.475	.750	1.875	1.975
.75	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
.82	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
1.0	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
1.2	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	1.000	1.875	1.975
1.5	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475
1.8	.400	.813	.913	.400	1.063	1.163	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.0	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.2	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.5	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975			
2.7	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975			
3.0	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
3.3	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
3.9	.400	1.375	1.475	.562	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
4.7	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
5.0	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
5.6	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
6.8	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
7.5	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
8.2	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
10.0	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
12.0	.562	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475						
15.0	.562	1.875	1.975	.750	1.875	1.975									
18.0	.670	1.875	1.975	1.000	1.875	1.975									
20.0	.670	1.875	1.975	1.000	1.875	1.975									
22.0	.670	1.875	1.975	1.000	1.875	1.975									
25.0	.750	1.875	1.975	1.000	2.375	2.475									
27.0	.750	1.875	1.975	1.000	2.375	2.475									

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads. CRC "C" dimensions for A12 and K12 capacitors is 0.1" less than MIL-C-83421/1 requires.

A12 | A | 104 | J | S | W

STYLE

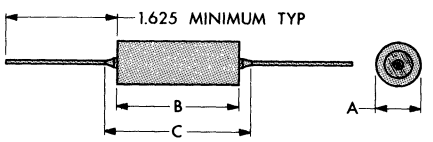
VOLTAGE
A=30VDC
B=50VDC
C=100VDC
D=200VDC
E=400VDC

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

CAPACITANCE TOLERANCE
K=10% J=5% G=2% F=1% D=½% B=¼% A=.1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

LEAD CODE
W=Tinned copper clad steel: #22 (.025") for .312" case dia & smaller; #20 (.032") for .400" & .500" case dia.
C=Tinned oxygen-free copper: #18 (.040") for .562" case dia. & larger.



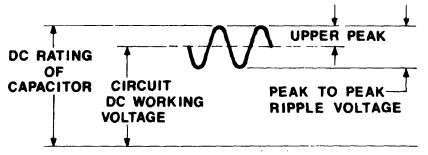
COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

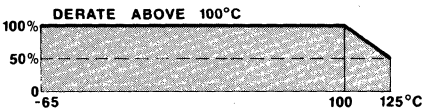
Component Research (CRC)

A12 METALLIZED POLYCARBONATE CAPACITOR

uF	AC RATINGS														
	30 VDC			50 VDC			100 VDC			200 VDC			400 VDC		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
0.0010	22.00	22.00	0.0060	36.00	36.00	0.0090	60.00	60.00	0.0150	120.00	80.00	0.020	240.00	100.00	0.025
0.0012	22.00	22.00	0.0070	36.00	36.00	0.0110	60.00	60.00	0.0180	120.00	80.00	0.024	240.00	100.00	0.030
0.0015	22.00	22.00	0.0080	36.00	36.00	0.0130	60.00	60.00	0.0220	120.00	80.00	0.030	240.00	98.67	0.037
0.0018	22.00	22.00	0.0100	36.00	36.00	0.0160	60.00	60.00	0.0270	120.00	80.00	0.036	240.00	100.00	0.045
0.0020	22.00	22.00	0.0110	36.00	36.00	0.0180	60.00	60.00	0.0300	120.00	80.00	0.040	240.00	100.00	0.050
0.0022	22.00	22.00	0.0120	36.00	36.00	0.0200	60.00	60.00	0.0330	120.00	80.00	0.044	240.00	100.00	0.055
0.0027	22.00	22.00	0.0150	36.00	36.00	0.0240	60.00	60.00	0.0410	120.00	80.00	0.054	240.00	100.74	0.068
0.0033	22.00	22.00	0.0180	36.00	36.00	0.0300	60.00	60.00	0.0500	120.00	80.00	0.066	240.00	100.61	0.083
0.0039	22.00	22.00	0.0210	36.00	36.00	0.0350	60.00	60.00	0.0580	120.00	80.00	0.078	240.00	99.49	0.097
0.0047	22.00	22.00	0.0260	36.00	36.00	0.0420	60.00	60.00	0.0710	120.00	80.00	0.094	240.00	102.13	0.120
0.0050	22.00	22.00	0.0280	36.00	36.00	0.0450	60.00	60.00	0.0750	120.00	80.00	0.100	240.00	104.00	0.130
0.0056	22.00	22.00	0.0310	36.00	36.00	0.0500	60.00	60.00	0.0840	120.00	78.57	0.110	240.00	100.00	0.140
0.0068	22.00	22.00	0.0370	36.00	36.00	0.0610	60.00	60.00	0.1000	120.00	82.35	0.140	240.00	100.00	0.170
0.0075	22.00	22.00	0.0370	36.00	36.00	0.0610	60.00	60.00	0.1000	120.00	74.67	0.140	240.00	90.67	0.170
0.0082	22.00	22.00	0.0450	36.00	36.00	0.0740	60.00	60.00	0.1200	120.00	78.05	0.160	240.00	102.44	0.210
0.0100	22.00	22.00	0.0550	36.00	36.00	0.0900	60.00	60.00	0.1500	120.00	80.00	0.200	240.00	100.00	0.250
0.0120	22.00	22.00	0.0660	36.00	36.00	0.1100	60.00	60.00	0.1800	120.00	76.67	0.230	240.00	100.00	0.300
0.0150	22.00	22.00	0.0820	36.00	36.00	0.1400	60.00	58.67	0.2200	120.00	77.33	0.290	240.00	93.33	0.350
0.0180	22.00	22.00	0.1000	36.00	36.00	0.1600	60.00	57.78	0.2600	120.00	73.33	0.330	240.00	91.11	0.410
0.0200	22.00	22.00	0.1100	36.00	36.00	0.1800	60.00	56.00	0.2800	120.00	72.00	0.360	240.00	88.00	0.440
0.0220	22.00	22.00	0.1200	36.00	36.00	0.2000	60.00	52.73	0.2900	120.00	67.27	0.370	240.00	85.45	0.470
0.0270	22.00	22.00	0.1500	36.00	36.00	0.2400	60.00	50.37	0.3400	120.00	65.19	0.440	240.00	81.48	0.550
0.0330	22.00	22.00	0.1800	36.00	36.00	0.3000	60.00	49.70	0.4100	120.00	61.82	0.510	240.00	78.79	0.650
0.0390	22.00	22.00	0.2200	36.00	36.00	0.3500	60.00	48.21	0.4700	120.00	60.51	0.590	240.00	74.87	0.730
0.0470	22.00	22.00	0.2600	36.00	36.00	0.4200	60.00	46.81	0.5500	120.00	57.02	0.670	240.00	70.64	0.830
0.0500	22.00	22.00	0.2800	36.00	36.00	0.4500	60.00	46.40	0.5800	120.00	56.00	0.700	240.00	70.40	0.880
0.0560	22.00	22.00	0.3100	36.00	36.00	0.5000	60.00	45.71	0.6400	120.00	55.71	0.780	240.00	67.86	0.950
0.0680	22.00	22.00	0.3700	36.00	34.12	0.5800	60.00	41.76	0.7100	120.00	50.00	0.850	240.00	60.00	1.020
0.0750	22.00	22.00	0.3700	36.00	30.93	0.5800	60.00	37.87	0.7100	120.00	45.33	0.850	240.00	54.40	1.020
0.0820	22.00	22.00	0.4500	36.00	32.20	0.6600	60.00	38.05	0.7800	120.00	43.90	0.900	240.00	50.24	1.030
0.1000	22.00	22.00	0.5500	36.00	30.00	0.7500	60.00	36.00	0.9000	120.00	44.00	1.100	240.00	48.00	1.200
0.1200	22.00	22.00	0.6600	36.00	30.00	0.9000	60.00	35.00	1.0500	120.00	40.00	1.200	240.00	44.67	1.340
0.1500	22.00	22.00	0.8300	36.00	26.13	0.9800	60.00	33.07	1.2400	120.00	35.73	1.340	240.00	40.00	1.500
0.1800	22.00	22.00	1.0000	36.00	25.11	1.1300	60.00	31.11	1.4000	120.00	34.22	1.540	240.00	37.78	1.700
0.2000	22.00	20.00	1.0000	36.00	24.00	1.2000	60.00	30.00	1.5000	120.00	33.00	1.650	240.00	37.00	1.850
0.2200	22.00	18.55	1.0200	36.00	23.09	1.2700	60.00	27.27	1.5000	120.00	32.00	1.760	240.00	35.09	1.930
0.2700	22.00	17.04	1.1500	36.00	18.96	1.2800	60.00	24.00	1.6200	120.00	29.04	1.960	240.00	33.19	2.240
0.3300	22.00	16.00	1.3200	36.00	17.94	1.4800	60.00	23.03	1.9000	120.00	28.00	2.310	240.00	32.12	2.650
0.3900	22.00	14.97	1.4600	36.00	17.03	1.6600	60.00	22.05	2.1500	120.00	26.97	2.630	240.00	32.21	3.140
0.4700	22.00	14.04	1.6500	36.00	15.74	1.8500	60.00	21.02	2.4700	120.00	26.04	3.060	240.00	30.98	3.640
0.5000	22.00	13.52	1.6900	36.00	15.20	1.9000	60.00	20.00	2.5000	120.00	25.04	3.130	240.00	30.00	3.750
0.5600	22.00	12.93	1.8100	36.00	14.36	2.0100	60.00	18.86	2.6400	120.00	22.64	3.170	240.00	28.93	4.050
0.6800	22.00	12.00	2.0400	36.00	14.00	2.3800	60.00	16.00	2.7200	120.00	20.00	3.400	240.00	26.47	4.500
0.7500	22.00	10.88	2.0400	36.00	12.69	2.3800	60.00	14.51	2.7200	120.00	18.13	3.400	240.00	24.00	4.500
0.8200	22.00	10.00	2.0500	36.00	12.00	2.4600	60.00	14.00	2.8700	120.00	18.05	3.700	240.00	23.41	4.800
1.0000	22.00	8.40	2.1000	36.00	10.00	2.5000	60.00	12.00	3.0000	120.00	15.00	3.750	240.00	20.80	5.200
1.2000	22.00	7.17	2.1500	36.00	9.10	2.7300	60.00	10.83	3.2500	120.00	13.50	4.050	240.00	18.33	5.500
1.5000	22.00	5.79	2.1700	36.00	7.73	2.9000	60.00	10.00	3.7500	120.00	12.00	4.500	240.00	16.00	6.000
1.8000	22.00	4.89	2.2000	36.00	6.67	3.0000	60.00	8.33	3.7500	120.00	11.11	5.000	240.00	15.11	6.800
2.0000	22.00	4.40	2.2000	36.00	6.20	3.1000	60.00	8.20	4.1000	120.00	10.00	5.000	240.00	14.00	7.000
2.2000	22.00	4.00	2.2000	36.00	5.82	3.2000	60.00	7.49	4.1200	120.00	9.09	5.000	240.00	12.73	7.000
2.5000	22.00	3.52	2.2000	36.00	5.34	3.3400	60.00	7.04	4.4000	120.00	8.00	5.000			
2.7000	22.00	3.26	2.2000	36.00	4.95	3.3400	60.00	6.52	4.4000	120.00	7.70	5.200			
3.0000	22.00	2.93	2.2000	36.00	4.53	3.4000	60.00	6.01	4.5100	120.00	7.03	5.270			
3.3000	22.00	2.67	2.2000	36.00	4.24	3.5000	60.00	5.52	4.5500	120.00	6.50	5.360			
3.9000	22.00	2.26	2.2000	36.00	3.69	3.6000	60.00	5.03	4.9000	120.00	5.54	5.400			
4.7000	22.00	1.87	2.2000	36.00	3.06	3.6000	60.00	4.26	5.0000	120.00	4.60	5.400			
5.0000	22.00	1.76	2.2000	36.00	2.88	3.6000	60.00	4.00	5.0000	120.00	4.32	5.400			
5.6000	22.00	1.57	2.2000	36.00	2.57	3.6000	60.00	3.57	5.0000	120.00	3.86	5.400			
6.8000	22.00	1.29	2.2000	36.00	2.12	3.6000	60.00	2.94	5.0000						
7.5000	22.00	1.17	2.2000	36.00	1.92	3.6000	60.00	2.67	5.0000						
8.2000	22.00	1.07	2.2000	36.00	1.76	3.6000	60.00	2.44	5.0000						
10.0000	22.00	0.88	2.2000	36.00	1.44	3.6000	60.00	2.00	5.0000						
12.0000	22.00	0.73	2.2000	36.00	1.20	3.6000	60.00	1.67	5.0000						
15.0000	22.00	0.59	2.2000	36.00	0.96	3.6000									
18.0000	22.00	0.49	2.2000	36.00	0.80	3.6000									
20.0000	22.00	0.44	2.2000	36.00	0.72	3.6000									
22.0000	22.00	0.40	2.2000	36.00	0.65	3.6000									
25.0000	22.00	0.35	2.2000	36.00	0.58	3.6000									
27.0000	22.00	0.33	2.2000	36.00	0.53	3.6000									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





COMPONENT RESEARCH CO., INC. ■ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research CRC

G12 METALLIZED POLYCARBONATE CAPACITOR

G12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 2 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminal to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% 0% to −2%	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 100,000 ÷ 0.18 = 555,555 MEGOHMS.

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.1uF	1,000,000 Megohms	60,000 Megohms	30,000 Megohms	10,000 Megohms
GREATER THAN 0.1uF	100,000 Megohms-uF	6,000 Megohms-uF	3,000 Megohms-uF	1,000 Megohms-uF

G12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁻⁶atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 2 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

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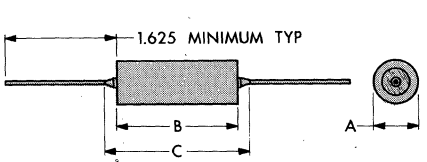
Component Research (CRC)

G12 METALLIZED POLYCARBONATE CAPACITOR

uF	CASE DIMENSIONS															
	30 VDC				50 VDC				100 VDC				200 VDC			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	G12A102	.170	.500	.600	G12B102	.170	.500	.600	G12C102	.170	.500	.600	G12D102	.170	.500	.600
.0012	G12A122	.170	.500	.600	G12B122	.170	.500	.600	G12C122	.170	.500	.600	G12D122	.170	.500	.600
.0015	G12A152	.170	.500	.600	G12B152	.170	.500	.600	G12C152	.170	.500	.600	G12D152	.170	.500	.600
.0018	G12A182	.170	.500	.600	G12B182	.170	.500	.600	G12C182	.170	.500	.600	G12D182	.170	.500	.600
.002	G12A202	.170	.500	.600	G12B202	.170	.500	.600	G12C202	.170	.500	.600	G12D202	.170	.500	.600
.0022	G12A222	.170	.500	.600	G12B222	.170	.500	.600	G12C222	.170	.500	.600	G12D222	.170	.500	.600
.0027	G12A272	.170	.500	.600	G12B272	.170	.500	.600	G12C272	.170	.500	.600	G12D272	.170	.500	.600
.0033	G12A332	.170	.500	.600	G12B332	.170	.500	.600	G12C332	.170	.500	.600	G12D332	.170	.500	.600
.0039	G12A392	.170	.500	.600	G12B392	.170	.500	.600	G12C392	.170	.500	.600	G12D392	.170	.500	.600
.0047	G12A472	.170	.500	.600	G12B472	.170	.500	.600	G12C472	.170	.500	.600	G12D472	.170	.500	.600
.005	G12A502	.170	.500	.600	G12B502	.170	.500	.600	G12C502	.170	.500	.600	G12D502	.170	.500	.600
.0056	G12A562	.170	.500	.600	G12B562	.170	.500	.600	G12C562	.170	.500	.600	G12D562	.170	.500	.600
.0068	G12A682	.170	.500	.600	G12B682	.170	.500	.600	G12C682	.170	.500	.600	G12D682	.170	.500	.600
.0075	G12A752	.170	.500	.600	G12B752	.170	.500	.600	G12C752	.170	.500	.600	G12D752	.170	.562	.662
.0082	G12A822	.170	.500	.600	G12B822	.170	.500	.600	G12C822	.170	.500	.600	G12D822	.170	.562	.662
.01	G12A103	.170	.500	.600	G12B103	.170	.500	.600	G12C103	.170	.500	.600	G12D103	.170	.687	.787
.012	G12A123	.170	.500	.600	G12B123	.170	.500	.600	G12C123	.170	.500	.600	G12D123	.170	.687	.787
.015	G12A153	.170	.500	.600	G12B153	.170	.500	.600	G12C153	.170	.500	.600	G12D153	.170	.687	.787
.018	G12A183	.170	.500	.600	G12B183	.170	.500	.600	G12C183	.170	.562	.662	G12D183	.193	.687	.787
.02	G12A203	.170	.500	.600	G12B203	.170	.500	.600	G12C203	.170	.562	.662	G12D203	.193	.687	.787
.022	G12A223	.170	.500	.600	G12B223	.170	.500	.600	G12C223	.170	.562	.662	G12D223	.193	.687	.787
.027	G12A273	.170	.500	.600	G12B273	.170	.500	.600	G12C273	.170	.562	.662	G12D273	.193	.687	.787
.033	G12A333	.170	.500	.600	G12B333	.170	.500	.600	G12C333	.170	.562	.662	G12D333	.193	.687	.787
.039	G12A393	.170	.500	.600	G12B393	.170	.500	.600	G12C393	.170	.562	.662	G12D393	.235	.687	.787
.047	G12A473	.170	.500	.600	G12B473	.170	.500	.600	G12C473	.193	.562	.662	G12D473	.235	.687	.787
.05	G12A503	.170	.500	.600	G12B503	.170	.500	.600	G12C503	.193	.562	.662	G12D503	.235	.687	.787
.056	G12A563	.170	.500	.600	G12B563	.170	.500	.600	G12C563	.193	.562	.662	G12D563	.235	.687	.787
.068	G12A683	.170	.500	.600	G12B683	.170	.562	.662	G12C683	.235	.562	.662	G12D683	.312	.687	.787
.075	G12A753	.170	.500	.600	G12B753	.170	.562	.662	G12C753	.235	.562	.662	G12D753	.312	.687	.787
.082	G12A823	.170	.562	.662	G12B823	.170	.562	.662	G12C823	.235	.562	.662	G12D823	.312	.687	.787
.1	G12A104	.170	.562	.662	G12B104	.193	.562	.662	G12C104	.235	.687	.787	G12D104	.312	.687	.787
.12	G12A124	.170	.562	.662	G12B124	.193	.562	.662	G12C124	.235	.687	.787	G12D124	.312	.687	.787
.15	G12A154	.170	.562	.662	G12B154	.193	.562	.662	G12C154	.235	.687	.787	G12D154	.312	.813	.913
.18	G12A184	.193	.562	.662	G12B184	.235	.562	.662	G12C184	.235	.687	.787	G12D184	.312	.813	.913
.2	G12A204	.193	.562	.662	G12B204	.235	.562	.662	G12C204	.235	.687	.787	G12D204	.312	.813	.913
.22	G12A224	.193	.562	.662	G12B224	.235	.562	.662	G12C224	.235	.687	.787	G12D224	.312	.813	.913
.27	G12A274	.235	.562	.662	G12B274	.235	.687	.787	G12C274	.312	.687	.787	G12D274	.312	1.063	1.163
.33	G12A334	.235	.562	.662	G12B334	.235	.687	.787	G12C334	.312	.813	.913	G12D334	.312	1.063	1.163
.39	G12A394	.235	.687	.787	G12B394	.235	.687	.787	G12C394	.312	.813	.913	G12D394	.400	1.063	1.163
.47	G12A474	.235	.687	.787	G12B474	.312	.687	.787	G12C474	.400	.687	.787	G12D474	.400	1.063	1.163
.5	G12A504	.235	.687	.787	G12B504	.312	.687	.787	G12C504	.400	.687	.787	G12D504	.400	1.063	1.163
.56	G12A564	.235	.687	.787	G12B564	.312	.687	.787	G12C564	.400	.687	.787	G12D564	.400	1.063	1.163
.68	G12A684	.235	.813	.913	G12B684	.312	.687	.787	G12C684	.400	.813	.913	G12D684	.500	1.125	1.225
.75	G12A754	.235	.813	.913	G12B754	.312	.687	.787	G12C754	.400	.813	.913	G12D754	.500	1.125	1.225
.82	G12A824	.235	.813	.913	G12B824	.312	.687	.787	G12C824	.400	.813	.913	G12D824	.500	1.375	1.475
1.0	G12A105	.235	.813	.913	G12B105	.312	.813	.913	G12C105	.400	1.063	1.163	G12D105	.500	1.375	1.475
1.2	G12A125	.312	.813	.913	G12B125	.312	.813	.913	G12C125	.400	1.063	1.163	G12D125	.500	1.375	1.475
1.5	G12A155	.312	.813	.913	G12B155	.400	.813	.913	G12C155	.400	1.375	1.475				
1.8	G12A185	.312	.813	.913	G12B185	.400	.813	.913	G12C185	.400	1.375	1.475				
2.0	G12A205	.312	.813	.913	G12B205	.400	.813	.913	G12C205	.500	1.375	1.475				
2.2	G12A225	.312	.813	.913	G12B225	.400	.813	.913	G12C225	.500	1.375	1.475				
2.5	G12A255	.312	1.063	1.163	G12B255	.400	.813	.913	G12C255	.500	1.375	1.475				
2.7	G12A275	.312	1.063	1.163	G12B275	.400	1.063	1.163	G12C275	.500	1.375	1.475				
3.0	G12A305	.312	1.063	1.163	G12B305	.400	1.063	1.163	G12C305	.500	1.375	1.475				
3.3	G12A335	.312	1.063	1.163	G12B335	.400	1.063	1.163	G12C335	.500	1.375	1.475				
3.9	G12A395	.400	1.063	1.163	G12B395	.400	1.375	1.475								
4.7	G12A475	.400	1.063	1.163	G12B475	.500	1.375	1.475								
5.0	G12A505	.400	1.063	1.163	G12B505	.500	1.375	1.475								
5.6	G12A565	.400	1.063	1.163	G12B565	.500	1.375	1.475								
6.8	G12A685	.400	1.375	1.475	G12B685	.500	1.375	1.475								
7.5	G12A755	.400	1.375	1.475	G12B755	.500	1.375	1.475								
8.2	G12A825	.400	1.375	1.475	G12B825	.500	1.375	1.475								
10.0	G12A106	.500	1.375	1.475												

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



G12 | A | 104 | J | S | W

STYLE

VOLTAGE
A=30VDC
B=50VDC
C=100VDC
D=200VDC

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20 (.032") for .400" & .500" case dia.

CAPACITANCE TOLERANCE
K=10% J=5% G=2% F=1% D=½% B=¼% A=.1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

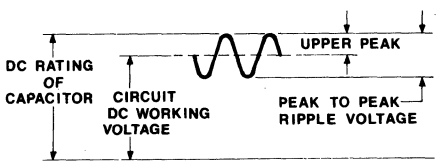
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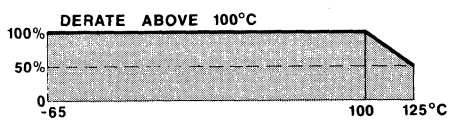
Component Research CRC

G12 METALLIZED POLYCARBONATE CAPACITOR

uF	AC RATINGS											
	30 VDC			50 VDC			100 VDC			200 VDC		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
.0010	22.0	22.0	.0055	36.0	36.0	.0090	60.0	60.0	.0150	120.0	120.0	.030
.0012	22.0	22.0	.0066	36.0	36.0	.0108	60.0	60.0	.0180	120.0	120.0	.036
.0015	22.0	22.0	.0083	36.0	36.0	.0135	60.0	60.0	.0225	120.0	120.0	.045
.0018	22.0	22.0	.0099	36.0	36.0	.0162	60.0	60.0	.0270	120.0	120.0	.054
.0020	22.0	22.0	.0110	36.0	36.0	.0180	60.0	60.0	.0300	120.0	120.0	.060
.0022	22.0	22.0	.0121	36.0	36.0	.0198	60.0	60.0	.0330	120.0	120.0	.066
.0027	22.0	22.0	.0149	36.0	36.0	.0243	60.0	60.0	.0405	120.0	120.0	.081
.0033	22.0	22.0	.0182	36.0	36.0	.0297	60.0	60.0	.0495	120.0	120.0	.099
.0039	22.0	22.0	.0215	36.0	36.0	.0351	60.0	60.0	.0585	120.0	120.0	.117
.0047	22.0	22.0	.0259	36.0	36.0	.0423	60.0	60.0	.0705	120.0	120.0	.141
.0050	22.0	22.0	.0275	36.0	36.0	.0450	60.0	60.0	.0750	120.0	120.0	.150
.0056	22.0	22.0	.0308	36.0	36.0	.0504	60.0	60.0	.0840	120.0	120.0	.168
.0068	22.0	22.0	.0374	36.0	36.0	.0612	60.0	60.0	.1020	120.0	120.0	.204
.0075	22.0	22.0	.0413	36.0	36.0	.0675	60.0	60.0	.1125	120.0	120.0	.225
.0082	22.0	22.0	.0451	36.0	36.0	.0738	60.0	60.0	.123	120.0	120.0	.246
.010	22.0	22.0	.0550	36.0	36.0	.090	60.0	60.0	.150	120.0	120.0	.30
.012	22.0	22.0	.0660	36.0	36.0	.108	60.0	60.0	.180	120.0	120.0	.36
.015	22.0	22.0	.0825	36.0	36.0	.135	60.0	60.0	.225	120.0	120.0	.45
.018	22.0	22.0	.0990	36.0	36.0	.162	60.0	60.0	.27	120.0	120.0	.54
.020	22.0	22.0	.1100	36.0	26.0	.180	60.0	60.0	.30	120.0	120.0	.60
.022	22.0	22.0	.1210	36.0	36.0	.198	60.0	60.0	.33	120.0	120.0	.66
.027	22.0	22.0	.1485	36.0	36.0	.243	60.0	60.0	.405	120.0	120.0	.81
.033	22.0	22.0	.1815	36.0	36.0	.297	60.0	54.54	.45	120.0	103.03	.85
.039	22.0	22.0	.2145	36.0	31.79	.31	60.0	46.15	.45	120.0	120.0	1.17
.047	22.0	22.0	.2585	36.0	26.38	.31	60.0	60.00	.705	120.0	120.0	1.41
.050	22.0	22.0	.275	36.0	24.80	.31	60.0	60.00	.75	120.0	120.0	1.50
.056	22.0	22.0	.308	36.0	22.14	.31	60.0	60.00	.84	120.0	107.14	1.50
.068	22.0	18.23	.31	36.0	26.47	.45	60.0	60.00	1.02	120.0	120.00	2.04
.075	22.0	16.53	.31	36.0	24.00	.45	60.0	58.66	1.10	120.0	109.33	2.05
.082	22.0	21.95	.45	36.0	21.95	.45	60.0	53.65	1.10	120.0	100.00	2.05
.100	22.0	18.00	.45	36.0	34.00	.85	60.0	60.00	1.50	120.0	82.00	2.05
.12	22.0	15.00	.45	36.0	28.33	.85	60.0	50.00	1.50	120.0	68.33	2.05
.15	22.0	12.00	.45	36.0	22.66	.85	60.0	40.00	1.50	120.0	57.33	2.15
.18	22.0	18.88	.85	36.0	24.44	1.10	60.0	33.33	1.50	120.0	47.77	2.15
.20	22.0	17.00	.85	36.0	22.00	1.10	60.0	30.00	1.50	120.0	43.00	2.15
.22	22.0	15.45	.85	36.0	20.00	1.10	60.0	27.27	1.50	120.0	39.09	2.15
.27	22.0	16.29	1.10	36.0	22.22	1.50	60.0	30.37	2.05	120.0	33.33	2.25
.33	22.0	13.33	1.10	36.0	18.18	1.50	60.0	26.06	2.15	120.0	27.27	2.25
.39	22.0	15.38	1.50	36.0	15.38	1.50	60.0	22.05	2.15	120.0	30.76	3.00
.47	22.0	12.76	1.50	36.0	17.44	2.05	60.0	19.14	2.25	120.0	25.53	3.00
.50	22.0	12.00	1.50	36.0	16.40	2.05	60.0	18.00	2.25	120.0	24.00	3.00
.56	22.0	10.71	1.50	36.0	14.64	2.05	60.0	16.07	2.25	120.0	21.42	3.00
.68	22.0	10.11	1.72	36.0	12.05	2.05	60.0	14.70	2.50	120.0	19.41	3.30
.75	22.0	9.17	1.72	36.0	10.93	2.05	60.0	13.33	2.50	120.0	17.60	3.30
.82	22.0	8.39	1.72	36.0	10.00	2.05	60.0	12.19	2.50	120.0	17.07	3.50
1.0	22.0	6.88	1.72	36.0	8.60	2.15	60.0	12.00	3.00	120.0	14.00	3.50
1.2	22.0	7.16	2.15	36.0	7.16	2.15	60.0	9.99	3.00	120.0	11.66	3.50
1.5	22.0	5.73	2.15	36.0	6.66	2.50	60.0	8.80	3.30			
1.8	22.0	4.77	2.15	36.0	5.55	2.50	60.0	7.33	3.30			
2.0	22.0	4.30	2.15	36.0	5.00	2.50	60.0	7.00	3.50			
2.2	22.0	3.90	2.15	36.0	4.54	2.50	60.0	6.36	3.50			
2.5	22.0	3.60	2.25	36.0	4.00	2.50	60.0	5.60	3.50			
2.7	22.0	3.33	2.25	36.0	4.44	3.00	60.0	5.18	3.50			
3.0	22.0	2.99	2.24	36.0	3.99	3.00	60.0	4.66	3.50			
3.3	22.0	2.72	2.24	36.0	3.63	3.00	60.0	4.24	3.50			
3.9	22.0	3.09	3.01	36.0	3.38	3.30						
4.7	22.0	2.55	3.00	36.0	2.97	3.50						
5.0	22.0	2.40	3.00	36.0	2.80	3.50						
5.6	22.0	2.14	3.00	36.0	2.50	3.50						
6.8	22.0	1.94	3.30	36.0	2.05	3.50						
7.5	22.0	1.76	3.30	36.0	1.86	3.50						
8.2	22.0	1.71	3.50	36.0	1.70	3.50						
10.0	22.0	1.40	3.50									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research CRC

P12 METALLIZED POLYCARBONATE CAPACITOR

P12 SPECIFICATIONS		
CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derated linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 2 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	150% rated DC voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	+1.5% to −1.0% +0.5% to −1.5	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.5uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.68uF CAPACITOR AT 25°C IS 200,000 ÷ 0.68 = 294,117 MEGOHMS.

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.5uF	400,000 Megohms	200,000 Megohms	30,000 Megohms	2,500 Megohms
GREATER THAN 0.5uF	200,000 Megohms-uF	100,000 Megohms-uF	15,000 Megohms-uF	1,250 Megohms-uF

P12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 100°C, at 120% rated AC voltage at 400Hz	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁻⁶atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 2 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL) AND TERMINALS TO CASE)	Apply 150% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	200,000 megohm-uF need not exceed 400,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent making of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

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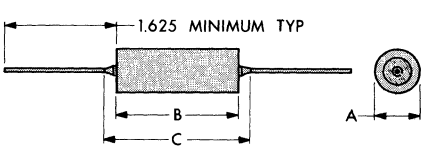
Component Research (CRC)

P12 METALLIZED POLYCARBONATE CAPACITOR

CASE DIMENSIONS

CAP uF	50 VDC Diam. A	50 VDC Length B	50 VDC Length C	100 VDC Diam. A	100 VDC Length B	100 VDC Length C	200 VDC Diam. A	200 VDC Length B	200 VDC Length C	400 VDC Diam. A	400 VDC Length B	400 VDC Length C
.001	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0012	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0015	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0018	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.002	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0022	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0027	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0033	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0039	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0047	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.005	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0056	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0068	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.0075	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.0082	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.01	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.012	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.015	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.018	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.02	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.022	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.027	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.033	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.039	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.047	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.05	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.056	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.068	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.075	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.082	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.1	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.12	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.15	.235	.687	.787	.312	.687	.787	.312	.813	.913	.500	1.125	1.225
.18	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.20	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.22	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.27	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.33	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.39	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.47	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.50	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.56	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.68	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
.75	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
.82	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
1.0	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.750	1.875	1.975
1.2	.400	1.063	1.163	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975
1.5	.400	1.063	1.163	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975
1.8	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.0	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.2	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.5	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.7	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.0	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.3	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.9	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975			
4.7	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
5.0	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
5.6	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
6.8	.670	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475			
7.5	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
8.2	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
10.0	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
12.0	.750	1.875	1.975	1.000	1.875	1.975						
15.0	.750	1.875	1.975	1.000	1.875	1.975						
18.0	1.000	1.875	1.975	1.000	2.375	2.475						
20.0	1.000	1.875	1.975	1.000	2.375	2.475						
22.0	1.000	1.875	1.975	1.000	2.375	2.475						
25.0	1.000	2.375	2.475									
27.0	1.000	2.375	2.475									

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.



P12 | B | 104 | J | S | W

STYLE

VOLTAGE
- B = 50VDC
- C = 100VDC
- D = 200VDC
- E = 400VDC

CAPACITANCE TOLERANCE
K = 10% G = 2% D = ½%
J = 5% F = 1% B = ¼%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

SLEEVING CODE
S = Mylar sleeve
X = No sleeve

LEAD CODE
W = Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C = Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

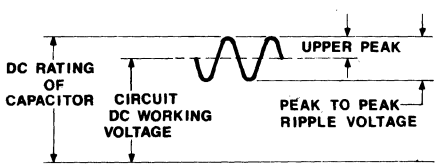
CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

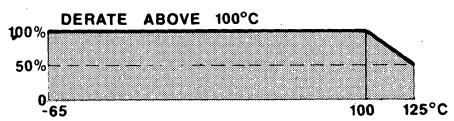
Component Research (CRC)

P12 METALLIZED POLYCARBONATE CAPACITOR

CAP uF	AC RATINGS											
	50 VDC			100 VDC			200 VDC			400 VDC		
	Volts RMS	Freq. In KHz	Amps RMS	Volts RMS	Freq. In KHz	Amps RMS	Volts RMS	Freq. In KHz	Amps RMS	Volts RMS	Freq. In KHz	Amps RMS
.001	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0012	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0015	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0018	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.002	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0022	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0027	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0033	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0039	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0047	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.005	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0056	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0068	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.0075	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.0082	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.01	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.012	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.015	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.018	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.02	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.022	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.027	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.033	36.0	40.00	.25	60.0	32.00	.40	120.0	40.00	1.00	240.0	32.3	1.6
.039	36.0	32.00	.28	60.0	29.00	.42	120.0	40.00	1.20	240.0	27.4	1.6
.047	36.0	32.00	.34	60.0	28.00	.50	120.0	39.70	1.40	240.0	25.5	1.8
.05	36.0	32.00	.36	60.0	28.00	.53	120.0	37.30	1.40	240.0	24.0	1.8
.056	36.0	31.70	.40	60.0	27.50	.58	120.0	33.30	1.40	240.0	21.4	1.8
.068	36.0	29.00	.45	60.0	27.40	.70	120.0	27.40	1.40	240.0	17.0	1.8
.075	36.0	29.00	.50	60.0	25.00	.70	120.0	27.00	1.50	240.0	17.0	2.0
.082	36.0	28.00	.53	60.0	25.00	.78	120.0	26.00	1.60	240.0	16.3	2.0
.1	36.0	26.60	.60	60.0	25.00	.94	120.0	21.30	1.60	240.0	13.3	2.0
.12	36.0	26.00	.70	60.0	25.00	1.10	120.0	17.80	1.60	240.0	11.1	2.0
.15	36.0	25.00	.85	60.0	24.80	1.40	120.0	16.00	1.80	240.0	11.0	2.4
.18	36.0	24.60	1.00	60.0	20.70	1.40	120.0	13.30	1.80	240.0	11.0	3.0
.20	36.0	22.20	1.00	60.0	18.70	1.40	120.0	12.00	1.80	240.0	10.0	3.0
.22	36.0	20.00	1.00	60.0	16.90	1.40	120.0	11.00	1.80	240.0	10.0	3.0
.27	36.0	20.00	1.20	60.0	15.80	1.60	120.0	10.00	2.00	240.0	10.0	4.2
.33	36.0	16.00	1.20	60.0	13.00	1.60	120.0	8.80	2.20	240.0	8.7	4.3
.39	36.0	14.00	1.20	60.0	11.00	1.60	120.0	8.20	2.40	240.0	7.3	4.3
.47	36.0	14.00	1.50	60.0	10.20	1.80	120.0	8.00	2.80	240.0	6.4	4.5
.50	36.0	13.30	1.50	60.0	9.60	1.80	120.0	8.00	3.00	240.0	6.0	4.5
.56	36.0	11.90	1.50	60.0	8.60	1.80	120.0	7.60	3.20	240.0	5.4	4.5
.68	36.0	11.90	1.80	60.0	7.80	2.00	120.0	7.40	3.80	240.0	5.0	5.0
.75	36.0	10.60	1.80	60.0	7.10	2.00	120.0	7.40	4.20	240.0	4.4	5.0
.82	36.0	9.75	1.80	60.0	6.50	2.00	120.0	7.00	4.30	240.0	4.1	5.0
1.0	36.0	8.00	1.80	60.0	5.80	2.20	120.0	5.70	4.30	240.0	3.3	5.0
1.2	36.0	7.40	2.00	60.0	5.70	2.60	120.0	5.00	4.50	240.0	3.3	6.0
1.5	36.0	5.90	2.00	60.0	5.30	3.00	120.0	4.00	4.50	240.0	2.7	6.0
1.8	36.0	5.70	2.30	60.0	5.10	3.50	120.0	3.70	5.00	240.0	2.4	6.4
2.0	36.0	5.10	2.30	60.0	4.70	3.50	120.0	3.30	5.00	240.0	2.1	6.4
2.2	36.0	4.60	2.30	60.0	4.20	3.50	120.0	3.00	5.00	240.0	2.0	6.4
2.5	36.0	4.60	2.60	60.0	4.80	4.50	120.0	3.20	6.00	240.0	1.9	7.0
2.7	36.0	4.30	2.60	60.0	4.40	4.50	120.0	3.00	6.00	240.0	1.7	7.0
3.0	36.0	3.90	2.60	60.0	4.00	4.50	120.0	2.70	6.00	240.0	1.6	7.0
3.3	36.0	3.50	2.60	60.0	3.60	4.50	120.0	2.40	6.00	240.0	1.4	7.0
3.9	36.0	3.00	2.60	60.0	3.10	4.50	120.0	2.10	6.00			
4.7	36.0	2.80	3.00	60.0	2.80	5.00	120.0	1.80	6.40			
5.0	36.0	2.60	3.00	60.0	2.70	5.00	120.0	1.70	6.40			
5.6	36.0	2.40	3.00	60.0	2.40	5.00	120.0	1.50	6.40			
6.8	36.0	2.00	3.00	60.0	2.00	5.00	120.0	1.30	6.40			
7.5	36.0	2.00	3.50	60.0	2.00	6.00	120.0	1.20	7.00			
8.2	36.0	1.90	3.50	60.0	1.95	6.00	120.0	1.14	7.00			
10.0	36.0	1.60	3.50	60.0	1.60	6.00	120.0	.93	7.00			
12.0	36.0	1.50	4.00	60.0	1.42	6.40						
15.0	36.0	1.20	4.00	60.0	1.14	6.40						
18.0	36.0	1.18	4.80	60.0	.98	6.60						
20.0	36.0	1.10	4.80	60.0	.88	6.60						
22.0	36.0	.97	4.80	60.0	.80	6.60						
25.0	36.0	.96	5.40									
27.0	36.0	.88	5.40									



1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research (CRC)

C 15 METALLIZED POLYPROPYLENE CAPACITOR

C15 SPECIFICATIONS (QUALIFIED TO MIL-C-83421/2)

CONSTRUCTION	Metallized polypropylene dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
OPERATING TEMPERATURE	−55°C to +105°C	At voltage and current shown in table.
DIELECTRIC ABSORPTION	0.02% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.07% maximum	At 25°C when measured per MIL-C-83421 at 1KHz.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal. Do not exceed 800V P/P
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	0 to −4% max. 0 to +3% max.	From 25°C to +105°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25% max.	When measured at any two corresponding temperature points taken in five successive temperature cycles from −55°C to +105°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.
EQUIVALENT SERIES RESISTANCE	Per Table	At 25°C at 100KHz.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 300,000 ÷ 0.18 = 1,666,666 MEGOHMS.

RANGE	25°C	85°C	105°C
.001 TO 0.1uF	3,000,000 Megohms	150,000 Megohms	20,000 Megohms
GREATER THAN 0.1uF	300,000 Megohms-uF	15,000 Megohms-uF	2,000 Megohms-uF

C15 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	24 hours at 85°C at rated current at 40KHz	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +105°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6} atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINAL TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	300,000 megohms-uF need not exceed 3,000,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1 uF measure at 0.1KHz	4.7.9	0.07% max.	100% Test
10	EQUIVALENT SERIES RESISTANCE	At 25°C at 100KHz	TBD	Per table	100% Test
11	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research — CRC

C 15 METALLIZED POLYPROPYLENE CAPACITOR

CASE DIMENSIONS • AC RATINGS

* PART NO.	uF	RATED VDC	DIAM. A	LENGTH B	E.S.R. (OHMS) MAX. @ 100kHz	RATED VRMS @ 400Hz	25°C MAX. ARMS	35°C MAX. ARMS	45°C MAX. ARMS	55°C MAX. ARMS	65°C MAX. ARMS	75°C MAX. ARMS	85°C MAX. ARMS	95°C MAX. ARMS	105°C MAX. ARMS
C15C474_SC	0.470	100	0.400	0.875	0.025	60	5.3	4.9	4.6	4.2	3.7	3.2	2.6	1.9	0.8
C15C564_SC	0.560	100	0.500	0.875	0.024	60	6.0	5.6	5.2	4.8	4.3	3.7	3.0	2.1	1.0
C15C684_SC	0.680	100	0.500	0.875	0.023	60	6.2	5.8	5.4	4.9	4.4	3.8	3.1	2.2	1.0
C15C824_SC	0.820	100	0.500	0.875	0.022	60	6.3	5.9	5.5	5.0	4.5	3.9	3.2	2.2	1.0
C15C105_SC	1.000	100	0.562	0.906	0.017	60	7.7	7.2	6.7	6.1	5.4	4.7	3.9	2.7	1.2
C15C205_SC	2.000	100	0.670	1.094	0.014	60	10.3	9.7	8.9	8.2	7.3	6.3	5.2	3.7	1.6
C15C305_SC	3.000	100	0.750	1.094	0.013	60	11.4	10.7	9.9	9.0	8.1	7.0	5.7	4.0	1.8
C15C505_SC	5.000	100	0.750	1.406	0.012	60	13.6	12.7	11.8	10.7	9.6	8.3	6.8	4.8	2.1
C15C106_SC	10.000	100	1.000	1.687	0.010	60	15.0	15.0	15.0	14.3	12.8	11.1	9.1	6.4	2.9
C15C206_SC	20.000	100	1.000	2.437	0.009	60	15.0	15.0	15.0	15.0	15.0	14.1	11.5	8.2	3.6
C15D184_SC	0.180	200	0.400	0.875	0.031	120	4.8	4.5	4.1	3.8	3.4	2.9	2.4	1.7	0.8
C15D224_SC	0.220	200	0.500	0.875	0.030	120	5.4	5.1	4.7	4.3	3.8	3.3	2.7	1.9	0.9
C15D274_SC	0.270	200	0.500	0.875	0.029	120	5.5	5.2	4.8	4.4	3.9	3.4	2.8	2.0	0.9
C15D334_SC	0.330	200	0.500	0.875	0.028	120	5.6	5.3	4.9	4.5	4.0	3.5	2.8	2.0	0.9
C15D394_SC	0.390	200	0.562	0.906	0.026	120	6.2	5.8	5.4	4.9	4.4	3.8	3.1	2.2	1.0
C15D474_SC	0.470	200	0.562	1.094	0.025	120	7.0	6.5	6.1	5.5	4.9	4.3	3.5	2.5	1.1
C15D564_SC	0.560	200	0.562	1.094	0.024	120	7.2	6.7	6.2	5.7	5.1	4.4	3.6	2.5	1.1
C15D684_SC	0.680	200	0.670	1.094	0.023	120	8.0	7.5	6.9	6.3	5.7	4.9	4.0	2.8	1.3
C15D824_SC	0.820	200	0.670	1.094	0.022	120	8.2	7.7	7.1	6.5	5.8	5.0	4.1	2.9	1.3
C15D105_SC	1.000	200	0.670	1.094	0.021	120	8.4	7.9	7.3	6.7	6.0	5.2	4.2	3.0	1.3
C15D205_SC	2.000	200	0.750	1.406	0.017	120	11.1	10.4	9.6	8.8	7.8	6.8	5.5	3.9	1.8
C15D305_SC	3.000	200	1.000	1.437	0.015	120	13.9	13.0	12.0	11.0	9.8	8.5	7.0	4.9	2.2
C15D505_SC	5.000	200	1.000	1.687	0.013	120	15.0	15.0	14.2	12.9	11.6	10.0	8.2	5.8	2.6
C15E563_SC	0.056	400	0.400	0.875	0.058	240	3.5	3.3	3.0	2.8	2.5	2.1	1.7	1.2	0.6
C15E683_SC	0.068	400	0.500	0.875	0.046	240	4.4	4.1	3.8	3.5	3.1	2.7	2.2	1.5	0.7
C15E823_SC	0.082	400	0.500	0.875	0.039	240	4.7	4.4	4.1	3.7	3.4	2.9	2.4	1.7	0.7
C15E104_SC	0.100	400	0.500	0.875	0.035	240	5.0	4.7	4.4	4.0	3.6	3.1	2.5	1.8	0.8
C15E124_SC	0.120	400	0.562	0.906	0.033	240	5.5	5.2	4.8	4.4	3.9	3.4	2.8	2.0	0.9
C15E154_SC	0.150	400	0.670	0.906	0.032	240	6.2	5.8	5.3	4.9	4.4	3.8	3.1	2.2	1.0
C15E184_SC	0.180	400	0.670	0.906	0.031	240	6.3	5.9	5.4	5.0	4.4	3.8	3.1	2.2	1.0
C15E224_SC	0.220	400	0.670	1.094	0.030	240	7.0	6.6	6.1	5.6	5.0	4.3	3.5	2.5	1.1
C15E274_SC	0.270	400	0.670	1.094	0.029	240	7.2	6.7	6.2	5.7	5.1	4.4	3.6	2.5	1.1
C15E334_SC	0.330	400	0.670	1.094	0.028	240	7.3	6.8	6.3	5.8	5.2	4.5	3.7	2.6	1.2
C15E394_SC	0.390	400	0.750	1.094	0.026	240	7.9	7.4	6.8	6.2	5.6	4.8	3.9	2.8	1.2
C15E474_SC	0.470	400	0.750	1.094	0.025	240	8.1	7.6	7.0	6.4	5.7	4.9	4.0	2.9	1.3
C15E564_SC	0.560	400	0.750	1.406	0.025	240	9.2	8.6	7.9	7.2	6.5	5.6	4.6	3.2	1.4
C15E684_SC	0.680	400	0.750	1.406	0.024	240	9.4	8.8	8.1	7.4	6.6	5.7	4.7	3.3	1.5
C15E824_SC	0.820	400	0.750	1.656	0.023	240	10.4	9.7	9.0	8.2	7.4	6.4	5.2	3.7	1.6
C15E105_SC	1.000	400	0.750	1.656	0.022	240	10.7	10.0	9.3	8.5	7.6	6.5	5.3	3.8	1.7
C15E205_SC	2.000	400	1.000	1.938	0.017	240	15.0	14.1	13.0	11.9	10.6	9.2	7.5	5.3	2.4

*

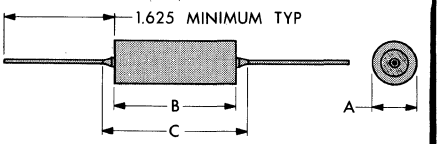
To complete Part Number, select capacitance-tolerance letter from list below, and insert as 8th character.

K = 10% • J = 5% • G = 2% • F = 1%

D = ½% • B = ¼% • A = $^{1}/_{10}$%

If insulated sleeving is not desired then replace the ninth character "S" with an "X".

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	+.03 −.09 With or Without Sleeving
"C" Bead to Bead Max. Length	"C" Dimension is 0.2" maximum more than "B" dimension in table



FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATIONS DEPARTMENT

COMPONENT RESEARCH CO., INC. ■ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research (CRC)

A19 METALLIZED POLYPHENYLENE SULFIDE

A19 SPECIFICATIONS		
CONSTRUCTION	Metallized polyphenylene sulfide dielectric, hermetically sealed, extended metal film electrodes, radial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421.	
OPERATING TEMPERATURE	−65°C to +125°C.	At full rated voltage,
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% 0% to −2%	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE	25°C	85°C	100°C	125°C
	1,000,000 Megohms	60,000 Megohms	50,000 Megohms	10,000 Megohms

A19 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	**BURN-IN**	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	**THERMAL AGING**	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	**SEAL TEST (FINE LEAK)**	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6}atm/cm³/sec. max.	100% Test
4	**SEAL TEST (GROSS LEAK)**	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	**AC SQUARE WAVE**	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	**DC HI-POT**	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	**INSULATION RESISTANCE**	At 25°C at rated DC voltage	4.7.7	1,000,000 Megohms min.	100% Test
8	**% CAPACITANCE TOLERANCE**	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	**% DISSIPATION FACTOR**	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	**VISUAL AND MECHANICAL INSPECTION**	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

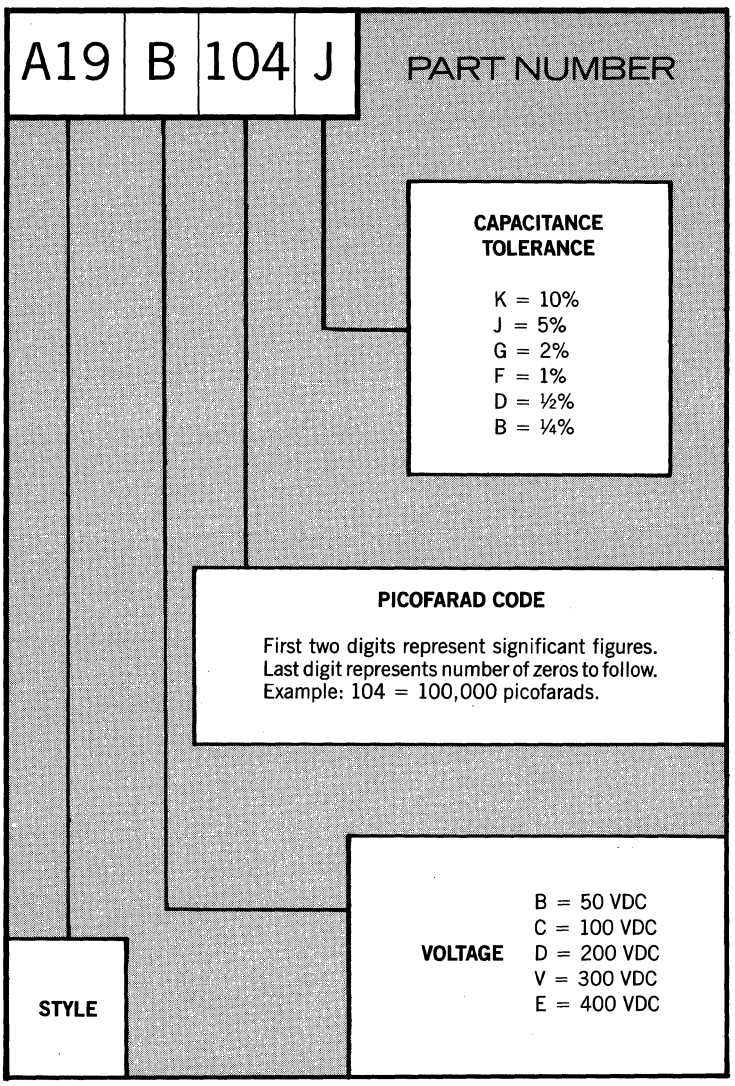
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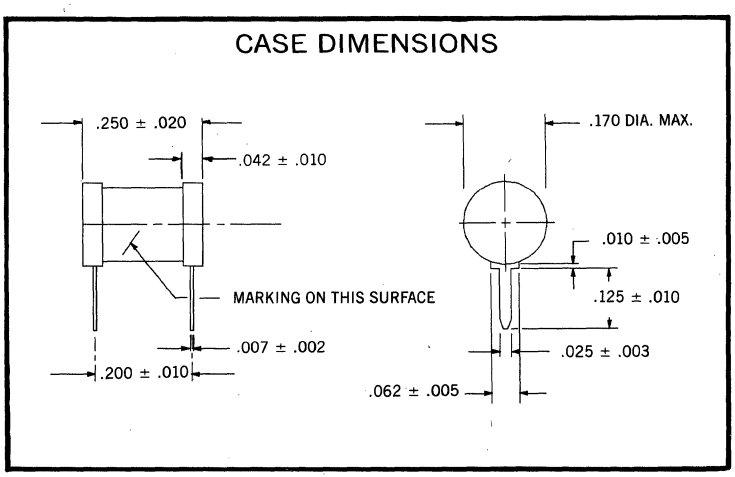
Component Research CRC

A19 METALLIZED POLYPHENYLENE SULFIDE

CASE DIMENSIONS & AC RATINGS

UF	BASIC PART NO.	D.C. RATING	AC VOLTAGE RATING rms 400 Hz	MAXIMUM rms AMPERES
.0005	A19E501	400	240	0.05
.00056	A19E561	400	240	0.05
.00068	A19E681	400	240	0.05
.00082	A19E821	400	240	0.05
.001	A19E102	400	240	0.05
.0012	A19E122	400	240	0.05
.0015	A19E152	400	240	0.05
.0018	A19V182	300	180	0.05
.002	A19V202	300	180	0.05
.0022	A19V222	300	180	0.05
.0027	A19V272	300	180	0.05
.0033	A19D332	200	120	0.05
.0039	A19D392	200	120	0.05
.0047	A19D472	200	120	0.05
.005	A19D502	200	120	0.05
.0056	A19D562	200	120	0.05
.0068	A19C682	100	60	0.05
.0082	A19C822	100	60	0.05
.01	A19C103	100	60	0.05
.012	A19C123	100	60	0.05
.015	A19C153	100	60	0.05
.018	A19C183	100	60	0.05
.02	A19B203	50	36	0.05
.022	A19B223	50	36	0.05
.027	A19B273	50	36	0.05
.033	A19B333	50	36	0.05
.039	A19B393	50	36	0.05
.047	A19B473	50	36	0.05
.05	A19B503	50	36	0.05
.056	A19B563	50	36	0.05





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Component Research CRC

J11 METALLIZED TEFLON CAPACITOR

PRODUCT FEATURES

.068 μF 50VDC ACTUAL SIZE CAPACITOR



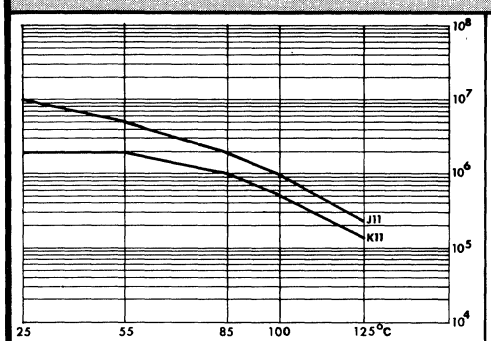
HIGH INSULATION RESISTANCE: 10,000,000 MEGOHMS MINIMUM. (FOR J11 SERIES, ALL VALUES UP TO 0.1uF).

LOW DIELECTRIC ABSORPTION: 0.01% MAXIMUM VOLTAGE RECOVERY.

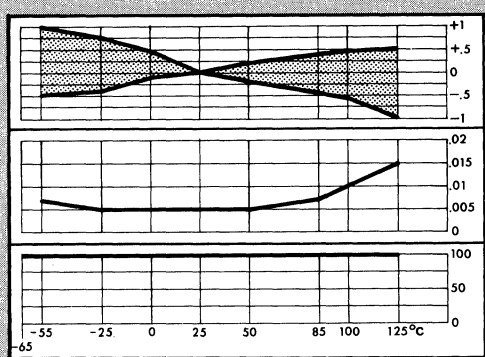
LONG TERM STABILITY: LESS THAN 0.5% CAPACITANCE DRIFT AFTER 2000 HRS. AT 125°C AT RATED VOLTS.

SERIES 11 CAPACITORS HAVE BEEN QUALIFIED FOR USE IN SPACE AND MISSILE SYSTEMS WHERE MAXIMUM RELIABILITY AND LOW DIELECTRIC LOSS ARE ESSENTIAL.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- GYRO CIRCUITS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT1303

TEST RESULTS FOR 80 SERIES D11B CAPACITORS LIFE TESTED FOR 2000 HOURS AT 125°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. D11B CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN as J11 SERIES.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
D11B	0.1	12	$5x10^5$	$3.9x10^6$	$5x10^7$	±1	−.035	−.35	.2	.01	.065
D11B	0.22	32	$5x10^5$	$2x10^6$	$2.5x10^7$	±1	−.01	+.85	.2	.005	.075
D11B	0.47	11	$5x10^5$	$1x10^6$	$1x10^6$	±1	−.005	+.58	.2	.01	.10
D11B	1.0	6	$2.5x10^5$	$5.2x10^5$	$3.8x10^6$	±1	−.005	+.24	.2	.01	.12
D11B	0.5	20	$5x10^5$	$3.8x10^6$	$5x10^7$	±1	+.02	+.48	.2	.01	.02

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Component Research (CRC)

J11 METALLIZED TEFLON CAPACITOR

J11 SPECIFICATIONS

CONSTRUCTION	Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmetal requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +125°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.05% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −55°C −25°C 0°C 50°C 85°C 100°C 125°C	From −0.5% to +1.0% From −0.35% to +0.75% From −0.1% to +0.45% From −0.2% to +0.2% From −0.45% to +0.4% From −0.65% to +0.45% From −1.0% to +0.5%
CAPACITANCE STABILITY	±0.10%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1 × 10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.68uF CAPACITOR AT 25°C IS 1,000,000 ÷ 0.68 = 1,475,000 MEGOHMS.

RANGE	25°	55°C	85°C	100°C	125°C
.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	25,000 Megohms-uF

J11 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10^{-6}atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.05% max.	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research (CRC)

J11 METALLIZED TEFLON CAPACITOR

uF	CASE DIMENSIONS											
	50 VDC				100 VDC				200 VDC			
	J11	Diam. A	Length B	Length C	J11	Diam. A	Length B	Length C	J11	Diam. A	Length B	Length C
.001	J11B102	.235	.687	.887	J11C102	.235	.687	.887	J11D102	.235	.687	.887
.0012	J11B122	.235	.687	.887	J11C122	.235	.687	.887	J11D122	.235	.687	.887
.0015	J11B152	.235	.687	.887	J11C152	.235	.687	.887	J11D152	.235	.687	.887
.0018	J11B182	.235	.687	.887	J11C182	.235	.687	.887	J11D182	.235	.687	.887
.002	J11B202	.235	.687	.887	J11C202	.235	.687	.887	J11D202	.235	.687	.887
.0022	J11B222	.235	.687	.887	J11C222	.235	.687	.887	J11D222	.235	.687	.887
.0027	J11B272	.235	.687	.887	J11C272	.235	.687	.887	J11D272	.235	.687	.887
.0033	J11B332	.235	.687	.887	J11C332	.235	.687	.887	J11D332	.235	.687	.887
.0039	J11B392	.235	.687	.887	J11C392	.235	.687	.887	J11D392	.235	.687	.887
.0047	J11B472	.235	.687	.887	J11C472	.235	.687	.887	J11D472	.235	.687	.887
.005	J11B502	.235	.687	.887	J11C502	.235	.687	.887	J11D502	.235	.687	.887
.0056	J11B562	.235	.687	.887	J11C562	.235	.687	.887	J11D562	.235	.687	.887
.0068	J11B682	.235	.687	.887	J11C682	.235	.687	.887	J11D682	.235	.687	.887
.0082	J11B822	.235	.687	.887	J11C822	.235	.687	.887	J11D822	.235	.687	.887
.01	J11B103	.235	.687	.887	J11C103	.235	.687	.887	J11D103	.235	.687	.887
.012	J11B123	.235	.687	.887	J11C123	.235	.687	.887	J11D123	.235	.687	.887
.015	J11B153	.312	.687	.887	J11C153	.312	.687	.887	J11D153	.312	.687	.887
.018	J11B183	.312	.687	.887	J11C183	.312	.687	.887	J11D183	.312	.813	1.013
.02	J11B203	.312	.687	.887	J11C203	.312	.687	.887	J11D203	.312	.813	1.013
.022	J11B223	.312	.687	.887	J11C223	.312	.687	.887	J11D223	.312	.813	1.013
.027	J11B273	.312	.687	.887	J11C273	.312	.813	1.013	J11D273	.312	.813	1.013
.033	J11B333	.312	.687	.887	J11C333	.312	.813	1.013	J11D333	.400	.813	1.013
.039	J11B393	.312	.687	.887	J11C393	.400	.813	1.013	J11D393	.400	1.063	1.263
.047	J11B473	.312	.687	.887	J11C473	.400	.813	1.013	J11D473	.400	1.063	1.263
.05	J11B503	.312	.687	.887	J11C503	.400	.813	1.013	J11D503	.400	1.063	1.263
.056	J11B563	.312	.813	1.013	J11C563	.400	.813	1.013	J11D563	.400	1.063	1.263
.068	J11B683	.312	.813	1.013	J11C683	.400	.813	1.013	J11D683	.400	1.063	1.263
.082	J11B823	.312	.937	1.137	J11C823	.400	1.063	1.263	J11D823	.500	1.125	1.325
.1	J11B104	.312	.937	1.137	J11C104	.400	1.063	1.263	J11D104	.500	1.125	1.325
.12	J11B124	.312	1.063	1.263	J11C124	.500	1.125	1.325	J11D124	.500	1.375	1.575
.15	J11B154	.312	1.063	1.263	J11C154	.500	1.125	1.325	J11D154	.562	1.375	1.575
.18	J11B184	.400	1.063	1.263	J11C184	.500	1.125	1.325	J11D184	.562	1.375	1.575
.20	J11B204	.400	1.063	1.263	J11C204	.562	1.125	1.325	J11D204	.562	1.375	1.575
.22	J11B224	.400	1.063	1.263	J11C224	.562	1.125	1.325	J11D224	.562	1.375	1.575
.27	J11B274	.400	1.063	1.263	J11C274	.562	1.125	1.325	J11D274	.670	1.375	1.575
.33	J11B334	.500	1.125	1.325	J11C334	.562	1.125	1.325	J11D334	.670	1.375	1.575
.39	J11B394	.500	1.125	1.325	J11C394	.562	1.375	1.575	J11D394	.562	1.875	2.075
.47	J11B474	.562	1.125	1.325	J11C474	.670	1.375	1.575	J11D474	.670	1.875	2.075
.50	J11B504	.562	1.125	1.325	J11C504	.670	1.375	1.575	J11D504	.670	1.875	2.075
.56	J11B564	.562	1.125	1.325	J11C564	.670	1.375	1.575	J11D564	.670	1.875	2.075
.68	J11B684	.562	1.125	1.325	J11C684	.670	1.875	2.075	J11D684	.750	1.875	2.075
.82	J11B824	.562	1.375	1.575	J11C824	.670	1.875	2.075	J11D824	.750	1.875	2.075
1.0	J11B105	.670	1.375	1.575	J11C105	.670	1.875	2.075	J11D105	.750	1.875	2.075
1.5	J11B155	.670	1.875	2.075	J11C155	.750	1.875	2.075	J11D155	1.00	1.875	2.075
2.0	J11B205	.670	1.875	2.075	J11C205	1.00	1.875	2.075	J11D205	1.00	2.375	2.575

J11 | B | 104 | J | S | A

STYLE

VOLTAGE
B=50VDC
C=100VDC
D=200VDC

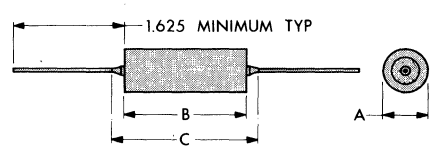
SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
A=Solderable leads: #22 (.025") for .312" case dia. & smaller; #20 (.032") for .400" case dia. & larger.

CAPACITANCE TOLERANCE
K=10% J=5% G=2% F=1% D=½% B=¼% A=.1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research (CRC)

H11 METALLIZED TEFLON CAPACITOR

H11 SPECIFICATIONS

CONSTRUCTION	Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmetal requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +200°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.05% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −65°C +125°C +200°C	 ±2.0% max. ±3.0% max. ±3.5% max.
CAPACITANCE STABILITY	±0.10%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.68uF CAPACITOR AT 25°C IS 1,000,000 ÷ 0.68 = 1,475,000 MEGOHMS.

RANGE	25°	55°C	85°C	100°C	125°C
.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	25,000 Megohms-uF

H11 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁻⁶atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.05% max.	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research CRC

H11 METALLIZED TEFLON CAPACITOR

uF	CASE DIMENSIONS											
	50 VDC				100 VDC				200 VDC			
	H11	Diam. A	Length B	Length C	H11	Diam. A	Length B	Length C	H11	Diam. A	Length B	Length C
.001	11B102	.235	.687	.887	11C102	.235	.687	.887	11D102	.235	.687	.887
.0012	11B122	.235	.687	.887	11C122	.235	.687	.887	11D122	.235	.687	.887
.0015	11B152	.235	.687	.887	11C152	.235	.687	.887	11D152	.235	.687	.887
.0018	11B182	.235	.687	.887	11C182	.235	.687	.887	11D182	.235	.687	.887
.002	11B202	.235	.687	.887	11C202	.235	.687	.887	11D202	.235	.687	.887
.0022	11B222	.235	.687	.887	11C222	.235	.687	.887	11D222	.235	.687	.887
.0027	11B272	.235	.687	.887	11C272	.235	.687	.887	11D272	.235	.687	.887
.0033	11B332	.235	.687	.887	11C332	.235	.687	.887	11D332	.235	.687	.887
.0039	11B392	.235	.687	.887	11C392	.235	.687	.887	11D392	.235	.687	.887
.0047	11B472	.235	.687	.887	11C472	.235	.687	.887	11D472	.235	.687	.887
.005	11B502	.235	.687	.887	11C502	.235	.687	.887	11D502	.235	.687	.887
.0056	11B562	.235	.687	.887	11C562	.235	.687	.887	11D562	.235	.687	.887
.0068	11B682	.235	.687	.887	11C682	.235	.687	.887	11D682	.235	.687	.887
.0082	11B822	.235	.687	.887	11C822	.235	.687	.887	11D822	.235	.687	.887
.01	11B103	.235	.687	.887	11C103	.235	.687	.887	11D103	.235	.687	.887
.012	11B123	.235	.687	.887	11C123	.235	.687	.887	11D123	.235	.687	.887
.015	11B153	.312	.687	.887	11C153	.312	.687	.887	11D153	.312	.687	.887
.018	11B183	.312	.687	.887	11C183	.312	.687	.887	11D183	.312	.813	1.013
.02	11B203	.312	.687	.887	11C203	.312	.687	.887	11D203	.312	.813	1.013
.022	11B223	.312	.687	.887	11C223	.312	.687	.887	11D223	.312	.813	1.013
.027	11B273	.312	.687	.887	11C273	.312	.813	1.013	11D273	.312	.813	1.013
.033	11B333	.312	.687	.887	11C333	.312	.813	1.013	11D333	.400	.813	1.013
.039	11B393	.312	.687	.887	11C393	.400	.813	1.013	11D393	.400	1.063	1.263
.047	11B473	.312	.687	.887	11C473	.400	.813	1.013	11D473	.400	1.063	1.263
.05	11B503	.312	.687	.887	11C503	.400	.813	1.013	11D503	.400	1.063	1.263
.056	11B563	.312	.813	1.013	11C563	.400	.813	1.013	11D563	.400	1.063	1.263
.068	11B683	.312	.813	1.013	11C683	.400	.813	1.013	11D683	.400	1.063	1.263
.082	11B823	.312	.937	1.137	11C823	.400	1.063	1.263	11D823	.500	1.125	1.325
.1	11B104	.312	.937	1.137	11C104	.400	1.063	1.263	11D104	.500	1.125	1.325
.12	11B124	.312	1.063	1.263	11C124	.500	1.125	1.325	11D124	.500	1.375	1.575
.15	11B154	.312	1.063	1.263	11C154	.500	1.125	1.325	11D154	.562	1.375	1.575
.18	11B184	.400	1.063	1.263	11C184	.500	1.125	1.325	11D184	.562	1.375	1.575
.20	11B204	.400	1.063	1.263	11C204	.562	1.125	1.325	11D204	.562	1.375	1.575
.22	11B224	.400	1.063	1.263	11C224	.562	1.125	1.325	11D224	.562	1.375	1.575
.27	11B274	.400	1.063	1.263	11C274	.562	1.125	1.325	11D274	.670	1.375	1.575
.33	11B334	.500	1.125	1.325	11C334	.562	1.125	1.325	11D334	.670	1.375	1.575
.39	11B394	.500	1.125	1.325	11C394	.562	1.375	1.575	11D394	.562	1.875	2.075
.47	11B474	.562	1.125	1.325	11C474	.670	1.375	1.575	11D474	.670	1.875	2.075
.50	11B504	.562	1.125	1.325	11C504	.670	1.375	1.575	11D504	.670	1.875	2.075
.56	11B564	.562	1.125	1.325	11C564	.670	1.375	1.575	11D564	.670	1.875	2.075
.68	11B684	.562	1.125	1.325	11C684	.670	1.875	2.075	11D684	.750	1.875	2.075
.82	11B824	.562	1.375	1.575	11C824	.670	1.875	2.075	11D824	.750	1.875	2.075
1.0	11B105	.670	1.375	1.575	11C105	.670	1.875	2.075	11D105	.750	1.875	2.075
1.5	11B155	.670	1.875	2.075	11C155	.750	1.875	2.075	11D155	1.00	1.875	2.075
2.0	11B205	.670	1.875	2.075	11C205	1.00	1.875	2.075	11D205	1.00	2.375	2.575

H11 | B | 104 | J | X | A

STYLE

VOLTAGE
B=50VDC
C=100VDC
D=200VDC

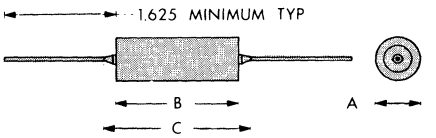
SLEEVING CODE
X=No sleeve

LEAD CODE
A=Solderable leads: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ case dia. & larger.

CAPACITANCE TOLERANCE
K=10% F=1%
J=5%
G=2%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research CRC

J93 POLYSTYRENE CAPACITOR

PRODUCT FEATURES

.056 μF 50VDC ACTUAL SIZE CAPACITOR



5,000,000 MEGOHM MIN. INSULATION RESISTANCE FOR VALUES 0.1uF AND LESS.

0.02% MAXIMUM DIELECTRIC ABSORPTION.

0.1% MAXIMUM SHELF DRIFT FOR 10 YEARS (OR IN NORMAL USE).

UTILIZES CRC UNIQUE PATENTED, RUGGED, LOW LOSS LEAD TERMINATIONS, QUALIFIED FOR ALL HI-REL PROGRAMS.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE PROGRAMS.

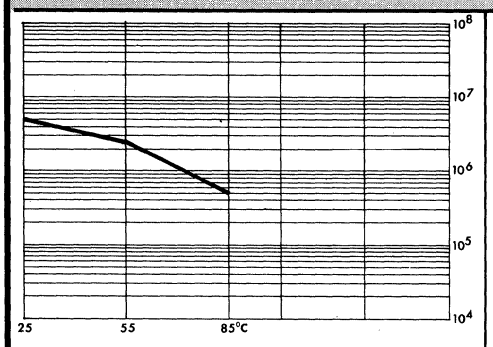
100% RELIABILITY SCREENING, INCLUDES TEMPERATURE CYCLING, FINE LEAK TEST, AC SQUARE WAVE TEST.

SIMILAR GENERIC PARTS HAVE BEEN QUALIFIED FOR TRIDENT PROGRAM.

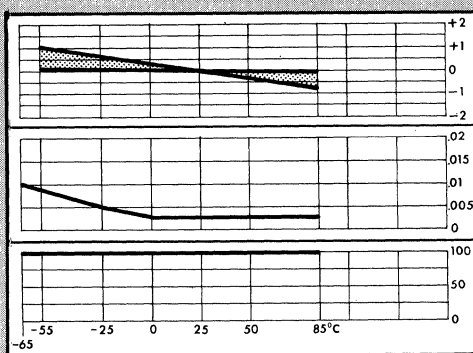
AVAILABLE IN ±0.1% TO ±10% CAPACITANCE TOLERANCE FROM 50VDC TO 400VDC.

AC AND DC RATED.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



% CAPACITANCE CHANGE WITH TEMPERATURE

% DISSIPATION FACTOR WITH TEMPERATURE

% VOLTAGE RATING WITH TEMPERATURE

TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT1304

TEST RESULTS FOR 75 SERIES N53 CAPACITORS LIFE TESTED FOR 2000 HOURS AT +85°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. N53 CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN as J93 SERIES CAPACITORS.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
N53B	.012	20	$5x10^5$	$2x10^7$	$5x10^7$	0.5	0.00	+.26	.05	.01	.01
N53B	.1	20	$5x10^5$	$1x10^7$	$5x10^7$	0.5	−.03	+.29	.05	.01	.01
N53B	.82	15	$5x10^5$	$5x10^6$	$4x10^7$	0.5	−.02	+.18	.05	.01	.01
N53C	.02	5	$5x10^5$	$3.3x10^7$	$5x10^7$	0.5	−.025	+.245	.05	.01	.01
N53C	.039	5	$5x10^5$	$5.5x10^6$	$1x10^8$	0.5	−.01	+.30	.05	.01	.01
N53C	.068	20	$5x10^5$	$1x10^7$	$2x10^7$	0.5	+.06	+.22	.05	.01	.01

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research (CRC)

J93 POLYSTYRENE CAPACITOR

J93 SPECIFICATIONS

OPERATING TEMPERATURE	−65°C to 85°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.02% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.02% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	−80 ±50 PPM/°C −60 ±50 PPM/°C	For values 0.001uF to 0.0082uF For values 0.01uF to 2.7uF Special polystyrene capacitors can be supplied with a temperature coefficient of −20 to −100 PPM/°C that is linear to ±30 PPM/°C and ±10 PPM/°C. A wide selection is available of large uF values in bathtub and custom cases.
CAPACITANCE STABILITY	0.03% maximum Drift	With five cycles from −25°C to +85°C
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 1.0uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 2.0uF CAPACITOR AT 25°C IS 1,000,000 ÷ 2 = 500,000 MEGOHMS.

RANGE	25°C	55°C	85°C
0.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	1,000,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	100,000 Megohms-uF

J93 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. min. @ 85°C, 140% rated DC volts	4.7.2	There shall be no physical damage	100% Test
2	THERMAL AGING	From −65°C to +85°C, 5 cycles min.	4.7.3	There shall be no physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁻⁶atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Place in 85°C hot water for 60 seconds minimum and observe for bubbles	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz square wave at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measured at 0.1KHz	4.7.9	0.02% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship as required.	4.7.1	Per specification	1.0% AQL

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research CRC

J93 POLYSTYRENE CAPACITOR

uF	CASE DIMENSIONS															
	50 VDC				100 VDC				200 VDC				400 VDC			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	93B102	.193	.562	.662	93C102	.193	.687	.787	93D102	.235	.687	.787	93E102	.312	.687	.787
.0012	93B122	.193	.562	.662	93C122	.193	.687	.787	93D122	.235	.687	.787	93E122	.312	.687	.787
.0015	93B152	.193	.562	.662	93C152	.193	.687	.787	93D152	.235	.687	.787	93E152	.312	.687	.787
.0018	93B182	.193	.562	.662	93C182	.193	.687	.787	93D182	.235	.687	.787	93E182	.312	.687	.787
.002	93B202	.193	.562	.662	93C202	.193	.687	.787	93D202	.235	.687	.787	93E202	.312	.687	.787
.0022	93B222	.193	.562	.662	93C222	.193	.687	.787	93D222	.235	.687	.787	93E222	.312	.687	.787
.0027	93B272	.193	.562	.662	93C272	.193	.687	.787	93D272	.235	.687	.787	93E272	.312	.687	.787
.0033	93B332	.193	.562	.662	93C332	.193	.687	.787	93D332	.235	.687	.787	93E332	.312	.687	.787
.0039	93B392	.193	.562	.662	93C392	.193	.687	.787	93D392	.235	.687	.787	93E392	.312	.687	.787
.0047	93B472	.193	.562	.662	93C472	.193	.687	.787	93D472	.235	.687	.787	93E472	.312	.687	.787
.005	93B502	.193	.562	.662	93C502	.193	.687	.787	93D502	.235	.687	.787	93E502	.312	.687	.787
.0056	93B562	.193	.562	.662	93C562	.193	.687	.787	93D562	.235	.687	.787	93E562	.312	.687	.787
.0068	93B682	.193	.562	.662	93C682	.193	.687	.787	93D682	.235	.687	.787	93E682	.312	.687	.787
.0075	93B752	.193	.687	.787	93C752	.193	.813	.913	93D752	.235	.813	.913	93E752	.312	.813	.913
.0082	93B822	.193	.687	.787	93C822	.193	.813	.913	93D822	.235	.813	.913	93E812	.312	.813	.913
.01	93B103	.193	.687	.787	93C103	.193	.813	.913	93D103	.235	.813	.913	93E103	.312	.813	.913
.012	93B123	.193	.687	.787	93C123	.193	.813	.913	93D123	.235	.813	.913	93E123	.312	.813	.913
.015	93B153	.235	.687	.787	93C153	.235	.813	.913	93D153	.312	.813	.913	93E153	.400	.813	.913
.018	93B183	.235	.813	.913	93C183	.312	.813	.913	93D183	.400	.813	.913	93E183	.400	1.063	1.163
.02	93B203	.235	.813	.913	93C203	.312	.813	.913	93D203	.400	.813	.913	93E203	.400	1.063	1.163
.022	93B223	.235	.813	.913	93C223	.312	.813	.913	93D223	.400	.813	.913	93E223	.400	1.063	1.163
.027	93B273	.235	.813	.913	93C273	.312	.813	.913	93D273	.400	.813	.913	93E273	.400	1.063	1.163
.033	93B333	.235	.813	.913	93C333	.312	.813	.913	93D333	.400	.813	.913	93E333	.400	1.063	1.163
.039	93B393	.312	.813	.913	93C393	.400	.813	.913	93D393	.400	1.063	1.163	93E393	.500	1.125	1.225
.047	93B473	.312	.813	.913	93C473	.400	.813	.913	93D473	.400	1.063	1.163	93E473	.500	1.125	1.225
.05	93B503	.312	.813	.913	93C503	.400	.813	.913	93D503	.400	1.063	1.163	93E503	.500	1.125	1.225
.056	93B563	.312	.813	.913	93C563	.400	.813	.913	93D563	.400	1.063	1.163	93E563	.500	1.125	1.225
.068	93B683	.400	.813	.913	93C683	.400	1.063	1.163	93D683	.500	1.125	1.225	93E583	.500	1.375	1.475
.075	93B753	.400	.813	.913	93C753	.400	1.063	1.163	93D753	.500	1.125	1.225	93E753	.500	1.375	1.475
.082	93B823	.400	.813	.913	93C823	.400	1.063	1.163	93D823	.500	1.125	1.225	93E823	.500	1.375	1.475
.1	93B104	.400	.813	.913	93C104	.400	1.063	1.163	93D104	.500	1.125	1.225	93E104	.500	1.375	1.475
.12	93B124	.400	.813	.913	93C124	.400	1.063	1.163	93D124	.500	1.125	1.225	93E124	.500	1.375	1.475
.15	93B154	.400	1.063	1.163	93C154	.500	1.125	1.225	93D154	.500	1.375	1.475	93E154	.562	1.375	1.475
.18	93B184	.400	1.063	1.163	93C184	.500	1.125	1.225	93D184	.500	1.375	1.475	93E184	.562	1.375	1.475
.20	93B204	.400	1.063	1.163	93C204	.500	1.125	1.225	93D204	.500	1.375	1.475	93E204	.562	1.375	1.475
.22	93B224	.400	1.063	1.163	93C224	.500	1.125	1.225	93D224	.500	1.375	1.475	93E224	.562	1.375	1.475
.27	93B274	.500	1.125	1.225	93C274	.500	1.375	1.475	93D274	.562	1.375	1.475	93E274	.670	1.375	1.475
.33	93B334	.500	1.125	1.225	93C334	.500	1.375	1.475	93D334	.562	1.375	1.475	93E334	.670	1.375	1.475
.39	93B394	.500	1.375	1.475	93C394	.562	1.375	1.475	93D394	.670	1.375	1.475	93E394	.670	1.875	1.975
.47	93B474	.562	1.375	1.475	93C474	.670	1.375	1.475	93D474	.670	1.875	1.975	93E474	.750	1.875	1.975
.50	93B504	.562	1.375	1.475	93C504	.670	1.375	1.475	93D504	.670	1.875	1.975	93E504	.750	1.875	1.975
.56	93B564	.562	1.375	1.475	93C564	.670	1.375	1.475	93D564	.670	1.875	1.975	93E564	.750	1.875	1.975
.68	93B684	.670	1.375	1.475	93C684	.670	1.875	1.975	93D684	.750	1.875	1.975	93E684	1.000	1.875	1.975
.75	93B754	.670	1.875	1.975	93C754	.750	1.875	1.975	93D754	1.000	1.875	1.975	93E754	1.000	2.375	2.475
.82	93B824	.670	1.875	1.975	93C824	.750	1.875	1.975	93D824	1.000	1.875	1.975	93E824	1.000	2.375	2.475
1.0	93B105	.670	1.875	1.975	93C105	.750	1.875	1.975	93D105	1.000	1.875	1.975	93E105	1.000	2.375	2.475
1.2	93B125	.750	1.875	1.975	93C125	1.000	1.875	1.975								
1.5	93B155	.750	1.875	1.975	93C155	1.000	1.875	1.975								
1.8	93B185	1.000	1.875	1.975	93C185	1.000	2.375	2.475								
2.0	93B205	1.000	1.875	1.975	93C205	1.000	2.375	2.475								
2.2	93B225	1.000	1.875	1.975												
2.5	93B255	1.000	2.375	2.225												
2.7	93B275	1.000	2.375	2.225												

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

J93 | B | 104 | J | S | W

STYLE

VOLTAGE
B=50VDC
C=100VDC
D=200VDC
E=400VDC

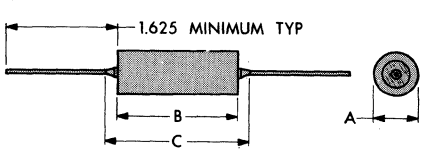
SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20(.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½% A=.1%
G=2%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving +0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research CRC

A52 FOIL POLYCARBONATE CAPACITOR

A52 SPECIFICATIONS

CONSTRUCTION	Polycarbonate dielectric, extended foil electrodes, hermetically sealed, leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421 except vibration and shock. Vibration is at 20g's and shock at 50g's.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% maximum capacitance change	From −55°C to +125°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

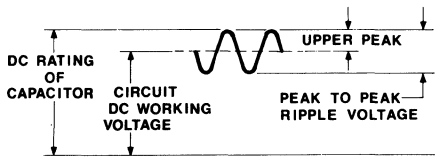
FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C is 100,000 ÷ 0.18 = 555,000 MEGOHMS.

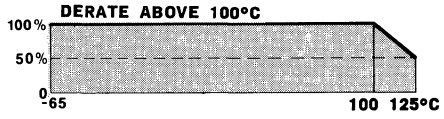
RANGE	25°C	85°C	125°C
.001 TO 0.1uF	1,000,000 Megohms	500,000 Megohms	30,000 Megohms
GREATER THAN 0.1uF	100,000 Megohms-uF	50,000 Megohms-uF	3,000 Megohms-uF

A52 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hours minimum at 100°C. at 120% rated AC voltage at 400Hz not to exceed 240VRMS	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
4	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 sec. min. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL) AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	.25 maximum	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship as required.	4.7.1	Per specification	1.0% AQL

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. TYPE A52 CAPACITORS CAN HANDLE MUCH HIGHER PULSE REPETITION RATES THAN METALLIZED CAPACITORS.





COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research (CRC)

A52 FOIL POLYCARBONATE CAPACITOR

CASE DIMENSIONS • AC RATINGS

	TYPE A52C 100VDC					TYPE A52D 200VDC					TYPE A52V 300VDC					TYPE A52E 400VDC				
			AC RATINGS					AC RATINGS					AC RATINGS					AC RATINGS		
uF	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps
.001	.193	.562	60	60	.038	.193	.562	120	120	.075	.193	.562	180	180	.113	.193	.687	240	240	.15
.0012	.193	.562	60	60	.045	.193	.562	120	120	.090	.193	.562	180	180	.135	.193	.687	240	240	.18
.0015	.193	.562	60	60	.056	.193	.562	120	120	.112	.193	.562	180	180	.169	.193	.687	240	240	.22
.0018	.193	.562	60	60	.067	.193	.562	120	120	.135	.193	.562	180	180	.202	.193	.687	240	240	.27
.002	.193	.562	60	60	.075	.193	.562	120	120	.150	.193	.562	180	180	.225	.193	.687	240	240	.30
.0022	.193	.562	60	60	.083	.193	.562	120	120	.165	.193	.562	180	180	.248	.193	.687	240	240	.33
.0027	.193	.562	60	60	.101	.193	.562	120	120	.202	.193	.687	180	180	.304	.193	.687	240	240	.4
.0033	.193	.562	60	60	.124	.193	.562	120	120	.247	.193	.687	180	180	.371	.193	.687	240	240	.5
.0039	.193	.562	60	60	.146	.193	.562	120	120	.293	.193	.687	180	180	.439	.193	.687	240	240	.6
.0047	.193	.562	60	60	.176	.193	.687	120	120	.353	.193	.687	180	180	.529	.235	.687	240	240	.7
.005	.193	.562	60	60	.188	.193	.687	120	120	.375	.193	.687	180	180	.562	.235	.687	240	240	.75
.0056	.193	.562	60	60	.210	.193	.687	120	120	.420	.193	.687	180	180	.623	.235	.687	240	240	.85
.0068	.193	.687	60	60	.255	.193	.687	120	120	.511	.235	.687	180	180	.766	.312	.687	240	240	1.0
.0075	.193	.687	60	60	.282	.235	.687	120	120	.563	.235	.687	180	180	.845	.312	.687	240	240	1.13
.0082	.193	.687	60	60	.308	.235	.687	120	120	.615	.235	.687	180	180	.923	.312	.687	240	240	1.23
.01	.235	.687	60	60	.375	.235	.687	120	120	.750	.312	.687	180	180	1.13	.312	.687	240	224	1.4
.012	.235	.687	60	60	.451	.235	.687	120	120	.902	.312	.687	180	172	1.3	.312	.687	240	200	1.5
.015	.235	.687	60	60	.561	.312	.687	120	120	1.12	.312	.687	180	150	1.4	.312	.813	240	190	1.8
.018	.312	.687	60	60	.674	.312	.687	120	120	1.35	.312	.687	180	134	1.5	.312	.813	240	178	2.0
.02	.312	.687	60	60	.750	.312	.687	120	112	1.4	.312	.813	180	132	1.65	.400	.813	240	168	2.1
.022	.312	.687	60	60	.822	.312	.687	120	110	1.5	.312	.813	180	130	1.8	.400	.813	240	158	2.2
.027	.312	.687	60	60	1.02	.312	.813	120	106	1.8	.312	.813	180	118	2.0	.400	.813	240	148	2.5
.033	.312	.687	60	60	1.22	.312	.813	120	98	2.0	.400	.813	180	108	2.2	.400	1.063	240	130	2.7
.039	.312	.813	60	60	1.46	.400	.813	120	90	2.2	.400	.813	180	98	2.4	.400	1.063	240	117	2.9
.047	.312	.813	60	60	1.76	.400	.813	120	82	2.4	.400	.813	180	85	2.5	.400	1.063	240	102	3.0
.05	.400	.813	60	60	1.88	.400	.813	120	80	2.5	.400	1.063	180	83.2	2.6	.500	1.125	240	102	3.2
.056	.400	.813	60	60	2.07	.400	.813	120	73	2.5	.400	1.063	180	78	2.7	.500	1.125	240	100	3.5
.068	.400	.813	60	53	2.2	.400	1.063	120	65	2.7	.400	1.063	180	67	2.8	.500	1.125	240	96	4.0
.075	.400	.813	60	50	2.4	.400	1.063	120	61	2.9	.400	1.063	180	63	3.0	.500	1.375	240	97	4.6
.082	.400	.813	60	49	2.5	.400	1.063	120	59	3.0	.500	1.125	180	61	3.15	.500	1.375	240	98	5.0
.1	.400	1.063	60	44	2.7	.500	1.125	120	55	3.4	.500	1.125	180	56	3.50	.562	1.375	240	85	5.3
.12	.400	1.063	60	37	2.8	.500	1.125	120	48	3.6	.500	1.125	180	53	4.00	.562	1.375	240	75	5.6
.15	.400	1.063	60	37	2.9	.500	1.125	120	43	4.00	.500	1.375	180	48	4.50	.562	1.375	240	53	6.0
.18	.400	1.063	60	27	3.0	.500	1.375	120	40	4.50	.500	1.375	180	45	5.00					
.2	.500	1.125	60	26	3.3	.500	1.375	120	38	4.75	.562	1.375	180	45	5.63					
.22	.500	1.125	60	25	3.4	.500	1.375	120	37	5.00	.562	1.375	180	45	6.00					
.27	.500	1.125	60	22	3.8	.562	1.375	120	33	5.50										
.33	.500	1.125	60	20	4.13	.562	1.375	120	29	6.00										
.39	.500	1.375	60	20	5.00															
.47	.562	1.375	60	20	6.00															

A52 C 104 J S W

STYLE

VOLTAGE
C=100VDC
D=200VDC
V=300VDC
E=400VDC

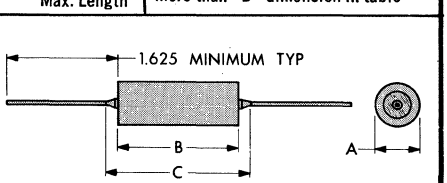
SLEEVING CODE
S=Mylar sleeve
X=No sleeve

CAPACITANCE TOLERANCE K=10% G=2% J=5% F=1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving +0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	"C" Dimension is 0.2″ maximum more than "B" dimension in table



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research CRC

B52 FOIL POLYCARBONATE CAPACITOR

DIMENSIONS & AC RATINGS

	TYPE B52F 400VRMS RATED							TYPE B52P 600VRMS RATED						
	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING −65°C TO 100°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING −65°C TO 100°C			
µF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.033	B52F333KXC	.400	1.063	400	400	360	3.0	B52P333KXC	.500	1.375	600	600	600	5.0
.039	B52F393KXC	.400	1.063	400	400	308	3.0	B52P393KXC	.500	1.375	600	600	513	5.0
.047	B52F473KXC	.500	1.125	400	400	306	3.6	B52P473KXC	.500	1.375	600	600	426	5.0
.056	B52F563KXC	.500	1.125	400	400	255	3.6	B52P563KXC	.500	1.375	600	600	357	5.0
.068	B52F683KXC	.500	1.125	400	400	235	4.0	B52P683KXC	.562	1.375	600	600	353	6.0
.075	B52F753KXC	.500	1.375	400	400	235	4.4	B52P753KXC	.562	1.375	600	600	320	6.0
.082	B52F823KXC	.500	1.375	400	400	235	4.8	B52P823KXC	.562	1.375	600	600	293	6.0
.092	B52F923KXC	.562	1.375	400	400	230	5.3	B52P923KXC	.670	1.375	600	600	305	7.0
.1	B52F104KXC	.562	1.375	400	400	220	5.5	B52P104KXC	.670	1.375	600	600	280	7.0
.12	B52F124KXC	.562	1.375	400	400	200	6.0	B52P124KXC	.670	1.375	600	600	233	7.0
.15	B52F154KXC	.562	1.375	400	400	160	6.0	B52P154KXC	.670	1.875	600	600	214	8.0
.18	B52F184KXC	.670	1.375	400	400	155	7.0	B52P184KXC	.670	1.875	600	600	178	8.0
.22	B52F224KXC	.670	1.375	400	400	127	7.0	B52P224KXC	.670	1.875	600	600	146	8.0
.27	B52F274KXC	.670	1.875	400	400	118	8.0	B52P274KXC	.750	1.875	600	600	133	9.0
.33	B52F334KXC	.670	1.875	400	400	97	8.0	B52P334KXC	.750	1.875	600	600	109	9.0
.39	B52F394KXC	.670	1.875	400	400	82	8.0	B52P394KXC	.750	2.375	600	600	103	10.0
.47	B52F474KXC	.750	1.875	400	400	77	9.0	B52P474KXC	.750	2.375	600	600	85.1	10.0
.56	B52F564KXC	.750	1.875	400	400	64	9.0							
.68	B52F684KXC	.750	2.375	400	400	53	9.0							
.75	B52F754KXC	.750	2.375	400	400	53	10.0							
.82	B52F824KXC	.750	2.375	400	400	49	10.0							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

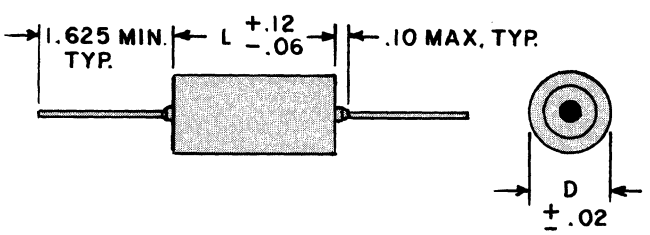
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE
.041 ±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 & LARGER

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research (CRC)

B12 METALLIZED POLYCARBONATE CAPACITOR

DIMENSIONS & AC RATINGS

TYPE B12F 400VRMS RATED

TYPE B12P 600VRMS RATED

uF	600 VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS) Part No.	D	L	MAX. AC RATING −65°C TO 100°C RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS) Part No.	D	L	MAX. AC RATING −65°C TO 100°C RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.01	B12F103KXW	.312	.813	400	400	400	1.0	B12P103KXC	.400	1.063	600	600	600	1.5
.012	B12F123KXW	.312	.813	400	400	400	1.2	B12P123KXC	.400	1.063	600	600	600	1.8
.015	B12F153KXW	.312	.813	400	400	400	1.5	B12P153KXC	.400	1.063	600	600	600	2.3
.018	B12F183KXW	.312	.813	400	400	355	1.6	B12P183KXC	.400	1.063	600	600	600	2.7
.022	B12F223KXC	.400	.813	400	400	309	1.7	B12P223KXC	.400	1.063	600	600	509	2.8
.027	B12F273KXC	.400	.813	400	400	252	1.7	B12P273KXC	.400	1.063	600	600	414	2.8
.033	B12F333KXC	.400	.813	400	400	218	1.8	B12P333KXC	.400	1.063	600	600	339	2.8
.039	B12F393KXC	.400	.813	400	400	205	2.0	B12P393KXC	.400	1.063	600	600	287	2.8
.047	B12F473KXC	.400	1.063	400	400	187	2.2	B12P473KXC	.500	1.125	600	600	272	3.2
.056	B12F563KXC	.400	1.063	400	400	164	2.3	B12P563KXC	.500	1.125	600	600	236	3.3
.068	B12F683KXC	.400	1.063	400	400	159	2.7	B12P683KXC	.500	1.125	600	600	200	3.4
.075	B12F753KXC	.400	1.063	400	400	149	2.8	B12P753KXC	.500	1.375	600	600	200	3.75
.082	B12F823KXC	.500	1.125	400	400	146	3.0	B12P823KXC	.500	1.375	600	600	195	4.0
.092	B12F923KXC	.500	1.125	400	400	140	3.2	B12P923KXC	.562	1.375	600	600	191	4.4
.1	B12F104KXC	.500	1.125	400	400	128	3.2	B12P104KXC	.562	1.375	600	600	180	4.5
.12	B12F124KXC	.500	1.375	400	400	110	3.3	B12P124KXC	.562	1.375	600	600	160	4.8
.15	B12F154KXC	.500	1.375	400	400	110	4.1	B12P154KXC	.562	1.375	600	600	134	5.0
.18	B12F184KXC	.562	1.375	400	400	95	4.3	B12P184KXC	.670	1.375	600	600	120	5.4
.22	B12F224KXC	.562	1.375	400	400	91	5.0	B12P224KXC	.670	1.375	600	600	102	5.6
.27	B12F274KXC	.562	1.375	400	400	74	5.0	B12P274KXC	.670	1.875	600	600	101	6.8
.33	B12F334KXC	.670	1.375	400	400	67	5.5	B12P334KXC	.670	1.875	600	600	82	6.8
.39	B12F394KXC	.670	1.375	400	400	57	5.5	B12P394KXC	.670	1.875	600	600	70	6.8
.47	B12F474KXC	.670	1.875	400	400	47	5.5	B12P474KXC	.750	1.875	600	600	61	7.2
.56	B12F564KXC	.670	1.875	400	400	42	5.9	B12P564KXC	.750	1.875	600	535	53.5	7.5
.68	B12F684KXC	.670	1.875	400	400	40	6.8	B12P684KXC	.750	1.875	600	470	47	8.0
.75	B12F754KXC	.750	1.875	400	400	40	7.5	B12P754KXC	.750	2.375	600	533	53.3	10.0
.82	B12F824KXC	.750	1.875	400	366	36	7.5	B12P824KXC	1.0	2.375	600	488	48.8	11.0
.92	B12F924KXC	.750	2.375	400	370	37	8.5							
1.0	B12F105KXC	.750	2.375	400	340	34	8.5							
1.2	B12F125KXC	.750	2.375	400	333	33.3	10.0							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

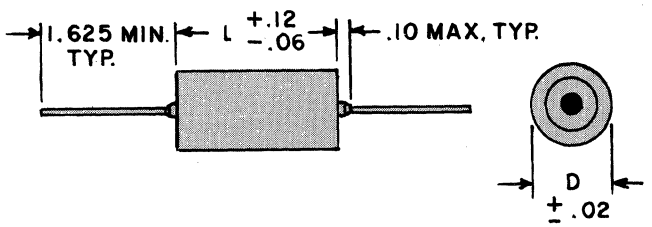
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE

.032 ±.003 (#20AWG) TINNED COPPER-CLAD STEEL FOR CASE DIAMETER .312

.041 ±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 & LARGER

Component Research CRC

B55 FOIL POLYPROPYLENE CAPACITOR

DIMENSIONS & AC RATINGS

	TYPE B55F 400VRMS RATED							TYPE B55P 600VRMS RATED						
	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —55°C TO 85°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —55°C TO 85°C			
uF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.033	B55F333KXC	.400	1.063	400	400	400	4	B55P333KXC	.500	1.375	600	600	600	6
.039	B55F393KXC	.400	1.063	400	400	400	4	B55P393KXC	.500	1.375	600	600	600	6
.047	B55F473KXC	.500	1.125	400	400	400	5	B55P473KXC	.500	1.375	600	600	511	6
.056	B55F563KXC	.500	1.125	400	400	357	5	B55P563KXC	.500	1.375	600	600	428	6
.068	B55F683KXC	.500	1.125	400	400	294	5	B55P683KXC	.562	1.375	600	600	412	7
.075	B55F753KXC	.500	1.375	400	400	320	6	B55P753KXC	.562	1.375	600	600	373	7
.082	B55F823KXC	.500	1.375	400	400	293	6	B55P823KXC	.562	1.375	600	600	342	7
.092	B55F923KXC	.562	1.375	400	400	305	7	B55P923KXC	.670	1.375	600	600	348	8
.1	B55F104KXC	.562	1.375	400	400	280	7	B55P104KXC	.670	1.375	600	600	360	8
.12	B55F124KXC	.562	1.375	400	400	233	7	B55P124KXX	.670	1.375	600	600	266	8
.15	B55F154KXC	.562	1.375	400	400	187	7	B55P154KXC	.670	1.875	600	600	214	8
.18	B55F184KXC	.670	1.375	400	400	178	8	B55P184KXC	.670	1.875	600	600	200	9
.22	B55F224KXC	.670	1.375	400	400	146	8	B55P224KXC	.670	1.875	600	600	164	9
.27	B55F274KXC	.670	1.875	400	400	133	9	B55P274KXC	.750	1.875	600	600	178	12
.33	B55F334KXC	.670	1.875	400	400	109	9	B55P334KXC	.750	1.875	600	600	145	12
.39	B55F394KXC	.670	1.875	400	400	92.7	9	B55P394KXC	.750	2.375	600	600	144	14
.47	B55F474KXC	.750	1.875	400	400	102.0	12	B55P474KXC	.750	2.375	600	600	119	14
.56	B55F564KXC	.750	1.875	400	400	85.7	12							
.68	B55F684KXC	.750	2.375	400	400	70.6	12							
.75	B55F754KXC	.750	2.375	400	400	74.6	14							
.82	B55F824KXC	.750	2.375	400	400	68.3	14							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

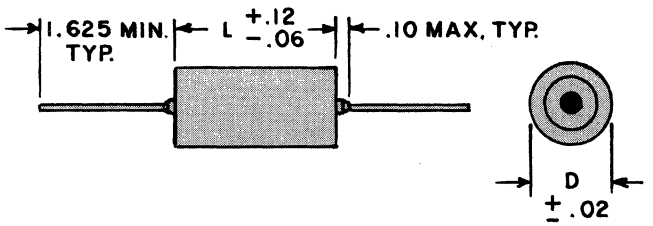
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE
.041 ±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 & LARGER

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, FAX: (213) 829-9584

Component Research (CRC)

B15 METALLIZED POLYPROPYLENE CAPACITOR

DIMENSIONS & AC RATINGS

	TYPE B15F 400VRMS RATED							TYPE B15P 600VRMS RATED						
	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —55°C TO 85°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —55°C TO 85°C			
uF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.01	B15F103KXW	.312	.813	400	400	400	2.5	B15P103KXC	.400	1.063	600	600	600	3.5
.012	B15F123KXW	.312	.813	400	400	400	2.5	B15P123KXC	.400	1.063	600	600	600	3.5
.015	B15F153KXW	.312	.813	400	400	400	2.5	B15P153KXC	.400	1.063	600	600	600	3.5
.018	B15F183KXW	.312	.813	400	400	400	2.5	B15P183KXC	.400	1.063	600	600	600	3.5
.022	B15F223KXC	.400	.813	400	400	400	3.0	B15P223KXC	.400	1.063	600	600	600	3.5
.027	B15F273KXC	.400	.813	400	400	400	3.0	B15P273KXC	.400	1.063	600	600	518	3.5
.033	B15F333KXC	.400	.813	400	400	364	3.0	B15P333KXC	.400	1.063	600	600	424	3.5
.039	B15F393KXC	.400	.813	400	400	308	3.0	B15P393KXC	.400	1.063	600	600	369	3.5
.047	B15F473KXC	.400	1.063	400	400	298	3.5	B15P473KXC	.500	1.125	600	600	340	4
.056	B15F563KXC	.400	1.063	400	400	250	3.5	B15P563KXC	.500	1.125	600	600	286	4
.068	B15F683KXC	.400	1.063	400	400	206	3.5	B15P683KXC	.500	1.125	600	600	235	4
.075	B15F753KXC	.400	1.063	400	400	187	3.5	B15P753KXC	.500	1.375	600	600	267	5
.082	B15F823KXC	.500	1.125	400	400	195	4	B15P823KXC	.500	1.375	600	600	244	5
.092	B15F923KXC	.500	1.125	400	400	174	4	B15P923KXC	.562	1.375	600	600	261	6
.1	B15F104KXC	.500	1.125	400	400	160	4	B15P104KXC	.562	1.375	600	600	240	6
.12	B15F124KXC	.500	1.375	400	400	167	5	B15P124KXC	.562	1.375	600	600	200	6
.15	B15F154KXC	.500	1.375	400	400	134	5	B15P154KXC	.562	1.375	600	600	160	6
.18	B15F184KXC	.562	1.375	400	400	133	6	B15P184KXC	.670	1.375	600	600	155	7
.22	B15F224KXC	.562	1.375	400	400	109	6	B15P224KXC	.670	1.375	600	600	127	7
.27	B15F274KXC	.562	1.375	400	400	88.8	6	B15P274KXC	.670	1.875	600	600	118	8
.33	B15F334KXC	.670	1.375	400	400	84.7	7	B15P334KXC	.670	1.875	600	600	96.8	8
.39	B15F394KXC	.670	1.375	400	400	72.1	7	B15P394KXC	.670	1.875	600	600	82.4	8
.47	B15F474KXC	.670	1.875	400	400	68.1	8	B15P474KXC	.750	1.875	600	600	93.6	11
.56	B15F564KXC	.670	1.875	400	400	57	8	B15P564KXC	.750	1.875	600	600	78.5	11
.68	B15F684KXC	.670	1.875	400	400	47	8	B15P684KXC	.750	1.875	600	600	64.7	11
.75	B15F754KXC	.750	1.875	400	400	58.6	11	B15P754KXC	.750	2.375	600	600	69.3	13
.82	B15P824KXC	.750	1.875	400	400	53.7	11	B15P824KXC	1.0	2.375	600	600	63.4	15
.92	B15F924KXC	.750	2.375	400	400	56.6	13							
1.0	B15F105KXC	.750	2.375	400	400	52	13							
1.2	B15F125KXC	.750	2.375	400	400	43.3	13							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

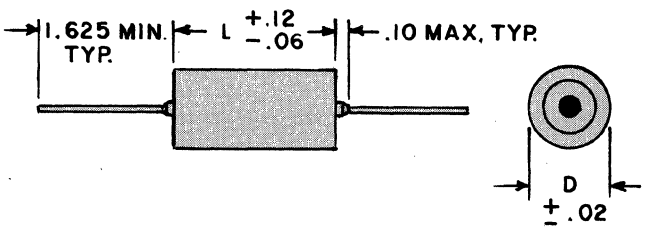
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



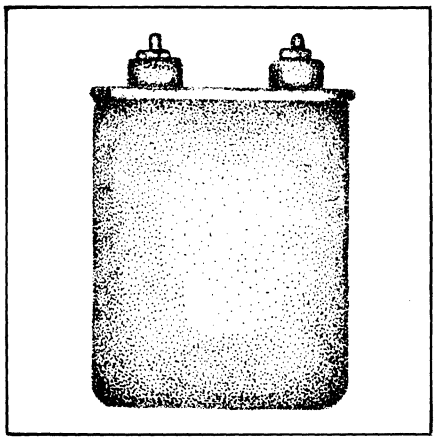
LEAD SIZE

.032 ±.003 (#20AWG) TINNED COPPER-CLAD STEEL FOR CASE DIAMETER .312

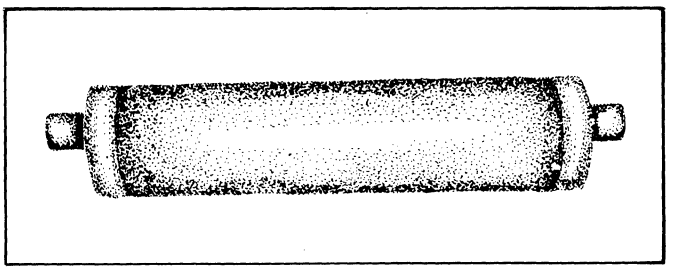
.041 ±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 & LARGER

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Composite dielectric of kraft tissue & polyester film with mineral oil impregnant. DC Filter, limited AC, and pulse discharge applications.

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Composite dielectric of kraft tissue & polypropylene film. Economical unit for DC filter, limited AC, & pulse applications.

NS & TS Series

Polypropylene film & teflon film with silicone fluid impregnant. Very high rep. rate discharge service & high frequency operation into megahertz band.

NX Series

Ideally suited for pulse & AC applications. Low loss characteristics allow operation in both pulse discharge & AC applications up to 10 kilohertz.

MO Series

Low voltage & high capacitance applications -- pulse discharge, induction heating, DC filter & flash photolysis. More compact for low voltage applications compared to other standard rated capacitors.

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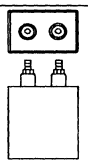
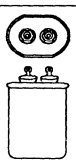
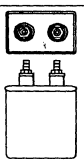
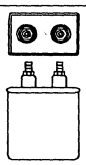
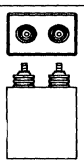
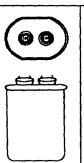
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FILM CAPACITORS

Dielectric	Style	CDE Type	Capacitance (µF)	Voltage Range	Temperature Range	Dissipation Factor	Insulation Resistance	Withstanding Voltage	Product Strengths	Applications
Polyester Film-Foil	Radial Epoxy Dipped	DLM	.001-.47	100 WVdc (63 Vac)	−55°C-+125°C*	1% Max.	30,000 MΩ Min.	250%	Small Footprint Miniature Size	General Purpose Inductive Style
	Radial Epoxy Dipped	DLR	.001-.68	100 WVdc (63 Vac)	−55°C-+125°C*	1% Max.	30,000 MΩ Min.	250%	Compact Size Auto Insertable	General Purpose Inductive Style
	Radial Epoxy Dipped	DMT	.001-1.0	100-600 WVdc (63-220 Vac)	−55°C-+125°C*	1% Max.	30,000 MΩ×µF 100,000 MΩ Min.	250%	Wide Range of Cap. and Voltage	General Purpose
	Axial - Oval Wrap & Filled	MFP	.01-5	50-600 WVdc (35-220 Vac)	−55°C-+125°C*	.75% Max.	30,000 MΩ×µF 100,000 MΩ Min.	250%	Low Profile	Circuit Cards General Purpose
	Axial - Round Wrap & Filled	WMC	.00047-.47	80-400 WVdc (50-200 Vac)	−55°C-+125°C*	.75% Max.	30,000 MΩ×µF 100,000 MΩ Min.	250%	Miniature Size	Modules General Purpose
	Axial - Round Wrap & Filled	WMF	.001-5	50-600 WVdc (35-220 Vac)	−55°C-+125°C*	.75% Max.	30,000 MΩ×µF 100,000 MΩ Min.	250%	Wide Range of Cap. and Voltage	Commercial Industrial
Polyester Metallized	Radial Epoxy Dipped	DMM	.01-10	100-630 WVdc (63-220 Vac)	−55°C-+125°C*	1% Max.	5,000 MΩ×µF 10,000 MΩ Min.	175%	Optional Lead Spacing Self Healing	CD Applications General Purpose
	Radial Epoxy Dipped	DMMA	.01-5	125-480 WVdc (250-1000 Vdc)	−55°C-+105°C*	.60% Max.	10,000 MΩ×µF 30,000 MΩ Min.	200%	High Vac Capability Self Healing	AC Applications
	Axial - Oval Wrap & Filled	MMA	.01-5	125-480 WVdc (250-1000 Vdc)	−55°C-+105°C*	.60% Max.	10,000 MΩ×µF 30,000 MΩ Min.	200%	High Vac Capability Self Healing	AC Applications
	Axial - Oval Wrap & Filled	MMP	.01-10	100-630 WVdc (63-220 Vac)	−55°C-+125°C*	1% Max.	5,000 MΩ×µF 10,000 MΩ Min.	175%	Low Profile Self Healing	Circuit Cards General Purpose
	Axial - Round Wrap & Filled	MTE	.047-50	60-150 WVdc (38-95 Vac)	−55°C-+125°C*	.75% Max.	10,000 MΩ×µF 30,000 MΩ Min.	160%	Sub-Miniature Self Healing	Modules General Purpose
	Axial - Round Wrap & Filled	MMWA	.01-10	50-1000 WVdc (35-300 Vac)	−55°C-+125°C*	.75% Max.	10,000 MΩ×µF 30,000 MΩ Min.	200%	Wide Range of C and V Self Healing	General Purpose
Poly-propylene Film-Foil	Radial Epoxy Dipped	DPP	.001-.47	100-630 WVdc (63-220 Vac)	-40°C-+85°C	.10% Max.	50,000 MΩ×µF 100,000MΩ Min.	200%	Withstands Soldering	High Frequency Precise Values
	Axial - Round Wrap & Filled	WPP	.001-3	100-1000 WVdc (63-220 Vac)	−55°C-+105°C	.10% Max.	100,000 MΩ×µF 200,000 MΩ Min.	250%	Close Tolerances High Stability	High Frequency Precise Values
Poly-propylene Metallized	Radial Epoxy Dipped	DPM	.01-6.8	250-630 WVdc (150-220 Vac)	-40°C-+85°C	.10% Max.	10,000 MΩ×µF 30,000 MΩ Min.	250%	Low ESR Optional Lead Spacing	High Current General Purpose
	Axial - Round Wrap & Filled	935	1-30	100-400 WVdc (63-250 Vac)	−55°C-+105°C	.10% Max.	200,000 MΩ×µF	200%	Low ESR U.L. Approved	Power Supplies High Current Circuits
	Axial - Round Wrap & Filled	950	5-80	250 WVac	-40°C-+100°C**	.15% Max.	100,000 MΩ×µF	175%	High Cap. Values U.L. Approved	Motor Run Lighting
	Round Plastic Case	955	5-70	240-370 WVac	-40°C-+100°C**	.10% Max.	100,000 MΩ×µF	175%	Easy Mounting U.L. Approved	Motor Run Lighting
Polycarbon-ate Film-Foil	Axial - Round Wrap & Filled	WCR	.001-2	50-200 WVdc (35-125 Vac)	−55°C-+125°C	.30% Max.	50,000 MΩ×µF 500,000 MΩ Min.	200%	High Temp. High Stability	Military Precise Values
Poly-carbonate Metallized	Axial - Round Wrap & Filled	MCR	.01-5	100-600 WVdc (63-220 Vac)	−55°C-+125°C	.30% Max.	50,000 MΩ×µF 200,000 MΩ Min.	200%	Compact Size High Temp.	Military Precise Values
	Axial - Round Wrap & Filled	MTC	.047-30	50-150 WVdc (35-95 Vac)	−55°C-+125°C	.30% Max.	50,000 MΩ×µF 200,000 MΩ Min.	160%	Sub-Miniature High Temp.	Modules Precise Values

* Full rated voltage at 85°C - Derate 50% at 125°C ** Full rated voltage at 90°C - Derate 15% at 100°C

AC/DC OIL-FILLED CAPACITORS

Case Style										
Catalog Type	SCRN	LPC	OT	T-N	TMK	TKM	KKSF, KASF KTSF, KBSF	CRP, CRS, CRT	KKN, KAN, KTN, KBN, KNN	KKXZ
Main Applications	Commutating Snubbers	Laser, Photocopiers, Defibrulators	Filters, Power-Supplies		Filters, Blocking, Power-Supplies		Motor-run, Lighting Power-Supplies			Microwave Ovens, Voltage-Doublers
Capacitance Ratings	0.25 to 50µF	22 to 240µF	0.1 to 35µF	0.5 to 15µF	0.1 to 15µF	1.0 to 75µF	1.0 to 70µF	1.0 to 80µF	1.0 to 50µF	0 7 to 1.05µF
Capacitance Change Due to Temperature	±5%	−10% to +5%	±5%				+5% to −7%		±5%	
Capacitance Tolerance	±10%						Std. ±10% 660 VAC ±6% Min. ±3%		Std. ±10% Min. ±6%	±5%
AC Voltage Ratings 60Hz	N/A	N/A	236 to 950 VAC	N/A	N/A	N/A	240 VAC to 660 VAC		330 VAC to 660 VAC	2,000 VAC to 2,500 VAC
DC Voltage Ratings	200 to 2,000 Peak Volts	3 to 10,000	400 to 3,000	600 to 5,000	6,000 to 10,000	5 to 50,000	N/A	N/A	N/A	N/A
Rated Temperature	−40°C to 65°C Ambient	−10°C to 45°C Ambient	−55°C to 85°C Ambient				−55°C to 90°C Case Temp.		−55°C to 70°C Case Temp.	−40°C to 60°C Case Temp.
Dissipation Factor	0.2% to 0.3%	<1%		≤1%	0.5%		0.2%		0.5%	0.3%
Service Life Objective Max. Rating	40,000 Hours to 95% Survival	>2,000,000 Discharges	40,000 Hours				150,00 Hours* 94% Survival			2,000 Hours
Dielectric	Kraft/Polypropylene Kraft Polypropylene	Kraft	Kraft Kraft/Polypropylene				Soggy Foil™		Kraft/Polypropylene	
Case Finish	Painted Terneplate	Painted Steel	Terneplate	Painted Terneplate	Painted Steel		Terneplate	Aluminum or Terneplate	Terneplate	
ANSI/EIA Standard	RS401	N/A	N/A	N/A	N/A	N/A	RS495		RS454	RS479

*EIA Standard is 60,000 hours.

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ALUMINUM CAPACITORS

Axial Leaded Capacitors

Type	Applications	Product Strengths	Life Test	Temp. Range C	Max CV Range	Nominal Size DXL Inches
201	Automotive, Commercial & Industrial Electronics	Subminiature +105 C	1000 hrs +105 C	−40 +105	10,000µF - 100µF 6.3V 250V	0.197 × 0.492 to 0.703 × 1.575
202 203	Office & Consumer Electronics	High Cap Subminiature +85 C Subminiature Long Life, Low Leakage	1000 hrs +85 C 2000 hrs +85 C	−40 +85	10,000µF - 2.2µF 6.3V - 450V 2200µF - 100µF 6.3V - 100V	0.197 × 0.492 to 0.709 × 1.575
557/ UHL	Data & Mobile Communications and Military	Commercial Equivalent to 39018/01 Extra High Temperature	2000 hrs +125 C	−55 +125	1000µF - 27µF 5V - 200V	0.380 × 1.062 to 0.380 × 2.812
UHA UHB	Rugged Military and Transportation	Max. Vibration to 30g Max. Vibration to 50g	10,000 hrs +85 C	−55 +105	15,000 - 320 µF 7V - 200 V	3/4 × 15/8 to 1 × 35/8

Radial Leaded Capacitors

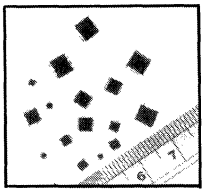
Type	Applications	Product Strengths	Life Test	Temp. Range C	Max CV Range	Nominal Size DXL Inches
226 227	Automotive, Commercial & Industrial Electronics	Subminiature +105C Subminiature +85C	1000 hrs +100C 1000 hrs + 85C	−40 +105 −40 +85	10,000-100µF 6.3V - 250V 10,000 - 22µF 6.3V - 450V	0.197 × 0.433 to 0.709 × 1.575
228 229	Compact Office and Consumer Electronics	Ultra Subminiature all 7mm lengths Ultra Subminiature - Low Leakage, All 7mm lengths	1000 hrs +85C	−40 +85	100µF - 10µF 6.3V - 50V 100µF - 10µF 6.3V - 50V	0.157 × 0.276 to 0.250 × 0.276
230 241	Instrumentation & Telecom	Subminiature-Long Life, Low Leakage Subminiature-Long Life, High Capacitance	2000 hrs +85C	−40 +85	2200µF - 100µF 6.3V - 100V 10,000µF - 100µF 6.3V -250V	0.197 × 0.433 to 0.709 × 1.398
232 239	Switching Power Supply Output Filters	Low ESR - Low 100kHz Impedance Higher Capacitance	2000 hrs +105C 2000 hrs +105C	−55 +105 −55 +105	470 nuF - 220µF 6.3V - 50V 2200µF - 330µF 6.3V - 63V	0.315 × 0.453 to 0.630 × 1.398
300/301 300R/301R	Switching Power Supply Input and Output Filters	Low ESR, Low 100 kHz Z, Strong Welded Leads Lower ESR-Higher Ripple	2000 hrs with ripple +105C	−55 +105	18,000 - 330µF 6.3V - 250V 18,000 - 2200µF 6.3V - 63V	1/2 × 1 to 1 × 35/8
350	Very High Frequency Switching Power	Very Low Z beyond 100 kHz Welded Lead,Low ESL	2000 hrs with ripple +105C	−55 +105	15,500 - 620µF 3V - 100V	3/4 × 1 1/2 to 1 × 2 5/8
380, (480) 380X 380R	Snap-in for Switching Power Supply Input and Output Filters	Snap-in Press-Lok, Strong Welded Leads Higher Capacitance Lower ESR, Higher Ripple	1000 hrs with ripple +85C 2000 hrs at +85C	−40 +85	82,000 - 680µF 6.3V - 450V 150,000 - 3300µF 6.3V - 150V 2200 - 360µF 200V - 450V	0.87 × 0.98 to 1.38 × 3.15
381, (481)	Snap-in for Switching Power Supply Input and Output Filter	Snap-in, Press-Lok, High Ripple, Long Life	2000 hrs at +105C	−40 +105	120,000 - 560µF 6.3V - 400V	0.87 × 0.98 to 1.38 × 3.15
4CM 4CMX	Power Supply Filters, Welders, Power Hold up, Industrial Applications	Lowest Cost, High Capacitance Values Highest Capacitance Type	1000 hrs +85C or 500 hrs +85C with ripple	−40 +85	0.33F - 1000µF 6.3V - 450V 0.91F - 2200µF 6.3V - 450V	13/8 × 15/8 to 2 × 5 5/8
400 400X 400R	High-Ripple Power Supply Filters, Long Life Industrial Applications	Increased Reliability with Increased Temp. Higher Capacitance Lower ESR and Higher Ripple	2000 hrs + 85C or 1500 hrs +5C with ripple	−40 +95	0.33F - 1000µF 6.3V - 450V 0.33F-2100µF 6.3V - 450V 0.33F - 820µF 6.3V - 450V	13/8 × 15/8 to 2 × 5 5/8
401 401X 401R	Wide Temperature Applications, Military Power Supply Filters	Longer Life, Wide Temperature Range Higher Capacitance Lowest ESR and Higher Ripple	2000 hrs +105C or 2000 hrs +85C with ripple	−55 +105	0.33F - 2200µF 6.3V - 250V 0.47F-3900µF 6.3V - 250V 0.33F - 33000µF 6.3V - 63V	13/8 × 15/8 to 2 × 5 5/8

Computer Grade, Screw Terminal Capacitors

Type	Applications	Product Strengths	Life Test	Temp. Range C	Max CV Range	Nominal Size DXL Inches
DCM DCMX	Power Supply Filters, Welders, Power Hold Up, Industrial Applications	Lowest Cost, High Cap. Values Wide Voltage Range Highest Capacitance Type	1000 hrs. at +85°C or 100 hrs +85°C with Ripple	−40 +85	0.74F - 440µF 6.3V - 450V 1.1F - 5000µF 6.3V - 450V	13/8 × 15/8 to 3 × 8 5/8
500 500X 500R	High-Ripple Power Supply Filters, Main Frame Computers, Long Life, Industrial Applications	Increased Reliability with Increased Temp., Wide Voltage Range Higher Capacitance Lower ESR and Higher Ripple	2000 hrs. +95°C or 1500 hrs. + 85°C with Ripple	−40 +95	0.78F -4400µF 6.3V - 450V 1.0F - 7400µF 6.3V - 450V 1.0F - 6100µF 6.3V - 450V	13/8 × 15/8 to 3 × 8 5/8
550	Motor Control and High Ripple/High Voltage	Ultra-high ripple capability	1000 hrs. +105C	−40 +105	19,000 - 7600µF 200V - 450V	13/8 × 15/8 to 3 × 8 5/8
101 101X	Wide Temperature Applications, Military Power Supply Filters	Commercial Version of MIL-C-39018/04, 06, 10 Higher Capacitance	2000 hrs. +105°C 2000 hrs. +85°C with Ripple	−55 +105	0.63F - 6200µF 6.3V - 250V 1.0F - 8900µF 6.3V - 250V	13/8 × 15/8 to 3 × 5 7/8

NEW! TYPE MC MICA CAPACITOR CHIP

High Frequency, high stability CHIP Mica Capacitors for Instruments and RF.



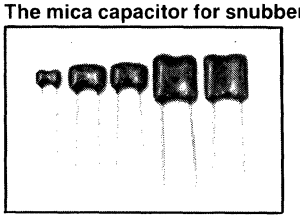
- Temperature range −55° to 125°C
- Low impedance to beyond 1 GHz
- Near zero capacitance change, all environments
- Handles pulses with dV/dt >20,000
- Rock Stable Through Severe Environments
- Easy to Attach to Printed Circuit Boards
- Capacitance values 1 to 2000 pF ±0.25% to ±5%
- Voltages 100 and 500 WVdc
- Case Sizes 0805, 1210, 1812 and 2220

Performance Highlights

- Great for High Frequency Applications Like CATV and Flight Radio
- Available in Tight Tolerance Exact Values

NEW! SNUBBER MIKES

The mica capacitor for snubbers and resonant Power Supplies



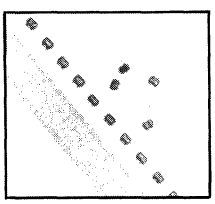
- Up to 1500 Vdc voltage ratings
- 20,000 V/µs dV/dt capability minimum
- Quiet - No piezoelectric-effect buzzing
- Zero Capacitance change with voltage
- Near zero capacitance change with frequency and temperature
- 0.0005 typical dissipation factor
- −55°C to +125°C at rated voltage

Performance Highlights

- Capacitance values from 100pF to 0.01µF
- Up to 8.7 amperes continuous current ratings

NEW! CD4 RF CAPACITOR

The mica capacitor for high frequency and instrumentation



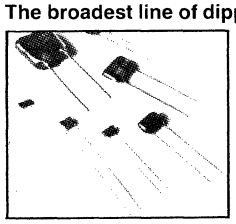
- Replaces other 0.1" lead-spacing capacitors
- Cool operation - Typical Qs > 3000
- Shockproof and delamination free
- Near zero capacitance change with frequency
- Near zero capacitance change with temperature
- Zero capacitance change with voltage
- 0.0005 typical dissipation factor
- 20,000 V/µs dV/dt capability minimum
- −55°C to +125°C at rated voltage

Performance Highlights

- Low impedance to beyond 1 GHz
- The value you need - Up to 1500 pF in 5% steps

FULL-LINE MICA CAPACITORS

The broadest line of dipped mica capacitors



Performance Highlights

- More stable than other types
- Capacitance values 1 pF to 0.082 µF
- Rated voltage 50 to 2500 Vdc
- Choice of MIL-C-5 or hi rel MIL-C-39001
- Tight tolerance ±1/2 pF and ±1/2% available
- Standard tolerance ±5%

CDE Catalog Designation		CD 6	CD 7	CD 5	CD 10	CD 15	CDA 15	CD 19	CD 30	CD 42
MIL-C-5 Style		—	—	—	CM 04	CM 05	—	CM 06	CM 07	CM 08
Max., Capacitance pF @ indicated VDCW	100VDCW	120	1500	200	400	1500	1500	8200	40,000	82,000
	300VDCW	120	300	120	300	820	820	6800	30,000	68,000
	500VDCW	75	180		250	510	510	5100	20,000	51,000
	1000VDCW							4700	13,000	
	1500VDCW								8,200	
	2000VDCW								4,300	
	2500VDCW								3,000	

MIL-C-39001		CMR 03	CMR 04	CMR 05	CMR 06	CMR 07	CMR 08
	50VDCW	400					
	100VDCW	200	390				82,000
	300VDCW	120	300				68,000
	500VDCW		240	390	4700	20,000	51,000

CDM MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

Capacitors

a division of
CSI Technologies, Inc.

SUMMARY — CAPACITANCE/ VOLTAGE RATINGS

SERIES	TYPE	FEATURE	1nF 10nF 100nF 1uF 10uF 100uF
FT	FILTER	TUBULAR XHV	50 - 250 kV
M	FILTER	XMITTER	0.6-40 kV
CP	FILTER	MIL SPEC	0.6 - 2.5 kV 3.0 - 5.0 kV 6.0 - 12.5 kV
AE	PULSE	RAILS X LOW L	5 - 40 kV
MED	DEFIB	SMALLEST	2.8 - 8 kV
FC	INDUCTOR	LIGHT WEIGHT	.3 mH - 200 mH
WPC	PULSE	RAILS LOW L HIGH E	35 - 100 kV
WM	PULSE	GENERAL PURPOSE FLASHLAMP	2 - 5 kV 7.5 kV 15 kV 25 kV
ES	ENERGY STORAGE	HIGH R.R. WIDE ΔT LOW ESR NON-FLAM.	3300 JOULES 3 - 50 kV 5500 JOULES 4 - 125 kV 8800 JOULES 4 - 125 kV
NB	AC	LOW D.F. BALLAST	1.3 - 4.0 kVAC
CUSTOM	ANY WOUND DIELECTRIC	125° C 5 n H 10 KJ TO 250 kVDC	

Capacitors
a division of
CSI Technologies, Inc.

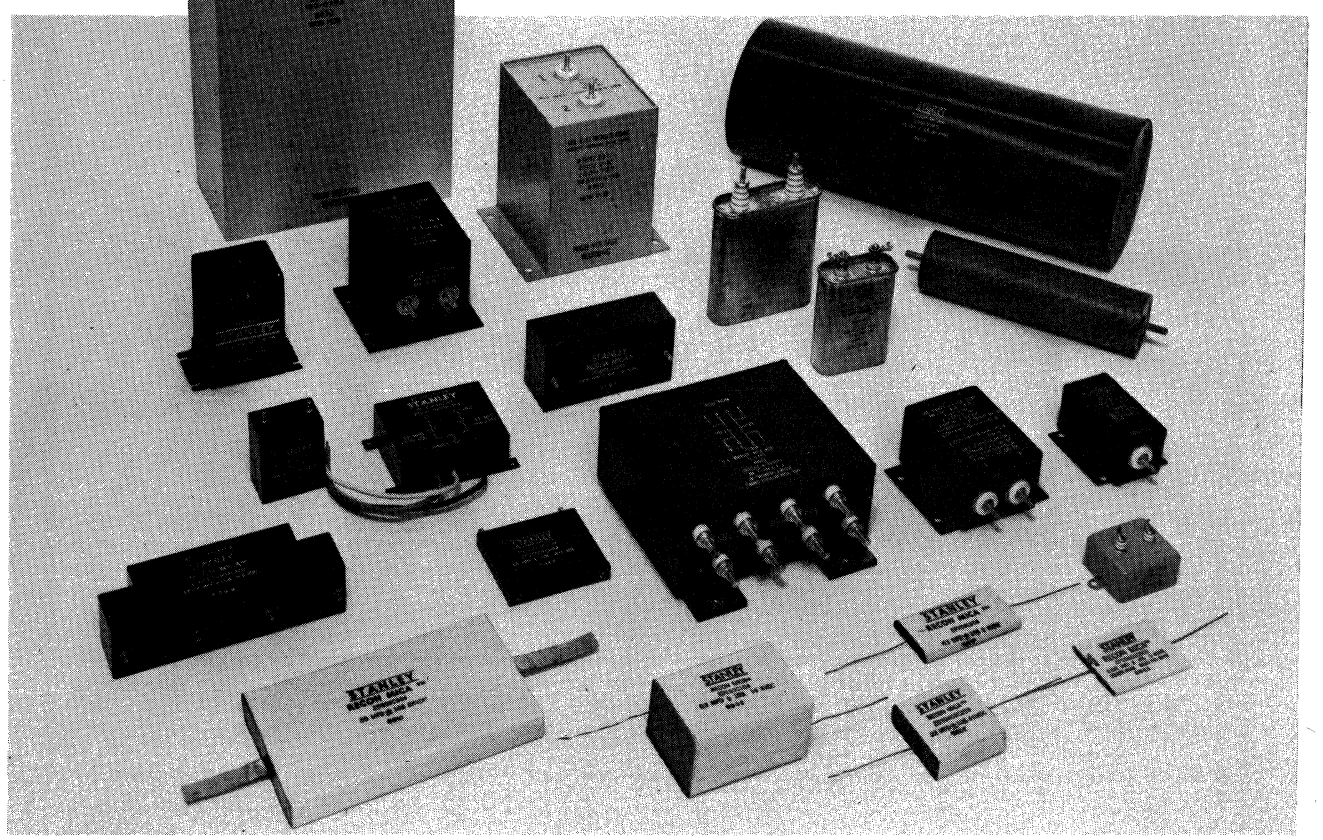
810 Rancheros Drive, San Marcos, CA 92069-3009, (619) 747-4000, TLX WUI 697832 or RCA 295433

- **Reconstituted Mica Capacitors**
- **Pulse Forming Networks**
- **Phenolic Round Tube Capacitors**
- **Phenolic Rectangular Tube Capacitors**
- **Rectangular Steel Can Capacitors**
- **Wrap and Fill Capacitors**
- **Custom Designed Capacitors**

DEL HIGH VOLTAGE CAPACITORS

- ☐ HIGH RELIABILITY
- ☐ HIGH ENERGY DENSITY
- ☐ HIGH VERSATILITY
- ☐ HIGH TEMPERATURE

Custom Design — Mil Specifications
DEL ELECTRONICS will develop custom capacitors for critical applications where size, shape and electrical properties are critical. Polypropylene, Mylar, or Paper dielectrics in combination with mineral or silicone oil are utilized in a wide range of AC, pulse and DC applications. Reconstituted mica capacitors are available for high temperature, small size and low weight requirements.



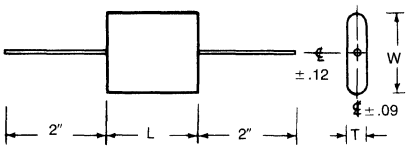
DEL

STANLEY ELECTRONICS
DIVISION OF DEL ELECTRONICS CORP.
250 East Sandford Boulevard, Mount Vernon, NY 10550, Tel: (914) 699-2000, FAX: (914) 699-4005, TWX: (710) 562-0130

RECON MICA™

DC CAPACITORS

WRAP AND FILL



Stanley RECON MICA™ wrap and fill high voltage D-C capacitors are manufactured under controlled environmental conditions and utilize the very finest of materials. The reconstituted mica paper, aluminum foil, thermosetting resin, polyester thermosetting tape and two-part epoxy end fill are all of the highest quality available providing the user with the reliability he seeks for his equipment. All manufacturing processes are quality controlled by specification, thereby assuring consistency in the end product. These capacitors are ideally suited for power supply filtering, energy storage, voltage doubling, and D-C blocking.

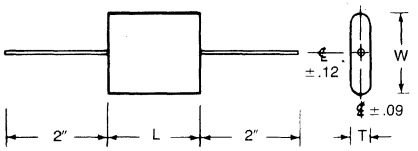
PART NO.	MFD	L	W	T
1000 wvdc				
ZD1D102C224	0.22	2.00	1.81	0.19
ZD1D102C254	0.25	2.00	1.84	0.21
ZD1D102C334	0.33	2.00	1.91	0.25
ZD1D102C504	0.50	2.00	1.84	0.39
ZD1D102C105	1.00	2.00	1.84	0.76
ZD1D102C205	2.00	2.00	1.84	1.49
ZD1D102C405	4.00	3.00	1.87	1.73
ZD1D102C605	6.00	3.00	1.87	2.59
ZD1D102C805	8.00	3.00	1.87	3.42
ZD1D102C106	10.00	3.00	1.94	4.15
2000 wvdc				
ZD1D202C104	0.10	2.00	1.73	0.12
ZD1D202C224	0.22	2.00	1.86	0.22
ZD1D202C254	0.24	2.00	1.90	0.24
ZD1D202C334	0.33	2.00	1.98	0.30
ZD1D202C504	0.50	2.00	1.90	0.46
ZD1D202C105	1.00	2.00	1.90	0.90
ZD1D202C205	2.00	2.00	1.90	1.78
ZD1D202C405	4.00	3.00	1.95	2.09
ZD1D202C605	6.00	3.00	1.95	3.13
3000 wvdc				
ZD1D302C103	0.010	1.50	1.66	0.07
ZD1D302C223	0.022	1.50	1.71	0.11
ZD1D302C253	0.025	1.50	1.72	0.12
ZD1D302C333	0.033	1.50	1.76	0.14
ZD1D302C503	0.050	1.50	1.82	0.19
ZD1D302C104	0.100	2.00	1.84	0.20
ZD1D302C224	0.22	2.00	2.06	0.36
ZD1D302C254	0.25	2.00	1.89	0.45
ZD1D302C334	0.33	2.00	1.96	0.57
ZD1D302C504	0.50	2.00	1.97	0.84
ZD1D302C105	1.00	3.12	1.92	0.96
ZD1D302C205	2.00	3.12	1.92	1.89
ZD1D302C405	4.00	4.25	2.70	1.89
4000 wvdc				
ZD1D402C103	0.010	1.50	1.71	0.11
ZD1D402C223	0.022	1.50	1.79	0.17
ZD1D402C253	0.025	1.50	1.82	0.19

PART NO.	MFD	L	W	T
4000 wvdc (cont'd.)				
ZD1D402C333	0.033	1.50	1.86	0.22
ZD1D402C503	0.050	1.50	1.83	0.38
ZD1D402C104	0.10	2.00	2.01	0.33
ZD1D402C224	0.22	2.00	2.04	0.68
ZD1D402C254	0.25	2.00	2.60	0.65
ZD1D402C334	0.33	2.00	2.04	1.01
ZD1D402C504	0.50	2.00	2.60	1.30
ZD1D402C105	1.00	4.25	1.97	1.08
ZD1D402C205	2.00	4.25	1.97	2.16
5000 wvdc				
ZD1D502C103	0.010	2.00	1.70	0.10
ZD1D502C223	0.022	2.00	1.79	0.16
ZD1D502C253	0.025	2.00	1.80	0.18
ZD1D502C333	0.033	2.00	1.86	0.22
ZD1D502C503	0.050	2.00	1.80	0.34
ZD1D502C104	0.10	2.00	1.80	0.66
ZD1D502C224	0.22	3.12	1.99	0.61
ZD1D502C254	0.25	3.12	2.04	0.66
ZD1D502C334	0.33	3.12	1.99	0.91
ZD1D502C504	0.50	3.12	2.04	1.30
ZD1D502C105	1.00	3.12	2.04	2.58
6000 wvdc				
ZD1D602C103	0.010	2.12	1.73	0.13
ZD1D602C253	0.025	2.12	1.86	0.22
ZD1D602C333	0.033	2.12	1.93	0.27
ZD1D602C503	0.050	2.12	1.86	0.42
ZD1D602C104	0.10	2.12	1.86	0.82
ZD1D602C254	0.25	3.12	1.93	1.01
ZD1D602C334	0.33	3.12	2.01	1.25
ZD1D602C504	0.50	4.25	2.01	1.24
ZD1D602C105	1.00	4.25	2.01	2.46
7500 wvdc				
ZD1D752C103	0.010	4.25	1.68	0.09
ZD1D752C253	0.025	4.25	1.77	0.15
ZD1D752C333	0.033	4.25	1.81	0.18
ZD1D752C503	0.050	4.25	1.90	0.32
ZD1D752C104	0.10	4.25	1.90	0.48

PART NO.	MFD	L	W	T
7500 wvdc (cont'd.)				
ZD1D752C254	0.25	4.25	1.96	1.09
ZD1D752C334	0.33	4.25	1.92	1.46
ZD1D752C504	0.50	4.25	1.96	2.16
ZD1D752C105	1.00	4.25	1.96	4.29
10,000 wvdc				
ZD1D103C502	0.005	4.25	1.70	0.10
ZD1D103C103	0.010	4.25	1.75	0.14
ZD1D103C253	0.025	4.25	2.00	0.25
ZD1D103C333	0.033	4.25	1.82	0.35
ZD1D103C503	0.050	4.25	2.00	0.48
ZD1D103C104	0.10	4.25	2.00	0.94
ZD1D103C254	0.25	4.25	1.86	2.40
12,500 wvdc				
ZD1D123C252	0.0025	4.25	1.67	0.09
ZD1D123C502	0.0050	4.25	1.72	0.12
ZD1D123C103	0.010	4.25	1.81	0.18
ZD1D123C253	0.025	4.25	1.86	0.41
ZD1D123C333	0.033	4.25	1.92	0.50
ZD1D123C503	0.050	4.25	1.93	0.75
ZD1D123C104	0.10	4.25	1.98	1.42
ZD1D123C254	0.25	4.25	1.99	3.49
15,000 wvdc				
ZD1D153C102	0.0010	4.25	1.66	0.08
ZD1D153C252	0.0025	4.25	1.72	0.12
ZD1D153C502	0.0050	4.25	1.79	0.17
ZD1D153C103	0.010	4.25	1.92	0.26
ZD1D153C253	0.025	4.25	1.98	0.58
ZD1D153C333	0.033	4.25	1.94	0.77
ZD1D153C503	0.050	4.25	1.98	1.13
ZD1D153C104	0.10	4.25	1.91	2.32
20,000 wvdc				
ZD1D203C102	0.0010	4.25	1.70	0.10
ZD1D203C252	0.0025	4.25	1.79	0.17
ZD1D203C502	0.0050	4.25	1.92	0.27
ZD1D203C103	0.010	4.25	1.92	0.50
ZD1D203C253	0.025	4.25	1.99	1.16
ZD1D203C333	0.033	4.25	2.01	1.51
ZD1D203C503	0.050	4.25	1.99	2.30

REPETITIVE DISCHARGE CAPACITORS

WRAP AND FILL



Stanley RECON MICA™ repetitive discharge capacitors are ideally suited for applications requiring complete discharge at repetition rates from 1 pps up to and including 16,000 pps, at peak currents reaching 1,000 amperes.† These devices are optimally designed to yield the greatest power handling capability while maintaining the lowest volume affording the equipment designer more energy per unit volume. Pulse forming networks for both laser pulsers and radar transmitter modulators are just two of the more common uses for the capacitors listed herein.

Higher peak currents are achievable at lower repetition frequencies. To increase the peak current and stay within the rating of the capacitor, reduce the pulse repetition rate by the square of the current ratio. *Example:* P/N ZP1D601C503 is listed at 15,000 pps at 50 amperes. To increase to 100 amperes reduce the prf to 3750 pps. $15{,}000/(100/50)^2 = 3750$.

†Higher repetition frequencies and higher voltages are available upon request. Stanley's engineering staff is ready to assist you.

PART NO.	MFD	L	W	T	Max** PRF	Max* I PK
600 V						
ZP1D601C503	0.05	1.75	1.69	0.10	15,000	40
ZP1D601C104	0.10	1.75	1.78	0.16	10,000	40
ZP1D601C254	0.25	2.25	2.21	0.19	5,000	60
ZP1D601C504	0.50	3.25	2.24	0.21	3,500	125
ZP1D601C105	1.0	3.25	2.24	0.42	2,100	400
ZP1D601C205	2.0	3.25	2.24	0.83	1,300	1,000
1000 V						
ZP1D102C103	0.01	1.50	1.25	0.07	16,000	75
ZP1D102C503	0.05	1.75	1.72	0.11	5,000	80
ZP1D102C104	0.10	1.75	1.81	0.18	3,000	80
ZP1D102C254	0.25	2.25	2.27	0.22	2,000	95
ZP1D102C504	0.50	3.25	2.67	0.23	1,600	160
ZP1D102C105	1.0	3.25	2.67	0.45	1,000	480
ZP1D102C205	2.0	3.25	2.67	0.87	500	1,000
3000 V						
ZP1D302C501	0.0005	1.25	1.25	0.08	16,000	20
ZP1D302C102	0.0010	1.25	1.30	0.10	16,000	20
ZP1D302C152	0.0015	1.50	1.30	0.10	13,000	40
ZP1D302C252	0.0025	1.75	1.31	0.10	9,000	60
ZP1D302C502	0.005	2.00	1.34	0.13	6,000	60
ZP1D302C103	0.010	2.00	1.78	0.16	3,700	80
ZP1D302C253	0.025	2.00	1.95	0.28	1,800	115
ZP1D302C503	0.05	2.50	2.22	0.37	1,300	500
ZP1D302C104	0.10	4.50	2.21	0.35	1,000	1,000
ZP1D302C254	0.25	4.50	2.25	0.80	500	1,000

PART NO.	MFD	L	W	T	Max** PRF	Max* I PK
5000 V						
ZP1D502C501	0.0005	1.25	1.27	0.14	12,000	30
ZP1D502C102	0.0010	1.25	1.29	0.18	6,600	30
ZP1D502C152	0.0015	1.75	1.29	0.16	5,800	90
ZP1D502C252	0.0025	2.00	1.30	0.18	4,000	90
ZP1D502C502	0.005	2.50	2.10	0.17	3,800	95
ZP1D502C103	0.010	2.50	2.12	0.25	2,000	250
ZP1D502C253	0.025	4.50	2.15	0.27	1,500	500
ZP1D502C503	0.05	4.50	2.25	0.44	1,000	500
ZP1D502C104	0.10	4.50	2.27	0.85	500	1,000
10,000 V						
ZP1D103C501	0.0005	1.25	1.71	0.35	5,000	40
ZP1D103C102	0.0010	1.25	1.77	0.48	3,000	75
ZP1D103C152	0.0015	1.75	1.74	0.41	2,400	100
ZP1D103C252	0.0025	2.00	2.14	0.43	2,000	320
ZP1D103C502	0.005	3.25	2.24	0.43	1,700	670
ZP1D103C103	0.010	4.50	2.55	0.45	1,200	1,000
ZP1D103C253	0.025	4.50	2.70	0.78	600	1,000
15,000 V						
ZP1D153C501	0.0005	1.50	1.70	0.55	3,000	60
ZP1D153C102	0.0010	1.50	1.75	0.74	1,800	180
ZP1D153C152	0.0015	1.75	1.75	0.72	1,300	320
ZP1D153C252	0.0025	2.00	2.17	0.82	1,100	350
ZP1D153C502	0.005	3.25	2.54	0.75	900	850
ZP1D153C103	0.010	4.50	2.57	0.87	600	1,000

**Amperes*

***In pulses per second at 25 degrees centigrade. For higher ambient temperatures reduce average power or provide external cooling or consult Stanley's engineering staff.*

DEL
STANLEY ELECTRONICS
DIVISION OF DEL ELECTRONICS CORP.
250 East Sandford Boulevard, Mount Vernon, NY 10550, Tel: (914) 699-2000, FAX: (914) 699-4005, TWX: (710) 562-0130

ELECTRONIC CONCEPTS INC.

TYPE 5MP SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYPROPYLENE

Type 5MP capacitors have been developed by Electronic Concepts for use in switching power supplies. These metallized polypropylene capacitors are manufactured by using special techniques in order to achieve the optimum characteristics for high current, high capacitance, low ESR applications.

For filter designs where capacitance of 50 mfd or less is suitable for the circuit, type 5MP affords the opportunity to improve general system design. These unique capacitors also exhibit none of the "roll-off" of capacitance with frequency often associated with electrolytics.

In addition to the features which make type 5MP particularly suitable for switching applications, they are also characterized by low losses. Other advantages of polypropylene are long-term stability, retrace, low dielectric absorbtion, and high insulation resistance.

INTERNAL CONSTRUCTION

Extended foil winding (non-inductive)

ENCLOSURE

Mylar tape outerwrap

ENVIRONMENTAL

These capacitors shall meet or exceed the requirements of MIL-C-55514 for all the following:

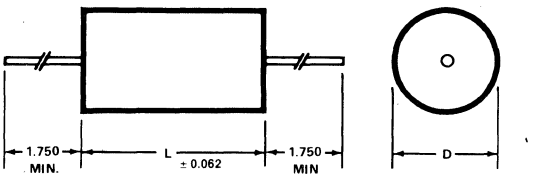
Vibration	(Para. 3.16)
Immersion	(Para. 3.21)
Shock	(Para. 3.17)
Moisture Resistance	(Para. 3.22)
Life	(Para. 3.23)

Electronic Concepts, Inc. is qualified as a supplier for the MIL versions CFR13 and CFR14 capacitors. These capacitors are manufactured to meet the requirements of MIL-C-55514/9. MIL designations are shown in the table above. The last two characters of the MIL designations (CFR13ALB106 - -) specify capacitance tolerance and failure rate respectively (CFR13ALB-106KM).

Capacitance tolerance: M = 20%, K = 10% and J = 5%.

Failure rate level: M, P, R or S

EC Type 5MP12 Military Style CFR13



All dimensions are in inches.

CATALOG NUMBERING SYSTEM

5MP 12 D 106 K

TYPE

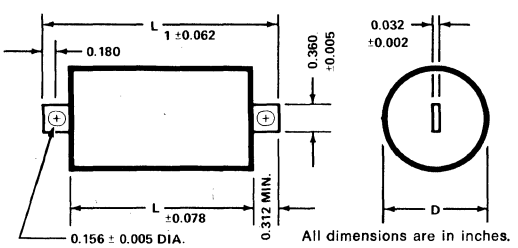
STYLE
Wrap and fill axial leads

VOLTAGE
D = 100 VDC
F = 200 VDC
J = 400 VDC

CAPACITANCE
Expressed in Picofarads, the first two digits are significant figures. The third is the number of zeroes. (e.g., 106 equals 10,000,000 pF).

TOLERANCE
M-20% K-10% J-5%
Closer tolerances upon request

EC Type 5MP16 Military Style CFR14



All dimensions are in inches.

CATALOG NUMBERING SYSTEM

5MP 16 D 106 K

TYPE

STYLE
Wrap and fill lug termination

VOLTAGE
D = 100 VDC
F = 200 VDC
J = 400 VDC

CAPACITANCE
Expressed in Picofarads, the first two digits are significant figures. The third is the number of zeroes. (e.g., 106 equals 10,000,000 pF).

TOLERANCE
M-20% K-10% J-5%
Closer tolerances upon request

OPERATING TEMPERATURE RANGE
−55°C to +105°C without derating.

CAPACITANCE TOLERANCE
Standard tolerance is ±10%. Tolerances of ±20% and ±5% are available.
NOTE: *Capacitance shall be measured at 25°C, and at or referred to a frequency of 1 KHz for all values.*

DIELECTRIC STRENGTH
Capacitors shall withstand a DC potential of twice rated voltage for one minute through a limiting resistance of 100 ohms/volt without damage or breakdown.

DISSIPATION FACTOR
When measured at the frequency specified for capacitance measurement, the dissipation factor shall not exceed 0.1%.

INSULATION RESISTANCE
When measured at the applicable test temperature, and rated voltage, after 2 minutes electrification, the insulation resistance shall equal or exceed the following values:

	+25°C	+85°C	+105°C
Megohm X Microfarads	300,000	30,000	3,000
Except the insulation resistance in megohms need not exceed	500,000	50,000	5,000

CAPACITANCE CHANGE
Temperature coefficient −200 ±50 PPM/°C from 25°C to −55°C. −350 ±50 PPM/°C from 25°C to 105°C.

ELECTRONIC CONCEPTS INC.
P.O. BOX 1278 EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

ELECTRONIC CONCEPTS INC.

TYPE 5MP SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYPROPYLENE

EC Type 5MP12 Military Style CFR13

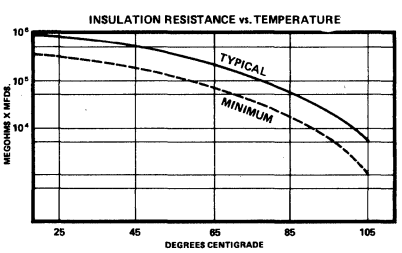
Commercial EC Part Number	Equivalent Military Designation	Capacitance Nominal in MFD	D Diameter	L Length	Lead Dia.	ESR Ohms 20-100 kHz Max	Maximum Ripple Current (AMP RMS) 20-100 kHz Case Temperature +25°C	+35°C	+45°C	+55°C	+65°C	+75°C	+85°C	Resonant Frequency in kHz	I Peak	DVDT
100 VDC																
5MP12D105-	CFR13ALB105--	1.0	.469 ±.062	.750	.032	.015	9.2	8.5	7.8	7.0	6.0	4.9	4.5	1065	407	407
5MP12D205-	CFR13ALB205--	2.0	.534 ±.062	.938	.032	.012	10.8	10.0	9.1	8.2	7.0	5.8	5.3	703	528	264
5MP12D305-	CFR13ALB305--	3.0	.624 ±.093	.938	.040	.011	12.1	11.2	10.3	9.2	8.0	6.5	5.9	574	790	263
5MP12D505-	CFR13ALB505--	5.0	.640 ±.093	1.250	.040	.010	13.8	12.7	11.6	10.4	9.0	7.4	6.7	385	828	166
5MP12D106-	CFR13ALB106--	10.0	.805 ±.093	1.500	.040	.009	15.0	15.0	14.2	12.7	11.0	9.0	8.2	248	1280	128
5MP12D206-	CFR13ALB206--	20.0	.875 ±.125	2.250	.040	.008	15.0	15.0	15.0	15.0	13.6	11.1	10.0	141	1517	76
5MP12D306-	CFR13ALB306--	30.0	1.075 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	12.4	11.4	115	2277	76
5MP12D506-	(Not Available)	50.0	1.375 ±.125	2.250	.040	.004	15.0	15.0	15.0	15.0	15.0	13.6	12.4	89	3795	76
200 VDC																
5MP12F105-	CFR13ALC105--	1.0	.450 ±.062	1.250	.032	.020	7.3	7.3	7.3	7.3	7.2	5.9	5.4	861	250	250
5MP12F205-	CFR13ALC205--	2.0	.605 ±.093	1.250	.032	.015	12.0	12.0	11.3	10.1	8.7	7.1	6.5	609	498	249
5MP12F305-	CFR13ALC305--	3.0	.654 ±.093	1.500	.040	.013	15.0	13.8	12.6	11.3	9.8	8.0	7.3	452	576	192
5MP12F505-	CFR13ALC505--	5.0	.769 ±.093	1.750	.040	.011	15.0	15.0	14.7	13.1	11.4	9.3	8.5	323	782	156
5MP12F106-	CFR13ALC106--	10.0	.905 ±.125	2.250	.040	.009	15.0	15.0	15.0	15.0	13.8	11.3	10.3	200	1139	114
5MP12F206-	CFR13ALC206--	20.0	1.315 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	14.1	12.8	141	2277	114
400 VDC																
5MP12J105-	CFR13ALE105--	1.0	.620 ±.093	1.500	.040	.019	9.5	9.5	9.5	9.5	9.5	7.8	7.1	784	319	319
5MP12J205-	CFR13ALE205--	2.0	.802 ±.093	1.750	.040	.015	15.0	15.0	15.0	13.4	11.6	9.5	8.7	511	521	260
5MP12J305-	CFR13ALE305--	3.0	.961 ±.125	1.750	.040	.012	15.0	15.0	15.0	15.0	13.1	10.7	9.8	417	781	260
5MP12J505-	CFR13ALE505--	5.0	1.067 ±.125	2.250	.040	.010	15.0	15.0	15.0	15.0	15.0	12.5	11.4	283	950	190
5MP12J106-	CFR13ALE106--	10.0	1.543 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	15.0	14.1	200	1898	190

EC Type 5MP16 Military Style CFR14

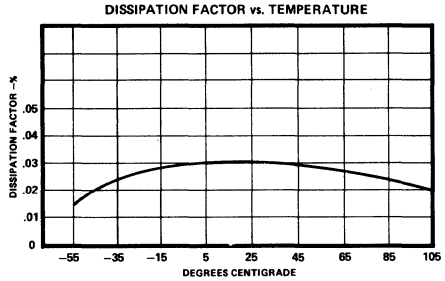
Commercial EC Part Number	Equivalent Military Designation	Capacitance Nominal in MFD	D Diameter	L Length	L_1	ESR Ohms 20-100 kHz Max	Maximum Ripple Current (AMP RMS) 20-100 kHz Case Temperature +25°C	+35°C	+45°C	+55°C	+65°C	+75°C	+85°C	Resonant Frequency in kHz	I Peak	DVDT
100 VDC																
5MP16D105-	CFR14LLB105--	1.0	.469 ±.062	.922	1.640	.015	10.3	9.5	8.7	7.8	6.7	5.5	5.0	949	407	407
5MP16D205-	CFR14LLB205--	2.0	.534 ±.062	1.110	1.828	.012	12.0	11.0	10.0	8.9	7.8	6.3	5.8	617	528	264
5MP16D305-	CFR14LLB305--	3.0	.624 ±.093	1.110	1.828	.011	13.3	12.3	11.2	10.0	8.7	7.1	6.5	504	790	263
5MP16D505-	CFR14LLB505--	5.0	.640 ±.093	1.422	2.140	.010	14.8	13.7	12.5	11.2	9.7	7.9	7.2	347	828	166
5MP16D106-	CFR14LLB106--	10.0	.805 ±.093	1.672	2.390	.009	17.8	16.5	15.0	13.5	11.7	9.5	8.7	227	1280	128
5MP16D206-	CFR14LLB206--	20.0	.875 ±.125	2.422	3.140	.008	21.6	20.0	18.3	16.4	14.2	11.6	10.6	133	1517	76
5MP16D306-	CFR14LLB306--	30.0	1.075 ±.125	2.422	3.140	.006	24.3	22.5	20.5	18.4	15.9	13.0	11.9	108	2277	76
5MP16D506-	(Not Available)	50.0	1.375 ±.125	2.422	3.140	.004	29.6	27.3	25.5	23.6	20.6	20.0	19.7	84	3795	76
200 VDC																
5MP16F105-	CFR14LLC105--	1.0	.450 ±.062	1.422	2.140	.020	7.3	7.3	7.3	7.3	7.3	6.4	5.8	776	250	250
5MP16F205-	CFR14LLC205--	2.0	.605 ±.093	1.422	2.140	.015	14.3	13.3	12.1	10.8	9.4	7.7	7.0	548	498	249
5MP16F305-	CFR14LLC305--	3.0	.654 ±.093	1.672	2.390	.013	15.9	14.7	13.5	12.0	10.4	8.5	7.8	414	576	192
5MP16F505-	CFR14LLC505--	5.0	.769 ±.093	1.922	2.640	.011	18.3	17.0	15.5	13.9	12.0	9.8	8.9	299	782	156
5MP16F106-	CRF14LLC106--	10.0	.905 ±.125	2.422	3.140	.009	22.4	20.7	18.9	16.9	14.6	12.0	10.9	188	1139	114
5MP16F206-	CFR14LLC206--	20.0	1.315 ±.125	2.422	3.140	.006	27.4	25.4	23.2	20.7	17.9	14.7	13.4	133	2277	114
400 VDC																
5MP16J105-	CFR14LLE105--	1.0	.620 ±.093	1.672	2.390	.019	9.5	9.5	9.5	9.5	9.5	8.3	7.5	716	319	319
5MP16J205-	CFR14LLE205--	2.0	.802 ±.093	1.922	2.640	.015	15.0	15.0	15.0	14.2	12.3	10.0	9.1	472	521	260
5MP16J305-	CFR14LLE305--	3.0	.961 ±.125	1.922	2.640	.012	21.1	19.5	17.8	15.9	13.8	11.3	10.3	386	781	260
5MP16J505-	CFR14LLE505--	5.0	1.067 ±.125	2.422	3.140	.010	24.4	22.6	20.6	18.5	16.0	13.1	11.9	265	950	190
5MP16J106-	CFR14LLE106--	10.0	1.543 ±.125	2.422	3.140	.006	30.0	27.8	25.4	22.7	19.7	16.1	14.7	188	1898	190

ELECTRICAL CHARACTERISTICS vs. TEMPERATURE

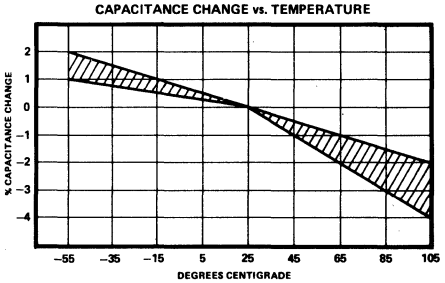
INSULATION RESISTANCE vs. TEMPERATURE



DISSIPATION FACTOR vs. TEMPERATURE



CAPACITANCE CHANGE vs. TEMPERATURE



ELECTRONIC CONCEPTS INC.

TYPE 5MC SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYCARBONATE

A new innovation pioneered by Electronic Concepts, Inc. leads the way to a new era of miniature metallized polycarbonate film capacitors physically designed to minimize circuit board real estate in switch mode power converters while maintaining a low ESR, excellent ripple capability and high resonant frequency. Electronic Concepts offers, in addition to conventional axial leaded termination, a flat tinned copper tab termination for increased current carrying capability and higher resonant frequency.

To aid the best layout potential, the copper tab terminated version is offered in both high and low profiles for each capacitance/voltage rating.

Excellent electrical characteristics and super miniaturization are offered to switch mode power supply designers with his requirements in mind.

5MC26 and 5MC27 type capacitors are qualified to MIL-c-55514/11, styles CFR26 and CFR27.

5MC29 type capacitors are qualified to MIL-C-55514/12, style CFR29.

CAPACITANCE In MFD	AXIAL LEADS 5MC22			LOW PROFILE 5MC26			HIGH PROFILE 5MC27			TYPE 5MC29			ESR Milliohms 100 KHz	Ripple Current Max @ 25°	Resonant Frequency KHz 5MC22, 5MC26, 5MC27	Resonant Frequency KHz 5MC29
	T	H	L	T	H	L	T	H	L	T	W	H				
50 VDC																
1.0	.250	.343	.687										18	7.8	1106	
3.0	.406	.593	.687										15	9.8	638	
5.0	.406	.593	.812										13	10.6	460	
10.0	.562	.812	.812	.812	.562	.750	.562	.812	.750	.562	.862	.750	11	12.6	325	390
20.0	.718	.968	.937	.968	.718	.875	.718	.968	.875	.718	.968	.875	10	14.8	215	258
50.0	1.000	1.375	1.062	1.375	1.000	1.000	1.000	1.375	1.000	1.000	1.375	1.000	6	23.5	128	154
75 VDC																
1.0	.281	.375	.812										19	7.9	1028	
3.0	.468	.718	.812							.468	.718	.750	15	10.3	593	712
5.0	.500	.750	.937				.500	.750	.875	.500	.750	.875	13	11.6	431	517
10.0	.718	1.031	.937	1.031	.718	.875	.718	1.031	.875	.718	1.031	.875	12	13.5	305	366
20.0	.937	1.312	1.062	1.312	.937	1.000	.937	1.312	1.000	.937	1.312	1.000	11	16.5	203	244
50.0	1.312	1.687	1.312	1.687	1.312	1.250	1.312	1.687	1.250	1.312	1.687	1.250	6	24.2	116	139
100 VDC																
1.0	.281	.375	.937										20	8.0	963	
3.0	.437	.750	.937							.437	.750	.875	15	10.6	556	667
5.0	.593	.906	.937	.906	.593	.875	.593	.906	.875	.593	.906	.875	13	12.4	431	517
10.0	.781	1.093	1.062	1.093	.781	1.000	.781	1.093	1.000	.781	1.093	1.000	12	14.6	287	344
20.0	.906	1.281	1.312	1.281	.906	1.250	.906	1.281	1.250	.906	1.281	1.250	11	17.1	183	220
50.0	1.437	1.812	1.437	1.812	1.437	1.375	1.437	1.812	1.375	1.437	1.812	1.375	6	23.6	111	133

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads Except the insulation resistance in megohms need not exceed	100,000	7,000	700
	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

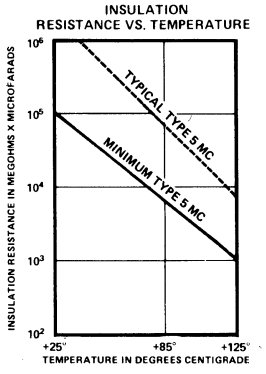
Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

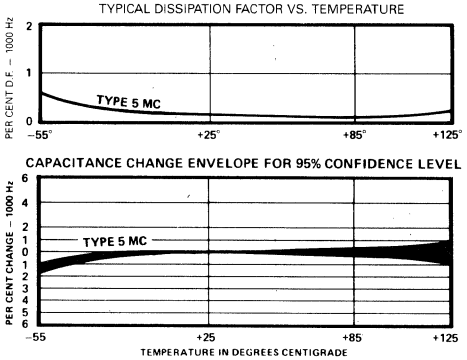
The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1 KHz.

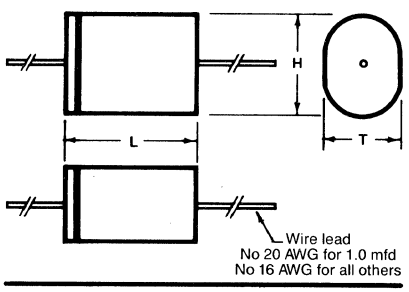
ELECTRICAL CHARACTERISTICS VS TEMPERATURE



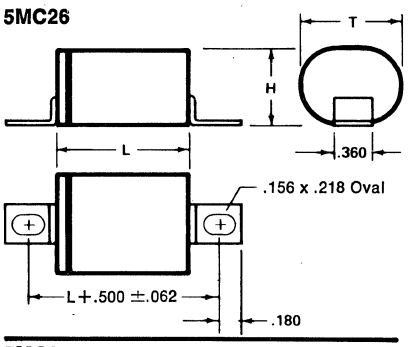


DIMENSIONAL DATA

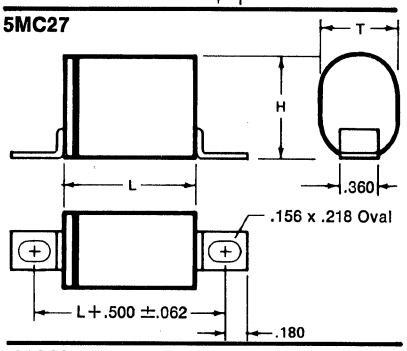
5MC22



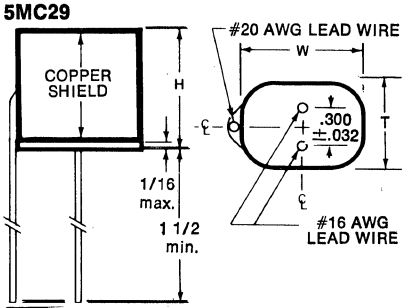
5MC26



5MC27



5MC29



L: + 3/32, − 1/16
T & H & W: .291 thru .500 : + .062, − .156
.501 and greater : + .093, − .187

ELECTRONIC CONCEPTS INC.

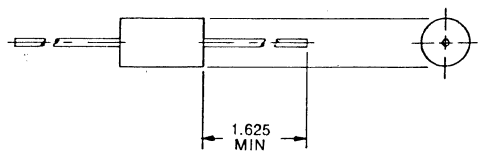
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ELECTRONIC CONCEPTS INC. ESTABLISHED RELIABILITY CAPACITORS

FIXED, PLASTIC DIELECTRIC, DC, IN NON-METAL CASES PER MIL-C-55514

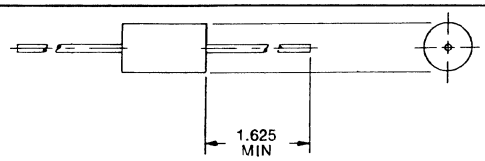
CFR02

ALL DIMENSIONS ARE IN INCHES.



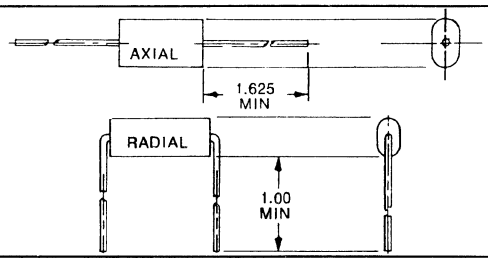
Dielectric: plastic film.
Characteristic "M": polyester film and foil
Characteristic "Q": polycarbonate film and foil
Construction: round configuration, axial leaded.
Capacitance values in MFD:
Characteristic "M": .0068 thru 1.0 100V; .0010 thru 1.0 200V; .0018 thru 1.0 400V; .0010 thru 0.1 600V
Characteristic "Q": .0010 thru 1.0 100V; .0010 thru 1.0 200V
Capacitance tolerance:
"M" ±2%, ±5%, ±10%
"Q" ±1%, ±2%, ±5%, ±10%

CFR05



Dielectric: metallized polycarbonate plastic film. Characteristic "R".
Construction: round configuration, axial leaded.
Capacitance values in MFD:
.0010 thru 50.0 50V .010 thru 10.0 200V
.0010 thru 20.0 100V .010 thru 5.0 400V
Capacitance tolerance: ±1%, ±2%, ±5%, ±10%

CFR06

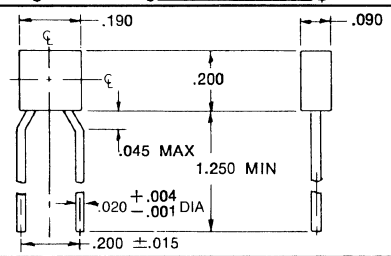


Dielectric: metallized plastic film
Characteristic "R": metallized polycarbonate
"N": metallized polyester
Construction: oval configuration, axial or radial leaded
Capacitance values in MFD:

Characteristic "R"	Characteristic "N"
.0010 thru 50.0 50V	.010 thru 10.0 200V
.0010 thru 20.0 100V	.010 thru 3.3 400V

Capacitance tolerance:
"R" ±1%, ±2%, ±5%, ±10%
"N" ±2%, ±5%, ±10%

CFR12

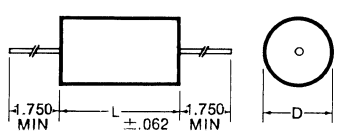


Dielectric: metallized polycarbonate plastic film.
Construction: molded rectangular case, radial leaded.
Capacitance values in MFD:

.0010 thru .0033 250V	.010 thru .018 100V
.0039 thru .0056 200V	.022 thru .027 75V
.0068 thru .0082 150V	.033 thru .056 50V

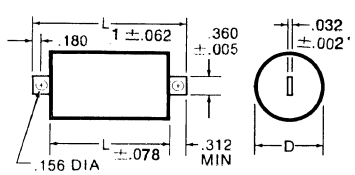
.068 thru 1.0 available in larger size CFR 16, 50V
See MIL-C-55514/8C for additional information.

CFR13



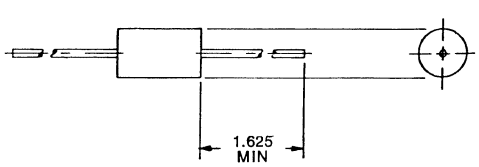
Switch-Mode Power Supply Capacitors.
Dielectric: metallized polypropylene film.
Construction: round configuration, axial leaded.
Capacitance values in MFD:
1.0 thru 30.0 100V
1.0 thru 20.0 200V
1.0 thru 10.0 400V
Capacitance tolerance: ±5%, ±10%, ±20%

CFR14



Switch-Mode Power Supply Capacitors.
Dielectric: metallized polypropylene film.
Construction: round configuration, lug terminal.
Capacitance values in MFD:
1.0 thru 30.0 100V
1.0 thru 20.0 200V
1.0 thru 10.0 400V
Capacitance tolerance: ±5%, ±10%, ±20%

CFR15

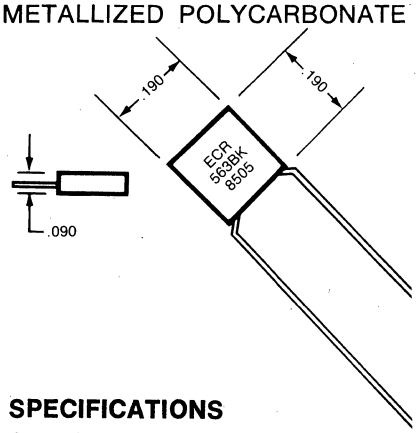


Dielectric: polypropylene plastic film.
Construction: round configuration, film foil, axial leaded.
Capacitance values in MFD:
.012 thru 1.0 200V
.0068 thru 1.0 400V
.001 thru 1.0 600V
.0056 thru 0.56 800V
Capacitance tolerance: ±5%, ±10%, ±20%

ELECTRONIC CONCEPTS INC.
P.O. BOX 1278 EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

ELECTRONIC CONCEPTS INC. AVIONICAPS®

METALLIZED POLYCARBONATE



TYPE ECR

- NO PIEZOELECTRIC EFFECT
- NOT FREQUENCY SENSITIVE
- NOT VOLTAGE SENSITIVE
- QUALIFIED TO MIL-C-55514/8, STYLES CFR12 AND CFR16

A new innovation pioneered by Electronic Concepts leads the way to a new era of smaller metallized film capacitors. Now a combination of excellent electrical characteristics and compactness is offered the equipment designer in a size equal to a ceramic CK05 capacitor.

Besides the superior electrical characteristics Type ECR are self-healing, as is the case with all metallized capacitors.

Additionally, these capacitors do not exhibit any of the drawbacks inherent in all ceramic capacitors.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads	100,000	7,000	700
Except the insulation resistance in megohms need not exceed	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1KHz.

VALUE IN MFD	VDC	PHYSICAL SIZE T	H	L	LEAD SPACING LS	SEE FIGURE
.0010	250	.090	.190	.190	.200	1
.0012	250	.090	.190	.190	.200	1
.0015	250	.090	.190	.190	.200	1
.0018	250	.090	.190	.190	.200	1
.0022	250	.090	.190	.190	.200	1
.0027	250	.090	.190	.190	.200	1
.0033	250	.090	.190	.190	.200	1
.0039	200	.090	.190	.190	.200	1
.0047	200	.090	.190	.190	.200	1
.0056	200	.090	.190	.190	.200	1
.0068	150	.090	.190	.190	.200	1
.0082	150	.090	.190	.190	.200	1
.010	100	.090	.190	.190	.200	1
.012	100	.090	.190	.190	.200	1
.015	100	.090	.190	.190	.200	1
.018	100	.090	.190	.190	.200	1
.022	75	.090	.190	.190	.200	1
.027	75	.090	.190	.190	.200	1
.033	50	.090	.190	.190	.200	1
.039	50	.090	.190	.190	.200	1
.047	50	.090	.190	.190	.200	1
.056	50	.090	.190	.190	.200	1
.068	50	.095	.245	.295	.200	2
.082	50	.095	.245	.295	.200	2
.10	50	.095	.245	.295	.200	2
.12	50	.095	.295	.295	.200	2
.15	50	.095	.295	.295	.200	2
.18	50	.095	.295	.295	.200	2
.22	50	.095	.395	.395	.300	2
.27	50	.095	.395	.395	.300	2
.33	50	.095	.395	.395	.300	2
.39	50	.095	.395	.395	.300	2
.47	50	.145	.395	.395	.300	2
.56	50	.145	.395	.395	.300	2
.68	50	.195	.395	.395	.300	2
.82	50	.195	.395	.395	.300	2
1.0	50	.195	.395	.395	.300	2

DIMENSIONAL DATA

Figure 1

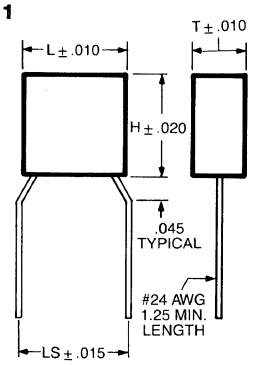
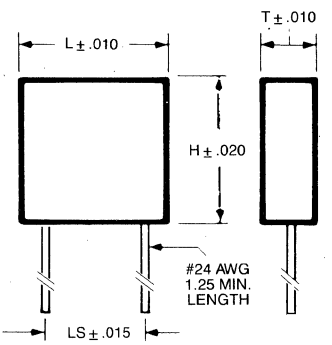
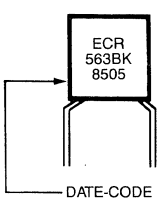


Figure 2



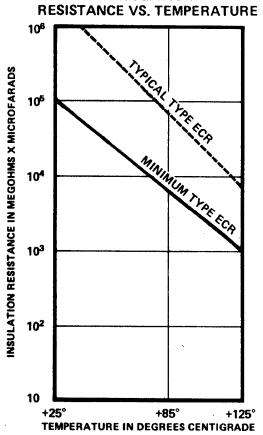
Part Marking



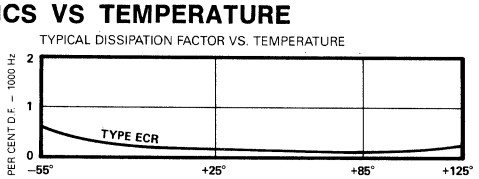
The first two digits represent the year, the second two digits represent the week. ie. 8452 is the 52nd week of 1984, 8512 is the 12th week of 1985.

ELECTRICAL CHARACTERISTICS VS TEMPERATURE

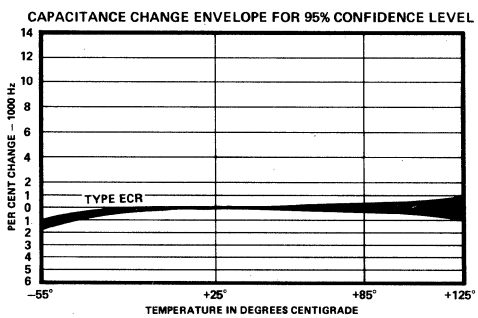
INSULATION RESISTANCE VS. TEMPERATURE



TYPICAL DISSIPATION FACTOR VS. TEMPERATURE



CAPACITANCE CHANGE ENVELOPE FOR 95% CONFIDENCE LEVEL



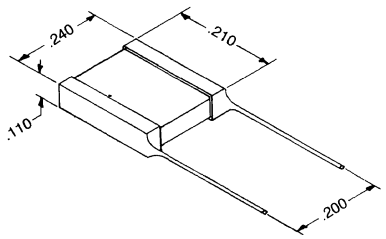
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ELECTRONIC CONCEPTS INC.

MINIATURE HERMETICALLY SEALED POLYCARBONATE

TYPE HECR



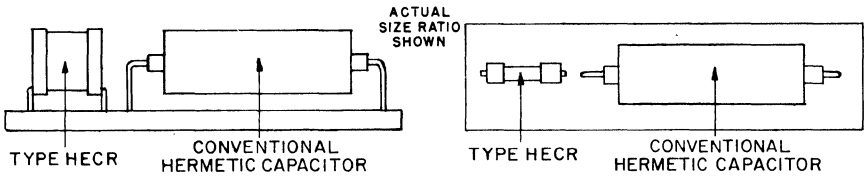
THE FIRST POLYCARBONATE TO OFFER SUBMINIATURE SIZE AND HERMETICITY

The Avionicap® HECR represents a major improvement in capacitor design that will advance the trend toward miniaturization. This improvement is made possible by a new, patented manufacturing process that enables us to maximize density and actually compress the capacitance of a conventional hermetic capacitor into a subminiature package. Type HECR is the smallest hermetically sealed polycarbonate capacitor on the market today, measuring as compact as .100″ × .200″ × .230″, which is 3.5 times smaller in volume than conventional hermetic polycarbonate capacitors. The HECR represents a competitive edge to the user, because it is the first time both subminiature size and hermeticity are available in a polycarbonate capacitor.

Now qualified to MIL-C-39022/11, style CHR20 through CHR25
Also available with insulating plastic sleeves.

OFFERS GREATER DESIGN LATITUDE WITHOUT COMPROMISE

It is no longer necessary for the designer to compromise because of lack of availability. Before the introduction of the HECR, the choice was between using either a larger than ideal hermetic or a non-hermetic in a small enough size. But now the designer can have both miniature size and hermetics — and as a result, he can miniaturize without compromising performance, reliability or environmental protection requirements.



NO LOSS IN ELECTRICAL CHARACTERISTICS AS COMPARED TO CONVENTIONAL HERMETICS

Even though the size of the HECR has been reduced, performance has not been. The HECR still offers excellent stability retrace and insulation resistance, long term capacitance stability, and capacitance as high as 1.0 MFD. There is full hermeticity in accordance with MIL-C-202, method 112. And it meets the environmental and performance standards of MIL-C-83421, as well as other military and commercial standards.

LENDS ITSELF TO END PRODUCT MINIATURIZATION — WITH GREATER PCB DENSITY

Because of its subminiature size the HECR will save valuable printed circuit board surface area and volume, thus allowing for a smaller pc board, and therefore more boards packaged in a specified area. In addition, this capacitor has a rectangular rather than a tubular shape, and is radially rather than axially mounted. As a result the surface area requirement is even further reduced.

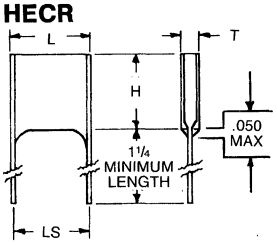
The HECR facilitates miniaturization of the component package and the end product, to reduce system weight and production costs.

NUMERALS INDICATE CASE NUMBERS. SEE ADJACENT TABLE FOR CASE DIMENSIONS

VALUE IN MFD	VDC						VALUE IN MFD	VDC						VALUE IN MFD	VDC					
	30	50	100	150	200	300		30	50	100	150	200	300		30	50	100	150	200	300
.0010						1	.010		1	2			3	.10		3	5	6		
.0012						1	.012		1	2		3	4	.12		3	5			
.0015						1	.015		1	2		3	4	.15		3	6			
.0018						1	.018		1			3	5	.18	3	4	6			
.0022					1	2	.022		1		3	4	5	.22	3	4	6			
.0027					1	2	.027		1		3	4	5	.27	3	4				
.0033				1	2	3	.033	1	2	3	4	5	6	.33	4	5				
.0039				1	2	3	.039	1	2	3	4	5	6	.39	4	5				
.0047				1	2	3	.047	1	2	3		5		.47	5	6				
.0056			1	2		3	.056	2		3	5	6		.56	5	6				
.0068			1	2		3	.068	2	3	4	5	6		.68	5	6				
.0082			1			3	.082	2	3	4	6			.82	6					
														1.00	6					

CASE NO.	T +.030 −.010	H +.030 −.010	L +.030 −.020	LS ±.015
1	.110	.210	.240	.200
2	.170	.270	.240	.200
3	.170	.270	.340	.300
4	.190	.380	.340	.300
5	.190	.380	.450	.400
6	.220	.500	.450	.400

DIMENSIONAL DATA TYPE HECR



ALL DIMENSIONS SHOWN IN INCHES

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SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

ELPAC COMPONENTS 32 YEARS OF EXCELLENCE

FILM CAPACITORS MADE EASY

Elpac's film capacitors offer high quality at competitive prices. They are typically available from 0.0001 to 25 microfarads at voltages from 50 to 1,000 VDC with temperatures up to 125°C (teflon is good up to 200°C). Film capacitors are non-polarized and are noted for their low leakage and capacitance stability over variations in voltage, frequency, and temperature. They also provide excellent volumetric efficiency at higher voltage ratings (over 100 volts), and are applicable to high energy filter applications because of their extremely low DF and exceptionally low ESR (the lowest of all capacitor dielectrics). Film capacitors are typically utilized in test and measurement instruments, telecommunication equipment, industrial control systems, and computers or computer peripherals.

...Available in 10 series.
Each with multiple packaging options.

FILM CAPACITORS PRODUCT GUIDE

APPLICATION	MD Polyester & Foil	ZD Metallized Polyester	Z Miniature Metallized Polyester	B Metallized Polycarbonate	C Miniature Metallized Polycarbonate	CS Power Cap	HS Highly Stable Metallized Polycarbonate	PD Polystyrene & Foil	PMB Metallized Polypropylene	PSB Metallized Polypropylene
Coupling	Yes	Yes	Yes	Yes	Yes	High Current	Yes	Occasional	Yes	AC RATED
Bypass & Filtering	Yes	Yes	Yes	Yes	Yes	LOW ESR	Yes	Seldom	Yes	LOW ESR
Timing	Occasional	Occasional	Occasional	Yes	Yes	Switching Regulators	Yes	Yes	Yes	SWITCHING REGULATIONS
Pulse-Discharge	Yes	Yes	Occasional	Yes	Occasional	Pulse Service	Seldom	No	Seldom	CRITICAL FILTERING
Arc Suppression	Yes	Yes	Yes	Occasional	Occasional	Critical Filtering	Seldom	No	Seldom	HIGH FREQUENCY
Ripple Suppression	Yes	Occasional	Occasional	Occasional	Occasional		Seldom	No	Seldom	
Freq. Determination (tuning)	No	No	No	Yes	Yes	High Frequency	Yes	Yes		
CAPACITANCE RANGE										
Style										
A (W&F Oval)	.001/5.0	.001/10.0	.001/25.0	.001/10.0	.001/12.0	1/50.0	—	.001/1.5	.001/4.0	—
B W&F Tubular)	.001/5.0	.001/10.0	.001/25.0	.001/10.0	.001/12.0	—	.001/10.0	.001/1.5	.001/10.0	.47/10.0
G (Hermetic Rectangular	.001/2.0	.001/4.0	.001/8.0	.001/2.0	.0118.0	—	—	.001/1.0	—	—
L (Hermetic Tubular)	.001/5.0	.001/10.0	.001/25.0	.001/10.0	.001/12.0	—	—	.001/2.0	—	—
R (Epoxy Radial)	.001/3.0	.001/5.0	.001/15.0	.001/5.0	.001/12.0	—	—	.001/2.0	—	—
X (Epoxy Axial)	.001/2.0	.001/4.0	.001/10.0	.001/4.0	.001/12.0	—		.001/1.0	—	—
VOLTAGE RANGE (VDC) (NOMINAL)	50 to 600	50 to 600	50 to 600	50 to 600	50 to 600	100 to 400	50 to 600	50 to 600	50 to 600	100 to 400
TEMP RANGE −55° C to	125° C	125° C	125° C	125° C FULL RATED	125° C FULL RATED	−50/ +125	125° C FULL RATED	85° C MAX	105° C FULL RATED	105° C FULL RATED
Derate From	85° C (to 50%)	85° C (to 50%)	85° C (to 50%)	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd
TEMP. COEFF. (PPM/° C)										
−55°C to +125°C	960	960	960	120	120	—	120	—	—	—
−55°C to +105°C	—	—	—	—	—	+120	—	—	300	300
−55°C to +85° C	—	—	—	—	—	—	—	90	—	—
DISSIPATION FACTOR(%)1 KHz*	0.5	1.0	1.0	0.3	0.3	0.3	0.3	0.1	0.1	0.1
INSULATION RES. (Megohm x MFD)	50,000	10,000	10,000	25,000	25,000	25,000	50,000	100,000	50,000	50,000
Need Not Exceed (Megohms)	100,000	40,000	40,000	50,000	50,000	50,000	100,000	200,000	100,000	100,000
DIELECTRIC STRENGTH* ** As % of DC Rating**										
Term to Term	200	150	150	150	150	150	150	200	150	150
Term to Case	200	200	200	200	200	200	200	200	200	200

* Except values over 1µf at 60 Hz
** Measured at rated voltage or 100 volts, whichever is less, after 2 minutes electrification
*** Measured at dc test potential for 60 seconds through limiting resistance of 100 ohms/volt

NOTE: Other capacitance tolerances, voltages, and sizes available on special request

ELPAC COMPONENTS
A DIVISION OF ELPAC ELECTRONICS, INC.
3131 S. STANDARD AVENUE, SANTA ANA, CA 92705
FAX (714) 241-7293 • TEL. (714) 979-4440

ILLINOIS CAPACITOR, INC.

MEETING YOUR NEEDS...for Quality Capacitors!
...for Sales & Engineering Assistance!
...for On-Time Delivery!

Aluminum electrolytic capacitors are available off-the-shelf in continuous heavy-duty...miniature...subminiature...sub-subminiature...low leakage...extended temperature types...even special case sizes and configurations.

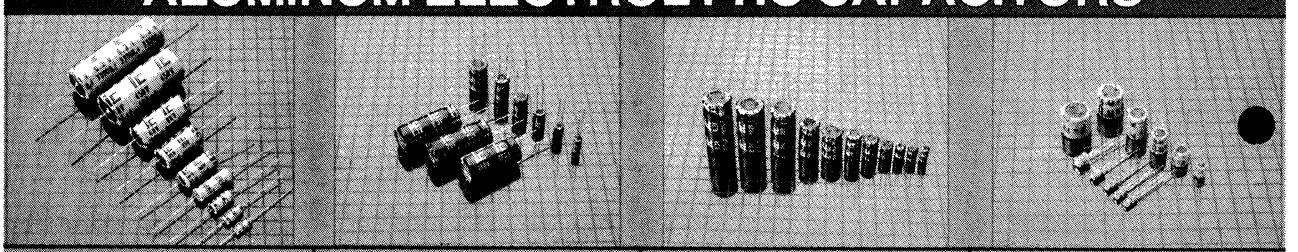
Off-the-shelf film capacitors, including metallized self-healing polyester, polypropylene and polycarbonate dielectrics are also available in a variety of values.

Miniature, temperature-stable, and general purpose ceramic disc capacitors are stocked in depth.

Every **IC** capacitor is automatically 100% inspected and tested throughout the manufacturing process, and, again before delivery to inventory.

In addition **IC** offers epoxy end seals, mylar sleeving, cut and formed leads. **IC** capacitors are also available in tape and reel configurations and in flat (ammo) packs.

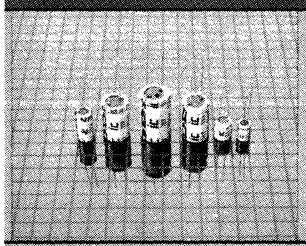
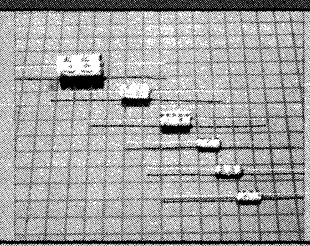
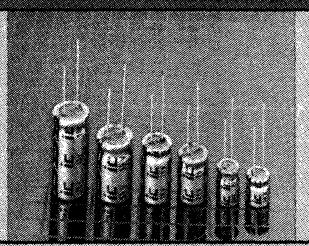
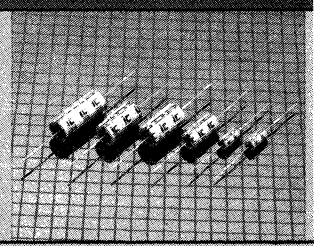
ALUMINUM ELECTROLYTIC CAPACITORS



TTA	CKR	RMR	RSS
+85°C MINIATURE	+85°C SUBMINIATURE	+105°C SUBMINIATURE	LOW PROFILE, SUB-SUBMIN.
Capacitance Range: 0.47 Mfd to 33,000 Mfd **Voltage Range:** 6.3 WVDC to 450 WVDC **Operating Temperature:** −40°C to +85°C **Rating:** 2,000 Hr. @ +85°C **Tolerance:** ±20% Std. (±10% Opt.) **Leakage Current:** ≤0.006 CV or 2μA minimum **Style:** Axial Lead **Solvent Tolerant End Seal:** Standard (≤250 WVDC) **Epoxy End Seal:** Optional **Tape & Reel/** Available	**Capacitance Range:** 0.1 Mfd to 15,000 Mfd **Voltage Range:** 6.3 WVDC to 250 WVDC **Operating Temperature:** −40°C to +85°C **Rating:** 2,000 Hr. @+85°C **Tolerance:** ±20% Std. (±10%, −10, +30% Opt.) **Leakage Current:** ≤0.006 CV or 2μA minimum **Style:** Radial Lead **Solvent Torerant End Seal:** Standard **Epoxy End Seal:** Optional **Tape & Reel/Ammo Pack:** Available	**Capacitance Range:** 0.47 Mfd to 10,000 Mfd **Voltage Range:** 6.3 WVDC to 450 WVDC **Operating Temperature:** −40°C to +105°C **Tolerance:** ±20% Std. (±10% Opt.) **Leakage Current:** ≤0.002 CV or 2μA minimum **Style:** Radial Lead **Solvent Tolerant End Seal:** Standard (≤250 WVDC) **Epoxy End Seal:** Optional **Tape & Reel/Ammo Pack:** Available	**Capacitance Range:** 0.1 Mfd to 3,300 Mfd **Voltage Range:** 6.3 WVDC to 50 WVDC **Operating Temperature:** −40°C to +85°C **Tolerance:** ±20% Std. (±10% Opt.,) **Leakage Current:** ≤0.006 CV or 1μA minimum **Style:** Radial Lead **Solvent Tolerant End Seal:** Standard **Epoxy End Seal:** Optional **Tape & Reel/Ammo Pack:** Available

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ALUMINUM ELECTROLYTIC CAPACITORS

RLR
LOW LEAKAGE

Capacitance Range:
0.1 Mfd to 2,200 Mfd
Voltage Range:
6.3 WVDC to 50 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
±20% Std.
(±10% Opt.)
Leakage Current:
≤0.002 CV or 0.4μA minimum
Style:
Radial Lead
Solvent Tolerant End Seal:
Standard
Epoxy End Seal:
Optional
Tape & Reel/Ammo Pack:
Available

TLA
LOW LEAKAGE

Capacitance Range:
0.1 Mfd to 100 Mfd
Voltage Range:
10 WVDC to 50 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
±20% Std.
(±10% Opt.)
Leakage Current:
≤0.002 CV or 0.4μA minimum
Style:
Axial Lead
Solvent Tolerant End Seal:
Standard
Epoxy End Seal:
Optional
Tape & Reel/Available

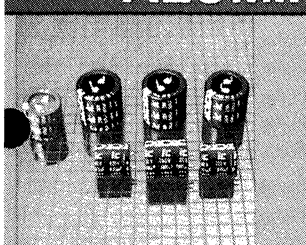
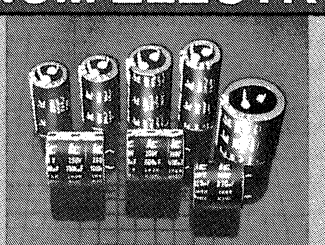
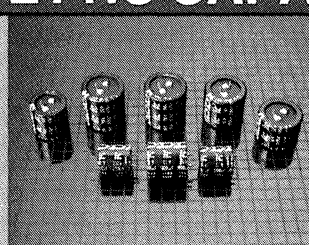
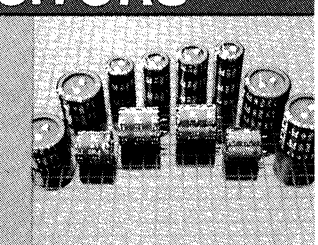
RZS
+105°C LOW IMPEDANCE

Capacitance Range:
22 Mfd to 2,200 Mfd
Voltage Range:
6.3 WVDC to 63 WVDC
Operating Temperature:
−55°C to +105°C
Tolerance:
±20% Std.
(±10% Opt.)
Leakage Current:
≤0.01 CV @ 2 minutes
High Frequency, Low ESR
Style:
Radial Lead
Solvent Tolerant End Seal:
Standard
Epoxy End Seal:
Optional
Tape & Reel/Ammo Pack:
Available

THA
+125°C HIGH TEMPERATURE

Capacitance Range:
.47 Mfd to 1,000 Mfd
Voltage Range:
6.3 WVDC to 100 WVDC
Operating Temperature:
−40°C to +125°C
Tolerance:
−10+50% Std.
(±20% Opt.)
Leakage Current:
≤.002 CV or 2μA minimum
Style:
Axial Lead
Epoxy End Seal:
Optional
Tape & Reel/Available

ALUMINUM ELECTROLYTIC CAPACITORS

LBA
+85°C SNAP MOUNT

Capacitance Range:
330Mfd to 1800Mfd
Voltage Range:
200WVDC to 400WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
±20% Std.
(±10%, −10+30% Opt.)
Leakage Current:
≤.02CV or 2mA max.
Style
Standard, 2 pin
Solvent Tolerant End Seal:
Standard (≤250WVDC)

LMU
+105°C SNAP MOUNT

Capacitance Range:
330Mfd to 1,500Mfd
Voltage Range:
200WVDC to 400WVDC
Operating Temperature:
−40°C to +105°C
Tolerance:
±20% Std.
(±10%, −10+30% Opt.)
Leakage Current:
≤.02CV or 2mA max.
Style
Standard, 2 pin
Solvent Tolerant End Seal:
Standard (≤250WVDC)

LPR
+85°C SNAP MOUNT

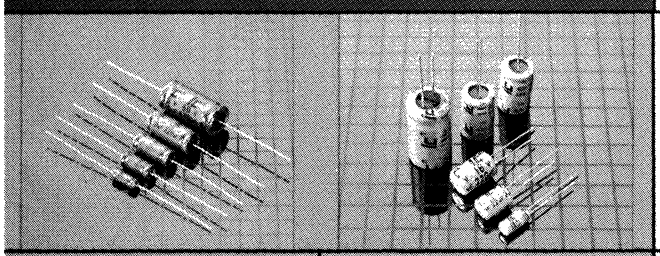
Capacitance Range:
100 Mfd to 22,000 Mfd
Voltage Range:
10 WVDC to 250 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
±20% Std.
(±10%, −10 +30% Opt.)
Leakage Current:
≤.02 CV or 2mA max.
Style:
Low Profile, 2 pin
Solvent Tolerant End Seal:
Standard

LUG
+85°C SNAP MOUNT

Capacitance Range:
100 Mfd to 15,000 Mfd
Voltage Range:
10 WVDC to 450 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
±20% Std.
(±10%, −10 +30% Opt.)
Leakage Current:
≤.02 CV or 2mA max.
Style:
Standard, 2 pin
Solvent Tolerant End Seal:
Standard (≤250 WV)

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ALUMINUM ELECTROLYTIC CAPACITORS



BPA

+85°C NON POLAR

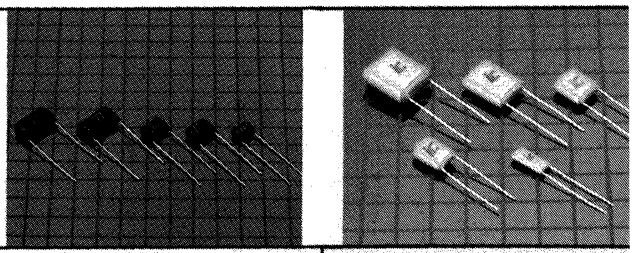
Capacitance Range:
.47 Mfd to 1,000 Mfd
Voltage Range:
16 WVDC to 100 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
±20% Std.
(±10% Opt.)
Leakage Current:
≤.03 CV or 3μA minimum
Style:
Axial Lead
Epoxy End Seal:
Optional
Tape & Reel/ Available

BPS

+85°C NON POLAR

Capacitance Range:
.47 Mfd to 1,000 Mfd
Voltage Range:
10 WVDC to 100 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
±20% Std.
(±10% Opt.)
Leakage Current:
≤.03 CV or 3μA minimum
Style:
Radial Lead
Epoxy End Seal:
Optional
Tape & Reel/Ammo Pack:
Available

FILM CAPACITORS



FFR

FILM/FOIL POLYESTER

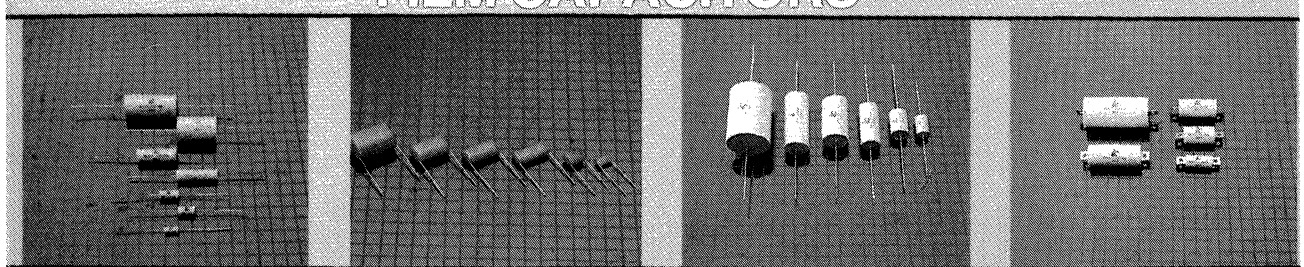
Capacitance Range:
.001 Mfd to .22 Mfd
Voltage Range:
100 WDVC
Tolerance:
±10% Std.
(±5% Opt.)
Operating Temperature:
−55°C to +125°C
Style:
Radial Lead
Construction:
Flame Retardant Epoxy
Extended Foil
Non-Inductively Wound
Tape & Reel/Ammo Pack:
Available

UMR

FILM/FOIL POLYESTER

Capacitance Range:
.001 Mfd to .47 Mfd
Voltage Range:
100 WVDC
Tolerance:
±10% Std.
±5% Std.
Operating Temperature:
−55°C to +85°C
Style:
Radial Lead
Construction:
Epoxy
Inductively Wound
Tape & Reel/Ammo Pack:
Available

FILM CAPACITORS



MPW

METALLIZED POLYPROPYLENE

Capacitance Range:
.001 Mfd to 10 Mfd
Voltage Range:
160 WVDC to 630 WVDC
Tolerance:
±10% Std.
(±5, ±2, ±1% Opt.)
Operating Temperature:
−55°C to +100°C
Style:
Axial Lead, Round
Construction:
Wrap & Filled
Self-Healing, Extended Foil
Non-Inductively Wound
Low ESR, Low ESL
Tape & Reel/ Available

MPR

METALLIZED POLYPROPYLENE

Capacitance Range:
.01 Mfd to 2.2 Mfd
Voltage Range:
250 WVDC to 630 WVDC
Tolerance:
±10% Std.
(±5% Opt.)
Operating Temperature:
−55°C to +100°C
Style:
Radial Lead
Construction:
Flame Retardant Epoxy
Self-Healing, Extended Foil
Non-Inductively Wound
Low ESR, Low ESL
Tape & Reel/Ammo Pack:
Available

MPH

METALLIZED POLYPROPYLENE

Capacitance Range:
1.0 Mfd to 30 Mfd
Voltage Range:
100 WVDC to 400 WVDC
Tolerance:
±10% Std.
(±5% Opt.)
Operating Temperature:
−55°C to +105°C
Style:
Axial Lead, Round
Construction:
Flame Retardant Tape &
Epoxy End Filled
High Current, High Frequency
Self-Healing, Extended Foil
Non-Inductively Wound
Low ESR, Low ESL
Meets MIL 55514

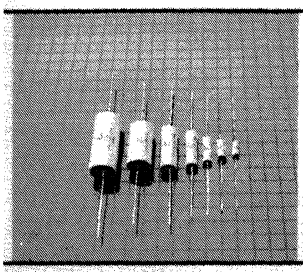
MPL

METALLIZED POLYPROPYLENE

Capacitance Range:
1.0 Mfd to 30 Mfd
Voltage Range:
100 WVDC to 400 WVDC
Tolerance:
±10% Std.
(±5% Opt.)
Operating Temperature:
−55°C to +105°C
Style:
Lug Terminal, Round
Construction:
Flame Retardant Tape &
Epoxy End Filled
Self-Healing, Extended Foil
Non-Inductively Wound
High Current, High Frequency
Low ESR, Low ESL
Meets MIL 55514

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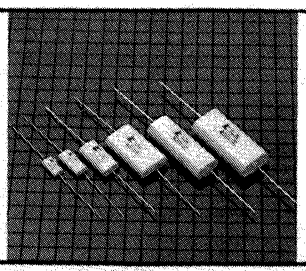
FILM CAPACITORS



MWR

METALLIZED POLYESTER

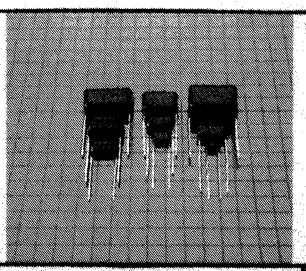
Capacitance Range:
.001 Mfd to 22 Mfd
Voltage Range:
63 WVDC to 1,000 WVDC
Tolerance:
±10% Std.
(±5% Opt.)
Operating Temperature:
−55°C to +125°C
Style:
Axial Lead, Round
Construction:
Wrap & Filled
Self-Healing, Extended Foil
Non-Inductively Wound
Low ESR, Low ESL
Tape & Reel/ Available



MWF

METALLIZED POLYESTER

Capacitance Range:
0.1 Mfd to 18 Mfd
Voltage Range:
100 WVDC to 630 WVDC
Tolerance:
±10% Std.
(±5% Opt.)
Operating Temperature:
−55°C to +125°C
Style:
Axial Lead, Flat
Construction:
Wrap & Filled
Self-Healing, Extended Foil
Non-Inductively Wound
Low ESR, Low ESL

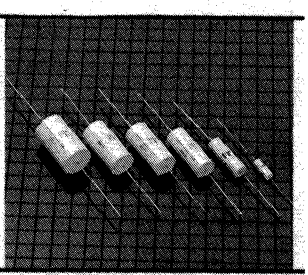


MSR

METALLIZED POLYESTER

Capacitance Range:
.01 Mfd to 10 Mfd
Voltage Range:
100 WVDC to 1,000 WVDC
Tolerance:
±10% Std.
(±5% Opt.)
Operating Temperature:
−55°C to +125°C
Style:
Radial Lead
Construction:
Flame Retardant Epoxy
Self-Healing, Extended Foil
Non-Inductively Wound

Tape & Reel/ Available

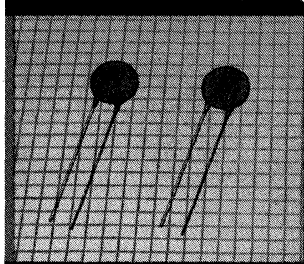


MCW

METALLIZED POLYCARBONATE

Capacitance Range:
.001 Mfd to 22 Mfd
Voltage Range:
63 WVDC to 400 WVDC
Tolerance:
±10% Std.
(±1, ±2, ±5% Opt.)
Operating Temperature:
−55°C to +125°C
Style:
Axial Lead, Round
Construction:
Wrap & Filled
Self-Healing, Extended Foil
Non-Inductively Wound
Low ESR, Low ESL
Tape & Reel/ Available

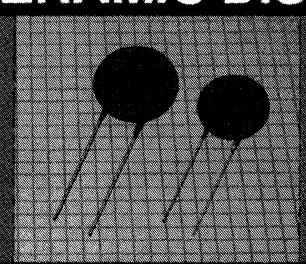
CERAMIC DISC CAPACITORS



SCR

TEMPERATURE STABLE

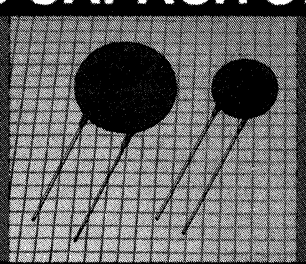
Capacitance Range:
1 pfd to 680 pfd
Rated Voltage:
50 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
≤10 pfd: ±0.5 pf (D) Std.
≥12 pfd: ±10% (K) Std.
Temperature Characteristics:
Y5F
EIA RS198 Type:
Class I
Style:
Radial Lead
Construction:
Durez Phenolic



GMR

GENERAL PURPOSE

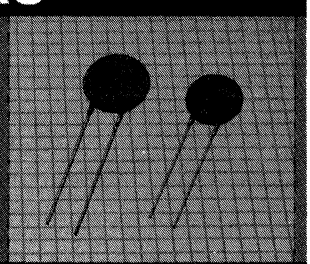
Capacitance Range:
.047 Mfd to .47 Mfd
Rated Voltage:
12 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
±20° (M) Std.
−20 +80% (Z) Std.
Temperature Characteristics:
Y5T (M), Y5V (Z)
EIA RS198 Type:
Class III
Style:
Miniature, Radial Lead
Construction
Durez Phenolic



GQR

GENERAL PURPOSE

Capacitance Range:
.001 Mfd to .01 Mfd
Rated Voltage:
500 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
−20 +80% (Z) Std.
Temperature Characteristics:
Z5V
EIA RS198 Type:
Class II
Style:
Radial Lead
Construction:
Durez Phenolic



GCR

GENERAL PURPOSE

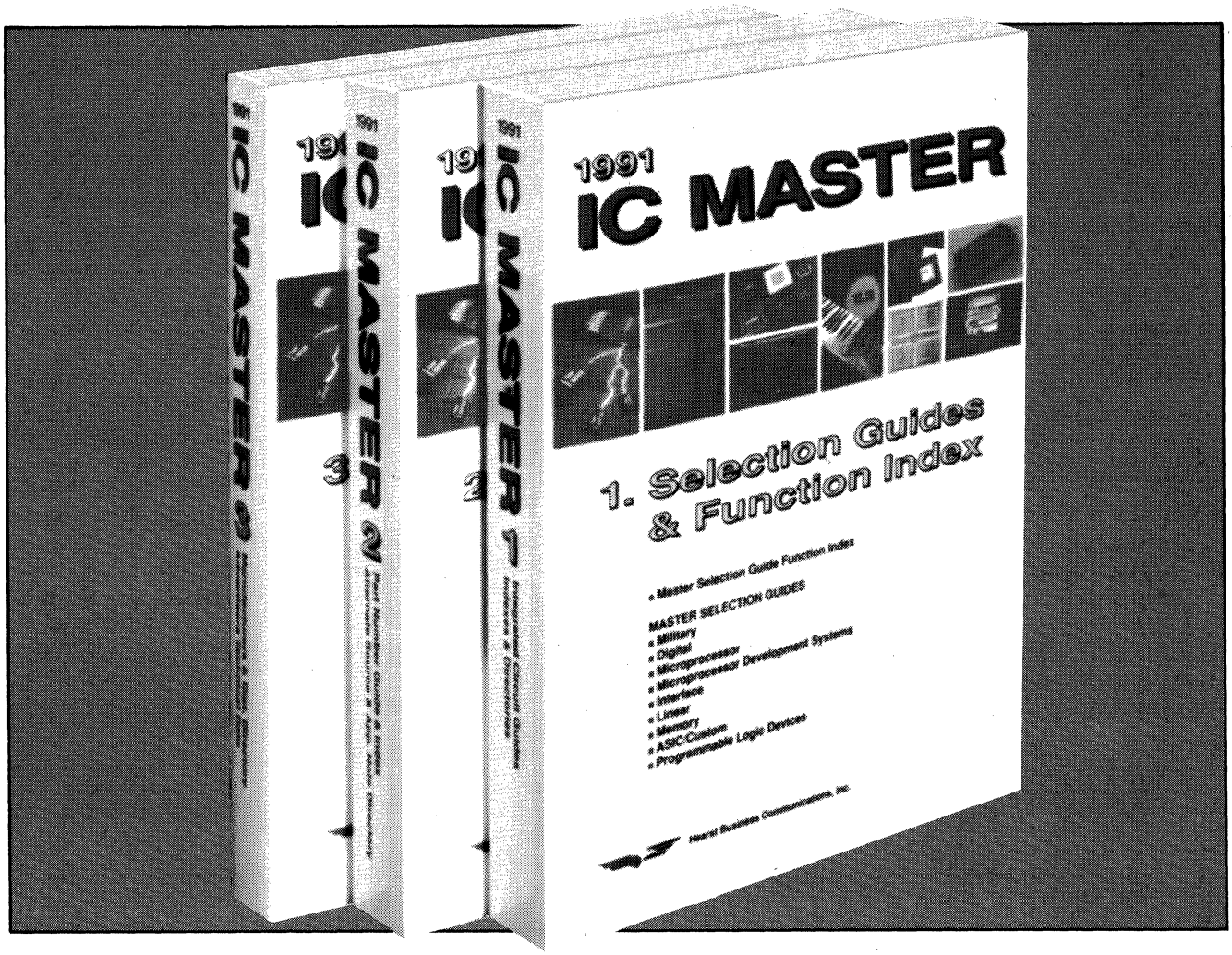
Capacitance Range:
.001 Mfd to 0.1 Mfd
Rated Voltage:
50 WVDC
Operating Temperature:
−40°C to +85°C
Tolerance:
±20% (M) Std.
−20, +80% (Z) Std.
Temperature Characteristics:
Y5T (M), Y5V (Z)
EIA RS198 Type:
Class II
Style:
Radial Lead
Construction:
Durez Phenolic

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Miniature type capacitors PCM 5 mm

	MKS 2	MKS 2-i	MKS 2-HR	MKS 22	MKS 20	MKC 2	MKP 20	MKI 2	MKI 20	FKS 2	FKC 2	FKP 2	FKI 2
Dielectric	Polyester film	Polyester film	Polyester film	Polyester film	Polyester film	Polycarbonate film	Polypropylene film	Polyphenylene-sulfid film (PPS)	Polyphenylene-sulfid film (PPS)	Polyester film	Polycarbonate film	Polypropylene film	Polyphenylene-sulfid film (PPS)
Test category in accordance with IEC	55/100/21	55/100/56	55/100/56	55/100/21	55/100/21	55/100/21	55/085/56	55/125/56	55/125/56	55/100/56	55/100/56	55/085/56	55/125/56
Temperature ranges	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +85°C	−55°C to +125°C	−55°C to +125°C	−55°C to +100°C	−55°C to +100°C	−55°C to +85°C	−55°C to +125°C
Dissipat. fact. tan δ at 1kHz and +20°C	$\leqslant 8\times10^{-3}$ >1µF : $\leqslant 10\times10^{-3}$	$\leqslant 8\times10^{-3}$	$\leqslant 8\times10^{-3}$	$\leqslant 8\times10^{-3}$	$\leqslant 8\times10^{-3}$	$\leqslant 3\times10^{-3}$	$\leqslant 0.5\times10^{-3}$	$\leqslant 15\times10^{-4}$ >0.1µF : $\leqslant 20\times10^{-4}$	$\leqslant 15\times10^{-4}$	$\leqslant 7\times10^{-3}$	$\leqslant 2\times10^{-3}$	$\leqslant 3\times10^{-4}$ >1000µF : $\leqslant 4\times10^{-4}$	$\leqslant 15\times10^{-4}$
Insulation resistance at +20°C†	$\geqslant 5\times10^{3}$ MΩ >0.33 : $\geqslant$1000 s	$\geqslant 1.5\times10^{4}$ MΩ >0.33 : $\geqslant$5000 s	$\geqslant 2\times10^{4}$ MΩ >0.33 : $\geqslant$6000 s	$\geqslant 3.75\times10^{3}$ MΩ >0.33 : $\geqslant$1250 s	$\geqslant 1.5\times10^{4}$ MΩ	$\geqslant 3.75\times10^{3}$ MΩ >0.33 : $\geqslant$1250 s	$\geqslant 3\times10^{4}$ MΩ	$\geqslant 1\times10^{4}$ MΩ >0.47 : $\geqslant$3000 s	$\geqslant 1.5\times10^{4}$ MΩ	$\geqslant 3\times10^{4}$ MΩ	$\geqslant 5\times10^{5}$ MΩ	$\geqslant 5\times10^{5}$ MΩ	$\geqslant 5\times10^{4}$ MΩ
Voltage ranges	50VDC 63VDC 100VDC 250VDC 400VDC	63VDC 100VDC 250VDC 400VDC	63VDC 100VDC 250VDC 400VDC	50VDC 63VDC 100VDC	63VDC 100VDC	63VDC 100VDC	100VDC 250VDC	63VDC	63VDC	100VDC 250VDC 400VDC	100VDC 250VDC 400VDC	63VDC 100VDC 250VDC 400VDC	100VDC
100 pF													
220 pF													
↓													
680 pF											5 5		
1000 pF													
1500 pF											5	5 5 5	5
2200 pF				5	5					5 5 5			
3300 pF													
4700 pF													
6800 pF													
0.01 µF												5	
0.015 µF									NEW				
0.022 µF	5 5	5 5	5 5	5	5		5	5					
0.033 µF													
0.047 µF						5	5		5				
0.068 µF													
0.1 µF	5	5 5	5 5			5	NEW						
0.15 µF													
0.22 µF	5			5			NEW						
0.33 µF													
0.47 µF	5 *												
0.68 µF													
1.0 µF	*												
1.5 µF	*												
2.2 µF	*												
3.3 µF	*												
4.7 µF	5*												
6.8 µF	NEW												
Capacitance tolerances	±20% ±10% ±5% (±5%*)	±20% ±10% ±5%	±20% ±10% ±5%	±20% ±10% (±5%*)	±20% ±10% (±5%*)	±20% ±10% ±5%	±20% ±10% (±5%*)	±20% (other tolerances*)	±20% ±10%	±20% ±10% ±5%	±20% ±10% ±5% ±2.5%	±10% ±5% ±2.5% (±1%*)	±20% ±10% (±5%*)

Capacitances

† The insulation resistance data refers to the lowest rated voltage of each range. Further details concerning higher rated voltages see general catalogue.

* Closer tolerances are available subject to special enquiry.

	SMD-capacitors	PCM 2.5 mm metallized				PCM 7.5 mm			Radio interference suppression capacitors in accordance with VDE 0565-1					
	MKS 01-SMD	MKS 02	MKS 022	MKC 02	FKC 02	MKS 3	MKS 33	MKC 3	MKS 5-R	MP 3-Y	MP 30-Y	MP 3-X1	MP 3-X2	MP 380
Dielectric	Polyester film	Polyester film	Polyester film	Polycarbonate film	Polycarbonate film	Polyester film	Polyester film	Polycarbonate film	Polyester film	Paper, resin impregnated				
Test category in accordance with IEC	SMD 5.7 : 55/100/21 SMD 7.3 : 55/100/56	55/100/21	55/100/21	55/100/21	55/100/21	55/100/21	55/100/21	55/100/21	40/085/21	40/085/21 40/110/56**	40/110/56	40/110/56	40/085/56 40/110/56**	40/110/56
Temperature ranges	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−40°C to +85°C	−40°C to + 85°C −40°C to +110°C**	−40°C to +110°C	−40°C to +110°C	−40°C to + 85°C −40°C to +110°C**	−40°C to +110°C
Dissipat. fact. tan δ at 1kHz and +20°C	$\leqslant 8\times10^{-3}$	$\leqslant 8\times10^{-3}$	$\leqslant 8\times10^{-3}$	$\leqslant 3\times10^{-3}$	$\leqslant 2\times10^{-3}$	$\leqslant 8\times10^{-3}$	$\leqslant 8\times10^{-3}$	$\leqslant 3\times10^{-3}$	$\leqslant 8\times10^{-3}$	$\leqslant 13\times10^{-3}$	$\leqslant 13\times10^{-3}$	$\leqslant 13\times10^{-3}$	$\leqslant 13\times10^{-3}$	$\leqslant 13\times10^{-3}$
Insulation resistance at +20°C†	$\geqslant 3.75\times10^{3}$ MΩ >0.33 : $\geqslant 1250$ s	$\geqslant 3.75\times10^{3}$ MΩ >0.33 : $\geqslant 1250$ s	$\geqslant 3.75\times10^{3}$ MΩ	$\geqslant 3.75\times10^{3}$ MΩ	$\geqslant 5\times10^{6}$ MΩ	$\geqslant 1\times10^{4}$ MΩ >0.33 : $\geqslant 1500$ s	$\geqslant 3.75\times10^{3}$ MΩ	$\geqslant 3.75\times10^{3}$ MΩ >0.33 : $\geqslant 1250$ s	$\geqslant 1.5\times10^{4}$ MΩ >0.33 : $\geqslant 5000$ s	$\geqslant 12\times10^{3}$ MΩ	$\geqslant 12\times10^{3}$ MΩ	$\geqslant 12\times10^{3}$ MΩ	$\geqslant 6\times10^{3}$ MΩ >0.47 : $\geqslant 2000$ s	$\geqslant 12\times10^{3}$ MΩ
Voltage ranges	50 VDC, 50 VDC	50 VDC, 63 VDC, 100 VDC	50 VDC, 63 VDC	63 VDC	100 VDC	50 VDC, 63 VDC, 100 VDC, 250 VDC	63 VDC, 100 VDC, 250 VDC, 400 VDC, 630 VDC	100 VDC, 250 VDC	250 VAC, 300 VAC	250 VAC	250 VAC	300 VAC	250 VAC, 275 VAC	440 VAC
Capacitances 100 pF														
220 pF														
↓ 680 pF	SMD 5.7													
1000 pF					2.5		7.5			10		10	10	10
1500 pF														
2200 pF		2.5	2.5				7.5				15			
3300 pF														
4700 pF	SMD 7.3													
6800 pF														
0.01 µF		2.5			NEW		7.5			15		15		15
0.015 µF														
0.022 µF			2.5	2.5		7.5	7.5	7.5					15	
0.033 µF													15	
0.047 µF									15 15		22.5			22.5
0.068 µF														
0.1 µF				NEW		7.5					27.5	22.5		27.5
0.15 µF														
0.22 µF		2.5				7.5		7.5	22.5 22.5			27.5	22.5 22.5	
0.33 µF														
0.47 µF						7.5			27.5 27.5				27.5 27.5	
0.68 µF														
1.0 µF		NEW				7.5								
1.5 µF														
2.2 µF									37.5 37.5 NEW					
3.3 µF														
4.7 µF														
6.8 µF														
10 µF														
15 µF														
22 µF														
Capacitance tolerances	±20% (other tolerances*)	±20%±10% (±5%)	±20% (other tolerances*)	±20%±10% ±5%	±20%±10% ±5%	±20%±10% ±5%	±20%±10%±5%	±20%±10% ±5%	±20%±10%	±20%	±20%	±20%	±20%	±20%

† The insulation resistance data refers to the lowest rated voltage of each range. Further details concerning higher rated voltages see general catalogue.

* Closer tolerances are available subject to special enquiry.

** These data are only valid for VDE, SEMKO and CSA.

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	MKS 4	MKC 4	MKC 4-SV21	MKP 4	MKS 10	MKC 10	MKP 10	MKI 10	FKP 1	FKI 1	FKS 3	FKC 3	FKP 3
Dielectric	Polyester film	Polycarbonate film	Polycarbonate film	Polypropylene film	Polyester film	Polycarbonate film	Polypropylene film	Polyphenylene-sulfid film (PPS)	Polypropylene film	Polyphenylene-sulfid film (PPS)	Polyester film	Polycarbonate film	Polypropylene film
Test category in accordance with IEC	55/100/56	55/100/56	55/100/56	55/085/56	55/100/56	55/100/56	55/085/56	55/125/56	55/085/56	55/125/56	55/100/56	55/100/56	55/085/56
Temperature ranges	−55° to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +85°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +125°C	−55°C to +100°C	−55°C to +125°C	−55°C to +100°C	−55°C to +100°C	−55°C to +85°C
Dissipat. fact. tan δ at 1kHz and +20°C	⩽8×10-3 >1µF: ⩽10×10-3	⩽3×10-3	⩽3×10-3	⩽1×10-3	⩽6×10-3 >1µF: ⩽8×10-3	⩽2×10-3 >1µF: ⩽4×10-3	⩽3×10-4	⩽12×10-4 >1µF: ⩽15×10-4	⩽3×10-4	⩽12×10-4	⩽8×10-3	⩽2×10-3	⩽4×10-4
Insulation resistance at +20°C†	⩾1.5×10 4 MΩ >0.33 : ⩾5000 s	⩾1.5×10 4 MΩ >0.33 : ⩾5000 s	⩾1.5×10 4 MΩ >0.33 : ⩾5000 s	⩾1×10 5 MΩ >0.33 : ⩾30000 s	⩾1.5×10 4 MΩ >0.33 : ⩾5000 s	⩾3×10 4 MΩ >0.33 : ⩾10000 s	⩾1×10 5 MΩ >0.33 : ⩾30000 s	⩾1.5×10 4 MΩ >0.33 : ⩾5000 s	⩾1×10 5 MΩ >0.1 : ⩾10000 s	⩾5×10 4 MΩ	⩾3×10 4 MΩ	⩾5×10 5 MΩ	⩾5×10 5 MΩ
Voltage ranges	63VDC 100VDC 160VDC 250VDC 400VDC 630VDC 1000VDC 1500VDC	63VDC 100VDC 250VDC 400VDC	100VDC 250VDC	160VDC 250VDC 400VDC 630VDC	63VDC 100VDC 250VDC	250VDC 400VDC 630VDC 1000VDC	160VDC 250VDC 400VDC 630VDC 1000VDC 1600VDC 2000VDC	250VDC 400VDC	400VDC 630VDC 1000VDC 1250VDC 1600VDC 2000VDC	1600VDC	100VDC 160VDC 250VDC 400VDC 630VDC 1000VDC	100VDC 160VDC 250VDC 400VDC 630VDC 1000VDC	100VDC 160VDC 250VDC 400VDC 630VDC 1000VDC
100 pF													
220 pF													
↓													
680 pF									15 15	15			7.5
1000 pF												10	
1500 pF											7.5 7.5		7.5
2200 pF							15		15 22.5	22.5	7.5 7.5 7.5	10 10 15	7.5 10
3300 pF													
4700 pF							15				10 10		10 10
6800 pF				15			15		15 22.5				7.5 10 15
0.01 µF				7.5		7.5	7.5 10 15	10 10	15 22.5 27.5	27.5	10	10	
0.015 µF												15	
0.022 µF	7.5 10 10 15			7.5 10	7.5	7.5 10	10 15 22.5		15 22.5 27.5	37.5	10		10 15
0.033 µF		10				15			22.5 27.5 37.5			15	
0.047 µF	15 15 22.5			7.5 10	7.5	10 15 22.5	10 15 22.5 27.5 37.5	15 15	22.5 27.5 37.5		10	15 15	15
0.068 µF		10 15											
0.1 µF	7.5 10 15 22.5 27.5	7.5		10 15 15	7.5 10 15	15 22.5 27.5	15 15 27.5 37.5		27.5 37.5				15
0.15 µF		10 15 22.5											
0.22 µF	10 15 22.5 27.5	10 15 22.5	15	15 22.5	10 15	22.5 27.5	22.5 37.5	22.5 22.5					
0.33 µF													
0.47 µF	7.5 10 15 22.5 27.5	15 22.5	15 22.5	15 22.5	22.5	22.5 27.5	22.5 27.5 37.5						
0.68 µF													
1.0 µF	27.5	15 27.5		22.5 27.5 27.5	22.5 27.5	27.5	27.5 27.5 37.5	27.5 27.5					
1.5 µF													
2.2 µF	15 22.5 22.5 27.5	22.5 27.5	22.5 27.5	27.5 37.5 37.5	27.5		37.5 37.5						
3.3 µF													
4.7 µF	22.5 27.5	22.5 27.5	27.5	27.5 37.5									
6.8 µF													
10 µF	27.5	27.5		37.5									
15 µF													
22 µF													
Capacitance tolerances	±20%±10% ±5%	±20%±10% ±5%	±20%±10% ±5%	±20%±10% ±5%	±20%±10% ±5%	±20%±10% ±5%	±20%±10% ±5%	±20%±10% (other tolerances*)	±20%±10%±5% (other tolerances*)	±20%±10% (other tolerances*)	±20%±10% ±5%	±20%±10% ±5%	±20%±10% ±5%

Capacitances

The figures in the tables of capacitances refer to the PCM= Printed Circuit Module (lead spacing) at the lead exit points

Capacitors with axial leads
WIMA MKB 3/MKB 5 and MKB 6 are in our general catalogue April 1991 edition, pages 54 and 55.

† The insulation resistance data refers to the lowest rated voltage of each range. Further details concerning higher rated voltages see general catalogue.

* Closer tolerances are available subject to special enquiry.

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FILM CAPACITORS

Dielectric	Series	Capacitance Range	Voltage Range	Construction & Features
Polystyrene	KSP	100PF to 56000PF	63V to 160VDC	Radial, Molded Box, 5mm to 25mmLS
Polystyrene	KSC	33PF to 0.82uF	63V to 1000VDC	Axial, Epoxy
Polyester	KFU	1000PF to 1.0uF	100V to 1000VDC	Radial, Molded Box, 10mm to 27.5mmLS
Metallized Polyester	KEU	1000PF to 1.0uF 1000PF to 1.0uF 1000PF to 22.0uF 0.01uF to 10.0uF 1000PF to 0.47uF	50V to 400VDC 63V to 630VDC 63V to 1000VDC 63V to 1000VDC 50V	Radial, Molded Box, 5mmLS, Available on T/R Radial, Molded Box, 7.5mmLS, Available on T/R Radial, Molded Box, 10mm to 27.5mmLS Axial, Wrap and Fill Chip, Available on T/R
Polycarbonate	KKU	100PF to 0.1uF	160V to 400VDC	Radial, Molded Box, 10mm to 22.5mmLS
Metallized Polycarbonate	KCU	0.01uF to 4.7uF 0.01uF to 10.0uF	100V to 630VDC 100V to 630VDC	Radial, Molded Box 10mm to 27.5mmLS Axial, Wrap and Fill
Polypropylene	KLP	100PF to 68000PF	63V to 100VDC	Radial, Molded Box, 5mm to 10mmLS
Polypropylene	KLI	2200PF to 0.22uF 1000PF to 0.22uF	630V to 1500VDC 630V to 1500VDC	Radial, Molded Box, 22.5mm to 37.5mmLS Radial, Molded Box, 15mm to 37.5mmLS
Metallized Polypropylene	KNI	0.01uF to 2.7uF	250V to 400VDC	Radial, Molded Box, 10mm to 37.5mmLS
Metallized Polypropylene	KNP	8000PF to .51uF	63V to 250VDC	Radial, Molded Box, 5mm to 10mmLS
Metallized Polypropylene	KNU	2200PF to 2.7uF	400V to 1500VDC	Radial, Molded Box, 15mm to 27.5mmLS

RADIO INTERFERENCE SUPPRESSION CAPACITORS

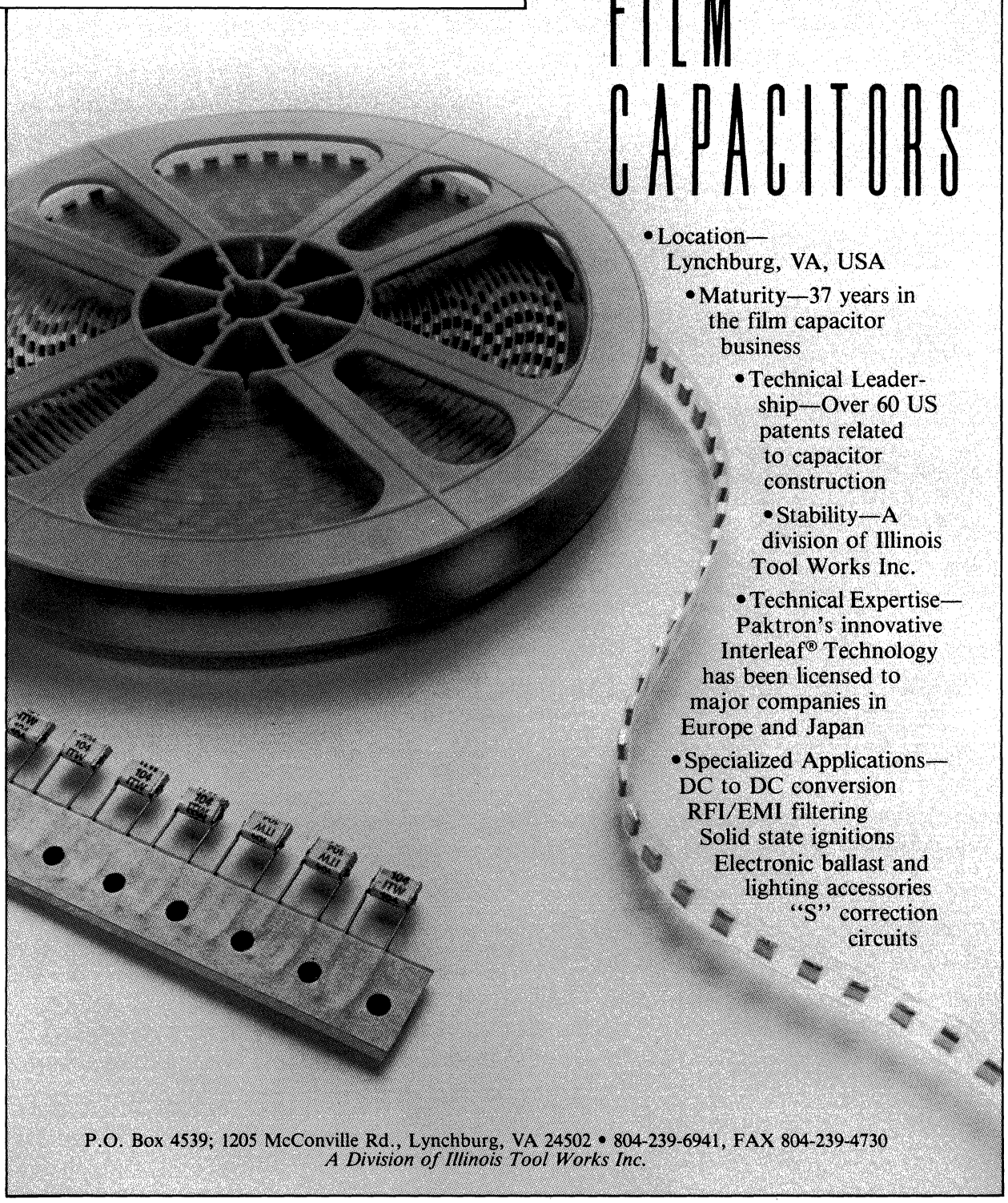
Dielectric	Series	Capacitance	Voltage	Construction & Features	Approvals
Y Class					
Polypropylene Film Metallized	KNB2520	1000PF to 22000PF	250VAC	Radial, Molded Box, 10mm to 15mmLS, available with PVC insulation and/or stranded wire leads as well as solid wire	VDE, OVE, SEMKO, DEMKO, FI, UL, NEMKO, CSA, SEV
X1 Class					
Paper Impregnated Metallized	KPB2300	.01uF to .22uF	250VAC	Radial, Round Molded Case, stranded wire leads with PVC insulation or solid wire with PVC	VDE, OVE, SEV, NEMKO, SEMKO, DEMKO, FI
Polypropylene Film Metallized	KNB1540	2200PF to 0.47uF	250VAC	Radial, Molded Box, 15mm to 27.5mmLS, available with PVC insulation and/or stranded wire as well as solid wire	SEV, UL, CSA, SEMKO, NEMKO, DEMKO, FI Pending: VDE, OVE
X2 Class					
Polypropylene Film Metallized	KNB1520	.01uF to 1.0uF	250VAC	Radial, Molded Box, 15mm to 37.5mmLS, available with PVC insulation and/or stranded wire leads as well as solid wire	VDE, SEV, SEMKO, UL, DEMKO, FEMKO
Polypropylene Film Metallized	KNB1530	.015uF to 2.2uF	250VAC	Radial, Molded Box, 15mm to 37.5mmLS, available with PVC insulation and/or stranded wire leads as well as solid wire	VDE, OVE, SEMKO, NEMKO, DEMKO, FI, UL, CSA, SEV
Polyester Film Metallized	KEB1520	.01uF to 1.5uF	250VAC	Radial, Molded Box, 15mm to 37.5mmLS, available with PVC insulation and/or stranded wire leads as well as solid wire	VDE, SEV, SEMKO, FI, DEMKO, NEMKO, UL
X1Y Class (2Y+1X)					
Paper Impregnated Metallized	KPB7300	X .022uF to 0.47uF Y 2700PF to 27000PF	250VAC	Round Molded Case, 3 leads, either solid wire or stranded, w/or without PVC	VDE, OVE, SEV, SEMKO, NEMKO, DEMKO, FI

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- Technical Leadership—Over 60 US patents related to capacitor construction
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- Technical Expertise—Paktron's innovative Interleaf® Technology has been licensed to major companies in Europe and Japan
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  RFI/EMI filtering
  Solid state ignitions
  Electronic ballast and lighting accessories
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RA



- Multilayer metallized polyester
- .001 to 4.7 MFD
- ± 5, 10, 20%
- 50 to 400 VDC
- Full voltage to 125 °C
- 5, 7.5, 10, 15mm lead spacing
- Smallest film construction available

ST PPS



- Surface mount film
- Multilayer metallized polyester or PPS
- Reflow solderable to 230 °C—ST
- Reflow and wave solderable to 260 °C—PPS
- 25 VDC—PPS
- 50 VDC—ST
- 1812, 2225, 2824, 3827 EIA sizes
- .01 to .47 MFD—PPS
- .01 to 2.2 MFD—ST

CS



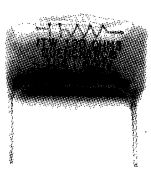
- Multilayer metallized polyester
- 1.0 to 25.0 MFD
- 50 to 250 VDC
- Excellent CV
- Compact footprint on 10mm lead spacing
- Ideal for frequencies 1 KHZ to 1 MHZ
- Very low ESR and ESL
- High ripple current

PC



- Multilayer metallized polycarbonate
- 5mm lead spacing
- .01 to .47 MFD
- 50 VDC
- ± 1, 2, 5, 10%
- Flame retardant coating
- Miniature size

Q



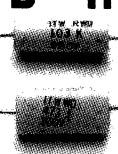
- Quencharc® capacitor
- Metallized polyester R/C snubber network
- .1, .25, .50, 1.0 MFD
- 50 to 600 VDC, 125 to 250 VAC
- ½, 1, 2 watt carbon comp. series resistor
- U.L. recognized version available
- Flame retardant coating
- Snubber network
- ARC suppression
- Transient suppression

PP



- Polypropylene/foil
- 100 pf to .15 MFD
- ± 1, 2, 2½, 5, 10%
- 100 to 600 VDC
- Sealed polypropylene case
- "The 1% solution"
- Tight T.C. applications

WD RWD



- Metallized polycarbonate
- WD—oval
- RWD—round
- .01 to 25.0 MFD
- ± 2, 5, 10%
- 50 to 250 VDC
- Flame retardant case
- Full voltage to 125 °C

PA



- Polypropylene/foil
- .0033 to .47 MFD
- ± 2, 5, 10, 20%
- 200 to 1600 VDC
- Flame retardant coating
- High pulse applications

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MINIGLOSSARY BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\ K\ A}{t_D}$

Metric: $C = \frac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\ CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \left(\frac{T_t}{T_O}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{---} + \frac{1}{C_N}$

Two: $C_T = \frac{C_1 C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{---} + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	$\times 10^{-12}$
Nano	$\times 10^{-9}$
Micro	$\times 10^{-6}$
Milli	$\times 10^{-3}$
Deci	$\times 10^{-1}$
Deca	$\times 10$
Kilo	$\times 10^{3}$
Mega	$\times 10^{6}$
Giga	$\times 10^{9}$
Tera	$\times 10^{12}$

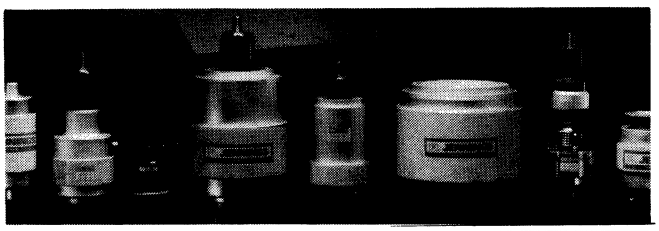
Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

JENNINGS VACUUM/GAS CAPACITORS

Jennings offers over 400 high voltage vacuum capacitors in various models, capacitance values, voltage and current ratings for radio frequency applications. Units are available in both glass and ceramic envelopes. Working voltage ratings are from 2 to 36 KV, at capacitance values to 5000 pfd, and with current ranges to 420 amps RMS (air-cooled) and 1,000 amps (water cooled) — depending upon capacity, frequency, and working voltage.

The examples described represent our most requested models. Please write or call for our comprehensive capacitor catalog that details our complete line.



VACUUM FIXED CAPACITORS

Peak Voltage Kilovolts				Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)	Type	Capacity pF	Amperes[2] (Max.)	Length	Diameter
12	7	CFDS	1000	95	4.6	3.6
15	9	CFDP	1500, 2000	200	3.3	5.6
15	9	CFED	5000	250	13.0	8.2
25	15	CFED	500, 750, 1000	180	3.8	4.6
30	18	CY	1, 2, 3, 5	12	3.3	0.8
30	20	CLF1	150, 200, 250	100	6.5	2.6
30	18	CFED	150, 300	140	3.6	3.4
30	18	CFFM	2500	400	5.8	8.2
35	25	CLF1	6, 12, 25, 50, 75, 100	85	6.5	2.3
35	21	CFFP	2000	360	5.8	8.2
50	30	CFHP	1000	350	6.2	7.2
55	33	CFHP	450	300	5.5	5.6
60	36	CFHD	12, 25, 50, 100, 200, 300	240	5.4	4.6

GAS FIXED CAPACITORS

Peak Voltage Kilovolts					Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF + DC	RF Working [1] Peak	Type	Capacity pF	Amperes[2] (Max.)	Length	Diameter
20	18	12	CGF1-1000	1000	215	3.5	4.8
35	30	20	CGF2-1000	1000	270	4.0	6.0
50	40	25	CGF2-500	500	240	5.5	5.7

VACUUM VARIABLE CAPACITORS

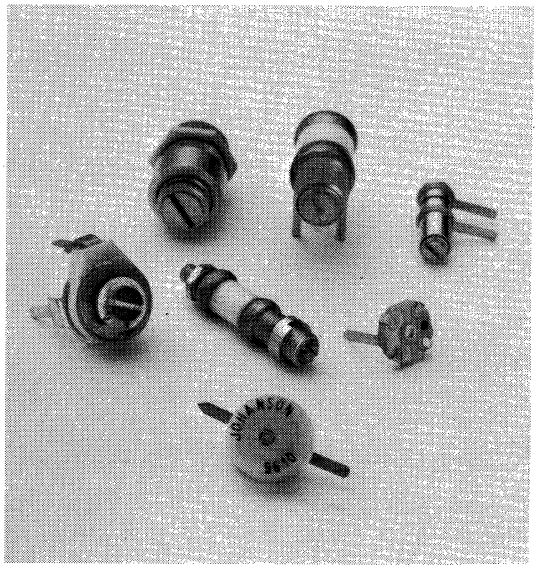
Peak Voltage Kilovolts				Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)	Type	Capacity pF	Amperes[2] (Max.)	Length	Diameter
5	3	CACA[4]	5-125	22	4.2	1.3
5	3	CSV1	5-500	45	5.8	2.4
5	5	CMV2	6-500	38	4.7	1.8
5	3	CVCJ	7-1000	70	7.6	3.1
3	3	CMV1	8-1000	40	4.3	1.8
5	3	CVCD	10-1500, 20-2000, 50-3000	100	8.3	4.6
5	5	CMV1	25-4000	70	6.6	3.2
15	9	CADD[4]	3-30	20	4.1	1.3
15	9	CVDD	6.5-50, 10-100	65	6.6	2.4
15	9	CVDD	10-300, 20-500	95	7.5	3.4
15	9	CSVF[4]	12-500	65	7.9	3.5
15	9	CVDD	25-750, 25-1000	150	8.0	4.6
15	9	CVDP	35-1500, 50-2300	160	9.8	5.6
15	9	CVEP	100-2000	200	10.2	7.2
15	9	CVED	100-5000	200	21.3	9.3
20	12	CVEP	25-500, 50-1000, 100-1500	210	10.2	7.2
30	18	CVFNP[5]	10-50	20	5.1	4.0
35	21	CVFP	100-1500, 100-2000	220	14.5	8.2
40	24	CVFP	15-250, 25-450	170	9.6	5.6
40	24	CVFP	20-750, 35-1000	225	11.7	7.2
40	24	CWV2	100-1600 (water cooled)	790	25.0	8.6
50	30	CWV2	25-450, 30-650 (water cooled)	840	17.9	7.6
50	30	CVHP	60-1000	250	14.5	8.0
50	30	CWV1	100-1000 (water cooled)	840	21.6	8.6
55	33	CVHP	10-250, 25-450, 30-650	240	11.9	7.2
60	36	CWV1	100-1600 (water cooled)	1000	23.0	12.6

GAS VARIABLE CAPACITORS

Peak Voltage Kilovolts				Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1]	Type	Capacity pF	Amperes[2] (Max.)	Length	Diameter
5	3	CHV1	1.5-45	18	3.5	0.9
15	9	CHV1	2.5-50	30	6.4	1.4

1 The maximum RF working voltage that can be applied over the 2-32 MHz frequency range while not exceeding the RF current rating.
2 RF current rating is dependent upon capacity, frequency and working voltage. Rating shown is largest unit in series. Write for complete applications data.
3 Dimensions of largest unit in a series. Available with metric thread mounting – on request.
4 Non-magnetic version available.
5 Neutralizing Capacitor.

JENNINGS 970 McLaughlin Ave., San Jose, CA 95122
(408) 292-4025



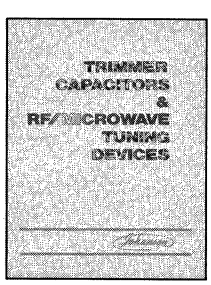
Johanson Variable Capacitors

Since 1950, the name Johanson has been synonymous with leadership in the design and manufacture of high quality variable capacitors. Our application engineers have the know-how to solve your critical application problems...we invite your inquiries.

When you specify Johanson, you are specifying the finest in variable capacitors.

ELECTRONIC ACCURACY THROUGH MECHANICAL PRECISION

Manufacturing Corporation
Rockaway Valley Road
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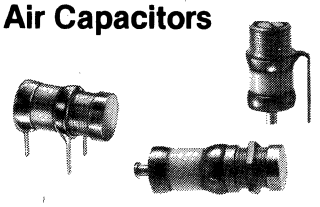


Free Catalog

Call or write for our complete catalog

from Johanson

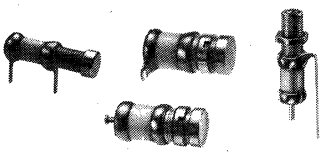
Standard Air Capacitors



- ☐ Capacitance ranges: .8-10pf to 1-30pf
- ☐ Q's to > 10,000
- ☐ Excellent tuning stability and low dynamic noise
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ Engineering prototype kit JK-500

*U.S. Patent No. Re. 30,406

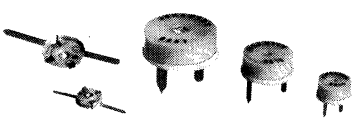
Miniature Air Capacitors



- ☐ Capacitance ranges: .35-3.5pf to .8-10pf
- ☐ Q's to > 10,000
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Ideal for miniature microwave, VHF and UHF applications
- ☐ Engineering prototype kit JK-500

*U.S. Patent No. Re. 30,406

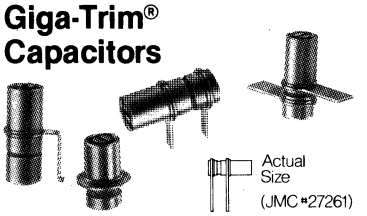
Thin-Trim® /Seal-Trim® Ceramic Capacitors



- ☐ Capacitance ranges: .2-.6pf to 20-100pf
- ☐ Q's to > 3000 at 100 MHz
- ☐ Ideal for sub-miniature hybrid circuit applications
- ☐ Seal-Trims impervious to all standard PCB cleaning solvents
- ☐ Conform to MIL-C-81 requirements
- ☐ Engineering prototype kits available

U.S. Patent No. 4,179,722

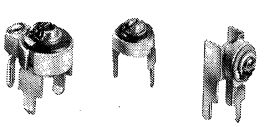
Giga-Trim® Capacitors



- ☐ Capacitance ranges: .3-1.2pf to .8-8pf
- ☐ Q's over 4000 at 250 MHz
- ☐ Ideal for microwave oscillators and filters
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ New Zero TC verisons
- ☐ Engineering prototype kit JK-272

U.S. Patent No. Re. 30,406

Variable Ceramic Capacitors



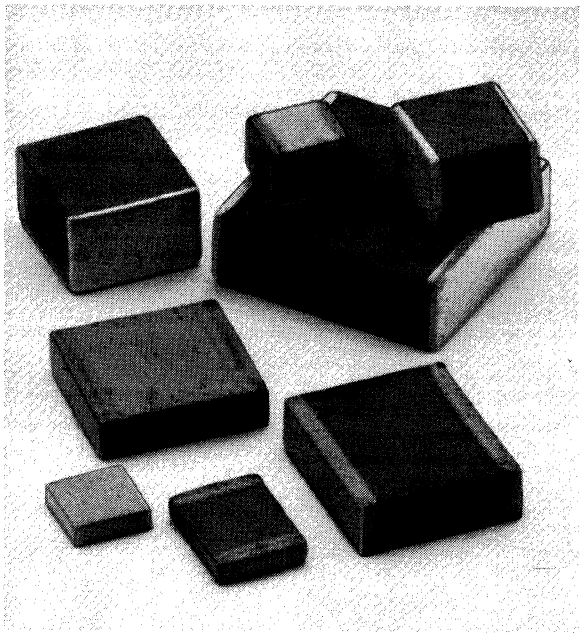
- ☐ Low cost
- ☐ Broad tuning ranges: 1.7-6pf to 6.0-70pf
- ☐ Top, side and bottom tuning styles available
- ☐ Ideal for crystal oscillators, CATV amplifiers and all varieties of test and communication equipment
- ☐ Engineering prototype kit JK-930

Microwave Tuning Elements



- ☐ Provide a unique money-saving means of introducing a variable reactance into waveguides, cavities, and other microwave structures
- ☐ High resolution
- ☐ Patented* self-locking constant torque adjustment mechanism

*U.S. Patent No. Re. 30,406



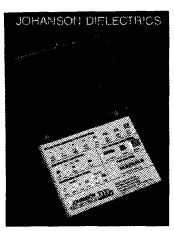
The "First Word" in Ceramic Chip Capacitors

For 25 years Johanson Dielectrics has provided an industry standard in the design and manufacture of the finest ceramic chip capacitors available.

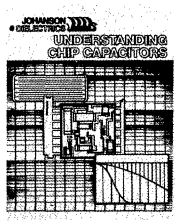
Johanson Dielectrics dedication to quality and on time delivery make them the choice of circuit designers worldwide.

JOHANSON DIELECTRICS

2220 Screenland Drive, Burbank, California 91505
TEL 818-841-8500 FAX 818-841-7261



NEW Ceramic Chip Capacitor Catalog
24 page catalog detailing a wide variety of chip types, sizes and dielectric materials.

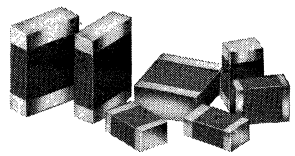


Understanding Chip Capacitors
28 pages of useful information on all phases of chip capacitor technology.

Call or write for your free copy.

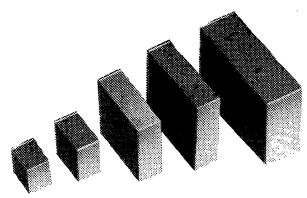
from JOHANSON DIELECTRICS

Ultra High Capacitance Chip Capacitors



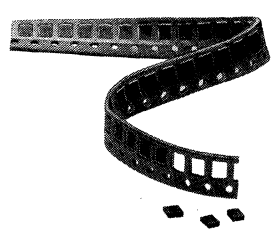
Fourteen configurations are available in four basic dielectrics: NPO/COG, BX/X7R, Z5U, and Y5V characteristics, to meet MIL-C-55681A and EIA 198B specifications. Capacitors feature high volume efficiency of capacitance, and are ideal for hybrid circuit applications.

High Voltage Chip Capacitors



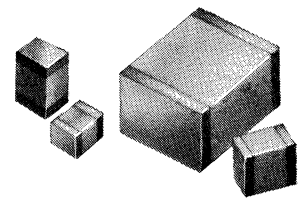
Available in either NPO/COG or BX/X7R dielectric, these units are designed to obtain high voltage values to 4000 VDCW. Typical applications include high voltage power supplies and voltage multiplier circuits.

Multilayer Ceramic Chip Capacitors on Tape & Reel



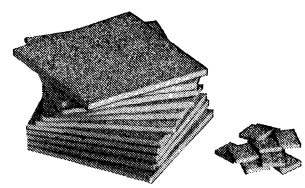
Ceramic chip capacitors designed for automatic placement on ceramic substrates on printed circuit boards in high volume surface mounted applications. Offered in three sizes R15, R18 and S41 they are suited for use with all the popular automatic placement systems. Available in 8mm tape on reel. Larger size units can be provided on 12mm tape on reel.

High Q Microwave Chip Capacitors



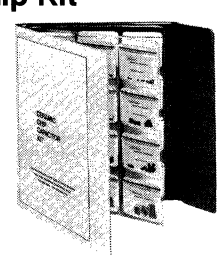
High Q microwave chip capacitors are available in four basic sizes, displaying excellent performance in the VHF, UHF and microwave ranges. The configu ration, insertion loss and resonance-free performance make these chips ideal for microstrip and hybrid MIC applications.

Ceramic Capacitor Wafers (Single Layer)



Ideally suited for micromodule and miniature hybrid integrated circuits where low profile requirements preclude the use of conventional multilayer chip capacitors. These units are used as bypass, coupling and filtering elements, (to 18GHz in microwave applications). Custom configurations are also available for high voltage applications to 15 KV.

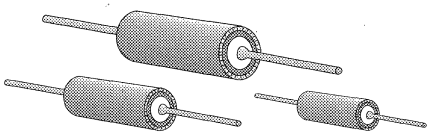
Chip Kit



Designer kits contain standard size chips in popular capacitance values and dielectric characteristics with palladium silver terminations. Kits are supplied in a special vinyl cover for convenient shelf storage with each chip value individually packaged for easy acesss. Available with NPO/COG dielectric No. S-900, BX/X7R and Y5V dielectric No. S-905 ceramic capacitor wafers (single layer) No. S-910 and High Q S-915.

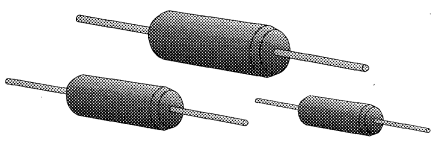
KEMET®

HERMETICALLY SEALED TANTALUM



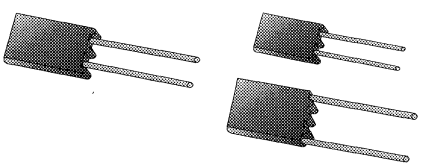
T110, **T212** (CSR13), **T222** (CSR09) **T242** (CSR23), **T252** (CSR33), **T262** (CSR21)per MIL-C-39003 also available. Cap. values from .0047-330µF; ±20%, ±10%, and ±5% tol.; 6-125VDC. 4 Case sizes. Higher CV values available in **T140** series. Ultra miniature **T222** cap. values from .0047-22µF. Available on tape and reel.

MOLDED TANTALUM



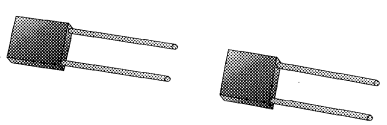
AXIAL

Miniature molded gold color epoxy. Laser marked. Low impedance at high frequencies. Cap. values from 0.1-330µF;2-50VDC. 6 Case sizes. **T323** (CX01 & CX05) per MIL-C-49137 available. Available on tape and reel.



RADIAL

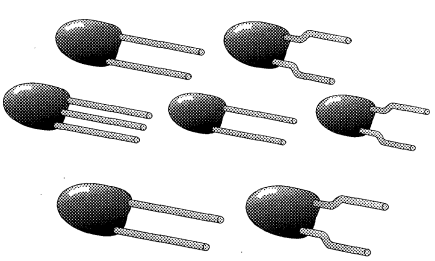
Precision molded gold color epoxy. Laser marked. Rectangular case, plus a radius on positive side of case. Capacitance values from 0.1-330µF; 6-50VDC. 6 Case sizes.



MICRONS

A complete line of micro-miniature solid tantalum capacitors. Microns consist of ultra small anode assemblies encapsulated in epoxy. Capacitance values from .68-220µF; 3-35VDC.

DIPPED TANTALUM

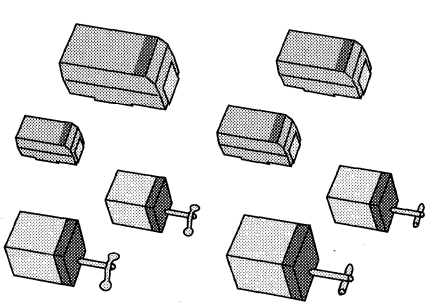


T35X 'UltraDip II " miniature dipped solid tantalum capacitors. Gold color epoxy. Laser marked. Compact design plus low DC leakage and DF. Cap. values from 0.1-680µF; 3-50VDC.12 Case sizes.

T36X Mil-C-49137 radial dipped capacitors are available in cap. values from 0.1µF-330µF; 6-50 volts.

T39X "Ultra Dip III" Three-Leaded design with anode lead in middle for "fail-safe" insertion. Cap. values from 0.1-680µF; 3-50VDC. Gold color epoxy. Laser marked. 12 Case sizes.

CHIPS TANTALUM



SOLID TANTALUM CHIP CAPACITORS

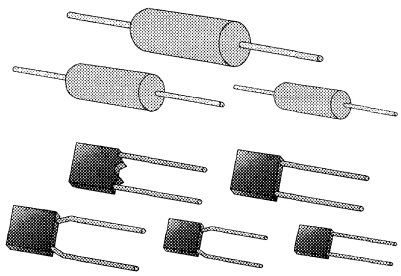
T411 and **T421** offer maximum volumetric efficiency and high temperature capability. Economical price. Capacitance values from 0.1-100µF; 4 to 50 VDC. 5 Case sizes.

T491 Molded tantalum chip capacitor mounts directly to printed circuit boards. Same world proven solid tantalum anode used in KEMET's leaded devices. Permanently attached to a solder coated lead frame. Assembly precision molded. Outstanding dimensional consistancy. Beveled case denotes polarity. Gold color epoxy. Laser marked. Cap. values from 0.1-100µF; 4 to 50VDC. Cap. tol. ±20% and ±10%. Available on 8mm and 12mm tape on 7" and 13" reels. Bulk packaging available.

KEMET *Electronics Corporation* • P. O. Box 5928 • Greenville, S. C. 29606 • 803/963-6300

KEMET®

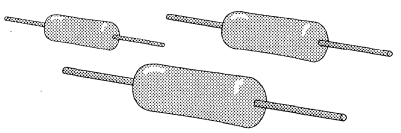
MOLDED MULTILAYER CERAMIC



AXIAL AND RADIAL

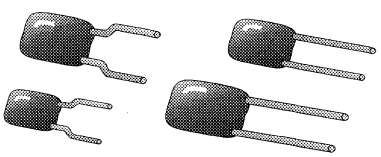
Molded gold color epoxy multilayer ceramic capacitors. Available in Ultra-stable (C0G), Stable (X7R) (Military BX or BP) or General Purpose (Z5U) temperature characteristics. Military versions conform to MIL-C-39014, MIL-C-11015, MIL-C-123 and MIL-C-20 standards. Capacitance values from 10pF-1μF; 50, 100 and 200 volts.

CONFORMALLY COATED MULTILAYER CERAMIC



AXIAL

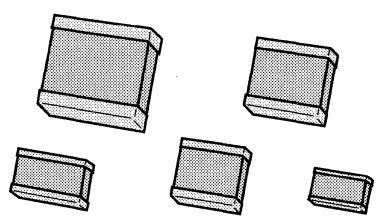
Maximum range, conformally coated capacitors. Available in C0G, X7R, and Z5U temperature characteristics. 5 Case sizes include over 138 CV values in capacitance range of 10pF-1.0μF; 50 and 100 volts. Gold color epoxy. Laser marked. Available on tape and reel.



RADIAL

Golden Max dipped multilayer ceramic capacitors. Reliable and economical. Available in C0G, X7R, or Z5U temperature characteristics. Gold color epoxy. Laser marked. Capacitance values from 1.0pF-6.8μF; 50, 100, and 200 volts. 6 Case sizes.

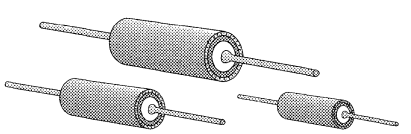
CHIPS CERAMIC



MULTILAYER CERAMIC CHIPS

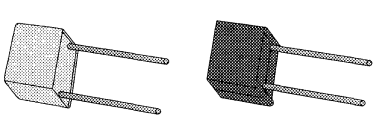
Available in NPO, X7R, or Z5U temperature characteristics. MIL-C-55681 and MIL-C-123 approved. Capacitance values from 1pF-1μF; 50, 100 and 200 volts. 9 Chip sizes. C0805 and C1206 sizes. Available in COPS (Component Placement System) 8mm or 12mm tape.

FILM



METALLIZED POLYCARBONATE

F241-F248 (CRH01-CHR10) meets MIL-C-83421 and MIL-C-39022. Designed for circuits requiring stable performance characteristics over a wide temperature range. Small size. Capacitance values from .01μF-22μF; 30 to 600 VDC. **F251** (CHS01-CHS03) meets MIL-C-87217.



FLAT KAPS

Small ultra stable film capacitors. **F310** and **F311** available to MIL-C-55514. **F110** hermetically sealed in metal cases. Capacitance values from .001μF-0.15μF; 50 volts. 6 Case sizes.

F310 - **F331** precision molded epoxy. Capacitance values from 0.001-1.0μF; 50 volts. 8 Case sizes.

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

TMC SERIES

TANTALUM CHIP CAPACITORS

KOA SPEER ELECTRONICS, INC.

TYPE TMC: *STANDARD CAPACITANCE RANGE*

STANDARD VALUES		VOLTAGE CODE	0G	0J	1A	1C	1D	1E	1V
85°C	RATED VOLTAGE (VDC)		4	7	10	16	20	25	35
	SURGE VOLTAGE (VDC)		5	9	13	20	26	32	46
125°C	DERATED VOLTAGE (VDC)		2.5	4	6.3	10	13	16	23
CAPACITANCE (u f)		CAP CODE	—	—	—	—	—	—	—
0.1		104							A
0.15		154							A
0.22		224							A
0.33		334							A
0.47		474						A	B
0.68		684					A		B
1.0		105				A		B	B
1.5		155			A			B	C
2.2		225		A			B	C	C
3.3		335	A			B	C	C	C
4.7		475			B	C	C	C	D,E
6.8		685		B	C	C	C	D,E	D,E
10		106	B	C	C	C,E	D,E	D,E	
15		156	C	C	C	D,E	D,E		
22		226	C	C	D,E	D,E			
33		336	C	D,E	D,E				
47		476	D,E	D,E					
68		686	D,E						

TYPE TMC-M: *EXTENDED CAPACITANCE RANGE*

STANDARD VALUES		VOLTAGE CODE	0G	0J	1A	1C	1D	1E	1V
85°C	RATED VOLTAGE (VDC)		4	7	10	16	20	25	35
	SURGE VOLTAGE (VDC)		5	9	13	20	26	32	46
125°C	DERATED VOLTAGE (VDC)		2.5	4	6.3	10	13	16	23
CAPACITANCE (u f)		CAP CODE	—	—	—	—	—	—	—
0.1		104							
0.15		154							
0.22		224							
0.33		334							
0.47		474							A
0.68		684						A	A
1.0		105					A	A	
1.5		155				A	A		B
2.2		225			A	A		B	
3.3		335		A	A		B		
4.7		475	A	A	A	B			
6.8		685	A	A	B				
10		106	A	B	B		C		E
15		156	B	B		C		E	
22		226	B		C		D,E		
33		336		C		D,E			
47		476	C		D,E				
68		686		D,E					
100		107	D,E	E					

FEATURES

- EPOXY MOLDED BODY, UL 94 V-O FLAMMABILITY
- EIA – U.S. AND EIA – JAPAN COMPATIBLE SIZES
- 100% BURN-IN AND END OF LINE TESTING
- EXTENDED VALUES PER CASE SIZE
- EXCELLENT HUMIDITY AND SOLDER HEAT RESISTANCE

TMC Series of molded tantalum chip capacitors offers an extensive range of values in EIA–U.S. and EIA–Japan compatible sizes. By design, strict process control, and a commitment to provide the most reliable product in the industry, the TMC has passed our customers' most severe humidity/temperature/pressure induced life stress testing. For surface mount applications, the space saving, highly reliable TMC is the most ideal tantalum chip capacitor.

Working Temperature Range: – 55°C to 125°C
(derate voltage above 85°C: refer to Standard Rating Chart D.V.)

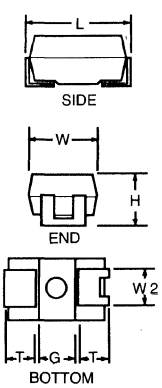
Voltage Range (Vdc): 4V to 35V

Tolerance: ± 20%, ± 10%

Dissipation Factor: measured at 20°C, 120Hz

TMC
0.1 – 1.0μf less than 4.0%
1.5 – 68μf less than 6.0%

TMC-M
0.47 – 33μf less than 6%
47μf – 100 μf less than 8%



D.C. Leakage Current: at rated voltage after 5 minutes .01CV or 0.5μA whichever is greater C – capacitance, V – voltage

CASE DIMENSIONS

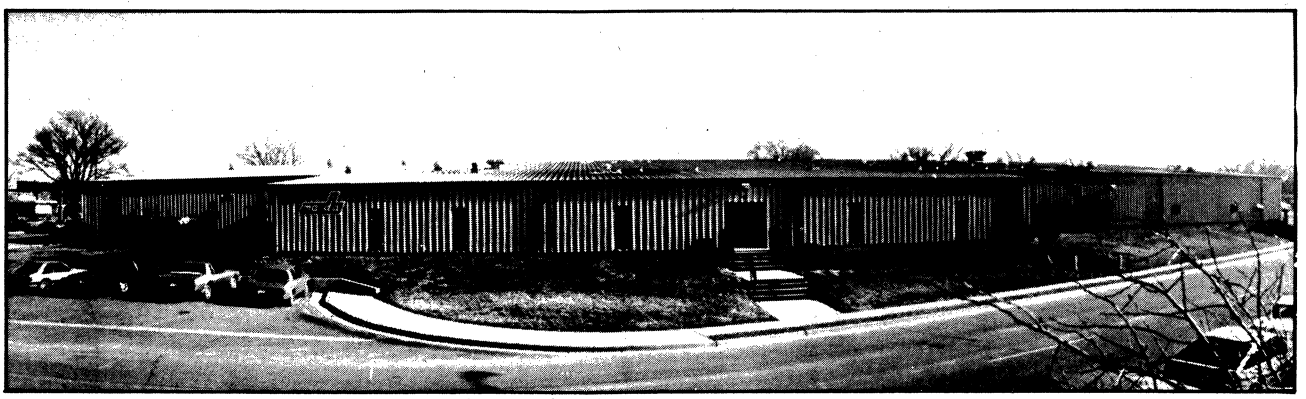
CASE KSE / EIA		L	W	H	T	G	W²
A/3216	mm	3.2 ± 0.2	1.6 ± 0.2	1.6 ± 0.2	0.7 ± 0.3	1.4 ± 0.2	1.2 ± 0.2
	in	.126 ± .008	.063 ± .008	.063 ± .008	.028 ± .012	.055 ± .008	.047 ± .008
B/3528	mm	3.4 ± 0.2	2.6 ± 0.2	1.9 ± 0.2	0.8 ± 0.3	1.4 ± 0.2	1.8 ± 0.2
	in	.134 ± .008	.102 ± .008	.073 ± .008	.031 ± .012	.055 ± .008	.071 ± .008
C/6032	mm	6.0 ± 0.3	3.2 ± 0.2	2.5 ± 0.2	1.3 ± 0.3	2.4 ± 0.2	2.4 ± 0.2
	in	.236 ± .012	.126 ± .008	.098 ± .008	.051 ± .012	.094 ± .008	.094 ± .008
D/----- (EIA-J)	mm	5.8 ± 0.2	4.5 ± 0.2	3.1 ± 0.2	1.3 ± 0.3	2.5 ± 0.2	3.3 ± 0.2
	in	.228 ± .012	.177 ± .008	.122 ± .008	.051 ± .012	.098 ± .008	.130 ± .008
E/7343 (EIA-D Size)	mm	7.3 ± 0.3	4.3 ± 0.3	2.8 ± 0.2	1.3 ± 0.3	3.8 ± 0.2	2.4 ± 0.2
	in	.287 ± .012	.169 ± .012	.110 ± .008	.051 ± .012	.150 ± .008	.094 ± .008

KOA SPEER ELECTRONICS, INC.

CERAMIC CAPACITORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"



90,000 square foot manufacturing facilities located in Hampton, Virginia

Maida

serving the electronics industry as partners in progress for more than forty-five years.

Maida Development Corporation is a domestically owned and operated manufacturer of a wide variety of electronic ceramic components. Since 1947, we have specialized in the custom design and fabrication of ceramic disk capacitors - from ceramic dielectric powder formulation through finished devices - to meet the specific requirements of our customers. Maida's major capacitor products include (1) Class I, Class II, and Class III high voltage disk capacitors, 1 KVDC thru 30 KVDC; (2) capacitors safety-recognized by UL, CSA, and VDE, for across-the-line, line-by-pass, and antenna-coupling applications; (3) close tolerance adjusted NPO disk capacitors; (4) low-inductance leadless disks; (5) slot-mountable "trapezoids" for printed circuits; (6) trimmer capacitors; (7) post insulators/capacitors; (8) radial tubular capacitors; (9) feedthrus and (10) sparkgaps.

Maida Development Company also produces a complete line of metal oxide varistors (MOV's) designed for transient voltage suppression and surge energy absorption. We are now the only U.S. manufacturer of these components, with ceramic formulation, powder preparation, fabrication, and assembly facilities all located in this country. Maida's varistors are recognized by UL, CSA, and VDE. Please contact Maida's Sales Department to request our full-line varistor catalog.

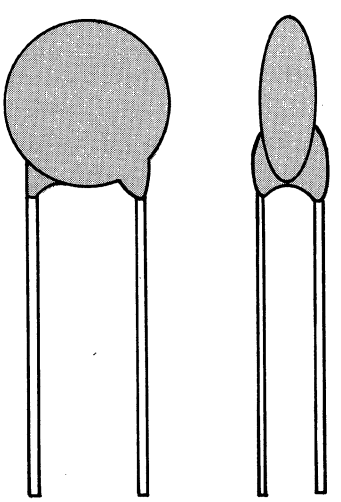
Delivery is both timely and reliable - with either bulk or tape-and-reel packaging.

Our sales representatives are strategically located throughout the USA and the world. Maida welcomes the opportunity to discuss and bid on capacitor requirements not covered by this catalog. Please contact our Engineering Department.

CERAMIC DISC CAPACITORS — 500V THRU 6KV

CLASS	T.C.	Maximum Capacitance, pF						
		VDC 500V	VDC 1KV	VDC 2KV	VDC 3KV	VDC 4KV	VDC 5KV	VDC 6KV
1	P100	81	68	51	36	27	22	18
1	NP0	910	910	750	470	360	300	240
1	N033	910	910	750	470	360	300	240
1	N075	1000	1000	820	560	430	330	270
1	N150	560	560	430	300	200	180	150
1	N220	620	620	470	330	240	200	160
1	N330	750	750	560	360	270	220	190
1	N470	1300	1300	1100	750	560	470	390
1	N750	1500	1500	1300	820	620	510	430
1	N1500	2700	2700	2200	1500	1100	910	750
1	N2200	3900	3900	3300	2200	1600	1300	1100
1	N3300	6800	6800	5600	3600	3700	2200	1800
1	N4700	22000	22000	18000	12000	9100	7500	4700
1	N5600	8200	8200	6200	4300	3000	2400	2000
2	X5F	10000	10000	7500	5100	3900	3000	2700
2	Z5P	18000	18000	9100	6200	4700	3600	3000
2	X5P	15000	15000	12000	7500	5600	4700	3900
2	X7R	20000	20000	15000	10000	7500	6200	5100
2	X5R	27000	27000	20000	15000	10000	8200	6800
3	Z5U	62000	62000	47000	33000	24000	20000	16000
3	X5U	18000	18000	9100	6200	4700	3600	3000

APPLICATIONS:
CLASS 1. High-Q, temperature compensating, or stable capacitance requirements.
CLASS 2. Semi-Stable General Purpose.
CLASS 3. General Purpose, Line-by-pass, Coupling, etc.



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CERAMIC CAPACITORS

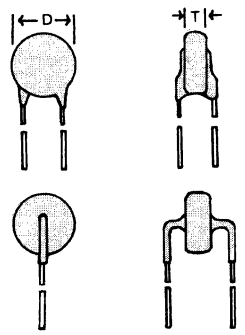
MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

HIGH VOLTAGE DISCS-10, 12, 15, 20 KVDC-X5R/Z5U

MAX. NOM. CAP. ±20% pF	10KV "T" MAX. 0.360 X5R	10KV "T" MAX. 0.360 Z5U	12KV "T" MAX. 0.400 X5R	12KV "T" MAX. 0.400 Z5U	15KV "T" MAX. 0.460 X5R	15KV "T" MAX. 0.460 Z5U	20KV "T" MAX. 0.560 X5R	20KV "T" MAX. 0.560 Z5U
100	D68	—	D68	—	D689	—	D689	—
200	D68	—	D68	—	D619	—	D719	—
250	D68	—	D61	—	D719	—	D719	—
500	D71	D68	D63	D68	D699	D619	D649	D719
750	D69	D61	D64	D61	D639	D719	D679	D629
1000	D64	D71	D63	D71	D679	D699	D769	D699
1500	D67	D62	D65	D69	D669	D649	D709	D639
2200	D66	D64	D66	D63	D709	D679	—	D769
2500	D66	D63	D70	D67	—	D659	—	D669
3000	D70	D63	D70	D67	—	D769	—	D669
4300	D70	D76	—	D66	—	D669	—	D709
5600	—	D66	—	D70	—	D709	—	—
6800	—	D70	—	D70	—	—	—	—

STYLE	MAX. "D"
D68/D689	0.406
D61/D619	0.469
D71/D719	0.532
D62/D629	0.594
D69/D699	0.659
D64/D649	0.719
D63/D639	0.781
D67/D679	0.840
D65/D659	0.969
D66/D669	1.100
D70/D709	1.350



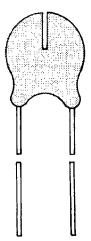
APPLICATIONS:
Voltage Multipliers, High Voltage Power Supplies

SPARK GAPS

STAND-ALONE SPARK GAPS

A stand-alone spark gap is a precisely dimensioned air-gap between two opposing lead wires which have been formed and insulated from each other.

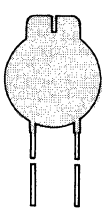
Nominal Spark Voltages Available: 1 KVDC to 4 KVDC
Capacitance: Less than 1 pF



COMBINATION CAPACITOR/SPARK GAP

A combination capacitor/spark gap employs a general purpose capacitor in parallel with a spark gap.

Nominal Spark Voltages Available: 1 KVDC to 4 KVDC
Capacitance Values Available: 1000 pF to 20,000 pF

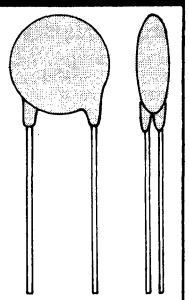


APPLICATIONS:
Protection of low voltage circuits from high voltage surges.

For specific requirements, please contact our Engineering Department.

UL, CSA, & VDE SAFETY-RECOGNIZED CAPACITORS

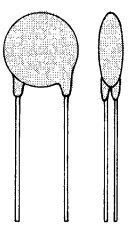
TYPE	AGENCY UL	AGENCY CSA	AGENCY VDE	T.C. EIA	T.C. IEC	CAP. pF MAX
UW	125/250 VAC	125 VAC	250 VAC X1, Y	Z5U	2E4	10,000
HX	—	—	500 VAC X2	—	2E4	30,000
★DP	125 VAC	125 VAC	—	Z5U	—	5,000



APPLICATIONS:
Line-by-pass, antenna coupling, across-the-line
★ "Double Protection" in above uses

250 & 500 VOLT AC POWER LINE CAPACITORS

STYLE CODE	MAX. "D" INCHES	MAX CAPACITANCE pF 250VAC	MAX CAPACITANCE pF 500VAC
60	0.312	1200	680
68	0.375	2500	1200
61	0.470	3600	2000
71	0.530	4300	2200
62	0.590	6800	3600
64	0.720	10000	6200
63	0.780	13000	6800
67	0.840	15000	8200
65	0.970	22000	12000
66	1.10	30000	15000

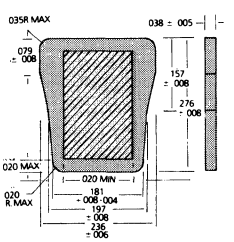


APPLICATIONS:
AC line voltage applications where minimum currents - reactive and resistive - are required.

TOLERANCES AVAILABLE:
±20% or +80 - 20%

500 VOLT TRAPEZOIDS - CLASS 1 and 2

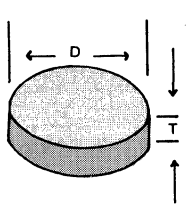
CLASS	T.C.	CAPACITANCE RANGE
1	P100	1.5pF - 3.3pF
	NPO	2.4pF - 18pF
	N030 thru N470	2.7pF - 24pF
	N750	5.6pF - 30pF
	N1500	22pF - 51pF
	N2200 thru N5600	30pF - 130pF
2	X5F	150pF - 220pF
	Z5P/X7R	150pF - 470pF
	Z5U	150pF - 1000pF
	Z5V	200pF - 1900pF



APPLICATIONS:
Solder into slot for minimum lead inductance.

500 VOLT LEADLESS DISCS-CLASS 1

T.C.	CAPACITANCE	"D" NOM.	"T"
NPO	2.2pF - 3.0pF	.250"	.120" max.
N080	3.3pF - 7.5pF	.250"	.062" max.
N150	1.8pF - 5.4pF	.250"	.120" max.
N220	5pF	.250"	.083" max.
N470	18pF	.250"	.032" max.
N750	24pF	.250"	.032" max.
N1500	39pF	.250"	.032" max.
N080	7.5pF	.312"	.062" max.
N150	10pF	.312"	.083" max.
N220	10pF	.312'	.090" max.



APPLICATIONS:
UHF circuits with very low inductance

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LOW VOLTAGE DISC CAPACITORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

TEMPERATURE COMPENSATING TYPE

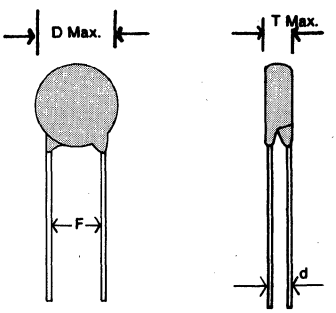
MAXIMUM CAPACITANCE VALUES BY TC TYPE

T.C. / W.V.	CAPACITANCE (pF) NPO	N80	N150	N220	N330	N470	N770	P350 - N1000	DIMENSIONS INCHES (mm) D	T	F	d
50V DC	22	18	16	30	20	22	39	110	.157 (4.0)	.157 (4.0)	.098 (2.5)	.020 (0.5)
	30	30	22	47	39	39	55	130	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	56	47	47	91	62	56	100	240	.248 (6.3)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	100	82	91	130	120	130	150	510	.315 (8.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	200	130	130	250	200	200	240	680	.394 (10.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	—	250	250	370	350	360	390	1000	.492 (12.5)	.118 (3.0)	.197 (5.0)	.020 (0.5)

GENERAL PURPOSE TYPE

MAX. CAPACITANCE VALUES BY TC TYPE

T.C. / W.V.	CAPACITANCE (pF) Y5P	Z5U	Z5V	DIMENSIONS INCHES (mm) D	T	F	d
50V DC	1200	1200	2200	.155 (4.0)	.157 (4.0)	.098 (2.5)	.020 (0.5)
	1800	1800	4700	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	3300	3300	10000	.248 (6.3)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	5600	5600	22000	.315 (8.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	8200	8200	40000	.394 (10.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	10000	10000	47000	.492 (12.5)	.118 (3.0)	.197 (5.0)	.020 (0.5)

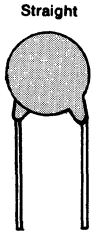


SEMICONDUCTOR TYPE

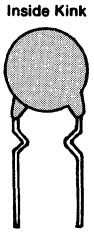
MAX. CAPACITANCE VALUES BY TC TYPES

T.C. / W.V.	CAPACITANCE (pF) Y5P	Y5R	Y5T	Y5U	Y5V	DIMENSIONS INCHES (mm) D	T	F	d
12V DC	—	10000	22000	22000	47000	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	—	22000	47000	47000	100000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	47000	100000	100000	—	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	—	220000	220000	220000	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	100000	330000	—	470000	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	—	470000	—	—	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
25V DC	—	4700	10000	10000 20000	22000	.197 (5.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	10000	15000	22000	—	47000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	22000	47000	100000	100000	.315 (8.0)	.157 (4.0)	.197(5.0)	.020 (0.5)
	22000	47000	100000	—	22000	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	47000	100000	—	220000	—	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	100000	—	—	—	470000	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
50V DC	—	—	—	10000	22000	.197 (5.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	10000	10000	1000	22000	47000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	15000	22000	22000	47000	100000	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	22000	47000	47000	100000	—	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	470000	—	100000	—	—	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	100000	100000	—	—	—	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)

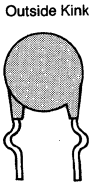
Straight



Inside Kink



Outside Kink



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VARISTORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

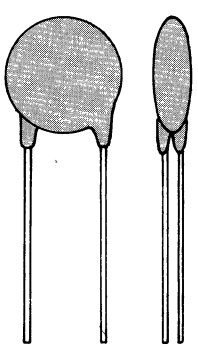
ZINC OXIDE VARISTORS — TRANSIENT VOLTAGE SURGE SUPPRESSION

"See section 4700, 'Voltage Sensitive Resistors', for comprehensive Listing of Maida's Zinc Oxide Varistors".

MDC-ZOV STYLE NUMBER	MODEL SIZE	CROSS REFERENCE — GE-MOV MODEL NUMBER	CONTINUOUS RMS VOLTAGE VAC	CONTINUOUS DC VOLTAGE VDC	TRANSIENT ENERGY (10×1000μS)	VARISTOR PEAK VOLTAGE @1mADC MIN	VARISTOR PEAK VOLTAGE @1mADC MAX	MAX CLAMPING VOLTAGE @ TEST CURRENT (8x20μS) V_c	MAX CLAMPING VOLTAGE @ TEST CURRENT (8x20μS) I_P	CAP @1KHZ ±30%
	(mm)		VOLTS	VOLTS	JOULES	VOLTS	VOLTS	VOLTS	AMPS	pF
D6921ZOV950RA06	14	V95LA7A	95	127	30	135	164	255	50	1800
D73ZOV131RA03	7	V130LA2	130	175	11	184	224	340	10	250
D6121ZOV131RA04	10	V130LA5			14		224	340	25	500
D6921ZOV131RA09	14	V130LA10A			38		224	340	50	1350
D6521ZOV131RA20	20	V130LA20A			70		224	340	100	2300
D6521ZOV131RB20	20	V130LA20B			70		220	325	100	2300
D73ZOV141RA03	7	V140LA2	140	180	12	198	242	360	10	230
D6121ZOV141RA04	10	V140LA5			16		242	360	25	460
D6921ZOV141RA09	14	V140LA10A			42		242	360	50	1270
D73ZOV151RA03	7	V150LA2	150	200	13	212	259	395	10	220
D6121ZOV151RA04	10	V150LA5			17		259	395	25	400
D6921ZOV151RA09	14	V150LA10A			45		259	395	50	1200
D6521ZOV151RA20	20	V150LA20A			80		268	395	100	2000
D6521ZOV151RB20	20	V150LA20B			80		243	360	100	2000
D73ZOV251RA21	7	V250LA4	250	330	21	354	432	650	10	130
D61ZOV251RA40	10	V250LA10A			40		432	650	25	160
D69ZOV251RA72	14	V250LA20A			72		432	650	50	550
D65ZOV251RA130	20	V250LA40A			130		432	650	100	920
D65ZOV251RB130	20	V250LA40B			130		413	620	100	920
D73ZOV271RA23	7	V275LA4	270	360	23	382	466	710	10	120
D61ZOV271RA043	10	V275LA10A			43		466	710	25	150
D69ZOV271RA75	14	V275LA20A			75		466	710	50	510
D65ZOV271RA140	20	V275LA40A			140		466	710	100	850
D65ZOV271RB140	20	V275LA40B			140		453	680	100	850
D73ZOV301RA25	7	V300LA4	300	405	25	425	518	775	10	110
D69ZOV321RA90	14	V320LA15A	320	420	90	453	553	850	50	400
D65ZOV321RA160	20	V320LA40A			160		553	850	100	720
D65ZOV321RB160	20	V320LA40B			160		540	810	100	720
D69ZOV421RA90	14	V420LA15A	420	560	90	594	725	1120	50	500
D65ZOV421RA160	20	V420LA40A			160		725	1120	100	910
D65ZOV421RB160	20	V420LA40B			160		690	1060	100	910
D69ZOV481RA105	14	V480LA40A	480	640	105	679	829	1240	50	440
D69ZOV481RA180	20	V480LA80A			180		829	1240	100	800
D65ZOV481RB180	20	V480LA80B			180		790	1160	100	800
D69ZOV511RA110	14	V510LA40A	510	675	110	722	881	1350	50	410
D65ZOV511RA190	20	V510LA80A			190		881	1350	100	740
D65ZOV511RB190	20	V510LA80B			190		860	1280	100	740
D69ZOV581RA120	14	V575LA40A	580	735	120	821	1002	1500	50	370
D65ZOV581RA220	20	V575LA80A			220		1002	1500	100	670
D65ZOV581RB220	20	V575LA80B			220		960	1410	100	670
D69ZOV102RA220	14	V1000LA80A	1000	1200	220	1414	1728	2700	50	210
D69ZOV102RA360	20	V1000LA160A			360		1728	2700	100	380
D65ZOV102RB360	20	V1000LA160B			360		1650	2420	100	380

Protection for Voltage Sensitive Equipment.
Transient voltage suppression from sources such as lightning induced transients, switching surges, ground faults and AC power lines.

APPLICATIONS:
Ground fault interrupters, CATC systems, IC's and microprocessor protection, power supplies, industrial control systems, RFI filters, etc.



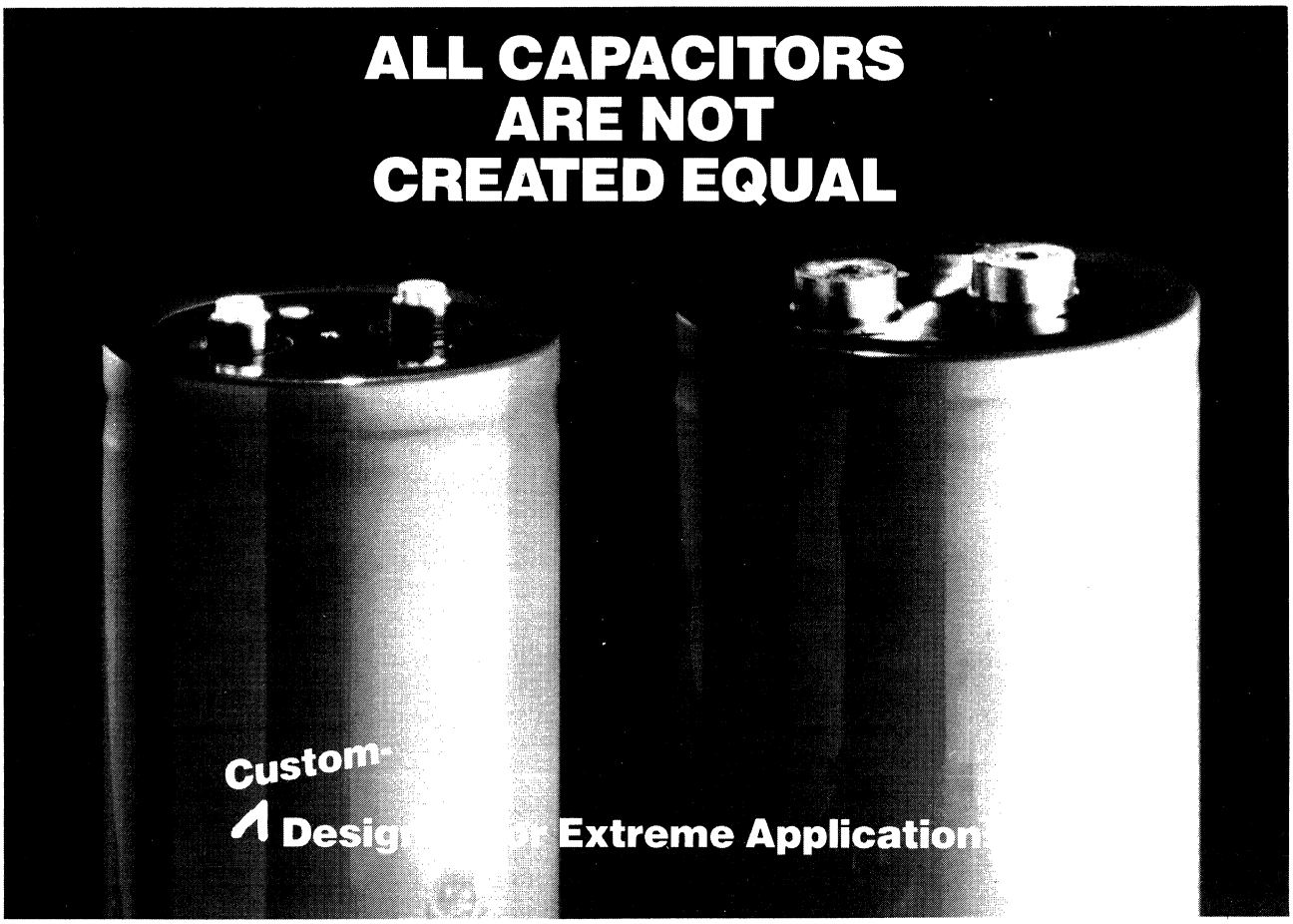
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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
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Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

MALLORY *custom aluminum electrolytic capacitors*



Features	Benefits
Hand-Selected Foils	• Eliminates traditional capacitor derating • Provides high voltage, ripple and temperature performance up to 500 V at 85°C with ripple current up to 50 amps (rms)
Vacuum-Impregnated	• Complete electrolyte penetration of cartridge • Guarantees superior performance and repeatability • High MTBF
Trough Aging	• Aged at 85°C to full voltage • Customer receives preformed capacitor • Lower D.C. leakage • Lower E.S.R. • Longer shelf life

EA capacitors are long-life aluminum electrolytic capacitors custom-designed for your extreme applications.

With capacitance ratings up to 500,000 µF, voltage ratings up to 500 V, ripple currents up to 50 amps (rms) and temperature stability up to 85C, Mallory EA capacitors provide superior performance across a wide range of application requirements.

When taking performance to extremes, look into EA capacitors from Mallory Canada.

Our engineering support team is waiting to assist in selecting the capacitor for your application.

Call today for a copy of our EA capacitor product guide.

Mallory Controls
P.O. Box 210—1079 Parkinson Road
Woodstock, Ontario N4S 7WB, Canada

Phone (519) 539-4891
Fax (519) 539-6684

MALLORY CONTROLS, A DIVISION OF EMERSON ELECTRIC CANADA LTD.
P.O. Box 210, 1079 Parkinson Road, Woodstock, Ontario, N4S 7W8, Canada
Phone: (519) 539-4891, Telex: 23:M0Y001, Fax: (519) 539-6684

TYPE 202
DIPPED TANTALUM CAPACITORS

Designed to take advantage of high purity tantalum powder resulting in smaller size units and minimum cost, with very low leakage current and excellent stability over both temperature and time, with a very limited distribution. Ideal for by-passing, coupling and timing applications.

SPECIFICATIONS

Capacitance Range: 0.1 to 330 μF
Rated Working Voltage: 3.15 to 50 VDC
Capacitance Tolerance: ±10% (K)
Operating Temperature Range: −55°C to +85°C
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conform to the test method of Capacitor Flame Test in UL 1414.

SURGE VOLTAGE

DC Rated Voltage at 85°C	3.15	6.3	10	16	20	25	35	50
DC Surge Voltage at 85°C	4.0	8.0	13	20	25	32	44	63

Capacitors shall withstand the surge voltage applied in series with a 1000 ohm resistor at the rate of ½ minute on, 5½ minutes off, for 1000 successive test cycles at 85°C. After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	Within 5% of initial value
Dissipation Factor	Within initial requirement specified
DC Leakage Current	Within initial requirement specified

ALLOWABLE REVERSE VOLTAGE

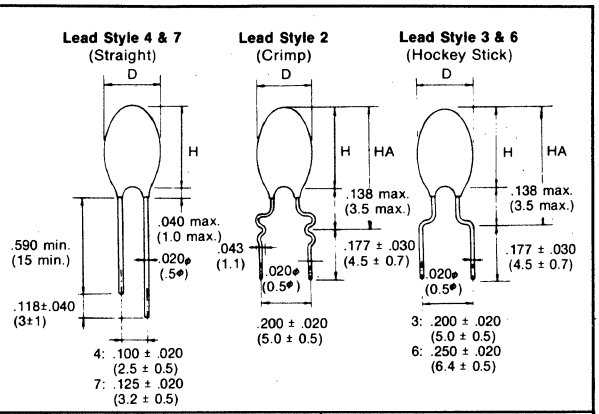
10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.

STANDARD RATINGS, SHOWING CASE SIZES

CAP (μF) \ RV (VDC)	3.15	6.3	10	16	20	25	35	50
.10							1	2
.15							1	2
.22							1	2
.33							1	2
.47							1	2
.68							1	2
1.0							1	3
1.5						1	2	4
2.2					1	2	3	5
3.3				1	2	3	4	6
4.7			1	2	3	4	5	
6.8		1	2	3	4	5	6	
10	1	2	3	4	5	6	7	
15	2	3	4	5	6	7	8	
22	3	4	5	6	7	8	9	
33	4	5	6	7	8	9	10	
47	5	6	7	8	9	10		
68	6	7	8	9	10			
100	7	8	9	10				
150	8	9	10					
220	9	10						
330	10							

NOTE: Intermediate non-standard values available. 1000 Pcs. Minimum.

DIMENSIONS: Inch (mm)



CASE SIZE	3.15 VDC — 35 VDC D MAX.	H MAX.	HA MAX.	50 VDC D MAX.	H MAX.	HA MAX.
1	.142(3.6)	.236(6.0)	.374(9.5)	-	-	-
2	.150(3.8)	.256(6.5)	.394(10.0)	.150(3.8)	.276(7.0)	.414(10.5)
3	.157(4.0)	.276(7.0)	.414(10.5)	.157(4.0)	.295(7.5)	.433(11.0)
4	.189(4.8)	.295(7.5)	.433(11.0)	.189(4.8)	.315(8.0)	.453(11.5)
5	.197(5.0)	.315(8.0)	.453(11.5)	.197(5.0)	.335(8.5)	.473(12.0)
6	.217(5.5)	.335(8.5)	.473(12.0)	.217(5.5)	.374(9.5)	.512(13.0)
7	.217(5.5)	.374(9.5)	.512(13.0)			
8	.256(6.5)	.453(11.5)	.591(15.0)			
9	.295(7.5)	.512(13.0)	.650(16.5)			
10	.315(8.0)	.551(14.0)	.689(17.5)			

ORDERING INFORMATION

202 L 3151 106 K 4

TYPE

FAILURE RATE
L: 2%/1000 Hrs.

VOLTAGE RATING

Code	Volts	Code	Volts	Code	Volts
3151	3.15	1602	16	2502	25
6301	6.3	2002	20	3502	35
1002	10			5002	50

CAPACITANCE IN PICOFARADS
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE
K = ±10%

LEAD STYLE

Lead Style	Lead Space Inch	mm	Code	Lead Style	Lead Space Inch	mm	Code
Straight .100″	.100	2.5	4	Hocky Stick .250″	.250	6.4	**6**
Straight .125″	.125	3.2	7	Tape & Reel .200″	.200	5.0	C or F
Crimp .200″	.200	5.0	2	Tape & Reel .100″	.100	2.5	H or J
Hockey Stick .200″	.200	5.0	3	Tape & Ammo Pack .200″	.200	5.0	**B**
Straight .200″	.200	5.0	*3	Tape & Ammo Pack 100″	.100	2.5	**G**

*Case Sizes 8,9,10 only

MATSUO ELECTRONICS 2134 Main St., Ste. 200 / Huntington Beach, CA 92648 / Tel. (714) 969-2491 / FAX (714) 960-6492
These specifications are subject to change without notice.

TYPE 204 (HIGH RELIABILITY) DIPPED TANTALUM CAPACITORS

BLUEDT® 204 Series is designed to maintain high reliability electrical performance characteristics. These high reliability 204 Series capacitors offer small case sizes and are ideal for use in any "Hi-Rel" product such as automotive electronics, telecommunications equipment, or any other industrial product where reliability is a must.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
Rated Voltage: 3.15, 6.3, 10, 16, 20, 25, 35, 50VDC
Capacitance Range: 0.1 to 470µF
Capacitance Tolerance: ±20%(M), ±10%(K), ±5%(J)
DC Leakage Current: 0.008 × CV or 0.4µA, whichever is greater (Rated voltage, 5 min, 25°C)
Dissipation Factor: See Table 1 (at 120Hz)

Surge Voltage

DC Rated Voltage at 85°C	3.15	6.3	10	16	20	25	35	50
DC Surge Voltage at 85°C	4.0	8.0	13	20	25	32	44	63

Capacitors shall withstand the surge voltage applied in series with a 1000 ohm resistor at the rate of ½ minute on, 5½ minutes off, for 1000 successive test cycles at 85°C. After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	Within 5% of initial value
Dissipation Factor	Within initial requirement specified
DC Leakage Current	Within initial requirement specified

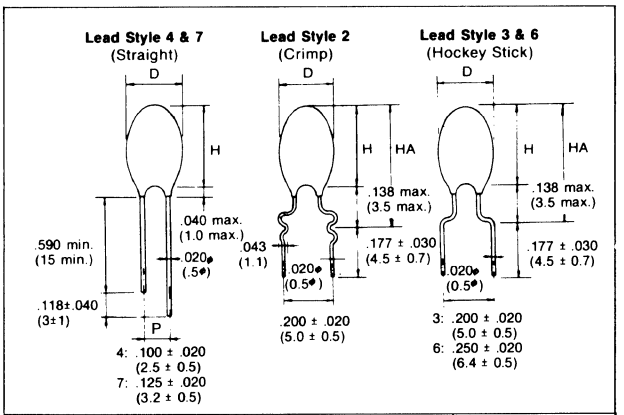
ALLOWABLE REVERSE VOLTAGE

10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.

STANDARD RATINGS, SHOWING CASE SIZES

R.V. (VDC) / Cap. (µF)	3.15	6.3	10	16	20	25	35	50
0.1							1	2
0.15							1	2
0.22							1	2
0.33							1	2
0.47							1	2
0.68							1	2
1.0							1	3
1.5						1	2	4
2.2					1	2	3	5
3.3				1	2	3	4	6
4.7			1	2	3	4	5	7
6.8		1	2	3	4	5	6	8
10	1	2	3	4	5	6	7	9
15	2	3	4	5	6	7	8	10
22	3	4	5	6	7	8	9	11
33	4	5	6	7	8	9	10	
47	5	6	7	8	9	10	11	
68	6	7	8	9	10	11		
100	7	8	9	10	11			
150	8	9	10	11				
220	9	10	11					
330	10	11						
470	11							

DIMENSIONS: Inches (mm)



Case Code	D max.	H max.	*P ± .02 (.5)
1	.142 (3.6)	.256 (6.5)	.098 (2.5)
2	.150 (3.8)	.276 (7.0)	.098 (2.5)
3	.157 (4.0)	.296 (7.5)	.098 (2.5)
4	.189 (4.8)	.315 (8.0)	.098 (2.5)
5	.197 (5.0)	.335 (8.5)	.098 (2.5)
6	.217 (5.5)	.374 (9.5)	.098 (2.5)
7	.236 (6.0)	.394 (10.0)	.098 (2.5)
8	.256 (6.5)	.453 (11.5)	.125 (3.2)
9	.295 (7.5)	.512 (13.0)	.197 (5.0)
10	.315 (8.0)	.551 (14.0)	.197 (5.0)
	.335 (8.5)	.787 (20.0)	.197 (5.0)

*Style 4 only

Packaging Style (available up to Case 8)

Code	Lead Spacing	Polarity	Style
H	.100 ± .020 (2.5 ± 0.5)	⊕ proceeding	Reeled
J		⊖ proceeding	Reeled
G		—	Ammo
C	.200 ± .020 (5.0 ± 0.5)	⊕ proceeding	Reeled
F		⊖ proceeding	Reeled
B		—	Ammo

ORDERING INFORMATION

204 M 3151 106 M 3

TYPE 204

FAILURE RATE
M: 1%/1000Hr.
N: 0.5%/1000Hr.

VOLTAGE RATING M

Code	Vol	Code	Vol	Code	Vol	Code	Vol
3151	3.15	1002	10	2002	20	3502	35
6301	6.3	1602	16	2502	25	5002	50

CAPACITANCE IN PICOFARADS 3151
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE 106
M = ±20%
K = ±10%
J = ±5%

LEAD STYLE M
SEE DIMENSIONS

MATSUO® TYPE 269 (BUILT-IN FUSE) TANTALUM CHIP CAPACITORS

MATSUO Type 269 is specially designed as a surface mount component for use in hybrid and low profile print circuit board applications.
Built-in fuse functions either as thermal fuse under small current or as electric fuse under larger currents.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
Rated Voltage: 10, 16, 20, 25, 35VDC
Capacitance Tolerance: ±20%(M)
DC Leakage Current: 0.01×CV or 0.5μA. Whichever is greater (Rated voltage, 5 minutes, 25°C)

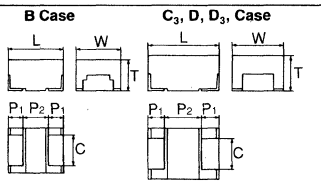
Failure Rate Level	M (1%/1000h)
Capacitance range:	1.0μF to 68μF
Dissipation Factor:	0.04 max. (1.0μF) 0.06 max. (1.5 ~ 68μF)

CATALOG NUMBERING SYSTEM

269 M 2502 105 M R

- TYPE
- FAILURE RATE LEVEL M:1%/1000Hrs.
- VOLTAGE RATING
- CAPACITANCE IN PICOFARADS — First two digits are significant figures. Third digit is the number of zeros following.
- CAPACITANCE TOLERANCE M = ±20%
- LEAD STYLE

DIMENSIONS: Inches (mm)



Cap. (μF) \ R.V. (VDC)	10	16	20	25	35
1.0				B	B,C_3
1.5			B	B	C_3
2.2		B	B		C_3
3.3		B		C_3	D,D_3
4.7	B		C_3		D,D_3
6.8		C_3		D,D_3	E
10		C_3	D,D_3		E
15	C_3	D,D_3		E	
22		D,D_3	E		
33	D,D_3	E			
47		E			
68	E				

Case Code	EIA Code	L ±.008 (0.2)	W ±.008 (0.2)	T ±.008 (0.2)	P_1 ±.008 (0.2)	P_2 min.	C ±.004 (0.1)
B	3528	.138 (3.5)	.110 (2.8)	.075 (1.9)	.031 (0.8)	.059 (1.5)	.087 (2.2)
C3	6032	.236 (6.0)	.126 (3.2)	.098 (2.5)	.051 (1.3)	.118 (3.0)	.087 (2.2)
D		.220 (5.6)	.181 (4.6)	.126 (3.2)	.051 (1.3)	.110 (2.8)	.126 (3.2)
D3	7243	.287 (7.3)	.173 (4.4)	.110 (2.8)	.051 (1.3)	.157 (4.0)	.094 (2.4)
E	7257	.287 (7.3)	.228 (5.8)	.138 (3.5)	.051 (1.3)	.157 (4.0)	.138 (3.5)

MATSUO® TYPE 242 MOLDED TANTALUM CAPACITORS

For High Density Packaging

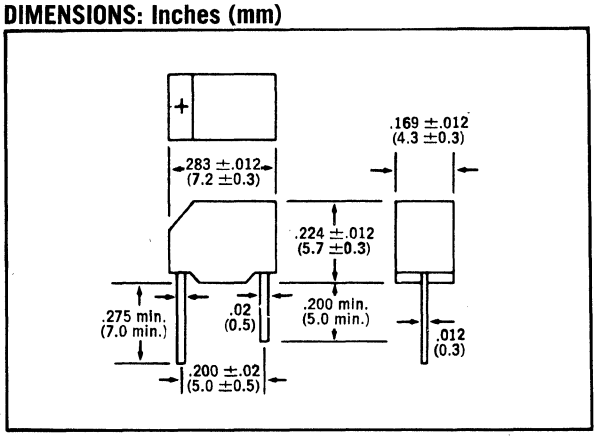
Impact resistant rectangular molded case. Uniform lead location for automatic insertion. Low impedance at high frequencies. Ideal for noise bypassing in high speed logical circuits. High capacitance in miniature case.

SPECIFICATIONS

Capacitance Range: 0.1 to 47 μF **Capacitance Tolerance:** ±20% (M)
Rated Working Voltage: 6.3, 10, 16, 20, 25, 35 & 50 VDC
Operating Temperature Range: −55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
DC Leakage Current (Rated Voltage, 5 min. 20°C): 0.01 CV (μA) or 0.5 μA, whichever is greater: (85°): 0.5 CV 5.0 μA, whichever is greater.
Conforms to UL 1414.
Available on tape in ammo-pack or reel.

CAP. (μF) \ R.V. (VDC)	6.3	10	16	20	25	35	50
0.1						•	•
0.15						•	•
0.22						•	•
0.33						•	•
0.47						•	•
0.68						•	•
1.0						•	•
1.5						•	•
2.2						•	•
3.3			•			•	•
4.7					•	•	
6.8				•		•	
10			•		•		
15		•		•			
22	•		•				
33		•					
47	•						

DIMENSIONS: Inches (mm)



ORDERING INFORMATION

242 M 1602 106 M 2

- TYPE
- FAILURE RATE LEVEL M: 1%/1000 Hrs.
- VOLTAGE RATING
- CAPACITANCE IN PICOFARADS — First two digits are significant figures. Third digit is the number of zeros following.
- CAPACITANCE TOLERANCE M = ±20%
- LEAD STYLE

Code	Volts	Code	Volts
6301	6.3	2502	25
1002	10	3502	35
1602	16	5002	50
2002	20		

MATSUO ELECTRONICS 2134 Main St., Ste. 200 / Huntington Beach, CA 92648 / Tel. (714) 969-2491 / FAX (714) 960-6492

These specifications are subject to change without notice.

TYPE 244/245 MOLDED TANTALUM CAPACITORS

TYPE 244

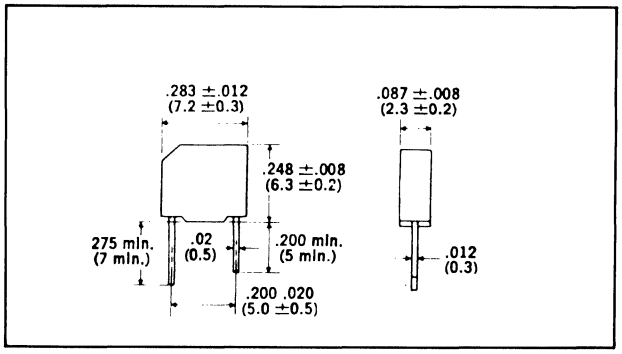
FOR NOISE BYPASSING

Impact resistant rectangular molded case. Eliminating the noise generated at the rise time of pulse in ultra-high speed logical circuits such as TTL and ECL.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (for temperature above 85°C, derate voltage to 67% of R.V.)
Failure Rate Level: M (1%/1000 Hrs.)
Rated Voltage: 16, 35, 50 VDC
Capacitance: 1, 3.3MFD
Capacitance Tolerance: ±20% (M)
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conforms to UL 1414
Available on tape in ammo-pack or reel.

DIMENSIONS: Inches (mm)



STANDARD RATING

CATALOG NO.	DC RATED VOLTAGE (VDC)	CAPACITANCE (μF)
244M 1602-335M	16	3.3
244M 3502-105M	35	1.0
244M 5002-105M	50	1.0

TYPE 245

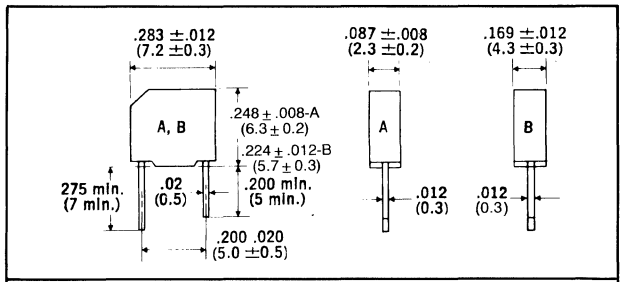
Hybrid Capacitor — Fuse

Eliminates the noise generated at rise time in ultra-high speed logical circuits such as TTL and ECL. Built-in fuse functions either as thermal fuse under small current or as electric fuse under larger currents.

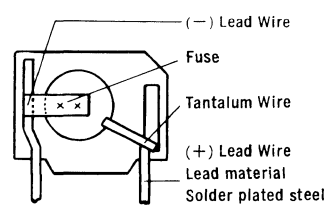
SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (For temperature above 85°C, derate voltage to 67% of R.V.)
Rated Voltage: 10 VDC to 50 VDC
Capacitance Range: 1.0 to 33 MFD
Capacitance Tolerance: ±20% (M)
DC Leakage Current: (Rated voltage, 5 minutes, 25°C) 0.01 CV (μA) or 0.5 μA whichever is greater.
Conforms to UL 1414.
Circuit Breaking Performance
Built-in fuse functions as a thermal fuse at current of less than 5 amperes. At current of more than 5 amperes, built-in fuse functions by the current flowing through fuse.
Available on tape in ammo-pack or reel.

DIMENSIONS: Inches (mm)



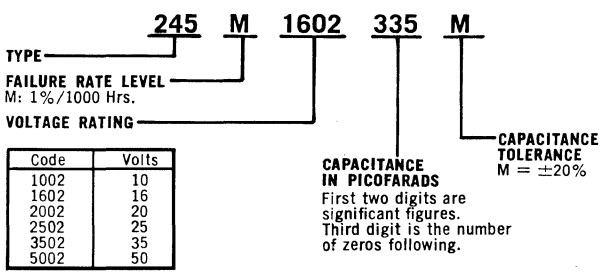
CONSTRUCTION



STANDARD RATINGS, SHOWING CASE SIZES

CAP. (μF) \ R.V. (VDC)	10	16	20	25	35	50
1.0					A	A
2.2					B	B
3.3		A			B	B
4.7				B	B	
6.8			B		B	
10		B		B		
15	B		B			
22		B				
33	B					

ORDERING INFORMATION



Code	Volts
1002	10
1602	16
2002	20
2502	25
3502	35
5002	50

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These specifications are subject to change without notice.

TYPE 267 TANTALUM CHIP CAPACITORS

MATSUO Type 267 is specially designed as a surface mount component for use in hybrid and low profile print circuit board applications. Fully-molded construction provides excellent mechanical protection, superior moisture resistance and high soldering heat resistance.

FEATURES:

- Ultra small dimensions (A case): 3.2 × 1.6mm.
- Dimensions are equivalent to EIA standards and IECQ. (Case A, B, C3 and D3).
- Flame retardant resin molded case.
- Precise dimensions allow for high density package.
- Reeled packaging is compatible with automatic mounting equipment per EIA-481.
- Failure rate: M(1%/1000Hr.).
- Symmetrical construction of positive and negative terminals provides "SELF-ALIGNMENT".
- Soldering: 260°C for 10 sec. by re-flow or dip.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
Rated Voltage: 4, 6.3, 10, 16, 20, 25, 35VDC
Capacitance Tolerance: ±20%(M) ±10%(K)
DC Leakage Current: 0.008 × CV or 0.4μA, Whichever is greater (Rated voltage, 5 minutes, 25°C)
Dissipation Factor: See Table 1 (at 120Hz)

Surge Voltage

DC Rated Voltage at 85°C	4	6.3	10	16	20	25	35
DC Surge Voltage at 85°C	5.0	8.0	13	20	25	32	44

Capacitor shall withstand the surge voltage applied in series with a 1000 ohm resistor at the rate of ½ minute on, 5½ minute off, for 1000 successive test cycles at 85°C.
After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	**Within 5% of initial value**
Dissipation Factor	**Within initial requirement specified**
DC Leakage Current	**Within initial requirement specified**

ALLOWABLE REVERSE VOLTAGE

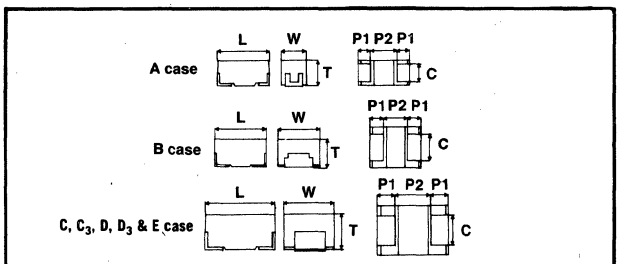
10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.

STANDARD RATINGS, SHOWING CASE SIZES

R.V. (VDC) / Cap. (μF)	4	6.3	10	16	20	25	35
0.1							A
0.15							A
0.22							A
0.33							A
0.47						A	(A) B
0.68						A	(A) B
1.0					A	(A)	B
1.5			A	(A)		B	(B) C,C3
2.2		A	(A)		B	(B)	C,C3
3.3	A	(A)		B	(B)	C3	(C),D3
4.7	(A)		B	(B)	C3	C,C3	D,D3
6.8		B	(B)	C3	C,C3	D3	D,D3
10	B	(B)	C3	C,C3	(C)	D,D3	E
15	(B)	C3	C	(C,C3)	D,D3		E
22	C3	C	(C,C3)	D,D3	(D,D3)	E	
33	C	(C,C3)	D,D3	(D,D3)	E		
47	(C,C3)	D,D3	(D,D3)	E			
68	D,D3	(D,D3)	E				
100	(D,D3)	E	(E)				
150	E	(E)					
220	(E)						

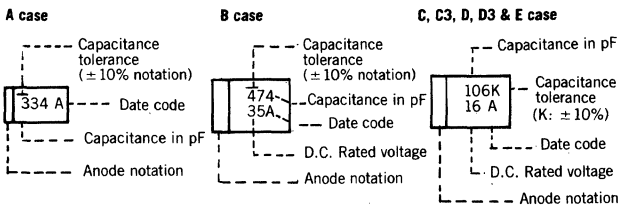
NOTE: ( ) = Designates Extended Range.

DIMENSIONS: Inches (mm)

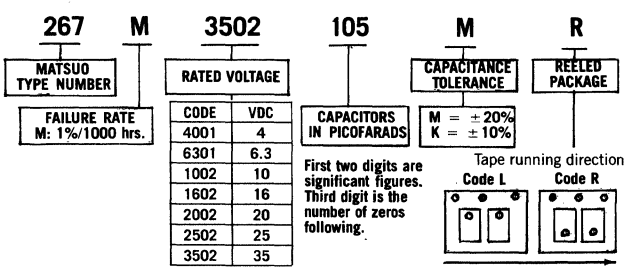


Case Code	EIA. Code	L ±.008 (0.2)	W ±.008 (0.2)	T ±.008 (0.2)	P_1 ±.008 (0.2)	P_2 min.	C ±.006 (0.15)
A	3216	.126 (3.2)	.063 (1.6)	.063 (1.6)	.030 (0.75)	.056 (1.4)	.047 (1.2)
B	3528	.138 (3.5)	.110 (2.8)	.075 (1.9)	.031 (0.8)	.059(1.5)	.087 (2.2)
C		.220 (5.6)	.130 (3.3)	.091 (2.3)	.051 (1.3)	.110 (2.8)	.087 (2.2)
C_3	6032	.236 (6.0)	.126 (3.2)	.098 (2.5)	.051 (1.3)	.118 (3.0)	.087 (2.2)
D		.220 (5.6)	.181 (4.6)	.126 (3.2)	.051 (1.3)	.110 (2.8)	.126 (3.2)
D_3	7243	.287 (7.3)	.173 (4.4)	.110 (2.8)	.051 (1.3)	.157 (4.0)	.094 (2.4)
E	7257	.287 (7.3)	.228 (5.8)	.138 (3.5)	.051 (1.3)	.157 (4.0)	.138 (3.5)

Marking



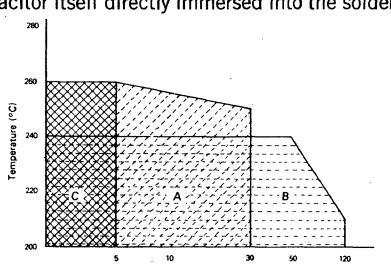
ORDERING INFORMATION



GUIDE TO APPLICATION

Soldering condition

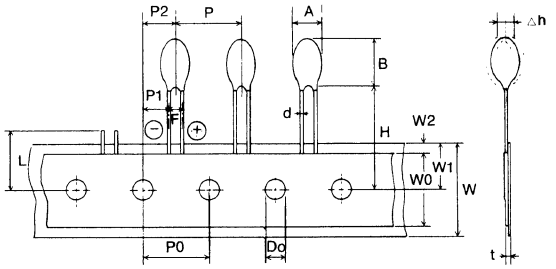
1. Pre-heating:
   Preheating at 130–160°C is recommended to avoid thermal shock in soldering.
2. Soldering:
   Temperature of capacitor body itself should not exceed 260°C.
   2–1 Direct heating (condition A)
   Substrate or PC board placed and floated on the solder bath.
   Substrate or PC board placed on a hot plate.
   Substrate or PC board passed through on the solder bath.
   2–2 Heating in oven (condition B)
   By hot air.
   2–3 Immersion (dipping) (condition C)
   Capacitor itself directly immersed into the solder.



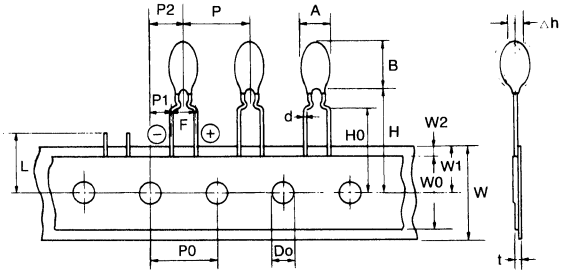
TYPE 202 & 204 (RADIAL LEAD)

PACKAGING FOR AUTOMATIC INSERTION and MOUNTING

Lead Spacing .100 ± .020 (2.5 ± 0.5)



Lead Spacing .200 ± .020 (5.0 ± 0.5)



DIMENSIONS: Inches (mm)

Item	Symbol	Specification	
		Value	Tolerance
Body diameter	A	See Dimension Table	
Body height	B		
Lead wire diameter	d	.020 (0.5)	.002 (0.05)
Pitch of component	P	.500 (12.7)	.039 (1.0)
Feed hole pitch	Po	.500 (12.7)	.012 (0.3)
Feed hole center to lead	P1	.200 (5.1)	.020 (0.5)
Hole center to component center	P2	.250 (6.35)	.039 (1.0)
Lead to lead distance	F	.098 (2.5)	+.031 (0.8) −.008 (0.2)
Component alignment	h	0	.039 (1.0)
Tape width	W	.709 (18.0)	.020 (0.5)
Hold down tape width	W0	.374 (9.5) minimum	
Hole position	W1	.354 (9.0)	.020 (0.5)
Hold down tape position	W2	.098 (2.5) maximum	
Height of component from tape center	H	.787 (20.0)	.020 (0.5)
Feed hole diameter	Do	.157 (4.0)	.008 (0.2)
Total tape thickness	t	.028 (0.7)	.008 (0.2)
Length of snipped lead	L	.433 (11.0) maximum	

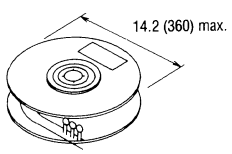
DIMENSIONS: Inches (mm)

Item	Symbol	Specification	
		Value	Tolerance
Body diameter	A	See Dimension Table	
Body height	B		
Lead wire diameter	d	.020 (0.5)	.002 (0.05)
Pitch of component	P	.500 (12.7)	.039 (1.0)
Feed hole pitch	Po	.500 (12.7)	.012 (0.3)
Feed hole center to lead	P1	.152 (3.85)	.020 (0.5)
Hole center to component center	P2	.250 (6.35)	.039 (1.0)
Lead to lead distance	F	.197 (5.0)	+.031 (0.8) −.008 (0.2)
Component alignment	h	0	.039 (1.0)
Tape width	W	.709 (18.0)	.020 (0.5)
Hold down tape width	W0	.374 (9.5) minimum	
Hole position	W1	.354 (9.0)	.020 (0.5)
Hold down tape position	W2	.098 (2.5) maximum	
Lead wire clinch height	Ho	.630 (16.0)	.020 (0.5)
Feed hole diameter	Do	.157 (4.0)	.008 (0.2)
Total tape thickness	t	.028 (0.7)	.008 (0.2)
Length of snipped lead	L	.433 (11.0) maximum	
(Height of component from tape center	(H)	.787 (20.0)	

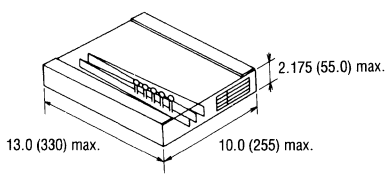
HOUSING OF TAPED COMPONENT

Type 202, 204, 242, 244 & 245

Reeled Package



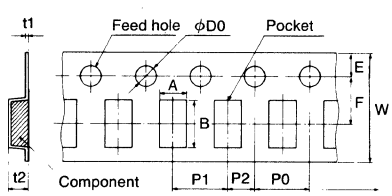
Ammo Package



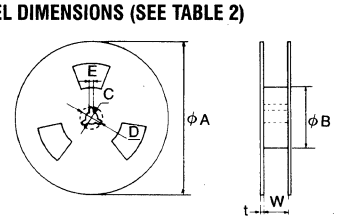
TYPE 267 (CHIP)

REELED PACKAGE

TAPE DIMENSIONS (SEE TABLE 1)



REEL DIMENSIONS (SEE TABLE 2)



DIMENSIONS: Inches (mm)

Table 1

Type	Case Code	A ±.004 (0.1)	B ±.004 (0.1)	W ±.012 (0.3)	F ±.002 (0.05)	E ±.004 (0.1)	P1 ±.004 (0.1)	P2 ±.002 (0.05)	P0 ±.004 (0.1)	∅D+.004 (0.1) −0	T1	T2
267	A	.075 (1.9)	.138 (3.5)	.315 (8.0)	.138 (3.5)	.069 (1.75)	.157 (4.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.079 Max. (2.0)
	B	.130 (3.3)	.150 (3.8)	.315 (8.0)	.138 (3.5)	.069 (1.75)	.157 (4.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.087 ±.004 (2.2 ±0.1)
	C	.142 (3.6)	.236 (6.0)	.472 (12.0)	.222 (5.65)	.059 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.098 ±.004 (2.5 ±0.1)
	C3	.146 (3.7)	.252 (6.4)	.472 (12.0)	.222 (5.65)	.069 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.118 ±.004 (3.0 ±0.1)
	D	.193 (4.9)	.236 (6.0)	.472 (12.0)	.222 (5.65)	.059 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.138 ±.004 (3.5 ±0.1)
	D3	.189 (4.8)	.303 (7.7)	.472 (12.0)	.222 (5.65)	.059 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.130 ±.004 (3.3 ±0.1)
	E	.240 (6.1)	.303 (7.7)	.472 (12.0)	.222 (5.65)	.059 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.150 ±.004 (3.8 ±0.1)

Table 2

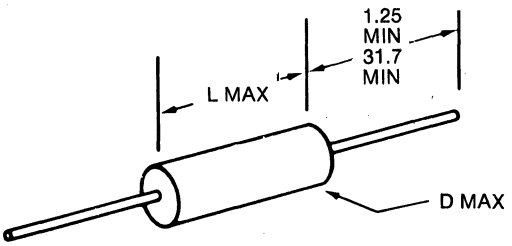
Type	Case Code	∅A±.079 (2)	∅B min.	∅C±.031 (0.5)	∅D±.031 (0.8)	E±.020 (0.5)	W±.059 (1.5)	t±.020 (0.5)	Quantity/Reel pcs.
267	A,B	7 (178)	3.150 (80)	.512 (13.0)	.827 (21.0)	.079 (2.0)	.394 (10.0)	.079 (2.0)	2,000
	C, C_3, D, D_3, E	7 (178)	3.150 (80)	.512 (13.0)	.827 (21.0)	.079 (2.0)	.561 (14.0)	.079 (2.0)	500

MATSUO ELECTRONICS 2134 Main St., Ste. 200 / Huntington Beach, CA 92648 / Tel. (714) 969-2491 / FAX (714) 960-6492

These specifications are subject to change without notice.

METUCHEN CAPACITORS INC.
NPO, X7R, & Z5U Conformally Coated Axial-Leaded Ceramic Capacitors

RUGGED, RELIABLE, AND IDEAL FOR AUTOMATIC INSERTION



MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Conformal coating

LEAD MATERIAL: .020 Dia. — Solderable tinned copper

MARKING:

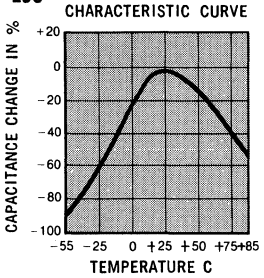
Parts will be marked with the following:

Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

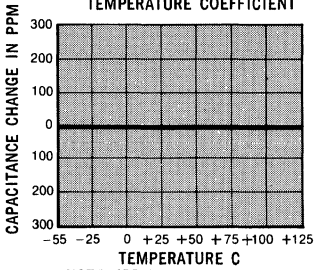
EIA specifications apply regarding Q, TC tol and CAP tol on all units of 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES

Z5U TYPICAL TEMPERATURE CHARACTERISTIC CURVE



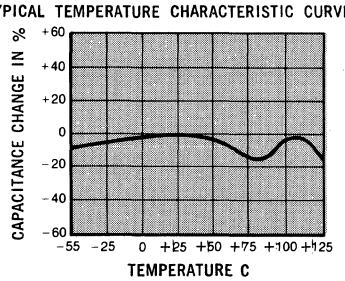
NPO TEMPERATURE COEFFICIENT



NOTE: IPPM equals 0.0001%

TYPICAL TEMPERATURE CHARACTERISTIC CURVE

X7R



NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100 VDC

TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55°C to +125°C (EIA Characteristic COG)

INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%

Meets or exceeds requirements of MIL-C-20

DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF

X7R & Z5U characteristics not shown. Please contact factory for sizes.

MCI PART NO.	GT07		GT10		GT14		
	In.	mm	In.	mm	In.	mm	
L MAX	.170	4.32	.260	6.60	.400	10.16	
D MAX	.100	2.54	.100	2.54	.150	3.81	
Capacitance in pF	WVDC 100	50	WVDC 100	50	WVDC 100	50	Capacitance Characteristic EIA
10							100
12							120
15							150
18							180
22							220
27							270
33							330
39							390
47							470
56							560
68							680
82							820
100							101
120							121
150							151
180							181
220							221
270							271
330							331
390							391
470							471
560							561
680							681
820							821
1000							102
1200							122
1500							152
1800							182
2200							222
2700							272
3300							332
3900							392
4700							472
5600							562
6800							682
8200							822
10,000							103

HOW TO ORDER

GT07 B CG 101 J

SIZE:

WVDC: (B = 50V)[1] (D = 100V)

CHARACTERISTIC: (CG = NPO) (BM = X7R) (BN = Z5U)

CAPACITANCE CODE:[2]

TOLERANCE:[3]

1. **WVDC AVAILABLE:** 50 VDC, 100 VDC
2. 101 = 100 pF i.e., the third digit signifies number of zeroes
3. **MINIMUM AVAILABLE CAPACITANCE TOLERANCES:**
   B = ±.1 pF (10 pF and below)
   C = ±.25 pF (10 pF and below)
   D = ±.5 pF (10 pF and below)
   F = ±1% (10 pF and above)
   G = 2% (10 pF and above)
   J = ±5% (10 pF and above)
   K = 10% (5.6 pF and above)
   M = 20% (2.7 pF and above)
   Z = +80%, −20% (all values)
   P = +100%, −0% (GMV — all values)

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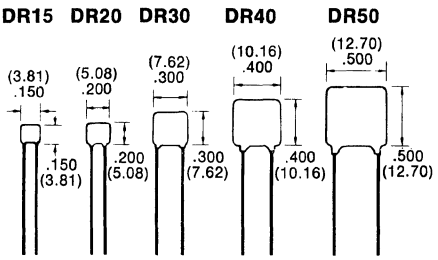
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Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

MCI PART NUMBERS



MAXIMUM PHYSICAL DIMENSIONS

MCI PART NO.	DR15	DR20	DR30	DR40	DR50
S ±.030	.100 (2.54)	.100 (2.54)	.200 (5.08)	.200 (5.08)	.400 (10.16)
D +.004 −.001	.016 (.406)	.020 (.508)	.020 (.508)	.020 (.508)	.025 (.635)
T MAX	.100 (2.54)	.125 (3.18)	.150 (3.81)	.150 (3.81)	.200 (5.08)
AWG#	26	24	24	24	22

S = Lead spacing D = Lead size T = Body thickness mm are in parentheses

MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Dipped epoxy

LEAD MATERIAL: Solderable tinned copper

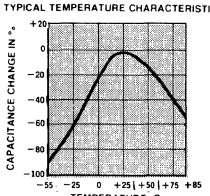
MARKING:
Parts will be marked with the following:

Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

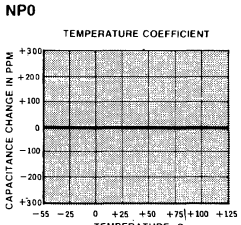
EIA specifications apply regarding Q. TC tol and CAP tol on all units 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES

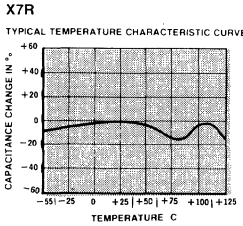
Z5U

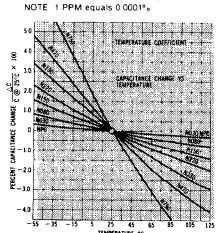


NP0



X7R





HOW TO ORDER

DR15 B CG 101 J

SIZE:

WVDC: (B = 50V)[1] (D = 100V)

CHARACTERISTIC: (CG = NPO) (BM = X7R) (BN = Z5U)

CAPACITANCE CODE:[2]

TOLERANCE:[3]

1. **WVDC AVAILABLE:** 50 VDC, 100 VDC, 200 VDC
2. 101 = 100pF i.e., the third digit signifies number of zeroes
3. **MINIMUM AVAILABLE CAPACITANCE TOLERANCES:**
   B = ±.1 pF (10 pF and below) J = ±5% (10 pF and above)
   C = ±.25 pF (10 pF and below) K = ±10% (5.6 pF and above)
   D = ±.5 pF (10 pF and below) M = ±20% (2.7 pF and above)
   F = ±1% (10 pF and above) Z = +80%, −20% (all values)
   G = ±2% (10 pF and above) P = +100%, −0% (GMV — all values)

Z5U CHARACTERISTICS

CAPACITANCE RANGE: .001 MFD to 4.7 MFD

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request

TEMPERATURE COEFFICIENT: +22%, −56% from +10°C to +85°C (EIA Characteristic Z5U)

DISSIPATION FACTOR: 3% maximum at 1 kHz, 25°C

INSULATION RESISTANCE: 100 K megohms or 500 megohm-microfarad, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±20%, +80% −20%, or +100% −0%

MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

MCI PART NO.	DR15		DR20		DR30		DR40		DR50		Capacitance Characteristic EIA
Capacitance in pF	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	
1000											102
1200											122
1500											152
1800											182
2200											222
2700											272
3300											332
3900											392
4700											472
5600											562
6800											682
8200											822
10,000											103
12,000											123
15,000											153
18,000											183
22,000											223
27,000											273
33,000											333
39,000											393
47,000											473
56,000											563
68,000											683
82,000											823
100,000											104
120,000											124
150,000											154
180,000											184
220,000											224
270,000											274
330,000											334
390,000											394
470,000											474
560,000											564
680,000											684
820,000											824
1,000,000											105
1,200,000											125
1,500,000											155
1,800,000											185
2,200,000											225
2,700,000											275
3,300,000											335
3,900,000											395
4,700,000											475

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/908-679-3366/FAX 908-679-3222

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Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request
TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55° to 125°C (EIA Characteristic COG)
DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF
INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage
DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current
CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%
Meets or exceeds requirements of MIL-C-20
MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

MCI PART NO	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	
1.0																109
1.2																129
1.5																159
1.8																189
2.2																229
2.7																279
3.3																339
3.9																399
4.7																479
5.6																569
6.8																689
8.2																829
10																100
12																120
15																150
18																180
22																220
27																270
33																330
39																390
47																470
56																560
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6800																682
8200																822
10,000																103
12,000																123
15,000																153
18,000																183
22,000																223
27,000																273
33,000																333
39,000																393
47,000																473
56,000																563
68,000																683
82,000																823
100,000																104

X7R CHARACTERISTICS

TEMPERATURE COEFFICIENT: ±15% from −55°C to +125°C (EIA Characteristic X7R)
DISSIPATION FACTOR: 2.5% maximum at 1 kHz, 25°C
CAPACITANCE TOLERANCES AVAILABLE: ±5%, ±10%, ±20%, +80% −20%, or +100% −0%
Meets or exceeds requirements of MIL-C-39014
Working Voltage, Insulation Resistance and Dielectric Strength same as NPO Radial
MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

MCI PART NO.	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	
10																100
12																120
15																150
18																180
22																220
27																270
33																330
39																390
47																470
56																560
68																680
82																820
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2700																272
3300																332
3900																392
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6800																682
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390,000																394
470,000																474
560,000																564
680,000																684
820,000																824
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1,200,000																125
1,500,000																155
1,800,000																185
2,200,000																225
2,700,000																275
3,300,000																335
3,900,000																395
4,700,000																475

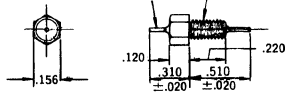
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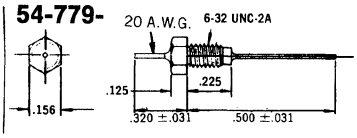
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Feed-Thru Ceramic Capacitors RESIN SEAL

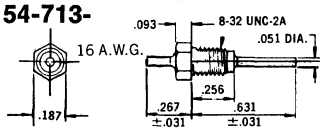
54-790- 22 A.W.G. 4-40 UNC-2A



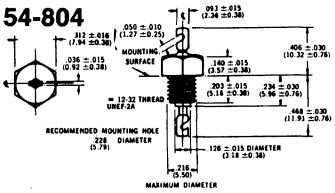
54-779- 20 A.W.G. 6-32 UNC-2A



54-713- 16 A.W.G. 8-32 UNC-2A .051 DIA.

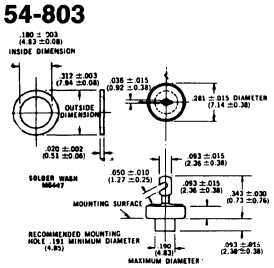


54-804

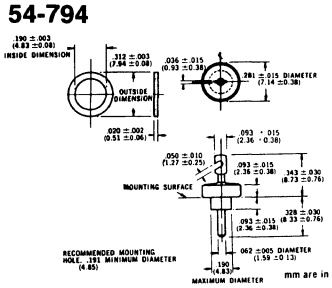


Working Voltage +85°C	Working Voltage +125°C	Cap. pF	Ordering Number
200 WVDC	100 WVDC	10	54-713-001-100M
200 WVDC	100 WVDC	100	54-713-001-101M
200 WVDC	100 WVDC	1000	54-713-001-102Z
200 WVDC	100 WVDC	5000	54-713-001-502P
200 WVDC	100 WVDC	10	54-779-001-100M
200 WVDC	100 WVDC	100	54-779-001-101M
200 WVDC	100 WVDC	500	54-779-001-501P
200 WVDC	100 WVDC	1000	54-779-001-102P
200 WVDC	100 WVDC	22,000	54-779-001-223Z
200 WVDC	100 WVDC	10	54-790-001-100M
200 WVDC	100 WVDC	100	54-790-001-101M
200 WVDC	100 WVDC	500	54-790-001-501Z
200 WVDC	100 WVDC	1000	54-790-001-102P
200 WVDC	100 WVDC	22,000	54-790-001-223Z

54-803



54-794

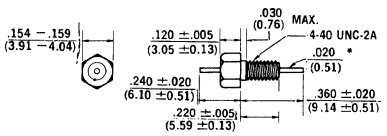


mm are in parentheses

Ordering Number	Type	Tolerance %	Capacitance pF
54-794-002-101M	54-794	20	100
54-794-002-471M		20	470
54-794-002-102P		GMV	1000
54-803-004-101M	54-803	20	100
54-803-004-471M		20	470
54-803-004-102P		GMV	1000
54-804-002-101M	54-804	20	100
54-804-002-471M		20	470
54-804-002-102P		GMV	1000

SCI 910X/911X/912X

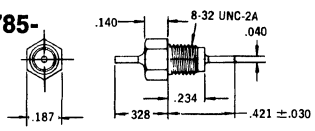
* For 24 gauge tinned copper leads, replace "X" with "0"; for 26 gauge tinned steel leads (.016 Dia.) replace "X" with "2." When steel lead is used, maximum DC current is 5 amps.



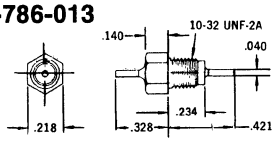
Series	SCI 910X	SC 911X	SCI 912X
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115 VAC 60 Hz
DC AMPS MAX	10	10	10
CAPACITANCE (GMV)	100 pF 1000 5000	100 pF 1000 5000	100 pF 1000 5000
	.01 µF .027 .05	.01 µF .027 .05	.01 µF

HIGH CAPACITY MULTI-LAYER FEED-THRU CAPACITORS

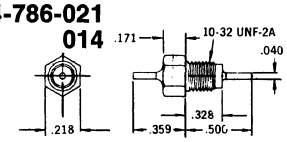
54-785-



54-786-013



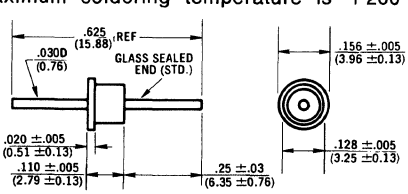
54-786-021
014



Working Voltage @ 125°C	Cap. µF	Ordering Number
100 WVDC	.05	54-785-005-503P
100 WVDC	.3	54-786-013-304Z
50 WVDC	.5	54-786-021-504Z
50 WVDC	1.0	54-786-014-105Z

SCI 9900/9910/9920

All units are hermetically sealed (glass to metal) on one end, while the other end is epoxy sealed. These units are also available reversed with the hermetic seal at the opposite end. To order, add "R" to the end of the part number; e.g. 9900-502R. Installation: Series 9900 units are designed to be soldered in place. Maximum soldering temperature is +200°C (400°F).



Ordering Number	Rated DC Current	Capacitance (GMV)	Working Voltage
SCI-9910-101	5 AMPS	100pF	100 WVDC
SCI-9910-501	5 AMPS	500pF	100 WVDC
SCI-9910-102	5 AMPS	1000pF	100 WVDC
SCI-9910-122	5 AMPS	1200pf	100 WVDC
SCI-9910-272	5 AMPS	2700pf	100 WVDC
SCI-9910-502	5 AMPS	5000pf	100 WVDC
SCI-9910-153	5 AMPS	.015µf	50 WVDC
SCI-9920-101	5 AMPS	100pf	200 WVDC/ 115 VAC 60 Hz
SCI-9920-501	5 AMPS	500pf	200 WVDC/ 115 VAC 60 Hz
SCI-9920-102	5 AMPS	1000pf	200 WVDC/ 115 VAC 60 Hz
SCI-9920-122	5 AMPS	1200pf	200 WVDC/ 115 VAC 60 Hz

All EMI Filtered D Subminiature Connectors stocked by MCI are manufactured in the U.S.A. by **Spectrum Control, Inc...**
The world's leading manufacture of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.
Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/908-679-3366/FAX 908-679-3222

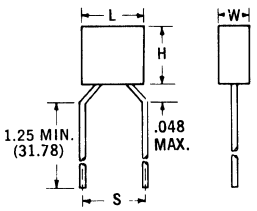
METUCHEN CAPACITORS INC.

NPO Ceramic Capacitors QUALIFIED TO MIL-C-20

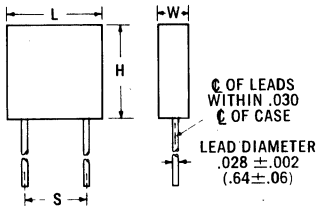
- 0 ±30 ppm/°C Per MIL-C-20
- .1 to 100,000 Pf −55°C +125°C
- Low Dissipation Factor
- Tight Tolerances

RADIAL LEAD CAPACITORS

CCR05



CCR06, 07, 08 & 09



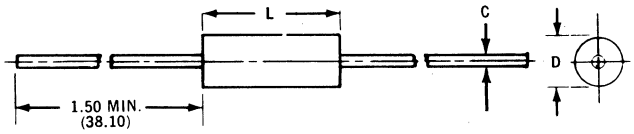
Mil. Equiv.	H & L	W	S
CCR05	.190 ±.010	.090 ±.010	.200 ±.015
CCR09	.190 ±.010	.090 ±.010	.100 ±.015
CCR06	.290 ±.010	.090 ±.010	.200 ±.015
CCR07	.480 ±.020	.140 ±.010	.400 ±.020
CCR08	.480 ±.020	.240 ±.010	.400 ±.020

ER	Slash Sheet	Volt	Cap. Range pF
CCR05 CCR09	35	200 100 50	1-330 360-1800 2200-3300
CCR06	36	200 100 50	360-1800 2000-4700 5100-18,000
CCR07	37	200 100 50	2200-4700 5600-12,000 15,000-100,000
CCR08	38	200 100 50	3900-4700 15,000-18,000 56,000-68,000

All dimensions shown in inches.

AXIAL LEAD CAPACITORS

CCR75, 76, 77, 78 & 79



Mil. Equiv.	L	D	Lead Size
CCR75	.160 ±.010	.090 ±.010	.016
CCR76	.250 ±.010	.090 ±.010	.016
CCR77	.390 ±.010	.140 ±.010	.025
CCR78	.500 ±.020	.250 ±.015	.025
CCR79	.690 ±.020	.350 ±.015	.025

ER	Slash Sheet	Volt	Cap. Range pF
CCR75	27	200 100 50	.1-75 82-240 270-680
CCR76	28	200 100 50	82-130 270-680 750-1000
CCR77	29	200 100 50	150-680 750-2200 2400-5600
CCR78	30	200 100 50	820-3300 3900-12,000 15,000-27,000
CCR79	31	200 100 50	3900-10,000 15,000-39,000 47,000-82,000

Fixed Capacitors, Ceramic Dielectric (Temperature Compensating), Established Reliability

ER **CCR05** **CG** (0±30ppm/°C) **102** **G** **R**

STYLE

05 = Radial .190x.190 75 = Axial .160x.090
09 = Radial .190x.190 76 = Axial .250x.090
06 = Radial .290x.290 77 = Axial .390x.140
07 = Radial .480x.480 78 = Axial .500x.250
08 = Radial .480x.480 79 = Axial .690x.350

CAPACITANCE

Nominal capacitance expressed in picofarads (uF) by three-digit number, first two digits represent significant figures, last digit specifies number of zeroes to follow. When the nominal value is less than 10 pF, the letter 'R' indicates the decimal point and the succeeding digit(s) represent significant figure(s). For example: IRO indicates 1.0 pF; R75 indicates 0.75 pF and OR5 indicates 0.5 pF.

FAILURE RATE LEVEL

M = 1.0%
P = 0.1%
R = 0.01%
S = 0.001%
Expressed in % per 1000 hours

CAPACITANCE TOLERANCE

C = ±.25 pF
D = ±.5 pF
F = ±1%
G = ±2%
J = ±5%
K = ±10%

For your convenience we welcome credit card purchases (min. $35.00).

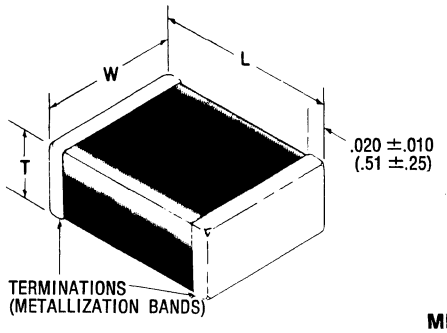
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METUCHEN CAPACITORS INC.

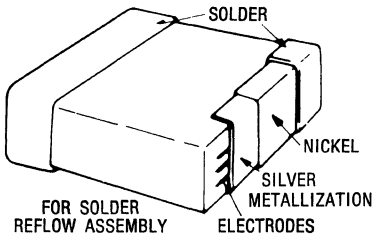
For your convenience we welcome credit card purchases (min. $35.00).

Ceramic Chip/MIL-C-55681
ESTABLISHED RELIABILITY

CAPACITOR OUTLINE DRAWINGS

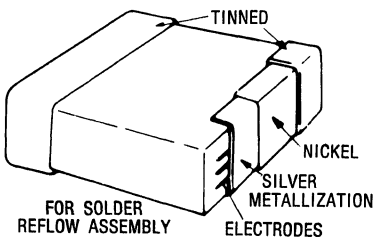


"SOLDERGUARD" I



MILITARY DESIGNATION "S" OR "U"

"SOLDERGUARD" II



MILITARY DESIGNATION "W" OR "Y"

DIMENSIONS—MILLIMETERS & (INCHES)

Style	Size Code	L	W	T Min.	T Max.
CDR01	C0805	2.03 ±.38 (.080 ±.015)	1.27 ±.38 (.050 ±.015)	.51 (.020)	1.40 (.055)
CDR02	C1805	4.57 ±.38 (.180 ±.015)	1.27 ±.38 (.050 ±.015)	.51 (.020)	1.40 (.055)
CDR03	C1808	4.57 ±.38 (.180 ±.015)	2.03 ±.38 (.080 ±.015)	.51 (.020)	2.03 (.080)
CDR04	C1812	4.57 ±.38 (.180 ±.015)	3.18 ±.38 (.125 ±.015)	.51 (.020)	2.03 (.080)
CDR05	C1825	4.57 +.51 −.38 (1.80 +.020 −.015)	6.35 +.51 −.38 (.250 +.020 −.015)	.51 (.020)	2.03 (.080)
CDR06	C2225	5.72 ±.51 (.225 ±.020)	6.35 ±.51 (.250 ±.020)	.51 (.020)	2.03 (.080)
CDR31	C0805	2.00 ±.20 (.078 ±008)	1.25 ±.20 (.049 ±.008)	.50 ±.20 (.020 ±.008)	1.30 ±.20 (.051 ±.008)
CDR32	C1206	3.20 ±.20 (.125 ±.008)	1.60 ±.20 (.062 ±.008)	.50 ±.20 (.020 ±.008)	1.30 ±.20 (.051 ±.008)
CDR33	C1210	3.20 ±.25 (.125 ±.010)	2.50 ±.25 (.098 ±.010)	.50 ±.25 (.020 ±.010)	1.50 ±.25 (.059 ±.010)
CDR34	C1812	4.50 ±.25 (.176 ±.010)	3.20 ±.25 (.125 ±.010)	.50 ±.25 (.020 ±.010)	1.50 ±.25 (.059 ±.010)
CDR35	C1825	4.50 ±.30 (.176 ±.012)	6.40 ±.30 (.250 ±.012)	.50 ±.30 (.020 ±.012)	1.50 ±.30 (.059 ±.012)

ORDERING INFORMATION

CDR01 B P 101 B K S M

STYLE & SIZE CODE
STYLE
C — Ceramic
D — Dielectric, Fixed Chip
R — Established Reliability

RATED TEMPERATURE
−55°C to +125°C

DIELECTRICS
P — 0 ±30 ppm/°C
X — ±15%

CAPACITANCE
Expressed in picofarads (pF)
First 2 digits represent significant figures and the last digit specifies the number of zeros to follow.
Example: 103 — 10,000 picofarads. When nominal value is less than 10 pF, the letter "R" is used to indicate the decimal point.
Example: 1R0 — 1.0 pF; R75 — 0.75 pF; 0R5 — 0.5 pF.

RATED VOLTAGE
A — 50; B — 100

CAPACITANCE TOLERANCE

B	C	D	F	J	K	M
±.1pF	±.25 pF	±.5 pF	±1%	±5%	±10%	±20%

TERMINATION FINISH
S — Solder Coated, Final (SolderGuard I)
U — Base Metallization Barrier Metal— Solder Coated (SolderGuard I)
W — Base Metallization— Barrier Metal— Tinned (Tin or Tin/Lead Alloy) (SolderGuard II)
Y — Base Metallization Barrier Metal— 100% in coated (SolderGuard II)

FAILURE RATE LEVEL
M — 1.0 (%/1000 hrs.)
P — 0.1
R — 0.01
S — 0.001

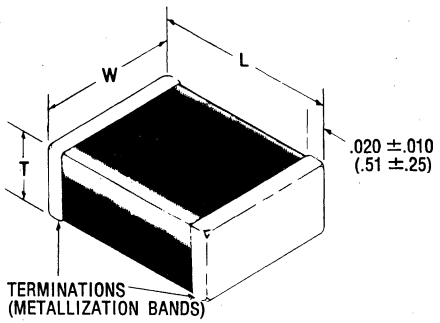
All Ceramic Chip Capacitors stocked by MCI are manufactured in the U.S.A by KEMET...
A world of top quality capacitors, built to KEMET® standards. Distributed for KEMET.

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/908-679-3366/FAX 908-679-3222

METUCHEN CAPACITORS INC.

High Voltage Ceramic Chip Capacitor

NPO



Size	1515	1812	1825	2020	3333	4040	5440	5550	6560
L	.150	.175	.175	.200	.330*	.400*	.540*	.550*	.650*
W	.150	.125	.250	.200	.330*	.400*	.400*	.500*	.600*
WVDC	Max Capacitance Values								
500v	3900	3900	.01µF	.01µF	.039µF	.056µF	.082µF	.1µF	..15µF
1kV	8200	1500	3300	2700	.01µF	.018µF	.022µF	.033µF	.047µF
2kV	330	560	1200	1000	3900	6800	8200	.012µF	.018µF
3kV	100	220	470	390	1500	2200	3900	4700	6800

*Denotes L & W tolerance of ±.025
NOTES: 1. Values are in pF unless otherwise specified.
2. Dimensions are in inches

GENERAL SPECIFICATIONS:

Capacitance Range: 10pF to .15µF
Dissipation Factor: .15% max.
(measured @ 25°C, @ 1.0 VRMS @ 1mHz for values through 100 pF and 1 kHz for all higher values)
Operating Temp. Range: −55°C to +125°C
Temperature Coefficient: 0 ± 30ppm/°C over Temp. Range
Dielectric Withstanding Voltage: 500V: 2.5 x Rated Voltage
1kV & over: 1.5 x Rated Voltage
Insulation Resistance: 1,000 Ohm-Farad or 100,000 megOhms min., whichever is less.

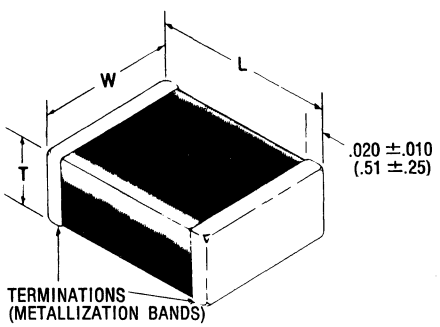
PART NUMBERING SYSTEM HIGH VOLTAGE LINE

202 C 1825 A 122 J

Voltage (3rd digit is No. of zeros)
Mfg Designation
Size
Dielectric Type (A = NPO; B = X7R)
Cap. in pF (3rd digit is No. of zeros)
Capacitance Tolerance (F ± 1%; G ± 2%; J ± 5%; K ± 10%; M ± 20%)
(min. tolerance ± .25pF)

Other sizes and configurations are available on request.

X7R



Size	1515	1812	1825	2020	3333	4040	5440	5550	6560
L	.150	.175	.175	.200	.330*	.400*	.540*	.550*	.650*
W	.150	.125	.250	.200	.330*	.400*	.400*	.500*	.600*
WVDC	Max Capacitance Values								
500v	.027µF	.033µF	.068µF	.056µF	.27µF	.33µF	.68µF	.82µF	1.0µF
1kV	.012µF	.018µF	.039µF	.033µF	.12µF	.22µF	.33µF	.39µF	.56µF
2kV	2700	4700	.01µF	8200	.033µF	.056µF	.068µF	.1µF	..15µF
3kV	1000	1800	3300	2700	.012µF	.022µF	.027µF	.039µF	.056µF

*Denotes L & W tolerance of ±.025
NOTES: 1. Values are in pF unless otherwise specified.
2. Dimensions are in inches

GENERAL SPECIFICATIONS:

Capacitance Range: 10pF to .15µF
Dissipation Factor: 2.5% max.
(measured @ 25°C, @ 1kHz @ 1.0 VRMS)
Operating Temp. Range: −55°C to +125°C
Temperature Coefficient: ±15% from −55°C to +125°C
Dielectric Withstanding Voltage: 500V: 2.5 x Rated Voltage
1000V: 1.5 x Rated Voltage
>1kV: 1.2 x Rated Voltage
Insulation Resistance: 1,000 Ohm-Farad or 100,000 megOhms min., whichever is less.

Other sizes and configurations are available on request.

PART NUMBERING SYSTEM HIGH VOLTAGE LINE

302 C 1825 B 332 K

Voltage (3rd digit is No. of zeros)
Mfg Designation
Size
Dielectric Type (A = NPO; B = X7R)
Cap. in pF (3rd digit is No. of zeros)
Capacitance Tolerance (J ± 5%; K ± 10%; M ± 20%; Z +80%-20%)

Other sizes and configurations are available on request.

MasterCard VISA For your convenience we welcome credit card purchases (min. $35.00).

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/908-679-3366/FAX 908-679-3222

METUCHEN CAPACITORS INC.

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MasterCard VISA

Ceramic Chip/MIL-C-55681
ESTABLISHED RELIABILITY
RATINGS & PART NUMBER REFERENCE

CAP. pF	CAP. TOL.	MIL-C-55681 CDR01-06 CAPACITORS
100 VOLT — C0805 SIZE (MILITARY CDR01)		
10	J,K	CDR01BP100B(2)W(3)
12	J	CDR01BP120BJW(3)
15	J,K	CDR01BP150B(2)W(3)
18	J	CDR01BP180BJW(3)
22	J,K	CDR01BP220B(2)W(3)
27	J	CDR01BP270BJW(3)
33	J,K	CDR01BP330B(2)W(3)
39	J	CDR01BP390BJW(3)
47	J,K	CDR01BP470B(2)W(3)
56	J	CDR01BP560BJW(3)
68	J,K	CDR01BP680B(2)W(3)
82	J	CDR01BP820BJW(3)
100	J,K	CDR01BP101B(2)W(3)
120	J,K	CDR01B(1)121B(2)W(3)
150	J,K	CDR01B(1)151B(2)W(3)
180	J,K	CDR01B(1)181B(2)W(3)
220	K,M	CDR01BX221B(4)W(3)
270	K	CDR01BX271BKW(3)
330	K,M	CDR01BX331B(4)W(3)
390	K	CDR01BX391BKW(3)
470	K,M	CDR01BX471B(4)W(3)
560	K	CDR01BX561BKW(3)
680	K,M	CDR01BX681B(4)W(3)
820	K	CDR01BX821BKW(3)
1,000	K,M	CDR01BX102B(4)W(3)
1,200	K	CDR01BX122BKW(3)
1,500	K,M	CDR01RX152B(4)W(3)
1,800	K	CDR01BX182BKW(3)
2,200	K	CDR01BX222BKW(3)
2,700	K	CDR01BX272BKW(3)
3,300	K	CDR01BX332BKW(3)
50 VOLT — C0805 SIZE (MILITARY CDR01)		
3,900	K	CDR01BX392AKW(3)
4,700	K,M	CDR01BX472A(4)W(3)
100 VOLT — C1805 SIZE (MILITARY CDR02)		
220	J,K	CDR02BP221B(2)W(3)
270	J	CDR02BP271BJW(3)
3,900	K	CDR02BX392BKW(3)
4,700	K,M	CDR02BX472B(4)W(3)
5,600	K	CDR02BX562BKW(3)
6,800	K,M	CDR02BX682B(4)W(3)
8,200	K	CDR02BX822BKW(3)
10,000	K,M	CDR02BX103B(4)W(3)
50 VOLT — C1805 SIZE (MILITARY CDR02)		
12,000	K	CDR02BX123AKW(3)
15,000	K,M	CDR02BX153A(4)W(3)
18,000	K	CDR02BX183AKW(3)
22,000	K,M	CDR02BX223A(4)W(3)
100 VOLT — C1808 SIZE (MILITARY CDR03)		
330	J,K	CDR03BP331B(2)W(3)
390	J	CDR03BP391BJW(3)
470	J,K	CDR03BP471B(2)W(3)
560	J	CDR03BP561BJW(3)
680	J,K	CDR03BP681B(2)W(3)
820	J	CDR03BP821BJW(4)
1,000	J,K	CDR03BP102B(2)W(3)
12,000	K	CDR03BX123BKW(3)
15,000	K,M	CDR03BX153B(4)W(3)
18,000	K	CDR03BX183BKW(3)
22,000	K,M	CDR03BX223B(4)W(3)
27,000	K	CDR03BX273BKW(3)
33,000	K,M	CDR03BX333B(4)W(3)
50 VOLT — C1808 SIZE (MILITARY CDR03)		
39,000	K	CDR03BX393AKW(3)
47,000	K,M	CDR03BX473A(4)W(3)
56,000	K	CDR03BX563AKW(3)
68,000	K,M	CDR03BX683A(4)W(3)

CAP. pF	CAP. TOL.	MIL-C-55681 CDR01-06 CAPACITORS
100 VOLT — C1812 SIZE (MILITARY CDR04)		
1,200	J	CDR04BP122BJW(3)
1,500	J,K	CDR04BP152B(2)W(3)
1,800	J	CDR04BP182BJW(3)
2,200	J,K	CDR04BP222B(2)W(3)
2,700	J	CDR04BP272BJW(3)
3,300	J,K	CDR04BP332B(2)W(3)
39,000	K	CDR03BX393BKW(3)
47,000	K,M	CDR04BX473B(4)W(3)
56,000	K	CDR04BX563BKW(3)
50 VOLT — C1812 SIZE (MILITARY CDR04)		
82,000	K	CDR04BX823AKW(3)
100,000	K,M	CDR04BX104A(4)W(3)
120,000	K	CDR04BX124AKW(3)
150,000	K,M	CDR04BX154A(4)W(3)
180,000	K	CDR04BX184AKW(3)
100 VOLT — C1825 SIZE (MILITARY CDR05)		
3,900	J,K	CDR05BP392B(2)S(3)
4,700	J,K	CDR05BP472B(2)W(3)
5,600	J,K	CDR05BP562B(2)W(3)
68,000	K,M	CDR05BX683B(4)W(3)
82,000	K	CDR05BX823BKW(3)
100,000	K,M	CDR05BX104B(4)W(3)
120,000	K	CDR05BX124BKW(3)
150,000	K,M	CDR05BX154B(4)W(3)
50 VOLT — C1825 SIZE (MILITARY CDR05)		
220,000	K,M	CDR05BX224A(4)W(3)
270,000	K	CDR05BX274AKW(3)
330,000	K,M	CDR02BX335A(4)W(3)
100 VOLT — C2225 SIZE (MILITARY CDR06)		
6,800	J,K	CDR06BP682B(2)W(3)
8,200	J,K	CDR06BP822B(2)W(3)
10,000	J,K	CDR06BP103B(2)W(3)
50 VOLT — C2225 SIZE (MILITARY CDR06)		
390,000	K	CDR06BX394AKW(2)
470,000	K,M	CDR06BX474A(4)W(3)

CAP. pF	CAP. TOL.	CDR31 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C0805 SIZE (MILITARY CDR31)		
1.0	B,C	CDR31BP1R0B(5)W(3)
1.1	B,C	CDR31BP1R1B(5)W(3)
1.2	B,C	CDR31BP1R2B(5)W(3)
1.3	B,C	CDR31BP1R3B(5)W(3)
1.5	B,C	CDR31BP1R5B(5)W(3)
1.6	B,C	CDR31BP1R6B(5)W(3)
1.8	B,C	CDR31BP1R8B(5)W(3)
2.0	B,C	CDR31BP2R0B(5)W(3)
2.2	B,C	CDR31BP2R2B(5)W(3)
2.4	B,C	CDR31BP2R4B(5)W(3)
2.7	B,C,D	CDR31BP2R7B(6)W(3)
3.0	B,C,D	CDR31BP3R0B(6)W(3)
3.3	B,C,D	CDR31BP3R3B(6)W(3)
3.6	B,C,D	CDR31BP3R6B(6)W(3)
3.9	B,C,D	CDR31BP3R9B(6)W(3)
4.3	B,C,D	CDR31BP4R3B(6)W(3)
4.7	B,C,D	CDR31BP4R7B(6)W(3)
5.1	B,C,D	CDR31BP5R1B(6)W(3)
5.6	B,C,D	CDR31BP5R6B(6)W(3)
6.2	B,C,D	CDR31BP6R2B(6)W(3)
6.8	B,C,D	CDR31BP6R8B(6)W(3)
7.5	B,C,D	CDR31BP7R5B(6)W(3)
8.2	B,C,D	CDR31BP8R2B(6)W(3)
9.1	B,C,D	CDR31BP9R1B(6)W(3)
10	F,J,K	CDR31BP100B(7)W(3)
11	F,J,K	CDR31BP110B(7)W(3)
12	F,J,K	CDR31BP120B(7)W(3)
13	F,J,K	CDR31BP130B(7)W(3)

CAP. pF	CAP. TOL.	CDR31 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C0805 SIZE (MILITARY CDR31) (Cont'd)		
15	F,J,K	CDR31BP150B(7)W(3)
16	F,J,K	CDR31BP160B(7)W(3)
18	F,J,K	CDR31BP180B(7)W(3)
20	F,J,K	CDR31BP200B(7)W(3)
22	F,J,K	CDR31BP220B(7)W(3)
24	F,J,K	CDR31BP240B(7)W(3)
27	F,J,K	CDR31BP270B(7)W(3)
30	F,J,K	CDR31BP300B(7)W(3)
33	F,J,K	CDR31BP330B(7)W(3)
36	F,J,K	CDR31BP360B(7)W(3)
39	F,J,K	CDR31BP390B(7)W(3)
43	F,J,K	CDR31BP430B(7)W(3)
47	F,J,K	CDR31BP470B(7)W(3)
51	F,J,K	CDR31BP510B(7)W(3)
56	F,J,K	CDR31BP560B(7)W(3)
62	F,J,K	CDR21BP620B(7)W(3)
68	F,J,K	CDR31BP680B(7)W(3)
75	F,J,K	CDR31BP750B(7)W(3)
82	F,J,K	CDR31BP820B(7)W(3)
91	F,J,K	CDR31BP910B(7)W(3)
100	F,J,K	CDR31BP101B(7)W(3)
110	F,J,K	CDR31BP111B(7)W(3)
120	F,J,K	CDR31BP121B(7)W(3)
130	F,J,K	CDR31BP131B(7)W(3)
150	F,J,K	CDR31BP151B(7)W(3)
160	F,J,K	CDR31BP161B(7)W(3)
180	F,J,K	CDR31BP181B(7)W(3)
200	F,J,K	CDR31BP201B(7)W(3)
220	F,J,K	CDR31BP221B(7)W(3)
240	F,J,K	CDR31BP241B(7)W(3)
270	F,J,K	CDR31BP271B(7)W(3)
300	F,J,K	CDR31BP301B(7)W(3)
330	F,J,K	CDR31BP331B(7)W(3)
360	F,J,K	CDR31BP361B(7)W(3)
390	F,J,K	CDR31BP391B(7)W(3)
430	F,J,K	CDR31BP431B(7)W(3)
470	F,J,K	CDR31BP471B(7)W(3)
50 VOLT — BP — C0805 SIZE (MILITARY CDR31)		
510	F,J,K	CDR31BP511A(7)W(3)
560	F,J,K	CDR31BP561A(7)W(3)
620	F,J,K	CDR31BP621A(7)W(3)
680	F,J,K	CDR31BP681A(7)W(3)
100 VOLT — BX — C0805 SIZE (MILITARY CDR31)		
470	K,M	CDR31BX471B(4)W(3)
560	K,M	CDR31BX561B(4)W(3)
680	K,M	CDR31BX681B(4)W(3)
820	K,M	CDR31BX821B(4)W(3)
1,000	K,M	CDR31BX102B(4)W(3)
1,200	K,M	CDR31BX122B(4)W(3)
1,500	K,M	CDR31BX152B(4)W(3)
1,800	K,M	CDR31BX182B(4)W(3)
2,200	K,M	CDR31BX222B(4)W(3)
2,700	K,M	CDR31BX272B(4)W(3)
3,300	K,M	CDR31BX332B(4)W(3)
3,900	K,M	CDR31BX392B(4)W(3)
4,700	K,M	CDR31BX472B(4)W(3)
50 VOLT — BX — C0805 SIZE (MILITARY CDR31)		
5,600	K,M	CDR31BX562A(4)W(3)
6,800	K,M	CDR31BX682A(4)W(3)
8,200	K,M	CDR31BX822A(4)W(3)
10,000	K,M	CDR31BX103A(4)W(3)
12,000	K,M	CDR31BX123A(4)W(3)
15,000	K,M	CDR31BX153A(4)W(3)
18,000	K,M	CDR31BX183A(4)W(3)

(1) To complete Part Number for Dielectric, insert P or X symbol — J tolerance is not available with the BX Dielectric.
(2) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): J—±5%; K—±10%.
(3) To complete Part Number, insert Failure Rate Symbol: M—1.0%, P—0.1%; R—0.01%; S—.001%.
(4) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): K—±10%, M—±20% only.
(5) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF.
(6) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF, D—±0.5 pF.
(7) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): F—±1%, J—±5%, K—±10%.

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CAP. pF	CAP. TOL.	CDR32 CAPACITORS PER MIL-C-55681
1000 VOLT — BP — C1206 SIZE (MILITARY CDR32)		
1.0	B,C	CDR32BP1R0B/5)W(3)
1.1	B,C	CDR32BP1R1B(5)W(3)
1.2	B,C	CDR32BP1R2B/5)W(3)
1.3	B,C	CDR32BP1R3B(5)W(3)
1.5	B,C	CDR32BP1R5B(5)W(3)
1.6	B,C	CDR32BP1R6B(5)W(3)
1.8	B,C	CDR32BP1R8B(5)W(3)
2.0	B,C	CDR32BP2R0B(5)W(3)
2.2	B,C	CDR32BP2R2B(5)W(3)
2.4	B,C	CRD32BP2R4B(5)W(3)
2.7	B,C,D	CDR32BP2R7B(6)W(3)
3.0	B,C,D	CDR32BP3R0B(6)W(3)
3.3	B,C,D	CDR32BP3R3B(6)W(3)
3.6	B,C,D	CDR32BP3R6B(6)W(3)
3.9	B,C,D	CDR32BP3R9B(6)W(3)
4.3	B,C,D	CDR32BP4R3B(6)W(3)
4.7	B,C,D	CDR32BP4R7B(6)W(3)
5.1	B,C,D	CDR32BP5R1B(6)W(3)
5.6	B,C,D	CDR32BP5R6B(6)W(3)
6.2	B,C,D	CDR32BP6R2B(6)W(3)
6.8	B,C,D	CDR32BP6R8B(6)W(3)
7.5	B,C,D	CDR32BP7R5B(6)W(3)
8.2	B,C,D	CDR32BP8R2B(6)W(3)
9.1	B,C,D	CDR32BP9R1B(6)W(3)
10	F,J,K	CDR32BP100B(7)W(3)
11	F,J,K	CDR32BP110B(7)W(3)
12	F,J,K	CDR32BP120B(7)W(3)
13	F,J,K	CDR32BP130B(7)W(3)
15	F,J,K	CDR32BP150B 7)W(3)
16	F,J,K	CDR32BP160B(7)W(3)
18	F,J,K	CDR32BP180B(7)W(3)
20	F,J,K	CDR32BP200B(7)W(3)
22	F,J,K	CDR32BP220B 7)W(3)
24	F,J,K	CDR32BP240B(7)W(3)
27	F,J,K	CDR32BP270B(7)W(3)
30	F,J,K	CDR32BP300B(7)W(3)
33	F,J,K	CDR32BP330B(7)W(3)
36	F,J,K	CDR32BP360B(7)W(3)
39	F,J,K	CDR32BP390B(7)W(3)
43	F,J,K	CDR32BP430B(7)W(3)
47	F,J,K	CDR32BP470B(7)W(3)
51	F,J,K	CDR32BP510B(7)W(3)
56	F,J,K	CDR32BP560B(7)W(3)
62	F,J,K	CDR32BP620B(7)W(3)
68	F,J,K	CDR32BP680B(7)W(3)
75	F,J,K	CDR32BP750B(7)W(3)
82	F,J,K	CDR32BP820B(7)W(3)
91	F,J,K	CDR32BP910B(7)W(3)
100	F,J, K	CDR32BP101B(7)W(3)
100 VOLT — BP — C1206 SIZE (MILITARY CDR32)		
110	F,J,K	CDR32BP111B(7)W(3)
120	F,J,K	CDR32BP121B(7)W(3)
130	F,J,K	CDR32BP131B(7)W(3)
150	F,J,K	CDR32BP151B(7)W(3)
160	F,J,K	CDR32BP161B(7)W(3)
180	F,J,K	CDR32BP181B(7)W(3)
200	F,J,K	CDR32BP201B(7)W(3)
220	F,J,K	CDR32BP221B(7)W(3)
240	F,J,K	CDR32BP241B(7)W(3)
270	F,J,K	CDR32BP271B(7)W(3)
300	F,J,K	CDR32BP301B(7)W(3)
330	F,J,K	CDR32BP331B(7)W(3)
360	F,J,K	CDR32BP361B(7)W(3)
390	F,J,K	CDR32BP391B(7)W(3)
430	F,J,K	CDR32BP431B(7)W(3)
470	F,J,K	CDR32BP471B(7)W(3)
510	F,J,K	CDR32BP511B(7)W(3)
560	F,J,K	CDR32BP561B(7)W(3)
620	F,J,K	CDR32BP621B(7)W(3)
680	F,J,K	CDR32BP681B(7)W(3)
750	F,J,K	CDR32BP751B(7)W(3)

CAP. pF	CAP. TOL.	CDR32 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C1206 SIZE (MILITARY CDR32) (Cont'd)		
820	F,J,K	CDR32BP821B(7)W(3)
910	F,J,K	CDR32BP911B(7)W(3)
1,000	F,J,K	CDR32BP102B(7)W(3)
50 VOLT — BP — C1206 SIZE (MILITARY CDR32)		
1.100	F,J,K	CDR32BP112A(7)W(3)
1,200	F,J,K	CDR32BP122A(7)W(3)
1,300	F,J,K	CDR32BP132A(7)W(3)
1,500	F,J,K	CDR32BP152A(7)W(3)
1,600	F,J,K	CDR32BP162A(7)W(3)
1,800	F,J,K	CDR32BP182A(7)W(3)
2,000	F,J,K	CDR32BP202A(7)W(3)
2,200	F,J,K	CDR32BP222A(7)W(3)
100 VOLT — BX — C1206 SIZE (MILITARY CDR32)		
4,700	K,M	CDR32BX472B(4)W(3)
5,600	K,M	CDR32BX562B(4)W(3)
6,800	K,M	CDR32BX682B(4)W(3)
8,200	K,M	CDR32BX822B(4)W(3)
10,000	K,M	CDR32BX103B(4)W(3)
12,000	K,M	CDR32BX123B(4)W(3)
15,000	K,M	CDR32BX153B(4)W(3)
50 VOLT — BX — C1206 SIZE (MILITARY CDR32)		
18,000	K,M	CDR32BX183A(4)W(3)
22,000	K,M	CDR32BX223A(4)W(3)
27,000	K,M	CDR32BX273A(4)W(3)
33,000	K,M	CDR32BX333A(4)W(3)
39,000	K,M	CDR32BX393A(4)W(3)

CAP. pF	CAP. TOL.	CDR33, 34, 35 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C1210 SIZE (MILITARY CDR33)		
1,000	F,J,K	CDR33BP102B(7)W(3)
1,100	F,J,K	CDR33BP112B(7)W(3)
1,200	F,J,K	CDR33BP122B(7)W(3)
1,300	F,J,K	CDR33BP132B(7)W(3)
1,500	F,J,K	CDR33BP152B(7)W(3)
1,600	F,J,K	CDR33BP162B(7)W(3)
1,800	F,J,K	CDR33BP182B(7)W(3)
2,000	F,J,K	CDR33BP202B(7)W(3)
2,200	F,J,K	CDR33BP222B(7)W(3)
50 VOLT — BP — C1210 SIZE (MILITARY CDR33)		
2,400	F,J,K	CDR33BP242A(7)W(3)
2,700	F,J,K	CDR33BP272A(7)W(3)
3,000	F,J,K	CDR33BP302A(7)W(3)
3,300	F,J,K	CDR33BP332A(7)W(3)
100 VOLT — BX — C1210 SIZE (MILITARY CDR33)		
15,000	K,M	CDR33BX153B(4)W(3)
18,000	K,M	CDR33BX183B(4)W(3)
22,000	K,M	CDR33BX223B(4)W(3)
27,000	K,M	CDR33BX273B(4)W(3)
50 VOLT — BX — C1210 SIZE (MILITARY CDR33)		
39,000	K,M	CDR33BX393A(4)W(3)
47,000	K,M	CDR33BX473A(4)W(3)
56,000	K,M	CDR33BX563A(4)W(3)
68,000	K,M	CDR33BX683A(4)W(3)
82,000	K,M	CDR33BX823A(4)W(3)
100,000	K,M	CDR33BX104A(4)W(3)
100 VOLT — BP — C1812 SIZE (MILITARY CDR34)		
2,200	F,J,K	CDR34BP222B(7)W(3)
2,400	F,J,K	CDR34BP242B(7)W(3)

CAP. pF	TOL. CAP.	CDR33, 34, 35 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C1812 SIZE (MILITARY CDR34) (Cont'd)		
2,700	F,J,K	CDR34BP272B(7)W(3)
3,000	F,J,K	CDR34BP302B(7)W(3)
3,300	F,J,K	CDR34BP332B(7)W(3)
3,600	F,J,K	CDR34BP362B(7)W(3)
3,900	F,J,K	CDR34BP392B(7)W(3)
4,300	F,J,K	CDR34BP432B(7)W(3)
4,700	F,J,K	CDR34BP472B(7)W(3)
50 VOLT — BP — C1812 SIZE (MILITARY CDR34)		
5,100	F,J,K	CDR34BP512A(7)W(3)
5,600	F,J,K	CDR34BP562A(7)W(3)
6,200	F,J,K	CDR34BP622A(7)W(3)
6,800	F,J,K	CDR34BP682A(7)W(3)
7,500	F,J,K	CDR34B752A(7)W(3)
8,200	F,J,K	CDR34BP822A(7)W(3)
9,100	F,J,K	CDR34BP812A(7)W(3)
10,000	F,J,K	CDR34BP103A(7)W(3)
100 VOLT — BX — C1812 SIZE (MILITARY CDR34)		
27,000	K,M	CDR34BX273B(4)W(3)
33,000	K,M	CDR34BX333B(4)W(3)
39,000	K,M	CDR34BX393B(4)W(3)
47,000	K,M	CDR34BX473B(4)W(3)
56,000	K,M	CDR34BX563B(4)W(3)
50 VOLT — BX — C1812 SIZE (MILITARY CDR34)		
100,000	K,M	CDR34BX104A(4)W(3)
120,000	K,M	CDR34BX124A(4)W(3)
150,000	K,M	CDR34BX154A(4)W(3)
180,000	K,M	CDR34BX184A(4)W(3)
100 VOLT — BP — C1825 SIZE (MILITARY CDR35)		
4,700	K,M	CDR35BP472B(7)W(3)
5,100	K,M	CDR35BP512B(7)W(3)
5,600	F,J,K	CDR35BP562B(7)W(3)
6,200	F,J,K	CDR35BP622B(7)W(3)
6,800	F,J,K	CDR35BP682B(7)W(3)
7,500	F,J,K	CDR35BP752B(7)W(3)
8,200	F,J,K	CDR35BP822B(7)W(3)
9,100	F,J,K	CDR35BP912B(7)W(3)
10,000	F,J,K	CDR35BP103B(7)W(3)
50 VOLT — BP — C1825 SIZE (MILITARY CDR35)		
11,000	F,J,K	CDR35BP113A(7)W(3)
12,000	F,J,K	CDR35BP123A(7)W(3)
13,000	F,J,K	CDR35BP133A(7)W(3)
15,000	F,J,K	CDR35BP153A(7)W(3)
16,000	F,J,K	CDR35BP163A(7)W(3)
18,000	F,J,K	CDR35BP183A(7)W(3)
20,000	F,J,K	CDR35BP203A(7)W(3)
22,000	F,J,K	CDR35BP223A(7)W(3)
100 VOLT — BX — C1812 SIZE (MILITARY CDR35)		
56,000	K,M	CDR35BX563B(4)W(3)
68,000	K,M	CDR35BX683B(4)W(3)
82,000	K,M	CDR35BX823B(4)W(3)
100,000	K,M	CDR35BX104B(4)W(3)
120,000	K,M	CDR35BX124B(4)W(3)
150,000	K,M	CDR35BX154B(4)W(3)
50 VOLT — BX — C1825 SIZE (MILITARY CDR35)		
180,000	K,M	CDR35BX184A(4)W(3)
220,000	K,M	CDR35BX224A(4)W(3)
270,000	K,M	CDR35BX274A(4)W(3)
330,000	K,M	CDR35BX334A(4)W(3)
390,000	K,M	CDR35BX394A(4)W(3)
470,000	K,M	CDR35BX474A(4)W(3)

(1) To complete Part Number for Dielectric, insert P or X symbol — J tolerance is not available with the BX Dielectric.
(2) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): J—±5%; K—±10%.
(3) To complete Part Number, insert Failure Rate Symbol: M—1.0%, P—0.1%;R—0.01%; S—.001%.
(4) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): K—±10%, M—±20% only.
(5) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF.
(6) To complete Part Number, Insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF, D—±0.5 pF.
(7) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): F—±1%,J—±5%, K—±10%.

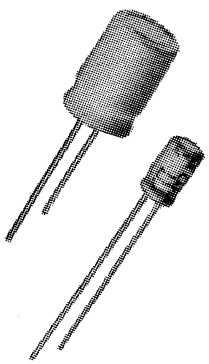
All Ceramic Chip Capacitors stocked by MCI are manufactured in the U.S.A by KEMET...

A world of top quality capacitors, built to KEMET® standards. Distributed for KEMET.

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/908-679-3366/FAX 908-679-3222

MULTI PRODUCTS INTERNATIONAL MPC CAPAR
250 Lackawanna Avenue
West Paterson, New Jersey 07424
(201) 890-1344 • FAX: 201-890-1677

Aluminum Miniature General Purpose



CRSS, CRSST: 85°C, 105°C radial, 2000 hour load life, reduced case sizes, 1 to 10,000uf; 6.3 to 250WVDC

CRE, CAE: standard, 85°C radial, axial, .1 to 10,000uf; 6.3 to 450WVDC

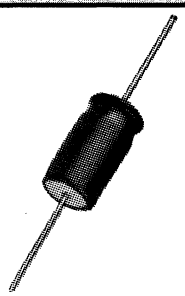
CRET, CAET: 105°C radial, axial, .1 to 10,000uf; 6.3 to 450WVDC

CLPLC: 85°C Three leaded high CV, 100 to 33,000uf; 6.3 to 250WVDC

CRSM: radial super-subminiature, 7mm maximum height; .1 to 100uf; 6.3 to 50WVDC

CNR, CNA: radial, axial bi-polar 85°C, .47 to 1,000uf; 10 to 50WVDC

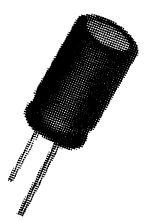
Aluminum Low Leakage



CLE: radial super subminiature, .002CV leakage current, 7mm maximum case height; .1 to 100uf; 6.3 to 50WVDC

CLEL, CLEA: radial, axial .002CV leakage current; .1 to 2,200uf; 6.3 to 100WVDC

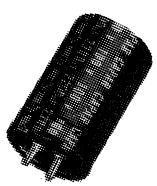
Aluminum Low ESR



CMRZ: 105°C radial subminiature, 2000 hour load life, solvent-proof seal and safety vent, low impedence and ESR .22 to 6,800uf; 6.3 to 63WVDC

CRZ: 105°C radial miniature, 2000 hour load life, safety vent, low impedence and ESR, higher ripple .22 to 2,200uf; 6.3 to 63WVDC

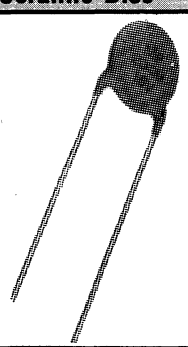
Aluminum Snap-In Case



CLPT, CSDT: low profile or small diameter, 105°C, low ESR, reduced case sizes .100 to 23,000uf; 10 to 250WVDC

CLLP, CLSD: low profile or small diameter 85°C, new reduced case sizes, 220 to 22,000uf; 16 to 450WVDC

Ceramic Disc



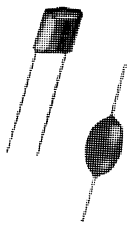
CLASS I: temperature stable, all T.C.s including NPO, N750, N1500; from 1PF, 25 to 1000WVDC

CLASS II: general purpose, all T.C.s including Y5T, Z5U, Z5V, S2L, S3N, Z5F; from .1PF to .1uf; 12 to 1000WVDC

HIGH VOLTAGE: 2KV to 5KV, Z5U T.C.; 82PF to .02uf, 20% tolerance

AC CAPACITORS: to UL 1414 for across the line, 125VAC; 100PF to .01uf, Y5P and Y5V T.C.s

Film



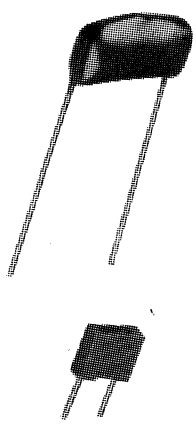
CEM: polyester film, radial leads subminiature 63 to 400WVDC, .001 to .47uf ± 10%, ± 5%, non inductive

CAP: polyester, axial leads, non inductive .001 to 1uf; 50 to 630WVDC, high current capability

CPRM, CPAM: radial, axial, polypropylene, non inductive 100 to 2000WVDC, .001 to .47uf; .1% max DF at 1kHz @ 25°C, linear T.C.

CPSTA, CPSTR: polystyrene, axial, radial leads, 56 to 10,000pf, 50 to 500WVDC, low DF, high IR tolerance: 10% to 1%

Metalized Film



CRPP, CAPP: radial, axial, metalized polypropylene, non inductive 55° to +105°C, .001 to 4.7uf; 250 to 630VDC

CRM5, CRM: metalized polyester, radial leads, .01 to 10uf; 100 to 630VDC, 85°C high stability of capacitance and DF temperature, self healing CRM5, all lead centers 5mm

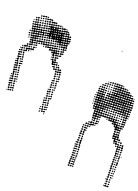
CUB: box subminiature, metalized polyester, .0047 to 6.8uf; 63 to 100VDC, all lead centers are 5mm

CMB: box metalized polyester, precision molded UL 94V-1 case, .01 to 6.8uf; .100 to 630VDC, self healing.

CAM, CTM: metalized polyester, axial, leads, oval, tubular, non inductive high stability, self-healing .100 to 630VDC, .01 to 10uf

CRPC, CAPC: radial, axial, metalized polycarbonate for high frequency, non inductive .01 to 6.8uf; 100 to 400WVDC, −40 to +85°C

Multilayer Ceramic Capacitors



MR: radial-leaded, NPO (CG), X7R (2R1), Z5U (2E6) dielectrics, values to 2uf; 100WVDC (Z5U)

MA: axial-leaded, NPO (CG), X7R (2R1), Z5U (2E6) dielectrics, values to .39uf; 25WVDC (Z5U)

MC: surface mount, NPO (CG), X7R (2R1), Z5U (2E6) dielectrics, 0805 to 2225 case sizes, values to .039uf; 50WVDC (Z5U)

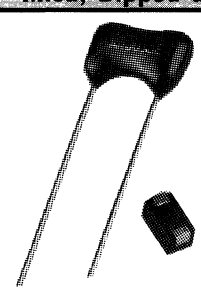
Tantalum



CDT: dipped epoxy reduced case sizes. −55 to +125°C .1 to 680uf; 3 to 50VDC

CTC: 125°C chip molded epoxy surface mount, 4 to 35WVDC, .1 to 68uf; .01CV leakage

Mica, Dipped and Surface Mount

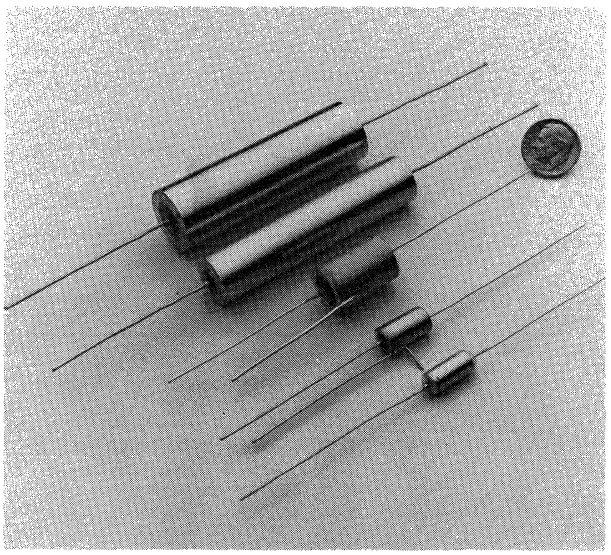


DM: DM05 to DM42 case sizes. MIL-C-5 approved. CM04, 5, 6, 7 and 8 types, high reliability and ultra stability, 125°C, 1PF to 1uf; 50 to 500VDC standard tolerance: 5%, 2%, 1%

UC CHIP: 1PF to 2000PF .100, 500VDC, tolerance: ± .25PF to ±5%, excellent solderability without thermal shock

MultiComp, Inc.

A Spectrum Electronics Corporation



HERMETICALLY SEALED CAPACITORS

FEATURES:

- Close Tolerance Sets (Matched in 0.25% tolerance band)
- Stable (Less than 0.5% drift through life)
- High Insulation Resistance
- Low Dielectric Absorption
- True Hermetically Sealed
- Non-Inductive
- High Current
- Tailored Temperature Coefficient
- Custom Value
- Components used as standards to determine sweep timing or waveform shapes.
- Reliability 99.995%

MulitComp capacitors are designed for special applications and high precision circuitry. Presently Mylar, Polypropylene, Polystyrene, and Polycarbonate films are being used in foil/film and metalized constructions to ensure the best possible stability over time and temperature excursions. These components also provide other excellent characteristics such as: Low Dissipation Factor, and Low Electrical Stress Noise. These capacitors have outstanding performance in applications such as: Input Coupling, Timing, Vertical Divider Compensating, Frequency Determining, Calibration, and Waveform Shaping.

PLASTIC DIELECTRIC HERMETICALLY SEALED EXTENDED FOIL FILM, AND METALIZED CONSTRUCTION

INPUT COUPLING CAPACITORS

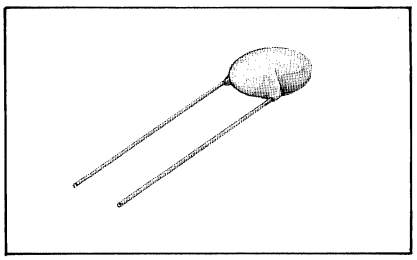
Characteristics	Polypropylene	Polystyene	Polycarbonate	Polyester (Mylar)	Impregnated Polycarbonate
Capacitance Value Range	300pf to 0.5µf	.001µf to 1.0µf	450pf to 10.0µf	.001µf to 1.0µf	0.02µf to 0.1µf
Capacitance Tolerance Range @25°C, 1KHz	±1.5% to ±2.0%	±1.5% to ±3.0%	±1.5% to ±3.0%	±3.5%	−15% to 10%
Dissipation Factor 1KHz, @25°C Typical	0.10%	0.10%	0.30%	0.40%	0.20%
Voltage Rating Range (D.C. Working)	25V to 400V	25V to 400V	25V to 3,000V	100V to 400V	400 to 1000 DCVW
Set Matching Initial Tolerance Band End of Life Tolerance Band	 N.A. N.A.	 0.25% 0.75%	 0.25% 0.75%	 0.50% 1.00%	
Value Dirft Through Life	0.20%	0.30%	0.40%	0.50%	
Insulation Resistance (Typical) 1×10^9 Minimum @ Rated Voltage/One Minute Charge	$5 \times 10^{12}\Omega \times \mu f$	$7 \times 10^{11}\Omega \times \mu f$	$1 \times 10^{11}\Omega \times \mu f$	$1 \times 10^{11}\Omega \times \mu f$	$3 \times 10^{11}\Omega \times \mu f$
Temperature Coefficient Range Typical	−310 to 0ppm/°C	−90 to 0ppm/°C	−110 to +190ppm/°C	0 to +150ppm/°C	−200 to −100ppm/°C
Operating Temperature Range	−55°C to +85°C	-55°C to +95°C	-55°C to +105°C	-55°C to +105°C	−55°C to +105°C
Storage Temperature Range	−65°C to +85°C	-65°C to +95°C	-65°C to +105°C	-65°C to +105°C	−65°C to +105°C
Set Pairing					0.4% to 1.0%
Maximum Electrical Stress Noise					One Change No More than 0.8µf

For further information and pricing, contact MULTICOMP'S marketing department at:

3005 S.W. 154th TERRACE, BEAVERTON, OREGON 97006 • (503) 626-4200 • FAX (503) 643-4889

disc ceramic capacitors

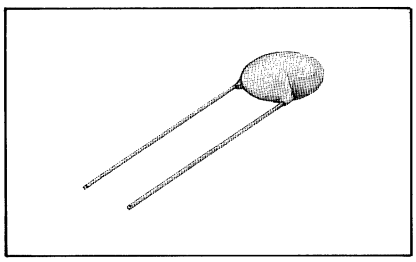
MURATA ERIE NORTH AMERICA



Low Voltage and Ultra Small

	DISC	ULTRA SMALL DISC
Capacitance Ranges:	.5pF to .47μF	1pF to .047μF
Voltage Ratings:	12 VDC to 1000 VDC	12, 16, 25 & 50V
Temperature Characteristics:	Y5R, Y5P, Y5U, Y5V, Z5U, Y5F COG thru N1500	B, F, HC, CK, CJ, CH & SL
Dimensions:	.157″ to .690″ Dia.	.138 ± .020 Die.

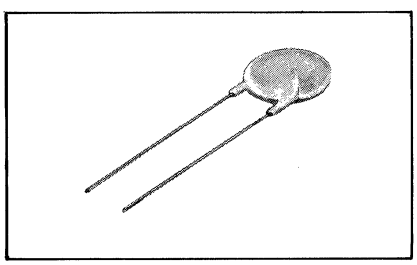
Available in standard packaging for auto-insertion



Medium Voltage

Capacitance Range:	.1pF to .02μF
Voltage Ratings:	1,000; 2,000; 3,000; 6,000 VDC
Temperature Characteristics:	B, E, F SL
High Temperature Characteristics (+125°C):	R: (Less than 0.2% DF at 1 KHz) C: (Less than 0.2% DF at 1 KHz)
Dimensions:	.177″ to .669″

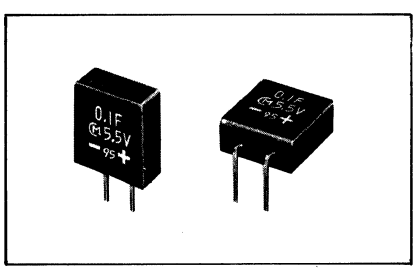
Available in standard packaging for auto-insertion



Safety Recognized UL, CSA, etc.

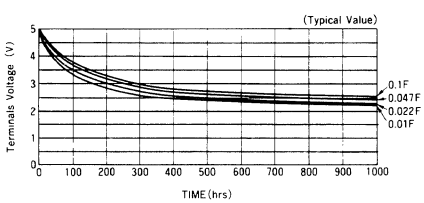
Capacitance Range:	100pF to .01μF
Voltage Ratings:	125, 250, 400 VAC
Temperature Characteristics:	B, F, FZ
Dimensions:	.394″ to .669″ Dia.
Approval Types:	UL, CSA, VDE, SEMKO, BS, SEV, EI, NEMKO, SAA

*Many items have multiple safety recognitions.
*Many items are double protection safety recognized.
Available in standard packaging for auto-insertion.



Ace Cap Electric Double Layer Capacitor

SELF-DISCHARGING CHARACTERISTICS



Charging Condition		Discharging Condition	
Applied Voltage	5.0V	Between Terminal	Open
Series Resistance	0 Ω	Environment	25°C max. 70% RH max.
Charging Time	60 min.		

Part Number	Rated Voltage (VD.C.)	Capacitance (F)	Capacitance Tolerance (%)	Dimensions (mm) a	b	c	d	E S R. (Ω)	*Current (μA)
AC310G103Z5R5	5.5	0.01	+80 −20	10.5	9.5	5.0	12.0	200 MAX.	50 MAX.
AC310G223Z5R5	5.5	0.022	+80 −20	10.5	9.5	5.0	12.0	150 MAX.	50 MAX.
AC310G473Z5R5	5.5	0.047	+80 −20	10.5	9.5	5.0	12.0	60 MAX.	70 MAX.
AC310G104Z5R5	5.5	0.1	+80 −20	12.5	11.5	5.0	14.0	60 MAX.	150 MAX.

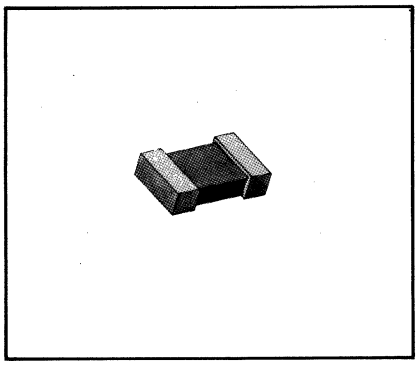
Available in standard flat packaging for auto-insertion. (at 30mins)

PLEASE CONTACT OUR FACTORY FOR SPECIAL REQUESTS

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

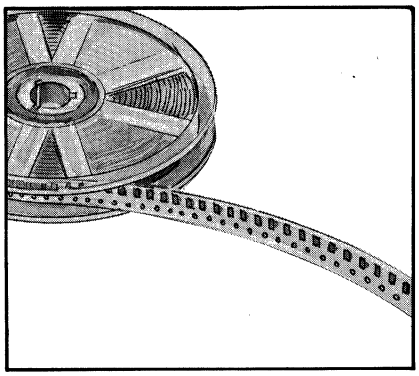
monolithic ceramic capacitors

MURATA ERIE NORTH AMERICA



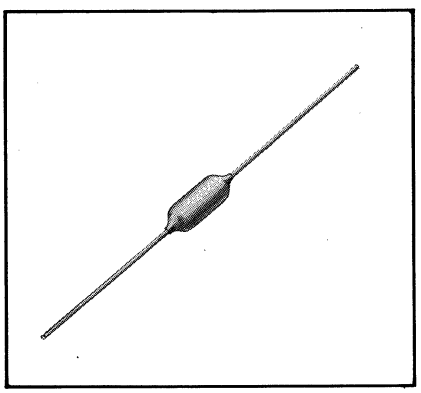
Chips

Capacitance Range:	1pF to 22µF
Voltage Ratings:	16, 25, 50, 100,200, 500 and 1000 VDC
Temperature Characteristics:	COG, X7R, Z5U, Y5V
Dimensions:	.060" x .030" to .492" x .394"



Chips for Tape and Reel

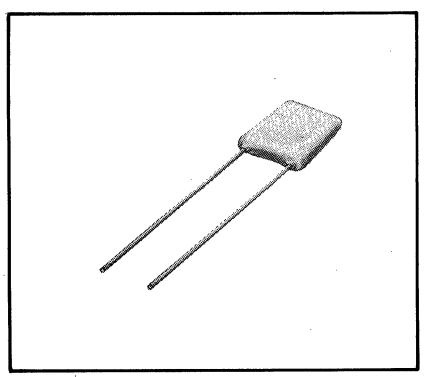
Capacitance Range:	1pF to 3.3µF
Voltage Ratings:	16, 25, 50, 100, 200, 500 and 1000 VDC
Temperature Characteristics:	COG, X7R, Z5U, Y5V
Dimensions:	.060″ × .030″ to .220″ × .250″
Carrier Tape:	Standard 8 & 12 MM



Axial Leaded Conformal Epoxy Coated

Capacitance Range:	10 pF to 1µF
Voltage Ratings:	50, 100, and 200 VDC
Temperature Characteristics:	COG, X7R, Z5U
Dimensions:	.170″ × .100″ to .400″ × .150″

Available in standard packaging for auto-insertion



Radial Leaded Conformal Epoxy Coated

Capacitance Range:	.5 pF to 100µF
Voltage Ratings:	25, 50, 100, 200 and 500 VDC
Temperature Characteristics:	COG, X7R, Z5U, Y5V
Dimensions:	.138" x .120" to 1.38" x .827"

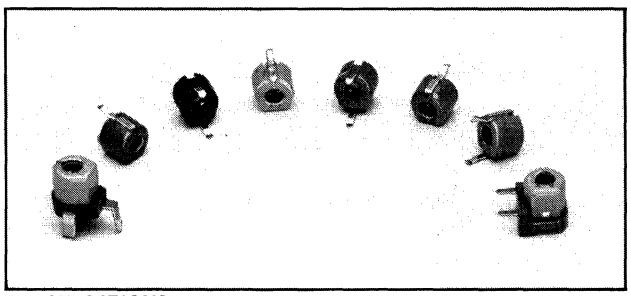
Available taped and reeled for auto-insertion (most values)

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

TRIMMING CAPACITORS

MURATA ERIE NORTH AMERICA

TZO3 SERIES



SPECIFICATIONS

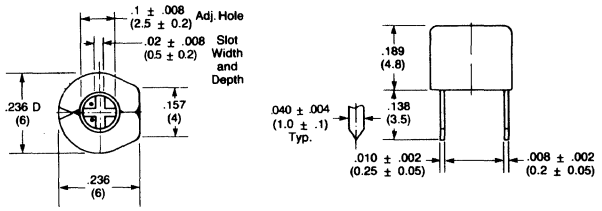
Cap. Range: 1.25pF to 2.3pF thru 10pF to 120pF
Working Voltage: 100VDC or 50 VDC
Withstanding Voltage: 220 VDC (100V units) or 110VDC (50 V units)
Insulation Resistance: 10^4MΩ min. (50 VDC, C max.)
Operating Torque: .3 to 2 in.-oz.

The TZ Series ceramic trimmer capacitors are built into and protected by a color coded plastic case. This unique, axle-less and solder-less construction protects the unit from damages during assembly and provides exceptionally linear temperature coefficient at low cost.

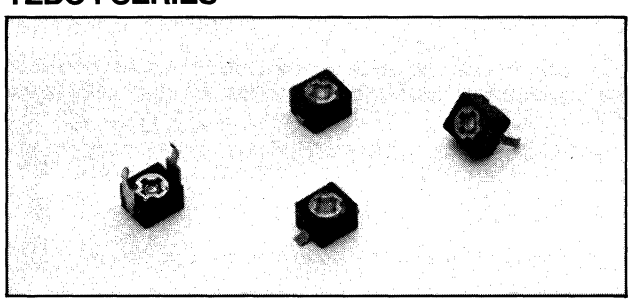
FEATURES

- **QPL approval to MIL-C-81***
- **Excellent shock and vibration resistance**
- **Exceptionally linear TC**
- **Dust and flux resistant construction**
- **Plastic case meets UL94V-0**
- **Very adaptable to auto insertion**
- **Available as washable unit utilizing a unique "O" ring seal. A "169" suffix should be added to the standard part number to indicate washable type.**

TYPICAL DIMENSIONS



TZBO4 SERIES



SPECIFICATIONS

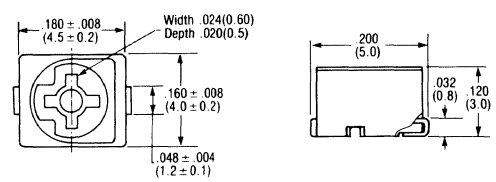
Cap. Range: 1.4pF to 3.0pF thru 7.0pF to 50.0pF
Working Voltage: 100VDC or 50 VDC
Withstanding Voltage: 220 VDC
Insulation Resistance: 10^4MΩ min.
Operating Torque: 15 to 200g-cm

Murata Erie's new chip trimmer capacitors are specifically designed for automatic surface placement. The small size and outstanding performance over a wide frequency spectrum make them entirely compatible with other types of surface mounted components.

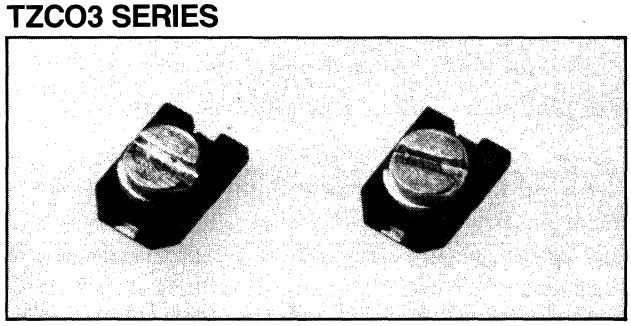
FEATURES

- **QPL approval to MIL-C-81***
- **Miniature rectangular shape just 4.0 × 4.5 × 3.0 mm**
- **Specifically designed for auto surface placement. Designed to withstand solder bath (260°C, 5 sec.) and flux baths**
- **Impervious to solvent cleaners**
- **Can be reflow soldered**
- **Available (optionally) as totally sealed package**
- **Conventional snap-in configuration available**

TYPICAL DIMENSIONS



TZCO3 SERIES



SPECIFICATIONS

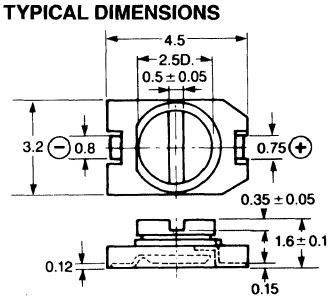
Cap. Range: 2.0pF to 6.0pF thru 5.0pF to 20pF
Working Voltage: 100VDC
Withstanding Voltage: 220 VDC
Insulation Resistance: 10^4MΩ min.
Operating Torque: 15 to 200g-cm

This new low profile chip trimming capacitor is specifically designed to meet the requirements of high density surface mount applications and automated placement equipment.

FEATURES

- **Extremely small size—just 3.2 mm × 4.5 mm × 1.6 mm**
- **Designed for auto-placement in surface mount applications**
- **Color-coded**
- **Heat-resistant resin withstands reflow soldering temperatures**
- **Can be adjusted with standard adjustment tools**

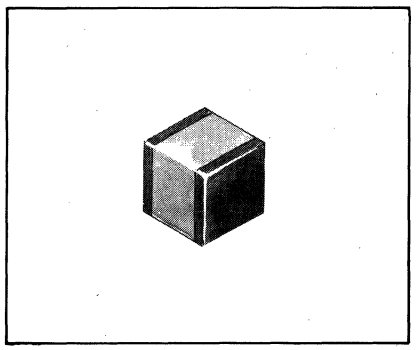
TYPICAL DIMENSIONS



MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

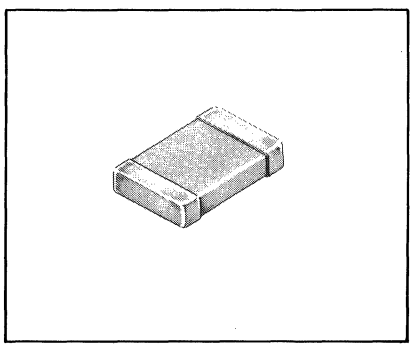
fixed ceramic capacitors for microwave applications

MURATA ERIE NORTH AMERICA



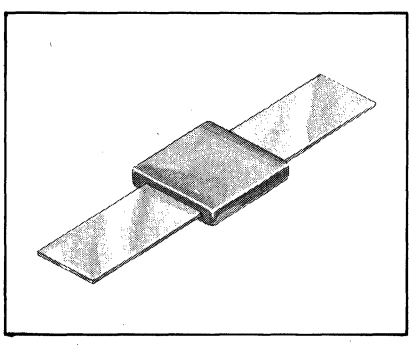
Monolithic Chips—MA Series

Capacitance Ranges:	0.1pF to .1mF
Voltage Ratings:	50, 100, 200, 300, 500 VDC
Tolerances:	B, ±0.1pF thru M, ±20%, thru Z +80 −20%
Q:	10,000 @ 1 MHz
Temperature Characteristics:	P90, ±20ppm/°C, NPO, X7R
Size:	.055″ x .055″ to .110″ x .110″



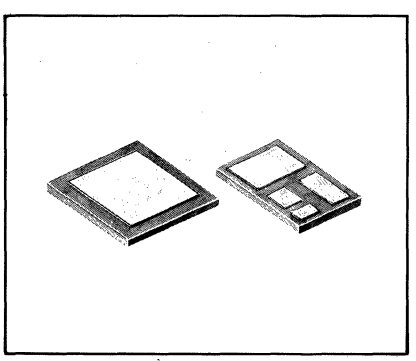
Monolithic Chips - GRH700

Capacitance Ranges:	1.0 to 1000pF
Voltage Ratings:	50 to 500 V
Q:	15,000 ÷ C (pF) @ 100 MHz
Case Size:	1210 and 0805
Temperature Characteristics:	COG
Insulation Resistance:	1.0 to 470pF 10^6 Megohms over 470pF 10^5 Megohms



Glass Encapsulated Monolithic RF Power—UFP Series

Capacitance Ranges:	**10**pF to 3000pF
Voltage Ratings:	300 to 5,400 VDC
Q:	5000 @ 1 MHz
RF Current Ratings:	8 Amperes
Temperature Characteristics:	P90, ±20ppm/°C
Size:	$^{37}/_{64}$″ x $^{35}/_{64}$ to $1^{1}/_{16}$″ x $1^{1}/_{16}$″



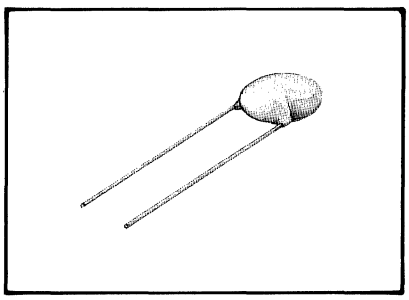
Parallel Plate Single Layer Ceramic Capacitors for MIC—CLA Series

	Single Electrode	Multi Electrodes
Capacitance Ranges:	1-130pF	.1-5.9pF/electrode
Voltage Ratings:	50 VDC	50 VDC
Number of Electrodes:	1	3-5
Q:	≥200	≥200
Temperature Characteristics:	N750, N2200, ±20%	
Size:	.010″ x .010″ to .035″ x .035″	.020″ x .020″ to .035″ x .035″

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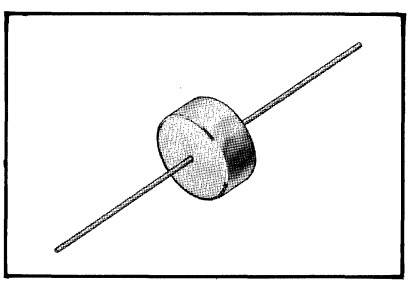
high voltage ceramic capacitors

MURATA ERIE NORTH AMERICA



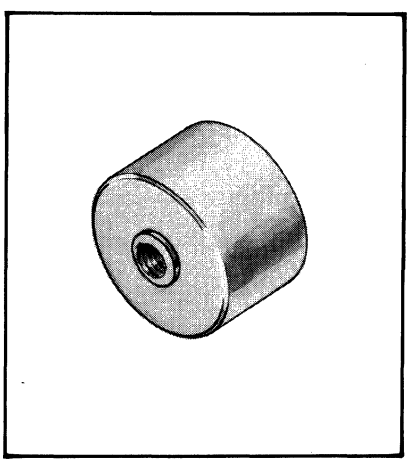
High Voltage—DHR Series

Capacitance Range:	100pF to 2,200pF
Voltage Ratings:	7,500; 10,000; 15,000 VDC
Temperature Characteristics:	Y5P, Z5U, N4700
Dimensions:	.354″ to .870″ Dia.



10 and 15 KVDC—DHL/DHG Series

Capacitance Ranges:	750pF and 1000pF
Voltage Ratings:	10 and 15 KVDC
Temperature Characteristics:	Y5P
Size:	.39″ x .79″ Dia. to .47″ x .79″ Dia.



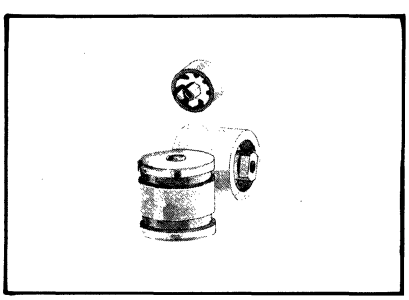
10 to 40 KVDC, DHS Series

For AC and DC Pulse Applications

Capacitance Ranges:	190pF to 8000pF
Voltage Ratings:	10, 15, 20, 30, 40 KVDC
Temperature Characteristics:	N4700
Size:	.63″ x .79″ Dia. to 1.42″ x 2.36″ Dia.

For General Purpose Applications

Capacitance Ranges:	180pF to 9300pF
Voltage Ratings:	10, 15, 20, 30, 40 KVDC
Temperature Characteristics:	Z5V
Size:	.75″ x .79″ Dia. to 1.61″ x 2.36″ Dia.



High Voltage, High Current Ceramic Capacitors—DCC Series

Operating Temperature Range:	−55°C to +85°C
Insulation Resistance:	10^4 megohms min. at 500 VDC
Capacitance Range:	3 to 1000pF
Capacitance Tolerance:	D thru M depending on Cap. Value
Rated Voltage:	5 to 20 KVDC
R.F. Current Rating (30 MHz):	1.4 to 35 Amp
EIA Standard:	NPO, N750, N3300, X5U depending upon Cap. Value

PLEASE CONTACT OUR FACTORY FOR SPECIAL REQUESTS

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

EEM

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

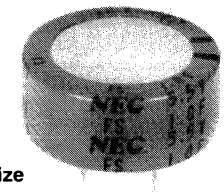
W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94043 • 415/960-6000 • FAX: 415-965-6272

NEC SUPERCAP—DOUBLE LAYER CAPACITORS



Shown Actual Size

The expanding use of digital processing with its associated memory is driving the need for a standby power source to maintain the contents of volatile memories or to continue processing function during AC power outages. Historically, this standby function has been a choice between primary or secondary batteries.

The use of nonrechargeable (primary) batteries, such as Lithium, may be risky since there is no way to determine how much charge is still available to handle a power outage of unknown duration. Rechargeable batteries, such as Ni-Cd, may exhibit discharge memory, must have a controlled charge rate to limit current to battery, and must be periodically replaced.

More recently, the use of CMOS and other low power drain technologies in processor and memory IC's has drastically reduced the total standby power requirements. This coupled with the fact that most power outages last only a short period of time (order of several hours) has opened the door for the **SUPERCAP** as a third alternative standby power source.

SUPERCAP is a completely innovative type of capacitor providing a volumetric efficiency (capacitance per unit volume of a given voltage) of 10 to 50 times that of conventional aluminum electrolytic capacitors. The high capacitance (1 000 000 microfarads) and low leakage current makes the **SUPERCAP** an efficient, reliable, and cost effective energy storage device. **SUPERCAP** can be used as standby power sources for CMOS memories and microcomputers up to several weeks during power outages.

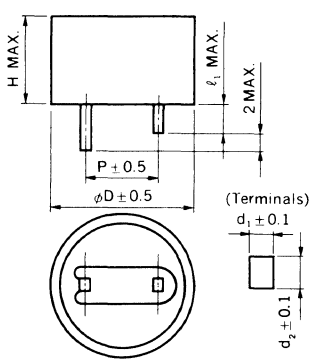
The **SUPERCAP** can be assembled on printed circuit boards by conventional soldering processes together with all other components. The **SUPERCAP** can be charged and discharged at both high and low current rates; i.e., microamps to amps.

Catalog Numbering System

F— 0H 105 Z

- Z — Capacitance tolerance: $^{+80}_{-20}$%
- 105 — Capacitance; First two digits represent significant figures. 3rd digit specifies number of zeros to follow. Microfarad code.
- 0H — Max. DC working voltage: OH: 5.5V; 1A: 11V
- F— — Super capacitor: FA: FA-Series; FS: FS-Series; FYH: FY-Series; FYD: FY-Series; FR: FR-Series; FE: FE-Series

DIMENSIONS (UNIT: mm)



STANDARD PRODUCTS 3.1 FA SERIES

Catalog NBR	Cap. (Farad)	Max. W.V. (V.D.C.)	Max. ESR (Ω at 1 kHz)	Max. I_a (mA)	Dimensions (Unit)	D	H max.	P	d_1	d_2	ℓ_1 max.
FA0H473Z	0.047	5.5	20	0.071	mm (inch)	16.0 (0.630)	15.5 (0.610)	5 (0.197)	0.6 (0.024)	1.2 (0.047)	5.0 (0.197)
FA0H104Z	0.1	5.5	8	0.15	mm (inch)	21.5 (0.846)	15.5 (0.610)	7.5 (0.295)	0.6 (0.024)	1.2 (0.047)	5.5 (0.217)
FA0H224Z	0.22	5.5	5	0.33	mm (inch)	28.5 (1.122)	16.5 (0.650)	10 (0.394)	1.0 (0.039)	5.5 (0.055)	9.5 (0.374)
FA0H474Z	0.47	5.5	3.5	0.71	mm (inch)	36.5 (1.437)	16.5 (0.650)	15 (0.591)	0.6 (0.024)	1.7 (0.067)	9.5 (0.374)
FA0H105Z	1.0	5.5	2.5	1.5	mm (inch)	44.5 (1.752)	18.5 (0.728)	20 (0.787)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)
FA1A223Z	0.022	11	20	0.066	mm (inch)	16.0 (0.630)	25.0 (0.984)	5 (0.197)	0.6 (0.024)	1.2 (0.047)	5.0 (0.197)
FA1A104Z	0.1	11	8	0.3	mm (inch)	28.5 (1.122)	25.5 (1.004)	10 (0.394)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)
FA1A224Z	0.22	11	6	0.66	mm (inch)	36.5 (1.437)	27.5 (1.083)	15 (0.591)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)
FA1A474Z	0.47	11	4	1.41	mm (inch)	44.5 (1.752)	28.5 (1.122)	20 (0.787)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)

3.3 FS SERIES

FS0H223Z	0.022	5.5	60	0.033	mm (inch)	11.5 (0.453)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FS0H473Z	0.047	5.5	40	0.071	mm (inch)	13.0 (0.512)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.2 (0.087)
FS0H104Z	0.1	5.5	25	0.15	mm (inch)	16.5 (0.650)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FS0H224Z	0.22	5.5	25	0.33	mm (inch)	16.5 (0.650)	13.0 (0.512)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FS0H474Z	0.47	5.5	13	0.71	mm (inch)	21.5 (0.846)	13.0 (0.512)	7.62 (0.300)	0.6 (0.024)	1.2 (0.047)	3.0 (0.118)
FS0H105Z	1.0	5.5	7	1.5	mm (inch)	28.5 (1.122)	14.0 (0.551)	10.16 (0.400)	0.6 (0.024)	1.4 (0.055)	6.1 (0.240)

3.5 FY SERIES • FYH Type: Small Diameter

Catalog NBR	Cap. (Farad)	Max. W.V. (V.D.C.)	Max. ESR (Ω at 1 kHz)	Max. I_a (mA)	SD* (V)	Dimensions (Unit)	D	H max.	P	d_1	d_2	ℓ_1 max.
FYD0H223Z	0.022	5.5	220	0.033	4.2	mm (inch)	11.5 (0.453)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYD0H473Z	0.047	5.5	220	0.071	4.2	mm (inch)	11.5 (0.453)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYD0H104Z	0.1	5.5	100	0.15	4.2	mm (inch)	13.0 (0.512)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.2 (0.087)
FYD0H224Z	0.22	5.5	120	0.33	4.2	mm (inch)	14.5 (0.571)	15.0 (0.591)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.4 (0.095)
FYD0H474Z	0.47	5.5	65	0.71	4.2	mm (inch)	16.5 (0.65)	15.0 (0.591)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYD0H105Z	1.0	5.5	35	1.5	4.2	mm (inch)	21.5 (0.85)	16.0 (0.629)	7.62 (0.300)	0.6 (0.024)	1.2 (0.047)	3.0 (0.118)
FYD0H145Z	1.4	5.5	45	2.1	4.2	mm (inch)	21.5 (.85)	19.0 (0.748)	7.62 (0.300)	0.6 (0.024)	1.2 (0.047)	3.0 (0.118)
FYD0H225Z	2.2	5.5	35	3.3	4.2	mm (inch)	28.5 (1.122)	22.0 (0.866)	10.16 (0.400)	0.6 (0.024)	1.4 (0.055)	6.1 (0.240)

3.5 FY SERIES • FYH Type: Low Height

FYH0H223Z	0.022	5.5	200	0.033	4.2	mm (inch)	11.5 (0.453)	7.0 (0.276)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYH0H473Z	0.047	5.5	100	0.071	4.2	mm (inch)	13.0 (0.512)	7.0 (0.276)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.2 (0.087)
FYH0H104Z	0.1	5.5	50	0.15	4.2	mm (inch)	16.5 (0.65)	7.5 (0.295)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYH0H224Z	0.22	5.5	60	0.33	4.2	mm (inch)	16.5 (0.65)	9.5 (0.374)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYH0H474Z	0.47	5.5	35	0.71	4.2	mm (inch)	21.5 (0.85)	10.0 (0.394)	7.62 (0.300)	0.6 (0.024)	1.2 (0.047)	3.0 (0.118)
FYH0H105Z	1.0	5.5	20	1.5	4.2	mm (inch)	28.5 (1.122)	11.0 (0.433)	10.16 (0.400)	0.6 (0.024)	1.4 (0.055)	61 (0.240)

3.5 FY SERIES • Very Low Height

FYL0H103Z	0.01	5.5	300	0.015	4.2	mm (inch)	11.0 (0.43)	5.0 (0.197)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYL0H223Z	0.022	5.5	200	0.033	4.2	mm (inch)	11.0 (0.43)	5.0 (0.197)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYL0H104Z	0.047	5.5	200	0.071	4.2	mm (inch)	12.0 (0.47)	5.0 (0.197)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.2 (0.087)

*SD: Voltage holding characteristic.

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NEC SUPERCAP—DOUBLE LAYER CAPACITORS (Continued)

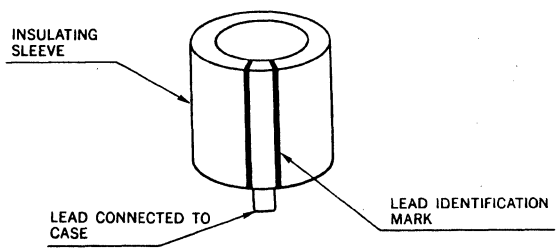
Standard Products

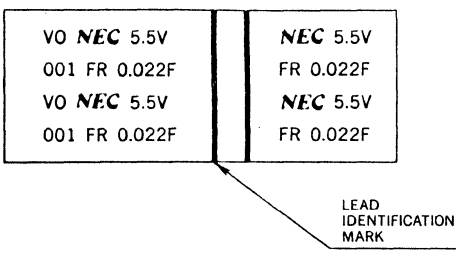
FR-Series

Part Number	Capacitance (Farads)	Max. WV	Max. ESR (Ω at 1 KHz)	Current (at 30 Min.) (mA)	Voltage Holding Characteristics (V)	Dimensions					
						φD	H	P	L	d_1	d_2
FROH223Z	0.022	5.5	220	0.033	4.2	11.5	14.0	5.08	2.7	0.4	1.2
FROH473Z	0.047	5.5	110	0.071	4.2	14.5	14.0	5.08	2.4	0.4	1.2
FROH104Z	0.10	5.5	150	0.15	4.2	14.5	15.5	5.08	2.4	0.4	1.2
FROH224Z	0.22	5.5	180	0.33	4.2	14.5	21.0	5.08	2.4	0.4	1.2
FROH474Z	0.47	5.5	100	0.71	4.2	16.5	21.5	5.08	2.7	0.4	1.2
FROH105Z	1.0	5.5	60	1.5	4.2	21.5	22.0	7.62	3.0	0.6	1.2



MARKINGS

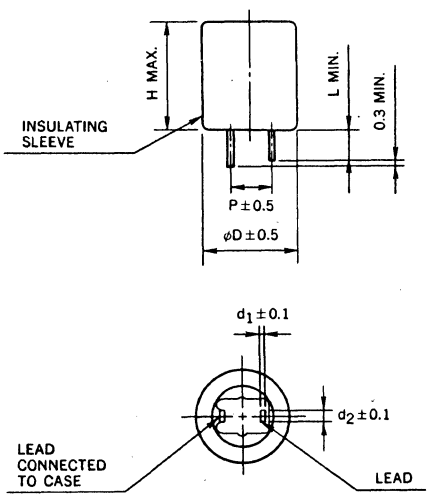




FE-Series

Part Number	Capacitance (Farads)	Max. WV	Max. ESR (Ω at 1KHz)	Current (at 30) Min.) (mA)	Dimensions					
					φD	H	P	L	d_1	d_2
FEOH473Z	0.047	5.5	14.0	0.071	14.5	14.0	5.1	2.2	0.4	1.2
FEOH104Z	0.10	5.5	6.5	0.15	16.5	14.0	5.1	2.7	0.4	1.2
FEOH224Z	0.22	5.5	3.5	0.33	21.5	15.5	7.6	3.0	0.6	1.2
FEOH474Z	0.47	5.5	1.8	0.71	28.5	16.5	10.2	6.1	0.6	1.4
FEOH105Z	1.0	5.5	1.0	1.5	36.5	18.5	15.0	6.1	0.6	1.7
FEOH155Z	1.5	5.5	0.6	2.3	44.5	18.5	20.0	6.1	1.0	1.4

DIMENSIONS (Unit: mm)



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R-SERIES SOLID TANTALUM CAPACITORS

PERFORMANCE CHARACTERISTICS

- Operating temperature range
  −55 to +125°C with proper voltage derating as shown in following table.

- DC working voltage and surge voltage

Working	@ 85°C	2.5	4	6.3	10	16	20	25	35	V
	@ 125°C	1.6	2.5	4	6.3	10	13	16	22	V
Surge	@ 85°C	3.3	5.2	8	13	20	26	33	46	V

- Capacitance (at 25°C, 120 Hz)
  Range 0.01 μF to 100 μF
  Tolerance ±20%, ±10%

- Capacitance change with temperature
  −12% at −55°C,
  +12% at 85°C and +15% at 125°C.

- Dissipation factor (at 25°C, 120Hz)
  0.01 μF to 4.7 μF 4% max
  6.8 μF to 68 μF 6% max
  100 μF 8% max

- DC leakage current (at 25°C)
  0.01CVμA or 0.5μA whichever is greater

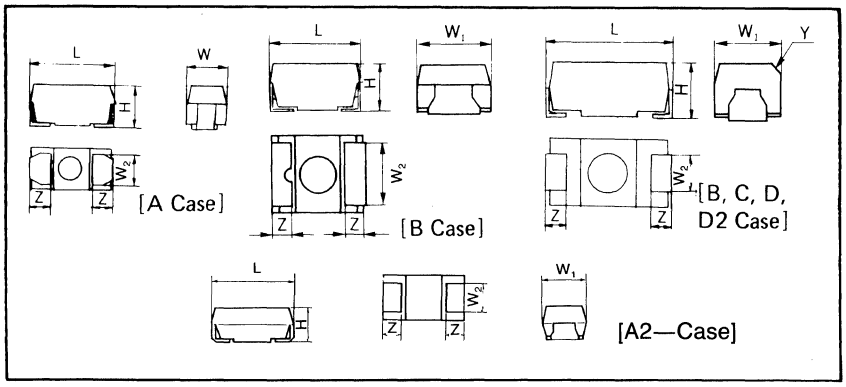
- Humidity (90 ~ 95% RH at 40°C, 500h)
  Capacitance change ±5% (±12% @ 2.5V)
  Dissipation factor 150% of initial requirements
  DC Leakage current initial requirements

- Load life (at 125°C, DC W.V., 1000h)
  Capacitance change ±10% (±12% @ 2.5V)
  Dissipation factor initial requirements
  DC Leakage current initial requirements

- Resistance to soldering heat
  (solder reflow @260°C, 10 sec.
  or solder dip @260°C, 5 sec.
  Capacitance change ±5% (±12% @ 2.5V)
  Leakage current initial requirements
  Dissipation factor initial requirements

NEC obtained IEC Qualification Approval on R-series tantalum capacitors, JP154-9, JP154-10 and JP154-11 on Sept. 29, 1987

DIMENSIONS [mm]

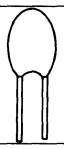
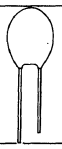


Case Code	L	W_1	W_2	H	Z	Y
A	3.2±0.2	1.6±0.2	1.2±0.1	1.6±0.2	0.8±0.3	
A2	3.2±0.2	1.6±0.2	1.2±0.1	1.2 MAX.	0.8±0.3	
B2	3.5±0.2	2.8±0.2	2.3±0.1	1.9±0.2	0.8±0.3	
B	4.7±0.3	2.6±0.3	1.4±0.1	2.1±0.3	0.8±0.3	0.4C
C	6.0±0.3	3.2±0.3	1.8±0.1	2.5±0.3	1.3±0.3	0.4C
D2	5.8±0.3	4.6±0.3	2.4±0.1	3.2±0.3	1.3±0.3	
D	7.3±0.3	4.3±0.3	2.4±0.1	2.8±0.3	1.3±0.3	0.5C

VDC / μF	2.5	4	6.3	10	16	20	25	35
0.010								A
0.015								A
0.022								A
0.033								A
0.047								A
0.068								A
0.10						A2		A
0.15						A2		A
0.22						A2		A
0.33						A2	A	A
0.47						A, A2	A	A, B2, B
0.68					A, A2	A		A, B2, B
1.0				A, A2	A		A	B2, B
1.5			A, A2	A, A2	A	A	B2, B	B2, B, C
2.2		A, A2	A	A	A, B	B2, B	B2	B, B2, C
3.3		A, A2	A	A, B	B2, B	B2	B2, B, C	C,D
4.7	A2	A	A, B	B2, B	B2, B, C	B, B2, C	C	D2, D
6.8		A, B	B2, B	B2, C	B2, C	C	D2, D	D2, D
10		A, B2, B	B2, C	B, B2, C	C, D	C, D2	D2, D	
15	A	B2, C	B, B2, C	C, D	C, D2	D2, D		
22		B, B2, C	C	C, D2, D	D2, D	D2, D		
33		C	C, D2, D	D2, D	D2, D			
47		C, D2, D	D2, D	D2, D				
68		D2, D	D2, D					
100		D2, D						

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Quick Reference Guide to NEC Tantalum Capacitors

Type / Item	Solid Electrolytic Tantalum				
	D-Series	**P-Series**	**Q-Series**	**R-Series**	**U-Series**
Configuration					
	Dipped, Polar	**Subminiature Dipped**	**Dipped, Polar**	**Molded Chip, Polar**	**Subminiature Epoxy End Seal, Axial**
Operating Temperature Range	−55°C to +85°C	−55°C to +85°C	−55°C to +85°C +125°C(2/3WV)	−55°C to +85°C +125°C(2/3WV)	−55°C to +85°C
DC Working Voltage	4V to 50V	4V to 35V	6.3V to 35V	4V to 35V	3V to 35V
Capacitance Range	0.1µF to 330µF	0.01µF to 100µF	0.1µF to 47µF	0.01µF to 100µF	0.01µF to 10µF
Capacitance Tolerance	±20% ±10% ±5%	±20% ±10%	±20% ±10%	±20% ±10%	±20% ±10% (Special)
DC Leakage Current	0.01CVµA or 0.5µA whichever is greater	0.01CVµA or 0.5µA whichever is greater	0.005CVµA or 0.3µA whichever is greater	0.01CVµA or .05µA whichever is greater	0.005CVµA or .05µA whichever is greater
Dissipation Factor	4% 0.1µF to 1.0µF	4% 0.01µF to 1.0µF	4% 0.1µF to 1µF	4% 0.1µF to 4.7µF	3% 0.01µF to 1.0µF
	6% 1.5µF to 6.8µF	6% 1.5µF to 68µF	6% 1.5µF to 47µF	6% over to 6.8µF	6% 1.5µF to 4.7µF
	8% 10µF to 68µF	8% 10µF to 68µF		8% 100µF	6% 6.8µF to 10µF
	10% 100µF to 330µF	10% 100µF			

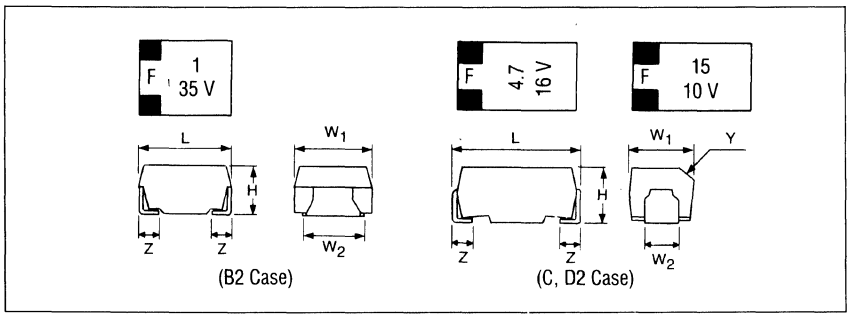
Cross Reference

Description	NEC	KEMET	SPRAGUE	AVX	PANASONIC	MEPCO	MATSUO
Epoxy — Dipped Industrial	D-Series (ND) Q-Series (NQ)	T350 to T356	199D 196D	TAP	SQ	41DS 41GS	22IL 202
Epoxy — Dipped Subminiature	P-Series (NP)		186D	TAM			
Epoxy — Molded Chip	R-Series (NR)	T491	195D 193D 293D	TAQ TAJ	TE YE	49BC 49MC 49SC	267 268
Subminiature Axial Leads	U-Series (NU)	T322	182D 188D			40CS	

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SVE-SERIES SOLID TANTALUM CAPACITORS (Fuse Built-In Type)

DIMENSIONS [mm]



(Unit:mm)

Case Code	L	W_1	W_2	H	Z	Y
B2	3.5±0.2	2.8±0.2	2.3±0.1	1.9±0.2	0.8±0.3	—
C	6.0±0.3	3.2±0.3	1.8±0.1	2.5±0.3	1.3±0.3	0.4C
D2	5.8±0.3	4.6±0.3	2.4±0.1	3.2±0.3	1.3±0.3	—

STANDARD RATINGS

Catalog Number	Capacitance (μF)	Case Code	DC Leakage Current (μA)	Dissipation Factor
50V Rating				
TESVEC1H105M12R	1.0	C	0.5	0.04
TESVED21H335M12R	3.3	D2	1.6	0.04
35V Rating				
TESVEB21V105M8R	1.0	B2	0.5	0.04
TESVEC1V225M12R	2.2	C	0.7	0.04
TESVED21V475M12R	4.7	D2	1.6	0.04
25V Rating				
TESVEB21E155M8R	1.5	B2	0.5	0.04
TESVEC1E335M12R	3.3	C	0.8	0.04
TESVED21E685M12R	6.8	D2	1.7	0.06
20V Rating				
TESVEB21D225M8R	2.2	B2	0.5	0.04
TESVEC1D475M12R	4.7	C	0.9	0.04
TESVED21D106M12R	10	D2	2.0	0.06
16V Rating				
TESVEB21C335M8R	3.3	B2	0.5	0.04
TESVEC1C475M12R	4.7	C	0.9	0.04
TESVEC1C685M12R	6.8	C	1.0	0.06
TESVEC1C106M12R	10	C	1.6	0.06
TESVED21C156M12R	15	D2	2.4	0.06
TESVED21C226M12R	22	D2	3.5	0.06
10V Rating				
TESVEB21A475M8R	4.7	B2	0.5	0.04
TESVEC1A156M12R	15	C	1.5	0.06
TESVED21A156M12R	15	D2	1.5	0.06
TESVED21A336M12R	33	D2	3.3	0.06

NOTE: For details regarding marking, part number, tape and reel request catalog.

PERFORMANCE CHARACTERISTICS

- Operating temperature range
  −55 to +125°C with proper voltage derating as shown in following table.

- DC working voltage and surge voltage

Working	@ 85°C	10	16	20	25	35	50	V
	@125°C	6.3	10	13	16	22	33	V
Surge	@ 85°C	13	20	26	33	46	65	V

- Capacitance (at 25°C, 120 Hz)
  Range 1.0 μF to 33 μF
  Tolerance ±20%

- Capacitance change with temperature
  Not to exceed −12% at −55°C, +12% at 85°C and +15% at 125°C.

- Dissipation factor (at 25°C, 120Hz)
  1.0 μF to 4.7 μF less than 0.04
  6.8 μF to 33 μF less than 0.06

- DC leakage current (at 25°C)
  0.01CVμA or 0.5μA whichever is greater

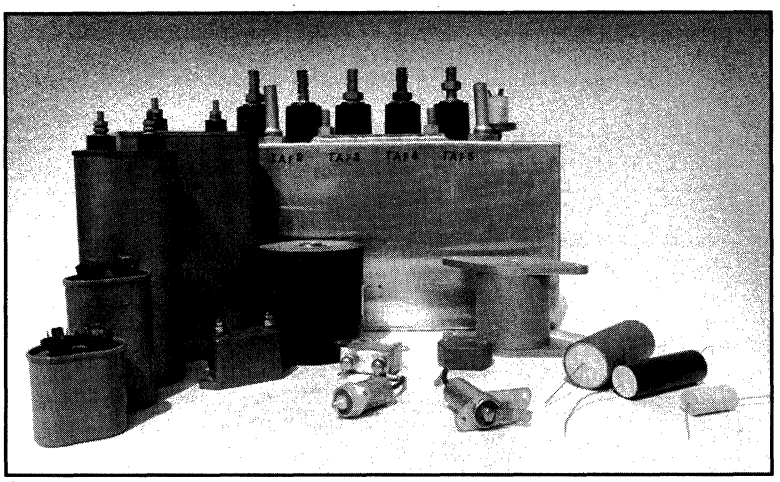
- Humidity (90 ~ 95% RH at 40°C, 500h)
  Capacitance change ±5%
  Dissipation factor 150% of initial requirements
  DC Leakage current initial requirements

- Load life (at 85°C, DC W.V., 1000h)
  Capacitance change ±10%
  Dissipation factor initial requirements
  DC Leakage current initial requirements

- Resistance to soldering heat (solder reflow @260°C, 10 sec. or solder dip @260°C, 5 sec.)
  Capacitance change ±5%
  Leakage current initial requirements
  Disipation factor initial requirements

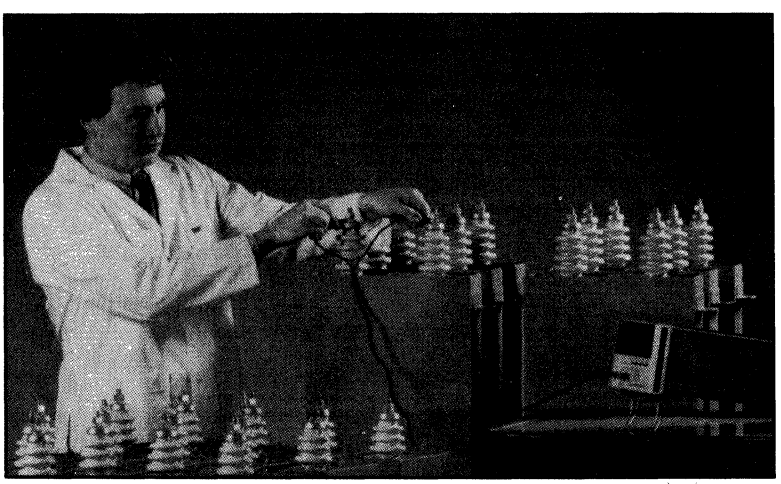
- Fuse blow-out characteristic
  Blow-out time: 5 s MAX. with 5A applied

NWL ... the Source for Custom



A sampling of our diversified size and case capability.

NWL Capacitors . . .
Dedicated entirely to the design, production and marketing of high voltage custom oil-filled capacitors for the industrial community, NWL Capacitors has two facilities to serve your capacitor needs. Snow Hill, North Carolina, our newest facility and Riviera Beach, Florida. Either location you have the assurance of quality when you do business with NWL Capacitors because we are a division of NWL Transformers. In business for over 60 years, NWL employs over 300 people with an excellent reputation for manufacturing transformers, power supplies, reactors, chokes, and electronic controls.



Engineering Excellence

NWL's engineering staff has over 60 years of cumulative engineering experience in the design and manufacture of industrial capacitors.

This experience tells us that for most applications a properly specified custom capacitor will perform better and provide long term cost savings when compared to "stock units".

Our engineers analyze every request and custom build each order to the customer's exact requirements.

Efficient computer-based design techniques plus a large and varied raw materials inventory, allows NWL to design capacitors specifically for your requirements, and deliver quickly.

Modern Equipment

NWL's production equipment is built to exacting specifications to support our engineer's design techniques. Multiple vacuum chambers allow all capacitors to be both dried and impregnated without being moved. We consistently achieve vacuum levels of less than 10 microns.

These techniques result in capacitors with superior mechanical form and higher corona inceptive voltages. All this means a longer, safer operating life.

Quality . . . Quality Assurance

Quality assurance personnel test each and every production capacitor according to customer requirements. This assures consistent high quality in every product shipped to the field.

All capacitors are 100% tested by a quality control inspector before shipping.

NWL CAPACITORS

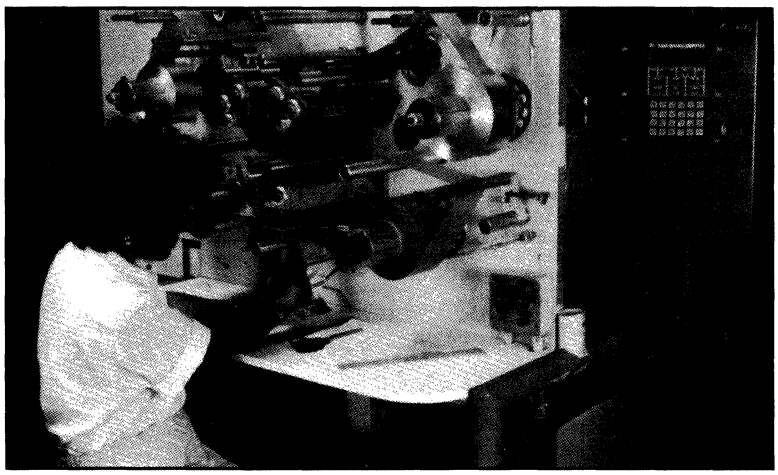
For All Sales Contact; One Industrial Drive, Snow Hill, NC 28580, (919) 747-5943, FAX; (919) 747-8979
8050 Monetary Drive, Riviera Beach, FL 33404, (407) 848-9009, FAX: (407) 848-9011

High Voltage Capacitors

Quick Delivery

NWL's deliveries are the best in the industry because:

- We maintain large inventories of foil and film in a wide variety of widths and thicknesses.
- Our custom-built high capacity film slitting machines means any film width we need is immediately available. Thus, our capacitor deliveries are not controlled by the lead times of our film suppliers.
- Sophisticated computer-based production control and material planning systems let us quickly and effectively review and adjust our schedules to meet customer requirements.



One of many winding machines that accept a wide variety of materials.

Specifications

Voltages: from 200 - 200,000
Currents: from .001 - 150,000A
Capacitance: from 50 Pico-farads to 2000 Microfarads
KVAR: up to 2000
Frequency: DC-15 Mhz

These industries and applications served, while representative of the diverse nature of NWL's design and manufacturing capabilities, are by no means all-inclusive. The NWL design engineering team will be happy to help solve your specific problems.

Products

- Water Cooled • Ignition Caps
- Welded Steel • Welded Aluminum
- R-C Networks • Natural MICA
- Bathtubs • Drawn Rectangulars
- Drawn Ovals • Feedthru's • PFN's
- Tubular Caps • Wrap & Fill
- Reconstituted MICA

Vacuum chambers for fluid impregnation

Products *(continued)*

- Flat Pac Capacitors
  High energy density low inductance for fast rise time applications.
- Military Spec Equipment
  All of our products can be built to military specifications.
- Power Factor Correction
  Custom paper-polypropylene low loss capacitors.

Applications

- DC Filter • Energy Storage • Laser
- Corona Free • Power Supplies
- Induction Heating • Pulse Power
- Transmitting • Noise Suppression
- Arc Suppression • Plate Blocking
- Dielectric Heating • Commutating
- Radar • Broadcast • Ion Beam
- Magnetizing • Ignition • Snubber
- Pulse Forming Networks



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High Voltage Capacitors

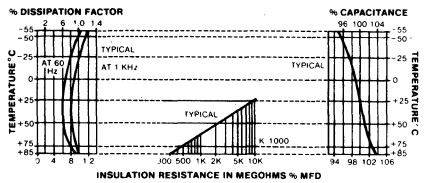
PERFORMANCE CHARACTERISTICS

DIELECTRIC:
A combination of plastic film and the finest grade of capacitor kraft tissue is used. Capacitors are impregnated and filled with the proper highly purified dielectric fluid. The closely controlled processing assures high reliability and prolonged life.

OPERATING TEMPERATURE
NWL High Voltage Capacitors are designed to operate over a temperature range of—55° to +85°C without derating.

CAPACITANCE
Measurements are made at a frequency of 1000 Hz. Standard tolerance for all capacitors in this catalog is ±20% at +25°C. Closer tolerances are available upon request. Capacitance change over the temperature range is shown graphically and does not exceed ±5%.

DISSIPATION FACTOR
Dissipation factor is less than 1.0% at 1000 Hz +25°C. (See graph)



INSULATION RESISTANCE
Terminal to Terminal: I.R. at +25°C is 10,000 MEGS x MFD minimum, but does not have to exceed 25,000 Megohms. I.R. at +85°C is 300MEGS x MFD minimum, but does not have to exceed 2,000 Megohms. Terminal to Case: Where the case is not a terminal: I.R. shall exceed 10,000 Megohms at +25°C.

DIELECTRIC STRENGTH
Capacitors with ratings up to 10,000 VDC shall be tested at 200% of rated voltage. Capacitors with voltage ratings in excess of 10,000 VDC shall be tested at 150% of rated voltage. Terminal to case test, where the case is not a terminal, shall be performed at test voltage plus 1000 VDC. Duration of test shall be one minute and a resistance of one OHM/VOLT minimum shall be in series with the capacitor during test and discharge.

LIFE TEST AND EXPECTANCY
Capacitors shall withstand a life test of 500 hours at +85°C and at a voltage as per watt-second table below. One failure out of 24 samples tested is permissible.

Group I
Capacitors with: 5 watt-seconds and less
5.1 to 50 watt-seconds with capacitance less than 15 μf
51 to 200 watt-seconds with capacitance less than 5 μf
Life Test Voltage: 140% rated VDC
Life Expectancy: 4400 hours without derating at +85°C

Group II
Capacitors with: 5.1 to 50 watt-seconds with capacitance of 15 μf or more
51 to 200 watt-seconds with capacitance of 5 μf or more
201 watt-seconds and over with capacitance less than 2 μf
Life Test Voltage: 120% of rated VDC
Life Expectancy: 3300 hours without derating at +85°C

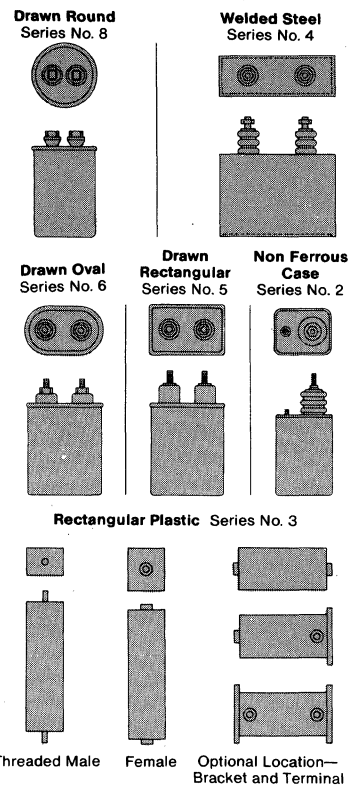
Group III
Capacitors with: 201 watt-seconds and over with capacitance of 2 μf or more
Life Test Voltage: 100% of rated VDC
Life Expectancy: 1800 hours without derating at +85°C

RIPPLE VOLTAGE
The sum of the peak AC voltage and the DC voltage shall not exceed the rated DC voltage. The peak AC voltage should not exceed: 25% at 60 Hz. 20% at 120 Hz. 8% at 400 Hz. 5% at 1 KHz.

ENVIRONMENTAL TESTS
NWL High Voltage Capacitors will meet requirements of MIL-C-25 and/or MIL-C-19978 wherever applicable.

CONSULTING SERVICE
The Engineering Department is available for assistance on any problems or applications that require special design or configuration.

A sampling of the various configurations and materials within our manufacturing capability. For easy reference refer to Series Numbers.



Capacitor Application Chart

DIELECTRIC	VOLTAGE RANGE	CAPACITY RANGE	STABILITY −20°C TO +50°C	TEMPERATURE RANGE	TEMPERATURE COEFFICIENT OR CAPACITY	DISSIPATION FACTOR @+25°C	INSULATION RESISTANCE MEG X MFD @ +25°C	DIELECTRIC ABSORPTION	USABLE FREQUENCY RANGE	APPLICATION
KRAFT PAPER PLUS MYLAR	IKVDC TO 200 KVDC AVAILABLE TO 75 KVAC	.001 Mfd TO 500 Mfd	1.0% PER YEAR	−55°C TO +85°C AVAILABLE TO −55°C TO +125°C	+5%	.6% TYPICAL	10,000 MEGOHM x Mfd	.5% TYPICAL	DC TO 5 KHz	All D.C. Applications. Power Supply Filters. Heavy & Light Duty Energy Discharge. Laser Drive
KRAFT PAPER PLUS POLY-PROPYLENE	600 VDC TO 200 KVDC AVAILABLE TO 75 KVAC	.0001 Mfd TO 250 Mfd.	1.0% PER YEAR	−55 C TO +85 C	+5%	.25% TYPICAL	50,000 MEGOHM x Mfd	.3% TYPICAL	DC TO 50 KHz	PFN & Laser Drive All D.C. Applications, Heavy & Light Duty Energy Discharge, Ferro-Resonant Power Supplies, Power Factor Correction A.C. Applications, High Frequency A.C. SCR Commutating Applications
POLY-PROPYLENE	50 VDC TO 100 KVDC	.001 Mfd TO 100 Mfd	.2% PER YEAR	−55 C TO +105 C	−250 PPM/ C	.02% TYPICAL	200,000 MEGOHM x Mfd	.2% TYPICAL	DC TO 10 MHz	PFN, High Frequency A.C. RF Coupling & Bypass. High Power Plate Blocking Applications. General Usage where Low Losses are Required. SCR, Snubber.
METALLIZED POLY-PROPYLENE	50 VDC TO 1000 VDC TO 440 VAC	.001 Mfd TO 100 Mfd	.2% PER YEAR	−55 C TO +105 C	−250 PPM/ C	.05% TYPICAL	100,000 MEGOHM x Mfd	.25% TYPICAL	DC TO 10 KHz	Affords all the Properties of Polypropylene Dielectric Capacitors, with the Addition of High Volumetric Efficiency & Self-Healing Characteristics.
MYLAR	50 VDC TO 1000 VDC	.001 Mfd TO 100 Mfd	.2% PER YEAR	−55 C TO +125°C WITH DERATING	−5% @ −55°C +14%@ +125°C	.5% TYPICAL	100,000 MEGOHM x Mfd	.25% TYPICAL	DC to 50 KHz	Low Voltage Power Supply Filters. Coupling, Decoupling, & Bypass Requiring Low Impedences. Low Frequency, Low Power Switching & Triggering.
K FILM	3 KVDC TO 6 KVDC	1 Mfd TO 100 Mfd	1.0% Per Year	−20 C TO 60°C	+10%	2% TYPICAL	1,000 MEGOHM X Mfd	2% TYPICAL	DC	Defribillators.
MICA	500v PEAK TO 35KvPEAK	100 Pf TO 250,000	(+−) .5% (+−) .1 Pf	−55 TO+125°C	(+−) 200 PPM°C	.1% TYPICAL	> 7,500 MEGOHMS	—	DC TO 15 MHz	Broadcast, rf heating, rf coupling welding

NWL CAPACITORS
For All Sales Contact; One Industrial Drive, Snow Hill, NC 28580, (919) 747-5943, FAX; (919) 747-8979
8050 Monetary Drive, Riviera Beach, FL 33404, (407) 848-9009, FAX: (407) 848-9011

eem MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

Philips Components

Discrete Products Division

A North American Philips Company

TANTALUM SOLID, WET AND CHIP CAPACITORS

5900 Australian Avenue, West Palm Beach, FL 33407 (407) 863-1800, FAX: (407) 863-1811

Type MIL-Slash No.	Designation	Style	Description	Capacitance Range	Voltage Range
WET SLUG MIL-C-3965					
/1	CL14 CL16	43XW	Hermetic Seal, Screw Mount, Cylindrical Case	3.5- 200 µf	20-630v
/19	CL17 CL18	43XW	Hermetic Seal, Stud Mount, Cylindrical Case	12-1300 µf	30-630v
/21	CL55	43JW	Hermetic Seal, Rectangular Module	70-2400 µf	15-150v
/4	CL64 CL65	40LW	Elastomer Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
/24	CL66 CL67	40SW	Hermetic Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
MIL-C-39006			Established Reliability		
/18	CLR10	43XW	Extended Range, Axial Lead, Tubular Case	2.0- 140 µf	8-360v
/19	CLR14	43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	3.5- 200 µf	20-630v
/20	CLR17	43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	12-1300 µf	30-630v
/09	CLR65-8000	40SW	Glass-to-Tantalum Hermetic Seal, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
/22	CLR79	40AW	Hermetic Seal, Non-Silver Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
/25	CLR81	40BW	Extended Range, Hermetic Seal, Non-Silver Case, Axial Lead, Tubular Case	6.8-2200 µf	6-125v
SOLID SLUG MIL-C-26655B					
/2	CS12 CS13	40SS	Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
MIL-C-39003			Established Reliability		
/02	CSR09	40TS	Polar, Miniature, Hermetic Seal, Axial Lead, Tubular Case	.047- 18 µf	6- 75v
/01	CSR13	40SS	Polar, Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
/09	CSR21	40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6- 300 µf	6- 50v
/03	CSR23	40XS	Polar, Extended Range, Hermetic Seal, Axial Lead, Tubular Case	1.2-1000 µf	6- 50v
/06	CSR33	40YS	Polar, Extended Range, Hermetic Seal, for Low Impedance Application	1.2-1000 µf	6- 50v
/04	CSR91	40NS	Non-Polar, Hermetic Seal, Axial Lead, Tubular Case	.0023- 160 µf	6-100v
SOLID CHIP MIL-C-55365/4			Established Reliability		
	CWR06	49BC	Polar Hybrid Tantalum Chip	.1- 100 µf	4- 50v
	CWR11	49MC	Polar Molded Tantalum Chip	.1- 47 µf	6- 50v
WET SLUG		40AW	Hermetic, Non-Silver Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
		40BW	Extended Range, Hermetic, Non-Silver Case, Axial Lead, Tubular Case	6.8-2200 µf	6-125v
		40EW	Extended Range, Polar, Non-Hermetic, Tubular, Axial	6.8-1800 µf	6-125v
		43JW	Hermetic, Rectangular Module, Spade Lugs	35-22000 µf	6-150v
		40LW	Polar, Non-Hermetic, Tubular, Axial Lead	1.7-1200 µf	6-125v
		40SW	Hermetic, Polar, Glass to Tantulum Seal, Tubular, Axial	1.7-1200 µf	6-125v
		40TW	Hermetic, Non-Silver Case, Tubular, Axial, High Temp.	1.7-1200 µf	6-125v
		43XW	Hermetic, Cylindrical Case, Stud or Screw Mount	3.5-1300 µf	20-630v
		40YW	Miniature, Non-Acid Electrolyte, Polar, Tubular, Non-Hermetic	0.1- 320 µf	6- 60v
SOLID CHIP		49BC	Polar, Hybrid Tantalum Chip, High Reliability	0.1- 100 µf	4- 50v
		49SC	Polar, Hybrid Tantalum Chip, Industrial	0.47- 100 µf	4- 50v
		49UC	Polar, Hybrid, Miniature Industrial Tantalum Chip	0.1-6.8 µf	4- 50v
		49MC	Polar, Hybrid, Commerical Chip, EIA Sizes	0.1- 100 µf	4- 50v
		49XC	Polar, Hybrid, Extended Industrial Chip	1.0- 220 µf	4- 50v
SOLID SLUG		40NS	Non-Polar, Hermetic, Tubular Case, Axial Lead	.0023- 160 µf	6-100v
		41PS	Polar, Non-Hermetic, Rectangular Plastic Case, Radial Lead	0.1- 220 µf	6-50v
		40SS	Polar, Standard Hermetic, Tubular Case, Axial Lead	.0047- 330 µf	6-100v
		40TS	Polar, Miniature Hermetic, Tubular Case, Axial Lead	.0047- 39 µf	4-100v
		40XS	Polar, Extended Range, Hermetic Tubular, Axial Lead	0.82-1000 µf	6- 60v
		40YS	Polar, Extended Range, Hermetic, For Low Impedance Applications	1.0-1000 µf	6- 60v
		40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6- 330 µf	6- 50v

Philips Components
Discrete Products Division
A North American Philips Company

ALUMINUM ELECTROLYTIC CAPACITORS

6071 St. Andrews Road, Columbia, SC 29212-3198 (803) 772-2500, FAX: (803) 772-2445

Designation	Description	Capacitance Range (ufd)	Working Voltage Range (Volts)	Operating Temp. Range (°C)	Load* Life (hrs)
AC MOTOR START					
3500	Motor Start	21-1,200	110-330	−20 to +85	
COMPUTER GRADE-SCREW TERMINALS, P.C. MOUNTED					
3120	High Performance	110-700,000	6-300	−40 to +105	3,000
3186	Standard	75-1,200,000	5-450	−40 to +85	1,000
3188	Long Life	100-1,000,000	3-400	−40 to +85	2,000
3191	Sym. Tolerance, SMPS Output	2,800-200,000	5-55	−55 to +85	1,500
SUPER SNAP™ SNAP-IN PRODUCTS					
3487	Standard	68-100,000	6.3-450	−40 to +85	1,000
3488	High Temperature	150-56,00	6.3-250	−40 to +105	1,000
3489	High Cap, SMPS Input	330-2,700	200-250	−40 to +85	1,000
3407	Ultra High Capacitance Products Available in 1991.		10-450	−40 to +85	2,000
3408	Ultra High Capacitance Products Available in 1991.		10-450	−40 to +105	2,000
SURFACE MOUNTED					
3970	Coupling & Decoupling	0.1-22	6.3-63	−40 to +85	1,000
2222-139	Long Life	0.22-220	6.3-100	−55 to +105	1,000
SOLID ALUMINUM PRODUCTS					
2222-128	Resin Dipped	0.1-68	6.3-40	−55 to +175	2,000/5,000
2222-123	Axial Leaded	1.0-2,200	4-40	−80 to +200	5,000/8,000
AXIAL-MINIATURE ELECTROLYTIC					
2222-021	Miniature Gen'l Purpose	.22-15,000	6.3-100	−40 to +85	1,000/5,000
2222-108	Industrial-105°C	2.2-2,200	6.3-6.3	−40 to +105	1,000
2222-118	Ext. Temp.-Long Life	1.0-15,000	6.3-200	−55 to +125	2,000
2222-119	Ext. Temp.-Long Life	1.0-4,700	10-63	−55 to +150	500
2222-132/133	Very Long Life	1.0-4,700	10-350	−40 to +85	6,000/8,000
3070	General Purpose	.33-10,000	6.3-385	−40 to +85	1,000/5,000
RADIAL MINIATURE ELECTROLYTIC					
Note: 3476, 3480, 3481, 3482, Not Recommended For New Designs					
2222-035	General Purpose	.1-4,7000	6.3-100	−40 to +85	1,000
2222-037	General Purpose, High Cap	.1-10,000	6.3-100	−40 to +85	1,000/2,000
2222-044	General Purpose	1.0-68	160-385	−40 to +85	2,000
2222-045/046	High Temperature, Low ESR Products Available in 1991.				1,000/2,000
2222-047/048	High Temperature, Low ESR Products Available in 1991.				1,000/2,000

***See the 1990-91 Resistor/Capacitor Data Book for Details.**

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FILM CAPACITORS

6071 St. Andrews Road, Columbia, SC 29212-3199 (803) 772-2500, FAX: (803) 772-2445

Designation	Construction	Enclosure	Lead	Voltage VDC/VAC	Capacitance (ufd)	Tolerance (+/−)
POLYESTER						
712A1 (365-369)	Metalized (MKT)	Epoxy	Radial	VDC63-630 VAC 40-220	.001-6.8	5%, 10%
719A1 (370 & 371)	Metalized (MKT)	Potted	Radial	VDC 63-400 VAC 40-220	.001-1.0	5%, 10%
719A2 (372)	Metalized (MKT)	Potted	Radial	VDC 63-400 VAC 40-220	.0047-.47	5%, 10%
719A3 (373)	Metalized (MKT)	Potted	Radial	VDC 63-400 VAC 40-220	.047-15	5%, 10%
POLYCARBONATE						
719B1 (344)	Metalized (MKC)	Potted	Radial	VDC 63-630 VAC 40-220	.01-6.8	5%, 10%
POLYSTYRENE						
704C1 (424-431)	Film/Foil (KS)	Sleeve	Axial	VDC 63-630 VAC 25-200	51pf-.039	1%, 2%, 5%
719C1 (443)	Film/Foil (KS)	Potted	Radial	VDC 63 VAC 25	100pf-.033	1%
POLYPROPYLENE						
703E1 (460-464)	Film/Foil (KP)	Conformal	Axial	VDC 63-630 VAC 40-200	47pf-.062	1%, 2%, 5%
719F1 (376)	F/F & Met'l (KP/MMKP)	Potted	Radial	VDC 630-2000 VAC 300-600	.001-0.27	5%
719F2 (378)	Metalized (MKP)	Potted	Radial	VDC 250-2000 VAC 160-600	.0033-3.3	5%
POLYESTER & PAPER CLASS X						
719J1 (330.4)	Metalized	Potted	Radial	VAC 250	.01-1.0	10%, 20%
	VDE 565-1, IMQ (CEI 40-7), SEMKO, UL 1283					
719J2 (330.5)	Metalized	Potted	Radial	VAC 250	.01-.68	10%, 20%
	VDE 565-1, FI, SEMKO, UL 1283					
719J4 (333.4)	Metalized	Potted	Radial	VAC 250	.01-1.0	10%
	VDE 565-1, FI, S, D, N, SEV 1055, 1978, UL 1414, CSA					
SMD (PPS)						
392, 393, 394	Metalized	Unencapsulated	SMD	VDC 25, VAC 16	.001-.47	5%, 10%

VARIABLE CAPACITORS

6071 St. Andrews Road, Columbia, SC 29212-3198 (803) 772-2500, FAX: (803) 772-2445

Designation	Voltage Rating (DC)	Capacitance Range	Temperature (°C)	Description
2800C/K (808)	150/250	1.5-5 pf 7-100 pf	−40 to +70 −40 to +85	Film Dielectric Variable Capacitor For Commercial and Industrial Applications
2800D/E/L/M (809)	200/300	0.6-2 pf 7-150 pf	−40 to +125	Film Dielectric Variable Capacitor For Professional Applications

Philips Components

Discrete Products Division

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MULTILAYER CERAMIC CHIP CAPACITORS

4561 COLORADO BLVD., LOS ANGELES, CA 90039 (818) 240-4880, TWX: 910-497-2282, FAX: 818-500-9174

Case Size	DIELECTRIC/CAPACITANCE RANGE			Voltage
	NPO	X7R	50 VDC Y5V	
0805	0.47-1000pF	180-.033μF	2200-.033μF	25, 50, 100, 200
1206	.047-3800pF	680-.1μF	.01-1.0μF	25, 50, 100, 200
1210	47-4700pF	2200-.22μF		25, 50, 100, 200
1808	100-5600pF	2200-.27μF		25, 50, 100, 200
1812	330-5600pF	4700-.47μF		25, 50, 100, 200
2220	470-.01μF	.01-1.0μF		25, 50, 100, 200
Tolerances Available: C, D, F, G, J, K, M, Z, P				
Packaging: Bulk, tape and reel per EIA RS481				

ELECTRICAL PARAMETERS

TEMPERATURE CHARACTERISTICS:
NPO: 0±30ppm/°C, −55°C to +125°C; **X7R:** ±15%, △C, −55°C to +125°C; **Y5V:** +22% to −82% △C, −30°C to +95°C.

INSULATION RESISTANCE:
100K megohms or 1000 megohm microfarads, whichever is less at 25°C. Measured after 2 min. with 50 mA limiting current.

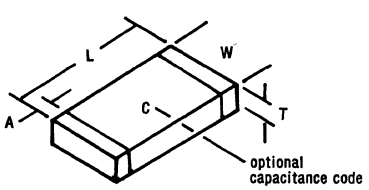
TERMINATIONS AVAILABLE:
Dipped Palladium Silver; Nickel Barrier, 100% Tin; Nickel Barrier, Tin/lead.

DISSIPATION FACTOR:
NPO: .1% maximum @ 25°C, 1.0 VRMS ±.25 VRMS @ 1 KHz. 1 MHz for values less than 1000 pF; **X7R:** 2.5% maximum @ 25°C, 1.0 VRMS ±.25 VRMS @ 1 KHz; **Y5V:** 2.5% max @ 25°C 1.0 VRMS ±1 VRMS @ 1 KHz.

DIELECTRIC STRENGTH:
NPO, X7R, Z5U: 250% rated voltage with 50mA maximum charging current.

MECHANICAL PARAMETER

INCH (MILLIMETER) INCH (MILLIMETER)



EIA SIZE CODE	L	W	T MAX.	A MIN./MAX.
0805	.079±.008 (2.03±.020)	.049±.008 (1.25±0.20)	.050 (1.27)	.010/.030 (0.25/0.76)
1206	.126±.008 (3.20±0.20)	.063±.008 (1.60±0.20)	.059 (1.25)	.010/.030 (0.25/0.76)
1210	.126±.008 (3.20±0.20)	.098±.008 (2.51±0.20)	.065 (1.65)	.010/.035 (0.25/0.89)
1812	.177±.012 (4.54±.30)	.126±.008 (3.20±.20)	.065 (1.65)	.010/.035 (0.25/0.89)
1808	.180±.015 (4.57±0.38)	.080±.015 (2.03±0.38)	.065 (1.65)	.010/.035 (0.25/0.89)
2220	.224±.008 (5.7±0.2)	.197±.008 (5.0±0.2)	.071 (1.8)	.010/.030 (0.25/0.75)

Philips Components

Discrete Products Division

A North American Philips Company

7158 Merchant Avenue, El Paso, TX 79915 (915) 775-4242 FAX: (915) 775-4249

CERAMIC LEADED CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range (VDC)
A	MonoAxial™ MULTILAYER Conformal Coated Axial Leaded	10 pf to 1.0 µF	up to 200VDC
G	Mono-Glass™ MULTILAYER Glass Encapsulated Axial Leaded	10 pf to .56 µF	up to 200VDC
K	Mono-Kap™MULTILAYER Radial Leaded	10 pf to 10 µF	up to 200VDC
P	Mono-Pak™ MULTILAYER Dual In-Line Package	10 pf to .33 µF	up to 200VDC
R	General Purpose and Temperature Stable Single Plate Caps	1.0 pf to .022 µF	30VDC and 100VDC

CERAMIC DISC CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range
D & S	General Purpose and Temperature Stable Class 1, 2 & 3	1.0 pf to .1 µF	50VDC to 6KVDC
S	Circuit Protection GAP-KAP®	.75 pf to .02 µF	up to 3000VDC; up to 6KVDC APO
S-UL	UL / VDE / CSA AC Rated Discs	100 pf to .01 µF	125VAC, 250VAC, and 400VAC
U	Ultra-Kap® Class IV	.01 µf to 2.2 µF	3VDC to 100VDC

RF TRANSMITTING CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range (VDC)
T	RF Rated, Special Application Transmitting Capacitors	3.0 pf to .001 µF	5KV, 7.5KV, 15KV and 20KVDC

MINIGLOSSARY BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where $Rs = ESR$

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\pi fC)\,(ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\,(Xc) = (DF)\,(\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\,(DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_o}{L_t} = \left(\frac{V_t}{V_o}\right)^x \quad \left(\frac{T_t}{T_o}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{ --- } + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{ --- } + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	$\times 10^{-12}$
Nano	$\times 10^{-9}$
Micro	$\times 10^{-6}$
Milli	$\times 10^{-3}$
Deci	$\times 10^{-1}$
Deca	$\times 10$
Kilo	$\times 10^{3}$
Mega	$\times 10^{6}$
Giga	$\times 10^{9}$
Tera	$\times 10^{12}$

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

PPD Film Capacitors

- **ultraminiature**
- **inexpensive**
- **flame retardant conformal coating**
- **automatically insertable**
- **metallized polyester**
- **metallized polypropylene**
- **film/foil polypropylene**

Features that you need . . .

Very small sizes

Axial, conformal coated (coating material meets UL 94V-0)

Box, cylindrical and oval shapes

Series windings for AC applications

Wide capacitance range (150 pf to 6.8 μF)

Tight capacitance tolerance

Non-standard ratings, sizes and characteristics available

Reliability by design

Ship-to-stock

Tape & Reel

Tight TC

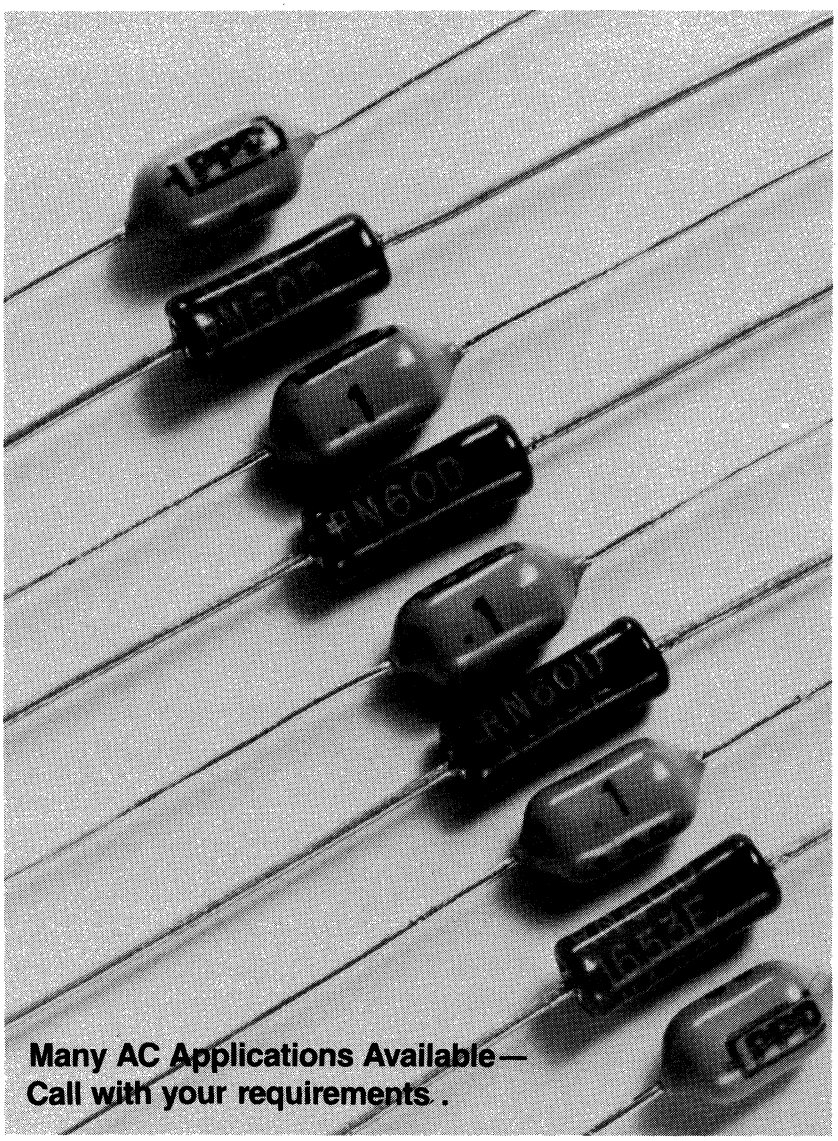
High IR

Low DF

And more

Film capacitors for . . .

Decoupling
Snubber
Ballast
Bypassing
Timing
Filtering
Coupling
Energy storage
Tuning
Small motor run



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Specifications subject to change without notice.

PEC 831 Metallized Polyester Film

General Characteristics

The PEC 831 is manufactured using a unique packaging process which allows the production of a compact body size for a given capacitance. This allows the designer to specify an automatically insertable, axial lead capacitor allowing higher circuit board densities than were previously possible. The general characteristics of the PEC 831 make it an ideal choice for general coupling, decoupling and filtering applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics.

Capacitance range	1000 pF to 6.8 μF
Capacitance tolerance	±5%, ±10%, ±20%
Voltage Ratings AC ratings are at 60Hz	40VDC/24VAC, 100VDC/63VAC, 200VDC/125VAC, 400VDC/200VAC
Temperature range	−55°C to +125° C. Over 85°C the voltage is derated linearly to 50% at 125°C.
Moisture resistance	After 72 hours at 75°C and 95%RH, the IR shall exceed 30% of the initial requirement.
Dielectric and electrodes	Polyester film vacuum metallized with aluminum.
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0.
Leads	Solder coated copper clad steel wire.
Temperature coefficient	See capacitance vs. temperature curve
Capacity stability	±2% over period of 2 years
Dielectric strength	160% rated DC voltage for 2 seconds.
Life test	140% rated DC voltage at 85°C for 250 hours.
Insulation resistance	C≤.33μF and V>100VDC: 30,000MΩ Min.
2 Min. Electrification, 25°C	C>.33μF and V ≥100VDC: 10,000 MΩ × μF Min.
10 VDC for V<100 VDC	C≤.1μF and V≤100VDC: 10,000 MΩ Min.
100VDC for V≥100VDC	C>.1μF and V<100VDC: 1,000 MΩ × μF Min.
Dissipation Factor	C≤1μF0.8% max. (0.5% average) at 1KHz C>1μF1.0% max. (0.6% average) at 1KHz
Self Inductance	10nH/cm along length of body and leads

MAXIMUM PULSE RISE TIME

	V/μs					
	CASE					
VDC	A	B	C	D	E	F
40V	6.2	3.6	1.9	1.5	1.1	0.84
63V	7.3	4.6	2.3	1.8	1.4	1.0
100V	12.1	7.3	3.8	2.9	2.3	1.7
200V	16.2	9.7	5.1	3.9	3.0	2.2
400V	51.0	25.0	11.6	8.6	6.5	4.7

Pulse Current = Cap. (μF) × Pulse Rise Time

CAP.	CASE					
μF	A	B	C	D	E	F
.001	400					
.0012	400					
.0015	400					
.0018	400					
.0022	400					
.0027	400					
.0033	400					
.0039	400					
.0047	400					
.0056	200	400				
.0068	200	400				
.0082	200	400				
.01	200	400				
.012	200	—	400			
.015	200	—	400			
.018	200	—	400			
.022	200	—	—	400		
.027	200	—	—	400		
.033	100	200	—	400		
.039	100	200	—	400		
.047	100	200	—	400		
.056	63	200	—	400		
.068	63	100	200	—	400	
.082	63	100	200	—	400	
.1	63	100	200	—	400	
.12	40	100	—	200	400	
.15	40	63	100	200	400	
.18	40	63	100	200	400	
.22	40	63	—	200	—	400
.27		63	—	200	—	400
.33			63	100	200	400
.39			63	100	200	—
.47				100	200	—
.56				100	200	—
.68				63	200	—
.82				63	200	—
1.0				63	100	200
1.5					100	200
2.2					63	100
3.3					63	—
4.7						63
6.8			VOLTS			63

CASE SIZE

	A	B	C	D	E	F
	D×L	D×L	D×L	D×L	D×L	D×L
IN.	.177×.250	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.5×6.4	4.5×9.0	5.0×12.6	6.3×15.5	8.8×18.9	8.8×24.6

CAP.	VOLTAGE (DC)				
μF	40V	63V	100V	200V	400V
.001					A
.0012					A
.0015					A
.0018					A
.0022					A
.0027					A
.0033					A
.0039					A
.0047					A
.0056				A	B
.0068				A	B
.0082				A	B
.01				A	B
.012				A	C
.015				A	C
.018				A	C
.022				A	D
.027				A	D
.033			A	B	D
.039			A	B	D
.047			A	B	D
.056		A	B	B	D
.068		A	B	C	E
.082		A	B	C	E
.1		A	B	C	E
.12	A	B	B	D	E
.15	A	B	C	D	E
.18	A	B	C	D	E
.22	A	B	D	D	F
.27	B	B	D	D	F
.33	C	C	D	E	F
.39	C	C	D	E	
.47	D	D	D	E	
.56	D	D	D	E	
.68	D	D	E	E	
.82	D	D	E	E	
1.0	D	D	E	F	
1.5	E	E	E	F	
2.2	E	E	F		
3.3	E	E			
4.7	F	F			
6.8	F	F			

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PPC 830 Polypropylene Film/Foil

General Characteristics.

The PPC 830 is an axial lead, polypropylene film capacitor that features small size, low price and flame retardant coating. The electrical stability of polypropylene and its characteristic high resistance to moisture allow these units to retain their original capacitance over long periods of time without degradation due to changing environmental conditions. The PPC 830 has the excellent characteristics previously found only in polystyrene capacitors but offers a higher temperature rating and, of course, flame resistance. The low negative TC and very low dissipation factor of the PPC 830 provide for a stable frequency response curve and high Q in resonant and filtering circuit applications. Since the PPC 830 also exhibits high insulation resistance (I.R.) and low dielectric absorption (D.A.), it is a good choice for storage and timing circuit applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics

Capacitance range	150pF to .56μF
Capacitance tolerance	±1% thru ±10%
Voltage ratings AC ratings are at 60Hz (higher voltages available upon request)	160VDC/90VAC, 400VDC/160VAC, 630VDC/200VAC
Temperature range	−55°C to 105°C. Over 85°C the voltage is derated linearly to 50% at 105°C.
Humidity range	95% RH max., 85% yearly average
Dielectric	Polypropylene film
Electrodes	Aluminum foil
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0
Leads	Solder coated copper clad steel wire.
Temperature coefficient of capacitance	−150 ± 100 ppm/°C
Capacitance stability	< ± 0.5% drift over period of 2 years
Test voltage/Dielectric strength	2.5 x rated voltage for 2 seconds
Insulation resistance	> 100,000 MΩ after 2 mins. at 100V, 25°C
Life test	140% rated voltage at 105°C for 250 hrs.
Dissipation factor	≤ .07% at 10KHz
Dielectric absorption	< .05%
Self inductance	10nH/cm along length of body and leads
Max pulse rise time	500V/μ sec

	160VDC/90VAC				400VDC/160VAC				630VDC/200VAC			
	mm		in		mm		in		mm		in	
PF	D	L	D	L	D	L	D	L	D	L	D	L
150	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
220	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
330	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
470	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
680	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
735	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
820	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1000	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1500	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
2200	4.8	10	.188	.394	4.8	10	.188	.394	5.2	10	.205	.394
3300	4.8	10	.188	.394	4.8	10	.188	.394	6.1	10	.240	.394
4100	4.8	10	.188	.394	5.2	10	.205	.394	6.5	10	.255	.394
4300	4.8	10	.188	.394	5.2	10	.205	.394	6.6	10	.260	.394
4700	4.8	10	.188	.394	5.3	10	.210	.394	5.8	12	.230	.475
4900	5	10	.195	.394	5.5	10	.215	.394	6	12	.235	.475
5600	5	10	.195	.394	5.6	10	.220	.394	6.2	12	.245	.475
6800	5	10	.195	.394	6	10	.235	.394	6.7	12	.265	.475
8200A	6	10	.235	.394	—	—	—	—	—	—	—	—
8200B	5	12	.195	.475	5.6	12	.220	.475	7.1	12	.280	.475
MFD												
.01A	6.2	10	.245	.394	—	—	—	—	—	—	—	—
.01B	5	12	.195	.475	6.4	12	.250	.475	7.7	12	.305	.475
.013	5.5	12	.215	.475	6.9	12	.270	.475	8.5	12	.335	.475
.015	5.7	12	.225	.475	7.1	12	.280	.475	7.9	14.7	.310	.580
.018	6	12	.235	.475	7.5	12	.295	.475	8.3	14.7	.325	.580
.022	6.5	12	.255	.475	8	12	.315	.475	8.8	14.7	.345	.580
.025	6.9	12	.270	.475	7.9	14.7	.310	.580	9.5	14.7	.375	.580
.027	7.1	12	.280	.475	8.1	14.7	.320	.580	9.9	14.7	.390	.580
.033	7.6	12	.300	.475	8.9	14.7	.350	.580	9	18.3	.355	.720
.047	7.9	14.7	.310	.580	10.3	14.7	.405	.580	9.9	18.3	.390	.720
.056	8.8	14.7	.345	.580	11	14.7	.435	.580	10.4	18.3	.410	.720
.060	9	14.7	.355	.580	9.1	18.3	.360	.720	10.8	22	.425	.865
.068	9.4	14.7	.370	.580	10.3	18.3	.405	.720	11.4	22	.450	.865
.082	8.4	18.3	.330	.720	11.4	18.3	.450	.720	12.4	22	.490	.865
.1A	9.1	18.3	.360	.720	11.9	18.3	.470	.720	—	—	—	—
.1B	8.1	22	.320	.865	10.3	22	.405	.865	13.5	22	.530	.865
.15	9.5	22	.375	.865	11.8	22	.465	.865	13.9	25.1	.548	.990
.22	11.4	22	.450	.865	13	22	.510	.865				
.27	12.4	22	.490	.865								
.33	11.9	22	.470	.865								
.47	12.7	25.1	.500	.990								
.56	14	25.1	.550	.990								

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PPC 831 Metallized Polypropylene Film

General Characteristics

The PPC 831 is an axial lead, metallized polypropylene film capacitor featuring small size, high performance, low price and conformal encapsulation with a flame retardant coating.

The physical and electrical characteristics of polypropylene as a dielectric are commendable. Polypropylene is relatively impervious to moisture. It is also extremely stable. The PPC 831 will, therefore, retain its original properties over extended periods of time in a fluctuating environment.

Other noteworthy attributes of the PPC 831 are high insulation resistance (IR) and a low dielectric absorption (DA) factor. Both of these parameters are of critical importance in the selection of a sample-and-hold capacitor in data acquisition applications. The DA of polypropylene is about 10 times less than that of polyester and is significantly less than that of polycarbonate or polystyrene.

Also to be considered are the gently sloping curves for temperature coefficient (TC), dissipation factor (DF) and capacitance variation with frequency. The relatively flat response of the PPC 831 assures dependable, stable performance when incorporated into critical resonant and filtering circuit applications.

Physical and electrical characteristics:

Capacitance — Measured at 1,000 Hz

Capacitance range — 1000 pF to 1.0 µF

Capacitance tolerance — 1%, 2.5%, 5%, 10%, 20%

Voltage ratings AC ratings at 60 Hz — 160 VDC/ 90 VAC, 250 VDC/ 220 VAC, 400 VDC/ 250 VAC, 630 VDC/ 300 VAC

Temperature range — −55°C to 105°C. Over 85°C the voltage is derated linearly to 50% at 105°C.

Dielectric — Aluminum metallized polypropylene film

Coating — Conformally coated with epoxy. Coating material meets UL 94V-0

Leads — Solder coated copper clad steel wire

Dissipation factor Measured at 25°C, 1 KHz — Less than .1%, Figures I & II

Dielectric absorption Per MIL-C-19978 — Less than .05%, Figure III

Insulation resistance Rated voltage, 2 min. electrification

	+25°C	+85°C	+105°C
MΩ × µF	100,000	5,000	500
≤MΩ	200,000	10,000	1,000

Life test 1Ω/ Volt in series — 1000 hours, 85°C, 140% voltage

Humidity — 72 hours, 75°C, 95% R.H. (Ref. EIA RS377, IR shall exceed 30% of minimum)

Dielectric strength 100Ω/ Volt in series — 200% rated voltage, 1 min.

Capacitance drift — ± .5% over 2 years 20°C to 40°C, 40% to 60% R.H.

Temperature coefficient — Figure IV

Self inductance — 10nH/cm along leads and body

MAXIMUM PULSE RISE TIME

	V/µs				
	CASE				
VDC	B	C	D	E	F
160V	8.3	4.6	3.5	2.7	2
250V	15.7	8	5.8	4.3	3.1
400V	21	10.7	7.8	5.8	4.2
630V	43	18.5	13	9.6	6.7

Pulse Current = Cap. (µF) × Pulse Rise Time

CAP. µF	CASE B	C	D	E	F
.001	630				
.0012	630				
.0015	630				
.0018	630				
.0022	630				
.0027	400	630			
.0033	400	630			
.0039	400	630			
.0047	400	630			
.0056	400	630			
.0068	400	630			
.0082	400	—	630		
.01	250	400	630		
.012	250	400	630		
.015	250	400	630		
.018	160	250	630		
.022	160	250	630		
.027	160	250	400	630	
.033	160	—	400	630	
.039	160	—	400	630	
.047	160	—	400	630	
.056		160	250	630	
.068		160	250	400	630
.082		160	250	400	630
.1		160	250	400	630
.12			160	400	630
.15			160	400	630
.18			160	250	400
.22			160	250	400
.27				250	400
.33				160	250
.39				160	250
.47				160	250
.56				160	250
.68				160	—
.82			VOLTS		160
1.0					160

CASE SIZE

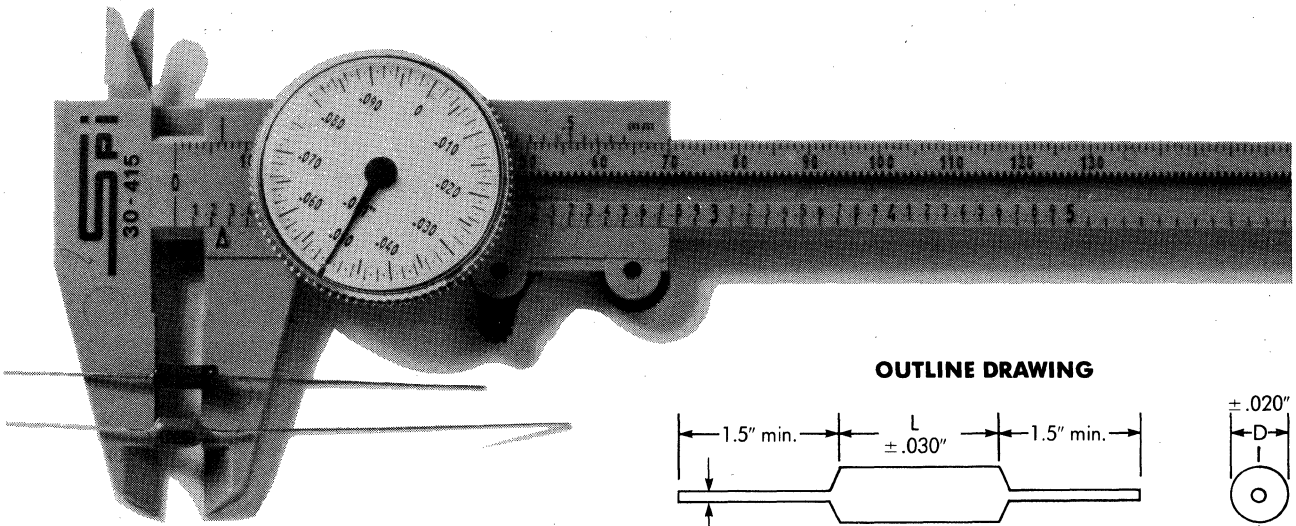
	B D x L	C D x L	D D x L	E D x L	F D x L
IN.	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.5×9.0	5.0×12.6	6.3×15.5	8.8×18.9	8.8×24.6

CAP. µF	VOLTAGE (DC) 160V	250V	400V	630V
.001				B
.0012				B
.0015				B
.0018				B
.0022				B
.0027			B	C
.0033			B	C
.0039			B	C
.0047			B	C
.0056			B	C
.0068			B	C
.0082			B	D
.01		B	C	D
.012		B	C	D
.015		B	C	D
.018	B	C	D	D
.022	B	C	D	D
.027	B	C	D	E
.033	B	D	D	E
.039	B	D	D	E
.047	B	D	D	E
.056	C	D	E	E
.068	C	D	E	F
.082	C	D	E	F
.1	C	D	E	F
.12	D	E	E	F
.15	D	E	E	F
.18	D	E	F	
.22	D	E	F	
.27	E	E	F	
.33	E	F		
.39	E	F		
.47	E	F		
.56	E	F		
.68	E			
.82	F			
1.0	F			

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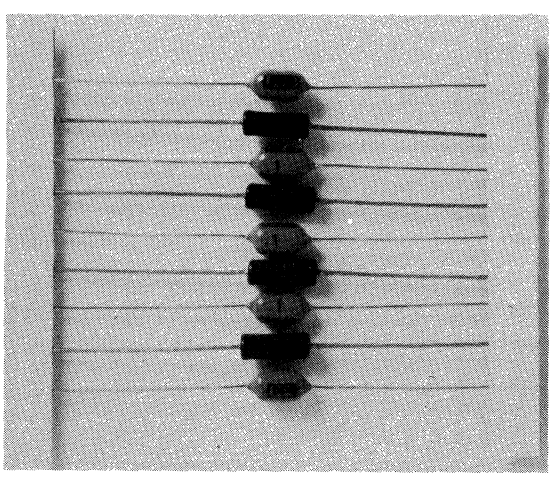
Specifications subject to change without notice.



The "A" and "B" case sizes of the PPC 831 and PEC 831 style capacitors are computer designed with today's manufacturing and design criteria firmly in mind — namely, automation.

Until now, the most useful configuration for automated assembly, with respect to general bypassing, filtering and timing requirements, has been the box style capacitor. This is because the corresponding axial style devices are of physical proportions incompatible with automatic insertion equipment. Unfortunately, the box capacitor presents the modern factory with its own unique problems. An expensive radial insertion machine must be obtained. Box insertion requires an additional step in the assembly process which adds both direct and indirect production costs. In comparison, axials insert 3 times faster than radials.

PPD has been studying this situation for some time now. The culmination of this work has been the development of the "A" and "B" case film capacitors. The designer is now presented with the capability of specifying axial lead, automatically insertable, metallized film capacitors in the range of .001 μF to .27 μF. Examination of the dimensions of the "A" and "B" cases will reveal that, in length, they closely approximate the dimensions of RN55 and RN60 style resistors. Both "A" and "B" cases have a .177" ± .020" diameter. They can, therefore, be taped on 0.2" centers. Ultimately, these devices can be sequenced on standard axial lead insertion machinery to provide high volume, low cost production.



OUTLINE DRAWING

CASE SIZE

	A	B	C	D	E	F
	D x L	D x L	D x L	D x L	D x L	D x L
IN.	.177×.250	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.50×6.35	4.50×9.02	4.95×12.62	6.27×15.49	8.76×18.92	8.81×24.64

PART NUMBERING INFORMATION

PPC 830

PPC830 / 1003 B / 400 / 2.5

- 2.5 — Tolerance
- 400 — Voltage (DC)
- B — A or B where alternate sizes available
- 1003 — Capacitance in pF, 3 significant figures and multiplier, ex. .1uF = 100, 000pF = 1003
- PPC830 — Type: PPC 830

PPC831 and PEC 831

PEC831 / .001 / 250 / 5

- 5 — Tolerance
- 250 — Voltage (VDC)
- .001 — Capacitance in uF
- PEC831 — Type: PEC 831 or PPC 831

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Typical Performance Characteristics

— — — Polypropylene ——— Polyester

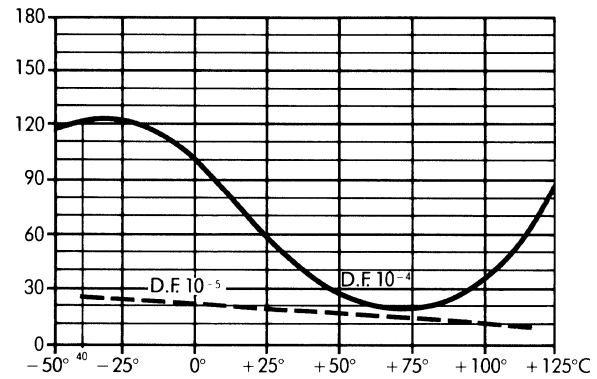


Fig. I *Dissipation factor variation with temperature*

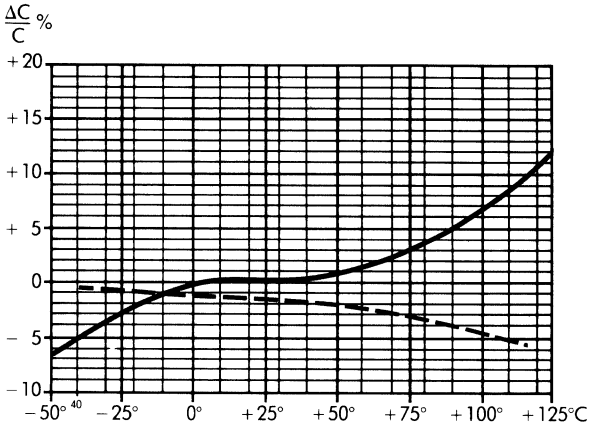


Fig. IV *Capacitance variation with temperature*

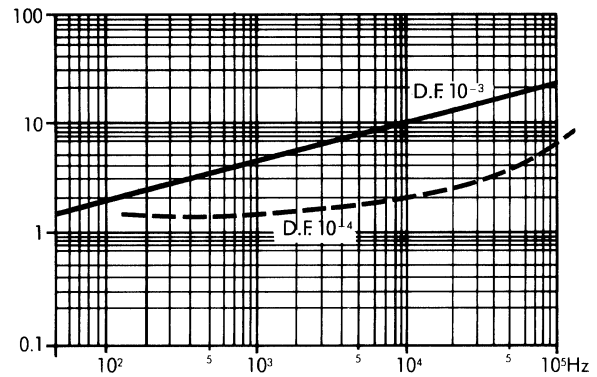


Fig. II *Dissipation factor variation with frequency*

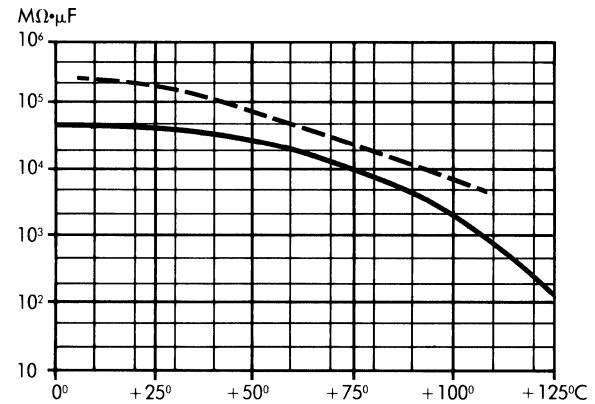


Fig. V *Insulation resistance variation with temperature*

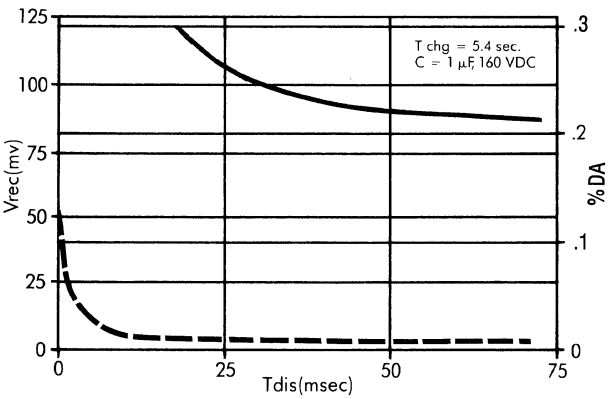


Fig. III *Dielectric absorption*

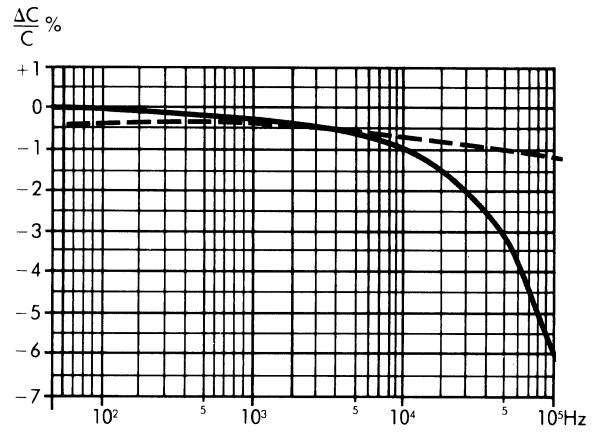


Fig. VI *Capacitance variation with frequency*

PPD

PPD FILM CAPACITORS, INC.
6001 Resco Court, Raleigh, N.C. 27613
(919) 781-3955
FAX (919) 781-4980

Printed in U.S.A.

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SAC 931 Metallized Polypropylene Capacitors For AC Applications

SERIES-WOUND CONSTRUCTION

Engineered to reduce or eliminate corona problems

General Characteristics

The SAC931 is an axial lead, premium quality capacitor, designed for 50-60 Hz applications. Wound with metallized polypropylene, it has multilayer, spray deposited end connections, for low ESR, and reliable operation. The firmly wound series sections are housed with a tough, flame retardant outer wrap, and with epoxy end seals.

Physical and Electrical Characteristics

Capacitance	Measured at 1 KHz
Capacitance range	0.01μF to 3.0μF
Capacitance tolerance	±5%, ±10%, ±20%
AC voltage ratings (50-60Hz)	400, 480, 540, 600V AC
Temperature range	−55 to +85°C
Dielectric	Metallized polypropylene film
Case insulation	Flame retardant outer wrap
Leads	Tinned, copper clad, steel wire
DF at +25°C, 1 KHz	Less than 0.07%

Insulation resistance (100VDC, 2 minute electrification)

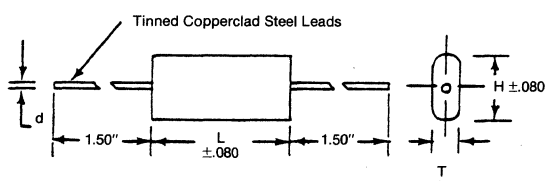
	+25°C	+85°C
MΩ × μF	100000	5000
MΩ	200000	10000

Additional information on request

STANDARD RATINGS

Dimensions in Inches — Voltage Ratings at +85°C

CAP μF	400VAC @ 60 Hz (600VDC)				480VAC @ 60 Hz (800VDC)				540VAC @ 60 Hz (1000VDC)				600VAC @ 60 Hz (1200VDC)			
	T	H	L	d	T	H	L	d	T	H	L	d	T	H	L	d
.01													.167	.311	1.187	.025
.018													.233	.324	1.187	.025
.022									.193	.292	1.187	.025	.250	.349	1.187	.025
.027					.168	.268	1.187	.025	.248	.348	1.187	.025	.278	.377	1.187	.025
.037					.201	.301	1.187	.025	.295	.395	1.187	.025	.328	.427	1.187	.025
.047	.166	.266	1.187	.025	.231	.331	1.187	.025	.336	.436	1.187	.025	.237	.484	1.50	.032
.10	.256	.356	1.187	.025	.352	.452	1.187	.025	.449	.549	1.187	.025	.382	.629	1.50	.032
.18	.230	.477	1.50	.032	.350	.597	1.50	.032	.460	.707	1.50	.032	.545	.792	1.50	.032
.22	.261	.508	1.50	.032	.369	.643	1.50	.032	.519	.766	1.50	.032	.522	.769	1.75	.032
.27	.297	.574	1.50	.032	.447	.694	1.50	.032	.584	.831	1.50	.032	.589	.836	1.75	.032
.33	.335	.600	1.50	.032	.504	.751	1.50	.032	.625	.872	1.50	.032	.663	.910	1.75	.032
.47	.440	.687	1.50	.032	.620	.867	1.50	.032	.714	1.09	1.75	.032	.812	1.06	1.75	.032
.68	.547	.794	1.50	.032	.620	.877	1.75	.032	.814	1.66	1.75	.040	.859	1.11	2.25	.040
1.0	.563	.810	1.75	.032	.763	1.01	1.75	.040	.886	1.13	2.25	.040				
1.5	.714	.961	1.75	.040	.852	1.10	2.25	.040								
2.0	.749	.996	1.75	.040												
2.7	.863	1.11	2.25	.040												
3.0	.912	1.16	2.25	.040												



Order by complete part number

SAC931 / .47 / 400 / K

- K: Capacitance Tolerance (J ± 5%, K ± 10%, M ± 20%)
- 400: Voltage (VAC) rms @ 50-60 Hz
- .47: Capacitance in μF
- SAC931: Type: SAC931

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QUALITY RELIABILITY PRICE standards

Film Capacitors



AVAILABLE FROM SEACOR

Our Complete Line of Film and Metallized Film Capacitors

	Polyester		Polycarbonate	Polypropylene		Polystyrene
	Film-Foil	Metallized	Metallized	Film-Foil	Metallized	Film-Foil
	MFWA	MMWA	CMWA	PFWA	PMWA	SFWA
	MFWF	MMWF	CMWF	PFWF	PMWF	SFWF
	MFKR	MMKR MMKS MMKT MNKR*	CMKR CMKS	PFKR PFKS	PMKR PNKY* PNKR*	SVKR
	MFDR MVDS	MMDR	—	PFDS PFDR	—	—
	—	—	—	—	—	SVVO SVVA
	—	—	—	—	PNM PNP	—

*Suppression cap

range: 3 pf to 2200 mfd
voltages: 15 vdc to 30,000 vdc
tolerance: ±0.25% to ±20%
approvals: UL, VDE, others
application information
motor run and other ac
low esr

specials

Assemblies C; R-C; L-C
Feed-Thrus
Matched sets
Flame retardant construction
High Current
Custom Designs

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Complete testing and individual printouts available.

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- High-Performance Miniatures
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- PC Board Snap-Mount
- Computer-Grade Flat Pack
- Qualified to MIL-C-62 and MIL-C-39018

CERAMIC CAPACITORS

- 2-Pin DIPs, Arrays and Networks
- Monolythic® Chips for Surface Mount Applications
- Discs DC/AC Rated
- Conformal Coated Axials and Radial Types

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- Solid Electrolyte, Wets and Foil Capacitors
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- Surface Mount Networks

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SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

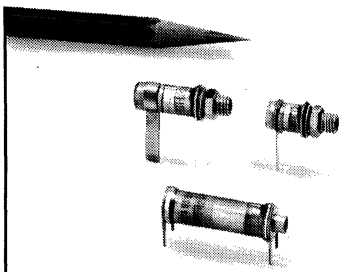
Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

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TRIMMER CAPACITORS AND INDUCTORS

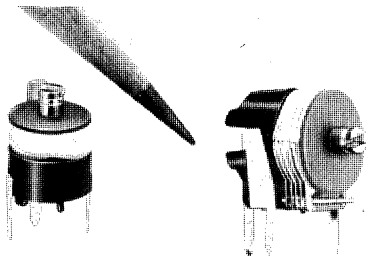
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- PC Mounting
- Panel Mounting



GLASS AND QUARTZ PISTONCAPS®

- Designed to meet MIL-C-14409D
- QPL models
- Extremely stable over temperature, frequency, voltage, etc.
- Cap ranges: 0.5-3.0 pF to 1.0-120 pF
- Zero backlash multiturn adjust mechanism
- Operating temp: −55° to +125°C (models to +200°C)
- Q to 1500 at 20 MHz
- Wide variety of configurations for PC and panel mounting
- Voltage ratings from 500 to 5000 V

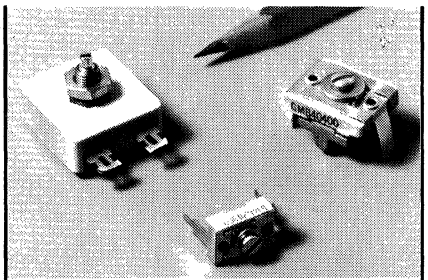
For more information, ask for Bulletin SG-205A.



FILMTRIM® SINGLE TURN PLASTIC

- Cap ranges: 1.0-5.0 pF to 25-500 pF
- Q to 5000 at 1 MHz
- Operating temp:
  PTFE, Polycarbonate, Polyimide: −40° to +85°C
  Polypropylene: −40° to +70°C
  High temp PTFE: −40° to +125°C
- 6 sizes from 5 mm to 16 mm
- More stable with temperature than other single turn trimmers

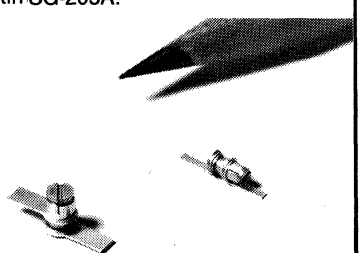
For more information, ask for Bulletin SG-402E.



MICA COMPRESSION

- Cap ranges: 2.5-7.0 pF to 1400-3055 pF
- Q to 600 at 1 MHz
- Rated working voltage to 500 V
- Can handle higher RF currents
- Operating temp: −35° to 85°C
- 8 mounting styles for PC, panel, and bracket mounting

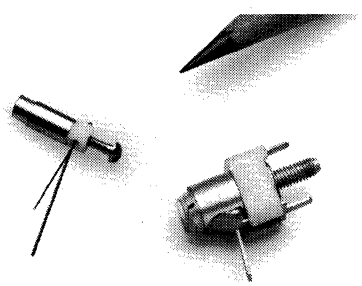
For more information, ask for Bulletin SG-500B.



SAPPHIRE PISTONCAPS®

- Q to 4000 at 250 MHz
- 6 mounting styles suitable for all RF structures
- Designed to meet MIL-C-14409D
- Operating temp: −55° to +125°C
- Cap ranges: 0.3-1.2 pF to 0.8-8.0 pF
- Subminiature size
- Multiturn resolution
- Extremely stable over temperature, frequency, voltage, etc.

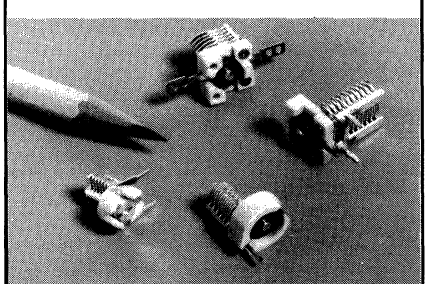
For more information, ask for Bulletin SG-207A.



MULTITURN PLASTIC

- Cap ranges: 0.25-1.5 pF; 2.0-10 pF
- Multiturn resolution at low cost
- Q typically > 2000 to VHF
- Temp coefficient of capacitance: −50 ± 50 ppm/°C; 0 ± 200 ppm/°C
- Operating temp: −55° to 125°C; −40° to 100°C

For more information, ask for Bulletin SG-401B.



AIRTRIM® SINGLE TURN AIR DIELECTRIC

- Cap ranges: 1.0-3.7 pF to 2.9-24.0 pF
- Q typically 8000 at 1 MHz; 4000 at 100 MHz; 1500 at 200 MHz
- Operating temp: −55° to 85°C
- Temp coefficient as low as 10 ± 10 ppm/°C
- 2 sizes and 10 mounting configurations for printed circuit and panel mounting
- Machined from solid brass

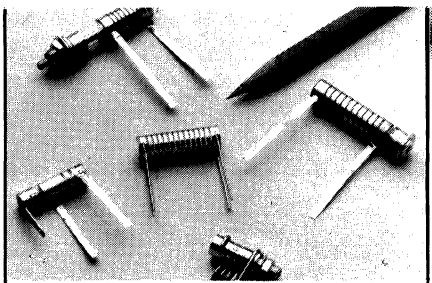
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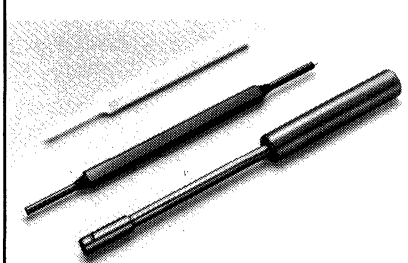


METALIZED INDUCTORS & LC TUNERS

Metalized Inductors
- Variables (±10%): overlapping ranges from 0.29 to 1.5 µH
- Fixed: 0.05 to 2.00 µH
- Min. SRF to 900 MHz, Min. Q to 200
- Temperature coefficient only ±10 ppm/°C over −55° to +125°C

LC Tuners
- Series resonant with SRF from 150 to 725 MHz in 4 ranges
- Parallel resonant with SRF from 170 to 1000 MHz in 5 ranges
- Temperature coefficient less than 40 ± 30 ppm/°C over −55° to +125°C

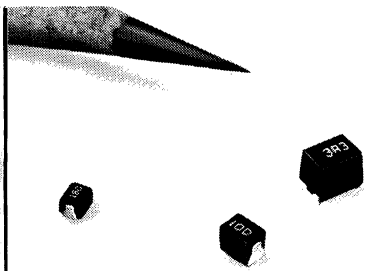
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TUNING TOOLS

- Nine models for lab and production use
- Hardened and plated steel tips
  Widths: 0.100″ (2.54 mm) and 0.087″ (2.21 mm)
  Thickness: 0.020″ (0.51 mm) and 0.015″ (0.38 mm)
- All plastic models
  Tips: 0.100″ (2.54 mm) × 0.014″ (0.36 mm) and 0.187″ (4.75 mm) × 0.020″ (0.51 mm)

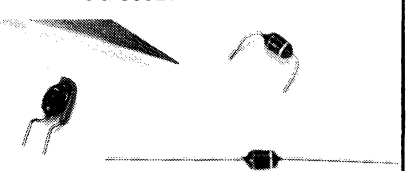
For more information, ask for Bulletin SG-206.



SURFCOIL® SMT INDUCTORS

- Inductance from 10 nH to 1 mH
- 8 model series in 3 sizes:
  2.5 × 2.0 × 1.6 mm (0.098″ × 0.079″ × 0.063″)
  3.2 × 2.5 × 2.2 mm (0.126″ × 0.098″ × 0.087″)
  4.5 × 3.2 × 3.2 mm (0.177″ × 0.126″ × 0.126″)
- Shielded, unshielded, ferrite core and nonmagnetic models
- Operating temp: −20° to +85°C
- Carrier and reel standard
- Fully encapsulated

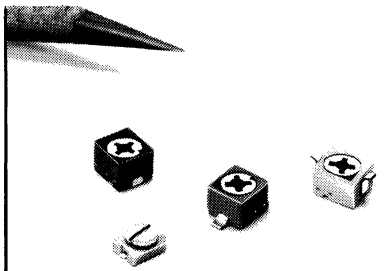
For more information, ask for Bulletin SG-800B.



WIREWOUND INDUCTORS

- Epoxy conformally coated
- Inductance values from 0.22 to 1000 µH
- Low price
- Four sizes:
  0.157″ D × 0.413″ long and 0.29″ long (4 mm D × 10.5 and 7.5 mm)
  0.110″ D × 0.295″ (2.8 mm D × 7.5 mm) and 0.165″ D × 0.256″ (4.2 mm D × 6.5 mm)
- Available with axial, radial, and vertical leads, bulk pack and taped
- Self resonant frequences to 300 MHz
- High Q (typically > 45, depending on model)
- Temperature Range: −20° to +80°C

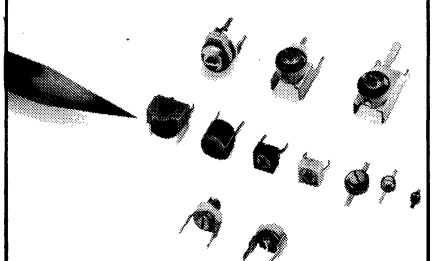
For more information, ask for Bulletin SG-900.



SURFTRIM® SURFACE MOUNT

- 2 sizes:
  3.2 × 4.5 × 1.6 mm
  4.0 × 4.5 × 2.7 mm (sealed)
- 4 mounting configurations
- Carrier and reel or bulk pack
- 1.7 to 50 pF in 7 cap ranges
- Operates to 85°C

For more information, ask for Bulletin SG-305C.



CERAMIC DIELECTRIC

Rugged 5 & 7 mm types
- Operating temp: −55° to +125°C
- Cap ranges: 1.3-2.0 pF to 12-160 pF

Miniature types suitable for hybrids
- Operating temp: −25° to +85°C
- 3 series: 2.0 × 1.2 mm; 3.0 × 1.5 mm; 5.0 × 2.0 mm
- Cap ranges: 2.5-10 pF to 5.5-40 pF

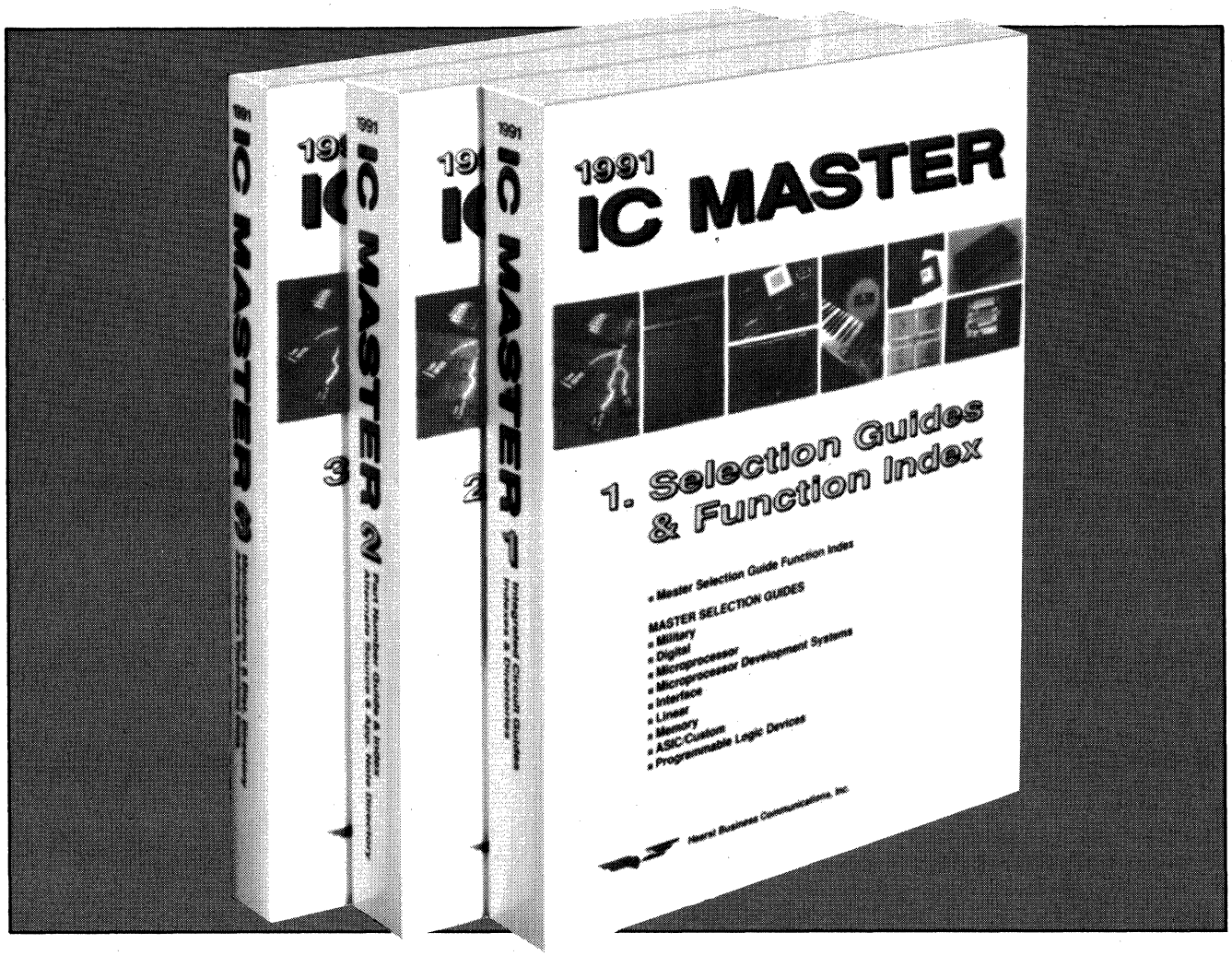
Microwave types
- Operating temp: −55° to 85°C
- Cap ranges: 0.5-2.0 pF; 1-4.0 pF; 2.0-10 pF
- Q > 500 at 100 MHz

Plastic encased 4 × 4.5 mm and 5 mm types
- Designed for volume applications
- SMT and printed-thru-hole models
- Cap ranges: 1.7-3.0 pF to 10-50 pF

For more information, ask for Bulletin SG-305C.

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WET SLUG, METAL CASE TANTALUMS



Tansitor is Listed as a Qualified Source For the Styles Below:

MIL-C-3965 CL64-67 Type W silver case.
MIL-C-39006/9 CLR65 Type W silver case.
MIL-C-39006/22, TYPE AQ: MIL-C-39006/25, TYPE AR-both double seal-elastomer & glass to tantalum hermetic. TYPE AT also qualified to /22 & /25 compression seal and very low ESR.
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CUSTOM CAPACITORS ARE OUR SPECIALITY: e.g. 22μF to 22000 μF: 6-125 Vdc
High Operating Temperature:1000 Hours @ 200C

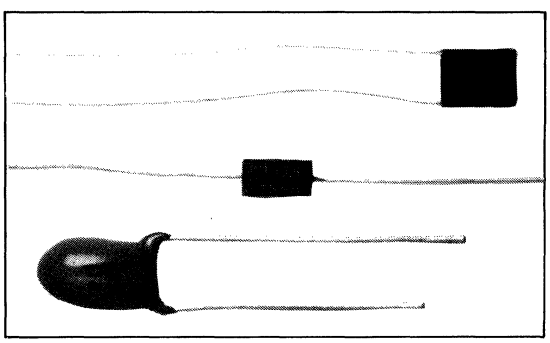
1.7 μF to 2200μF
6 to 125 Vdc
-55 C to + 85C,
Derated to 125C

POLARIZED & NON POLARIZED TANTALUM FOILS

Equivalent Military Specifications Include
MIL-C-3965: CL 30-33 & CL 51-54

0.15μF to 3500 μF
15 to 450 Vdc

SOLID TANTALUM SUBMINIATURES



CORDWOOD & MODULAR POLAR & NON POLAR

Qualified to MIL-C-49137
Styles CX 06 & CX 16

0.001μF to 470μF
2 to 50 Vdc

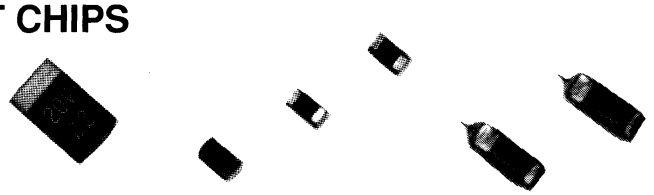
DIPPED

There are four axial lead styles

0.1μF to 680μF
3 to 50 Vdc

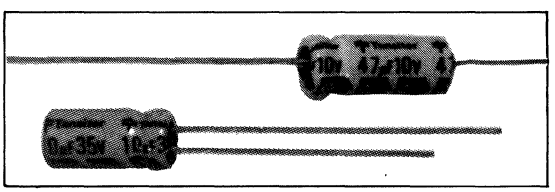
SURFACE MOUNT CHIPS

0.1μF to 100μF
4 to 35 Vdc



1μF to 330μF
4 to 50 Vdc

ALUMINUM ELECTROLYTICS



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Standard, Sub & Micro-Miniature
Operating Temperature to 105C

0.1μF to 47000μF
6.3 to 450 Vdc

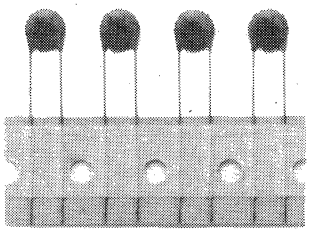
Low Leakage and low ESR

Tansitor
ELECTRONICS, INC.

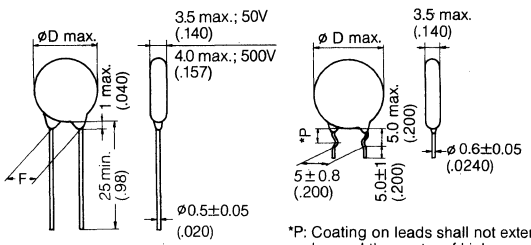
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CERAMIC CAPACITORS

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DIMENSIONS FOR CLASS I AND II



*P: Coating on leads shall not extend beyond the center of kink.

Dimensions in mm (inches)

CERAMIC DISC CAPACITORS-CLASS I, 50V

Dimensions mm (inches)		Rated capacitance (pF)			
D	Long lead F	TC*: CH (0±60)	RH (−220±60)	UJ (−750±120)	SL ($^{+350}_{-1000}$)
4 (.15)		1 to 39	1 to 39	2 to 68	1 to 120
5 (.20)	2.5±1 (.100)	47 to 68	47 to 68	82 to 120	150 to 220
6 (.24)		82	82	150	270
6 (.24)		100	100, 120	180	330
7 (.28)		120, 150	150	220, 270	390, 470
8 (.38)	5±1 (.200)	180, 220	180, 220	330, 390	560, 680
9 (.35)		270	270	470	820
10 (.39)		—	330	560	1000

*ppm/°C

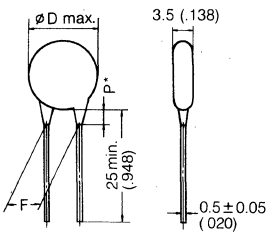
CERAMIC DISC CAPACITORS-CLASS II, 50V

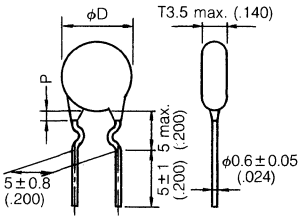
Dimensions mm (inches)		Rated capacitance (pF)		
D	Long lead F	TC : B (±10%)	D ($^{+20}_{-30}$ %)	F ($^{+30}_{-80}$ %)
4 (.15)		100 to 1200	1000, 1500	1000, 2200, 4700
5 (.20)	2.5±1 (.100)	1500, 1800, 2200	2200, 3300	10000
6 (.24)		2700	4700	—
6 (.24)		3300	—	—
7 (.28)		3900, 4700	6800	22000
8 (.38)	5±1 (.200)	5600, 5800	10000	—
9 (.35)		8200	15000	—
10 (.39)		10000	—	47000

CERAMIC DISC CAPACITORS-CLASS II, 500V

Dimensions mm (inches)		Rated capacitance (pF)	
D	Long lead F	TC : B (±10%)	E ($^{+20}_{-55}$ %)
7 (.28)		100 to 1000	1000
8 (.38)		1200, 1500	—
9 (.35)	5±1 (.200)	1800, 2200	2200
10 (.39)		2700	—
11 (.43)		3300, 3900	4700

CERAMIC SEMI-CONDUCTIVE CAPACITOR-CLASS III, 16V, 25V, 50V



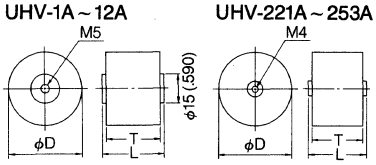


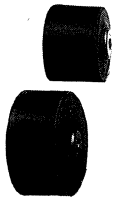
*P: SS45 1.5 max., SC45 2 max.
Dimensions in mm (inches)

Dimensions mm (inches)			Rated capacitance (pF)	Type
	D	F		
16Vdc TC: X (±15%)	4.5 (.18)	2.5 (.09)	22000	SS45
	5 (.20)	2.5 (.09)	33000	
	6 (.24)	5 (.20)	47000	
	6.5 (.26)	5 (.20)	68000	
	7.5 (.30)	5 (.20)	100000	
	9.5 (.37)	5 (.20)	150000	
	11 (.43)	5 (.20)	220000	
25Vdc TC: X (±15%)	4.5 (.18)	2.5 (.09)	1000 to 10000	
	5 (.20)	2.5 (.09)	15000	
	6 (.24)	5 (.20)	22000	
	6.5 (.26)	5 (.20)	33000	
	7.5 (.30)	5 (.20)	47000	
	9.5 (.37)	5 (.20)	68000	
	11 (.43)	5 (.20)	100000	
25Vdc TC: F ($^{+30}_{-80}$ %)	4 (.16)	2.5 (.09)	10000, 22000	
	6 (.24)	5 (.20)	47000	
	8 (.31)	5 (.20)	100000	
50Vdc TC: F ($^{+30}_{-80}$ %)	4.5 (.18)	2.5 (.09)	10000	SC45
	5 (.20)	2.5 (.09)	22000	
	7 (.28)	5 (.20)	47000	
	10 (.39)	5 (.20)	100000	

ULTRA HIGH-VOLTAGE CAPACITORS

UHV-1A ~ 12A UHV-221A ~ 253A





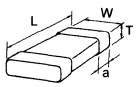
Rated voltage (kVdc)	Part No.	Rated capacitance (pF)	Capacitance tolerance (%)	Dimensions in mm (inches) D	T	L
20	UHV-1A	1400	±10	38 (1.50)	19 (.75)	23 (.91)
	UHV-2A	2500		48 (1.89)		
	UHV-3A	4000		60 (2.36)		
30	UHV-4A	940		38 (1.50)	22 (.87)	26 (1.024)
	UHV-5A	1700		48 (1.89)		
	UHV-6A	2700		60 (2.36)		
40	UHV-7A	700		38 (1.50)	28 (1.10)	32 (1.26)
	UHV-8A	1300		48 (1.89)		
	UHV-9A	2000		60 (2.36)		
50	UHV-10A	560		38 (1.50)	31 (1.22)	35 (1.38)
	UHV-11A	1000		48 (1.89)		
	UHV-12A	1700		60 (2.36)		
20	UHV-221A	200		20 (.79)	19 (.75)	23 (.91)
	UHV-222A	400		25 (.98)		
	UHV-223A	700		30 (1.18)		
	UHV-224A	1000		34 (1.34)		
30	UHV-231A	200		25 (.98)	22 (.87)	26 (1.02)
	UHV-232A	400		30 (1.18)		
	UHV-233A	700		34 (1.34)		
40	UHV-241A	100		20 (.79)	28 (1.10)	32 (1.26)
	UHV-242A	200		25 (.98)		
	UHV-243A	400		34 (1.34)		
50	UHV-251A	100		20 (.79)	31 (1.22)	35 (1.38)
	UHV-252A	200		30 (1.18)		
	UHV-253A	400		34 (1.34)		

MULTILAYER CERAMIC CAPACITORS

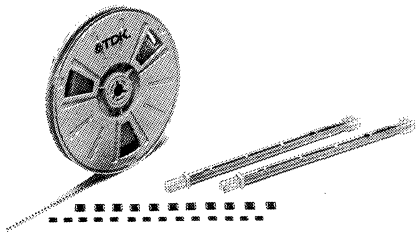
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MULTILAYER CERAMIC CHIP CAPACITORS

Shapes and dimensions — Dimensions in mm (inches)



Type (EIA)	L	W	T max.
C1005 (CC0402)	1.0±0.05 (.039)	0.5±0.05 (.020)	0.5 (.020)
C1608 (CC0603)	1.6±0.1 (.063)	0.8±0.1 (.031)	0.9 (.035)
C2012 (CC0805)	2.0 $^{+0.3}_{-0.1}$ (.079)	1.25±0.2 (.050)	1.45 (.057)
C3216 (CC1206)	3.2±0.2 (.126)	1.6±0.15 (.063)	1.3 (.05)
C3225 (CC1210)	3.2±0.4 (.126)	2.5±0.3 (.098)	1.9 (.075)
C4532 (CC1812)	4.5±0.5 (.177)	3.2±0.4 (.126)	1.9 (.075)
C5650 (CC2220)	5.6±0.5 (.220)	5.0±0.5 (.197)	1.9 (.075)



Temperature compensation, 50V, 25V

Type	Rated voltage (V)	Temperature characteristics	Rated capacitance (pF) T=0.5±0.05 (mm)	T=0.6±0.15 (mm)	T=0.8±0.1 (mm)	T=0.85±0.15 (mm)	T=1.1±0.2 (mm)	T=1.25±0.2 (mm)
C1005 (EIA; CC0402)	25	C0G	0.5 to 120					
		SL	0.5 to 330					
C1608 (EIA; CC0603)	50	C0G			0.5 to 330			
		PH			0.5 to 180			
		RH			0.5 to 220			
		SH			0.5 to 270			
		TH			0.5 to 330			
		UJ			0.5 to 470			
		SL			0.5 to 1000			
C2012 (EIA; CC0805)	50	C0G		0.5 to 390		430 to 680		750 to 1100
		PH		0.5 to 300		330 to 470		510 to 820
		RH·SH		0.5 to 390		430 to 560		620 to 1000
		TH		0.5 to 510		560 to 680		750 to 1000
		UJ		0.5 to 560		620 to 1000		1100 to 1300
		SL		0.5 to 1200		1300 to 1800		2000 to 2700
C3216 (EIA; CC1206)	50	C0G		0.5 to 1000		1100 to 1800	2000, 2200	
		PH		0.5 to 560		620 to 1000	1100 to 1500	
		RH		0.5 to 820		910 to 1500	1600 to 2200	
		SH·TH		0.5 to 1000		1100 to 1800	2000 to 2700	
		UJ		0.5 to 1200		1300 to 2200	2400 to 3300	
		SL		0.5 to 2700		3000 to 4700	5100 to 6800	
C3225 (EIA; CC1210)	50	C0G				2400 to 3000	3300 to 3900	
		SL				7500 to 9100	10000 to 12000	
C4532 (EIA; CC1812)	50	C0G				4300 to 5600	6200 to 8200	
		SL				13000 to 20000	22000 to 30000	
C5650 (EIA; CC2220)	50	C0G				9100, 10000	11000 to 15000	
		SL					33000 to 39000	

High dielectric constant, 50V, 25V, 16V

Type	Rated voltage (V)	Temperature characteristics	Rated capacitance (pF) T=0.5±0.05 (mm)	T=0.6±0.15 (mm)	T=0.8±0.1 (mm)	T=0.85±0.15 (mm)	T=1.1±0.2 (mm)	T=1.25±0.2 (mm)
C1005 (EIA; CC0402)	25	X7R	220 to 4700					
	16		5600 to 10000					
	25	Y5V	1000 to 15000					
	16		22000, 33000					
C1608 (EIA; CC0603)	50	X7R			220 to 15000			
	25				8200 to 15000			
	16				12000 to 47000			
		X7S			22000 to 68000			
	50	Y5V			1000 to 33000			
	25				33000			
	16				47000 to 150000			
C2012 (EIA; CC0805)	50	X7R		470 to 22000		27000 to 39000		47000 to 56000
	25			12000 to 22000		27000 to 39000		47000 to 56000
	16			27000 to 68000		82000 to 120000		150000 to 220000
		X7S		27000 to 120000		150000 to 220000		270000 to 330000
	50	Y5V		4700 to 47000		68000, 100000		
	25			22000 to 47000		68000, 100000		
	16			68000 to 220000		330000, 470000		680000, 1000000
C3216 (EIA; CC1206)	50	X7R		470 to 56000		68000 to 100000	120000, 150000	
	25			12000 to 56000		68000 to 100000	120000, 150000	
	16			68000 to 150000		180000 to 270000	330000 to 470000	
		X7S		68000 to 270000		330000 to 470000	560000, 680000	
	50	Y5V		4700 to 100000		150000	220000	
	25			47000 to 100000		150000	220000, 330000	
	16			220000 to 470000		680000, 1000000	1500000, 2200000	
C3225 (EIA; CC1210)	50	X7R					180000, 220000	
		Y5V				330000	470000	
C4532 (EIA; CC1812)	50	X7R				270000, 330000	390000	
		Y5V				680000	1000000	
C5650 (EIA; CC2220)	50	X7R				470000	560000, 680000	
		Y5V					1500000	

High dielectric constant, base metal electroded, 50V, 25V

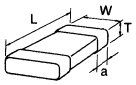
Type	Rated voltage (V)	Temperature characteristics	Rated capacitance (pF) T=0.6±0.15 (mm)	T=0.8±0.1 (mm)	T=0.85±0.15 (mm)	T=1.1±0.2 (mm)
C1608 (EIA; CC0603)	50	Y5V		1000 to 22000		
	25			33000		
C2012 (EIA; CC0805)	50	Y5V	4700 to 33000		47000	
	25		22000 to 47000		68000, 100000	
C3216 (EIA; CC1206)	50	Y5V	4700 to 68000		100000	150000
	25		22000 to 100000		150000	220000

MULTILAYER CERAMIC CAPACITORS

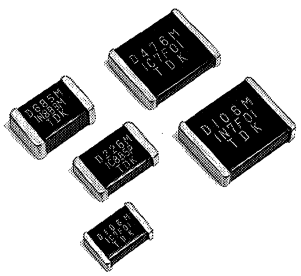
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LARGE-CAPACITANCE MULTILAYER CERAMIC CHIP CAPACITORS

Shapes and dimensions — Dimensions in mm (inches)



Type	L	W	T max.	a
HC8050	8.0±1.5 (.315)	5.0±0.8 (.197)	6.0 (.236)	1.5±0.8 (.059)
HC1063	10.0±1.5 (.394)	6.3±0.8 (.248)	6.0 (.236)	1.5±0.8 (.059)
HC1280	12.5±1.5 (.492)	8.0±0.8 (.315)	6.0 (.236)	1.5±0.8 (.059)
HC1612	16.0±1.5 (.630)	12.5±0.8 (.492)	6.0 (.236)	1.5±0.8 (.059)

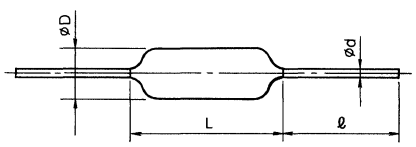


Capacitance ranges (μF)

Type	16V	25V	50V	75V
HC8050	6.8	3.3	3.3	1.5
HC1063	10	4.7, 6.8	4.7	2.2
HC1280	15, 22	10	6.8, 10	3.3, 4.7, 6.8
HC1612	33, 47	15, 22	15, 22	10

TC: +20, −30% (−25~+85°C)

DIPPED AXIAL LEADS-DA12, DA13



DA12



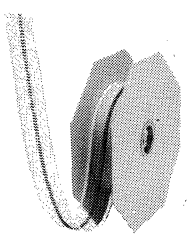
DA13

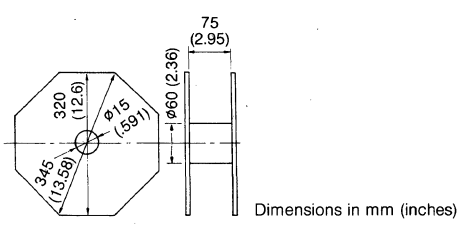


Type	Dimensions, mm (inches)			
	Lmax.	Dmax.	φd	ℓ min
DA12	4.3 (.17)	2.54 (.10)	$0.5^{+0.1}_{-0.03}$ (.02)	25 (.98)
DA13	6.6 (.26)	2.54 (.10)	$0.5^{+0.1}_{-0.03}$ (.02)	25 (.98)

Type	TC	Capacitance (pF)			
		C0G	SL	X7R	Y5V
	WV	50V (1H)	50V (1H)	50V (1H)	50V (1H)
DA12		0.5 to 1,100	0.5 to 2,700	1,000 to 39,000	4,700, 6,800, 10,000, 15,000, 22,000, 33,000, 47,000, 68,000, 100,000
DA13		1,200 to 1,500	3,000 to 4,700	47,000 to 100,000	150,000, 220,000
Capacitance tolerance		Up to 10pF ±0.5pF(D), ±0.25pF(C)	Over 10pF ±10%(K), ±5%(J)	±10%(K) ±20%(M)	+80% −20% (Z)

Reel





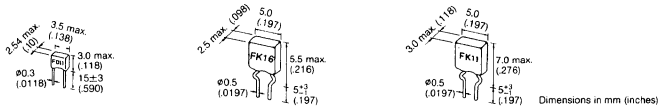
Dimensions in mm (inches)

MULTILAYER CERAMIC CAPACITORS

TDK CORPORATION OF AMERICA 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: 708-803-6100 **INDIANAPOLIS** Phone: 317-872-0370 **NEW YORK** Phone: 516-625-0151 **LOS ANGELES** Phone: 213-539-6631 **DETROIT** Phone: 313-462-1210 **NEW JERSEY** Phone: 201-736-0023 **BOSTON** Phone 508-624-4262 **HUNTSVILLE** Phone: 205-464-0222 **GREENSBORO** Phone: 919-292-0012 **DALLAS** Phone: 214-506-9800 **SAN FRANCISCO** Phone: 408-437-9585
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DIPPED RADIAL LEADS-FD11, FK11, FK16, FK20, FK22, FK26, FD23

Lead space 2.5 mm (.098 inches)

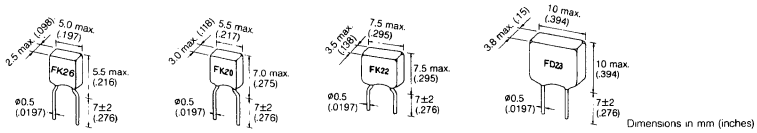


FD11 FK16 FK11

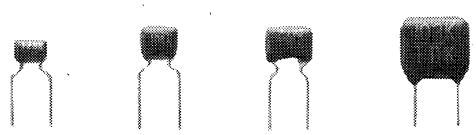


Type	TC	Capacitance (pF) C0G	SL	X7R·Y5R		Y5V	
	WV	50V (1H)	50V (1H)	50V (1H)	25V (1E)	50V (1H)	25V (1E)
FD11		0.5 to 560	0.5 to 1,800	1,000 to 22,000	27,000 to 39,000	10,000, 15,000, 22,000 33,000, 47,000	68,000 to 100,000
FK16		0.5 to 680	0.5 to 2,700	1,000 to 47,000	56,000 to 100,000	10,000, 15,000, 22,000 33,000, 47,000, 68,000 100,000	150,000, 220,000
FK11		750 to 3,300	3,000 to 8,200	56,000 to 150,000	180,000	150,000, 220,000, 330,000	
Capacitance tolerance		0.5 to 50pF ±0.5pF(D), ±25pF (C) 6 to 10pF ±0.5pF(D), ±1.0pF (F)	Over 10pF ±10%(K), ±5%(J)	±10%(K), ±20%(M)		+80 −20 %(Z)	

Lead space 5.0 mm (.197 inches)



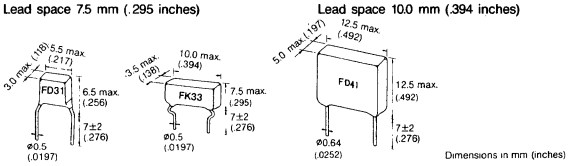
FK26 FK20 FK22 FD23



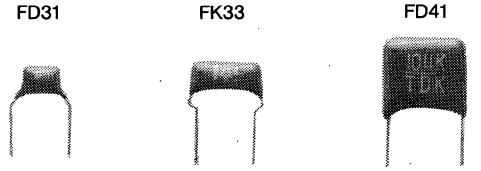
Type	TC	Capacitance (pF) C0G	SL	X7R·Y5R		Y5V	
	WV	50V (1H)	50V (1H)	50V (1H)	25V (1E)	50V (1H)	25V (1E)
FK26		0.5 to 680	0.5 to 2,700	1,000 to 47,000	56,000 to 100,000	10,000, 15,000, 22,000 33,000, 47,000, 68,000 100,000	150,000 to 220,000
FK20		750 to 3,300	3,000 to 8,200	56,000 to 150,000	180,000	150,000, 220,000, 330,000, 470,000	
FK22		3,600 to 5,600	9,100 to 18,000	180,000 to 270,000	330,000	470,000, 680,000 1,000,000 (1μF)	1,500,000 (1.5μF)
FD23		6,200 to 27,000	20,000 to 86,000	330,000 to 820,000		1,500,000 to 4,700,000	
Capacitance tolerance		0.5 to 50pF ±0.5pF(D), ±25pF(C) 6 to 10pF ±0.5pF(D), ±1.0pF(F)	Over 10pF ±10%(K), ±5%(J)	±10%(K), ±20%(M)		+80 −20 %(Z)	

DIPPED RADIAL LEADS-FD31, FK33, FD41

Lead space 7.5 mm (.295 inches) Lead space 10.0 mm (.394 inches)

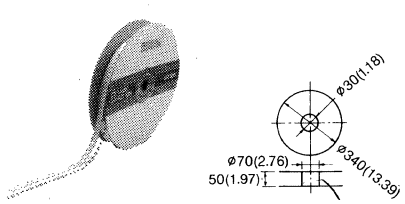


FD31 FK33 FD41

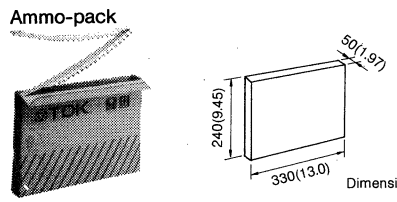


Type	TC	Capacitance (pF) C0G	SL	X7R·Y5R		Y5V	
	WV	50V(1H)	50V(1H)	50V(1H)	25V(1E)	50V(1H)	25V(1E)
FD31		750 to 3,300	3,000 to 8,200	56,000 to 150,000	180,000	100,000, 150,000 220,000, 330,000 470,000	
FK33		3,600 to 5,600	9,100 to 22,000	180,000 to 330,000	390,000	470,000, 680,000 1,000,000 (1μF)	1,500,000 (1.5μF)
FD41		30,000 to 33,000	75,000 to 100,000	1,000,000 to 1,200,000		6,800,000 (6.8μF)	
Capacitance tolerance		±10%(K) ±5%(J)		±20%(M) ±10%(K)		+80 −20 %(Z)	

Reel



Ammo-pack

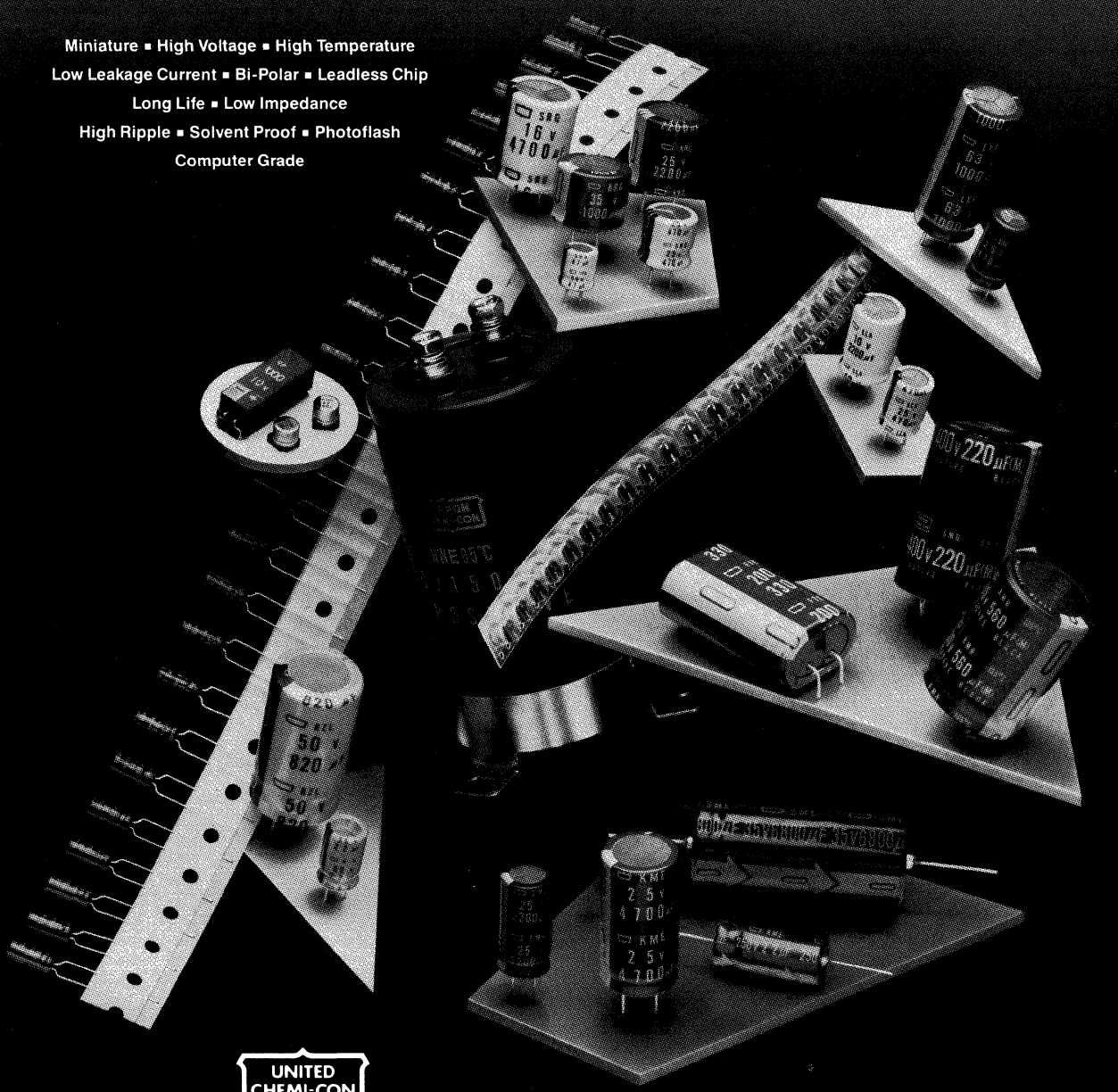


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Since 1931, the Recognized Leader in the Design and Manufacture of Aluminum Electrolytic Capacitors

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Miniature ▪ High Voltage ▪ High Temperature
Low Leakage Current ▪ Bi-Polar ▪ Leadless Chip
Long Life ▪ Low Impedance
High Ripple ▪ Solvent Proof ▪ Photoflash
Computer Grade



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United Chemi-Con, Inc. 9801 West Higgins Road Rosemont, Illinois 60018 Telephone 708-696-2000 FAX 708-640-6341

UNITED CHEMI-CON Product Selection Guide for Aluminum Electrolytic Capacitors

Series			Features	Load Life (R indicates with Ripple Current) °C	Hours	New/Extended	Miniaturization	Solvent-proof	Terminal Type	Rated Voltage Range (VDC)	Nominal Capacitance Range (μF)
Surface Mount		MF	Low profile, for reflow	85	2,000	●	●	●	SMD	4–50	0.1–150
		MFK	Low profile, for reflow	105	1,000–2,000	●	●	●	SMD	6.3–50	0.1–33 (1,000)
		MV	For reflow	85	1,000–2,000	●	●	●	SMD	4–50	0.1–220
		MVK	For reflow	105	1,000–2,000	●	●	●	SMD	6.3–50	0.1–470
Miniature	Low Profile	SREC	5 mm height	85	1,000		●	●	Radial	4–50	0.1–100
		KRE	5 mm height	105	1,000		●	●	Radial	4–50	0.1–100
		SRAC	7 mm height	85	1,000		●	●	Radial	4–63	0.1–470
		KMA	7 mm height	105	1,000		●	●	Radial	4–63	0.1–220
		SRC	9–20 mm height	85	1,000		●	●	Radial	6.3–50	0.1–3,300
		SRG	7–25 mm height	85	1,000–2,000		●	●	Radial	4–50	0.1–10,000
		KRG	7–25 mm height	105	1,000		●	●	Radial	6.3–50	0.1–10,000
		LLA	Low leakage current	85	1,000		●	●	Radial	6.3–50	0.1–15,000
	General Purpose	KMC	General purpose	105	1,000–2,000			●	Radial	6.3–250	0.47–10,000
		SME	General, miniaturized	85	2,000			☆	Radial/Axial	6.3–400	0.1–2,200
		KME	General, miniaturized	105	1,000 R			☆	Radial/Axial	6.3–400	0.1–2,200
		SMG	General, miniaturized	85	2,000	●	●	☆	Radial	6.3–450	0.1–2,200
		KMG	General, miniaturized	105	1,000 R	●	●	☆	Radial	6.3–450	0.1–2,200
	Bi-Polar	SME-BP	General, bi-polar	85	2,000		●	●	Radial	6.3–100	0.47–6,800
		KME-BP	High temperature, bi-polar	105	1,000		●	●	Radial	6.3–100	0.47–6,800
		SM-NP	General, bi-polar	85	1,000				Axial	6.3–50	4.7–2,200
		KSA-BP	For horizontal deflection	105	1,000 R				Radial	50	2.2–15
	Low Impedance High Reliability	SXE	General	105	1,000–2,000			●	Radial	6.3–100	1.5–15,000
		KMF	General	105	2,000–5,000 R	●	●	●	Radial	6.3–100	0.47–15,000
		LXF	General, long life	105	2,000–15,000 R	●	●	●	Radial	10–63	3.3–8,200
		SXG	Lowest impedance	105	1,000–2,000 R	●	●	●	Radial	10–63	3.3–8,200
	High Reliability	LX	General, long life	105	5,000			●	Radial	100–250	0.47–68
		LXA	General, long life	105	5,000–7,000			●	Radial	10–63	0.47–4,700
		GX	130°C	130	1,000				Radial/Axial	10–63	0.47–1,000
		GXC	130°C	130	1,000	●		●	Radial	10–63	0.47–1,000
Large Sized	Large Capacitance Lead Type	SMG	General, 20–40 mm height	85	2,000	●	●	☆	Radial	6.3–450	22–39,000
		KRF	20–50 mm height	105	1,000		●	●	Radial	10–250	68–39,000
		RZ	Low impedance	105	2,000			●	Radial	7.5–250	15–16,500
		RZA	Low impedance	105	5,000			●	Radial	6.3–250	56–33,000
	General Purpose	SMG	General purpose	85	2,000 R				Lug	160–450	68–1,800
		KMG	General purpose	105	2,000 R				Lug	160–450	68–1,800
		SMH	General, miniaturized	85	2,000 R		●		Lug	6.3–450	56–100,000
		KMH	General, miniaturized	105	2,000 R		●		Lug	6.3–450	68–82,000
	High Reliability	VD	For VDE specifications	105	2,000 R	●	●		Lug	250	82–2,200
		LXG	Long life	105	5,000 R	●	●		Lug	10–400	56–47,000
		TXG	Long life	105	10,000 R	●	●		Lug	10–250	150–47,000
		GX-VH	130°C	130	1,000				Radial	10–250	56–18,000
		RZL	Long life, low impedance	105	30,000 R	●		●	Radial	10–250	33–15,000
	Special Appl.	EL	For electronic ballast	105	5,000 R	●			Radial/Lug	160–350	22–330
		FTK	Flat shape	105	2,000				Radial	200, 400	33–560
		PH	For photoflash	55	—				Radial/Lug	330	60–1,200
Screw Type		RWE	For inverter	85	2,000 R		●		Screw	350–550	100–12,000
		RWF	For inverter, high ripple	85	5,000 R	●	●		Screw	350–450	2,700–15,000
		KME	General purpose	105	2,000 R				Screw	10–400	220–680,000
		LX	Long life	105	5,000 R	●	●		Screw	10–450	220–330,000

☆ Some models in the series are not solvent-proof.

UNITED CHEMI-CON UNITED CHEMI-CON 9801 West Higgins Road, Rosemont, Illinois 60018 TEL 708-696-2000 FAX 708-640-6341

WESCO METALLIZED POLYESTER CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage of 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 30,000 megohms-microfarads, but need not exceed 30,000 megohms.

DISSIPATION FACTOR

Shall not exceed 1.0% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathemtaical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

32MM RATINGS AND DIMENSIONS

Capacity in µF	35 VDC D	35 VDC L	50 VDC D	50 VDC L	100 VDC D	100 VDC L	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.0068	—	—	—	—	—	—	—	—	.218	.53	.312	.53
.0082	—	—	—	—	—	—	—	—	.234	.53	.171	.65
.01	—	—	—	—	—	—	—	—	.265	.53	.250	.65
.012	—	—	—	—	—	—	—	—	.203	.65	.265	.65
.015	—	—	—	—	—	—	—	—	.218	.65	.296	.65
.018	—	—	—	—	—	—	.203	.40	.234	.65	.328	.65
.022	—	—	—	—	—	—	.218	.40	.250	.65	.375	.65
.027	—	—	—	—	.171	.40	.234	.40	.265	.65	.390	.65
.033	—	—	—	—	.187	.40	.265	.40	.296	.65	.437	.65
.039	—	—	—	—	.187	.40	.203	.53	.234	.90	.328	.90
.047	—	—	—	—	.203	.40	.218	.53	.265	.90	.375	.90
.056	—	—	—	—	.218	.40	.234	.53	.265	.90	.390	.90
.068	—	—	—	—	.250	.40	.250	.53	.296	.90	.437	.90
.082	—	—	—	—	.187	.53	.265	.53	.328	.90	.468	.90
.1	—	—	—	—	.203	.53	.281	.53	.343	.90	.515	.90
.12	—	—	—	—	.218	.53	.312	.53	.328	1.18	.453	1.18
.15	—	—	—	—	.234	.53	.343	.53	.343	1.18	.515	1.18
.18	—	—	.187	.40	.250	.53	.296	.65	.375	1.18	.562	1.18
.22	—	—	.203	.40	.234	.65	.328	.65	.406	1.18	.625	1.18
.27	.171	.40	.218	.40	.250	.65	.359	.65	.453	1.18	.687	1.18
.33	.187	.40	.234	.40	.265	.65	.406	.65	.437	1.45	.656	1.45
.39	.203	.40	.250	.40	.281	.65	.437	.65	.468	1.45	.703	1.45
.47	.218	.40	.187	.53	.312	.65	.468	.65	.515	1.45	.781	1.45
.56	.250	.40	.203	.53	.343	.65	.406	.90	.546	1.45	.843	1.45
.68	.171	.53	.218	.53	.375	.65	.437	.90	.609	1.45	.921	1.45
.82	.187	.53	.250	.53	.359	.78	.406	1.18	.593	1.70	.906	1.70
1.00	.203	.53	.218	.65	.390	.78	.437	1.18	.656	1.70	1.000	1.70
1.25	.234	.53	.234	.65	.421	.78	.500	1.18	.734	1.70	1.171	1.70
1.50	.250	.53	.265	.65	.421	.90	.531	1.18	.796	1.70	1.265	1.70
1.80	.218	.65	.281	.65	.453	.90	.593	1.18	.875	1.70	1.375	1.70
2.00	.234	.65	.312	.65	.484	.90	.625	1.18	.921	1.70	1.406	1.70
3.00	.281	.65	.312	.78	.484	1.18	.656	1.45	—	—	—	—
4.00	.343	.65	.375	.78	.562	1.18	.750	1.45	—	—	—	—
5.00	.375	.65	.421	.78	.625	1.18	.765	1.70	—	—	—	—
8.00	.390	.78	.453	.90	.703	1.45	.828	2.06	—	—	—	—
10.00	.390	.90	.453	1.03	.781	1.45	.921	2.06	—	—	—	—
15.00	.468	.90	.546	1.03	—	—	—	—	—	—	—	—
20.00	.546	.90	.593	1.18	—	—	—	—	—	—	—	—
25.00	.500	1.18	.656	1.18	—	—	—	—	—	—	—	—
30.00	.562	1.18	.718	1.18	—	—	—	—	—	—	—	—

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD... ±10% OTHER... from ±20% to ±2%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity, Tolerance, VDC Rating and Date Code. (Note: On smaller units, Ⓣ trademark will be substituted for WESCO logo.)

METALLIZED POLYCARBONATE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 50,000 megohms-microfarads, but need not exceed 50,000 megohms.

DISSIPATION FACTOR

Shall not exceed 0.3% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathemtaical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD-202C, Method 103B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TYPE 32MPC RATINGS AND DIMENSIONS



Capacity in µF	35VDC D	35VDC L	Cat. No. 32MPC —K-03.5	50VDC D	50VDC L	Cat. No. 32MPC —K-05	100VDC D	100VDC L	Cat. No. 32MPC —K-1
.033	—	—	—	—	—	—	.156	.40	3302
.039	—	—	—	—	—	—	.171	.40	3902
.047	—	—	—	—	—	—	.187	.40	4702
.056	—	—	—	—	—	—	.203	.40	5602
.068	—	—	—	—	—	—	.218	.40	6802
.082	—	—	—	.156	.40	8202	.171	.53	8202
.1	—	—	—	.156	.40	1003	.187	.53	1003
.12	—	—	—	.171	.40	1203	.203	.53	1203
.15	—	—	—	.181	.40	1503	.218	.53	1503
.18	.156	.40	1803	.203	.40	1803	.234	.53	1803
.22	.171	.40	2203	.156	.53	2203	.250	.53	2203
.27	.187	.40	2703	.171	.53	2703	.234	.65	2703
.33	.203	.40	3303	.188	.53	3303	.250	.65	3303
.39	.218	.40	3903	.203	.53	3903	.265	.65	3903
.47	.234	.40	4703	.218	.53	4703	.296	.65	4703
.56	.171	.53	5603	.234	.53	5603	.312	.65	5603
.68	.187	.53	6803	.203	.65	6803	.296	.78	6803
.82	.203	.53	8203	.218	.65	8203	.328	.78	8203
1.0	.218	.53	1004	.250	.65	1004	.359	.78	1004
1.25	.250	.53	1254	.281	.65	1254	.390	.78	1254
1.50	.218	.65	1504	.296	.65	1504	.421	.78	1504
1.80	.234	.65	1804	.281	.78	1804	.421	.90	1804
2.0	.250	.65	2004	.296	.78	2004	.437	.90	2004
3.0	.296	.65	3004	.359	.78	3004	.453	1.18	3004
4.0	.296	.78	4004	.406	.78	4004	.515	1.18	4004
5.0	.328	.78	5004	.406	.90	5004	.515	1.45	5004
8.0	.406	.78	8004	.422	1.18	8004	.562	1.78	8004
10.0	.453	.78	1005	.484	1.18	1005	.625	1.78	1005
15.0	.421	1.18	1505	.578	1.18	1505	.718	2.06	1505
20.0	.476	1.18	2005	.578	1.45	2005	.828	2.06	2005
25.0	.546	1.18	2505	.656	1.45	2505	—	—	—
30.0	.593	1.18	3005	—	—	—	—	—	—

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD... ±10%/OTHER... from ±20% to ±1%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity, Tolerance, VDC Rating and Date Code. (Note: On smaller units, Ⓣ trademark will be substituted for WESCO logo.)

J K ELECTRONICS, INC d/b/a
WESCO ELECTRICAL COMPANY
201 MUNSON ST. • GREENFIELD • MASSACHUSETTS • 01301
TELEPHONE: 413-774-4358 FAX: 413-774-4562

WESCO METALLIZED POLYPROPLENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 100,000 megohms-microfarads, but need not exceed 100,000 megohms.

DISSIPATION FACTOR
Shall not exceed 0.1% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT
Capacitance shall change linearly over operating temperature range of −55°C to +85°C at rate of −290, ±75 parts per million/°C.

CAPACITANCE STABILITY (DRIFT)
Less than .2% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 105°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE
−55°C to +85°C with full rated voltage applied.

DIELECTRIC ABSORPTION
Shall not exceed .05% when tested in accordance with Mil-C-19978.



Capacity in µF	100 VDC D	L	Cat. No. 32MPL —K-1	200 VDC D	L	Cat. No. 32MPL —K-2	400 VDC D	L	Cat. No. 32MPL —K-4
.01	.171	.406	1002	.171	.406	1002	1.87	.531	1002
.012	.171	.406	1202	.171	.406	1202	.203	.531	1202
.015	.171	.406	1502	.187	.406	1502	.234	.531	1502
.018	.171	.406	1802	.203	.406	1802	.250	.531	1802
.022	.171	.406	2202	.171	.531	2202	.265	.531	2202
.027	.171	.406	2702	.171	.531	2702	.296	.531	2702
.033	.187	.406	3302	.187	.531	3302	.312	.531	3302
.039	.203	.406	3902	.203	.531	3902	.343	.531	3902
.047	.218	.406	4702	.218	.531	4702	.281	.656	4702
.056	.234	.406	5602	.234	.531	5602	.312	.656	5602
.068	.187	.531	6802	.250	.531	6802	.343	.656	6802
.082	.187	.531	8202	.275	.531	8202	.375	.656	8202
.1	.218	.531	1003	.250	.656	1003	.343	.781	1003
.12	.234	.531	1203	.265	.656	1203	.375	.781	1203
.15	.250	.531	1503	.296	.656	1503	.421	.781	1503
.18	.275	.531	1803	.328	.656	1803	.453	.781	1803
.22	.312	.531	2203	.359	.656	2203	.437	.906	2203
.27	.328	.531	2703	.359	.781	2703	.484	.906	2703
.33	.281	.656	3303	.359	.781	3303	.546	.906	3303
.39	.312	.656	3903	.406	.781	3903	.578	.906	3903
.47	.343	.656	4703	.390	.906	4703	.531	1.187	4703
.56	.375	.656	5603	.437	.906	5603	.578	1.187	5603
.68	.375	.781	6803	.484	.906	6803	.625	1.187	6803
.82	.390	.781	8203	.515	.906	8203	.687	1.187	8203
1.0	.421	.781	1004	.484	1.187	1004	.671	1.437	1004
1.25	.421	.906	1254	.531	1.187	1254	.750	1.437	1254
1.50	.453	.906	1504	.578	1.187	1504	.812	1.437	1504
1.80	.500	.906	1804	.640	1.187	1804	.796	1.687	1804
2.00	.515	.906	2004	.671	1.187	2004	.843	1.687	2004
3.00	.531	1.187	3004	.718	1.437	3004	1.03	1.687	3004
4.00	.609	1.187	4004	.828	1.437	4004	—	—	—
5.00	.671	1.187	5004	.828	1.687	5004	—	—	—
8.00	.750	1.437	8004	.937	2.062	8004	—	—	—
10.00	.843	1.437	1005	1.03	2.062	1005	—	—	—
12.00	.828	1.687	1205	—	—	—	—	—	—
15.00	.921	1.687	1505	—	—	—	—	—	—

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD...±10%/OTHER...from ±20% to ±1%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity, Tolerance, VDC Rating and Date Code. (Note: On smaller units, Ⓣ trademark will be substituted for WESCO logo.)

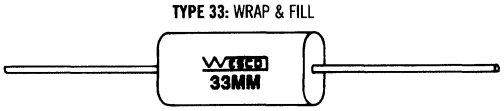
TYPICAL CASE STYLES

AXIAL LEADS

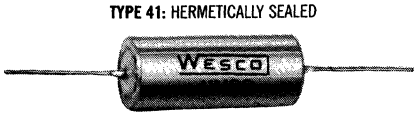
TYPE 32: WRAP & FILL



TYPE 33: WRAP & FILL



TYPE 41: HERMETICALLY SEALED

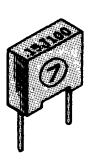


RADIAL LEADS

WRAP & FILL



"BOX"



OTHER AVAILABLE PRODUCTS

Data Sheet	Dielectric	Type
101	POLYESTER FILM-FOIL	32M - 33M
201	METALIZED POLYESTER	33MM
"BOX" CAPACITORS	METALIZED POLYESTER (Radial Leads)	60MM - 66MM 67MM - 68MM
402	METALIZED POLYCARBONATE (Hermetically Sealed)	41MPC
501	POLYSTYRENE FILM-FOIL	32P
601	POLYPROPYLENE FILM-FOIL	32PL
602	POLYPROPYLENE FILM-FOIL (Radial Leads)	F32PLRT
604	POLYPROPYLENE FILM-FOIL (AC Rated)	432PL

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MINIGLOSSARY BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\pi fC)\,(ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\,(Xc) = (DF)\,(\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\,(DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \left(\frac{T_t}{T_O}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{---} + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{---} + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	$\times 10^{-12}$
Nano	$\times 10^{-9}$
Micro	$\times 10^{-6}$
Milli	$\times 10^{-3}$
Deci	$\times 10^{-1}$
Deca	$\times 10$
Kilo	$\times 10^{3}$
Mega	$\times 10^{6}$
Giga	$\times 10^{9}$
Tera	$\times 10^{12}$

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

W O R L D P R O D U C T S

INTERFERENCE SUPPRESSORS

WX1 SERIES 0.01μF-2.2μF
X1 CLASS-300 VAC

Part Number	μF	L max mm	H max mm	W max mm	P ±0.4 mm	Dv/Dt V/μs
WX1-103K	0.01	18.0	10.5	5.5	15.0	1200
WX1-153K	0.015	18.0	10.5	5.5	15.0	1200
WX1-223K	0.022	18.0	10.5	5.5	15.0	1200
WX1-333K	0.033	18.0	10.5	5.5	15.0	1200
WX1-473K	0.047	18.0	12.5	6.5	15.0	1200
WX1-683K	0.068	18.0	13.5	7.5	15.0	1200
WX1-104K	0.1	18.0	14.5	8.5	15.0	600
WX1-154K	0.15	26.5	15.5	7.5	22.5	600
WX1-224K	0.22	26.5	16.5	8.5	22.5	600
WX1-334K	0.33	26.5	18.5	10.5	22.5	400
WX1-474K	0.47	31.5	20.5	11.5	27.5	400
WX1-684K	0.68	31.5	23.5	13.5	27.5	400
WX1-105K	1.0	31.5	24.5	15.0	27.5	400
WX1-155K	1.5	41.5	28.5	16.0	37.5	400
WX1-225K	2.2	41.5	33.0	18.0	37.5	400

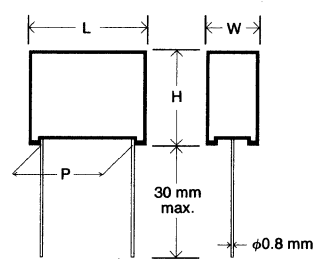
WXE AND WYE SERIES 0.001μF-2.2μF
X2 CLASS-275 VAC Y CLASS-250 VAC

Part Number	μF	L max mm	H max mm	W max mm	P ±0.4 mm	Dv/Dt V/μs
WYE-102M	0.001	13.0	10.5	4.5	10.0	2000
WYE-152M	0.0015	13.0	10.5	4.5	10.0	2000
WYE-222M	0.0022	13.0	10.5	5.5	10.0	2000
WYE-252M	0.0025	13.0	10.5	5.5	10.0	2000
WYE-332M	0.0033	13.0	12.5	5.5	10.0	2000
WYE-392M	0.0039	13.0	12.5	5.5	10.0	2000
WYE-472M	0.0047	13.0	13.5	5.5	10.0	2000
WYE-682M	0.0068	18.0	14.0	5.5	15.0	1400
WYE-103M	0.01	18.0	13.5	7.5	15.0	1400
WYE-153M	0.015	18.0	14.5	8.5	15.0	1400
WYE-223M	0.022	18.0	17.0	8.5	15.0	1400
WXE-103K	0.01	18.0	10.5	5.5	15.0	1200
WXE-153K	0.015	18.0	10.5	5.5	15.0	1200
WXE-223K	0.022	18.0	10.5	5.5	15.0	1200
WXE-333K	0.033	18.0	10.5	5.5	15.0	1200
WXE-473K	0.047	18.0	12.5	6.5	15.0	1200
WXE-683K	0.068	18.0	13.5	7.5	15.0	1200
WXE-104K	0.1	18.0	14.5	8.5	15.0	600
WXE-154K	0.15	26.5	15.5	7.5	22.5	600
WXE-224K	0.22	26.5	16.5	8.5	22.5	600
WXE-334K	0.33	26.5	18.5	10.5	22.5	400
WXE-474K	0.47	31.5	20.5	11.5	27.5	400
WXE-684K	0.68	31.5	23.5	13.5	27.5	400
WXE-105K	1.0	31.5	24.5	15.0	27.5	400
WXE-155K	1.5	41.5	28.5	16.0	37.5	400
WXE-225K	2.2	41.5	33.0	18.0	37.5	400

ORDERING INFORMATION

Suppressor Type	Value Code	Capacitor Tolerance	Special Codes
WXE WYE	104 472	K = ±10% M = ±20%	L06

OUTLINE DRAWING

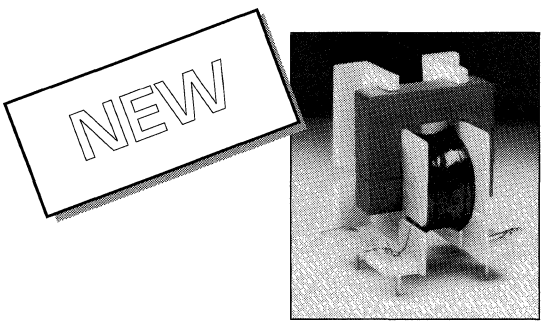


WORLD PRODUCTS INC.
19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380

AMECON

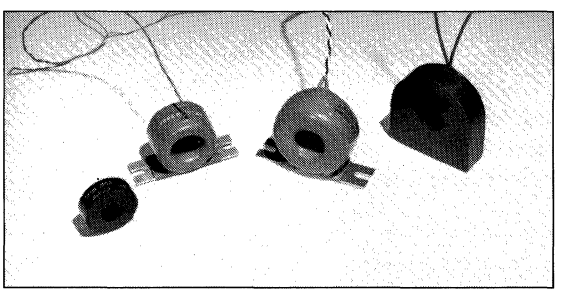
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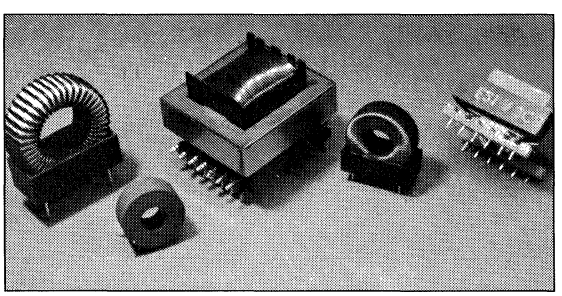
"Snap-On" 5-50A Load Detector

The LD-50 is ±3% accurate from 5A to 50A and can handle short-term currents up to 150A! It costs a fraction of sensors with comparable range and accuracy *and* it's designed for pc-mounting and auto-insertion. And the LD-50 features a revolutionary snap-on design that simplifies installation – even in pre-wired systems!



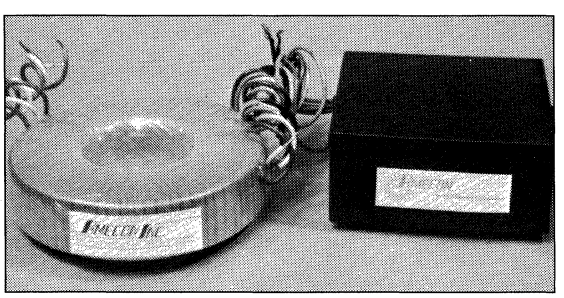
Toroidal Current Transformers

A complete line of CTs for current sensing, measurement and detection in controls and automation. For current-to-voltage and current-to-current applications. Amecon CTs are smaller, lighter and more compact. Three families are available: low profile/high accuracy; standard size/high accuracy; standard size/normal accuracy.



Switch Mode Power Supply Transformers and Inductors

Current sense transformers, inverter transformers and filter inductors. A large selection of sizes are available, including miniature and low profile; in open winding, encapsulated and semi-encapsulated configurations. Custom designs to 200A. High frequency inverter transformers for power transistors and MOSFETs with power levels from 10VA to 1.0kVA covering frequencies from 5 to 100kHz with low power losses.



Toroidal Power Transformers

Low-noise, high efficiency power transformers are available with ratings from 10VA to 10kVA. In custom configurations and off-the-shelf models.

COILS, CHOKES & INDUCTORS

Manufacturer	EEM Starting Page No.	AF	RF	IF	High Q	Shielded	Variable (Adjustable)	Choke/Filter	Chip	Spiral	Inductors: Toroidal	Inductors: Power, Switch Mode	Inductors: Suppression, Common Mode	Other Types
Amecon	A•1156	√	√*		√*	√*		√*		√*	√*	√*	√*	
Automatic Coil	A•1159	√*	√§*	√§*	√*	√*	√*	√*		√*	√*	√*	√*	
Bell Industries	A•1164		√	√	√	√	√	√	√§		√	√		
BH Electronics	A•1170		√§*			√§		√§			√§*	√§	√§	
Caddell-Burns	A•1172	√	√	√	√	√	√	√				√		
Coilcraft	A•1187		√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	Air Cove Inductors
Communication Coil	A•1193	√§*	√§*	√§*	√§*	√§*	√§*	√§*		√§*	√§*	√§*	√§*	
Dale Electronics	A•1194	√§	√§	√	√	√		√	√		√§	√	√	
Delevan	A•1202		√§*			√§*	√	√§*	√§		√	√		
EWC	A•1201	√§*	√§*		√§*	√*		√§*			√*	√*	√*	
Frontier Electronics	A•1206		√			√	√	√			√	√	√	
GC International Inc.	A•1207	√§	√§	√	√	√		√§	√§		√	√	√	
Gowanda	A•1208		√		√	√					√§	√	√	Tunable coil forms- Bobbin Core Chokes Miniture High Current Chokes Encapsulated Power Chokes-Toroidal
Lodestone Pacific	A•1210				√	√	√							Component & Toroid Mounts Ferrite Cores
Magnelab	A•1209	√		√§*	√§*	√		√§*			√	√*	√*	
Microtran Company	A•1212	√*			√*			√*			√*	√*	√*	Miniature Encapsulated
Murata Erie N. A.	A•1213		√§					√	√§				√	
Nytron/Vishay	A•1214		√*		√*	√*	√*							
Pico Electronics	A•1236	√§*			√§*	√§*		√§*			√§*	√§*	√§*	
Piconics Inc.	A•1248	√§	√§	√§	√§		√§		√§*	√§*	√§*			
Prem Magnetics	A•1250	√	√			√		√				√		
RCD	A•1254	√§*	√§*	√§*	√§*	√§*		√§*	√§*		√§*	√§*	√§*	
Renco Electronics	A•1255	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	
Standex Electronics	A•1262	√	√*	√	√	√	√	√			√*	√*	√*	
Tamura Corp.	A•1269							√			√	√§	√	
TDK Corp.	A•1273		√§			√§		√§	√§		√§	√§	√§	
Torotel Prods.	A•1274	√*	√*	√*	√*	√*	√*	√*	√*		√*	√*	√*	
Torelco Inc.	A•1278	√	√	√	√	√					√	√	√	
Vernitron Int'l	A•1279	√§			√§	√§		√§			√§	√§	√§	
Wilco Corp.	A•1280	√	√	√	√	√		√			√	√	√	

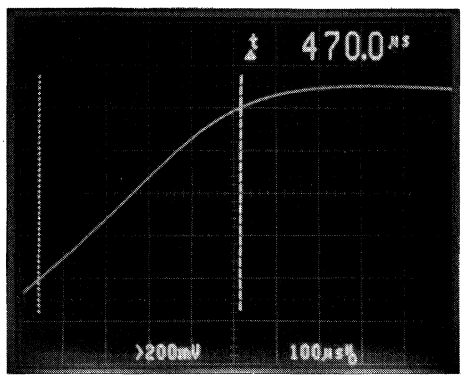
* Mil Spec § Surface Mount

AMECON
SERVING YOU SINCE 1972 WITH KNOWLEDGE & SENSIBLE PRODUCTS
1900 CHRIS LANE / ANAHEIM, CA 92805 / 714-634-2220 / FAX 714-634-0905 / TLX 510-100-0364

PRECISION WOUND HEAVY DUTY TOROIDAL INDUCTORS

FOR PROFESSIONAL LIGHT DIMMERS, MOTOR CONTROLS, SCR CONTROLS & LINE FILTERS

- **AVAILABLE IN SEMI OR FULL EPOXY MOLDED**
- **HORIZONTAL & VERTICAL MOUNTING**
- **ALL "UL" RECOGNIZABLE MATERIALS**
- **ABSOLUTELY LATEST "STATE OF THE ART" MATERIALS, PRODUCTION & TESTING TECHNOLOGIES ARE EMPLOYED THROUGHOUT ALL PHASES OF THIS PRODUCT LINE**
- **SPECIFICALLY DESIGNED FOR 240 VOLTS**



TYPICAL TURN ON RISE TIME 90° FIRING

NEW



VERTICAL MTG. SHOWN LEFT TO RIGHT. 10A, DUAL 20A., 50A & 100.A.

SPECIFICALLY DESIGNED FOR 240 VOLTS

Part No.	Rating Amps Rms	di/dt 10% 90% µs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
2634-116159	8.3	300	99	0.2584	2.80 x 1.30
3521-115198	10	300	101	0.2210	3.70 x 0.90
3032-114159	10	300	85	0.1640	3.20 x 1.30
2634-116159	10	300	123	0.2570	2.80 x 1.30
3532-114172	10	400	87	0.1895	3.70 x 1.30
3526-115188	10	350	101	0.2310	3.70 x 1.10
3532-115192	10	450	105	0.2630	3.70 x 1.20
3040-112125	15	300	91	0.0947	3.30 x 1.60
4021-113155	15	300	105	0.1257	4.20 x 0.90
3056-112120	15	400	93	0.1115	3.30 x 2.10
3048-113138	15	400	112	0.1450	3.30 x 1.80
3552-112134	15	500	97	0.1237	3.70 x 1.90
3542-113157	15	500	117	0.1600	3.70 x 1.60
3542-110098	20	300	84	0.0519	3.80 x 1.70
4026-111122	20	300	100	0.0703	4.20 x 1.20
4032-111131	20	400	108	0.0828	4.20 x 1.30
3542-112128	20	400	126	0.1044	3.70 x 1.60
4042-111128	20	500	110	0.0913	4.20 x 1.60
4032-110115	20	350	89	0.0587	4.30 x 1.40
3542-111113	20	350	103	0.0744	3.70 x 1.60
4042-110114	20	450	93	0.0656	4.30 x 1.70
3542-112139	20	440	133	0.1140	3.70 x 1.60

Part No.	Rating Amps Rms	di/dt 10% 90% µs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
4032-109100	25	300	92	0.0413	4.30 x 1.40
3542-109096	25	300	93	0.0416	3.80 x 1.70
3552-109092	25	350	94	0.0445	3.80 x 2.00
4042-109101	25	400	97	0.0470	4.30 x 1.70
4047-109101	25	450	99	0.0498	4.30 x 1.90
4042-110113	25	450	115	0.0650	4.30 x 1.70
4052-109101	25	500	100	0.0523	4.30 x 2.00
4058-109101	25	550	102	0.0558	4.30 x 2.20
4052-110112	25	550	118	0.0717	4.30 x 2.00
4032-109098	30	300	110	0.0404	4.30 x 1.40
4042-109100	300	400	116	0.0465	4.30 x 1.70
4052-109100	30	500	119	0.0521	4.30 x 2.00
4063-210052	40	300	95	0.0187	4.30 x 2.30
4052-211061	40	300	111	0.0246	4.20 x 2.00
4067-211062	40	400	116	0.0292	4.20 x 2.50
5252-210077	40	450	103	0.0263	5.50 x 2.00
4063-210051	50	300	116	0.0184	4.30 x 2.30
5252-209068	50	400	107	0.0187	5.50 x 2.00
5252-209084	50	500	119	0.0231	5.50 x 2.00
5252-208052	60	300	100	0.0116	5.50 x 2.10
5252-209067	60	400	125	0.0185	5.50 x 2.00
5278-208057	60	500	112	0.0158	5.50 x 2.90

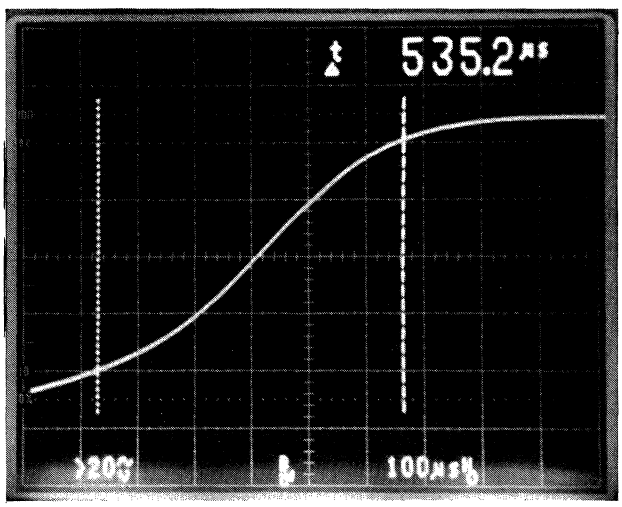
* Semi Epoxy Molded, Add 0.20" O.D. & 0.09" Ht. Full Epoxy Molded, Add 0.20" O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

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TYPICAL TURN ON RISE TIME 90° FIRING

SPECIFICALLY DESIGNED FOR 120 VOLTS

Part No.	Rating Amps Rms	dI/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
1618-119128	5	150	85	0.241	1.70 x 0.75
2017-118150	5	200	70	0.237	2.10 x 0.75
2017-119180	5	250	92	0.355	2.10 x 0.75
1618-118090	6.66	100	83	0.134	1.70 x 0.75
2017-117112	6.66	150	71	0.140	2.20 x 0.75
2023-117115	6.66	200	74	0.165	2.20 x 0.88
2017-115110	8.33	150	70	0.092	2.20 x 0.75
2617-115136	8.33	250	72	0.126	2.80 x 0.75
2622-115130	8.33	300	72	0.133	2.80 x 0.90
2626-115128	8.33	350	73	0.141	2.80 x 1.00
2626-116145	8.33	400	90	0.200	2.80 x 1.00

Part No.	Rating Amps Rms	dI/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
3024-115164	8.33	450	77	0.180	3.20 x 1.00
2617-115134	10	250	90	0.123	2.80 x 0.75
2622-115125	10	300	88	0.128	2.80 x 0.90
2626-114125	10	350	79	0.113	2.80 x 1.10
2626-115140	10	400	97	0.158	2.80 x 1.00
3024-114145	10	400	77	0.128	3.20 x 1.00
2634-114122	10	450	80	0.127	2.80 x 1.30
3024-115176	10	450	100	0.194	3.20 x 1.00
2634-115134	10	500	96	0.173	2.80 x 1.30
3032-114135	10	500	76	0.137	3.20 x 1.30

* Semi Epoxy Molded, Add 0.20" O.D. & 0.09" Ht. Full Epoxy Molded, Add 0.20" O.D. & Ht.
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PRECISION WOUND HEAVY DUTY TOROIDAL INDUCTORS

SPECIFICALLY DESIGNED FOR 120 VOLTS

Part No.	Rating Amps Rms	di/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
2626-113106	12.5	300	80	0.076	2.80 x 1.10
2634-112095	12.5	350	69	0.065	2.80 x 1.40
2634-113108	12.5	400	84	0.090	2.80 x 1.30
3521-114148	12.5	450	95	0.133	3.70 x 0.90
3032-113134	12.5	500	86	0.110	3.20 x 1.30
3024-112108	15	300	78	0.062	3.30 x 1.10
2634-112095	15	350	84	0.065	2.80 x 1.40
3032-111106	15	400	72	0.057	3.30 x 1.30
3032-112118	15	450	86	0.079	3.30 x 1.30
2634-113106	15	400	102	0.089	2.80 x 1.30
3526-112133	15	500	87	0.086	3.70 x 1.10
3032-113130	15	500	104	0.107	3.20 x 1.30
3532-111118	15	550	75	0.068	3.70 x 1.30
3024-112104	20	300	107	0.060	3.30 x 1.10
3521-111100	20	300	86	0.049	3.80 x 1.00
3032-110092	20	350	79	0.040	3.30 x 1.40
3526-112095	20	350	97	0.059	3.70 x 1.10
4021-110104	20	400	77	0.045	4.30 x 1.00
3526-110106	20	400	81	0.045	3.80 x 1.20
4021-110115	20	450	82	0.050	4.30 x 1.00
3526-111118	20	450	99	0.062	3.80 x 1.20
3532-110106	20	500	84	0.050	3.80 x 1.40
4021-111128	20	500	99	0.069	4.30 x 1.00
3532-111115	20	550	100	0.067	3.80 x 1.40
4026-110113	20	550	84	0.053	4.30 x 1.20
3521-110096	25	300	95	0.037	3.80 x 1.00
3526-110092	25	350	95	0.038	3.80 x 1.20
3532-110085	25	400	93	0.039	3.80 x 1.40
4021-109100	25	400	85	0.036	4.30 x 1.10
4026-109092	25	450	84	0.035	4.30 x 1.20
3532-110094	25	450	99	0.044	3.80 x 1.40
4026-109101	25	500	80	0.039	4.30 x 1.20
3532-110104	25	500	107	0.049	3.80 x 1.40
4032-109092	25	550	87	0.038	4.30 x 1.40

Part No.	Rating Amps Rms	di/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
4026-110111	25	550	107	0.052	4.30 x 1.20
4026-108065	30	300	73	0.020	4.30 x 1.30
4021-109090	30	350	97	0.032	4.30 x 1.10
4032-109068	30	400	87	0.027	4.30 x 1.40
3532-109084	30	400	100	0.032	3.80 x 1.40
4042-108060	30	450	77	0.022	4.30 x 1.80
3542-109073	30	450	95	0.031	3.80 x 1.70
4042-108065	30	500	82	0.025	4.30 x 1.80
3542-109082	30	500	103	0.035	3.80 x 1.70
4042-109072	30	550	97	0.034	4.30 x 1.70
3542-109088	30	550	108	0.038	3.70 x 1.70
3542-211057	35	350	90	0.019	3.80 x 1.60
4042-211053	35	400	88	0.019	4.20 x 1.60
4042-211058	35	450	92	0.021	4.30 x 1.70
4047-211058	35	500	94	0.022	4.30 x 1.80
4047-211063	35	550	98	0.024	4.30 x 1.80
3547-210051	40	350	88	0.015	3.80 x 1.80
4042-210052	40	400	89	0.015	4.30 x 1.70
4047-210052	40	450	91	0.016	4.30 x 1.80
4042-211058	40	450	105	0.021	4.30 x 1.70
4047-211057	40	500	106	0.022	4.30 x 1.80
4047-211062	40	550	111	0.024	4.30 x 1.80
4042-209049	50	400	95	0.011	4.30 x 1.70
4042-210056	50	450	115	0.016	4.30 x 1.70
4047-210051	50	450	111	0.016	4.30 x 1.80
4052-210051	50	500	113	0.017	4.30 x 2.00
4052-210055	50	550	118	0.018	4.30 x 2.00
4047-209045	60	400	111	0.011	4.30 x 1.90
4052-209046	60	450	114	0.012	4.30 x 2.00
4063-209042	60	500	112	0.012	4.30 x 2.40
4063-209046	60	550	117	0.013	4.30 x 2.40
5252-308036	75	400	88	0.005	5.50 x 2.10
5252-208036	75	400	101	0.008	5.50 x 2.10
5252-408032	100	375	95	0.004	5.50 x 2.10
5252-308034	100	400	108	0.005	5.50 x 2.10

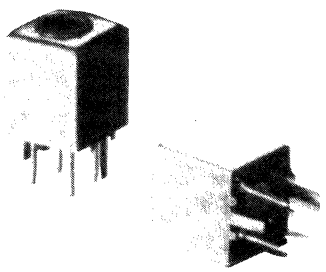
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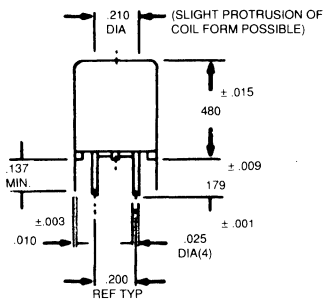
Automatic Coil Corp.
Subsidiary of Designatronics, Inc.
Dept. E 3545 N.W. 71st Street, Miami FL 33147
Phone: (305) 696-6660 • Fax: (305) 696-0626

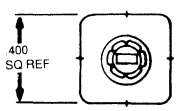
VARIABLE COILS - shielded - printed circuit

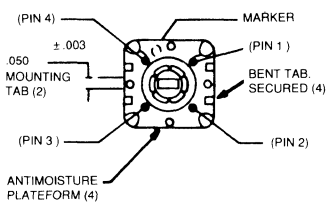
Automatic Coil Part Number	Inductance L (μ H) Min.	Max.	Q Min. • L. Min.	Q min. • L Max.	TEST FREQUENCY (M Hz)	DCR Max. (Ω)	DC Max. (mA)	SRF Min. (M Hz)
8178-040	.090	.110	65	65	25.0	.031	2200	250.0
8178-050	.106	.136	66	66	25.0	.034	2100	250.0
8178-060	.136	.166	70	70	25.0	.037	2000	260.0
8178-070	.162	.196	70	70	25.0	.049	1750	260.0
8178-080	.196	.246	70	70	25.0	.066	1600	260.0
8178-090	.243	.297	70	70	25.0	.061	1500	260.0
8178-100	.297	.363	70	70	25.0	.067	1460	230.0
8178-110	.361	.429	70	70	25.0	.073	1400	220.0
8178-120	.423	.517	70	70	25.0	.080	1360	210.0
8178-130	.504	.616	70	70	25.0	.083	1300	200.0
8178-140	.612	.748	70	70	25.0	.093	1260	173.0
8178-150	.738	.902	70	66	25.0	.100	1200	150.0
8178-160	.900	1.10	70	65	25.0	.110	1100	130.0
8178-300	1.08	1.36	66	50	7.9	.130	1000	120.0
8178-310	1.35	1.65	50	46	7.9	.140	100	110.0
8178-320	1.62	1.98	50	40	7.9	.200	900	100.0
8178-330	1.96	2.45	50	40	7.9	.260	800	66.0
8178-340	2.43	2.97	52	45	7.9	.380	700	63.0
8178-350	2.97	3.63	55	45	7.9	.610	600	76.0
8178-360	3.51	4.29	50	50	7.9	.700	600	71.0
8178-370	4.23	5.17	50	50	7.9	.880	400	64.0
8178-380	5.04	6.16	50	52	7.9	1.30	360	68.0
8178-390	6.12	7.48	55	55	7.9	1.70	280	52.0
8178-400	7.38	9.02	55	55	7.9	1.90	270	46.0
8178-410	9.00	11.0	55	55	7.9	2.00	260	40.0
8178-420	10.8	13.6	55	60	2.6	2.10	255	10.5
8178-430	13.5	16.5	60	70	2.6	2.20	250	10.0
8178-440	18.2	19.8	60	70	2.6	2.30	240	9.5
8178-450	19.8	24.5	65	70	2.6	2.60	230	9.0
8178-460	24.3	29.7	65	70	2.6	2.70	220	8.5
8178-470	29.7	36.3	65	70	2.6	3.00	210	8.0
8178-480	35.1	42.9	60	66	2.6	3.50	200	7.5
8178-490	42.3	51.7	55	60	2.6	3.60	190	6.4
8178-500	50.4	61.6	50	55	2.6	4.00	180	5.7
8178-510	61.2	74.8	50	56	2.6	4.30	170	4.9
8178-520	73.8	90.2	45	50	2.6	6.40	160	4.5
8178-530	90.0	110.0	45	45	2.6	6.50	150	4.3
8178-540	108.0	136.0	45	50	.790	9.30	145	3.8
8178-545	136.0	165.0	50	60	.790	10.0	140	3.5
8178-550	162.0	198.0	50	60	.790	11.0	130	3.3
8178-560	198.0	246.0	60	60	.790	12.0	120	3.1
8178-570	243.0	297.0	50	55	.790	22.0	90	2.9
8178-580	297.0	363.0	45	50	.790	23.0	85	2.7
8178-590	361.0	429.0	45	60	.790	26.0	80	2.3
8178-600	423.0	617.0	40	45	.790	28.0	75	1.9
8178-610	504.0	616.0	35	45	.790	33.0	65	1.7
8178-620	512.0	748.0	36	40	.790	39.0	60	1.8
8178-630	738.0	902.0	30	36	.790	49.0	55	1.3
8178-640	900.0	1100.0	30	35	.790	60.0	55	1.2

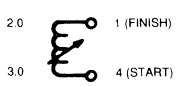
Windings are varnish impregnated and powdered iron components are moisture proofed.
Temperature Range: -55°C to + 105°C. Tolerence ± .005 unless otherwise stated.

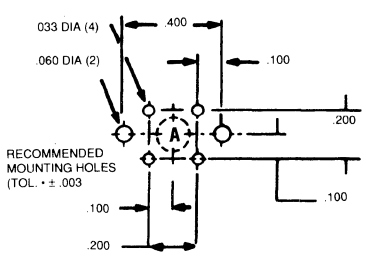












A OPTIONAL .140 DIA HOLE FOR THRU BASE TUNING

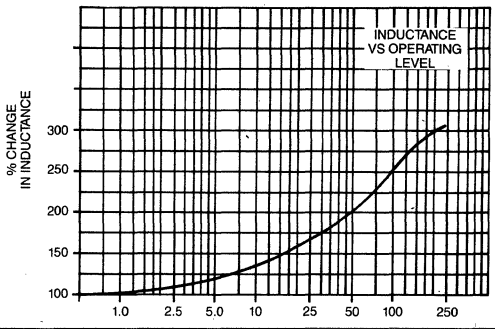
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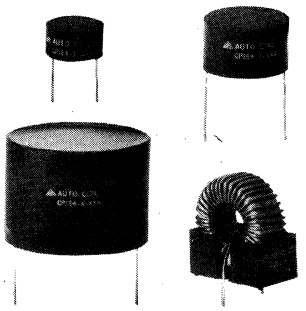
Toroid Power Inductors

- Economy models
- Reliable construction
- Single layer design
- Choice of mounting
- Solderable leads

$$X = \frac{V_{OP}}{V_{TEST}\ f_{OP}} \times 10^4$$

V_{OP} = operating voltage (RMS)
V_{TEST} = indicated test level (RMS)
f_{OP} = operating frequency





MAX. CONT. DCI RATING (AMS)	L (μH) WITHOUT D.C. +20-10%	AC TEST LEVEL 10 KHZ RMS	MAX DCR (OHMS)	% INDUCTANCE DROP FOR DC CURRENT INDICATED					LEAD DIA	SIZE	*AUTOMATIC COIL PART NUMBER
				10%	20%	30%	40%	50%			
1.0	20.7	.022	.040	1.24	1.76	2.65	3.53	4.40	.020	1	xxxxx1-101
1.0	32.0	.028	.052	.95	1.35	2.03	2.70	3.40	.020	1	xxxxx1-102
1.0	32.0	.032	.055	1.12	1.60	2.40	3.20	4.00	.020	2	xxxxx1-103
2.0	35.0	.045	.035	1.47	2.10	3.15	4.20	5.25	.025	3	xxxxx1-104
1.0	50.0	.050	.065	1.24	1.76	2.65	3.53	4.40	.020	3	xxxxx1-105
3.0	20.0	.026	.020	1.40	2.00	3.00	4.00	5.00	.032	4	xxxxx1-106
3.0	40.0	.052	.028	1.57	2.25	3.36	4.50	5.60	.032	5	xxxxx1-107
2.0	60.2	.040	.053	1.06	1.50	2.28	3.04	3.80	.025	5	xxxxx1-108
2.0	100.0	.084	.100	1.00	1.45	2.18	2.90	3.64	.020	5	xxxxx1-109
5.0	55.0	.090	.025	2.00	2.90	4.40	5.84	7.30	.040	6	xxxxx1-110
3.0	100.0	.120	.048	1.55	2.20	3.30	4.42	5.52	.032	6	xxxxx1-111
2.0	145.	.150	.085	1.27	1.82	2.72	3.63	4.54	.025	6	xxxxx1-112
7.5	55.0	.150	.017	3.00	4.28	6.42	8.57	10.70	.051	7	xxxxx1-113
3.0	100.	.200	.052	2.20	3.12	4.69	6.25	7.80	.032	7	xxxxx1-114
3.0	165.0	.260	.065	1.72	2.45	3.68	4.90	6.14	.032	7	xxxxx1-115
2.0	285.0	.340	.140	1.29	1.84	2.76	3.68	4.60	.025	7	xxxxx1-116
10.0	55.0	.170	.018	3.54	5.00	7.60	10.00	12.65	.064	8	xxxxx1-117
7.5	95.0	.220	.030	2.70	3.85	5.78	7.70	9.60	.051	8	xxxxx1-118
5.0	170.0	.300	.063	2.00	2.86	4.30	5.72	7.15	.040	8	xxxxx1-119
3.0	270.0	.380	.120	1.58	2.27	3.40	4.53	5.67	.032	8	xxxxx1-120
2.0	450.0	.490	.250	1.23	1.75	2.34	3.12	3.90	.025	8	xxxxx1-121

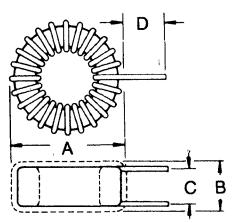
*CHOOSE STYLE (PAGE 10) TO COMPLETE PART NUMBER

Reduction of inductance due to DC current can be taken from tables. To find additional inductance change for operating levels and frequency other than listed in tables, solve for X using formula given above.

Use V_{OP} = Actual operating level (RMS)
V_{TEST} = RMS test level indicated at 10KHz
f_{OP} = Actual operating frequency
Refer to corresponding graph to determine inductance change in %.

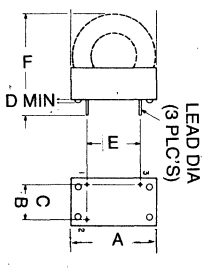
STANDARD STYLES

OPEN COIL CPIDIx-xxx



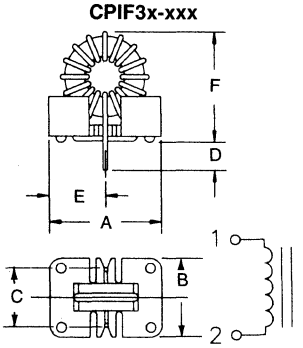
SIZE	A	B	CREF	D±.125
1	.55	.25	.180	.375
2	.64	.28	.200	.375
3	.70	38	.280	375
4	.85	.33	.220	.375
5	.85	.41	.280	.375
6	1.05	.55	.400	.750
7	1.40	.75	.500	.750
8	1.65	.90	.500	.750
9	1.90	1.0	.750	.750

SEMI-ENCAPSULATED CPIE2x-xxx



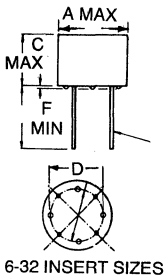
SIZE	A	B	C	D	E	F
1	—	—	—	—	—	—
2	—	—	—	—	—	—
3	—	—	—	—	—	—
4	.90	.50	.25	.5	.60	.95
5	.90	.50	.25	.5	.60	.95
6	1.25	.55	.40	.5	.80	1.35
7	1.65	.95	.75	.5	1.00	1.50
8	1.75	1.00	.75	.5	1.25	1.00
9	1.90	1.13	.90	.5	1.50	2.00

CLIP MOUNT CPIF3x-xxx



SIZE	A	B	C	D	E	F NOM
1	.58	.34	.22	.25	.290	.60
2	.65	.45	.30	.25	.330	.65
3	.65	.45	.30	.25	.330	.65
4	.83	.45	.30	.25	.415	.65
5	.83	.45	.30	.25	.415	.85
6	.95	.60	.45	.25	.475	.95
7	1.25	.75	.50	.25	.625	1.25

TOTALLY ENCAPSULATED CPIE4x-xxx

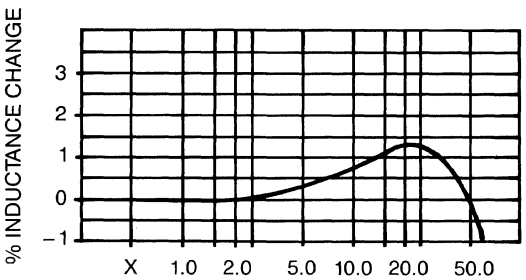


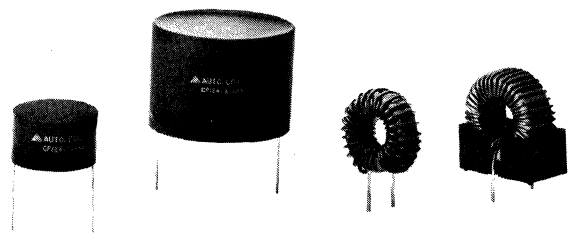
6-32 INSERT SIZES SIZES 7 THRU 10

SIZE	A	C	D	F	G
1	.750	.400	.500	.5	.025
2	.750	.400	.500	.5	.025
3	1.000	.500	.75	.5	.036
4	1.00	.500	.75	.5	.032
5	1.000	.500	.75	.5	.032
6	1.250	.800	1.00	.5	.032
7	1.625	1.000	1.25	.5	.040
8	1.750	1.125	1.50	.5	.040
9	2.125	1.25	1.900	.5	.040

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- High inductance stability
- Low inductance shift with operating voltage
- Predictable swing
- Tolerant to high peak currents
- Single layer design
- Choice of mounting
- Solderable leads

$$X = \frac{V_{OP}}{V_{TEST} \quad f_{OP}} \times 10^4$$

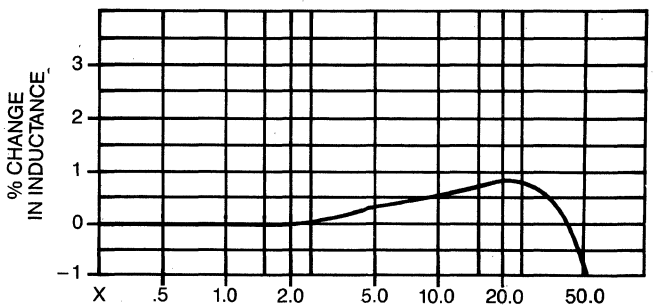
V_{OP} = operating voltage (RMS)
V_{TEST} = indicated test level (RMS)
f_{OP} = operating frequency

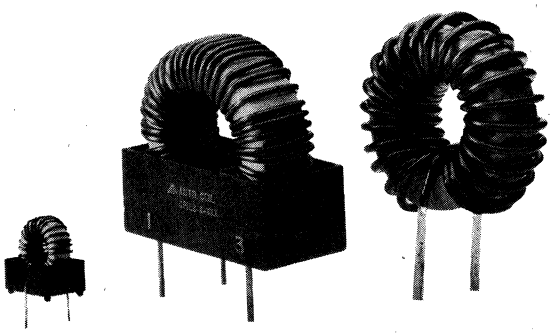
MAX DC CURRENT RATING (AMPS)	INDUCTANCE WITHOUT DC (µH) ± 10%	AC TEST LEVEL 10KHZ RMS	DCR MAX	MAX INDUCTANCE DROP for DC CURRENT INDICATED					INDUCTANCE AT MAX CURRENT	LEAD DIA	SIZE	*AUTOMATIC COIL PART NUMBER
				10%	20%	30%	40%	50%				
20.00	2.45	.024	.003	12.80	18.30	23.00	29.00	34.00	1.40	.08	7	xxxxx5-101
20.00	4.35	.036	.0035	9.60	14.10	17.70	21.70	25.00	1.70	.08	7	xxxxx5-102
20.00	9.80	.048	.005	6.40	9.40	11.80	14.40	16.83	2.25	.08	7	xxxxx5-103
20.00	11.50	.052	.005	5.90	8.70	10.90	13.36	15.53	3.80	.080	7	xxxxx5-104
10.00	33.00	.084	.010	3.50	5.10	6.40	7.90	9.18	15.50	.057	7	xxxxx5-105
5.00	61.00	.120	.024	2.56	3.78	4.70	5.80	6.73	40.00	.040	7	xxxxx5-106
4.00	100.00	.150	.037	2.00	3.00	3.75	4.60	5.30	64.00	.035	7	xxxxx4-107
3.00	250.00	.240	.058	1.20	1.92	2.25	2.80	3.40	148.00	032	7	xxxxx5-108
2.00	468.00	.330	.170	.88	1.40	1.65	2.10	2.50	285.00	.025	7	xxxxx5-109
1.00	500.00	.480	.360	.60	.98	1.15	1.50	1.70	770.00	.020	7	xxxxx5-110
1.00	1900.00	.670	.470	.43	.70	.80	1.00	1.23	1150.00	.020	7	xxxxx5-111
20.00	4.00	.058	.003	19.00	28.00	35.00	45.00	50.00	3.10	.08	8	xxxxx5-112
20.00	19.00	.130	.006	8.70	12.80	16.00	19.80	23.00	6.70	.08	8	xxxxx4-113
20.00	26.50	.150	.007	7.36	10.80	13.60	16.70	19.40	7.50	.08	8	xxxxx5-114
20.00	31.00	.163	.007	6.90	10.00	12.60	15.50	18.00	13.60	.080	8	xxxxx5-115
20.00	45.00	.200	.009	5.65	8.30	10.40	12.80	14.80	15.00	.080	8	xxxxx5-116
10.00	90.00	.280	.015	4.00	5.88	7.35	9.00	10.50	50.00	.057	8	xxxxx5-117
5.00	200.00	.420	.042	2.70	4.00	5.00	6.00	7.00	140.00	.040	8	xxxxx5-118
3.00	3.20	.520	.080	2.00	3.20	3.90	4.81	5.60	275.00	.032	8	xxxxx5-119
2.00	530.00	.670	.160	1.70	2.50	3.00	3.80	4.50	450.00	.025	8	xxxxx5-120
1.25	660.00	.750	.270	1.50	2.20	2.80	3.40	3.50	620.00	.020	8	xxxxx5-121
1.25	835.00	.850	.320	1.30	2.00	2.50	3.00	3.50	760.00	.020	8	xxxxx5-122
1.25	1000.00	.930	.340	1.20	1.80	2.20	2.70	3.20	880.00	.020	8	xxxxx5-123
20.00	3.20	.060	.003	25.00	36.00	45.00	56.00	65.00	2.80	.100	9	xxxxx5-124
20.00	8.00	.100	.005	15.30	23.00	29.00	35.00	40.00	5.50	.100	9	xxxxx5-125
20.00	25.00	.167	.008	8.80	13.00	16.00	20.00	23.00	8.80	.100	9	xxxxx5-126
20.00	51.00	.240	.010	6.00	9.00	11.30	14.00	16.00	19.00	.080	9	xxxxx5-127
20.00	73.00	.280	.012	5.00	7.40	9.20	11.30	13.00	24.00	.080	9	xxxxx5-128
10.00	140.00	.400	.021	3.80	5.60	7.00	8.60	10.00	70.00	.057	9	xxxxx5-129
5.00	200.00	.480	.046	3.00	4.50	5.70	6.05	8.10	152.00	.040	9	xxxxx5-130
5.00	330.30	.610	.060	2.40	3.60	4.50	4.40	6.40	210.00	.040	9	xxxxx5-131
3.00	520.00	.760	.120	2.00	2.83	3.55	4.40	5.00	400.00	.032	9	xxxxx5-132
2.00	810.00	1.000	.220	1.50	2.30	2.90	3.50	4.00	690.00	.025	9	xxxxx5-133
1.25	1000.00	1.060	.380	1.40	2.03	2.60	3.20	3.65	920.00	.020	9	xxxxx5-134
1.25	1300.00	1.200	.435	1.20	1.80	2.30	2.80	3.20	1115.00	.020	9	xxxxx5-135
20.00	4.20	.095	.003	30.00	44.00	55.00	67.00	78.00	3.78	.08	10	xxxxx5-136
20.00	17.00	.170	.008	15.00	22.00	28.00	34.00	39.00	11.60	.08	10	xxxxx5-137
20.00	68.00	.380	.011	7.50	11.00	14.00	17.00	20.00	16.00	.08	10	xxxxx5-138
20.00	96.00	.460	.012	6.20	9.00	11.50	14.20	16.50	36.00	.080	10	xxxxx5-139
10.00	200.00	.670	.026	4.30	6.25	7.80	9.60	11.20	116.00	.057	10	xxxxx5-140
10.00	270.00	.765	.030	3.80	5.60	7.00	8.50	9.90	132.00	.057	10	xxxxx5-141
5.00	490.00	1.030	.076	2.75	4.00	5.00	6.20	7.20	343.00	.040	10	xxxxx5-142
3.00	710.00	1.240	.144	2.28	6.00	7.70	9.50	11.00	632.00	.032	10	xxxxx5-143
3.00	1000.00	1.460	.177	2.00	2.85	3.60	4.40	5.20	770.00	.032	10	xxxxx5-144
2.00	1600.00	1.860	.340	1.50	2.25	2.80	3.45	4.00	1360.00	.025	10	xxxxx5-145
1.25	2000.00	2.100	.600	1.35	2.00	2.50	3.10	3.60	1840.00	.020	10	xxxxx5-146
1.25	2600.00	2.350	.680	1.20	1.77	2.20	2.70	3.20	2314.00	.020	10	xxxxx5-147

*CHOOSE STYLE (PAGE 10) TO COMPLETE PART NUMBER

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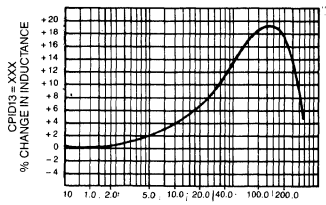
MAX.DC CURRENT RATING (AMPS)	INDUCTANCE WITHOUT DC µH ±10%	AC TEST LEVEL 10KHZ RMS	MAX DCR (OHMS)	MAX INDUCTANCE DROP for DC CURRENT INDICATED					INDUCTANCE AT MAX CURRENT	LEAD DIA	SIZE	*AUTOMATIC COIL PART NUMBER
				10%	20%	30%	40%	50%				
20.0	1.15	.024	.0032	25.00	35.00	106.0	134	156.0	1.1	.08	7	xxxxx4-101
20.0	2.05	.032	.0045	19.00	26.50	35.0	44	52.0	1.9	.08	7	xxxxx4-102
20.0	3.20	.040	.006	15.30	21.00	28.0	34	40.0	3.0	.08	7	xxxxx4-103
20.0	7.20	.060	.007	10.20	14.30	18.8	23.5	27.5	68.0	.080	7	xxxxx4-104
10.0	14.0	.084	.009	7.30	10.20	13.5	16.9	19.7	12.3	.057	7	xxxxx4-105
5.0	29.00	.120	.023	5.10	7.10	9.4	11.8	13.8	27.6	.040	7	xxxxx4-106
4.0	60.00	.170	.025	3.60	5.00	6.5	8.3	9.6	52.0	.035	7	xxxxx4-107
3.0	120.00	.240	.084	2.50	3.50	4.6	5.8	6.8	100.0	.032	7	xxxxx4-108
2.0	220.00	.330	.170	1.90	2.60	3.4	4.3	5.0	190.0	.025	7	xxxxx4-109
1.0	450.00	480	.360	1.30	1.80	2.4	3.0	3.5	423.0	.020	7	xxxxx4-110
1.0	900.00	.670	.470	.90	1.30	1.7	2.1	2.4	825.0	.020	7	xxxxx4-111
20.0	1.20	.046	.0032	48.00	66.00	88.0	110	129.0	1.35	.08	8	xxxxx4-112
20.0	1.90	.058	.0032	38.30	53.40	70.5	88.7	104.0	2.4	.08	8	xxxxx4-113
20.0	4.80	.093	.0045	24.00	33.00	44.0	55.4	64.8	4.75	.08	8	xxxxx4-114
20.0	12.80	.115	.006	15.50	21.60	28.5	35.9	42.0	8.8	.08	8	xxxxx4-115
20.0	24.50	.200	.007	10.60	14.80	20.0	24.6	28.8	17.5	.080	8	xxxxx4-116
10.0	47.00	.290	.011	7.70	10.70	14.0	17.7	20.7	41.0	.064	8	xxxxx4-117
7.5	98.00	.420	.023	5.30	7.40	9.8	12.3	14.4	80.0	.050	8	xxxxx4-118
5.0	220.00	.630	.056	3.50	4.90	6.5	8.2	9.6	173.0	.040	8	xxxxx4-119
4.0	475.00	.930	.104	2.40	3.40	4.4	5.5	6.5	350.0	.035	8	xxxxx4-120
2.0	1000.00	1.340	.300	1.70	2.30	3.1	3.9	4.5	850.0	.025	8	xxxxx4-121
2.0	1800.00	1.800	.400	1.20	1.70	2.3	2.9	3.3	1350.0	.025	8	xxxxx4-122
1.5	2700.00	2.200	.623	1.00	1.40	1.8	2.1	3.1	2000.0	.023	8	xxxxx4-123
20.0	.98	.047	.0032	61.00	85.70	113	142	166.0	1.26	.08	9	xxxxx4-124
20.0	3.00	.084	.0032	35.00	48.50	64.0	80.1	94.3	2.76	.08	9	xxxxx4-125
20.0	6.00	.120	.0045	24.60	34.30	45.3	57	66.6	5.22	.08	9	xxxxx4-126
20.0	15.50	.180	.007	15.40	21.40	28.3	35.6	41.5	10.3	.08	9	xxxxx4-127
20.0	30.00	.260	.008	11.20	15.60	20.6	26	30.4	21.6	.080	9	xxxxx4-128
10.0	66.00	.400	.016	7.40	10.40	13.7	17.2	20.0	54.0	.064	9	xxxxx4-129
7.5	120.00	.520	.033	5.60	7.80	10.3	13	15	98.0	.050	9	xxxxx4-130
5.0	240.00	.750	.064	3.90	5.40	7.2	9	10.5	195.0	.040	9	xxxxx4-131
5.0	500.00	1.070	.100	27.00	3.80	5.0	6.3	7.4	350.0	.040	9	xxxxx4-132
4.0	1000.00	1.530	.180	1.90	2.70	3.5	4.5	5.2	646.0	.035	9	xxxxx4-133
3.0	2200.00	2.260	.323	1.30	1.80	2.4	3.0	3.5	1300.0	.032	9	xxxxx4-134
20.0	2.00	.100	.0032	59.00	82.00	108	136	160.0	2.13	.08	10	xxxxx4-135
20.0	5.20	.150	.0045	37.00	52.00	68.0	86	100.0	4.9	.08	10	xxxxx4-136
20.0	11.50	.230	.008	24.70	34.50	45.0	57	67.0	10.0	.08	10	xxxxx4-137
20.0	23.50	.320	.009	17.50	24.30	32.0	40.4	47.3	17.0	.08	10	xxxxx4-138
20.0	50.00	.480	.012	11.90	16.50	21.8	27.5	32.0	26.0	.08	10	xxxxx4-139
20.0	100.00	.660	.013	8.50	11.80	15.6	19.6	23.0	55.0	.080	10	xxxxx4-140
10.0	245.00	1.050	.030	5.40	7.50	9.9	12.5	14.6	170.0	.064	10	xxxxx4-141
7.5	500.00	1.500	.065	3.80	5.30	7.0	8.8	10.3	340.0	.050	10	xxxxx4-142
6.5	1000.00	2.100	.145	2.70	3.80	5.0	6.3	7.3	525.0	.040	10	xxxxx4-143
6.5	2200.00	3.100	.230	1.80	2.50	3.3	4.2	4.9	990.0	.040	10	xxxxx4-144
4.0	4000.00	4.200	.380	1.30	1.90	2.5	3.1	3.6	1700.0	.035	10	xxxxx4-145

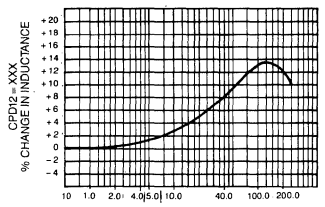
*CHOOSE STYLE (PAGE 10) TO COMPLETE PART NUMBER

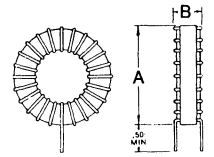
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- High energy storage
- Tolerant to high peak currents
- Minimal and predictable swing
- Open construction for max cooling
- Single layer design
- Choice of mounting
- Solderable leads









$$X = \frac{V_{OP}}{V_{TEST}\ f_{OP}} \times 10^4$$

V_{OP} = operating voltage (RMS)
V_{TEST} = indicated test level (RMS)
f_{OP} = operating frequency

MAX. CONT. DCI RATING (AMPS)	L(μH) WITHOUT D.C. ±-10%	AC TEST LEVEL 10KHZ RMS	MAX DCR (OHMS)	% INDUCTANCE DROP FOR D.C. CURRENT INDICATED				L(μH) AT MAX CURRENT	LEAD DIA	SIZE		AUTOMATIC COIL PART NUMBER
				10%	20%	30%	40%			DIM A MAX.	B MAX.	
5.0	50.0	.100	.030	4.6	—	—	—	44.0	.040	1.125	.450	CPID12-101
5.0	80.0	.125	.037	3.6	—	—	—	68.0	.040	1.125	.450	CPID12-102
5.0	90.0	.200	.040	5.0	—	—	—	81.0	.040	1.375	.620	CPID12-103
5.0	200.0	.300	.063	3.4	—	—	—	164.0	.040	1.375	1.250	CPID12-104
5.0	600.0	.732	.120	3.0	—	—	—	490	.040	1.375	1.375	CPID12-105
10.0	17.0	.060	.010	7.9	—	—	—	14.5	.050	1.125	.500	CPID12-106
10.0	43.0	.140	.018	7.3	—	—	—	36.0	.050	1.375	.660	CPID12-107
10.0	100.0	.300	.031	6.8	—	—	—	84.0	.050	1.375	1.250	CPID12-108
10.0	150.0	.400	.038	6.4	—	—	—	123.0	.050	1.875	.800	CPID12-109
10.0	22.0	.800	.065	6.4	—	—	—	246.0	.050	1.875	1.625	CPID12-110
15.0	15.0	.038	.006	12.0	—	—	—	12.9	.064	1.125	.520	CPID12-111
15.0	27.0	.110	.010	9.2	—	—	—	22.0	.064	1.375	.770	CPID12-112
15.0	60.0	.230	.015	8.8	15.0	—	—	48.0	.064	1.375	1.375	CPID12-113
15.0	82.0	.300	.017	8.5	14.6	—	—	65.0	.064	1.875	.950	CPID12-114
15.0	145.0	.570	.028	9.0	15.0	—	—	116.0	.064	1.875	1.625	CPID12-115
25.0	6.2	.035	.004	13.0	22.5	—	—	4.8	.080	1.250	.630	CPID12-116
25.0	10.5	.064	.005	14.3	24.5	—	—	8.4	.080	1.250	.700	CPID12-117
25.0	22.0	.140	.006	14.7	25.0	—	—	17.6	.080	1.375	1.250	CPID12-118
25.0	43.0	.220	.009	11.9	20.4	—	—	31.0	.080	1.875	.950	CPID12-119
25.0	86.0	.440	.014	11.9	20.4	—	—	62.0	.080	1.875	1.625	CPID12-120
40.0	2.0	.020	.002	22.5	38.6	—	—	1.6	.100	1.350	.630	CPID12-121
40.0	4.5	.040	.003	22.5	38.6	—	—	3.5	.100	1.350	1.450	CPID12-122
40.0	6.0	.040	.003	20.0	33.6	—	—	4.3	.100	1.500	.880	CPID12-123
40.0	12.0	.100	.005	20.0	33.6	—	—	8.6	.100	1.500	1.350	CPID12-124
40.0	21.0	.152	.005	17.0	30.0	39.0	—	14.5	.100	1.950	.950	CPID12-125
40.0	60.0	.360	.008	14.4	25.0	32.9	—	37.2	.100	1.950	1.625	CPID12-126

MAX. CONT. DCI RATING (AMPS)	L(μH) WITHOUT D.C. ±10%	AC TEST LEVEL 10KHZ RMS	MAX DCR (OHMS)	% INDUCTANCE DROP FOR D.C. CURRENT INDICATED					L(μH) AT MAX CURRENT	LEAD DIA	SIZE		AUTOCOIL PART NUMBER
				10%	20%	30%	40%	50%			DIM A MAX.	B MAX.	
5.0	110.0	.100	.030	2.0	3.75	5.00	—	—	77.0	.040	1.125	.450	CPID13-101
5.0	160.0	.124	.036	1.7	3.20	4.29	—	—	104.0	.040	1.125	.450	CPID13-102
5.0	170.0	.190	.038	2.6	4.58	—	—	—	130.0	.040	1.375	.620	CPID13-103
5.0	360.0	.400	.060	2.5	4.44	—	—	—	270.0	.040	1.375	1.250	CPID13-105
5.0	1000.0	.650	.120	1.5	2.70	3.60	—	—	560.0	.040	1.375	1.250	CPID13-106
10.0	36.0	.060	.011	3.82	6.75	9.00	—	—	23.4	.050	1.125	.500	CPID13-107
10.0	90.0	.140	.018	3.56	6.28	8.37	—	—	58.0	.050	1.375	.660	CPID13-108
10.0	212.0	.300	.030	3.30	5.82	7.75	10.00	—	125.0	.050	1.375	1.250	CPID13-109
10.0	300.0	.400	.038	3.16	5.57	7.43	9.66	—	168.0	.050	1.875	.800	CPID13-110
10.0	600.0	.800	.065	3.16	5.57	7.43	9.66	—	330.0	.050	1.875	1.625	CPID13-111
15.0	32.0	.056	.008	4.00	7.10	9.50	12.30	—	16.6	.064	1.125	.520	CPID13-112
15.0	70.0	.121	.011	4.10	7.20	9.60	12.47	—	38.0	.064	1.375	.770	CPID13-113
15.0	125.0	.232	.015	4.28	7.55	10.00	13.10	—	68.0	.064	1.375	1.375	CPID13-114
15.0	160.0	.300	.019	4.28	7.55	10.00	13.10	—	87.0	.064	1.875	.950	CPID13-115
15.0	300.0	.570	.028	4.42	7.80	10.40	13.52	—	171.0	.064	1.875	1.625	CPID13-116
25.0	13.0	.004	.004	6.37	11.25	15.00	—	—	6.2	.080	1.250	.630	CPID13-117
25.0	18.0	.006	.004	7.63	13.50	18.00	23.40	—	10.0	.080	1.250	.900	CPID13-118
25.0	26.5	.075	.005	6.60	11.63	15.50	20.10	—	13.8	.080	1.375	.700	CPID13-119
25.0	45.0	.140	.006	7.14	12.60	16.70	21.80	—	25.2	.080	1.375	1.250	CPID13-120
25.0	80.0	.210	.009	6.03	10.60	14.20	18.40	25.00	40.0	.080	1.950	.950	CPID13-121
25.0	180.0	.440	.014	5.77	10.10	13.58	17.60	23.00	83.0	.080	1.950	1.625	CPID13-122
40.0	4.4	.020	.002	11.00	19.30	25.70	33.40	—	2.3	.100	1.350	.630	CPID13-123
40.0	8.8	.040	.003	11.00	19.30	25.70	33.40	—	4.6	.100	1.350	1.000	CPID13-124
40.0	16.0	.060	.003	8.56	15.00	20.00	26.00	35.00	6.4	.100	1.500	.880	CPID13-125
40.0	25.0	.100	.004	9.50	16.80	22.40	29.00	39.00	11.5	.100	1.500	1.350	CPID13-126
40.0	43.0	.152	.005	8.30	14.60	19.50	25.30	34.00	17.0	.100	1.950	.950	CPID13-127
40.0	120.0	.360	.008	7.00	12.30	16.40	21.40	28.00	37.2	.100	1.950	1.625	CPID13-128

Complete design, manufacture and test facilities for your custom magnetic requirements. ...Call for design and application assistance.

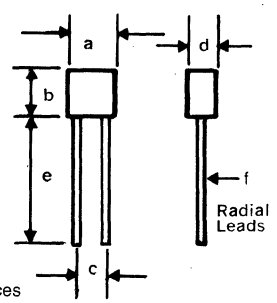
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Since 1924, leading manufacturer of standard and custom inductors.

ENCAPSULATED SUBMINIATURE AND MINIATURE TOROIDAL INDUCTORS

Features

- Applications: printed circuits and modules
- Environmental: designed to meet MIL-C-15305, Grade 1, Class B (−55°C to +125°C)
- Moisture and shock resistant, immersion proof
- Powdered iron toroidal core, low external magnetic field
- Identification: part number and inductance value printed in contrasting color

General Specifications (All Series)
Maximum operating temperature: 125°C
Rated temperature rise (at 90°C): 35°C
Dielectric withstanding voltage: 700 v rms
Terminal pull: 5 pounds
Altitude rating: 70,000 feet
Overload current: 1.4 times the rated current



Closer inductance tolerances *available on request.

T1 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100066	0.01	0.02	3000
100067	0.012	0.02	3000
100068	0.015	0.02	3000
100069	0.018	0.02	3000
100070	0.022	0.02	3000
100071	0.027	0.02	3000
100072	0.033	0.02	3000
100073	0.039	0.02	3000
100074	0.047	0.02	3000
100075	0.056	0.02	3000
100076	0.068	0.03	2500
100077	0.082	0.04	2200
100078	0.10	0.04	2200
100079	0.12	0.05	2000
100080	0.15	0.06	1800
100081	0.18	0.07	1600
100082	0.22	0.08	1500
100083	0.27	0.10	1400
100084	0.33	0.12	1300
100085	0.39	0.15	1150
100086	0.47	0.20	1000
100087	0.56	0.25	900
100088	0.68	0.30	800
100089	0.82	0.35	750
100090	1.0	0.40	700

a	b	c	d	e	f
.2	.2	.1	.1	1.0	#24

Inductance Tolerances: 0.01 to 0.082 uH, ±20%; 0.10 to 1.0 uH ±10%.

T2 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100092	0.10	0.04	2200
100093	0.12	0.05	2000
100094	0.15	0.06	1800
100095	0.18	0.07	1600
100096	0.22	0.08	1500
100097	0.27	0.10	1400
100098	0.33	0.11	1300
100099	0.39	0.14	1200
100100	0.47	0.17	1100
100101	0.56	0.22	1000
100102	0.68	0.27	900
100103	0.82	0.30	800
100104	1.0	0.35	750
100105	1.2	0.40	700
100106	1.5	0.50	630
100107	1.8	0.70	530
100108	2.2	0.90	470
100109	2.7	1.1	420
100110	3.3	1.3	390
100111	3.9	1.5	360
100112	4.7	1.8	330
100113	5.6	2.0	310
100114	6.8	2.2	300
100115	8.2	2.4	290
100116	10	2.6	280

a	b	c	d	e	f
.2	.2	.1	.1	1.0	#24

Inductance Tolerances: 0.10 to 0.82 uH, ±10%; 1.0 to 10 uH, ±5%.

T3 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100117	10	1.1	550
100118	12	1.3	500
100119	15	1.5	450
100120	18	1.9	410
100121	22	2.3	380
100122	27	2.7	350
100123	33	3.3	320
100124	39	3.9	290
100125	47	4.7	260
100126	56	5.6	240
100127	68	6.8	220
100128	82	8.1	200
100129	100	9.7	180
100130	120	12	160
100131	150	14	150
100132	180	17	140
100133	220	20	130
100134	270	24	120
100135	330	19	130
100136	390	22	120
100137	470	27	110
100138	560	32	100
100139	680	19	130
100140	820	23	120
100141	1000	27	110

a	b	c	d	e	f
.27	.27	.2	.15	1.0	#22

Inductance Tolerance: ±5%.

T4 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100142	100	6	280
100143	120	7	260
100144	150	8	240
100145	180	10	220
100146	220	12	200
100147	270	14	180
100148	330	17	160
100149	390	20	150
100150	470	24	140
100151	560	28	130
100152	680	33	120
100153	820	39	110
100154	1000	45	100
100155	1200	31	120
100156	1500	37	110
100157	1800	44	100
100158	2200	52	90
100159	2700	61	85
100160	3300	71	80
100161	3900	82	75
100162	4700	93	70
100163	5600	105	75
100164	6800	140	60
100165	8200	160	55

a	b	c	d	e	f
.375	.375	.2	.187	1.0	#22

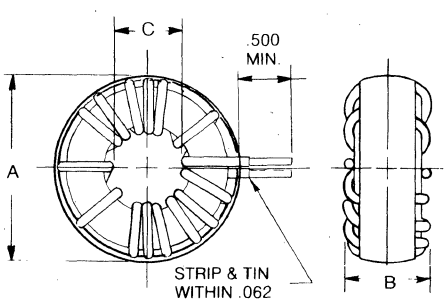
Inductance Tolerances: ±5%.

HIGH CURRENT TOROIDS

5700 SERIES

Chokes are ideal for all EMI/RFI filtering applications. They are also suitable for energy storage inductors in switching power supplies.

Miller Number	L at OADC μHy ±15%	Rated DC Amps	Min. Ind. μHy at Rated DC	DC Res. Ohms Max.	Size
5701	10	11.00	5	.003	
5702	25	5.50	12	.012	
5703	125	2.75	70	.12	1
5704	275	2.00	150	.24	
5705	450	1.50	250	.49	
5706	25	9.00	15	.012	
5707	75	5.00	40	.03	
5708	400	2.25	225	.33	2
5709	800	1.75	475	.64	
5710	1000	1.50	575	.98	
5711	50	9.50	25	.012	
5712	150	4.75	85	.046	3
5713	700	2.26	400	.42	
5714	1250	1.75	750	.85	
5715	1600	1.50	950	1.27	
5716	125	7.75	65	.032	4
5717	500	4.00	275	.15	
5718	1100	2.50	650	.33	
5719	2250	1.75	1350	.92	
5720	4500	1.25	2700	2.64	
5721	250	8.00	125	.041	
5722	900	3.75	500	.175	5
5723	1800	2.50	1000	.55	
5724	4000	1.75	2100	1.16	
5725	8000	1.00	4500	3.34	



Size	MAX. A	MAX. B	MIN. C
1	.875	.437	.187
2	1.125	.562	.312
3	1.250	.625	.375
4	1.812	.750	.750
5	2.125	.937	.625



SHIELDED SUBMINIATURE ADJUSTABLE RF COILS

Dimensions: 1/2" sq., × 5/8" high.

These compact adjustable coils offer a minimum two-to-one inductance range with relatively small changes in Q. The tuning adjustment is accessible from either the top or bottom of the coil assembly. Magnetic shielding is achieved through the use of cup cores while the metal shield offers effective electrostatic shielding. Printed circuit terminals on base and shield.

Miller Part No.	Inductance Min.	Inductance Max.	R Ohms Max.
9050	1.5 uH	3.0 uH	.66
9051	3.0 uH	7.0 uH	.85
9052	7.0 uH	14.0 uH	1.38
9053	14.0 uH	28.0 uH	2.10
9054	28.0 uH	60.0 uH	3.00
9055	6.0 uH	120.0 uH	4.00
9056	120.0 uH	280.0 uH	5.75
9057	280.0 uH	650.0 uH	12.00
9058	650.0 uH	1.3 mH	15.00
9059	1.3 mH	3.0 mH	23.00
9059-1	1.8 mH	2.2 mH	10.00
9060	3.0 mH	10.0 mH	76.00
9061	8.0 mH	20.0 mH	110.00
9062	15.0 mH	40.0 mH	150.00
9063	20.0 mH	60.0 mH	175.00

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MOLDED RF CHOKES

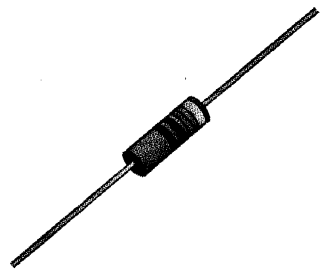
Miller Part No.	Induct. Micro-henries ±10%	Max. D.C. Resis-tance	Milli-amp Rating Max.	Mold Size
9230-94	.10	.07	1100	E
9230-96	.12	.08	1100	E
9230-00	.15	.10	1100	E
9230-02	.18	.12	1010	E
9230-04	.22	.14	935	E
9230-06	.27	.16	875	E
9230-08	.33	.20	780	E
9230-10	.39	.30	640	E
9230-12	.47	.35	590	E
9230-14	.56	.50	495	E
9230-16	.68	.60	450	E
9230-18	.82	.85	380	E
9230-20	1.00	1.00	350	E
9230-22	1.20	.18	825	E
9230-24	1.50	.22	745	E
9230-26	1.80	.30	640	E
9230-28	2.20	.40	550	E
9230-30	2.70	.50	495	E
9230-32	3.30	.85	380	E
9230-34	3.90	1.00	350	E
9230-36	4.70	1.20	320	E
9230-38	5.60	1.80	260	E
9230-40	6.80	2.00	245	E
9230-42	8.20	2.70	210	E
9230-44	10.00	3.70	180	E
9230-46	12.00	2.70	210	E
9230-48	15.00	2.80	205	E
9230-50	18.00	3.10	195	E
9230-52	22.00	3.30	190	E
9230-54	27.00	3.50	185	E
9230-56	33.00	3.40	187	E
9230-58	39.00	3.60	180	E
9230-60	47.00	4.50	165	E
9230-62	56.00	5.70	145	E
9230-64	68.00	6.70	135	E
9230-66	82.00	7.30	130	E
9230-68	100.00	8.00	125	E
9230-70	120.00	13.00	97	E
9230-72	150.00	15.00	85	E
9230-74	180.00	17.00	79	E
9230-76	220.00	21.00	73	E
9230-78	270.00	25.00	65	E
9230-80	330.00	28.00	62	E
9230-82	390.00	35.00	55	E
9230-84	470.00	42.00	50	E
9230-86	560.00	46.00	48	E
9230-88	680.00	60.00	42	E
9230-90	820.00	65.00	40	E
9230-92	1000.00	72.00	38	E

Miller Part No.	Induct. Micro-henries ±10%	Max. D.C. Resis-tance	Milli-amp Rating Max.	Mold Size
9310-00	.15*	.03	2450	D
9310-02	.22*	.055	1900	D
9310-04	.33*	.09	1400	D
9310-06	.47*	.12	1225	D
9310-07	.56	.135	1220	D
9310-08	.68	.15	1100	D
9310-10	.82	.22	900	D
9310-12	1.00	.29	830	D
9310-14	1.20	.42	650	D
9310-16	1.50	.50	600	D
9310-18	1.80	.65	525	D
9310-20	2.20	.95	435	D
9310-22	2.70	1.20	385	D
9310-24	3.30	2.00	300	D
9310-26	3.90	2.30	280	D
9310-28	4.70	2.60	260	D
9310-30	5.60	.32	750	D
9310-32	6.80	.50	600	D
9310-34	8.20	.60	545	D
9310-36	10.0	.90	445	D
9310-38	12.0	1.10	404	D
9310-40	15.0	1.40	370	D
9310-42	18.0	2.25	280	D
9310-44	22.0	2.50	265	D
9310-46	24.0	2.50	265	D
9310-48	27.0	2.60	260	D
9310-50	30.0	2.80	255	D
9310-52	33.0	3.00	250	D

Miller Part No.	Induct. Micro-henries ±5%	Max. D.C. Resis-tance	Milli-amp Rating Max.	Mold Size
9210-54	36	2.50	180	D
9210-56	39	2.60	176	D
9210-58	43	2.70	172	D
9210-60	47	2.75	170	D
9210-62	51	2.85	167	D
9210-64	56	3.00	164	D
9210-66	62	3.15	160	D
9210-68	68	3.30	156	D
9210-70	75	3.70	147	D
9210-72	82	3.90	143	D
9210-74	91	4.30	136	D
9210-76	100	4.50	133	D
9210-78	110	4.90	128	D
9210-80	120	5.20	124	D
9210-82	130	5.45	121	D
9210-84	150	6.05	114	D
9210-86	160	6.40	111	D
9210-88	180	6.75	108	D
9210-90	200	7.10	106	D
9210-92	220	7.45	103	D
9210-94	240	7.80	101	D

ELECTROMAGNETIC SHIELDING

Part No.	Induct. Micro-henries ±10%	Max. D.C. Resis-tance	Milli-amp Rating Max.	Mold Size
9250-101	0.10	.025	1790	F
9250-121	.12	.034	1530	F
9250-151	.15	.037	1470	F
9250-181	.18	.047	1300	F
9250-221	.22	.067	1100	F
9250-271	.27	.11	855	F
9250-331	.33	.13	780	F
9250-391	.39	.18	670	F
9250-471	.47	.25	565	F
9250-561	.56	.33	490	F
9250-681	.68	.45	420	F
9250-821	.82	.59	370	F
9250-102	1.00	.07	1070	F
9250-122	1.20	.10	895	F
9250-152	1.50	.12	815	F
9250-182	1.80	.14	775	F
9250-222	2.20	.19	650	F
9250-272	2.70	.28	535	F
9250-332	3.30	.35	480	F
9250-392	3.90	.40	450	F
9250-472	4.70	.55	380	F
9250-562	5.60	.72	335	F
9250-682	6.80	1.02	280	F
9250-822	8.20	1.32	250	F
9250-103	10.0	1.62	220	F
9250-123	12.0	2.00	200	F
9250-153	15.0	.80	315	F
9250-183	18.0	.89	300	F
9250-223	22.0	.96	290	F
9250-273	27.0	1.19	260	F
9250-333	33.0	1.37	240	F
9250-393	39.0	1.93	205	F
9250-473	47.0	2.11	195	F
9250-563	56.0	2.23	190	F
9250-683	68.0	2.70	170	F
9250-823	82.0	2.44	180	F
9250-104	100.0	3.12	160	F
9250-124	120.0	3.60	150	F
9250-154	150.0	4.10	140	F
9250-184	180.0	4.40	135	F
9250-224	220.0	5.00	125	F
9250-274	270.0	5.80	115	F
9250-334	330.0	6.40	110	F
9250-394	390.0	7.40	105	F
9250-474	470.0	9.50	92	F
9250-564	560.0	10.5	90	F
9250-684	680.0	11.8	80	F
9250-824	820.0	13.0	80	F
9250-105	1,000.0	17.5	70	F
9250-125	1,200.0	22.1	60	F
9250-155	1,500.0	26.5	55	F
9250-185	1,800.0	29.9	50	F
9250-225	2,200.0	33.8	50	F
9250-275	2,700.0	47.3	40	F
9250-335	3,300.0	53.0	40	F
9250-395	3,900.0	73.8	35	F
9250-475	4,700.0	81.6	31	F
9250-565	5,600.0	98.9	28	F
9250-685	6,800.0	111.0	27	F
9250-825	8,200.0	119.0	26	F
9250-106	10,000.0	137.0	24	F
9250-126	12,000.0	143.0	23	F
9250-156	15,000.0	157.0	22	F
9250-186	18,000.0	175.0	21	F
9250-226	22,000.0	274.0	17	F
9250-276	27,000.0	308.0	16	F
9250-336	33,000.0	343.0	15	F
9250-396	39,000.0	376.0	15	F
9250-476	47,000.0	473.0	13	F
9250-566	56,000.0	512.0	13	F
9250-686	68,000.0	580.0	12	F
9250-826	82,000.0	618.0	11	F
9250-107	100,000.0	678.0	11	F
9220-00	270	8.2	110	A
9220-02	300	8.7	107	A
9220-04	330	9.1	105	A
9220-06	360	9.6	102	A
9220-08	390	10.0	100	A
9220-10	430	10.6	97	A
9220-12	470	11.1	95	A
9220-14	500	11.6	93	A
9220-15	510	11.6	92	A
9220-16	560	12.3	91	A
9220-18	620	13.0	88	A
9220-20	680	13.7	85	A
9220-22	750	14.4	83	A
9220-24	820	15.1	81	A
9220-26	910	15.8	79	A
9220-28	1000	16.5	78	A
9220-30	1100	21.0	78	B
9220-32	1200	22.0	76	B
9220-34	1300	23.0	75	B
9220-36	1500	25.0	72	B
9220-38	1600	26.0	70	B
9220-40	1800	28.0	68	B
9220-42	2000	29.0	67	B
9220-44	2200	30.0	66	B
9220-46	2400	31.0	64	B
9220-48	2700	33.0	62	B
9220-50	3000	35.0	61	B
9220-52	3300	38.0	58	B
9220-54	3600	40.0	57	B
9220-56	3900	44.0	61	C
9220-58	4300	46.0	59	C
9220-60	4700	48.0	58	C
9220-62	5000	50.0	57	C
9220-64	5600	53.0	56	C
9220-66	6200	56.0	54	C
9220-68	6800	59.0	52	C
9220-70	7500	62.0	51	C
9220-72	8200	65.0	50	C
9220-74	9100	68.0	49	C
9220-76	10000	72.0	47	C



Mold Size	Mold Diameter	Mold Length	Lead Size	Lead Length
A	.190 ± .010	.440 ± .010	AWG #22	1.44 ± .188
B	.215 ± .010	.560 ± .010	AWG #21	1.44 ± .188
C	.240 ± .010	.740 ± .010	AWG #20	1.44 ± .188
D	.155 ± .010	.375 ± .010	AWG #22	1.44 ± .188
E	.095 ± .010	.250 ± .010	AWG #24	1.50 ± .188
F	.162 ± .010	.41 ± .010	AWG #22	1.44 ± .188

SERIES S,M,L.

Series	Lengths	Diameter	Lead Size	Lead Length
S	.44 max.	.188 max.	#22 AWG	1.3 min.
M	.60 max.	.25 max.	#21 AWG	1.3 min.
L	.90 max.	.31 max.	#21 AWG	1.3 min.

SERIES S

.1-22uH ± 10%
Above 22uH ± 5%

Part Number	L-Micro-Henries	Max DC Res. Ohms	Max. I mA
100170	0.10	0.02	4000
100171	0.12	0.025	3500
100172	0.15	0.03	3000
100173	0.18	0.03	3000
100174	0.22	0.03	3000
100175	0.27	0.04	2700
100176	0.33	0.05	2500
100177	0.39	0.08	2000
100178	0.47	0.08	2000
100179	0.56	0.10	1700
100180	0.68	0.12	1500
100181	0.82	0.18	1300
100182	1.0	0.24	1100
100183	1.2	0.35	1000
100184	1.5	0.43	850
100185	1.8	0.65	720
100186	2.2	0.80	610
100187	2.7	0.12	1600
100188	3.3	0.15	1400
100189	3.9	0.23	1200
100190	4.7	0.30	1000
100191	5.6	0.45	900
100192	6.8	0.55	800
100193	8.2	0.65	720
100194	10.0	0.73	650
100195	12.0	1.1	590
100196	15.0	1.4	500
100197	18.0	1.6	460
100198	22.0	1.8	430
100199	27.0	2.7	360
100200	33.0	3.5	300
100201	39.0	3.8	290
100202	47.0	4.0	275
100203	56.0	4.4	265
100204	68.0	4.7	250
100205	82.0	5.3	235
100206	100.0	6.0	220

SERIES M

1-22uH ± 10%
Above 22uH ± 5%

Part Number	L-Micro-Henries	Max DC Res. Ohms	Max. I mA
100207	1.0	0.04	2700
100208	1.2	0.04	2700
100209	1.5	0.04	2700
100210	1.8	0.05	2500
100211	2.2	0.05	2500
100212	2.7	0.05	2500
100213	3.3	0.05	2500
100214	3.9	0.07	2100
100215	4.7	0.09	1800
100216	5.6	0.14	1550
100217	6.8	0.17	1300
100218	8.2	0.25	1150
100219	10.0	0.32	1000
100220	12.0	0.47	870
100221	15.0	0.62	730
100222	18.0	0.72	660
100223	22.0	0.8	600
100224	27.0	1.2	520
100225	33.0	1.5	450
100226	39.0	2.3	380
100227	47.0	3.0	300
100228	56.0	4.2	270
100229	68.0	5.2	250
100230	82.0	6.2	220
100231	100.0	7.0	200
100232	120.0	7.5	200
100233	150.0	8.0	190
100234	180.0	9.0	185
100235	220.0	10.0	180

SERIES M *Continued*

Part Number	L-Micro-Henries	Max DC Res. Ohms	Max. I mA
100236	270.0	11.0	172
100237	330.0	12.0	165
100238	390.0	13.0	157
100239	470.0	14.0	150
100240	560.0	16.0	145
100241	680.0	17.0	140
100242	820.0	19.0	132
100243	1000.0	21.0	125

SERIES L

10-22uH ± 10%
Above 22uH ± 5%

100244	10.0	0.15	1800
100245	12.0	0.23	1600
100246	15.0	0.3	1300
100247	18.0	0.4	1150
100248	22.0	0.5	1000
100249	27.0	0.6	900
100250	33.0	0.7	850
100251	39.0	1.1	720
100252	47.0	1.3	620
100253	56.0	1.8	540
100254	68.0	2.4	450
100255	82.0	2.8	425
100256	100.0	3.2	400
100257	120.0	4.8	360
100258	150.0	6.4	280
100259	180.0	9.5	240
100260	220.0	12.0	200
100261	270.0	13.0	195
100262	330.0	14.0	190
100263	390.0	15.5	180
100264	470.0	17.0	170
100265	560.0	18.5	165
100266	680.0	20.0	155
100267	820.0	22.0	150
100268	1000.0	24.0	145
100269	1200.0	27.0	137
100270	1500.0	29.0	130
100271	1800.0	32.0	125
100272	2200.0	35.0	120
100273	2700.0	40.0	112
100274	3300.0	45.0	105
100275	3900.0	49.0	100
100276	4700.0	53.0	95
100277	5600.0	60.0	90
100278	6800.0	67.0	85
100279	8200.0	75.0	82
100280	10000.0	90.0	80

VERTICAL MOUNTED PRINTED CIRCUIT ADJUSTABLE RF COILS



Approx. .5 Dia. × .75 High

Miller Part No.	Inductance Min.	Inductance Max.	R Ohms Max.
23A107RPC	.095 uH	.125 uH	.02
23A157RPC	.130 uH	.170 uH	.02
23A227RPC	.185 uH	.265 uH	.02
23A337RPC	.285 uH	.410 uH	.03
23A477RPC	.420 uH	.580 uH	.03
23A687RPC	.540 uH	.850 uH	.03
23A827RPC	.640 uH	1.00 uH	.03
23A106RPC	.760 uH	1.25 uH	.04
23A156RPC	1.20 uH	1.87 uH	.06
23A226RPC	1.65 uH	2.75 uH	.14
23A336RPC	2.40 uH	4.10 uH	.17
23A476RPC	3.40 uH	5.80 uH	.24
23A686RPC	4.60 uH	8.50 uH	.39
23A826RPC	5.60 uH	10.00 uH	.64
23A125RPC	7.10 uH	12.50 uH	.77
23A155RPC	10.00 uH	18.70 uH	1.68
23A225RPC	14.80 uH	27.50 uH	1.91
23A335RPC	22.00 uH	41.00 uH	2.34
23A475RPC	31.00 uH	58.00 uH	2.72
23A685RPC	43.50 uH	85.00 uH	3.30
23A825RPC	61.00 uH	100.00 uH	3.89
23A104RPC	76.00 uH	125.00 uH	4.39
23A154RPC	105.00 uH	187.00 uH	5.46
23A224RPC	160.00 uH	275.00 uH	6.70
23A334RPC	240.00 uH	410.00 uH	8.30
23A474RPC	360.00 uH	580.00 uH	10.50
23A684RPC	530.00 uH	85.00 uH	12.90
23A824RPC	700.00 uH	1.00 mH	14.90
23A103RPC	910.00 uH	1.25 mH	17.10
23A153RPC	990.00 uH	1.87 mH	28.20
23A223RPC	1.60 mH	2.75 mH	34.80
23A333RPC	2.40 mH	4.10 mH	42.90
23A473RPC	3.40 mH	5.80 mH	51.60
23A683RPC	5.15 mH	8.50 mH	63.60
23A823RPC	7.40 mH	10.00 mH	75.60
23A102RPC	9.80 mH	12.50 mH	87.80
23A152RPC	12.00 mH	18.70 mH	111.00
23A222RPC	12.10 mH	27.50 mH	197.00
23A332RPC	18.20 mH	41.00 mH	244.00
23A472RPC	27.50 mH	58.00 mH	302.00
23A682RPC	40.00 mH	85.00 mH	378.00
23A822RPC	50.00 mH	100.00 mH	423.00
23A101RPC	62.00 mH	125.00 mH	468.00

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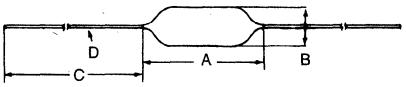
SUB-MINIATURE RF CHOKES



.1–1 uH ± 20%
1.2–15 uH ± 10%
Above 15 uH ± 5%

Miller Part No.	Inductance Nominal*	D.C. Resistance Max.	Milli-amp Rating Max.
70F107AP	.10 uh*	.013	3922
70F157AP	.15 uh*	.025	2828
70F227AP	.22 uh*	.038	2294
70F337AP	.33 uh*	.070	1690
70F477AP	.47 uh*	.125	1264
70F687AP	.68 uh*	.200	1000
70F757AP	.75 uh*	.264	870
70F827AP	.82 uh*	.290	830
70F106AI	1.0 uh	.048	2041
70F126AI	1.2 uh	.072	1666
70F156AI	1.5 uh	.096	1443
70F186AI	1.8 uh	.096	1443
70F226AI	2.2 uh	.156	1132
70F276AI	2.7 uh	.168	1091
70F336AI	3.3 uh	.240	912
70F396AI	3.9 uh	.264	870
70F476AI	4.7 uh	.457	661
70F566AI	5.6 uh	.492	637
70F686AI	6.8 uh	.624	566
70F756AI	7.5 uh	.624	566
70F826AI	8.2 uh	.744	518
70F916AI	9.1 uh	1.44	288
70F105AI	10 uh	1.56	277
70F125AI	12 uh	1.68	267
70F155AI	15 uh	1.92	250
70F185AI	18 uh	2.28	229
70F225AI	22 uh	2.28	229
70F255AI	25 uh	2.64	213
70F275AI	27 uh	2.64	213
70F335AI	33 uh	2.76	208
70F395AI	39 uh	3.36	188
70F475AI	47 uh	3.36	188
70F565AI	56 uh	3.84	176
70F685AI	68 uh	4.20	169
70F755AI	75 uh	4.56	162
70F825AI	82 uh	4.80	158
70F915AI	91 uh	4.92	156
70F104AI	100 uh	7.68	139
70F124AI	120 uh	8.16	135
70F154AI	150 uh	8.16	135
70F184AI	180 uh	8.16	135
70F204AI	200 uh	10.3	120
70F224AI	220 uh	11.5	114
70F254AI	250 uh	12.1	111
70F274AI	270 uh	13.2	106
70F304AI	300 uh	13.2	106
70F334AI	330 uh	13.9	103
70F354AI	350 uh	14.4	102
70F394AI	390 uh	15.8	97
70F474AI	470 uh	16.3	95
70F504AI	500 uh	18.0	91
70F564AI	560 uh	19.2	88
70F684AI	680 uh	19.8	87
70F754AI	750 uh	22.9	80
70F824AI	820 uh	22.9	80
70F914AI	910 uh	24.0	79
70F103AI	1.00 mh	24.0	79
70F123AI	1.20 mh	33.6	66
70F153AI	1.50 mh	37.2	63
70F183AI	1.80 mh	42.0	59
70F223AI	2.20 mh	45.6	57
70F253AI	2.50 mh	45.6	57
70F273AI	2.70 mh	45.6	57
70F333AI	3.30 mh	51.6	53
70F393AI	3.90 mh	57.6	51
70F473AI	4.70 mh	64.8	48
70F563AI	5.60 mh	69.6	46
70F683AI	6.80 mh	78.0	43
70F753AI	7.50 mh	85.2	41
70F823AI	8.20 mh	92.4	40
70F913AI	9.10 mh	98.4	39
70F102AI	10.0 mh	101	38
70F122AI	12 mh	100	50
70F152AI	15 mh	113	47
70F182AI	18 mh	128	44
70F222AI	22 mh	144	41
70F252AF	25 mh	115	46
70F272AF	27 mh	120	45
70F332AF	33 mh	134	43
70F392AF	39 mh	147	41
70F472AF	47 mh	168	38
70F502AF	50 mh	175	37
70F562AF	56 mh	189	36
70F682AF	68 mh	215	34
70F752AF	75 mh	222	33
70F822AF	82 mh	238	32
70F912AF	91 mh	250	31
70F101AF	100 mh	278	29
70F121AF	120 mh	288	48
70F151AF	150 mh	328	44
70F181AF	180 mh	374	41
70F221AF	220 mh	424	39
70F251AF	250 mh	468	37
70F271AF	270 mh	490	36
70F331AF	330 mh	540	34
70F391AF	390 mh	617	33
70F471AF	470 mh	704	30
70F501AF	500 mh	736	30

HIGH QUALITY COMMERCIAL CONFORMAL COATED INDUCTORS



Type 77

Part Number	L ± 10% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
77F1R0K	1.0	45	25.2	157	0.17	920
77F1R2K	1.2	50	7.96	144	0.21	880
77F1R5K	1.5	50	7.96	131	0.23	830
77F1R8K	1.8	55	7.96	121	0.25	790
77F2R2K	2.2	55	7.96	110	0.28	750
77F2R7K	2.7	60	7.96	100	0.30	720
77F3R3K	3.3	65	7.96	94	0.34	670
77F3R9K	3.9	65	7.96	86	0.37	640
77F4R7K	4.7	70	7.96	80	0.39	620
77F5R6K	5.6	70	7.96	74	0.43	590
77F6R8K	6.8	75	7.96	68	0.48	550
77F8R2K	8.2	80	7.96	53	0.52	530
77F100K	10	85	7.96	45	0.58	500
77F120K	12	75	2.52	34	0.63	480
77F150K	15	70	2.52	20	0.72	460
77F180K	18	65	2.52	14	0.77	430
77F220K	22	60	2.52	9.9	0.84	410
77F270K	27	55	2.52	7.6	0.94	390

Part Number	L ± 5% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
77F330J	33	55	2.52	6.3	1.03	370
77F390J	39	50	2.52	6.3	1.12	350
77F470J	47	45	2.52	6.3	1.22	340
77F560J	56	40	2.52	6.2	1.34	320
77F680J	68	40	2.52	5.7	1.47	305
77F820J	82	35	2.52	5.3	1.62	290
77F101J	100	30	2.52	4.8	1.80	275
77F121J	120	70	0.796	3.8	3.70	185
77F151J	150	70	0.796	3.5	4.20	175
77F181J	180	70	0.796	3.3	4.60	165
77F221J	220	70	0.796	3.0	5.10	155
77F271J	270	65	0.796	2.8	5.80	145
77F331J	330	65	0.796	2.6	6.40	137
77F391J	390	65	0.796	2.4	7.00	133
77F471J	470	60	0.796	2.25	7.70	126
77F561J	560	60	0.796	2.1	8.50	120
77F681J	680	55	0.796	1.95	9.40	113
77F821J	820	55	0.796	1.85	10.5	105
77F102J	1000	50	0.796	1.40	14.0	100

Type 78

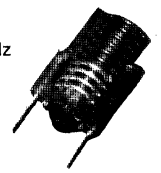
Part Number	L ± 20% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
78FR10M	0.10	40	25	400	0.06	500
78FR12M	0.12	40	25	400	0.06	500
78FR15M	0.15	40	25	400	0.07	500
78FR18M	0.18	40	25	400	0.08	450

Part Number	L ± 10% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
78FR22K	0.22	40	25	380	0.08	1025
78FR27K	0.27	40	25	360	0.08	950
78FR33K	0.33	40	25	350	0.08	815
78FR38K	0.39	40	25	320	0.09	700
78FR47K	0.47	40	25	300	0.10	650
78FR56K	0.56	40	25	280	0.11	545
78FR68K	0.68	40	25	250	0.12	495
78FR82K	0.82	40	25	200	0.12	415
78F1R0K	1.0	40	25	180	0.15	385
78F1R2K	1.2	40	7.9	165	0.18	590
78F1R5K	1.5	45	7.9	150	0.20	535
78F1R8K	1.8	50	7.9	125	0.25	455
78F2R2K	2.2	50	7.9	110	0.28	395
78F2R7K	2.7	50	7.9	95	0.30	355

Part Number	L ± 5% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
78F3R3J	3.3	50	7.9	70	0.34	270
78F3R9J	3.9	45	7.9	65	0.32	250
78F4R7J	4.7	45	7.9	50	0.35	230
78F5R6J	5.6	45	7.9	40	0.40	185
78F6R8J	6.8	40	7.9	30	0.45	175
78F8R2J	8.2	40	7.9	28	0.55	155
78F100J	10	40	2.5	22	0.72	130
78F120J	12	45	2.5	20	0.80	155
78F150J	15	50	2.5	16	0.88	150
78F180J	18	50	2.5	15	1.00	145
78F220J	22	50	2.5	13	1.20	140
78F270J	27	50	2.5	11	1.35	135
78F330J	33	50	2.5	10	1.50	193
78F390J	39	50	2.5	9.5	1.70	185
78F470J	47	60	2.5	8.5	2.30	167
78F560J	56	60	2.5	7.5	2.60	150
78F680J	68	60	2.5	6.5	2.90	137
78F820J	82	60	2.5	6.0	3.20	132
78F101J	100	60	2.5	5.5	3.50	125
78F121J	120	60	0.79	5.4	3.80	100
78F151J	150	60	0.79	4.7	4.40	90
78F181J	180	60	0.79	4.3	5.00	84
78F221J	220	60	0.79	4.0	5.70	76
78F271J	270	60	0.79	3.7	6.50	70
78F331J	330	60	0.79	3.4	9.50	65
78F391J	390	60	0.79	2.8	10.50	60
78F471J	470	60	0.79	2.5	11.60	53
78F561J	560	60	0.79	2.3	13.00	51
78F681J	680	60	0.79	2.0	18.00	45
78F821J	820	60	0.79	1.5	23.00	43
78F102J	1000	60	0.79	1.2	26.00	41

	A	B	C (Nom.)	D
77F DIMENSIONS				
Max.	.410	.157	1.0	.025
78F DIMENSIONS				
Max.	.280	.110	1.0	.020

48A SERIES

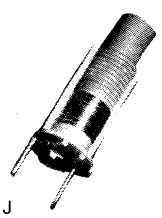


Frequency range: 30-250 MHz
Form length: .73
OD at base: .62
Lead spacing: .408
Wire size: AWG 20 TCW
Core: 10-32 × 3/8 Carbonyl J

For equipment operating in the 30–250 MHz range. These coils have unsurpassed stability and uniformity of electrical parameters. Polypropylene is molded around an accurately positioned winding.

Miller Part No.	L uH Min.	L uH Nom.	L uH Max.	Q Min.	I, dc Max. A	No Turns
48A518MPC	.046	.051	.055	100	2	1 1/2
48A778MPC	.071	.077	.082	100	2	2 1/2
48A117MPC	.099	.111	.122	100	2	3 1/2
48A147MPC	.118	.138	.157	100	2	4 1/2
48A187MPC	.15	.179	.207	100	2	5 1/2
48A227MPC	.181	.215	.278	100	2	6 1/2
48A257MPC	.209	.246	.283	100	2	7 1/2
48A287MPC	.241	.284	.316	100	2	8 1/2
48A317MPC	.27	.311	.351	100	2	9 1/2

49A SERIES



Form length: 1.05
OD at base: .46
Coil OD: .285
Lead spacing: .324
Wire size: AWG 22 polyurethane coated, with tinned leads
Core: 10-32 × 3/8 Carbonyl J

For equipment operating in the 10–250 MHz range. These coils have unsurpassed stability and uniformity of electrical parameters. Polypropylene is molded around an accurately positioned winding.

Miller Part No.	L uH Min.	L uH Nom.	L uH Max.	Q Min.	I, dc Max. A	No Turns
49A678MPC	.06	.067	.074	100	1.5	2 1/3
49A127MPC	.1	.116	.132	100	1.5	3 1/3
49A167MPC	.134	.164	.194	100	1.5	4 1/3
49A217MPC	.17	.214	.258	100	1.5	5 1/3
49A347MPC	.25	.338	.415	100	1.5	7 1/3
49A537MPC	.393	.525	.657	70	1.5	10 1/3
49A757MPC	.6	.75	.9	70	1.5	14 1/3
49A997MPC	.81	.99	1.16	70	1.5	18 1/3
49A126MPC	.96	1.15	1.34	70	1.5	21 1/3
49A146MPC	1.18	1.36	1.53	70	1.5	24 1/3

ADJUSTABLE RF COILS



.40 Sq. × .56 High

Ideal for communications applications in the 30–250 MHz range.

Miller Part No.	L. Min. uH	Q Min. at L Min.	L. Max. uH	Q. Min. at L Max.	Test Freq. MHz
SHIELDED					
4901-S	.037	90	.039	85	80
4902-S	.059	100	.071	95	75
4903-S	.086	105	.107	90	75
4904-S	.117	90	.159	90	50
4905-S	.150	90	.208	80	45
4906-S	.184	85	.262	70	45
4907-S	.188	85	.311	65	45
4908-S	.258	85	.363	60	45
4909-S	.296	85	.417	55	45
4910-S	.335	80	.454	50	45
UNSHIELDED					
4901	.041	113	.050	136	80
4902	.070	155	.100	139	75
4903	.103	147	.152	133	75
4904	.148	146	.252	162	50
4905	.193	138	.337	142	45
4906	.238	137	.417	122	45
4907	.286	135	.508	105	45
4908	.339	126	.600	89	45
4909	.390	132	.691	76	45
4910	.460	128	.788	72	45

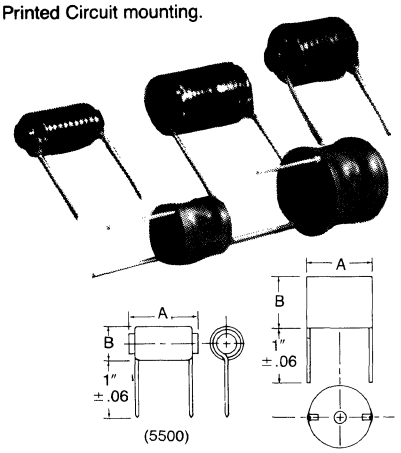
J.W. MILLER DIVISION, BELL INDUSTRIES/DEPT. EM • 306 E. Alondra Blvd. • Gardena, CA 90247 • 213-515-1720 • FAX 213-515-1962

HIGH CURRENT FILTER CHOKES

Chokes are ideal for all EMI/RFI filtering applications. They're also suitable for energy storage inductors in switching power supplies.

Covered with shrink tubing and varnish impregnated.

Printed Circuit mounting.



5500 SERIES
HIGH SATURATION FLUX DENSITY FERRITE RODS

Miller Part No.	L uH ±10%	R,dc Max. Ohms	I,dc Max. Amps	Dim. A Max.	Dim. B Max.
5501	5	.013	10	.88	.63
5502	10	.017	9	1.12	.63
5503	27	.030	7	.88	.81
5504	50	.045	5.6	1.12	.81
5505	100	.061	4.9	1.12	.81
5506	150	.069	4.6	1.38	.81
5507	250	.089	4	1.62	.81
5508	5	.009	14	.88	.64
5509	10	.012	12	1.12	.64
5510	27	.022	9	.88	.88
5511	50	.028	8	1.12	.88
5512	68	.034	7.3	1.12	.88
5513	100	.038	6.8	1.38	.88
5514	150	.046	6.3	1.62	.88
5515	5	.006	19	1.12	.69
5516	10	.008	16	1.38	.69
5517	27	.014	12.5	1.12	.94
5518	50	.020	10.5	1.38	.94
5519	68	.023	10	1.38	.94
5520	100	.027	10	1.62	.94
5521	5	.004	23	1.38	.72
5522	10	.006	20	1.69	.72
5523	27	.010	15	1.38	1
5524	50	.013	15	1.62	1

5600 SERIES
HIGH SATURATION FLUX DENSITY FERRITE BOBBINS

Miller Part No.	L uH ±10%	R,dc Max. Ohms	I,dc Max. Amps	Dim. A Max.	Dim. B Max.
5601	5	.007	15	.83	.91
5602	10	.008	14	.83	.91
5603	25	.023	8	.83	.91
5604	50	.034	6.6	.83	.91
5605	100	.072	4.5	.83	.91
5606	250	.173	2.9	.83	.91
5607	500	.378	2	.83	.91
5608	1,000	.801	1.3	.83	.91
5609	2,500	2.04	.85	.83	.91
5610	5	.005	20	1.22	1.11
5611	10	.006	17	1.22	1.11
5612	25	.009	14	1.22	1.11
5613	50	.017	10	1.22	1.11
5614	100	.034	7	1.22	1.11
5615	250	.083	4.6	1.22	1.11
5616	500	.129	3.7	1.22	1.11
5617	1,000	.279	2.5	1.22	1.11
5618	2,500	.690	1.6	1.22	1.11
5619	50	.012	14	1.50	1.11
5620	100	.025	9.8	1.50	1.11
5621	250	.059	6.4	1.50	1.11
5622	500	.090	5	1.50	1.11
5623	1,000	.195	3.5	1.50	1.11
5624	2,500	.499	2.2	1.50	1.11
5625	5,000	1.08	1.5	1.50	1.11
5626	100	.018	14	1.50	1.50
5627	250	.040	9	1.50	1.50
5628	500	.085	6.5	1.50	1.50
5629	1,000	.183	4.4	1.50	1.50
5630	2,500	.464	2.8	1.5	1.50
5631	5,000	.714	2.2	1.50	1.50
5632	10,000	1.55	1.5	1.50	1.50

Inductance measured @ 1 kHz with 0 Amps D.C. current.

Typical inductance change is less than 5% @ maximum rated current.

Leads: 1" long. Tinned within 1/8" of body.

PHENOLIC CORE SINGLE WINDINGS LAYER

.27 D × .75 L



Miller Part No.	Inductance Nominal*	D.C. Resistance Max.	Milliamp Rating Max.
4602	1.0 uh	.050	2000
4604	1.5 uh	.093	1800
4606	2.4 uh	.190	1500
4608	3.9 uh	.450	1000
4609	5.5 uh	.670	850
4610	6.2 uh	.830	700
4611	8.2 uh	1.20	600
4612	10.0 uh	1.50	500

IRON CORE SINGLE LAYER WINDINGS

.29 D × .88 L



Miller Part No.	Inductance Nominal	D.C. Resistance Max.	Milliamp Rating Max.
4622	10 uh ± 5%	.11	1500
4624	15 uh ± 5%	.17	1000
4626	24 uh ± 5%	.34	800
4628	39 uh ± 5%	.65	600
4629	55 uh ± 5%	1.0	500
4630	62 uh ± 5%	1.2	475
4631	82 uh ± 5%	1.9	450
4632	100 uh ± 5%	3.0	400

PHENOLIC CORE 3-SECTION WINDINGS

.5 D × .88 L



Miller Part No.	Inductance Nominal	D.C. Resistance Max.	Milliamp Rating Max.
4642	.10 mh ± 5%	5.4	160
4644	.15 mh ± 5%	6.5	160
4646	.24 mh ± 5%	8.5	160
4648	.39 mh ± 5%	11	160
4649	.55 mh ± 5%	13	160
4650	.62 mh ± 5%	15	160
4651	.75 mh ± 5%	16	160
4652	1.0 mh ± 5%	19	160

IRON CORE 3-SECTION WINDINGS

.5 D × .88 L



Miller Part No.	Inductance @ 1000 Hertz	D.C. Resistance Max.	Milliamp Rating Max.
4662	1.0 mh ± 5%	8.6	160
4664	1.5 mh ± 5%	11	160
4666	2.4 mh ± 5%	15	160
4668	3.9 mh ± 5%	20	160
4669	5.5 mh ± 5%	25	160
4670	6.2 mh ± 5%	37	100
4671	8.2 mh ± 5%	46	100
4672	10 mh ± 5%	50	100

FERRITE CORE 3-SECTION WINDINGS

.5 D × .88 L



Miller Part No.	Inductance @ 1000 Hertz	D.C. Resistance Max.	Milliamp Rating Max.
6302	2.5 mh ± 5%	9.0	160
6304	5.0 mh ± 5%	15	160
6306	10 mh ± 5%	31	160
6308	25 mh ± 5%	82	65
6310	50 mh ± 5%	127	65

HEAVY DUTY HASH CHOKES



Part No.	µH ±20%	Ohms Max.	Amps	Dimensions
5218	3.35	.010	20	17/32" × 15/16"
5219	4.90	.016	15	1/2" × 1 1/4"
5220	8.80	.021	10	1/2" × 1 1/4"
5230	4.00	.012	8	5/16" × 23/32"
5240	40.00	.082	3	3/16" × 1 1/4"
5248	68.00	.054	5	17/32" × 1 1/4"
5250	100.00	.216	2	5/16" × 1 1/4"
5252	125.00	.080	3.5	1/2" × 1 1/4"
5254	250.00	.170	2.5	7/16" × 1 1/4"
5256	500.00	.260	2.0	3/16" × 1 1/4"
5258	1000.00	.550	1.0	1/2" × 1 1/4"

VLS SERIES VARIABLE INDUCTORS (SHIELDED)

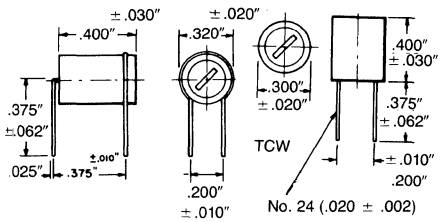
May be mounted either Vertically or Horizontally.

Printed Circuit: Mil-C-15305

Tunable Range: .10 uH–.12 uH ± 5% — All others ± 10%

Operating Temperature: −55°C to +125°C

Leads: No. 24 TCW



HORIZONTAL STYLE (OPTIONAL)

VERTICAL STYLE STANDARD

Part No.	Nom. L uH	DCR 25°C, Max. Ohms	Max. I mA	Part No.	Nom. L uH	DCR 25°C, Max. Ohms	Max. I mA
VLSR10	.10	0.030	2500	VLS121	120.00	2.38	316
VLSR12	.12	0.030	2500	VLS151	150.00	2.52	306
VLSR15	.15	0.030	2500	VLS181	180.00	2.88	288
VLSR18	.18	0.035	2400	VLS221	220.00	3.18	273
VLSR22	.22	0.038	2300	VLS271	270.00	3.50	260
VLSR27	.27	0.040	2200	VLS331	330.00	4.80	222
VLSR33	.33	0.040	2200	VLS391	390.00	5.44	209
VLSR39	.39	0.045	2100	VLS471	470.00	5.90	201
VLSR47	.47	0.045	2100	VLS561	560.00	6.30	194
VLSR56	.56	0.050	2000	VLS681	680.00	7.20	181
VLSR68	.68	0.055	1900	VLS821	820.00	8.00	172
VLSR82	.82	0.060	1800	VLS102	1,000.00	12.00	141
VLS1R0	1.00	0.070	1700	VLS122	1,200.00	13.50	132
VLS1R2	1.20	0.085	1670	VLS152	1,500.00	16.50	119
VLS1R5	1.50	0.100	1540	VLS182	1,800.00	18.00	114
VLS1R8	1.80	0.110	1470	VLS222	2,200.00	20.50	107
VLS2R2	2.20	0.120	1410	VLS272	2,700.00	22.50	102
VLS2R7	2.70	0.125	1380	VLS332	3,300.00	42.00	76
VLS3R3	3.30	0.165	1200	VLS392	3,900.00	47.50	71
VLS3R9	3.90	0.180	1135	VLS472	4,700.00	53.00	67
VLS4R7	4.70	0.245	985	VLS562	5,600.00	62.50	65
VLS5R6	5.60	0.265	950	VLS682	6,800.00	69.50	58
VLS6R8	6.80	0.330	853	VLS822	8,200.00	75.00	56
VLS8R2	8.20	0.460	720	VLS103	10,000.00	100.00	49
VLS100	10.00	0.640	620	VLS123	12,000.00	64.00	60
VLS120	12.00	0.800	545	VLS153	15,000.00	84.00	52
VLS150	15.00	0.865	520	VLS183	18,000.00	93.00	50
VLS180	18.00	0.940	504	VLS223	22,000.00	104.00	45
VLS220	22.00	1.03	460	VLS273	27,000.00	173.00	35
VLS270	27.00	1.18	418	VLS333	33,000.00	187.00	32
VLS330	33.00	1.30	398	VLS393	39,000.00	220.00	30
VLS390	39.00	1.41	385	VLS473	47,000.00	253.00	28
VLS470	47.00	1.61	350	VLS563	56,000.00	285.00	26
VLS560	56.00	2.08	330	VLS683	68,000.00	311.00	24
VLS680	68.00	2.20	320	VLS823	82,000.00	385.00	22
VLS820	82.00	2.42	300	VLS104	100,000.00	420.00	20
VLS101	100.00	2.15	333				

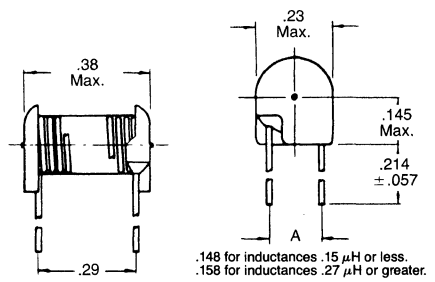
75F SERIES FIXED RF COILS

.148 for inductances .15 µH or less

.158 for inductances .27 µH or greater

For equipment operating in the 50–450 MHz range. The 75F Series of inductors have unsurpassed stability and uniformity of electrical parameters.

Polypropylene is molded around an accurately positioned winding.



.148 for inductances .15 µH or less.
.158 for inductances .27 µH or greater.

Part Number	L ± 10% uH	Q Ref.	Test Freq. MHz	Turns	A Dim.
75F238MPC	.032	105	50	2 1/2	.148
75F328MPC	.039	95	40	3 1/2	.148
75F518MPC	.049	104	40	4 1/2	.148
75F117MPC	.108	90	25	8 1/2	.148
75F157MPC	.142	90	25	10 1/2	.148
75F277MPC	.275	92	25	14 1/2	.153
75F397MPC	.364	93	25	15 1/2	.158
75F477MPC	.49	89	25	17 1/2	.159
75F597MPC	.57	92	25	19 1/2	.159

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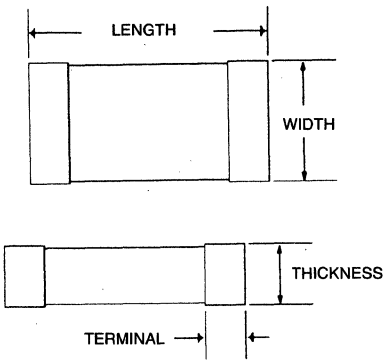
SURFACE MOUNT INDUCTIVE COMPONENTS

JWM CHIP BEADS

MATERIAL CHARACTERISTICS:

Properties	-1 Material	-2 Material
Initial permeability	180	400
Saturation flux density @ 10 Oersted	2950	2500
Curie temperature	170°C	125°C
Volume resistivity in Ohm/Cm	10^7	10^7

MARKING: On part None
On reel Manufacturers Name, Part Number, Quantity



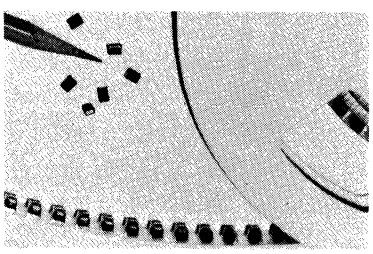
ELECTRICAL CHARACTERISTICS:

JWM Part #	Z @ 100 MHz (Ohms)	DCR Max. (Ohms)	Rated I (mA)	Length ±.2 mm	Width ±.2 mm	Thickness ±.2 mm	Terminal ±.2 mm
PMB0805-1	10	.10	600	2.00	1.25	0.90	0.30
PMB0805-2	15	.10	600	2.00	1.25	0.90	0.30
PMB1206-1	30	.12	500	3.20	1.60	1.10	0.30
PMB1206-2	35	.12	500	3.20	1.60	1.10	0.30
PMB1210-1	65	.15	400	3.20	2.50	1.30	0.30
PMB1210-2	75	.15	400	3.20	2.50	1.30	0.30
PMB1806-1	50	.18	300	4.50	1.60	1.60	0.30
PMB1806-2	60	.18	300	4.50	1.60	1.60	0.30
PMB1812-1	100	.20	300	4.50	3.20	1.50	0.30
PMB1812-2	120	.20	300	4.50	3.20	1.50	0.30

JWM PM20 CHIP INDUCTOR SERIES [1210]

JWM Part #	L (uH)	Tol. %	Q Min.	Test Freq. MHz	Min SRF MHz	Max. DCR OHMS	Rated I (MA)
PM20-R010M	0.010	20	15	100	2500	0.13	450
PM20-R012M	0.012	20	17	100	2300	0.14	450
PM20-R015M	0.015	20	19	100	2100	0.16	450
PM20-R018M	0.018	20	21	100	1900	0.18	450
PM20-R022M	0.022	20	23	100	1700	0.20	450
PM20-R027M	0.027	20	23	100	1500	0.22	450
PM20-R033M	0.033	20	25	100	1400	0.24	450
PM20-R039M	0.039	20	25	100	1300	0.27	450
PM20-R047M	0.047	20	26	100	1200	0.30	450
PM20-R056M	0.056	20	26	100	1100	0.33	450
PM20-R068M	0.068	20	27	100	1000	0.36	450
PM20-R082M	0.082	20	27	100	900	0.40	450
PM20-R10M	0.10	20	28	100	700	0.44	450
PM20-R12M	0.12	20	28	25.2	500	0.22	450
PM20-R15M	0.15	20	28	25.2	450	0.25	450
PM20-R18M	0.18	20	28	25.2	400	0.28	450
PM20-R22M	0.22	20	28	25.2	350	0.32	450
PM20-R27M	0.27	20	28	25.2	320	0.36	450
PM20-R33M	0.33	20	28	25.2	300	0.40	450
PM20-R39M	0.39	20	28	25.2	250	0.45	450
PM20-R47M	0.47	20	28	25.2	220	0.50	450
PM20-R56M	0.56	20	28	25.2	180	0.55	450
PM20-R68M	0.68	20	28	25.2	160	0.60	450
PM20-R82M	0.82	20	28	25.2	140	0.65	450
PM20-1R0K	1.0	10	28	7.96	120	0.70	400
PM20-1R2K	1.2	10	28	7.96	100	0.75	390
PM20-1R5K	1.5	10	28	7.96	85	0.85	370
PM20-1R8K	1.8	10	28	7.96	80	0.90	350
PM20-2R2K	2.2	10	30	7.96	75	1.0	320
PM20-2R7K	2.7	10	30	7.96	70	1.1	290
PM20-3R3K	3.3	10	30	7.96	60	1.2	260
PM20-3R9K	3.9	10	30	7.96	55	1.3	250
PM20-4R7K	4.7	10	30	7.96	50	1.7	220
PM20-5R6K	5.6	10	30	7.96	47	1.8	200
PM20-6R8K	6.8	10	30	7.96	43	2.0	180
PM20-8R2K	8.2	10	30	7.96	40	2.3	170
PM20-100K	10	10	30	2.52	36	2.5	150
PM20-120K	12	10	30	2.52	33	2.8	140
PM20-150K	15	10	30	2.52	30	3.2	130
PM20-180K	18	10	30	2.52	27	3.6	120
PM20-220K	22	10	30	2.52	25	4.0	110
PM20-270K	27	10	30	2.52	20	5.0	80
PM20-330K	33	10	30	2.52	17	5.6	70
PM20-390K	39	10	30	2.52	16	6.4	65
PM20-470K	47	10	30	2.52	15	7.0	60
PM20-560K	56	10	30	2.52	13	8.0	55
PM20-680K	68	10	30	2.52	12	9.0	50
PM20-820K	82	10	30	2.52	11	10	45
PM20-101K	100	10	20	0.796	10	10	40
PM20-121K	120	10	20	0.796	10	11	70
PM20-151K	150	10	20	0.796	8	15	65
PM20-181K	180	10	20	0.796	7	17	60
PM20-221K	220	10	20	0.796	7	21	50

Tighter Tolerances Available On Special Order



TESTING

Specifications and test methods can be a morass of contention between Manufacturers and Users of chip inductors, unless specifics are resolved prior to arrival at incoming inspection.
Testing procedure's vary from Manufacturer to Manufacturer. The most popular testing equipment is the HP4342A Q-meter, HP4191A Impedance Analyzer and the HP4192A Impedance Analyzer. None of these meters can be relied upon for an absolute reading so the use of correlation standards becomes a must in setting specifications.

Using the proper test fixture is also essential to correlation between 2 pieces of test equipment. This area does not have an established standard yet. Some Manufacturers use test probes, some use spring clip test fixtures and none of them contribute minimal inductance to the test equipment terminals.

The need to understand the Manufacturer's testing methods prior to selecting chip inductors for your application is important and can eliminate a lot of misunderstanding and confusion at incoming inspection.

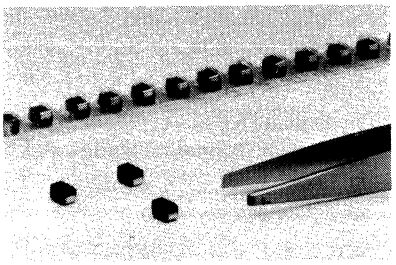
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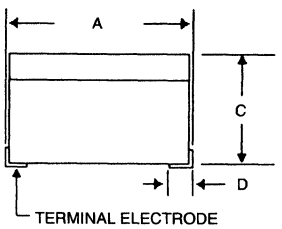
SURFACE MOUNT INDUCTIVE COMPONENTS

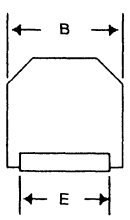
JWM PM40 CHIP INDUCTOR SERIES [1812]

JWM Part #	L (uH)	Tol. %	Q Min.	Test Freq. MHz	Min SRF MHz	Max. DCR OHMS	Rated I (MA)
PM40-R-10M	0.1	20	30	25.2	250	0.20	740
PM40-R-22M	0.22	20	30	25.2	230	0.20	740
PM40-R-27M	0.27	20	30	25.2	200	0.23	690
PM40-R-33M	0.33	20	30	25.2	180	0.25	690
PM40-R-39M	0.39	20	30	25.2	155	0.26	640
PM40-R-47M	0.47	20	30	25.2	135	0.29	610
PM40-R-56M	0.56	20	30	25.2	120	0.31	590
PM40-R-68M	0.68	20	30	25.2	110	0.35	550
PM40-R-82M	0.82	20	30	25.2	105	0.39	520
PM40-1R0M	1.0	20	40	7.96	100	0.50	450
PM40-1R2M	1.2	20	40	7.96	80	0.55	430
PM40-1R5M	1.5	20	40	7.96	70	0.60	410
PM40-1R8M	1.8	20	40	7.96	60	0.65	390
PM40-2R2M	2.2	20	40	7.96	55	0.70	380
PM40-2R7M	2.7	20	40	7.96	50	0.75	370
PM40-3R3M	3.3	20	40	7.96	45	0.80	355
PM40-3R9M	3.9	20	40	7.96	40	0.90	330
PM40-4R7M	4.7	20	40	7.96	35	1.00	315
PM40-5R6M	5.6	20	40	7.96	33	1.10	300
PM40-6R8M	6.8	20	40	7.96	27	1.20	285
PM40-8R2M	8.2	20	40	7.96	25	1.40	270
PM40-100K	10	10	40	2.52	20	1.60	250
PM40-120K	12	10	40	2.52	18	2.00	225
PM40-150K	15	10	40	2.52	17	2.50	200
PM40-180K	18	10	40	2.52	15	2.80	190
PM40-220K	22	10	40	2.52	13	3.20	180
PM40-270K	27	10	40	2.52	12	3.60	170
PM40-330K	33	10	40	2.52	11	4.00	160
PM40-390K	39	10	40	2.52	10	4.50	150
PM40-470K	47	10	40	2.52	10	5.80	140
PM40-560K	56	10	40	2.52	9.0	6.30	135
PM40-680K	68	10	40	2.52	9.0	7.10	130
PM40-820K	82	10	40	2.52	8.0	7.90	120
PM40-101K	100	10	30	0.796	8.0	8.80	110
PM40-121K	120	10	30	0.796	6.0	10.0	110
PM40-151K	150	10	30	0.796	5.0	11.0	105
PM40-181K	180	10	30	0.796	5.0	13.0	102
PM40-221K	220	10	30	0.796	4.0	13.0	100
PM40-271K	270	10	30	0.796	4.0	14.0	92
PM40-331K	330	10	30	0.796	3.5	16.0	85
PM40-391K	390	10	30	0.796	3.0	19.0	80
PM40-471K	470	10	30	0.796	3.0	31.0	62
PM40-561K	560	10	30	0.796	3.0	35.0	50
PM40-681K	680	10	30	0.796	3.0	39.0	50
PM40-821K	820	10	30	0.796	2.5	45.0	30
PM40-102K	1000	10	30	0.252	2.5	53.0	30

Tighter Tolerances Available On Special Order







Dimensions in mm

Series	Length A	Width B	Height C	Term. D	Term. E
PM20	3.2 ± .2	2.5 ± .2	2.2 ± .2	.6	1.75
PM40	4.5 ± .2	3.2 ± .2	3.2 ± .2	.7	2.50
PM20S	3.2 ± .3	2.5 ± .3	2.2 ± .3	.6	1.90

JWM PM20S (SHIELDED) CHIP INDUCTOR SERIES [1210]

JWM Part #	L (uH)	Test Freq. MHz	Tol. %	Q Min.	Test Freq. Q. MHz	Min. SRF MHz	Max. DCR. Ohms	Rated I (MA)
PM20S-100K	10	1.0	10	40	5.0	30	1.8	18
PM20S-120K	12	1.0	10	40	5.0	28	2.8	17
PM20S-150K	15	1.0	10	40	5.0	25	2.2	15
PM20S-180K	18	1.0	10	40	5.0	23	2.5	13
PM20S-220K	22	1.0	10	40	5.0	20	2.8	12
PM20S-270K	27	1.0	10	40	5.0	18	3.2	10
PM20S-330K	33	1.0	10	40	5.0	17	3.5	10
PM20S-390K	39	1.0	10	40	5.0	15	3.8	9
PM20S-470K	47	1.0	10	40	5.0	14	4.0	8
PM20S-560K	56	1.0	10	40	5.0	13	4.5	7
PM20S-680K	68	1.0	10	40	1.5	12	5.0	6
PM20S-820K	82	1.0	10	40	1.5	11	6.0	6
PM20S-101K	100	1.0	10	40	1.5	10	7.0	5
PM20S-121K	120	1.0	10	40	1.5	9	8.0	5
PM20S-151K	150	0.1	10	40	1.5	5	9.0	5
PM20S-181K	180	0.1	10	40	1.5	5	11	5
PM20S-221K	220	0.1	10	40	1.5	4	12	5
PM20S-271K	270	0.1	10	40	1.5	1	24	5

PM40/PM20 SERIES MOLDED/WOUND CHIP INDUCTORS PM20S SERIES SHIELDED CHIP INDUCTORS

ELECTRIC CHARACTERISTICS:

Inductance Range	PM20	.010 uH to 220 uH
	PM40	.10 uH to 1000 uH
	PM20S	10 uH to 270 uH
Tolerance	PM20	.010 uH to .82 uH ± 20%
		1.0 uH to 220 uH ± 10%
	PM40	.10 uH to 8.2 uH ± 20%
		10 uH to 1000 uH ± 10%
	PM20S	± 10%
Dielectric Strength		100 Vrms
Insulation Resistance		100M ohms 100 VDC, 30 sec.

PHYSICAL CHARACTERISTICS:

Operating Temperature	– 20°C to + 100°C
Soldering heat resistance	250°C for 5 seconds
Solderability	Preheat condition: 120°C for 4 minutes Solder temperature: 230°C Dwell time: 4 seconds At least 95% of electrode (terminal) shall be covered by solder
Terminal strength	3 lbs pull test
Resistance to solvents	Conforms to MIL-STD-202E
Marking	Inductance value on part Manufacturer name, Part number, Quantity and Date code on reel.

BH Electronics

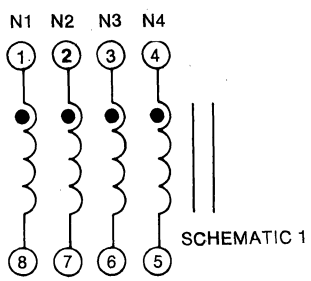
Data Communication Chokes

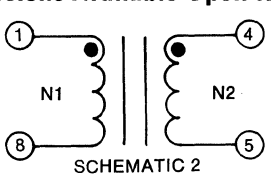
- **Intended for the rejection of RFI and EMI picked up by twisted pair Especially designed for use in baluns, telephone systems, drop lines, media filters and other high frequency data communication applications**
- **Custom designs in a wide variety of packages are available.**
- **1000 VDC isolation winding to winding and winding to core.**
- **PC Mount**
- **Surface Mount available**

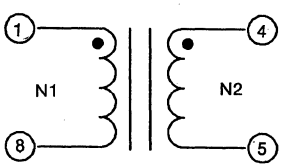
Listed below are eight typical designs. As previously manufactured parts they are available at low cost with minimal lead time. Samples are available upon request.

Part No.	Turns Ratio	Sine Wave OCL±25% @100Khz	Ciw Max. Any winding	DCR Max.	Schematic	Figure
500-1164	1:1	33 µH	20 pF	.05Ω	2	2
500-1165	1:1:1:1	27 µH	20 pF	.05Ω	1	2
500-1179	1:1:1:1	53 µH	30 pF	.1Ω	1	1
500-1266	1:1	15 mH	260 pF	1.0Ω	2	1
500-1267	1:1	125 µH	150 pF	.5Ω	2	1
500-1291	1:1	53 µH	30 pF	.1Ω	2	1
500-1299	1:1	475 µH	11 pF	.2Ω	3	3
500-1433	1:1	750 µH	15 pF	.25Ω	3	3
500-1517	1:1:1:1	50 µH MIN	20 pF	.1Ω	1	1
500-1532	1:1:1:1	12 µH	10 pF	.1Ω	1	1

Custom Versions Available Upon Request







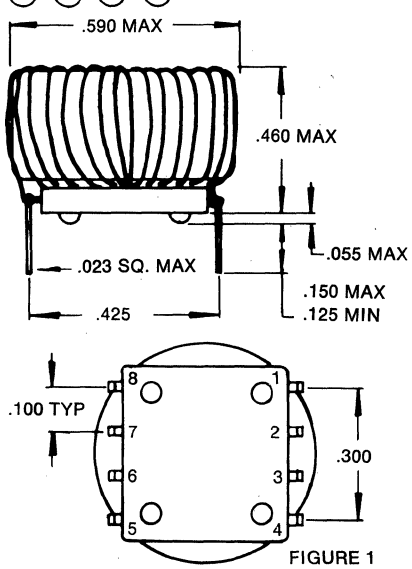


FIGURE 1

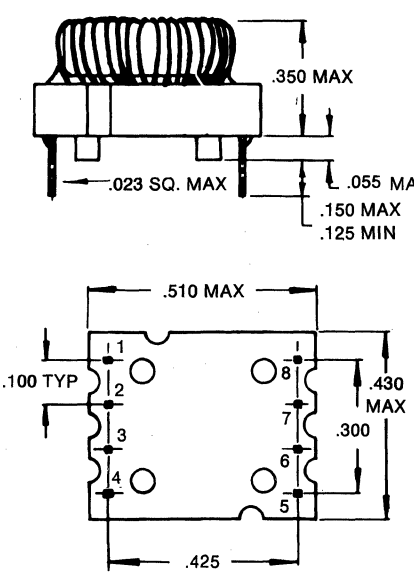


FIGURE 2

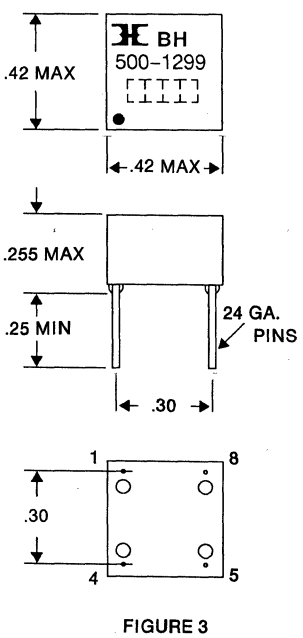


FIGURE 3

Header style may vary, pins 2, 3, 6 & 7 removed on some versions

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BH Electronics

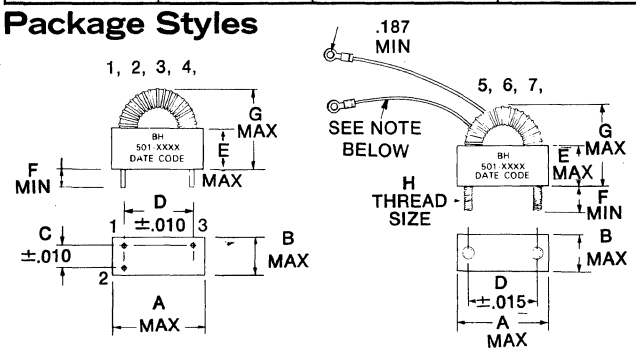
Toroid Inductors for Switching Power Supplies

- **Current Range, 1 AMP To 50 AMPS**
- **Cost Effective Design**
- **Wide Range of Inductance**
- **Maximum Temperature Rise, 40°C Above Ambient**
- **PC Mount**

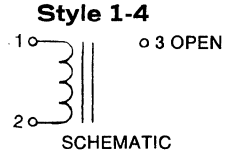
Electrical Characteristics at 25°C

BH Part Number	Rated DC Current (Amps)	Minimum Inductance At Rated DC μh	Minimum Inductance At Zero DC μh	DC Resistance Maximum Ω	Min. Energy Storage ½ LI²	Package Style	Lead Dia. Inches ±.004
501-1001	1.0	725	1400	.75	366	1	.025
501-1002	2.5	115	230	.12	366	1	.025
501-1003	2.5	370	740	.23	1166	2	.025
501-1004	4.1	40	80	.045	361	1	.032
501-1005	4.1	140	280	.086	1185	2	.032
501-1006	4.1	360	720	.177	3034	3	.032
501-1007	6.5	15	30	.018	359	1	.040
501-1008	6.5	50	100	.035	1162	2	.040
501-1009	6.5	140	280	.070	3000	3	.040
501-1010	6.5	290	580	.098	6190	4	.040
501-1011	10.0	7	14	.0075	350	1	.051
501-1012	10.0	20	40	.014	1150	2	.051
501-1013	10.0	60	120	.028	3000	3	.051
501-1014	10.0	120	240	.040	6200	4	.051
501-1015	20.0	6	12	.004	1200	5	NA
501-1016	20.0	15	30	.0072	3200	6	NA
501-1017	20.0	30	60	.010	6400	7	NA
501-1018	40.0	3.5	7.0	.0017	2800	6	NA
501-1019	40.0	7	14	.0024	5920	7	NA
501-1020	50.0	4.5	9	.0016	5875	7	NA

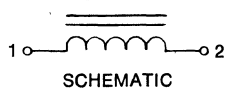
Package Styles



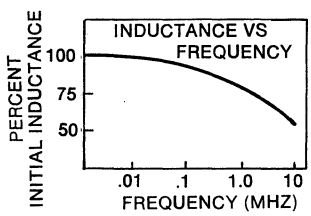
Style 1-4



Style 5-7



Typical Inductance Characteristics



Style	A	B	C	D	E	F	G	H
1	1.05 26,67	.55 13,97	.400 10,16	.800 20,32	.55 13,97	.20 5,08	1.10 27,94	N/A
2	1.45 36,83	.80 20,32	.600 15,24	.900 22,86	.58 14,73	.20 5,08	1.40 35,56	N/A
3	2.00 50,80	.95 24,13	.700 17,78	1.20 30,48	.75 19,05	.20 5,08	1.90 48,26	N/A
4	2.16 54,86	1.12 28,45	.900 22,86	1.50 38,10	1.05 26,67	.20 5,08	2.20 55,88	N/A

Style	A	B	C	D	E	F	G	H
5	1.45 36,83	.80 20,32	N/A	.900 22,86	.58 14,73	.25 6,35	1.40 15,56	6/32
6	2.00 50,80	.95 24,13	N/A	1.20 30,48	.75 19,05	.25 6,35	1.90 48,26	8/32
7	2.16 54,86	1.12 28,45	N/A	1.50 38,10	1.05 26,67	.25 6,35	2.20 55,88	10/32

NOTE: Style 5, 6, 7 Leads Cut to 6" Length/Custom Lengths Available Upon Request

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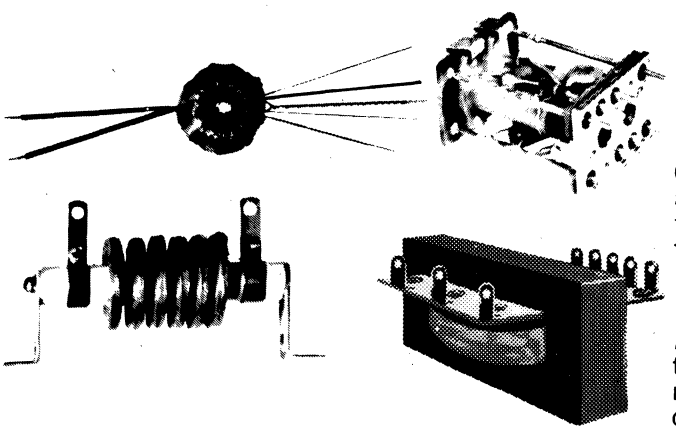
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MODIFIED STOCK COILS

Any of the coils shown on these pages can be wound to intermediate inductance values or modified to meet customer requirements, often at no additional cost.

HIGH CURRENT CHOKES

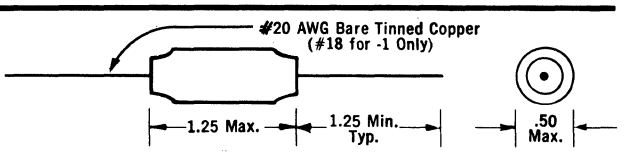
TYPE 6150 10-100μH
Recommended mounting pitch — 1.50″

FOR SWITCHING REGULATORS AND POWER FILTERS

NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on .75 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.

6150



STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance*	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	I_{NCR} I Amps
6150-1	10μH	30	2.5	.018	10	6.40	21
6150-2	20	18	2.5	.036	7.2	4.50	15
6150-3	30	12	2.5	.063	5.0	3.40	13
6150-4	40	12	2.5	.096	4.3	2.75	12
6150-5	50	10	2.5	.110	3.7	2.60	10
6150-6	75	8	2.5	.200	3.2	1.90	9
6150-7	100	26	.79	.400	2.2	1.30	7.8

*(−10, +20%)

HIGH CURRENT CHOKES

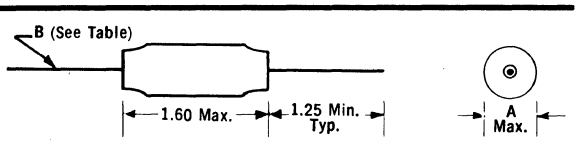
TYPE 6490 10μH-1.0mH 10% Tolerance
Recommended mounting pitch -- 1.75″

FOR SWITCHING REGULATORS AND POWER FILTERS

NOTES:

1. Inductance measured on General Radio 1650B Impedance Bridge at 1 kHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.
   Lead Wires — Bare tinned copper.

6490



STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	I_{NCR} I Amps	A Dia. In.	B Lead Size AWG
6490-1	10μH	.010	12.0	10.0	20	.65	14
6490-2	20	.017	9.0	7.7	16	.62	16
6490-3	30	.031	6.0	5.7	12	.61	18
6490-4	40	.050	5.0	4.5	11	.60	20
6490-5	50	.068	4.5	3.8	10	.59	20
6490-6	75	.13	3.4	2.8	9.0	.58	20
6490-7	100	.056	1.5	4.2	7.0	.79	18
6490-8	250	.14	0.90	2.7	4.5	.75	20
6490-9	500	.30	0.60	1.8	3.3	.72	20
6490-10	750	.56	0.45	1.3	2.6	.68	20
6490-11	1.0mH.	.80	0.35	1.1	2.3	.66	20

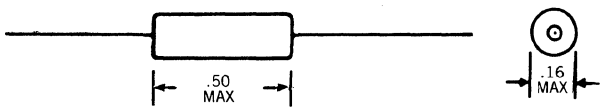
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7120-KIT LOW POWER MINIATURE INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
7120-13	10 µH	.08 Ω	970 ma
7120-15	15 µH	.13 Ω	790 ma
7120-17	22 µH	.16 Ω	640 ma
7120-19	33 µH	.20 Ω	530 ma
7120-21	47 µH	.29 Ω	430 ma
7120-23	68 µH	.44 Ω	370 ma
7120-25	100 µH	.56 Ω	300 ma
7120-27	150 µH	1.0 Ω	250 ma
7120-29	220 µH	1.6 Ω	200 ma
7120-31	330 µH	2.0 Ω	170 ma
7120-33	470 µH	2.8 Ω	140 ma
7120-37	1.0 mH	6.6 Ω	95 ma

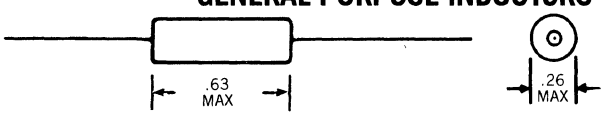
INDUCTOR SELECTION KITS FOR DESIGN ENGINEERS

These kits are intended as an aid to the designer of switching regulators, power supplies, and filters. Each kit contains an assortment of the most popular inductance values, allowing selection of the optimal inductor for a given application.

FREE REFILL ORDER FORMS are included, to replace parts as they are used or to obtain additional values not included with the kits.

FOR COMPLETE SPECIFICATIONS, SEE CATALOG DATA SHEETS.

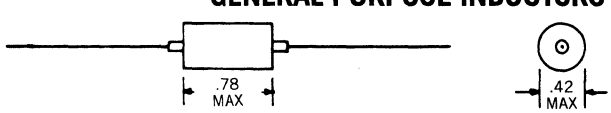
7070-KIT MEDIUM POWER GENERAL PURPOSE INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
7070-13	10 µH	.032 Ω	1,900 ma
7070-15	15 µH	.041 Ω	1,500 ma
7070-17	22 µH	.049 Ω	1,300 ma
7070-19	33 µH	.064 Ω	1,000 ma
7070-21	47 µH	.078 Ω	870 ma
7070-23	68 µH	.11 Ω	710 ma
7070-25	100 µH	.20 Ω	590 ma
7070-27	150 µH	.36 Ω	480 ma
7070-29	220 µH	.46 Ω	400 ma
7070-31	330 µH	.60 Ω	320 ma
7070-33	470 µH	.73 Ω	270 ma
7070-37	1.0 mH	1.6 Ω	190 ma

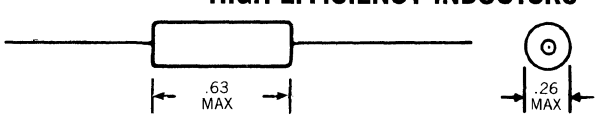
6860-KIT HIGH POWER GENERAL PURPOSE INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
6860-01	10 µH	.019 Ω	3.2 amps
6860-03	15 µH	.025 Ω	2.6 amps
6860-05	22 µH	.029 Ω	2.2 amps
6860-07	33 µH	.036 Ω	1.8 amps
6860-09	47 µH	.045 Ω	1.5 amps
6860-11	68 µH	.057 Ω	1.2 amps
6860-13	100 µH	.082 Ω	1.0 amps
6860-15	150 µH	.15 Ω	.83 amps
6860-17	220 µH	.23 Ω	.68 amps
6860-19	330 µH	.29 Ω	.56 amps
6860-21	470 µH	.37 Ω	.46 amps
6860-25	1.0 mH	.80 Ω	.32 amps

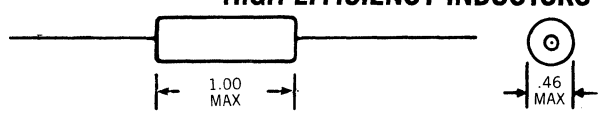
7300-KIT MEDIUM POWER HIGH EFFICIENCY INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
7300-01	10 µH	.055 Ω	2.8 amps
7300-03	15 µH	.069 Ω	2.2 amps
7300-05	22 µH	.084 Ω	1.9 amps
7300-07	33 µH	.11 Ω	1.5 amps
7300-09	47 µH	.13 Ω	1.3 amps
7300-11	68 µH	.15 Ω	1.1 amps
7300-13	100 µH	.27 Ω	.89 amps
7300-15	150 µH	.36 Ω	.72 amps
7300-17	220 µH	.45 Ω	.58 amps
7300-19	330 µH	.58 Ω	.47 amps
7300-21	470 µH	.86 Ω	.39 amps
7300-25	1.0 mH	2.0 Ω	.27 amps

7200-KIT HIGH POWER HIGH EFFICIENCY INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
7200-01	10 µH	.010 Ω	9.4 amps
7200-03	15 µH	.014 Ω	7.5 amps
7200-05	22 µH	.017 Ω	6.3 amps
7200-07	33 µH	.021 Ω	5.2 amps
7200-09	47 µH	.026 Ω	4.3 amps
7200-11	68 µH	.040 Ω	3.5 amps
7200-13	100 µH	.059 Ω	2.9 amps
7200-15	150 µH	.078 Ω	2.4 amps
7200-17	220 µH	.12 Ω	1.9 amps
7200-19	330 µH	.18 Ω	1.6 amps
7200-21	470 µH	.26 Ω	1.3 amps
7200-25	1.0 mH	.59 Ω	.92 amps

NOTE:

The 7200 and 7300 series use high permeability/high flux density cores for maximum current capacity. Core losses may reduce efficiency at higher (above 40–50 KHz) frequencies.

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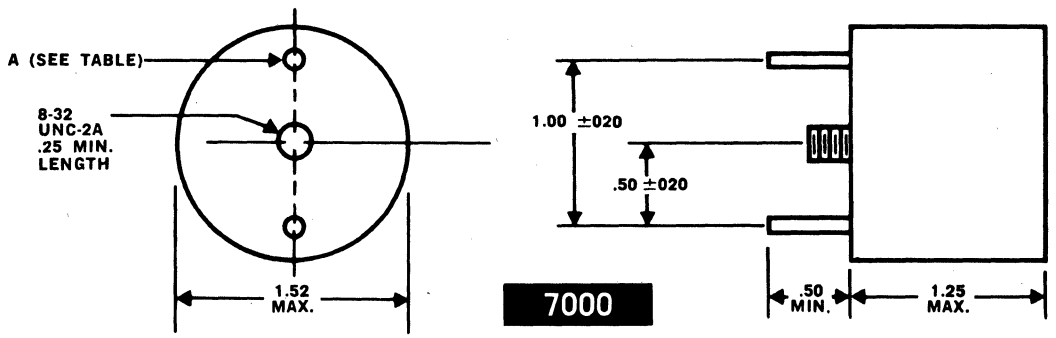
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HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

TYPE 7000 10μH — 10 mH — 10% Tolerance



NOTES:

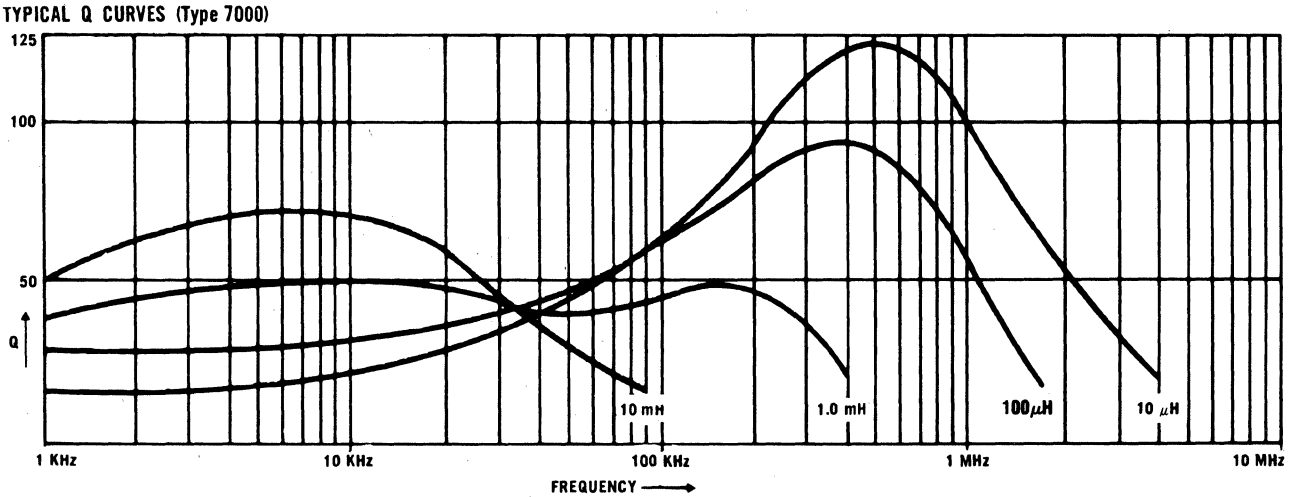
1. Inductance measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated IDC) is based on 3.0 watts power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage (winding to case and mounting stud) — 500 VRMS.
5. Operating temperature range: −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B).
   Leads — Bare tinned copper.
   Mounting Stud — 18-8 stainless steel.
   Case — epoxy encapsulated.
7. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps (2)	INCR I Amps (3)	A Lead Size AWG
7000-01	10 μH	.004	9.0	27	65	10
7000-02	12	.004	7.2	27	58	10
7000-03	15	.005	5.2	24	52	10
7000-04	18	.006	4.4	22	44	11
7000-05	22	.007	3.8	21	41	11
7000-06	27	.008	3.5	19	38	12
7000-07	33	.011	2.8	17	33	13
7000-08	39	.012	2.7	16	31	13
7000-09	47	.013	2.5	15	28	13
7000-10	56	.014	2.4	14	26	13
7000-11	68	.017	2.1	13	23	13
7000-12	82	.019	2.0	13	21	13
7000-13	100	.022	1.8	12	19	13
7000-14	120	.027	1.4	11	17	14
7000-15	150	.030	1.3	10	15	14
7000-16	180	.039	1.1	8.8	14	15
7000-17	220	.054	.90	7.5	13	16
7000-18	270	.060	.85	7.1	12	16
7000-19	330	.070	.75	6.5	11	16

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps (2)	INCR I Amps (3)	A Lead Size AWG
7000-20	390 μH	.090	.65	5.8	10	17
7000-21	470	.10	.62	5.5	8.8	17
7000-22	560	.11	.56	5.2	8.0	17
7000-23	680	.14	.51	4.6	7.5	18
7000-24	820	.17	.49	4.2	6.7	18
7000-25	1.0 mH	.22	.43	3.7	6.0	19
7000-26	1.2	.25	.37	3.5	5.4	19
7000-27	1.5	.29	.36	3.2	4.8	19
7000-28	1.8	.32	.33	3.1	4.4	19
7000-29	2.2	.44	.31	2.6	4.0	20
7000-30	2.7	.50	.27	2.4	3.6	20
7000-31	3.3	.69	.23	2.1	3.2	21
7000-32	3.9	.75	.21	2.0	3.0	21
7000-33	4.7	1.0	.20	1.7	2.8	22
7000-34	5.6	1.1	.18	1.6	2.6	22
7000-35	6.8	1.3	.17	1.5	2.3	22
7000-36	8.2	1.6	.14	1.4	2.1	23
7000-37	10	1.8	.13	1.3	1.9	23

TYPICAL Q CURVES (Type 7000)



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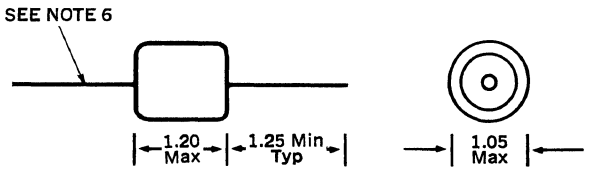
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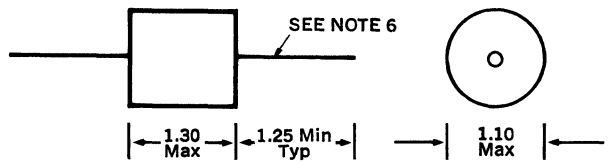
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HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

TYPE 7140 — **7140** — 10 μH-100 mH. 10% Tolerance
Recommended Mounting Pitch—1.50" — **7150** — **TYPE 7150 (EPOXY ENCAPSULATED VERSION)**





NOTES: (FOR BOTH TYPES)
1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. Current rating (Rated IDC) is based on 1.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation.
4. Dielectric Withstanding Voltage—1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. Leads are bare tinned copper: -01 thru -10, #14 AWG; -11, #15 AWG; -12 thru -49, #16 AWG.
7. Marking—Printed with Caddell-Burns Part Number.
8. Materials: (See below)

TYPE 7140
Coil Form: Ferrite
Magnet Wire: Per FED SPEC J-W-001177/9
Jacket: Flame Retardant PVC shrink tube UL Type FR-1 Per MIL-I-23053

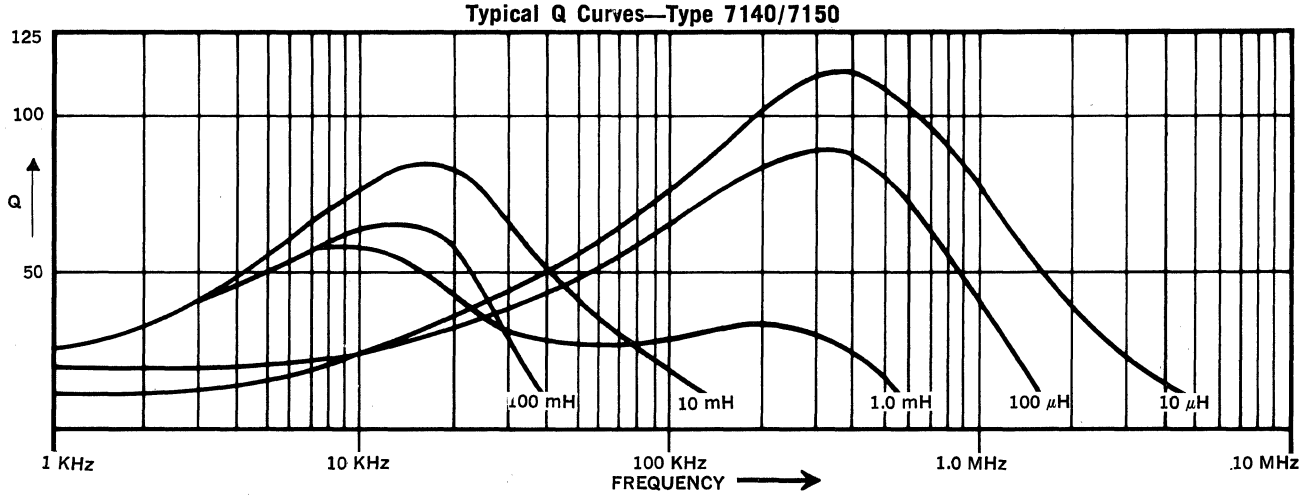
TYPE 7150
Coil Form: Ferrite
Magnet Wire: Per FED SPEC J-W-001177/9
Cover and Coating: Epoxy encapsulated

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-01	10 μH	0.0060	8.8	16	43
-02	12	0.0065	8.0	15	39
-03	15	0.0070	7.4	15	36
-04	18	0.0080	5.4	14	32
-05	22	0.0085	3.9	13	29
-06	27	0.0090	3.3	13	26
-07	33	0.010	3.1	12	24
-08	39	0.011	2.7	12	21
-09	47	0.012	2.6	11	20
-10	56	0.013	2.3	11	18
-11	68	0.017	2.1	9.4	16
-12	82	0.023	1.8	8.1	15
-13	100	0.025	1.6	7.7	14
-14	120	0.028	1.5	7.3	12
-15	150	0.032	1.4	6.8	11
-16	180	0.042	1.2	6.0	10
-17	220	0.048	1.1	5.6	9.2
-18	270	0.055	1.0	5.2	8.0
-19	330	0.072	0.96	4.6	7.4
-20	390	0.079	0.84	4.4	6.8
-21	470	0.11	0.72	3.7	6.2
-22	560	0.12	0.64	3.5	5.7
-23	680	0.14	0.62	3.3	5.1
-24	820	0.18	0.60	2.9	4.7
-25	1.0 mH	0.20	0.52	2.7	4.2

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-26	1.2 mH	0.23	0.48	2.6	3.8
-27	1.5	0.31	0.40	2.2	3.4
-28	1.8	0.35	0.37	2.1	3.1
-29	2.2	0.46	0.32	1.8	2.8
-30	2.7	0.54	0.30	1.7	2.6
-31	3.3	0.72	0.27	1.4	2.3
-32	3.9	0.79	0.25	1.4	2.1
-33	4.7	0.90	0.24	1.3	1.9
-34	5.6	1.2	0.20	1.1	1.8
-35	6.8	1.3	0.19	1.1	1.6
-36	8.2	1.7	0.16	0.94	1.5
-37	10	2.0	0.15	0.87	1.3
-38	12	2.7	0.12	0.75	1.2
-39	15	3.1	0.11	0.70	1.1
-40	18	3.5	0.10	0.65	1.0
-41	22	4.7	0.096	0.56	0.90
-42	27	5.3	0.088	0.53	0.81
-43	33	7.1	0.076	0.46	0.74
-44	39	7.9	0.070	0.44	0.68
-45	47	11	0.067	0.37	0.62
-46	56	12	0.062	0.35	0.57
-47	68	14	0.054	0.33	0.51
-48	82	18	0.051	0.29	0.46
-49	100	21	0.042	0.27	0.42

Typical Q Curves—Type 7140/7150



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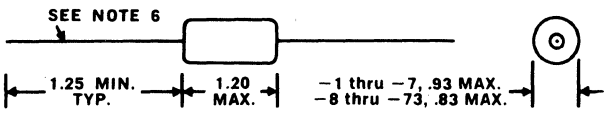
CADDELL-BURNS

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Mineola, New York 11501-3508
Telephone: 516-746-2310
Fax: 516-742-2416

HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS **6950**

TYPE 6950 10μH - 10H — 10% Tolerance
Recommended mounting pitch — 1.40″



NOTES:

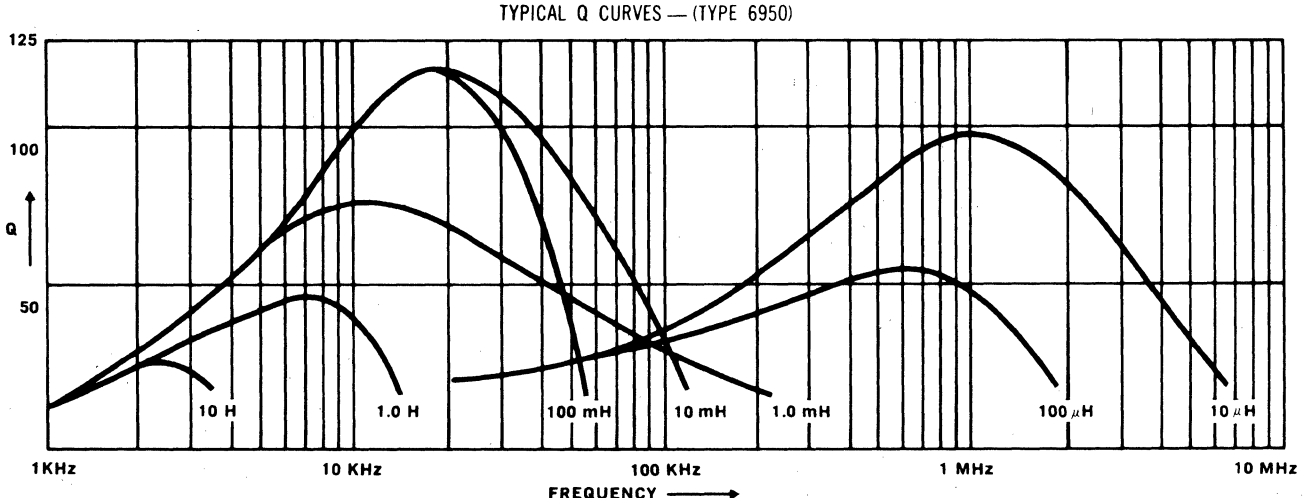
1. Inductance measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage — 1000 VRMS.
5. Operating temperature range: −55° to +105°C.
6. Leads are bare tinned copper: −1 thru −7, #14 AWG; −8 and −9, #16 AWG; −10 thru −14, #18 AWG; −15 thru −17, #19 AWG; −18 thru −73, #20 AWG.
7. Materials:
   Coil Form — Ferrite
   Magnet Wire — Per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B)
   Jacket — PVC Shrink Tube — FLAME RETARDANT UL TYPE FR-1 PER MIL-I-23053
8. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma (2)	INCR I ma (3)
6950-01	10 μH	.007	12	12,000	35,000
-02	12	.008	8.0	11,200	32,600
-03	15	.009	6.0	10,500	28,400
-04	18	.010	5.7	10,000	25,900
-05	22	.011	5.3	9500	23,800
-06	27	.012	5.0	9100	21,000
-07	33	.013	4.5	8800	18,700
-08	39	.020	3.4	7100	17,600
-09	47	.022	3.2	6700	16,300
-10	56	.034	2.6	5400	14,700
-11	68	.038	2.4	5100	13,300
-12	82	.042	2.2	4900	12,400
-13	100	.048	1.9	4600	11,100
-14	120	.054	1.7	4300	10,100
-15	150	.073	1.5	3700	9100
-16	180	.082	1.3	3500	8300
-17	220	.091	1.2	3300	7500
-18	270	.12	1.1	2900	6800
-19	330	.13	1.0	2800	6100
-20	390	.18	.92	2400	5600
-21	470	.20	.84	2200	5100
-22	560	.26	.78	2000	4700
-23	680	.30	.69	1800	4300
-24	820	.40	.56	1600	3900
-25	1.0 mH	.45	.54	1500	3500
-26	1.2	.50	.50	1400	3200
-27	1.5	.70	.45	1200	2900
-28	1.8	.80	.43	1100	2600
-29	2.2	1.1	.42	950	2400
-30	2.7	1.2	.40	910	2100
-31	3.3	1.6	.28	790	1900
-32	3.9	1.8	.26	750	1800
-33	4.7	2.4	.23	650	1600
-34	5.6	2.6	.21	620	1500
-35	6.8	3.0	.20	580	1300
-36	8.2	4.0	.19	500	1200
-37	10	4.6	.18	470	1100

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma (2)	INCR I ma (3)
6950-38	12 mH	6.1	.16	400	1000
-39	15	7.1	.15	380	910
-40	18	9.6	.14	320	830
-41	22	11	.12	300	750
-42	27	13	.095	280	680
-43	33	15	.085	260	610
-44	39	21	.077	220	560
-45	47	24	.067	200	510
-46	56	33	.065	180	470
-47	68	36	.062	170	430
-48	82	41	.057	160	390
-49	100	55	.051	140	350
-50	120	60	.048	130	320
-51	150	84	.040	110	290
-52	180	94	.033	100	260
-53	220	110	.032	95	240
-54	270	127	.030	88	210
-55	330	165	.027	78	190
-56	390	220	.023	67	180
-57	470	240	.021	65	160
-58	560	330	.020	55	150
-59	680	360	.017	53	130
-60	820	400	.016	50	120
-61	1.0 H	570	.014	42	110
-62	1.2	650	.013	40	100
-63	1.5	740	.012	37	90
-64	1.8	1000	.011	32	83
-65	2.2	1100	.010	30	75
-66	2.7	1500	.0090	26	68
-67	3.3	1700	.0085	24	61
-68	3.9	2200	.0080	21	56
-69	4.7	2500	.0073	20	51
-70	5.6	3500	.0062	17	47
-71	6.8	4000	.0058	16	43
-72	8.2	4800	.0050	15	39
-73	10	5400	.0042	14	35

TYPICAL Q CURVES — (TYPE 6950)



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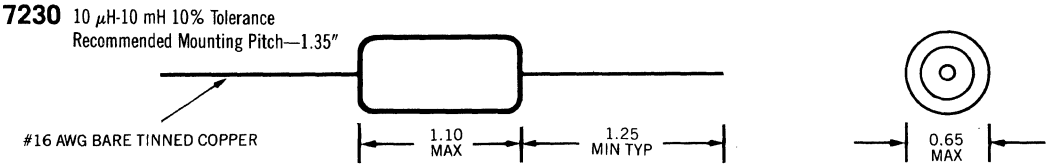
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Telephone: 516-746-2310
Fax: 516-742-2416

HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS **7230**

TYPE 7230 10 μH-10 mH 10% Tolerance
Recommended Mounting Pitch—1.35"



NOTES:

1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. The current rating (Rated IDC) is based on 0.75 watt power dissipation (I^2R) for an approximate 20°C temperature rise. Depending on the application, these units may be operated at higher currents.
   The core material for the 7230 series has been chosen for optimum current handling capability. Because this material has a relatively low volume resistivity, the core will appear as a shunt resistance on the order of 1 Kilohm, which may have to be taken into account when determining total power dissipation; e.g., if the induced voltage across the coil is 10 volts, there will be a V^2/R loss on the order of 0.10 watt, in addition to the I^2R losses associated with the winding.
3. The incremental current (INCR I) is the approximate current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation. If the current is increased beyond INCR I, the inductance will continue to decrease as shown by the saturation curve below.
4. Dielectric Withstanding Voltage: 1000 VRMS.
5. Operating Temperature Range: −55° to +105°C.
6. Marking: Printed with Caddell-Burns Part Number.
7. Materials:

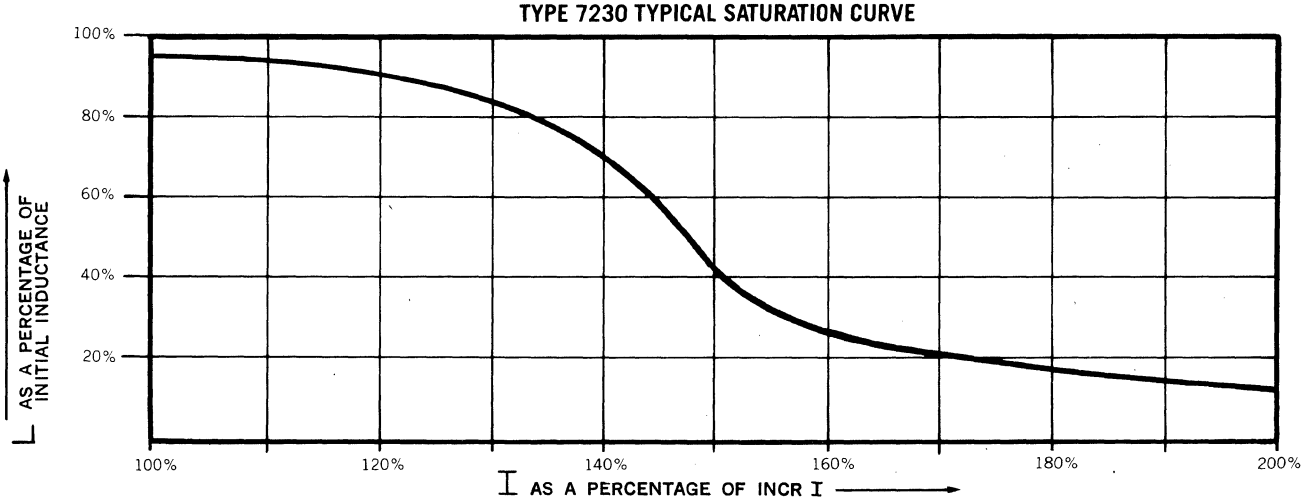
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 per MIL-I-23053

STANDARD VALUES: (Other values available on special order)

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-01	10 μH	0.0065	5.4	11	23
-02	12	0.0070	4.7	10	22
-03	15	0.0080	4.2	9.7	19
-04	18	0.011	3.8	8.3	18
-05	22	0.016	3.4	6.9	16
-06	27	0.021	3.1	6.0	14
-07	33	0.023	2.8	5.7	13
-08	39	0.025	2.5	5.5	12
-09	47	0.028	2.2	5.2	11
-10	56	0.031	2.0	4.9	10
-11	68	0.043	1.8	4.2	9.0
-12	82	0.047	1.6	4.0	8.3
-13	100	0.063	1.5	3.5	7.6
-14	120	0.086	1.4	3.0	6.8
-15	150	0.097	1.2	2.8	6.1
-16	180	0.11	1.1	2.6	5.6
-17	220	0.12	0.95	2.5	5.1
-18	270	0.17	0.85	2.1	4.6
-19	330	0.19	0.77	2.0	4.1

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-20	390 μH	0.21	0.70	1.9	3.8
-21	470	0.29	0.63	1.6	3.5
-22	560	0.32	0.56	1.5	3.2
-23	680	0.43	0.51	1.3	2.9
-24	820	0.47	0.45	1.3	2.6
-25	1.0 mH	0.54	0.41	1.2	2.4
-26	1.2	0.71	0.36	1.0	2.2
-27	1.5	1.0	0.33	0.87	1.9
-28	1.8	1.1	0.30	0.83	1.8
-29	2.2	1.3	0.27	0.76	1.6
-30	2.7	1.7	0.24	0.66	1.4
-31	3.3	2.3	0.22	0.57	1.3
-32	3.9	2.5	0.20	0.55	1.2
-33	4.7	2.8	0.18	0.52	1.1
-34	5.6	3.1	0.16	0.49	1.0
-35	6.8	4.2	0.14	0.42	0.91
-36	8.2	4.7	0.13	0.40	0.83
-37	10	5.3	0.12	0.38	0.75

TYPE 7230 TYPICAL SATURATION CURVE



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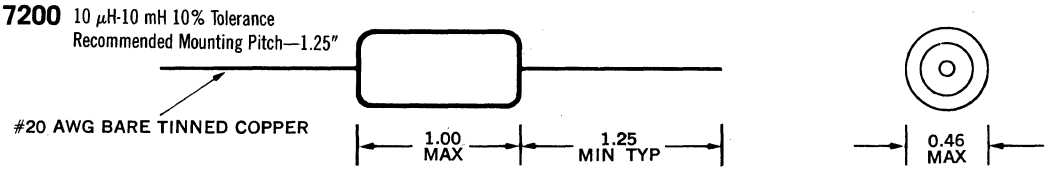
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Mineola, New York 11501-3508
Telephone: 516-746-2310
Fax: 516-742-2416

HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

7200

TYPE 7200 10 μH-10 mH 10% Tolerance
Recommended Mounting Pitch—1.25"



NOTES:

1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. The current rating (Rated IDC) is based on 0.5 watt power dissipation (I^2R) for an approximate 20°C temperature rise. Depending on the application, these units may be operated at higher currents.

   The core material for the 7200 series has been chosen for optimum current handling capability. Because this material has a relatively low volume resistivity, the core will appear as a shunt resistance on the order of 1 Kilohm, which may have to be taken into account when determining total power dissipation; e.g., if the induced voltage across the coil is 10 volts, there will be a V^2/R loss on the order of 0.10 watt, in addition to the I^2R losses associated with the winding.
3. The incremental current (INCR I) is the approximate current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation. If the current is increased beyond INCR I, the inductance will continue to decrease as shown by the saturation curve below.
4. Dielectric Withstanding Voltage: 1000 VRMS.
5. Operating Temperature Range: −55° to +105°C.
6. Marking: Printed with Caddell-Burns Part Number.
7. Materials:

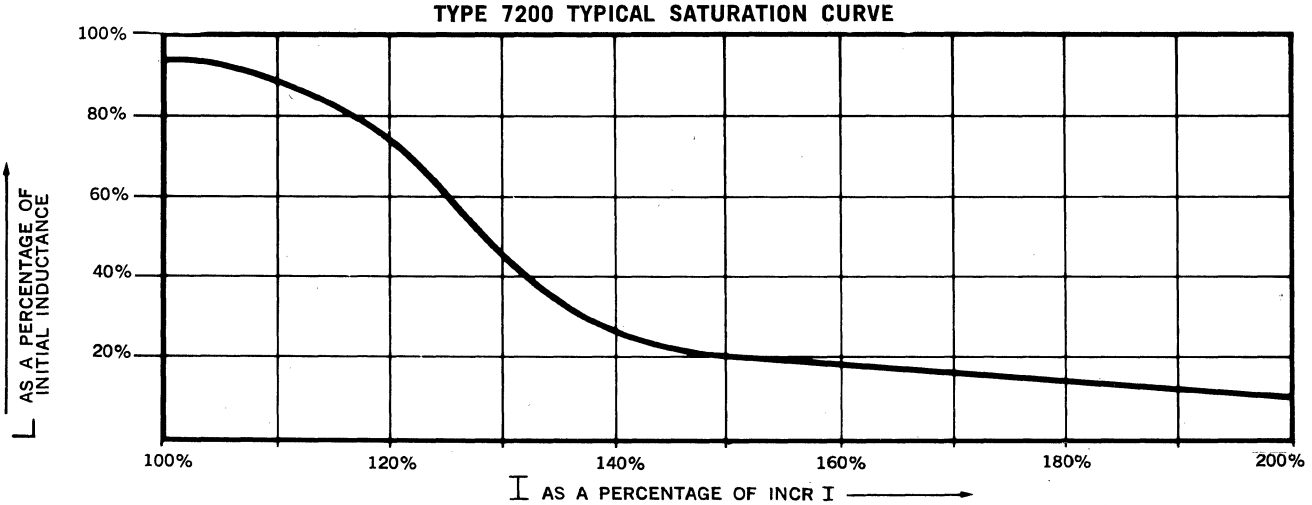
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 per MIL-I-23053

STANDARD VALUES: (Other values available on special order)

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-01	10 μH	0.010	6.0	7.1	9.4
-02	12	0.012	4.8	6.5	8.3
-03	15	0.014	4.0	6.0	7.5
-04	18	0.015	3.3	5.8	7.1
-05	22	0.017	2.9	5.4	6.3
-06	27	0.018	2.5	5.3	5.8
-07	33	0.021	2.2	4.9	5.2
-08	39	0.023	2.0	4.7	4.7
-09	47	0.026	1.7	4.4	4.3
-10	56	0.030	1.5	4.1	3.8
-11	68	0.040	1.3	3.5	3.5
-12	82	0.053	1.2	3.1	3.2
-13	100	0.059	1.1	2.9	2.9
-14	120	0.068	1.0	2.7	2.6
-15	150	0.078	0.90	2.5	2.4
-16	180	0.089	0.82	2.4	2.2
-17	220	0.12	0.74	2.0	1.9
-18	270	0.16	0.68	1.8	1.8
-19	330	0.18	0.61	1.7	1.6

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-20	390 μH	0.20	0.56	1.6	1.5
-21	470	0.26	0.51	1.4	1.3
-22	560	0.29	0.47	1.3	1.2
-23	680	0.39	0.43	1.1	1.1
-24	820	0.44	0.39	1.1	1.0
-25	1.0 mH	0.59	0.36	0.92	0.92
-26	1.2	0.66	0.33	0.87	0.84
-27	1.5	0.77	0.31	0.81	0.75
-28	1.8	0.87	0.29	0.76	0.68
-29	2.2	1.2	0.27	0.65	0.62
-30	2.7	1.6	0.25	0.56	0.56
-31	3.3	1.8	0.23	0.53	0.51
-32	3.9	2.0	0.22	0.50	0.47
-33	4.7	2.6	0.20	0.44	0.42
-34	5.6	2.9	0.19	0.42	0.39
-35	6.8	3.4	0.18	0.38	0.35
-36	8.2	4.4	0.17	0.34	0.32
-37	10	6.0	0.16	0.29	0.29

TYPE 7200 TYPICAL SATURATION CURVE



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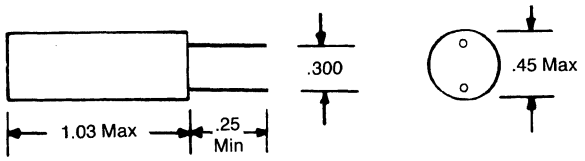
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Telephone: 516-746-2310
Fax: 516-742-2416

HIGH CURRENT CHOKES

TYPE 6890

6890

10 µH-1.0 H. 10% Tolerance



FOR SWITCHING REGULATORS AND POWER FILTERS

SPECIAL FEATURES

- **SINGLE ENDED** for minimum footprint
- **ENCAPSULATED** to withstand harsh environments
- **LOW RESISTANCE** for maximum efficiency

NOTES:

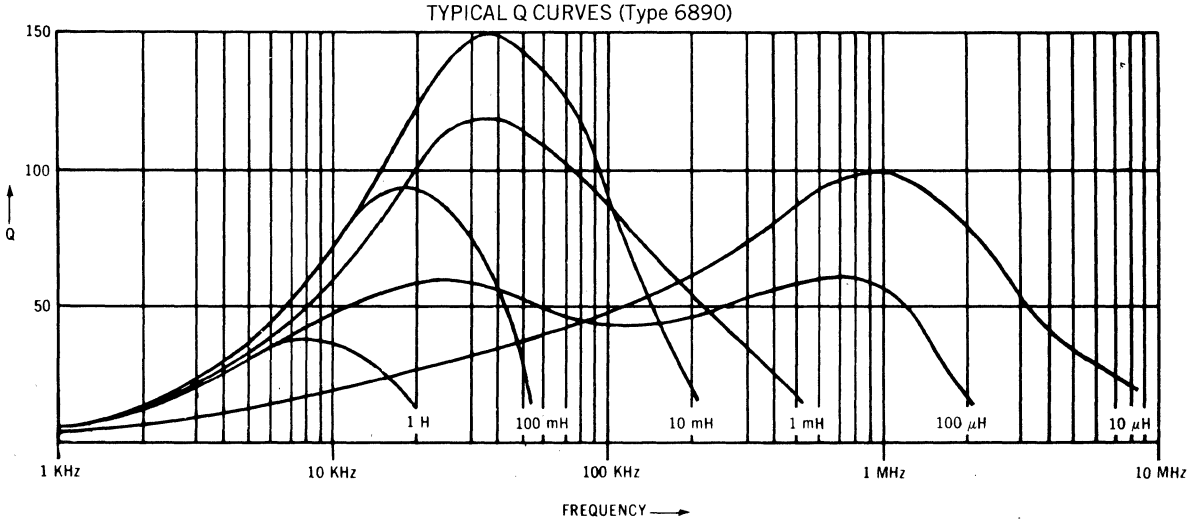
1. INDUCTANCE measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. CURRENT RATING (Rated IDC) is based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at higher currents.
3. INCREMENTAL CURRENT (INCR I) is the minimum current at which the inductance will be decreased by 5% because of saturation.
4. DIELECTRIC WITHSTANDING VOLTAGE: 1000 VRMS
5. OPERATING TEMPERATURE RANGE: −55° to +105°C.
6. MATERIALS:
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Case: Epoxy encapsulated
   Leads: #20 AWG (.032 dia) tinned copper.

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—01	10 µH	.023	45	4600	3200
—02	12	.025	40	4500	2900
—03	15	.030	32	4100	2600
—04	18	.032	21	3900	2400
—05	22	.035	12	3700	2200
—06	27	.038	8.5	3600	2000
—07	33	.043	5.8	3400	1800
—08	39	.047	3.5	3200	1700
—09	47	.054	3.2	3000	1500
—10	56	.060	2.9	2900	1400
—11	68	.068	2.7	2700	1200
—12	82	.073	2.5	2600	1100
—13	100	.098	2.3	2300	1000
—14	120	.14	2.1	1900	930
—15	150	.18	1.9	1700	830
—16	180	.20	1.5	1600	760
—17	220	.28	1.3	1400	680
—18	270	.31	1.3	1300	620
—19	330	.35	1.2	1200	560
—20	390	.38	1.1	1100	510
—21	470	.44	1.0	1050	460
—22	560	.48	.90	1000	430
—23	680	.63	.80	890	390
—24	820	.87	.72	760	350
—25	1.0 mH	.96	.65	720	320
—26	1.2	1.3	.62	620	290
—27	1.5	1.4	.58	600	260
—28	1.8	1.7	.53	540	240
—29	2.2	2.3	.44	470	220
—30	2.7	2.6	.39	440	190
—31	3.3	3.5	.36	380	180

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—32	3.9 mH	3.8	.34	360	160
—33	4.7	4.3	.32	340	150
—34	5.6	5.6	.26	300	140
—35	6.8	6.3	.24	280	120
—36	8.2	8.6	.21	240	110
—37	10	9.7	.20	220	100
—38	12	11	.19	210	92
—39	15	15	.17	180	84
—40	18	20	.14	160	75
—41	22	24	.13	140	68
—42	27	26	.12	130	62
—43	33	35	.10	120	56
—44	39	38	.095	110	51
—45	47	50	.080	100	47
—46	56	55	.072	95	43
—47	68	76	.066	81	39
—48	82	86	.062	76	35
—49	100	99	.057	71	32
—50	120	110	.052	67	29
—51	150	200	.047	50	26
—52	180	220	.043	48	24
—53	220	300	.038	41	22
—54	270	320	.035	40	20
—55	330	420	.032	35	18
—56	390	480	.029	32	16
—57	470	670	.026	27	15
—58	560	730	.024	26	14
—59	680	870	.019	24	12
—60	820	950	.018	23	11
—61	1.0 H	1100	.017	21	10

TYPICAL Q CURVES (Type 6890)



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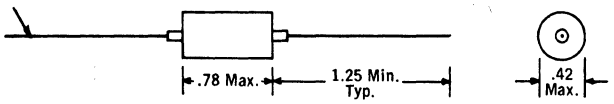
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Telephone: 516-746-2310
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HIGH CURRENT CHOKES

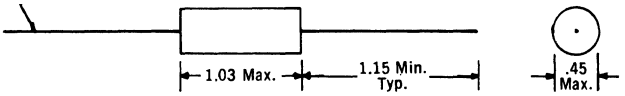
FOR SWITCHING REGULATORS AND POWER FILTERS

TYPE 6860

6860 10 μH-1.0 mH. 10% Tolerance
Recommended Mounting Pitch—1.25"



6870 **TYPE 6870 (EPOXY ENCAPSULATED VERSION)**



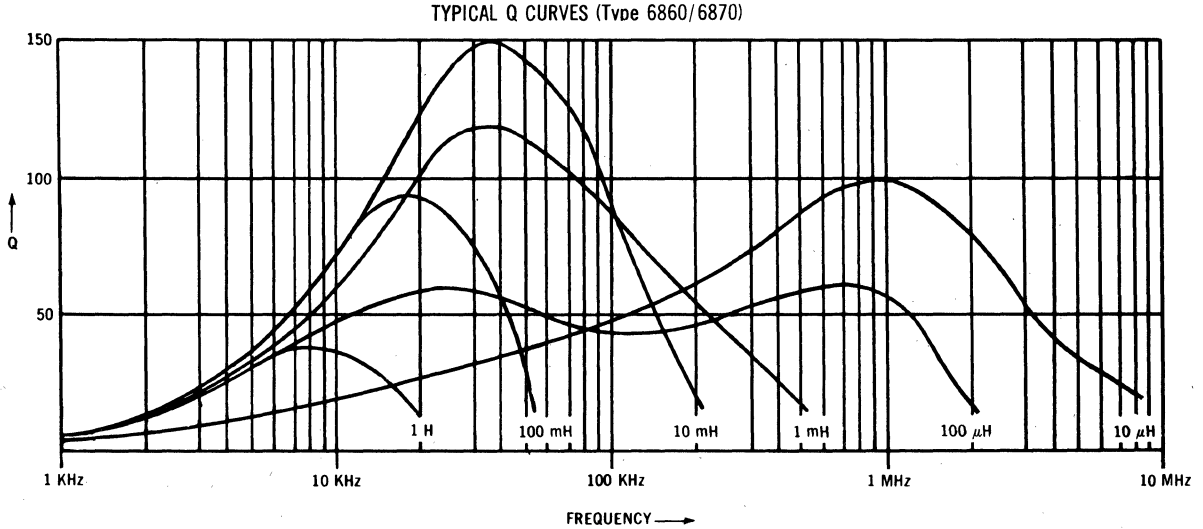
NOTES: (FOR BOTH TYPES)
1. Inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range — 55° to + 105°C.
6. Materials:
   Coil Form: Ferrite.
   Cover: TYPE 6860 - Polyester alpha-cellulose.
   Coating: Polyurethane per MIL-1-46058.
   TYPE 6870- Cover & Coating: Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—01	10 μH	.023	45	4600	3200
—02	12	.025	40	4500	2900
—03	15	.030	32	4100	2600
—04	18	.032	21	3900	2400
—05	22	.035	12	3700	2200
—06	27	.038	8.5	3600	2000
—07	33	.043	5.8	3400	1800
—08	39	.047	3.5	3200	1700
—09	47	.054	3.2	3000	1500
—10	56	.060	2.9	2900	1400
—11	68	.068	2.7	2700	1200
—12	82	.073	2.5	2600	1100
—13	100	.098	2.3	2300	1000
—14	120	.14	2.1	1900	930
—15	150	.18	1.9	1700	830
—16	180	.20	1.5	1600	760
—17	220	.28	1.3	1400	680
—18	270	.31	1.3	1300	620
—19	330	.35	1.2	1200	560
—20	390	.38	1.1	1100	510
—21	470	.44	1.0	1050	460
—22	560	.48	.90	1000	430
—23	680	.63	.80	890	390
—24	820	.87	.72	760	350
—25	1.0 mH	.96	.65	720	320
—26	1.2	1.3	.62	620	290
—27	1.5	1.4	.58	600	260
—28	1.8	1.7	.53	540	240
—29	2.2	2.3	.44	470	220
—30	2.7	2.6	.39	440	190
—31	3.3	3.5	.36	380	180

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—32	3.9 mH	3.8	.34	360	160
—33	4.7	4.3	.32	340	150
—34	5.6	5.6	.26	300	140
—35	6.8	6.3	.24	280	120
—36	8.2	8.6	.21	240	110
—37	10	9.7	.20	220	100
—38	12	11	.19	210	92
—39	15	15	.17	180	84
—40	18	20	.14	160	75
—41	22	24	.13	140	68
—42	27	26	.12	130	62
—43	33	35	.10	120	56
—44	39	38	.095	110	51
—45	47	50	.080	100	47
—46	56	55	.072	95	43
—47	68	76	.066	81	39
—48	82	86	.062	76	35
—49	100	99	.057	71	32
—50	120	110	.052	67	29
—51	150	200	.047	50	26
—52	180	220	.043	48	24
—53	220	300	.038	41	22
—54	270	320	.035	40	20
—55	330	420	.032	35	18
—56	390	480	.029	32	16
—57	470	670	.026	27	15
—58	560	730	.024	26	14
—59	680	870	.019	24	12
—60	820	950	.018	23	11
—61	1.0 H	1100	.017	21	10

TYPICAL Q CURVES (Type 6860/6870)



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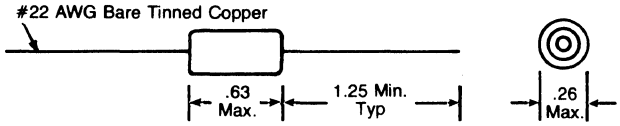
CADDELL-BURNS

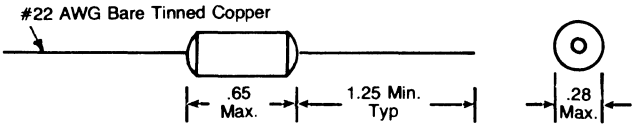
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Telephone: 516-746-2310
Fax: 516-742-2416

MINIATURE HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

TYPE 7070 — **7070** — 1.0μH-100mH. 10% Tolerance — Recommended Mounting Pitch—.80" — **7080** — **TYPE 7080 (EPOXY ENCAPSULATED VERSION)**





NOTES: (FOR BOTH TYPES)

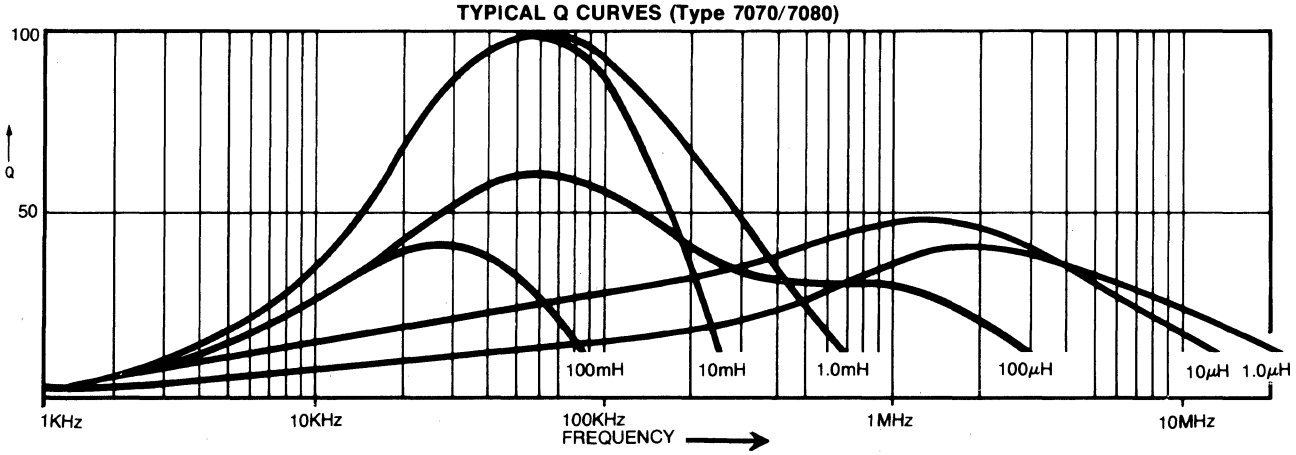
1. INDUCTANCE:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305.
   For 10μH thru 100mH; inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.25 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: TYPE 7070 - PVC shrink tube-flame retardant UL type FR-1 per MIL-I-23053
   TYPE 7080 - Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

DASH NO.	NOMINAL INDUCTANCE	MAX.DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-01	1.0μH	.010	155	5,000	6,400
-02	1.2	.011	148	4,800	6,000
-03	1.5	.012	128	4,600	5,000
-04	1.8	.013	120	4,400	4,500
-05	2.2	.014	108	4,200	4,100
-06	2.7	.015	100	4,100	3,600
-07	3.3	.016	96	4,000	3,200
-08	3.9	.017	90	3,800	3,000
-09	4.7	.022	85	3,400	2,700
-10	5.6	.028	76	3,000	2,500
-11	6.8	.031	70	2,800	2,300
-12	8.2	.035	51	2,700	2,000
-13	10	.038	35	2,600	1,900
-14	12	.043	21	2,400	1,700
-15	15	.049	14	2,300	1,500
-16	18	.054	10	2,200	1,400
-17	22	.059	8.0	2,100	1,300
-18	27	.070	6.5	1,900	1,100
-19	33	.077	6.1	1,800	1,000
-20	39	.084	5.7	1,700	940
-21	47	.093	5.1	1,600	870
-22	56	.12	4.3	1,500	790
-23	68	.13	3.6	1,400	710
-24	82	.16	3.2	1,300	650
-25	100	.24	3.0	1,000	590
-26	120	.32	2.7	880	540
-27	150	.43	2.1	760	480
-28	180	.48	1.7	720	440
-29	220	.55	1.6	670	400
-30	270	.62	1.5	640	360

DASH NO.	NOMINAL INDUCTANCE	MAX.DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-31	330μH	.72	1.4	590	320
-32	390	.79	1.3	560	300
-33	470	.88	1.2	530	270
-34	560	1.2	1.1	460	250
-35	680	1.5	1.0	410	230
-36	820	1.7	.96	380	210
-37	1.0mH	1.9	.88	360	190
-38	1.2	2.4	.78	320	170
-39	1.5	2.8	.64	300	150
-40	1.8	3.1	.60	280	140
-41	2.2	4.5	.54	240	120
-42	2.7	5.8	.44	210	110
-43	3.3	8.1	.43	180	100
-44	3.9	8.9	.40	170	95
-45	4.7	10	.38	160	86
-46	5.6	11	.35	150	79
-47	6.8	15	.29	130	72
-48	8.2	17	.26	120	65
-49	10	22	.24	110	59
-50	12	26	.23	100	54
-51	15	34	.19	86	48
-52	18	39	.17	80	44
-53	22	54	.16	68	40
-54	27	62	.15	64	36
-55	33	82	.12	55	32
-56	39	93	.11	52	30
-57	47	120	.096	46	27
-58	56	130	.092	44	25
-59	68	190	.088	36	23
-60	82	210	.080	35	21
-61	100	270	.074	30	19

TYPICAL Q CURVES (Type 7070/7080)



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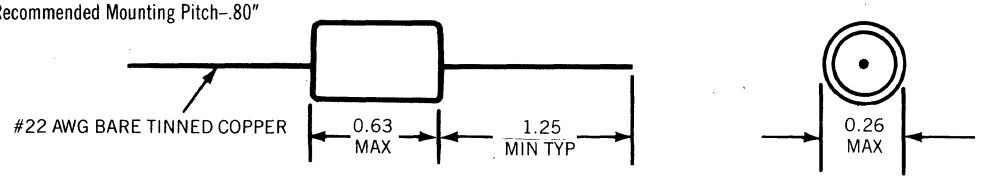
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MINIATURE HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS **7300**

TYPE 7300 10µH–10mH 10% Tolerance
Recommended Mounting Pitch–.80"



NOTES:

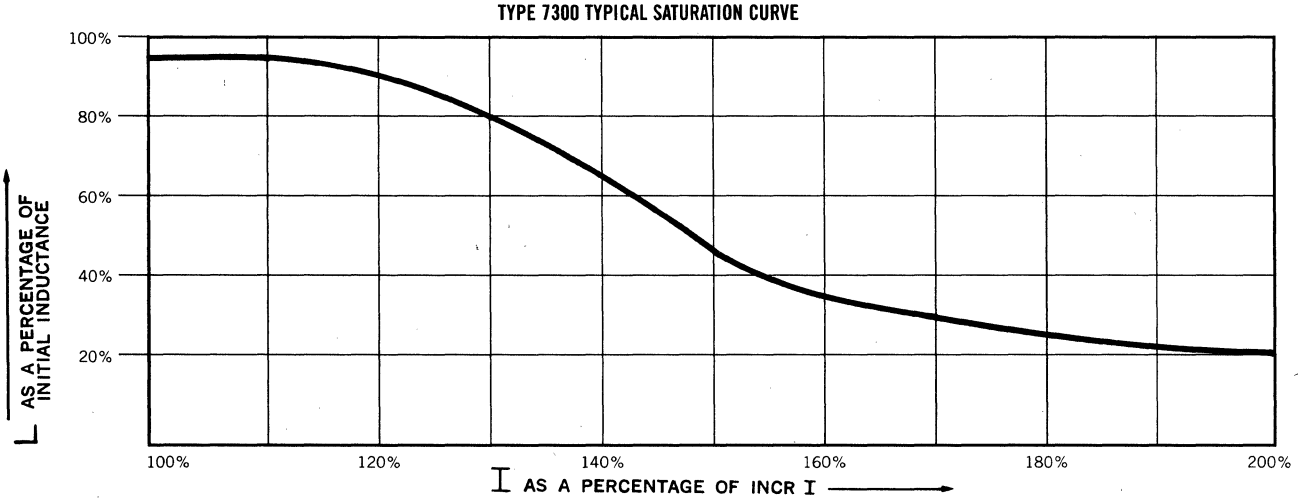
1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. The current rating (Rated IDC) is based on 0.25 watt power dissipation (I^2R) for an approximate 20°C temperature rise. Depending on the application, these units may be operated at higher currents.
   The core material for the 7300 series has been chosen for optimum current handling capability. Because this material has a relatively low volume resistivity, the core will appear as a shunt resistance on the order of 1 Kilohm, which may have to be taken into account when determining total power dissipation; e.g., if the induced voltage (2π fLI) across the coil is 10 volts, there will be a V^2/R loss on the order of 0.10 watt, in addition to the I^2R losses associated with the winding. This is not usually a factor unless the choke is operated at high levels of R.F. excitation.
3. The incremental current (INCR I) is the approximate current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation. If the current is increased beyond INCR I, the inductance will continue to decrease as shown by the saturation curve below.
4. Dielectric Withstanding Voltage: 1000 VRMS.
5. Operating Temperature Range: –55° to +105°C.
6. Marking: Printed with Caddell-Burns Part Number.
7. Materials:
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W 001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 per MIL-I-23053.

STANDARD VALUES: (Other values available on special order)

PART NO.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
7300-01	10µH	0.055	9.0	2.1	2.8
-02	12	0.061	8.0	2.0	2.6
-03	15	0.069	7.0	1.9	2.2
-04	18	0.077	6.2	1.8	2.1
-05	22	0.084	5.6	1.7	1.9
-06	27	0.093	5.0	1.6	1.7
-07	33	0.11	4.4	1.5	1.5
-08	39	0.12	3.8	1.4	1.4
-09	47	0.13	3.4	1.4	1.3
-10	56	0.14	3.0	1.3	1.2
-11	68	0.15	2.7	1.3	1.1
-12	82	0.17	2.4	1.2	0.98
-13	100	0.27	2.1	0.96	0.89
-14	120	0.31	1.9	0.90	0.80
-15	150	0.36	1.7	0.83	0.72
-16	180	0.39	1.5	0.80	0.66
-17	220	0.45	1.3	0.75	0.58
-18	270	0.49	1.2	0.71	0.54
-19	330	0.58	1.0	0.66	0.47

PART NO.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
7300-20	390µH	0.64	0.90	0.63	0.43
-21	470	0.86	0.80	0.54	0.39
-22	560	0.93	0.72	0.52	0.37
-23	680	1.1	0.64	0.48	0.33
-24	820	1.5	0.56	0.41	0.30
-25	1.0mH	2.0	0.50	0.35	0.27
-26	1.2	2.2	0.44	0.34	0.25
-27	1.5	3.0	0.40	0.29	0.22
-28	1.8	3.4	0.35	0.27	0.20
-29	2.2	3.8	0.32	0.26	0.18
-30	2.7	4.4	0.28	0.24	0.16
-31	3.3	5.9	0.25	0.21	0.15
-32	3.9	7.9	0.22	0.18	0.14
-33	4.7	8.9	0.19	0.17	0.12
-34	5.6	12	0.17	0.14	0.11
-35	6.8	13	0.15	0.14	0.10
-36	8.2	14	0.14	0.13	0.094
-37	10	17	0.12	0.12	0.084

TYPE 7300 TYPICAL SATURATION CURVE



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MINIATURE HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

TYPE 7120

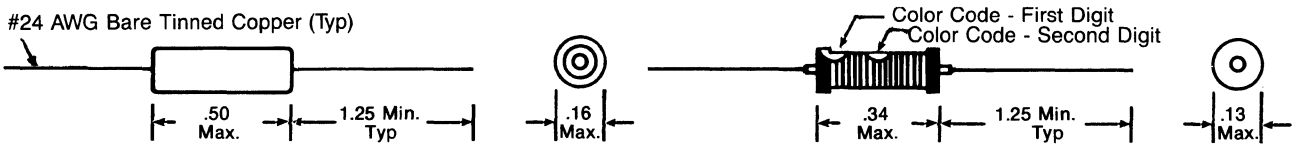
7120

1.0μH-10mH. 10% Tolerance
Recommended Mounting Pitch—.60"

7130

TYPE 7130

(conformally coated version)



NOTES: (FOR BOTH TYPES)

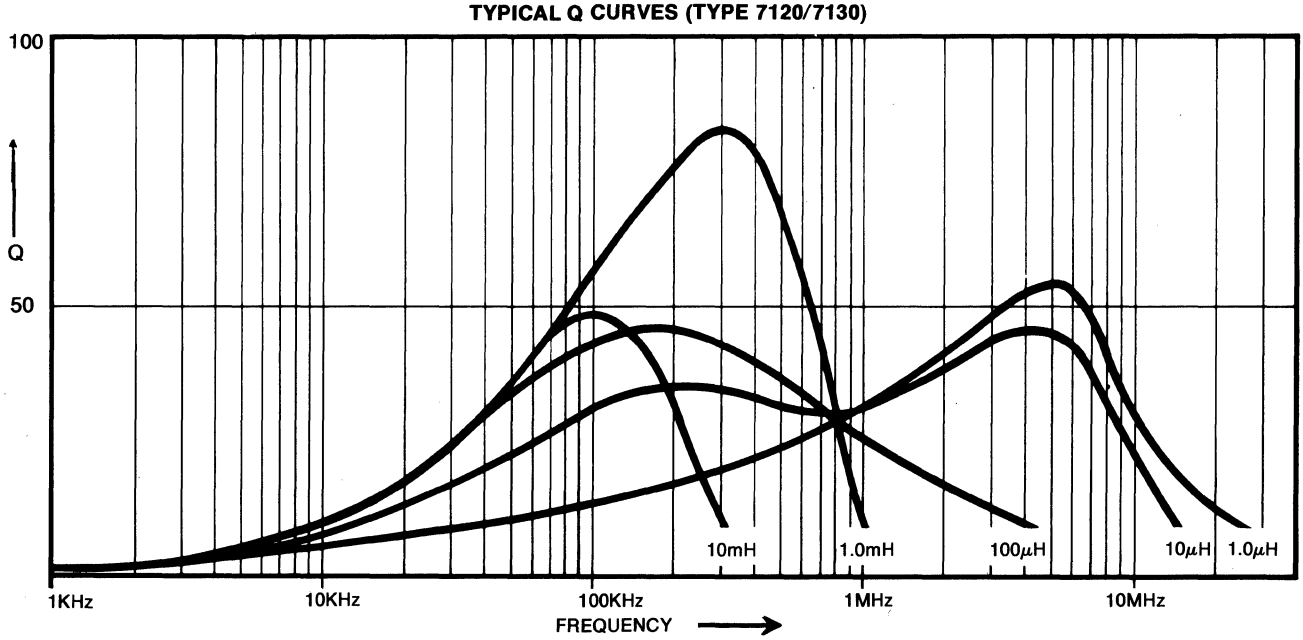
1. Inductance:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305. For 10μH thru 10mH, inductance (Ls) measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated 1 DC) is based on 0.2 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR 1) is the minimum current at which the inductance will be decreased by 5% from its initial (zero - DC) value because of saturation.
4. Dielectric Withstanding Voltage:
   Type 7120 - 1000 VRMS
   Type 7130 - 100 VRMS
5. Operating temperature range -55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: Type 7120 - PVC shrink tube - flame retardant UL type FR-1 per MIL-I-23053
   Type 7130 - conformally coated with Polyurethane per MIL-I-46058
   Magnet Wire: Per FED SPEC J-W-001177/9
   (MIL-W-583 Type B)
7. Marking:
   Type 7120 - Printed with part number
   Type 7130 - Color coded per dash number using standard EIA color code.

STANDARD VALUES (Electrical Characteristics are identical for both types. Other values are available on special order.)

DASH NO.	NOMINAL INDUCTANCE	MAX. DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-01	1.0μH	.018	190	3300	3000
-02	1.2	.019	170	3200	2700
-03	1.5	.020	160	3100	2500
-04	1.8	.023	150	2900	2100
-05	2.2	.031	130	2600	2000
-06	2.7	.033	120	2500	1900
-07	3.3	.054	110	1900	1700
-08	3.9	.060	100	1800	1500
-09	4.7	.068	86	1700	1400
-10	5.6	.074	64	1600	1300
-11	6.8	.080	44	1600	1200
-12	8.2	.087	32	1500	1100
-13	10	.095	25	1500	970
-14	12	.11	17	1400	880
-15	15	.15	13	1200	790
-16	18	.16	10	1100	710
-17	22	.19	8.4	1000	640
-18	27	.22	8.0	950	580
-19	33	.24	7.6	910	530
-20	39	.26	7.1	880	480
-21	47	.35	6.0	760	430
-22	56	.47	5.8	650	400
-23	68	.53	4.3	610	370
-24	82	.60	4.1	580	330
-25	100	.67	3.9	550	300

DASH NO.	NOMINAL INDUCTANCE	MAX. DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-26	120μH	.90	3.6	470	270
-27	150	1.2	3.2	410	250
-28	180	1.4	2.8	380	220
-29	220	1.9	2.3	320	200
-30	270	2.1	2.1	310	180
-31	330	2.4	1.9	290	170
-32	390	3.0	1.7	260	150
-33	470	3.4	1.4	240	140
-34	560	4.7	1.3	210	130
-35	680	6.4	1.2	180	110
-36	820	7.1	1.1	170	100
-37	1.0mH	7.9	1.0	160	95
-38	1.2	9.0	.94	150	87
-39	1.5	12	.76	130	78
-40	1.8	14	.72	120	71
-41	2.2	19	.64	100	64
-42	2.7	25	56	90	58
-43	3.3	29	53	83	52
-44	3.9	34	48	77	48
-45	4.7	37	.45	74	44
-46	5.6	50	.40	63	40
-47	6.8	58	.36	59	36
-48	8.2	68	.29	54	33
-49	10	75	.27	52	30

TYPICAL Q CURVES (TYPE 7120/7130)



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QUALITY COILS SINCE 1946

CADDELL-BURNS

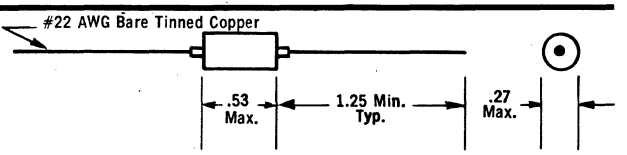
258 East Second Street
Mineola, New York 11501-3508

Telephone: 516-746-2310
Fax: 516-742-2416

SHIELDED CHOKES

1670

TYPE 1670 250μH-100mH 10% or 25% Tolerance (GMV also available).
Recommended mounting pitch — .80"



NOTES:
1. These units are especially suited for filtering applications where small size, low DC resistance and magnetic shielding are required. They are not recommended for applications requiring extremely high stability.
2. Inductance (LP) is measured at 1.0 KHz on a General Radio 1650-B impedance bridge. These units are available in either 10% or 25% inductance tolerance.
3. The test voltage specified in column 3 is the RMS voltage across the test unit during inductance measurement.
4. Current rating (Rated IDC) is based on 0.3 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
6. Dielectric Withstanding Voltage — 100 VRMS.
7. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.

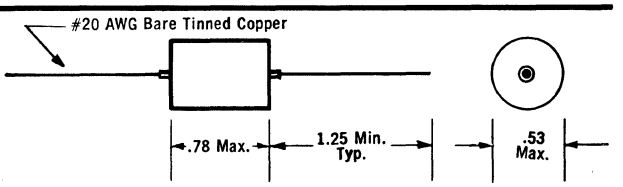
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Test Volts See Note 3	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 4	Incr I ma See Note 5
1670-1	250μH	.007	0.17	1.5	1330	60
1670-2	500	.014	0.39	1.1	880	44
1670-3	1.0mH	.028	0.80	0.90	610	30
1670-4	2.5	.07	1.8	0.40	400	20
1670-5	5.0	.14	3.1	0.30	310	13
1670-6	10	.15	6.3	0.20	220	9.4
1670-7	25	.30	13	0.14	150	6.0
1670-8	50	.40	28	0.10	100	4.3
1670-9	100	.24	54	0.70	75	3.0

SHIELDED CHOKES

1662

TYPE 1662 5.0mH-1.0H 10% or 25% Tolerance (GMV also available).
Recommended mounting pitch — 1.20"



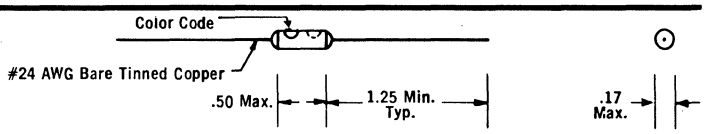
NOTES:
1. These units are especially suited for filtering applications where small size, low DC resistance and magnetic shielding are required. They are not recommended for applications requiring extremely high stability.
2. Inductance (Lp) is measured at 1.0 KHz on a General Radio 1650-B impedance bridge. These units are available in either 10% or 25% inductance tolerance.
3. The test voltage specified in column 3 is the RMS voltage across the test unit during inductance measurement.
4. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
6. Dielectric Withstanding Voltage — 100 VRMS.
7. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Test Volts See Note 3	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 4	Incr I ma See Note 5
1662-1	5.0mH	.14	.83	.28	770	20
1662-2	10	.16	2.4	.20	450	13
1662-3	25	.32	5.2	.11	310	8.0
1662-4	50	.42	12	.080	200	5.0
1662-5	100	.24	30	.050	130	4.0
1662-6	250	.40	65	.035	88	2.3
1662-7	500	.46	130	.024	62	1.6
1662-8	1.0H	.25	200	.015	50	1.2

MINIATURE SHIELDED CHOKES

TYPES 6375/6376 1.0μH-5.0mH 10% Tolerance
Recommended mounting pitch—.70"



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.25 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Construction — Epoxy encapsulated.
   Coating — Polyurethane per MIL-I-46058.

6375
6376

Marking — Color coded per dash number using standard EIA color as follows: 6375 — one color dot; 6376 — two color dots. e.g.: 6375-1 — one brown dot; 6376-1 — two brown dots, etc.

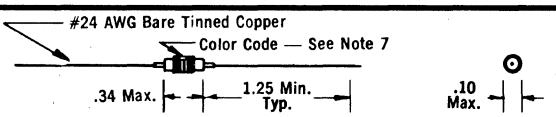
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 2	Incr I ma See Note 3
6375-1	1.0μH	55	7.9	.05	200	2200	2700
6375-2	2.5	45	7.9	.08	115	1700	1600
6375-3	5.0	35	7.9	.12	90	1400	1000
6375-4	10	65	2.5	.42	55	770	750
6375-5	25	55	2.5	.80	35	560	450
6375-6	50	60	2.5	1.5	27	400	300
6375-7	100	70	2.5	3.1	20	280	200
6376-1	100	50	.79	.60	6.0	640	50
6376-2	250	55	.79	.92	2.6	520	32
6376-3	500	50	.79	2.0	1.9	350	22
6376-4	1.0mH	45	.25	4.7	0.8	230	15
6376-5	2.5	45	.25	7.5	0.5	180	10
6377-6	5.0	45	.25	17	0.4	120	7.0

MINIATURE CHOKES

620

TYPE 620 1.0-100μH 10% Tolerance
Recommended mounting pitch—.60"



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — Color coded per dash number using standard EIA color code.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 2	Incr I ma See Note 3
620-1	1.0μH	50	7.9	.11	190	1300	4400
620-2	2.5	50	7.9	.18	120	1000	2600
620-3	5.0	45	7.9	.24	90	900	1800
620-4	7.5	40	7.9	.33	70	800	1350
620-5	10	40	2.5	.39	64	700	1100
620-6	15	60	2.5	.74	54	500	950
620-7	20	55	2.5	.96	46	450	780
620-8	25	60	2.5	1.2	40	400	680
620-9	50	85	2.5	3.6	28	270	490
620-10	75	90	2.5	6.3	22	170	410
620-11	100	80	2.5	8.6	20	150	320

SEND YOUR REQUIREMENTS. PROMPT QUOTES.

QUALITY COILS SINCE 1946

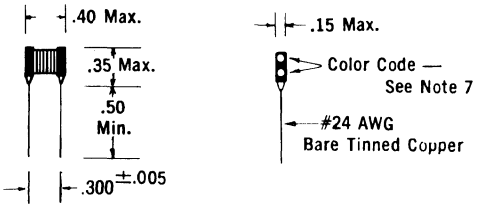
CADDELL-BURNS

258 East Second Street
Mineola, New York 11501-3508
Telephone: 516-746-2310
Fax: 516-742-2416

PRINTED CIRCUIT CHOKES

TYPE 6550 1.0μH-10mH 10% Tolerance

6550



STANDARD VALUES: (Other values available on special order.)

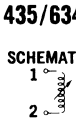
Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 2	Incr I ma See Note 3
6550-1	1.0μH	90	7.9	.015	180	3600	7000
6550-2	2.5	85	7.9	.03	110	2500	4100
6550-3	5.0	90	7.9	.06	75	1800	2900
6550-4	7.5	95	7.9	.11	70	1300	2500
6550-5	10	90	7.9	.19	55	1020	2100
6550-6	25	80	2.5	.50	18	630	1300
6550-7	50	70	2.5	1.1	11	420	1000
6550-8	75	45	2.5	1.2	5.5	400	860
6550-9	100	85	.79	1.5	2.8	365	700
6550-10	250	55	.79	2.7	1.6	270	450
6550-11	500	35	.79	3.3	1.3	240	340
6550-12	750	30	.79	4.2	1.2	215	280
6550-13	1.0mH	80	.25	8.6	1.0	150	210
6550-14	2.5	75	.25	16	.53	110	140
6550-15	5.0	45	.25	31	.45	80	100
6550-16	7.5	25	.25	50	.32	63	80
6550-17	10	50	.079	70	.26	53	70

NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — color coded per dash number using standard EIA color code.

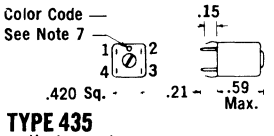
MINIATURE SHIELDED VARIABLE INDUCTORS

TYPES 435/6344 .25-70μH

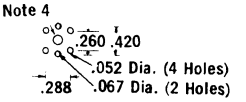
SCHEMATIC



435

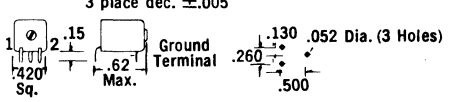


TYPE 435
vertical mount



Recommended Mounting Layout

Tolerance 2 place dec. ±.020
3 place dec. ±.005



TYPE 6344
horizontal mount

Recommended Mounting Layout

6344

NOTES:
1. For vertical mount, order as 435-1 . . . etc. For horizontal mount, order as 6344-1 . . . etc.
2. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
3. Self-resonant frequencies are measured at maximum inductance.
4. Unit can be tuned from top or bottom with ⅛" insulated screwdriver (part no. C-B 2102). For type 435 only, provide .156 dia. hole if bottom access to tuning core is desired.
5. Current rating is based on .15 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
6. Materials:
   Terminals — Tin-plated brass. Core — Ferrite.
   Coil Form and Base — Molded nylon. Shield Can — Cadmium-plated brass.
7. Marking — Marked with Caddell-Burns Part No. on side of can, and color-coded per dash number on bottom between two active terminals.

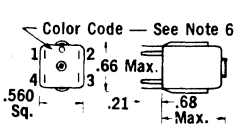
STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	Minimum Range L Max.	Minimum Q @ L Min.	Minimum Q @ L Max.	Test Freq. MHz	Min. SRF MHz Note 3	Max. DCR Ohms	Current Rating ma
435/6344-1	.25μH	.50μH	75	50	25	200	.03	2200
435/6344-2	.48	1.0	70	45	25	150	.08	1300
435/6344-3	.90	2.1	70	45	25/7.9	110	.17	930
435/6344-4	1.7	3.9	50	55	7.9	80	.60	500
435/6344-5	3.5	8.5	50	45	7.9	55	1.2	350
435/6344-6	7.5	17	60	40	7.9/2.5	40	2.3	250
435/6344-7	16.5	35	50	50	2.5	11	1.9	280
435/6344-8	33	70	45	45	2.5	8	2.9	220

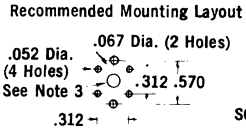
MINIATURE SHIELDED VARIABLE INDUCTORS

434

TYPE 434 .55-64μH
Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005



Recommended Mounting Layout





NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is based on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Materials:
   Terminals — Tin-plated brass.
   Coil Form and Base — Molded nylon.
   Core — Moisture proofed powdered iron.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	Minimum Range L Max.	Minimum Q @ L Min.	Minimum Q @ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
434-1	.55μH	.90μH	90	85	25	160	.06	1800
434-2	.90	1.4	90	70	25/7.9	130	.12	1200
434-3	1.4	2.4	60	70	7.9	100	.25	890
434-4	2.2	4.1	60	80	7.9	80	.60	570
434-5	3.9	7.7	55	55	7.9	52	1.0	440
434-6	7.5	11	35	70	7.9/2.5	21	1.2	400
434-7	11	17	55	75	2.5	16	1.4	370
434-8	18	27	55	75	2.5	14	1.8	330
434-9	27	42	55	70	2.5	13	2.4	280
434-10	42	64	55	65	2.5	11	3.1	250

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QUALITY COILS SINCE 1946

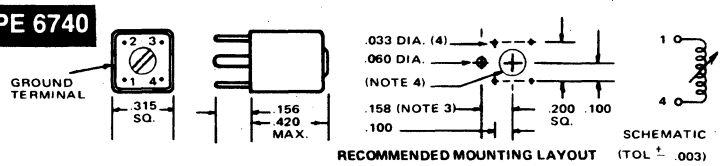
CADDELL-BURNS

258 East Second Street
Mineola, New York 11501-3508

Telephone: 516-746-2310
Fax: 516-742-2416

SUBMINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 6740



NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at nominal inductance.
3. Ground terminal may be bent as required to fit existing layouts.
4. Provide .156 DIA. hole if bottom access to tuning core is desired. Tuning range on −38 thru −61 may be extended by allowing core to extend 1/16" below mounting surface (when Lmin≈½Lnom).
5. Current rating is based on ¼ watt power dissipation.
6. MATERIALS–
   Terminals: tin plated copper.
   Terminal Base: molded phenolic.
   Coil Form: polyester fiberglass.
   Core: moisture-proofed powdered iron or ferrite.
   Shield Can: tin plated copper.
   Impregnation: varnish per MIL-V-173.

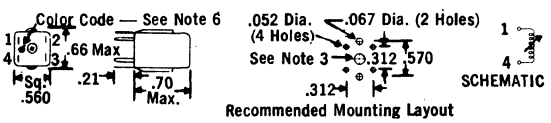
STANDARD VALUES (INTERMEDIATE AND SPECIAL VALUES AVAILABLE ON SPECIAL ORDER)

Dash No.	Nominal Inductance	Minimum Range LMIN	Minimum Range LMAX	Min Q @ LNOM	Test Freq. M Hz	Max DCR OHMS	Min SRF M HZ Note 2	Max IDC mA Note 5
−01	.10uH	.08uH	.12uH	80	25	.02	250	3500
−03	.15	.12	.18	85	25	.03	250	2800
−05	.22	.18	.27	85	25	.04	250	2500
−07	.33	.27	.39	90	25	.05	250	2200
−09	.47	.39	.56	90	25	.13	230	1350
−11	.68	.56	.82	90	25	.17	200	1200
−13	1.0	.82	1.2	90	25	.31	160	850
−15	1.5	1.0	1.8	60	7.9	.33	125	850
−17	2.2	1.5	2.7	65	7.9	.72	110	550
−19	3.3	2.2	3.9	65	7.9	1.3	95	425
−21	4.7	3.3	5.6	60	7.9	1.5	80	400
−23	6.8	4.7	8.2	60	7.9	1.8	62	350
−25	10	6.8	12.	60	7.9	2.2	45	325
−27	15	10	18	72	2.5	1.5	12	400
−29	22	15	27	67	2.5	1.8	9.5	350
−31	33	22	39	65	2.5	2.1	7.8	325
−33	47	33	56	57	2.5	2.6	6.6	300
−35	68	47	82	47	2.5	3.0	5.3	275
−37	100	68	120	45	2.5	3.5	5.0	250
−39	150	100	180	70	.79	3.6	3.4	250
−41	220	150	270	65	.79	6.0	2.8	200
−43	330	220	390	60	.79	7.9	2.3	150
−45	470	330	560	40	.79	11	1.9	125
−47	680	470	820	35	.79	13	1.7	125
−49	1.0mH	.68mH	1.2mH	32	.79	17	1.5	100
−51	1.5	1.0	1.8	37	.25	32	.86	85
−53	2.2	1.5	2.7	37	.25	41	.72	75
−55	3.3	2.2	3.9	40	.25	51	.69	65
−57	4.7	3.3	5.6	27	.25	80	.47	55
−59	6.8	4.7	8.2	25	.25	90	.39	50
−61	10	6.8	12	25	.25	110	.37	45

MINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 6380

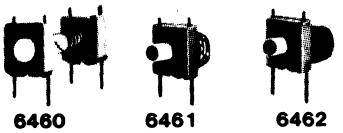
.08-370μH
Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is based on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Materials:
   Terminals — Tin-plated brass.
   Coil Form and Base — Molded nylon.
   Core — Moisture-proofed powered iron or ferrite.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns Part No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	Minimum Range L Max.	Minimum Q @ L Min.	Minimum Q @ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
6380-1	.08μH	.11μH	65	75	25	300	.012	4000
6380-2	.10	.17	75	85	25	280	.014	3700
6380-3	.13	.23	75	90	25	260	.015	3600
6380-4	.17	.28	80	90	25	230	.016	3500
6380-5	.25	.44	90	95	25	180	.024	2800
6380-6	.29	.53	90	95	25	170	.026	2700
6380-7	.48	.84	90	90	25	140	.058	1800
6380-8	.71	2.5	90	85	25/7.9	80	.10	1400
6380-9	1.8	5.7	70	110	7.9	50	.50	630
6380-10	4.5	14	55	120	7.9/2.5	18	.85	480
6380-11	12	40	60	115	2.5	10	1.6	350
6380-12	30	99	55	80	2.5	5.6	2.4	280
6380-13	73	190	55	115	2.5/.79	4.8	3.8	220
6380-14	148	370	75	120	.79	3.5	5.6	180



LOW-COST PRINTED-CIRCUIT VARIABLE INDUCTORS

TYPE 6460

Variable R.F. Inductors
Four Printed Circuit Terminals, Mounting—.5" x .8" Centers
Size 5/8" x 5/8" x .985 Long
Polyester Cellulose Coil Form

Stock No.	Inductance Range Microhenries Min.	Inductance Range Microhenries Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6460-1	06	09	80	105	008	22
6460-2	09	16	100	130	010	22
6460-3	15	29	120	140	011	22
6460-4	19	40	130	145	012	22
6460-5	32	68	80	105	08	20/44
6460-6	60	1 35	80	125	11	20/44
6460-7	1 14	2 5	90	135	15	20/44
6460-8	2 0	4 0	100	140	21	20/44
6460-9	3 1	5 6	110	120	26	20/44
6460-10	4 5	8 1	48	85	29	20/44
6460-11	7 0	11 4	43	150	37	20/44
6460-12	9 7	16 4	80	140	47	20/44
6460-13	15 6	26 2	90	155	61	20/44
6460-14	19 2	44	80	110	1 80	7/44
6460-15	41	95	80	90	2 56	7/44
6460-16	70	183	65	100	3 24	7/44
6460-17	180	525	90	98	5 76	7/44
6460-18	445	1040	94	105	9 32	7/44

Note: Inductance & Q at various frequencies can be altered by changing type of core used (see parts section for cores available) Dash No. 1 thru 15 uses Powdered Iron Core 302—250—6R Dash No. 16 thru 18 uses Ferrite Core 303—250—6R

TYPE 6461

Variable R.F. Coil Series
Size 5/8" x 5/8" x .625 Long
0.5" P C Mounting

Stock No.	Inductance Range Microhenries Min.	Inductance Range Microhenries Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6461-1	09	12	58	66	.007	22
6461-2	1	14	102	128	.009	22
6461-3	14	22	128	150	01 .	22
6461-4	18	33	134	155	011	22
6461-5	23	44	140	154	013	22
6461-6	37	68	87	105	102	7/41
6461-7	58	1 1	87	100	136	7/41
6461-8	1 1	2 2	72	115	2	7/41
6461-9	2	4 4	80	112	29	7/41
6461-10	3 3	8	96	140	77	7/44
6461-11	7	13 6	70	130	1 02	7/44
6461-12	12 4	25 5	85	134	1 42	7/44
6461-13	22 5	49	90	127	1 93	7/44
6461-14	47	100	86	97	2 8	7/44
6461-15	99	174	75	142	4 2	7/44
6461-16	170	332	95	146	6 0	7/44
6461-17	322	570	102	140	8 5	7/44
6461-18	525	910	97	125	10 4	7/44

TYPE 6462

Variable R.F. Coil with Powdered Iron Shield
Size 5/8" x 5/8" x 730 Long
0 5" P C Mounting

Stock No.	Inductance Range Microhenries Min.	Inductance Range Microhenries Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6462-1	08	10	84	89	.007	22
6462-2	4	8	82	100	11	7/41
6462-3	6	1 3	85	105	14	7/41
6462-4	1 1	2 6	71	115	20	7/41
6462-5	2 1	5 1	85	145	55	7/44
6462-6	3 4	8 6	96	145	75	7/44
6462-7	8 0	16 9	70	150	1 14	7/44
6462-8	16 2	39 5	94	142	1 52	7/44
6462-9	34	84	86	110	2 21	7/44
6462-10	57	124	80	145	2 74	7/44
6462-11	67	141	80	148	3 16	7/44

SEND YOUR REQUIREMENTS. PROMPT QUOTES.

Coilcraft

708/639-6400
Fax 708/639-1469
Telex 216378
Dept. E, 1102 Silver Lake Road
Cary, IL 60013

TO ORDER CALL 800/322-2645 In Illinois 708/639-6400

Coilcraft has built its reputation on providing high quality coils at low, factory-direct prices.

We're the only coil manufacturer who can give you technical information, Designer's Kits of standard parts, custom samples, start-up lots, or full production quantities—all with a single phone call.

Most orders are shipped overnight from a one million piece inventory of standard parts.

Need high volume production quantities? We can give you world prices, and the assurance of five plants offshore and a third in Mexico —all supported by two more Coilcraft plants and our engineering staff here in the USA.

Ordering information

To order stock items shown, call 800/322-2645 between 8 AM and 4 PM CST (in Illinois 708/639-6400).

Or write to Coilcraft, Dept. E, 1102 Silver Lake Road, Cary, IL 60013.

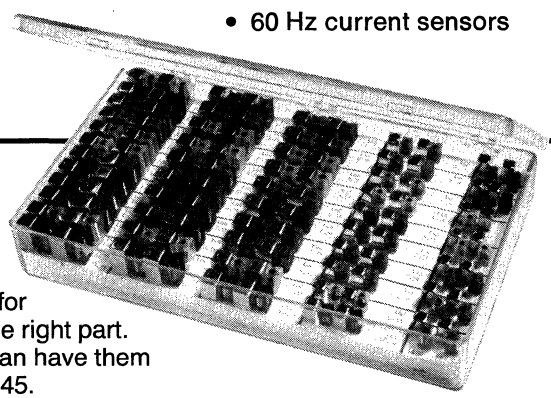
All orders must specify a purchase order number. There is no minimum quantity. Most orders are filled from stock and shipped via UPS unless otherwise specified.

Custom orders

In addition to the standard parts shown here, Coilcraft can custom-build a wide range of inductive devices to meet your precise requirements. For more information, please call our Sales Department at 708/639-2361.

Other Coilcraft inductive devices

- Wide band RF transformers
- LAN transformers
- T-1 carrier transformers
- Magnetics for switching power supplies
  - Chokes
  - Transformers
  - Mag amp toroids
  - Current sensors
- CRT magnetic components
- Common mode data line EMI filters
- LC resonators
- 60 Hz current sensors



DESIGNER'S KITS

These handy, low cost Designer's Kits put a wide range of component values at your fingertips. They're perfect for prototyping and can save hours of hunting around for the right part.

And when you're ready of production quantities, we can have them to you as early as the next day! To order call 800/322-2645.

"Unicoil" 7/10 mm tuneable inductors
.0435 µH - 1.5 µH
49 shielded, 49 unshielded
(2 of each)
Kit M102 $60

"Unicoil" 5 mm tuneable inductors
9 nH - 281 nH
19 shielded, 19 unshielded
(2 of each)
Kit M105 $60

"Slot Ten" 10 mm tuneable inductors
.07 µH - 1143 µH
18 shielded, 18 unshielded
(3 of each)
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4 nH - 33 µH
48 values (10 of each)
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0.1 µH - 1000 µH
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Tuneable and fixed
Inductance: 31.5 nH - 720 nH
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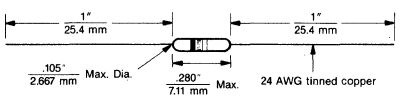
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FIXED INDUCTORS

AXIAL INDUCTORS

Save 20% — 50% compared to expensive molded chokes. These conformally coated coils provide equivalent electrical performance, equal or greater humidity resistance, low temperature coefficients, and greater mechanical reliability. Cross-reference to Dale IR 2/IM 2, Miller 9230, Nytronics DD/MD 75083, 4, 5, Delevan 1025, Jeffers 09. Coilcraft **Designer's Kit F102** contains samples of 25 values. To order, please contact Coilcraft.



Part Number	L uH ± 10%	Q Min.	Test Freq. MHz	DCR Max. Ohms	SRF Min. MHz.	Max Current mA
90-01	**0.1**	**38**	**25**	**0.08**	**680**	**1380**
90-02	**0.12**	**38**	**25**	**0.09**	**640**	**1300**
90-03	**0.15**	**38**	**25**	**0.11**	**600**	**1230**
90-04	**0.18**	**35**	**25**	**0.12**	**550**	**1120**
90-05	**0.22**	**33**	**25**	**0.14**	**510**	**1040**
90-06	**0.24**	**33**	**25**	**0.16**	**460**	**975**
90-07	**0.33**	**30**	**25**	**0.22**	**410**	**830**
90-08	**0.39**	**30**	**25**	**0.3**	**365**	**710**
90-09	**0.47**	**30**	**25**	**0.35**	**330**	**660**
90-10	**0.56**	**30**	**25**	**0.5**	**310**	**550**
90-11	**0.68**	**28**	**25**	**0.6**	**280**	**500**
90-12	**0.82**	**28**	**25**	**0.85**	**260**	**420**
90-13	**1**	**25**	**25**	**1**	**240**	**390**
90-14	**1.2**	**60**	**7.9**	**0.15**	**150**	**620**
90-15	**1.5**	**60**	**7.9**	**0.16**	**140**	**560**
90-16	**1.8**	**60**	**7.9**	**0.2**	**125**	**480**
90-17	**2.2**	**60**	**7.9**	**0.29**	**115**	**415**
90-18	**2.7**	**50**	**7.9**	**0.4**	**100**	**355**
90-19	**3.3**	**50**	**7.9**	**0.42**	**90**	**285**
90-20	**3.9**	**50**	**7.9**	**0.6**	**80**	**263**
90-21	**4.7**	**40**	**7.9**	**0.66**	**60**	**239**
90-22	**5.6**	**40**	**7.9**	**0.7**	**45**	**195**
90-23	**6.8**	**40**	**7.9**	**0.9**	**40**	**185**
90-24	**8.2**	**40**	**7.9**	**1**	**28**	**160**
90-25	**10**	**35**	**7.9**	**1.1**	**24**	**144**
90-26	12	60	2.5	1.62	20	160
90-27	**15**	**60**	**2.5**	**1.75**	**17**	**157**
90-28	18	60	2.5	1.85	16	149
90-29	**22**	**50**	**2.5**	**2**	**14**	**144**
90-30	27	50	2.5	2.1	12	140
90-31	**33**	**50**	**2.5**	**2.2**	**10**	**130**
90-32	39	50	2.5	2.3	9.5	125
90-33	**47**	**50**	**2.5**	**2.4**	**9**	**110**
90-34	56	50	2.5	3	7.8	100
90-35	**68**	**50**	**2.5**	**3.4**	**7**	**92**
90-36	82	50	2.5	3.8	6.7	88
90-37	**100**	**50**	**2.5**	**4.1**	**6.1**	**84**
90-38	120	60	0.79	6.5	4.8	66
90-39	**150**	**60**	**0.79**	**8.3**	**4.1**	**61**
90-40	180	60	0.79	8.9	4	57
90-41	**220**	**60**	**0.79**	**10.1**	**3.6**	**52**
90-42	270	60	0.79	11	3.3	47
90-43	**330**	**60**	**0.79**	**12.4**	**3.1**	**45**
90-44	390	60	0.79	13.6	2.9	40
90-45	**470**	**60**	**0.79**	**18.4**	**2.4**	**36**
90-46	560	60	0.79	20.3	2.2	35
90-47	**680**	**60**	**0.79**	**22.3**	**2**	**30**
90-48	820	60	0.79	25	1.9	29
90-49	**1000**	**60**	**0.79**	**27.4**	**1.8**	**28**

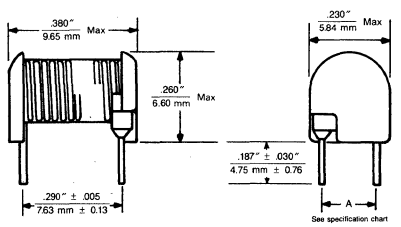
Parts in **bold face** are in stock, available for immediate shipment. For other values, allow 6-8 weeks.

NOTES:

1) Inductance measured with a Coilcraft AXL-A test fixture and HP4191/4192 Impedance Analyzers.
2) Q measured on HP4191/4192 with AXL-A, direct-connected to HP4342 Q-Meter.
3) Temperature rise at rated current and 90°C ambient
   .10 - 1.0 uH: 35°C
   1.2 - 1000 uH: 15°C
4) Maximum operating temperature
   .10 - 1.0 uH: 125°C
   1.2 - 1000 uH: 105°C
5) Color coding per MIL-C-15305C
6) Epoxy coating: flame resistant 94 FO
7) Designed to meet requirements of Military Specifications MS75083, MS75084 and MS75085.

132 SERIES

Very high Q and 5% tolerance make these coils an attractive alternative to axial inductors. Precision insert molding assures constant winding pitch and long-term stability. Coilcraft **Designer's Kit M104** contains samples of each value. To order, please contact Coilcraft.



Part Number	Color	Turns	Dim A	L nH ±5%	Q Min
132-01	Brown	1½	.148 inches/3.76 mm	31.5	60 @ 50 MHz
132-02	Red	2½	.148 inches/3.76 mm	36.5	64 @ 50 MHz
132-03	Orange	3½	.148 inches/3.76 mm	44.0	68 @ 50 MHz
132-04	Yellow	4½	.148 inches/3.76 mm	53.5	72 @ 50 MHz
132-05	Green	5½	.148 inches/3.76 mm	64.0	75 @ 50 MHz
132-06	Blue	6½	.148 inches/3.76 mm	79.0	80 @ 50 MHz
132-07	Violet	7½	.148 inches/3.76 mm	99.0	66 @ 25 MHz
132-08	Gray	8½	.148 inches/3.76 mm	117	68 @ 25 MHz
132-09	White	9½	.148 inches/3.76 mm	138	68 @ 25 MHz
132-10	Black	10½	.148 inches/3.76 mm	158	68 @ 25 MHz
132-11	Brown	11½	.148 inches/3.76 mm	197	66 @ 25 MHz
132-12	Red	12½	.153 inches/3.89 mm	235	72 @ 25 MHz
132-13	Orange	13½	.153 inches/3.89 mm	260	70 @ 25 MHz
132-14	Yellow	14½	.153 inches/3.89 mm	290	70 @ 25 MHz
132-15	Green	15½	.154 inches/3.91 mm	345	72 @ 25 MHz
132-16	Blue	16½	.156 inches/3.96 mm	410	72 @ 25 MHz
132-17	Violet	17½	.156 inches/3.96 mm	475	66 @ 25 MHz
132-18	Gray	18½	.156 inches/3.96 mm	550	66 @ 25 MHz
132-19	White	19½	.156 inches/3.96 mm	600	68 @ 25 MHz
132-20	Black	20½	.160 inches/4.06 mm	720	66 @ 25 MHz

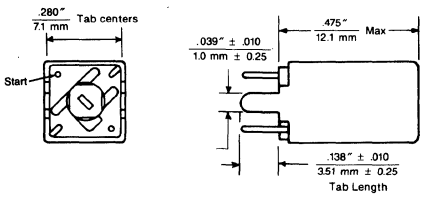
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TUNEABLE RF COILS

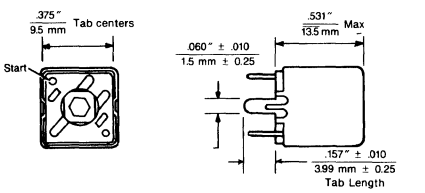
These Coilcraft variable inductors are precision molded in plastic to assure constant winding pitch and a consistent relationship to the printed circuit board. They're ideal for applications requiring low inductance and are more economical than any similar coil. Typical applications include RF coils, IF coils, oscillators, chokes, and helical resonators. Coilcraft **Designer's Kit M102** contains 49 shielded and 49 unshielded coils (2 each). To order, please contact Coilcraft.

- Compact 10mm or 7mm size (5mm parts also available)
- Molded-in windings assure tight tolerances
- Highly resistant to humidity, temperature, shock and vibration
- Threaded cores allow precise tuning
- Custom values and unshielded parts with higher values also available

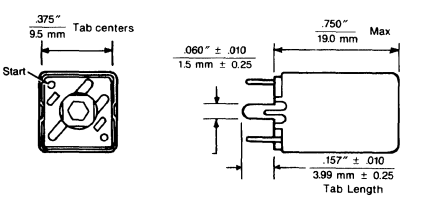
146/150 "UNICOIL"



142 "UNICOIL"



143/144 "UNICOIL"



Part Number	Color	Turns	No Core μH	L Min μH	L Nom μH	L Max μH	Min Q @ L Nom
150-01J08S	Brown	1½	.0425	.0435	.0445	.0455	72 @ 50 MHz
150-02J08S	Red	2½	.054	.056	.060	.064	80 @ 50 MHz
150-03J08S	Orange	3½	.068	.071	.076	.081	84 @ 50 MHz
150-04J08S	Yellow	4½	.0825	.086	.095	.104	85 @ 50 MHz
150-05J08S	Green	5½	.0955	.107	.115	.123	84 @ 50 MHz
150-06J08S	Blue	6½	.109	.125	.134	.143	82 @ 50 MHz
150-07J08S	Violet	7½	.123	.150	.156	.162	80 @ 50 MHz
146-01J08S	Brown	1½	.044	.045	.046	.047	76 @ 50 MHz
146-02J08S	Red	2½	.059	.062	.065	.068	78 @ 50 MHz
146-03J08S	Orange	3½	.075	.080	.085	.090	78 @ 50 MHz
146-04J08S	Yellow	4½	.095	.100	.110	.120	78 @ 50 MHz
146-05J08S	Green	5½	.115	.120	.135	.150	76 @ 50 MHz
146-06J08S	Blue	6½	.136	.142	.163	.184	72 @ 50 MHz
146-07J08S	Violet	7½	.155	.172	.194	.216	68 @ 50 MHz
146-08J08S	Gray	8½	.176	.200	.224	.248	66 @ 50 MHz
146-09J08S	White	9½	.202	.234	.260	.284	60 @ 50 MHz
146-10J08S	Black	10½	.224	.260	.288	.315	56 @ 50 MHz
144-01J12S	Brown	1½	.050	.052	.053	.054	—
144-02J12S	Red	2½	.067	.070	.074	.078	—
144-03J12S	Orange	3½	.088	.092	.099	.106	—
144-04J12S	Yellow	4½	.106	.111	.122	.133	—
144-05J12S	Green	5½	.126	.132	.149	.165	—
144-06J12S	Blue	6½	.147	.154	.175	.196	106 @ 40 MHz
144-07J12S	Violet	7½	.168	.176	.200	.223	104 @ 40 MHz
144-08J12S	Gray	8½	.190	.202	.226	.250	108 @ 40 MHz
144-09J12S	White	9½	.210	.239	.256	.274	108 @ 40 MHz
144-10J12S	Black	10½	.232	.270	.282	.295	106 @ 40 MHz
142-01J08S	Brown	1½	.058	.058	.0595	.061	—
142-02J08S	Red	2½	.081	.084	.086	.089	—
142-03J08S	Orange	3½	.110	.115	.120	.121	—
142-04J08S	Yellow	4½	.140	.147	.156	.160	88 @ 40 MHz
142-05J08S	Green	5½	.174	.182	.197	.205	94 @ 40 MHz
142-06J08S	Blue	6½	.210	.220	.240	.248	92 @ 40 MHz
142-07J08S	Violet	7½	.247	.259	.280	.290	90 @ 40 MHz
142-08J08S	Gray	8½	.284	.299	.322	.337	86 @ 40 MHz
142-09J08S	White	9½	.319	.338	.363	.377	88 @ 40 MHz
142-10J08S	Black	10½	.357	.382	.410	.422	82 @ 40 MHz
143-09J12S	White	9½	.300	.315	.369	.423	80 @ 40 MHz
143-10J12S	Black	10½	.338	.355	.416	.477	82 @ 40 MHz
143-11J12S	Brown	11½	.377	.396	.468	.540	78 @ 40 MHz
143-12J12S	Red	12½	.412	.433	.509	.585	80 @ 40 MHz
143-13J12S	Orange	13½	.452	.475	.556	.637	80 @ 40 MHz
143-14J12S	Yellow	14½	.490	.515	.604	.693	78 @ 40 MHz
143-15J12S	Green	15½	.522	.583	.660	.738	80 @ 40 MHz
143-16J12S	Blue	16½	.575	.638	.720	.801	76 @ 40 MHz
143-17J12S	Violet	17½	.612	.693	.770	.846	76 @ 40 MHz
143-18J12S	Gray	18½	.650	.754	.814	.874	82 @ 40 MHz
143-19J12S	White	19½	.675	.792	.846	.900	80 @ 40 MHz
143-20J12S	Black	20½	.715	.847	.896	.945	74 @ 40 MHz

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"SLOT 10" 10mm TUNEABLE RF COILS

These veratile Coilcraft variable inductors operate over a wide range of frequencies. Standard inductance values are available from less than 1 μH to over 1 mH. Custom values can also be provided upon request.

Coilcraft "Slot Ten" RF coils come in an international 10mm package. Their precision-molded slotted bobbins assure tight tolerances and high stability.

A variety of magnetic and electrostatic shielding options are offered. "Slot Ten" coils are tuned by means of ferrite or powdered iron tuning cores with a hex hole for easy, positive adjustment.

Coilcraft **Designer's Kit M100** contains 18 shielded and 18 unshielded coils (3 each) plus extra cores and sleeves to create all of the standard values shown. To order, please contact Coilcraft.

SELECTION GUIDE

Coilcraft "Slot Ten" coils come in five different styles. Consult this table for the inductance range, relative Q, and shielding options of each style. Then use the appropriate specification chart to pick a specific part number.

Style	L (μH)	Electrostatic Shield	Magnetic Shield	Recommended Frequency	Tuning Core	Relative Q	Relative Cost
Style 1	.8 — 624	No	No	Higher	Iron	Hi	Low
Style 2	.8 — 927	No	No	Higher	Ferrite	Hi	Low
Style 3	.7 — 450	Yes	No	Higher	Iron	Low	Med
Style 4	.8 — 624	Yes	Yes (Iron)	Lower	Iron	Med	Hi
Style 5	.9 — 1143	Yes	Yes (Ferrite)	Lower	Ferrite	Med	Hi

1 All readings taken on H.P. 4342-A Q Meter.
2 L min is achieved at maximum extension of the core toward PC board. Complete tuning range is reached within the boundaries of the coil form.
3 All specifications are recommended at standard "Q" meter frequency as a simple way to assure the quality of our parts. L and Q readings will vary with frequency change.
4 Unshielded parts are coated with lacquer to protect the winding.
5 Shielded parts have a sleeve insert to protect the winding.

STYLE 1
Unshielded with carbonyl E core

Part Number	Color	L min (μH)	L max (μH)	L nom (μH)	Min Q @ L nom	Test Frequency
SLOT TEN-1-01	Brown	.800	1.2	1.0	48	7.9 MHz
SLOT TEN-1-02	Red	1.2	1.8	1.5	50	7.9 MHz
SLOT TEN-1-03	Orange	1.76	2.64	2.2	56	7.9 MHz
SLOT TEN-1-04	Yellow	2.56	3.84	3.2	54	7.9 MHz
SLOT TEN-1-05	Green	3.6	5.4	4.5	54	7.9 MHz
SLOT TEN-1-06	Blue	5.2	7.8	6.5	51	7.9 MHz
SLOT TEN-1-07	Violet	7.6	11.4	9.5	48	7.9 MHz
SLOT TEN-1-08	Grey	11.2	16.8	14.0	38	2.5 MHz
SLOT TEN-1-09	White	16.0	24.0	20.0	38	2.5 MHz
SLOT TEN-1-10	Black*	22.4	33.6	28.0	38	2.5 MHz
SLOT TEN-1-11	Brown*	32.0	48.0	40.0	38	2.5 MHz
SLOT TEN 1-12	Red*	46.4	69.6	58.0	47	2.5 MHz
SLOT TEN-1-13	Orange*	67.2	100.2	84.0	48	2.5 MHz
SLOT TEN-1-14	Yellow*	96	144	120.0	40	790 KHz
SLOT TEN-1-15	Green*	137.6	206.4	172.0	34	790 KHz
SLOT TEN-1-16	Blue*	200	300	250.0	39	790 KHz
SLOT TEN-1-17	Violet*	280	432	360.0	30	790 KHz
SLOT TEN-1-18	Grey*	416	624	520.0	35	790 KHz

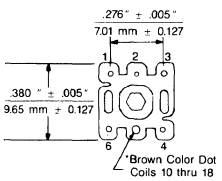
STYLE 2
Unshielded with ferrite core

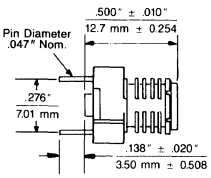
Part Number	Color	L min (μH)	L max (μH)	L nom (μH)	Min Q @ L nom	Test Frequency
SLOT TEN-2-01	Brown	.80	1.7	1.2	47	7.9 MHz
SLOT TEN-2-02	Red	1.25	2.75	2.0	48	7.9 MHz
SLOT TEN-2-03	Orange	1.75	4.0	2.9	48	7.9 MHz
SLOT TEN-2-04	Yellow	2.4	5.4	3.9	47	7.9 MHz
SLOT TEN-2-05	Green	3.5	7.8	5.6	47	7.9 MHz
SLOT TEN-2-06	Blue	4.7	10.6	7.6	46.4	7.9 MHz
SLOT TEN-2-07	Violet	7.4	15.6	11.5	38	2.5 MHz
SLOT TEN-2-08	Grey	11	25	18.2	40	2.5 MHz
SLOT TEN-2-09	White	16	35	25.3	40	2.5 MHz
SLOT TEN-2-10	Black*	22	50	36.5	40	2.5 MHz
SLOT TEN-2-11	Brown*	33	72	52.5	39	2.5 MHz
SLOT TEN-2-12	Red*	46	103	74.8	51	2.5 MHz
SLOT TEN-2-13	Orange*	66	136	100	40	790 KHz
SLOT TEN-2-14	Yellow*	95	198	146	44	790 KHz
SLOT TEN-2-15	Green*	136	297	216	40	790 KHz
SLOT TEN-2-16	Blue*	198	426	312	45	790 KHz
SLOT TEN-2-17	Violet*	286	630	530	33	790 KHz
SLOT TEN-2-18	Grey*	418	927	790	38	790 KHz

* Coils 10 thru 18 have a brown color dot on bottom of coil base.

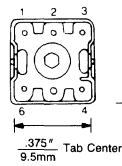
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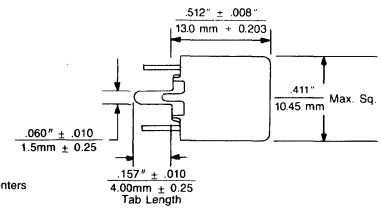
UNSHIELDED (Styles 1 and 2)



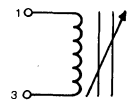


WITH SHIELD CAN (Styles 3, 4, and 5)





SCHEMATIC



STYLE 3
Shielded with carbonyl E core and plastic sleeve

STYLE 4
Shielded with carbonyl E core and sleeve

STYLE 5
Shielded with ferrite core and sleeve

Part Number	Color	L min (μH)	L max (μH)	L nom (μH)	Min Q @ L nom	Test Frequency
SLOT TEN-3-01	Brown	.70	.94	.82	65	25 MHz
SLOT TEN-3-02	Red	1.05	1.41	1.23	37	7.9 MHz
SLOT TEN-3-03	Orange	1.5	2.0	1.75	40	7.9 MHz
SLOT TEN-3-04	Yellow	2.04	2.76	2.4	40	7.9 MHz
SLOT TEN-3-05	Green	2.9	3.9	3.4	39	7.9 MHz
SLOT TEN-3-06	Blue	4.25	5.75	5.0	38	7.9 MHz
SLOT TEN-3-07	Violet	6	8.2	7.1	35	7.9 MHz
SLOT TEN-3-08	Grey	9.4	12.6	11.0	25	2.5 MHz
SLOT TEN-3-09	White	12.8	17.2	15.0	25	2.5 MHz
SLOT TEN-3-10	Black*	18.7	25.3	22.0	26	2.5 MHz
SLOT TEN-3-11	Brown*	26.4	35.6	31.0	25	2.5 MHz
SLOT TEN-3-12	Red*	37.4	50.6	44	29	2.5 MHz
SLOT TEN-3-13	Orange*	52.7	71.3	62	30	2.5 MHz
SLOT TEN-3-14	Yellow*	79	105	92	28	2.5 MHz
SLOT TEN-3-15	Green*	108.8	147.2	128	18	790 KHz
SLOT TEN-3-16	Blue*	155	208	182	20	790 KHz
SLOT TEN-3-17	Violet*	230	310	270	16	790 KHz
SLOT TEN-3-18	Grey*	336	450	390	18	790 KHz
SLOT TEN-4-01	Brown	.80	1.2	1.0	44	7.9 MHz
SLOT TEN-4-02	Red	1.2	1.8	1.5	45	7.9 MHz
SLOT TEN-4-03	Orange	1.76	2.64	2.2	48	7.9 MHz
SLOT TEN-4-04	Yellow	2.56	3.84	3.2	48	7.9 MHz
SLOT TEN-4-05	Green	3.6	5.4	4.5	46	7.9 MHz
SLOT TEN-4-06	Blue	5.2	7.8	6.5	43	7.9 MHz
SLOT TEN-4-07	Violet	7.6	11.4	9.5	40	7.9 MHz
SLOT TEN-4-08	Grey	11.2	16.8	14	32	2.5 MHz
SLOT TEN-4-09	White	16.0	24.0	20	33	2.5 MHz
SLOT TEN-4-10	Black*	22.4	33.6	28	32	2.5 MHz
SLOT TEN-4-11	Brown*	32.0	48.0	40	32	2.5 MHz
SLOT TEN-4-12	Red*	46.4	69.6	58	40	2.5 MHz
SLOT TEN-4-13	Orange*	67.2	100.8	85	40	2.5 MHz
SLOT TEN-4-14	Yellow*	96	144	120	33	790 KHz
SLOT TEN-4-15	Green*	137.6	206.4	172	28	790 KHz
SLOT TEN-4-16	Blue*	200.0	300.0	250	32	790 KHz
SLOT TEN-4-17	Violet*	288	432	360	26	790 KHz
SLOT TEN-4-18	Grey*	416	624	520	29	790 KHz
SLOT TEN-5-01	Brown	.86	2.0	1.4	43	7.9 MHz
SLOT TEN-5-02	Red	1.27	3.25	2.25	44	7.9 MHz
SLOT TEN-5-03	Orange	1.83	4.6	3.25	41	7.9 MHz
SLOT TEN-5-04	Yellow	2.48	6.4	4.5	40	7.9 MHz
SLOT TEN-5-05	Green	3.58	9.3	6.5	40	7.9 MHz
SLOT TEN-5-06	Blue	5.0	12.7	8.8	38	7.9 MHz
SLOT TEN-5-07	Violet	7.7	18.4	13.0	30	2.5 MHz
SLOT TEN-5-08	Grey	12.0	30.0	20.9	35	2.5 MHz
SLOT TEN-5-09	White	16	42	29.4	34	2.5 MHz
SLOT TEN-5-10	Black*	25	60	42.3	32	2.5 MHz
SLOT TEN-5-11	Brown*	36	90	62.8	30	2.5 MHz
SLOT TEN-5-12	Red*	48	126	87.2	42	2.5 MHz
SLOT TEN-5-13	Orange*	72	163	116	35	790 KHz
SLOT TEN-5-14	Yellow*	102	238	168	36	790 KHz
SLOT TEN-5-15	Green*	147	360	252	36	790 KHz
SLOT TEN-5-16	Blue*	215	522	312	45	790 KHz
SLOT TEN-5-17	Violet*	303	765	530	33	790 KHz
SLOT TEN-5-18	Grey*	440	1143	790	38	790 KHz

* Coils 10 tru 18 have a brown color dot on bottom of coil base.

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SURFACE MOUNT INDUCTORS

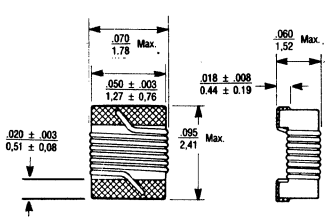
Coilcraft "CS" series chip inductors are designed especially for the needs of today's high frequency designer. Their ceramic construction delivers the highest possible SRF's as well as excellent Q values. The non-magnetic coilform also assures the utmost in thermal stability, predictability, and batch consistency. Parts are suitable for automatic placement and IR or other reflow solder processes. Coilcraft Designer's Kit C100 contains samples of most of the parts shown. To order, contact Coilcraft.

- Ceramic bodies, platinum palladium silver metallized terminations
- All parts available with flat top and wraparound terminal
- Options: tape and reel, nickel barrier, 100% testing, custom values, tighter tolerance.

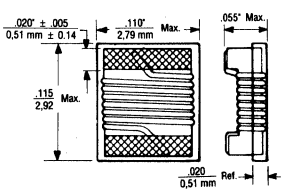
Part Number	Inductance	Q Min	Test Frequency MHz	Self Resonance MHz Min	R_{DC} Max Ohms	I_{DC} Max mA
0805CT-030	3 nH±20%	50	250	>3000	.08	600
0805CT-060	6	50	250	>3000	.11	600
0805CT-080	8	50	250	>3000	.12	600
0805CT-120	12	45	250	2750	.15	600
0805CT-150	15	45	250	2500	.17	600
0805CT-180	18	45	250	2400	.20	600
0805CT-220	22	45	250	2200	.22	500
0805CT-270	27	45	250	2000	.25	500
0805CT-330	33	40	250	1800	.27	500
0805CT-390	39	40	250	1600	.29	500
0805CT-470	47	40	200	1400	.31	500
0805CT-560	56 nH±10%	40	200	1300	.34	500
0805CT-680	68	40	200	1200	.38	500
0805CT-820	82	40	150	1020	.42	400
0805CT-101	100	40	150	950	.46	400
0805CT-121	120	35	150	860	.51	400
0805CT-151	150	35	100	780	.56	400
0805CT-181	180	35	100	710	.64	400
0805CT-221	220	30	100	630	.70	400
1008CT-040	4.7nH±20%	50	50	>3000	.15	900
1008CT-080	8.2	50	50	>3000	.22	900
1008CS-100	10	50	50	>3000	.08	1000
1008CS-120	12	50	50	>3000	.09	1000
1008CS-150	15	50	50	>3000	.10	1000
1008CS-180	18	50	50	2500	.11	1000
1008CS-220	22	50	50	2000	.12	1000
1008CS-270	27	50	50	1500	.13	1000
1008CS-330	33	50	50	1500	.14	1000
1008CS-390	39	50	50	1500	.15	1000
1008CS-470	47	50	50	1350	.16	1000
1008CS-560	56 nH±10%	50	50	1150	.18	1000
1008CS-680	68	50	50	1050	.20	1000
1008CS-820	82	50	50	950	.22	1000
1008CS-101	100	25	25	950	.56	800
1008CS-121	120	25	25	900	.63	800
1008CS-151	150	25	25	850	.70	800
1008CS-181	180	25	25	700	.77	750
1008CS-221	220	28	25	600	.84	720
1008CS-271	270	28	25	550	.91	690
1008CS-331	330	30	25	500	1.05	660

Part Number	Inductance	Q Min	Test Frequency MHz	Self Resonance MHz Min	R_{DC} Max Ohms	I_{DC} Max mA
1008CS-391	390	30	25	465	1.12	630
1008CS-471	470	30	25	425	1.19	600
1008CS-561	560	30	25	415	1.33	580
1008CS-621	620	30	25	375	1.40	560
1008CS-681	680	30	25	340	1.47	540
1008CS-751	750	33	25	330	1.54	520
1008CS-821	820	33	25	325	1.61	500
1008CS-911	910	33	25	305	1.68	480
1008CS-102	1000	33	25	290	1.75	460
1008CS-122	1.2uH±10%	20	7.9	200	2.0	440
1008CS-152	1.5	20	7.9	165	2.3	420
1008CS-182	1.8	20	7.9	150	2.6	400
1008CS-222	2.2	20	7.9	140	2.8	380
1008CS-272	2.7	20	7.9	110	3.2	360
1008CS-332	3.3	20	7.9	90	3.4	350
1008CS-392	3.9	20	7.9	70	3.6	340
1008CS-472	4.7	20	7.9	60	4.0	330
1812LS-123	12.0	42	2.5	55	2.0	310
1812LS-153	15.0	42	2.5	45	2.5	290
1812LS-183	18.0	45	2.5	37	2.8	270
1812LS-223	22.0	45	2.5	32	3.2	260
1812LS-273	27.0	45	2.5	27	3.6	240
1812LS-333	33.0	45	2.5	23	4.0	230
1812LS-393	39.0	45	2.5	19	4.5	210
1812LS-473	47.0	42	2.5	16	5.0	200
1812LS-563	56.0	42	2.5	13	5.5	190
1812LS-683	68.0	40	2.5	10	6.0	180
1812LS-823	82.0	40	2.5	9	7.0	170
1812LS-104	100	40	2.5	8.5	8.0	150
1812LS-124	120	33	0.79	8.5	11.5	135
1812LS-154	150	36	0.79	8.5	13.0	125
1812LS-184	180	36	0.79	8.0	14.2	120
1812LS-224	220	38	0.79	6.0	16.2	115
1812LS-274	270	38	0.79	5.0	20.5	105
1812LS-334	330	38	0.79	4.5	22.5	100
1812LS-394	390	38	0.79	3.5	24.5	90
1812LS-474	470	38	0.79	3.0	26.5	85
1812LS-564	560	33	0.79	2.0	28.5	75
1812LS-684	680	33	0.79	1.9	38.0	60
1812LS-824	820	30	0.79	1.6	41.0	55
1812LS-105	1000	30	0.79	1.5	44.0	50

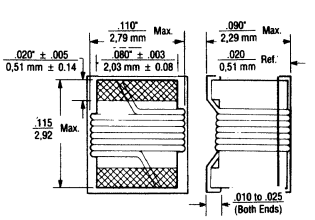
0805CT Series



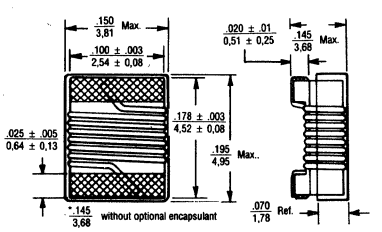
1008CT Series



1008CS Series



1812LS Series

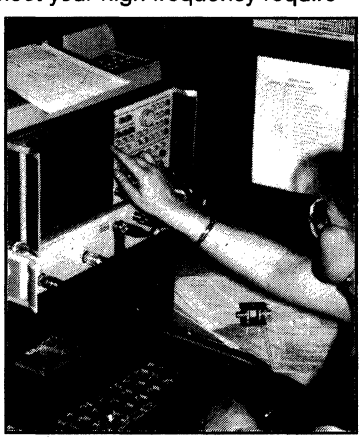


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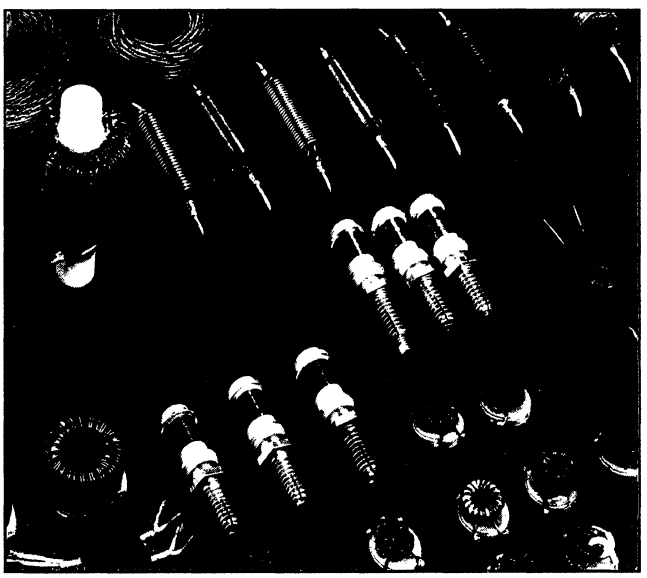


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- SUBMINIATURE
- SHIELDED
- METAL CASE
- EPOXY COATED
- HERMETICALLY SEALED
- AXIAL-RADIAL
- MIL-C-15305
- MIL-I-45208
- FERRITE CORE
- SURFACE MOUNT
- POWDERED IRON
- VARIABLE INDUCTANCE
- ENCAPSULATED
- MINIATURE
- PI-MULTI-PI
- FIXED
- BEAD CORES
- IMPREGNATED
- RF BALUNS
- MIL-T-27
- MIL-T-21038

Applications

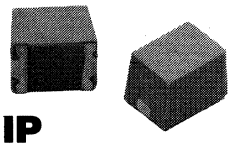
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- Special inductance tolerances available (±10%, ±5% and ±3%) upon request
- Printed marking
- Wide inductance range in small package
- Tape and reel packaging for automatic handling
- Component shape designed to accommodate automatic machine placement

ELECTRICAL SPECIFICATIONS

Inductance Range: .01μH to 1000μH

Standard Tolerances: ±20% for .01μH to .39μH
±10% for .47μH to 1000μH

Temperature Range: −20°C to 105°C

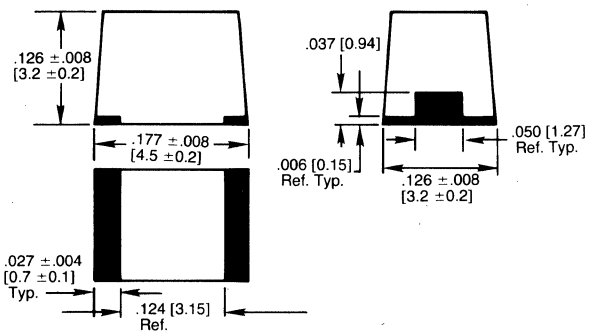
Coilform Material: Ceramic for .01μH to .82μH
Ferrite for 1.0μH to 1000μH

TEST EQUIPMENT

- H/P 4342A Q meter with Dale test fixture or equivalent
- H/P 4191A RF Impedance Analyzer (for SRF measurements)
- Wheatstone Bridge

DIMENSIONAL SPECIFICATIONS

[Numbers in brackets indicate millimeters]

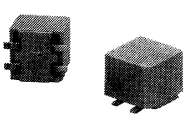


ORDERING INFORMATION

IMC-1812	10 μh	±10%
1.	2.	3.

1. Basic model
2. Inductance value (μh)
3. Inductance tolerance

MODEL IS-22, POT CORE

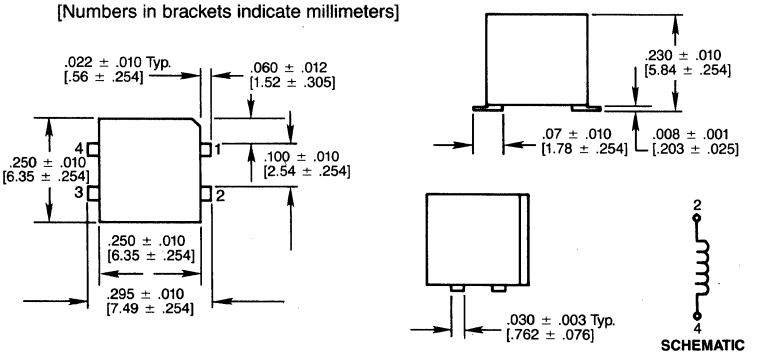


FEATURES

- Wide inductance range with low copper losses
- High Q
- Low EMI
- Compatible with wave, vapor phase reflow and infrared reflow soldering
- Compatible with autoplace equipment
- 16mm tape & reel package available per EIA RS-481A standard

DIMENSIONAL SPECIFICATIONS

[Numbers in brackets indicate millimeters]



ELECTRICAL SPECIFICATIONS

Inductance Range: 200 μH to 25,000 μH

Standard Tolerance: ±40%

Temperature Range: −20°C to +105°C

TEST EQUIPMENT

- H/P 4192A Impedance Analyzer (for Inductance and Q measurements)
- H/P 654A Audio Oscillator (for SRF measurements)
- ESI Model Number 1700 (for DCR measurements)

ORDERING INFORMATION

IS-22	1,000 μH	±40%
1.	2.	3.

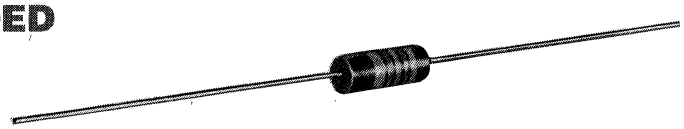
1. Basic model
2. Inductance value (μH)
3. Inductance tolerance

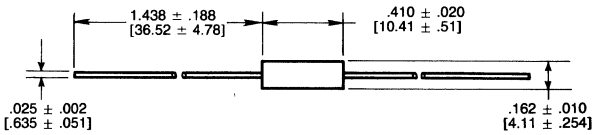
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MOLDED SHIELDED INDUCTORS

MODEL IMS-5, MIL-C-15305





FEATURES

- Epoxy molded construction provides superior moisture protection
- Meets requirements of MIL-C-15305
- Precision performance, excellent reliability, sturdy construction
- Wide inductance range in small package
- Flame retardant coating
- Electromagnetic shield — finest shield available
- Standard inductance tolerance ±10% (Special inductance tolerances available on request)

INDUCTANCE RANGE & MIL STANDARD

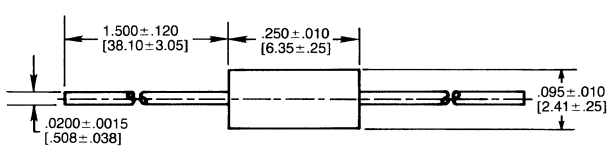
INDUCTANCE RANGE		CLASSIFICATION		MILITARY STANDARD
FROM	TO	GRADE	CLASS	
.10μH	.82μH	1	A	MS75087
1.0μH	12.0μH	1	A	MS75088
15.0μH	100,000μH	1	A	MS75089

NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)
.10	50	25	3.90	44	7.9	120.0	55	.79	3,900.0	45	.25
.12	51	25	4.70	44	7.9	150.0	55	.79	4,700.0	45	.25
.15	51	25	5.60	44	7.9	180.0	55	.79	5,600.0	44	.25
.18	50	25	6.80	50	7.9	220.0	55	.79	6,800.0	40	.25
.22	49	25	8.20	50	7.9	270.0	55	.79	8,200.0	40	.25
.27	47	25	10.0	50	7.9	330.0	55	.79	10,000.0	40	.25
.33	46	25	12.0	55	2.5	390.0	60	.79	12,000.0	30	.079
.39	44	25	15.0	45	2.5	470.0	60	.79	15,000.0	30	.079
.47	44	25	18.0	45	2.5	560.0	60	.79	18,000.0	30	.079
.56	43	25	22.0	45	2.5	680.0	60	.79	22,000.0	27	.079
.68	42	25	27.0	45	2.5	820.0	60	.79	27,000.0	27	.079
.82	40	25	33.0	45	2.5	1,000.0	60	.79	33,000.0	27	.079
1.00	44	25	39.0	50	2.5	1,200.0	45	.25	39,000.0	27	.079
1.20	44	7.9	47.0	50	2.5	1,500.0	45	.25	47,000.0	23	.079
1.50	44	7.9	56.0	50	2.5	1,800.0	45	.25	56,000.0	23	.079
1.80	44	7.9	68.0	50	2.5	2,200.0	45	.25	68,000.0	23	.079
2.20	44	7.9	82.0	50	2.5	2,700.0	45	.25	82,000.0	21	.079
2.70	44	7.9	100.0	50	2.5	3,300.0	45	.25	100,000.0	18	.079
3.30	44	7.9									

MODEL IMS-2, Miniature





FEATURES

- Epoxy molded construction provides superior moisture protection
- Designed to meet requirements of MIL-C-15305 and applicable military standards listed below
- Precision performance, excellent reliability, sturdy construction
- Small package for a shielded inductor
- Flame retardant coating
- Electromagnetic shield
- Standard inductance tolerance ±10% (Special inductance tolerances available on request)

INDUCTANCE RANGE & MIL STANDARD

INDUCTANCE RANGE		CLASSIFICATION		MILITARY STANDARD
FROM	TO	GRADE	CLASS	
.10μH	100μH	1	A	MS21426
120μH	560μH	1	A	MS21427

NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

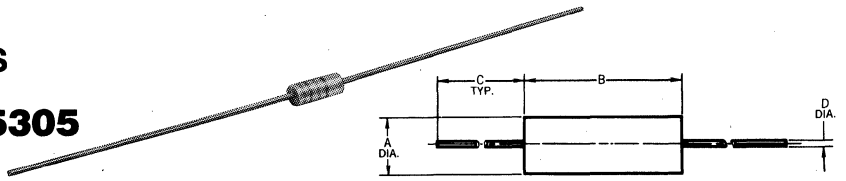
Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Inc. ±10% (μH)	Q. Min.	Test Freq. (Mhz)	Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)
.10	54	25.	1.0	37	25.	10.	57	7.9	100.	40	2.5
.12	52	25.	1.2	40	7.9	12.	36	2.5	120.	31	.79
.15	50	25.	1.5	41	7.9	15.	38	2.5	150.	33	.79
.18	49	25.	1.8	43	7.9	18.	40	2.5	180.	33	.79
.22	47	25.	2.2	45	7.9	22.	40	2.5	220.	35	.79
.27	46	25.	2.7	48	7.9	27.	40	2.5	270.	37	.79
.33	44	25.	3.3	49	7.9	33.	41	2.5	330.	40	.79
.39	42	25.	3.9	50	7.9	39.	42	2.5	390.	38	.79
.47	41	25.	4.7	53	7.9	47.	44	2.5	470.	36	.79
.56	41	25.	5.6	54	7.9	56.	44	2.5	560.	36	.79
.68	39	25.	6.8	55	7.9	68.	45	2.5			
.82	38	25.	8.2	55	7.9	82.	45	2.5			

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MOLDED INDUCTORS

MODELS IM, MIL-C-15305



FEATURES

- Epoxy molded construction provides moisture protection
- Designed to meet requirements of MIL-C-15305 and applicable military standards listed below
- Precision performance, excellent reliability, sturdy construction
- Wide inductance range in small package
- Flame retardant coating
- Wide range of tolerances: ±1%, ±3%, ±5%, ±10%, ±20%

INDUCTANCE RANGE & MIL STANDARD

Model No.	INDUCTANCE RANGE Mil. Range shown in bold face		CLASSIFICATION		Military Standard
	From	To	Grade	Class	
IM-1	.10 µH	1000 µH	–	–	–
IM-2	**.10 µH**	**1.00 µH**	1	B	MS75083
	1.2 µH	**27 µH**	1	A	MS75084
	33 µH	**1000 µH**	1	A	MS75085
IM-4	**.15 µH**	**4.7 µH**	1	B	MS18130
	5.6 µH	**33 µH**	1	A	MS14046
	36 µH	**240 µH**	1	A	MS90538
	270 µH	1800 µH	–	–	–
IM-6	**.10 µH**	**2.7 µH**	1	B	MS75008
	3.3 µH	**27 µH**	1	A	MS75101
	33 µH	220 µH	–	–	–
	270 µH	**1000 µH**	1	A	MS90539
IM-8	**1100 µH**	**3600 µH**	1	A	MS90540
IM-9	**68 µH**	**150 µH**	1	A	MS14047
IM-10	**3900 µH**	**10,000 µH**	1	A	MS90541

NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

DIMENSIONS

[Numbers in brackets indicate millimeters]

Model No.		A	B	C	D
IM-1	MAX.	.086 [2.18]	.210 [5.33]	1.62 [41.15]	.0215 [0.546]
	MIN.	.070 [1.78]	.190 [4.83]	1.38 [35.05]	.0185 [0.470]
IM-2	MAX.	.105 [2.67]	.260 [6.60]	1.626 [41.30]	.0215 [0.546]
	MIN.	0.85 [2.16]	.240 [6.10]	1.250 [31.75]	.0185 [0.470]
IM-4	MAX.	.165 [4.19]	.385 [9.78]	1.625 [41.28]	.027 [0.686]
	MIN.	.145 [3.68]	.365 [9.27]	1.250 [31.75]	.023 [0.584]
IM-6	MAX.	.200 [5.08]	.450 [11.4]	1.625 [41.28]	.027 [0.686]
	MIN.	.180 [4.57]	.430 [10.9]	1.250 [31.75]	.023 [0.584]
IM-8	MAX.	.225 [5.72]	.570 [14.5]	1.625 [41.28]	.030 [0.762]
	MIN.	.205 [5.21]	.550 [14.0]	1.250 [31.75]	.026 [0.660]
IM-9	MAX.	.260 [6.60]	.570 [14.48]	1.625 [41.28]	.027 [0.69]
	MIN.	.240 [6.10]	.550 [13.97]	1.250 [31.75]	.023 [0.58]
IM-10	MAX.	.250 [6.35]	.750 [19.0]	1.625 [41.28]	.034 [0.864]
	MIN.	.230 [5.84]	.730 [18.5]	1.250 [31.75]	.030 [0.762]

MODEL NO. IM-1

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
PHENOLIC CORE	.10	35	25.0
	.12	35	25.0
	.15	35	25.0
	.18	35	25.0
	.22	30	25.0
	.27	30	25.0
	.33	25	25.0
	.39	25	25.0
	.47	25	25.0
IRON CORE	.56	40	25.0
	.68	40	25.0
	.82	40	25.0
	1.0	40	25.0
	1.2	35	7.9
	1.5	40	7.9
	1.8	40	7.9
	2.2	45	7.9
	2.7	45	7.9
	3.3	45	7.9
	3.9	50	7.9
	4.7	55	7.9
	5.6	55	7.9
	6.8	55	7.9
	8.2	45	7.9
	10.	45	7.9
	12.	40	2.5
	15.	40	2.5
	18.	40	2.5
	22.	45	2.5
	27.	45	2.5
	33.	45	2.5
	39.	45	2.5
	47.	45	2.5
	56.	45	2.5
	68.	45	2.5
	82.	45	2.5
	100.	45	2.5
FERRITE CORE	120.	35	.79
	150.	35	.79
	180.	35	.79
	220.	35	.79
	270.	35	.79
	330.	35	.79
	390.	35	.79
	470.	35	.79
	560.	35	.79
	680.	35	.79
	820.	35	.79
	1000.	35	.79

MODEL NO. IM-2

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
PHENOLIC CORE	.10 ±10%	40	25.0
	.12 ±10%	40	25.0
	.15 ±10%	38	25.0
	.18 ±10%	35	25.0
	.22 ±10%	33	25.0
	.27 ±10%	33	25.0
	.33 ±10%	30	25.0
	.39 ±10%	30	25.0
	.47 ±10%	30	25.0
	.56 ±10%	30	25.0
	.68 ±10%	28	25.0
	.82 ±10%	28	25.0
	1.00 ±10%	25	25.0
IRON CORE	1.20 ±10%	25	7.9
	1.50 ±10%	28	7.9
	1.80 ±10%	30	7.9
	2.20 ±10%	30	7.9
	2.70 ±10%	37	7.9
	3.30 ±10%	45	7.9
	3.90 ±10%	45	7.9
	4.70 ±10%	45	7.9
	5.60 ±10%	50	7.9
	6.80 ±10%	50	7.9
	8.20 ±10%	55	7.9
	10.0 ±10%	55	7.9
	12.0 ±10%	45	2.5
	15.0 ±10%	40	2.5
	18.0 ±10%	50	2.5
	22.0 ±10%	50	2.5
	27.0 ±10%	50	2.5
FERRITE CORE	33.0 ±10%	45	2.5
	39.0 ±10%	45	2.5
	47.0 ±10%	45	2.5
	56.0 ±10%	45	2.5
	68.0 ±10%	50	2.5
	82.0 ±10%	50	2.5
	100. ±10%	50	2.5
	120. ±10%	30	.79
	150. ±10%	30	.79
	180. ±10%	30	.79
	220. ±10%	30	.79
	270. ±10%	30	.79
	330. ±10%	30	.79
	390. ±10%	30	.79
	470. ±10%	30	.79
	560. ±10%	30	.79
	680. ±10%	30	.79
	820. ±10%	30	.79
	1000. ±10%	30	.79

MODEL NO. IM-4

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
PHENOLIC CORE	.15 ±20%	50	25.0
	.22 ±20%	50	25.0
	.33 ±20%	45	25.0
	.47 ±20%	45	25.0
	.56 ±20%	50	25.0
	.68 ±10%	50	25.0
	.82 ±10%	50	25.0
	1.00 ±10%	50	25.0
	1.20 ±10%	33	7.9
	1.50 ±10%	33	7.9
	1.80 ±10%	33	7.9
	2.20 ±10%	33	7.9
	2.70 ±10%	33	7.9
	3.30 ±10%	33	7.9
	3.90 ±10%	33	7.9
	4.70 ±10%	33	7.9
IRON CORE	5.60 ±10%	45	7.9
	6.80 ±10%	50	7.9
	8.20 ±10%	50	7.9
	10. ±10%	55	7.9
	12. ±10%	65	2.5
	15. ±10%	65	2.5
	18. ±10%	75	2.5
	22. ±10%	75	2.5
	27. ±10%	60	2.5
	33. ±10%	65	2.5
	36. ± 5%	60	2.5
	39. ± 5%	60	2.5
	43. ± 5%	60	2.5
	47. ± 5%	55	2.5
	51. ± 5%	55	2.5
	56. ± 5%	55	2.5
	62. ± 5%	55	2.5
	68. ± 5%	55	2.5
	75. ± 5%	55	2.5
	82. ± 5%	50	2.5
	91. ± 5%	50	2.5
	100. ± 5%	50	2.5
	110. ± 5%	60	.79
	120. ± 5%	65	.79
	130. ± 5%	65	.79
	150. ± 5%	65	.79
	160. ± 5%	65	.79
	180. ± 5%	65	.79
	200. ± 5%	65	.79
	220. ± 5%	65	.79
	240. ± 5%	65	.79
	270. ± 5%	65	.79
	300. ± 5%	65	.79
	330. ± 5%	65	.79

	Ind. & Tol (µH)	Q Min.	Test Freq. L&Q (Mhz)
IRON CORE (continued)	360. ± 5%	65	.79
	390. ± 5%	65	.79
	430. ± 5%	65	.79
	470. ± 5%	65	.79
	510. ± 5%	65	.79
	560. ± 5%	65	.79
	620. ± 5%	65	.79
	680. ± 5%	55	.79
	750. ± 5%	55	.79
	820. ± 5%	55	.79
	910. ± 5%	55	.79
	1000. ± 5%	55	.79
	1100. ± 5%	30	.25
	1200. ± 5%	30	.25
	1300. ± 5%	30	.25
	1500. ± 5%	30	.25
	1600. ± 5%	30	.25
	1800. ± 5%	30	.25

MODEL NO. IM-6

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
PHENOLIC CORE	.10 ±10%	55	25.0
	.12 ±10%	55	25.0
	.15 ±10%	55	25.0
	.18 ±10%	55	25.0
	.22 ±10%	50	25.0
	.27 ±10%	50	25.0
	.33 ±10%	50	25.0
	.39 ±10%	50	25.0
	.47 ±10%	50	25.0
	.56 ±10%	50	25.0
	.68 ±10%	45	25.0
	.82 ±10%	40	25.0
	1.00 ±10%	40	25.0
	1.20 ±10%	30	7.9
	1.50 ±10%	30	7.9
	1.80 ±10%	30	7.9
	2.20 ±10%	30	7.9
	2.70 ±10%	30	7.9
IRON CORE	3.30 ±10%	30	7.9
	3.90 ±10%	30	7.9
	4.70 ±10%	30	7.9
	5.60 ±10%	30	7.9
	6.80 ±10%	30	7.9
	8.20 ±10%	30	7.9
	10.0 ±10%	30	7.9
	12.0 ±10%	50	2.5
	15.0 ±10%	55	2.5
	18.0 ±10%	60	2.5
	22.0 ±10%	60	2.5
	27.0 ±10%	65	2.5

	Ind. & Tol. (µH)	Q Min.	Test Freq. L&Q (Mhz)
IRON CORE	33.0 ±10%	75	2.5
	39.0 ±10%	75	2.5
	47.0 ±10%	75	2.5
	56.0 ±10%	75	2.5
	68.0 ±10%	75	2.5
	82.0 ±10%	75	2.5
	100. ±10%	65	2.5
	120. ±10%	65	.79
	150. ±10%	65	.79
	180. ±10%	65	.79
	220. ±10%	65	.79
	270. ± 5%	65	.79
	300. ± 5%	65	.79
	330. ± 5%	65	.79
	360. ± 5%	65	.79
	390. ± 5%	65	.79
	430. ± 5%	65	.79
	470. ± 5%	65	.79
	510. ± 5%	65	.79
	560. ± 5%	65	.79
	620. ± 5%	60	.79
	680. ± 5%	60	.79
	750. ± 5%	60	.79
	820. ± 5%	60	.79
	910. ± 5%	60	.79
	1000. ± 5%	60	.79

MODEL NO. IM-8

IRON CORE	1100.	± 5%	60	.25
	1200.	± 5%	60	.25
	1300.	± 5%	60	.25
	1500.	± 5%	65	.25
	1600.	± 5%	65	.25
	1800.	± 5%	65	.25
	2000.	± 5%	65	.25
	2200.	± 5%	70	.25
	2400.	± 5%	70	.25
	2700.	± 5%	70	.25
	3000.	± 5%	70	.25
	3300.	± 5%	70	.25
	3600.	± 5%	70	.25

MODEL NO. IM-9

IRON CORE	68.	±10%	70	2.5
	82.	±10%	65	2.5
	100.	±10%	65	2.5
	120.	±10%	75	.79
	150.	±10%	75	.79

MODEL NO. IM-10

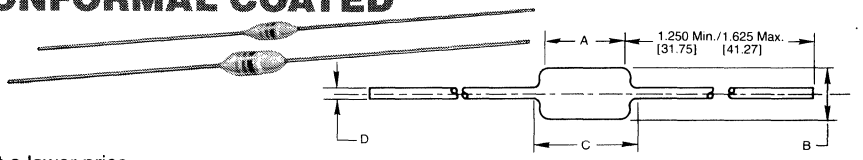
IRON CORE	3900.	± 5%	80	.25
	4300.	± 5%	80	.25
	4700.	± 5%	80	.25
	5000.	± 5%	80	.25
	5600.	± 5%	80	.25
	6200.	± 5%	80	.25
	6800.	± 5%	80	.25
	7500.	± 5%	80	.25
	8200.	± 5%	80	.25
	9100.	± 5%	80	.25
	10,000.	± 5%	80	.25

CONTACT: DALE ELECTRONICS, INC. E. Hwy. 50, P.O. Box 180, Yankton, SD 57078-0180
Phone (605) 665-9301

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EPOXY CONFORMAL COATED INDUCTORS

MODELS IR-2 and IR-4



FEATURES

- Equivalent in quality to molded chokes at a lower price
- Epoxy coating is more durable than lacquer coated models, yet is priced comparably
- Uniform coating is excellent for automatic insertion
- Excellent environmental characteristics
- Flame-retardant coating • Color band identification
- Wide range of tolerances: ±1%, ±3%, ±5%, ±10%, ±20%
- Wide temperature range (−55°C to +105°C)

[Numbers in brackets indicate millimeters]

MODEL	A (Max)	B (Max)	C (Max)	D
IR-2	.260 [6.60]	.120 [3.05]	.330 [8.38]	.0200±.0015 [.508±.038]
IR-4	.385 [9.78]	.180 [4.57]	.440 [11.18]	.025±.002 [.635±.051]

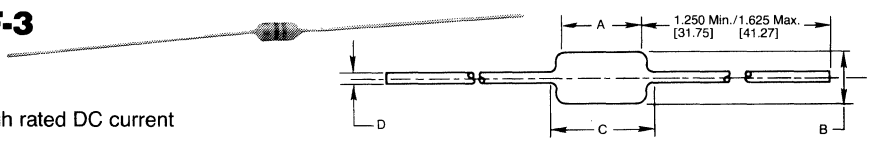
MODEL NO. IR-2

Ind. (µh)	Tol.	Q Min.	Test Freq. L & Q (Mhz)	Ind. (µh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.10	±10%	40	25.0	12.0	±10%	45	2.5
.12	±10%	40	25.0	15.0	±10%	40	2.5
.15	±10%	38	25.0	18.0	±10%	50	2.5
.18	±10%	35	25.0	22.0	±10%	50	2.5
.22	±10%	33	25.0	27.0	±10%	50	2.5
.27	±10%	33	25.0	33.0	±10%	45	2.5
.33	±10%	30	25.0	39.0	±10%	45	2.5
.39	±10%	30	25.0	47.0	±10%	45	2.5
.47	±10%	30	25.0	56.0	±10%	45	2.5
.56	±10%	30	25.0	68.0	±10%	50	2.5
.68	±10%	28	25.0	82.0	±10%	50	2.5
.82	±10%	28	25.0	100.0	±10%	50	2.5
1.00	±10%	25	25.0	120.	±10%	30	.79
1.20	±10%	25	7.9	150.	±10%	30	.79
1.50	±10%	28	7.9	180.	±10%	30	.79
1.80	±10%	30	7.9	220.	±10%	30	.79
2.20	±10%	30	7.9	270.	±10%	30	.79
2.70	±10%	37	7.9	330.	±10%	30	.79
3.30	±10%	45	7.9	390.	±10%	30	.79
3.90	±10%	45	7.9	470.	±10%	30	.79
4.70	±10%	45	7.9	560.	±10%	30	.79
5.60	±10%	50	7.9	680.	±10%	30	.79
6.80	±10%	50	7.9	820.	±10%	30	.79
8.20	±10%	55	7.9	1000.	±10%	30	.79
10.0	±10%	55	7.9				

MODEL NO. IR-4

Ind. (µh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)	Ind. (µh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.15	±20%	50	25.0	75.0	± 5%	55	2.5
.22	±20%	50	25.0	82.0	± 5%	50	2.5
.33	±20%	45	25.0	91.0	± 5%	50	2.5
.47	±20%	45	25.0	100.0	± 5%	50	2.5
.56	±10%	50	25.0	110.0	± 5%	60	.79
.68	±10%	50	25.0	120.0	± 5%	65	.79
.82	±10%	50	25.0	130.0	± 5%	65	.79
1.00	±10%	50	25.0	150.0	± 5%	65	.79
1.20	±10%	33	7.9	160.0	± 5%	65	.79
1.50	±10%	33	7.9	180.0	± 5%	65	.79
1.80	±10%	33	7.9	200.0	± 5%	65	.79
2.20	±10%	33	7.9	220.0	± 5%	65	.79
2.70	±10%	33	7.9	240.0	± 5%	65	.79
3.30	±10%	33	7.9	270.0	± 5%	65	.79
3.90	±10%	33	7.9	300.	± 5%	65	.79
4.70	±10%	33	7.9	330.	± 5%	65	.79
5.60	±10%	45	7.9	360.	± 5%	65	.79
6.80	±10%	50	7.9	390.	± 5%	65	.79
8.20	±10%	50	7.9	430.	± 5%	65	.79
10.0	±10%	55	7.9	470.	± 5%	65	.79
12.0	±10%	65	2.5	510.	± 5%	65	.79
15.0	±10%	65	2.5	560.	± 5%	65	.79
18.0	±10%	75	2.5	620.	± 5%	65	.79
22.0	±10%	75	2.5	680.	± 5%	55	.79
27.0	±10%	60	2.5	750.	± 5%	55	.79
33.0	±10%	65	2.5	820.	± 5%	55	.79
36.0	± 5%	60	2.5	910.	± 5%	55	.79
39.0	± 5%	60	2.5	1000.	± 5%	55	.79
43.0	± 5%	60	2.5	1100.	± 5%	30	.25
47.0	± 5%	55	2.5	1200.	± 5%	30	.25
51.0	± 5%	55	2.5	1300.	± 5%	30	.25
56.0	± 5%	55	2.5	1500.	± 5%	30	.25
62.0	± 5%	55	2.5	1600.	± 5%	30	.25
68.0	± 5%	55	2.5	1800.	± 5%	30	.25

MODELS IRF-1 and IRF-3



FEATURES

- Superior electrical specifications
  High Q & SRF, Low DC resistance, High rated DC current
- Available in bulk, ammo and reel pack per EIA RS-296
- Flame-retardant coating • Color band identification
- Wide inductance range: .10µh to 1000µh
- Uniform coating is excellent for automatic insertion

[Numbers in brackets indicate millimeters]

Dale Type	Dim. A (Max.)	Dim B. (Max.)	Dim. C (Max.)	Dim. D
IRF-1	.260 [6.60]	.110 [2.79]	.330 [8.38]	.0200±.0015 [.508±.038]
IRF-3	.385 [9.78]	.165 [4.19]	.410 [10.41]	.025±.002 [.635±.051]

MODEL NO. IRF-1

Ind. (µh)	Tol.	Q Min.	Test Freq. L & Q (Mhz)	Ind. (µh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.10	± 20%	40	25.0	10.	± 10%	50	7.9
.12	± 20%	40	25.0	12.	± 10%	50	2.5
.15	± 20%	40	25.0	15.	± 10%	50	2.5
.18	± 20%	40	25.0	18.	± 10%	50	2.5
.22	± 20%	40	25.0	22.	± 10%	50	2.5
.27	± 20%	40	25.0	27.	± 10%	50	2.5
.33	± 20%	40	25.0	33.	± 10%	50	2.5
.39	± 20%	40	25.0	39.	± 10%	50	2.5
.47	± 20%	40	25.0	47.	± 10%	60	2.5
.56	± 20%	40	25.0	56.	± 10%	60	2.5
.68	± 20%	40	25.0	68.	± 10%	60	2.5
.82	± 20%	40	25.0	82.	± 10%	60	2.5
1.0	± 10%	50	25.0	100.	± 10%	60	2.5
1.2	± 10%	50	7.9	120.	± 10%	60	.79
1.5	± 10%	50	7.9	150.	± 10%	60	.79
1.8	± 10%	50	7.9	180.	± 10%	60	.79
2.2	± 10%	50	7.9	220.	± 10%	60	.79
2.7	± 10%	50	7.9	270.	± 10%	60	.79
3.3	± 10%	50	7.9	330.	± 10%	60	.79
3.9	± 10%	50	7.9	390.	± 10%	60	.79
4.7	± 10%	50	7.9	470.	± 10%	60	.79
5.6	± 10%	50	7.9	560.	± 10%	60	.79
6.8	± 10%	50	7.9	680.	± 10%	60	.79
8.2	± 10%	50	7.9	820.	± 10%	60	.79
				1000.	± 10%	60	.79

MODEL NO. IRF-3

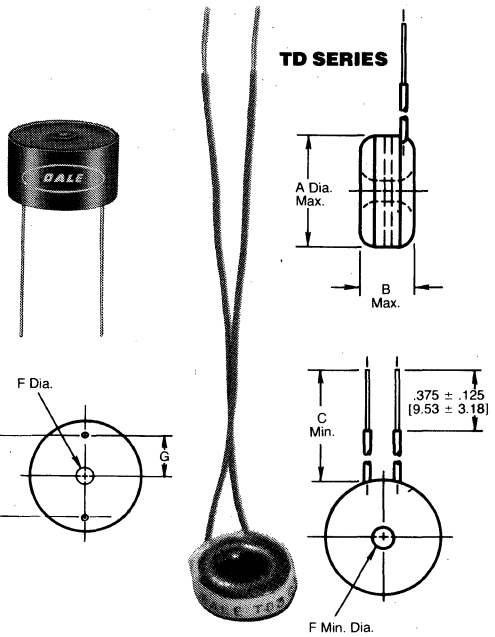
Ind. (µh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)	Ind. (µh)	Tol.	Q Min.	Test Freq. L & Q (Mhz)
.22	± 20%	55	25.0	18.	± 10%	65	2.5
.27	± 20%	55	25.0	22.	± 10%	60	2.5
.33	± 20%	55	25.0	27.	± 10%	55	2.5
.39	± 20%	55	25.0	33.	± 10%	55	2.5
.47	± 20%	55	25.0	39.	± 10%	50	2.5
.56	± 20%	55	25.0	47.	± 10%	45	2.5
.68	± 20%	55	25.0	56.	± 10%	40	2.5
.82	± 20%	55	25.0	68.	± 10%	40	2.5
1.0	± 10%	55	25.0	82.	± 10%	35	2.5
1.2	± 10%	50	7.9	100.	± 10%	30	2.5
1.5	± 10%	50	7.9	120.	± 10%	70	.79
1.8	± 10%	55	7.9	150.	± 10%	70	.79
2.2	± 10%	55	7.9	180.	± 10%	70	.79
2.7	± 10%	60	7.9	220.	± 10%	70	.79
3.3	± 10%	65	7.9	270.	± 10%	70	.79
3.9	± 10%	65	7.9	330.	± 10%	70	.79
4.7	± 10%	70	7.9	390.	± 10%	65	.79
5.6	± 10%	70	7.9	470.	± 10%	65	.79
6.8	± 10%	75	7.9	560.	± 10%	65	.79
8.2	± 10%	80	7.9	680.	± 10%	65	.79
10.	± 10%	85	7.9	820.	± 10%	65	.79
12.	± 10%	75	2.5	1000.	± 10%	65	.79
15.	± 10%	70	2.5				

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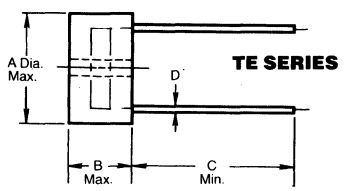
TOROIDAL FILTER INDUCTORS

MODELS TE & TD



FEATURES

- Choice of encapsulated (TE) or dipped (TD) styles
- TE style designed to meet the requirements of MIL-T-27, Type TF5S20ZZ. TD style combines low cost with excellent performance in commercial applications.
- High Q and wide selection of Q vs frequency ranges in one small package. Large number of standard inductance values.



SPECIFICATIONS

ELECTRICAL

Tolerance:
TE-2, TD-2 = ±1% > 2mH, ±2% = 0.05mH to 2.0mH
TE-3, TD-3 = ±1% > 2mH, ±2% 154μH to 2.0mH, ±5% < 150μH
TE-4, TD-4 = ±1% > 2mH, ±2% < 2mH
TE-5, TD-5 = ±1% > 2mH, ±2% < 2mH

Insulation Resistance: 1000 Megohms minimum

Dielectric Strength: 1000 Volts minimum (TE)
500 Volts minimum (TD)

MECHANICAL

Terminal Strength: 2 lb. pull test (TE)

Vibration: Per MIL-T-27 (TE)

Shock: Per MIL-T-27 (TE)

Weight: TE-2 = 2 grams TD-2 = 1.6 grams typ.
TE-3 = 5.1 grams TD-3 = 4.9 grams typ.
TE-4 = 20 grams TD-4 = 17 grams typ.
TE-5 = 53 grams TD-5 = 52 grams typ.

MATERIAL

Encapsulant: Epoxy (TE)

Coating: Vinyl (TD), non-flammable, abrasion and moisture resistant. Resists most cleaning agents. (Consult factory for chemicals which may be used.)

Standard Terminals: Tinned copper (TE); Stranded, tinned copper, Teflon insulated (TD)

Gauge: TE-2 = 24AWG TD-2 = 30AWG
TE-3 = 22AWG TD-3 = 26AWG
TE-4 = 20AWG TD-4 = 24AWG
TE-5 = 20AWG TD-5 = 24AWG

DIMENSIONS [Numbers in brackets indicate millimeters]

TYPE	A	B	C	D	E	F	G
TE-2	.437 [11.10]	.270 [6.86]	1.00 [25.40]	.020 [0.51]	.300 [7.62]	—	—
TD-2	.437 [11.10]	.250 [6.35]	2.00 [50.80]	—	—	—	—
TE-3	.685 [14.86]	.385 [9.78]	1.00 [25.40]	.025 [0.64]	.500 [12.70]	.093 [2.36]	.250 [6.35]
TD-3	.685 [14.86]	.320 [8.13]	3.0 [76.20]	—	—	.125 [3.18]	—
TE-4	1.062 [26.97]	.500 [12.70]	1.00 [25.40]	.032 [0.81]	.900 [22.86]	.120 [3.05]	.450 [11.43]
TD-4	1.062 [26.97]	.437 [11.10]	4.0 [101.6]	—	—	.220 [5.59]	—
TE-5	1.32 [33.53]	.725 [18.42]	1.00 [25.40]	.032 [0.81]	1.00 [25.40]	.144 [3.66]	.50 [12.70]
TD-5	1.32 [33.53]	.688 [17.48]	6.00 [142.4]	—	—	.220 [5.59]	—

INDUCTANCE RANGES

T.C. AVAIL.	TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5
Q0	50μH to 10mH	50μH to 15mH	150μH to 20mH	1mH to 100mH
Q3	470μH to 120mH	500μH to 1H	1mH to 2H	5mH to 2H
Q4	1mH to 250mH	1mH to 4H	2mH to 7.5H	10mH to 20H

TEMPERATURE COEFFICIENT CODE (APPLIES TO CORE ONLY)

DALE TYPES				T.C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE	T.C. AVAILABILITY		
TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5				Q0	Q3	Q4
X	X	X	X	TA	0 ± 1%	−55°C to +125°C		X	X
		X	X	TB	0 ± 0.1%	+13°C to +35°C		X	X
X	X	X	X	TD	0 ± 0.1%	0°C to +55°C		X	X
		X	X	TE	0 ± 0.15%	0°C to +55°C			X
	X	X	X	TL*	+40 to +110 PPM/°C +85 to +185 PPM/°C	−55°C to +25°C +25°C to +85°C			X
X	X	X	X	TM	0 ± 0.25%	−65°C to +125°C		X	X
X	X	X	X	TR	50 PPM/°C (Typical)	−65°C to +125°C	X		
X	X	X	X	TW	0 ± 0.25%	−55°C to +85°C		X	X

*Inverse of typical Temperature Coefficient of polystyrene capacitor.

CONTACT: DALE ELECTRONICS, INC. E. Hwy. 50, P.O. Box 180, Yankton, SD 57078-0180 • Phone (605) 665-9301

DC RESISTANCE AND SELF RESONANT FREQUENCIES
(Typical Values)

TE-2, TD-2

INDUCTANCE (mH)	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
0.050	1.9	—	—	10	—	—
0.100	2.7	—	—	7	—	—
0.330	7.7	—	—	3.1	—	—
0.470	9.3	2.3	—	2.5	2.4	—
1.00	26	4.2	2.3	1.4	1.2	2.0
3.30	79	9.7	5.4	.70	.79	.95
10.0	251	31	18	.34	.40	.43
33.0	—	118	54	—	.18	.21
100	—	408	227	—	.06	.10
250	—	—	450	—	—	.05

TE-3, TD-3

INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
50.0 μH	.68	—	—	7.6	—	—
100. μH	1.0	—	—	5.1	—	—
330. μH	3.3	—	—	2.9	—	—
1.00 mH	6.9	1.5	.82	1.4	1.1	1.0
3.30 mH	24	4.1	2.3	.79	.57	.55
10.0 mH	84	14	5.9	.40	.29	.25
15.0 mH	106	17	9.1	.34	.24	.21
33.0 mH	—	40	18	—	.14	.12
100. mH	—	138	58	—	.080	.077
330. mH	—	555	220	—	.040	.038
1.0 H	—	1500	670	—	.021	.019
4.00 H	—	—	2700	—	—	.009

TE-4, TD-4

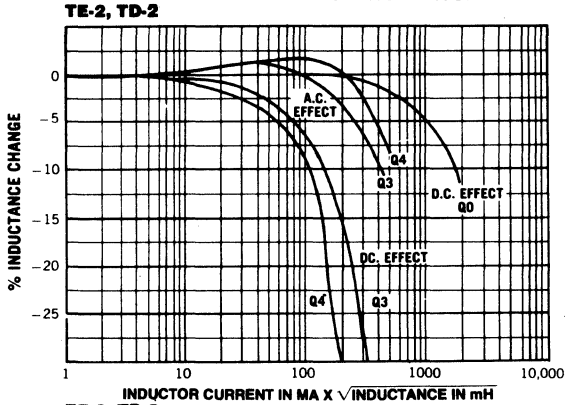
INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
150. μH	.54	—	—	2.6	—	—
1.00 mH	2.8	.70	—	1.0	.75	—
2.00 mH	5.5	1.4	.78	.64	.54	.45
10.0 mH	27	4.9	2.5	.24	.21	.18
20.0 mH	54	9.6	5.0	.18	.15	.13
100. mH	—	56	23	—	.059	.051
1.00 H	—	570	260	—	.016	.014
2.00 H	—	1200	520	—	.013	.011
7.5 H	—	—	2000	—	—	.004

TE-5, TD-5

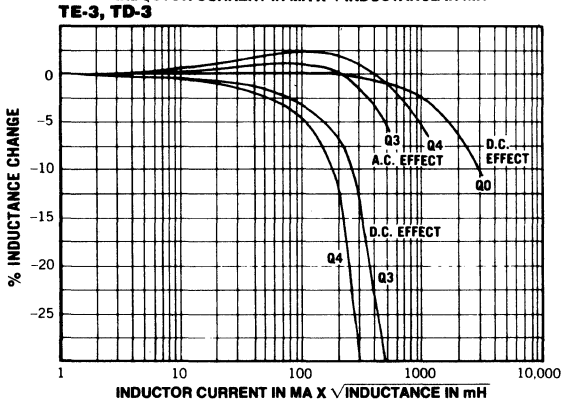
INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
1.00 mH	1.8	—	—	.80	—	—
3.30 mH	5.2	—	—	.44	—	—
5.00 mH	6.5	1.8	—	.33	.32	—
10.00 mH	13	2.4	1.7	.21	.20	.15
33.00 mH	49	8.8	3.9	.12	.11	.086
100.00 mH	133	27	11	.061	.057	.044
330.00 mH	—	80	44	—	.032	.024
1.00 H	—	222	121	—	.016	.012
2.00 H	—	475	217	—	.012	.008
10.00 H	—	—	1300	—	—	.003
20.00 H	—	—	2400	—	—	.002

INDUCTANCE VS D.C. BIAS
INDUCTANCE VS A.C. EXCITATION

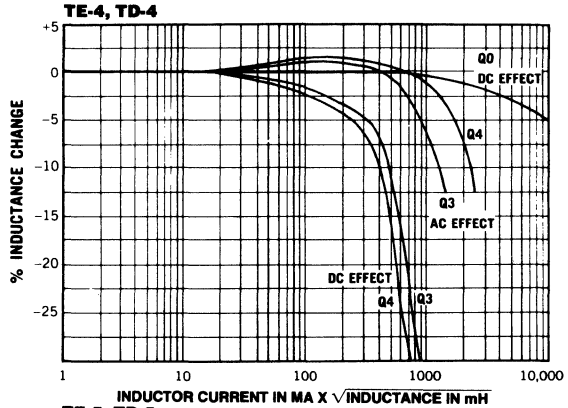
TE-2, TD-2



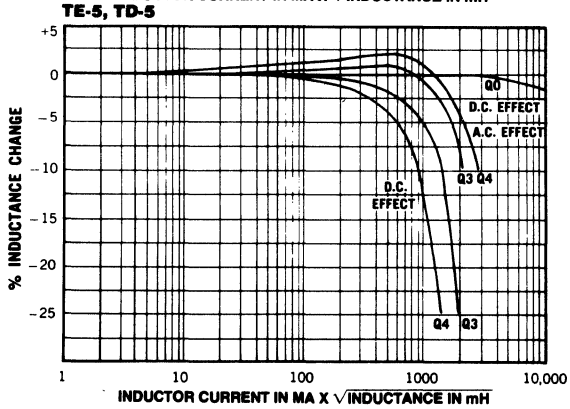
TE-3, TD-3



TE-4, TD-4



TE-5, TD-5



SAMPLE PART NUMBER

TE-X / TD-X	Q0	TR	5mH	1.0
DALE SIZE	Q TYPE	T.C. CODE	INDUCTANCE in μH, mH or H	% TOLERANCE

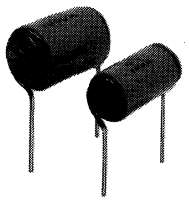
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A COMPANY OF VISHAY DALE

HIGH CURRENT FILTER INDUCTORS

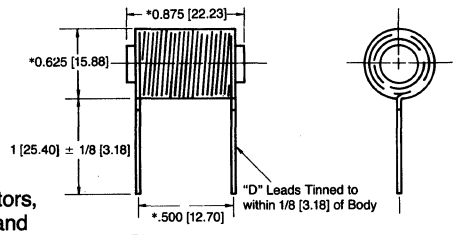
MODEL | FEATURES | DIMENSIONS

IH



FEATURES
- Printed circuit mounting
- Pre-tinned leads

TYPICAL APPLICATIONS
Noise filtering for switching regulators, power amplifiers, power supplies and SCR or Triac control circuits.

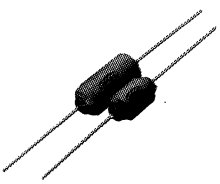


SCHEMATIC



*Dimensions shown represent Model IH-3 which is one of 24 available models with current ratings from 5 to 24 amps. For complete information, contact factory or write for a Magnetic Components Catalog.

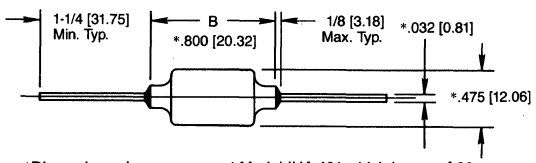
IHA



FEATURES
- Printed circuit mounting
- Pre-tinned leads
- Low cost construction
- For use with switching power supplies
- Protected by polyolefin sleeve

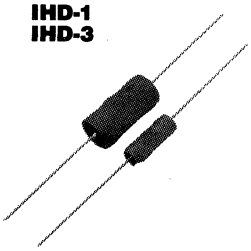
SCHEMATIC



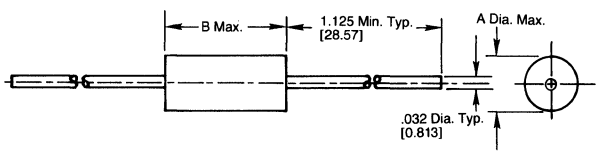


*Dimensions shown represent Model IHA-101 which is one of 20 models available with current ratings from 1.4 to 9.3 amps.

IHD-1 IHD-3

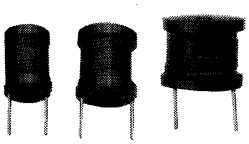


FEATURES
- Printed circuit mounting (axial leads)
- Protected by polyolefin sleeve
- Pre-tinned leads
- High saturation bobbin used allowing high inductance with low DC resistance
- Inductance: Measured at 1 KHz with no DC current
- Temperature Range: −55°C to +105°C

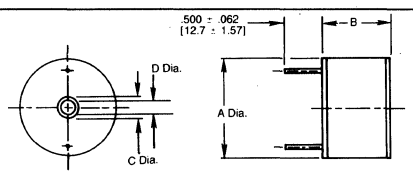


MODEL	A (Max.)	B (Max.)
IHD-1	.250 [6.35]	.650 [16.51]
IHD-3	.453 [11.51]	.900 [22.86]

IHB

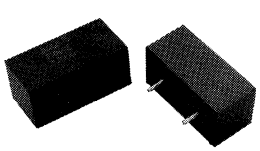


FEATURES
- Printed circuit mounting
- Wide range of inductance and current ratings
- Pre-tinned leads
- Optional insulating covering and printing available at additional cost
- Inductance: Measured at 1 KHz with no DC current
- Temperature Range: −55°C to +130°C

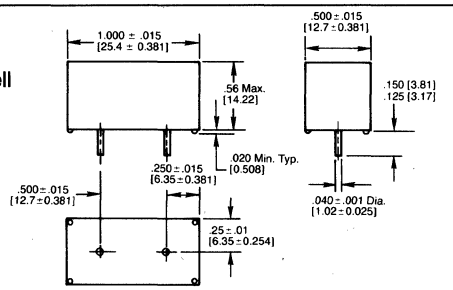


MODEL NO.	A (Max.)	B (Max.)	C (Max.)	D (Max.)
IHB-1	.660 [16.76]	.840 [21.34]	.162 [4.11]	.115 [2.92]
IHB-2	.825 [20.95]	.840 [21.34]	.162 [4.11]	.115 [2.92]
IHB-3	1.100 [27.94]	.840 [21.34]	.162 [4.11]	.115 [2.92]
IHB-4	1.600 [40.64]	1.030 [26.16]	.250 [6.35]	.175 [4.44]
IHB-5	1.600 [40.64]	1.450 [36.83]	.250 [6.35]	.175 [4.44]
IHB-6	2.000 [50.80]	1.500 [38.10]	.330 [8.38]	.160 [4.06]

IHM-2



FEATURES
- Totally encapsulated using a potted flame-resistant shell
- Pre-tinned leads • Printed circuit mounting
- Designed to meet MIL-T-27 specifications
- Inductance: Measured at 1 KHz with no DC current
- Insulation Strength: 10 Megohms minimum
- Temperature Rating: Continuous operation at temperatures between −55°C and +125°C



CONTACT: **DALE ELECTRONICS, INC.** E. Hwy. 50, P.O. Box 180, Yankton, SD 57078-0180 • Phone (605) 665-9301

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- Pulse transformers
- Data buss transformers

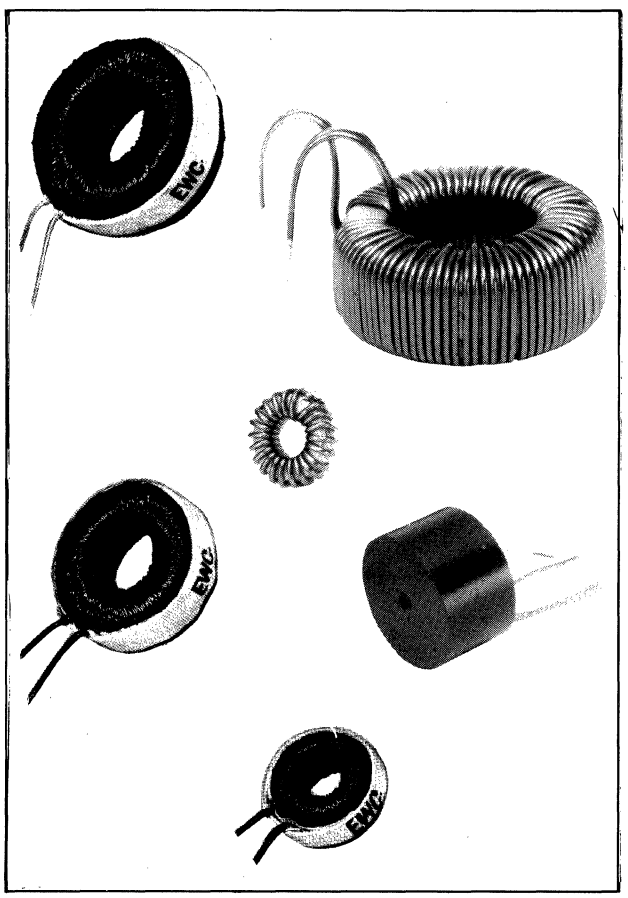
ENGINEERING — experienced engineers available to discuss your requirements. Inspection System approved to Mil-I-45208 Listed on the current QPL-27

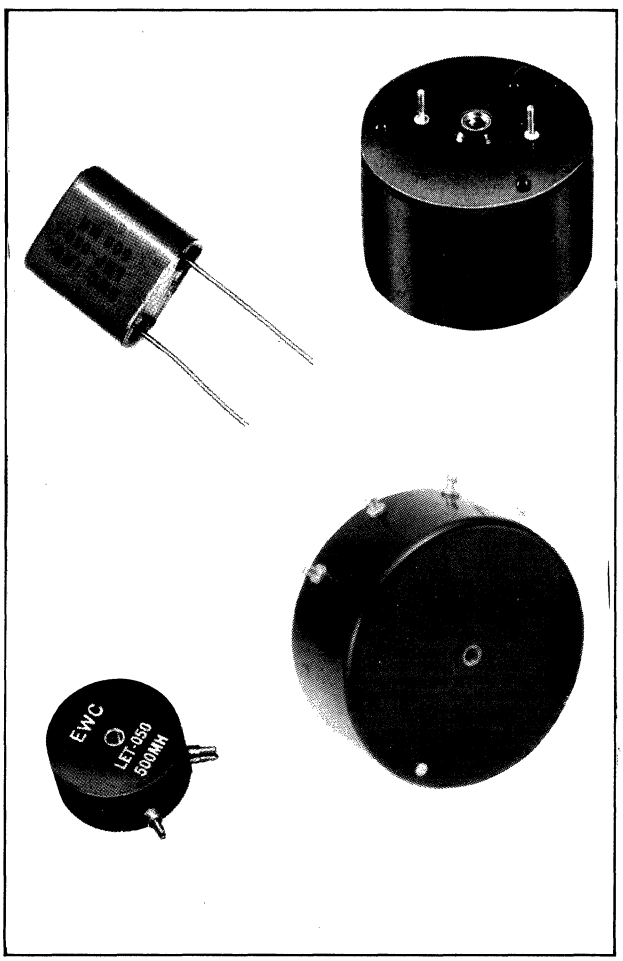
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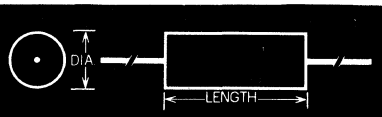
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MOLDED RF COILS

Series 1025 & 1026 Unshielded

Delevan Part Number	Inductance Microhenries ± 10%	Test Frequency (MHz)	Core Material
1025-94	.10 ± 10%	25.0	PHENOLIC (LT4K)
1025-96	.12 ± 10%	25.0	
1025-00	.15 ± 10%	25.0	
1025-02	.18 ± 10%	25.0	
1025-04	.22 ± 10%	25.0	
1025-06	.27 ± 10%	25.0	
1025-08	.33 ± 10%	25.0	
1025-10	.39 ± 10%	25.0	
1025-12	.47 ± 10%	25.0	
1025-14	.56 ± 10%	25.0	
1025-16	.68 ± 10%	25.0	
1025-18	.82 ± 10%	25.0	
1025-20	1.00 ± 10%	25.0	
1025-22	1.20 ± 10%	7.9	IRON (LT10K)
1025-24	1.50 ± 10%	7.9	
1025-26	1.80 ± 10%	7.9	
1025-28	2.20 ± 10%	7.9	
1025-30	2.70 ± 10%	7.9	
1025-32	3.30 ± 10%	7.9	
1025-34	3.90 ± 10%	7.9	
1025-36	4.70 ± 10%	7.9	
1025-38	5.60 ± 10%	7.9	
1025-40	6.80 ± 10%	7.9	
1025-42	8.20 ± 10%	7.9	
1025-44	10.0 ± 10%	7.9	
1025-46	12.0 ± 10%	2.5	
1025-48	15.0 ± 10%	2.5	
1025-50	18.0 ± 10%	2.5	
1025-52	22.0 ± 10%	2.5	
1025-54	27.0 ± 10%	2.5	
1025-56	33.0 ± 10%	2.5	FERRITE (LT10K)
1025-58	39.0 ± 10%	2.5	
1025-60	47.0 ± 10%	2.5	
1025-62	56.0 ± 10%	2.5	
1025-64	68.0 ± 10%	2.5	
1025-66	82.0 ± 10%	2.5	
1025-68	100.0 ± 10%	2.5	
1025-70	120.0 ± 10%	.79	
1025-72	150.0 ± 10%	.79	
1025-74	180.0 ± 10%	.79	
1025-76	220.0 ± 10%	.79	
1025-78	270.0 ± 10%	.79	
1025-80	330.0 ± 10%	.79	
1025-82	390.0 ± 10%	.79	
1025-84	470.0 ± 10%	.79	
1025-86	560.0 ± 10%	.79	
1025-88	680.0 ± 10%	.79	
1025-90	820.0 ± 10%	.79	
1025-92	1000.0 ± 10%	.79	
1026-00	.022 ± 20%	50	PHENOLIC (LT4K)
1026-02	.027 ± 10%	40	
1026-04	.033 ± 10%	40	
1026-06	.039 ± 10%	40	
1026-08	.047 ± 10%	40	
1026-10	.056 ± 10%	40	
1026-12	.068 ± 10%	40	
1026-14	.082 ± 10%	40	

Series 1537 Unshielded

Delevan Part Number	Inductance Microhenries	Q Min.	Test Frequency (MHz)	Core Material
1537-00	.15 ± 20%	50	25.0	PHENOLIC (LT4K)
1537-02	.22 ± 20%	50	25.0	
1537-04	.33 ± 20%	45	25.0	
1537-06	.47 ± 20%	45	25.0	
1537-07	.56 ± 10%	50	25.0	
1537-08	.68 ± 10%	50	25.0	
1537-10	.82 ± 10%	50	25.0	
1537-12	1.00 ± 10%	50	25.0	
1537-14	1.20 ± 10%	33	7.9	
1537-16	1.50 ± 10%	33	7.9	
1537-18	1.80 ± 10%	33	7.9	
1537-20	2.20 ± 10%	33	7.9	
1537-22	2.70 ± 10%	33	7.9	
1537-24	3.30 ± 10%	33	7.9	
1537-26	3.90 ± 10%	33	7.9	
1537-28	4.70 ± 10%	33	7.9	
1537-30	5.60 ± 10%	45	7.9	IRON (LT10K)
1537-32	6.80 ± 10%	50	7.9	
1537-34	8.20 ± 10%	50	7.9	
1537-36	10.0 ± 10%	55	7.9	
1537-38	12.0 ± 10%	65	2.5	
1537-40	15.0 ± 10%	65	2.5	
1537-42	18.0 ± 10%	75	2.5	
1537-44	22.0 ± 10%	75	2.5	
1537-46†	24.0 ± 5%	60	2.5	
1537-47	27.0 ± 10%	60	2.5	
1537-48†	27.0 ± 5%	60	2.5	
1537-50†	30.0 ± 5%	65	2.5	
1537-51	33.0 ± 10%	65	2.5	
1537-52†	33.0 ± 5%	65	2.5	
1537-54	36.0 ± 5%	60	2.5	
1537-56	39.0 ± 5%	60	2.5	
1537-58	43.0 ± 5%	60	2.5	
1537-60	47.0 ± 5%	55	2.5	
1537-62	51.0 ± 5%	55	2.5	
1537-64	56.0 ± 5%	55	2.5	
1537-66	62.0 ± 5%	55	2.5	
1537-68	68.0 ± 5%	55	2.5	
1537-70	75.0 ± 5%	55	2.5	
1537-72	82.0 ± 5%	50	2.5	
1537-74	91.0 ± 5%	50	2.5	
1537-76	100.0 ± 5%	50	2.5	
1537-78	110.0 ± 5%	60	.79	
1537-80	120.0 ± 5%	65	.79	
1537-82	130.0 ± 5%	65	.79	
1537-84	150.0 ± 5%	65	.79	
1537-86	160.0 ± 5%	65	.79	
1537-88	180.0 ± 5%	65	.79	
1537-90	200.0 ± 5%	65	.79	
1537-92	220.0 ± 5%	65	.79	
1537-94	240.0 ± 5%	65	.79	

UNSHIELDED RF COILS
Coils range in value from .022μH through 10,000μH. Special values, tighter tolerances and sizes are also available on a custom design basis. Coils can also be supplied in open construction or with reel tape packaging of axial leaded coils to our standard or to your specification.

Series 2500 Unshielded

Delevan Part Number	Inductance Microhenries	Q Min.	Test Frequency (MHz)	Core Material	Mold Size
2500-00	270±5%	65	.790	PHENOLIC (LT4K)	A
2500-02	300±5%	65	.790		A
2500-04	330±5%	65	.790		A
2500-06	360±5%	65	.790		A
2500-08	390±5%	65	.790		A
2500-10	430±5%	65	.790		A
2500-12	470±5%	65	.790		A
2500-14†	500±5%	65	.790		A
2500-15	510±5%	65	.790		A
2500-16	560±5%	65	.790		A
2500-18	620±5%	60	.790		A
2500-20	680±5%	60	.790		A
2500-22	750±5%	60	.790		A
2500-24	820±5%	60	.790		A
2500-26	910±5%	60	.790		A
2500-28	1000±5%	60	.790		A
2500-30	1100±5%	60	.250	IRON (LT10K)	B
2500-32	1200±5%	60	.250		B
2500-34	1300±5%	60	.250		B
2500-36	1500±5%	65	.250		B
2500-38	1600±5%	65	.250		B
2500-40	1800±5%	65	.250		B
2500-42	2000±5%	65	.250		B
2500-44	2200±5%	70	.250		B
2500-46	2400±5%	70	.250		B
2500-48	2700±5%	70	.250		B
2500-50	3000±5%	70	.250		B
2500-52	3300±5%	70	.250		B
2500-54	3600±5%	70	.250		B
2500-56	3900±5%	80	.250		C
2500-58	4300±5%	80	.250		C
2500-60	4700±5%	80	.250		C
2500-62	5000±5%	80	.250		C
2500-63†	5100±5%	80	.250		C
2500-64	5600±5%	80	.250		C
2500-66	6200±5%	80	.250		C
2500-68	6800±5%	80	.250		C
2500-70	7500±5%	80	.250		C
2500-72	8200±5%	80	.250		C
2500-74	9100±5%	80	.250		C
2500-76	10000±5%	80	.250		C

Series 2890 Unshielded

Delevan Part Number	Inductance Microhenries ±10%	Q Min.	Test Frequency (MHz)	Core Material
2890-00	1.2	60	7.9	PHENOLIC (LT4K)
2890-02	1.5	60	7.9	
2890-03	1.8	60	7.9	
2890-04	2.2	60	7.9	
2890-06	2.7	60	7.9	
2890-08	3.3	60	7.9	
2890-10	3.9	60	7.9	
2890-12	4.7	60	7.9	
2890-14	5.6	60	7.9	
2890-16	6.8	60	7.9	
2890-18	8.2	60	7.9	
2890-20	10.0	60	7.9	
2890-22	12.0	40	2.5	
2890-24	15.0	40	2.5	
2890-26	18.0	40	2.5	
2890-28	22.0	50	2.5	IRON (LT10K)
2890-30	27.0	45	2.5	
2890-32	33.0	60	2.5	
2890-34	39.0	55	2.5	
2890-36	47.0	65	2.5	
2890-38	56.0	65	2.5	
2890-39	68.0	75	2.5	
2890-40	82.0	75	2.5	
2890-42	100.0	75	2.5	
2890-44	120.0	95	0.79	

Series 2500 Unshielded

Physical Parameters			
Mold Size	**A**	**B**	**C**
Diameter			
±.010 Inches	.190	.215	.240
±.25 mm	[4.83]	[5.46]	[6.10]
Length			
±.010 Inches	.440	.560	.740
±.25 mm	[11.18]	[14.22]	[18.80]
Lead Type & Size			
Inches±.002	AWG #22 TCW .025	AWG #21 TCW .028	AWG #20 TCW .032
±.051 mm	[.635]	[.711]	[.813]

Military Specifications:
MS-90539 (LT10K)
MS-90540 (LT10K)
MS-90541 (LT10K) **Core Material** Iron

Series 1025 & 1026 Unshielded

Physical Parameters

	Inches	Millimeters
Length	.250±.010	[6.35±.25]
Diameter	.095±.010	[2.41±.25]
Lead Size AWG		
#24 TCW:	.020±.0015	[.508±.038]

Military Specifications:
MS-75083 (LT4K)
MS-75084 (LT10K)
MS-75085 (LT10K)

Series 1537 Unshielded

Physical Parameters

	Inches	Millimeters
Length	.373±.010	[9.53±.25]
Diameter	.156±.010	[3.96±.25]
Lead Size AWG		
#22 TCW:	.025±.002	[.635±.051]

Military Specifications:
MS-14046 (LT10K)
MS-18130 (LT4K)
MS-90538 (LT10K)

Series 2890 Unshielded

Physical Parameters

	Inches	Millimeters
Length	.900±.010	[22.86±.25]
Diameter	.280±.010	[7.11±.25]
Lead Size AWG		
#21 TCW:	.028±.002	[.711±.051]

Military Specifications:
MS-75103 (LT10K)
MS-91189 (LT4K)

For complete information call your local Delevan/SMD Distributor or Representative listed in the yellow pages or contact the factory direct **(716) 652-3600, FAX (716) 652-4814.**

DELEVAN / SMD Divisions — AMERICAN PRECISION INDUSTRIES, Electronic Components Group

SHIELDED RF COILS

Series 2534 Unshielded

Delevan Part Number	Inductance Millihenries	Q Min.	Test Frequency (MHz)	Core Material
2534-00	.10 ± 10%	80	790	FERRITE
2534-02	.12 ± 10%	80	790	
2534-04	.15 ± 10%	75	790	
2534-06	.18 ± 10%	70	790	
2534-08	.22 ± 10%	65	790	
2534-10	.27 ± 10%	80	790	
2534-12	.33 ± 10%	75	790	
2534-14	.39 ± 10%	70	790	
2534-16	.47 ± 10%	65	790	
2534-18	.56 ± 10%	65	790	
2534-20	.68 ± 10%	60	790	
2534-22	.82 ± 10%	50	790	
2534-24	1.00 ± 10%	45	790	
2534-26	1.20 ± 10%	70	250	
2534-28	1.50 ± 10%	70	250	
2534-30	1.80 ± 10%	70	250	
2534-32	2.20 ± 10%	70	250	
2534-34	2.70 ± 10%	65	250	
2534-36	3.30 ± 10%	65	250	
2534-38	3.90 ± 10%	65	250	
2534-40	4.70 ± 10%	60	250	
2534-42	5.60 ± 10%	60	250	
2534-44	6.80 ± 10%	55	250	
2534-46	8.20 ± 10%	50	250	
2534-48	10.0 ± 10%	45	250	
2534-50	12.0 ± 15%	35	79	
2534-52	15.0 ± 15%	35	79	
2534-54	18.0 ± 15%	35	79	
2534-56	22.0 ± 15%	35	79	
2534-58	27.0 ± 15%	35	79	
2534-60	33.0 ± 15%	30	79	
2534-62	39.0 ± 15%	30	79	
2534-64	47.0 ± 15%	30	79	FERRITE
2534-66	56.0 ± 15%	25	79	
2534-68	68.0 ± 15%	20	79	
2534-70	82.0 ± 15%	18	79	
2534-72	100.0 ± 15%	15	79	
2534-74	120.0 ± 15%	10	50	
2534-76	150.0 ± 15%	10	50	



Series 2534 Unshielded Physical Parameters

	Inches	Millimeters
Height	.345 Max.	[8.76 Max.]
Diameter	.25 ± .010	[6.35 ± .25]
Lead Size AWG		
#24 TCW:	.020 ± .0015	[.508 ± .038]

ER Series MIL-C-39010 Established Reliability Inductors —
(For All HI-REL Applications)

ER - 1641
MIL-C-39010 / 01 (.10 μH-.82 μH)
MIL-C-39010 / 02 (.91 μH-12.0 μH)
ER - 1537
MIL-C-39010 / 06 (15 μH-4.7 μH)
MIL-C-39010 / 07 (5.1 μH-33 μH)
ER - 1025
MIL-C-39010 / 08 (.10 μH-1.00 μH)
MIL-C-39010 / 09 (1.1 μH-27.0 μH)
MIL-C-39010 / 10 (30 μH-1000 μH)
SN10 Hi-Temp Solder
Approved through failure rate R .01%/1000 hrs. Contact your distributor or Delevan Rep for details.

MOLDED RF COILS—SHIELDED
Coils are electromagnetically shielded with inductance values of 1μH through 10,000μH. Inductance Tolerances of ±5% are available by special request. Shielded coils reduce magnetic coupling between components and should be used only where coupling problems exist, since cost is normally higher.

LCR SERIES RF COILS
a unique series of inductors designed for overseas manufacturers who wish to eliminate problems when correlating inductance values of coils manufactured to Q-Meter specifications (according to U.S. military requirements) when they are measured on an HP impedance analyzer or LCR meter. Equivalent Domestic Use Part Numbers include: Series No. 1025, 1026, 1537, 1840, & 2500.



TOROIDAL INDUCTORS

Series 2020

Delevan Part Number	Inductance Microhenries	Q Min.	Test Frequency (MHz)
2020-00	.10±10%	55	25
2020-02	.12±10%	60	25
2020-04	.15±10%	60	25
2020-06	.18±10%	60	25
2020-08	.22±10%	65	25
2020-10	.27±10%	65	25
2020-12	.33±10%	65	25
2020-14	.39±10%	65	25
2020-16	.47±10%	65	25
2020-18	.56±10%	70	25
2020-20	.68±10%	70	25
2020-22	.82±10%	70	25
2020-24	1.0 ± 5%	70	25
2020-26	1.2 ± 5%	60	7.9
2020-28	1.5 ± 5%	60	7.9
2020-30	1.8 ± 5%	60	7.9
2020-32	2.2 ± 5%	60	7.9
2020-34	2.7 ± 5%	60	7.9
2020-36	3.3 ± 5%	60	7.9
2020-38	3.9 ± 5%	60	7.9
2020-40	4.7 ± 5%	60	7.9
2020-42	5.6 ± 5%	60	7.9
2020-44	6.8 ± 5%	60	7.9
2020-46	8.2 ± 5%	60	7.9
2020-48	10.0 ± 5%	60	7.9

Series 2020

Physical Parameters
Dimensions in inches [millimeters].

Ltr.	Minimum		Maximum	
A	.200	[5.08]	.230	[5.84]
B	.190	[4.83]	.210	[5.33]
C	.090	[2.29]	.110	[2.79]

Lead Size
AWG #24 TCW
Current Rating at 90°C AMB. 35°C Rise
Core Material Iron
Military Specifications:
Series 2020 — MS-21422 (LT4K)

Series 0925

Delevan Part Number	Inductance Microhenries ±10%	Q Min.	Test Frequency (MHz)
0925-101	.10	54	25.0
0925-121	.12	52	25.0
0925-151	.15	50	25.0
0925-181	.18	49	25.0
0925-221	.22	47	25.0
0925-271	.27	46	25.0
0925-331	.33	44	25.0
0925-391	.39	42	25.0
0925-471	.47	41	25.0
0925-561	.56	41	25.0
0925-681	.68	39	25.0
0925-821	.82	38	25.0
0925-102	1.00	37	25.0
0925-122	1.20	40	7.9
0925-152	1.50	41	7.9
0925-182	1.80	43	7.9
0925-222	2.20	45	7.9
0925-272	2.70	48	7.9
0925-332	3.30	49	7.9
0925-392	3.90	50	7.9
0925-472	4.70	53	7.9
0925-562	5.60	54	7.9
0925-682	6.80	55	7.9
0925-822	8.20	55	7.9
0925-103	10.0	57	7.9
0925-123	12.0	36	2.5
0925-153	15.0	38	2.5
0925-183	18.0	40	2.5
0925-223	22.0	40	2.5
0925-273	27.0	40	2.5
0925-333	33.0	41	2.5
0925-393	39.0	42	2.5
0925-473	47.0	44	2.5
0925-563	56.0	44	2.5
0925-683	68.0	45	2.5
0925-823	82.0	45	2.5
0925-104	100.0	40	2.5
0925-124	120.0	31	.79
0925-154	150.0	33	.79
0925-184	180.0	33	.79
0925-224	220.0	35	.79
0925-274	270.0	37	.79
0925-334	330.0	40	.79
0925-394	390.0	38	.79
0925-474	470.0	36	.79
0925-564	560.0	36	.79

Series 0925 Shielded Physical Parameters

	Inches	Millimeters
Length	.250 ± .010	[6.35 ± .25]
Diameter	.095 ± .010	[2.41 ± .25]
Lead Size AWG		
#24 TCW:	.020 ± .0015	[.508 ± .038]

Coupling 3% Max.
Core Material

Dash No.	Core	Sleeve
-101 thru -104	Iron	Iron
-124 thru -564	Ferrite	Ferrite

Military Specifications:
MS-21426 (LT10K)
MS-21427 (LT10K)

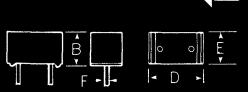
Dimensions in inches and [Millimeters]

Series 1641

Delevan Part Number	Inductance Microhenries ±10%	Q Min.	Test Frequency (MHz)	Current Rating Max. (mA)
1641-101	.10	50	25	1830
1641-121	.12	51	25	1570
1641-151	.15	51	25	1500
1641-181	.18	50	25	1330
1641-221	.22	49	25	1120
1641-271	.27	47	25	870
1641-331	.33	46	25	800
1641-391	.39	44	25	680
1641-471	.47	44	25	580
1641-561	.56	43	25	505
1641-681	.68	42	25	430
1641-821	.82	40	25	375
1641-102	1.0	44	25	1090
1641-122	1.2	44	7.9	900
1641-152	1.5	44	7.9	835
1641-182	1.8	44	7.9	775
1641-222	2.2	44	7.9	665
1641-272	2.7	44	7.9	545
1641-332	3.3	44	7.9	490
1641-392	3.9	44	7.9	455
1641-472	4.7	44	7.9	390
1641-562	5.6	44	7.9	340
1641-682	6.8	50	7.9	285
1641-822	8.2	50	7.9	250
1641-103	10.0	50	7.9	228
1641-123	12.0	55	2.5	205
1641-153	15.0	45	2.5	325
1641-183	18.0	45	2.5	305
1641-223	22.0	45	2.5	295
1641-273	27.0	45	2.5	265
1641-333	33.0	45	2.5	248
1641-393	39.0	50	2.5	209
1641-473	47.0	50	2.5	200
1641-563	56.0	50	2.5	194
1641-683	68.0	50	2.5	176
1641-823	82.0	50	2.5	186
1641-104	100	50	2.5	164
1641-124	120	55	.79	153
1641-154	150	55	.79	143
1641-184	180	55	.79	138
1641-224	220	55	.79	130
1641-274	270	55	.79	120
1641-334	330	55	.79	115
1641-394	390	60	.79	107
1641-474	470	60	.79	94
1641-564	560	60	.79	90
1641-684	680	60	.79	84
1641-824	820	60	.79	80
1641-105	1000	60	.79	70
1641-125	1200	45	.25	62
1641-155	1500	45	.25	56
1641-185	1800	45	.25	53
1641-225	2200	45	.25	50
1641-275	2700	45	.25	42
1641-335	3300	45	.25	40
1641-395	3900	45	.25	35
1641-475	4700	45	.25	32
1641-565	5600	44	.25	29
1641-685	6800	40	.25	27.6
1641-825	8200	40	.25	26.6
1641-106	10000	40	.25	24.7

For complete information on all Delevan/SMD Division inductive components call your local Delevan/SMD Distributor or Representative listed in the yellow pages or contact the factory direct
(716) 652-3600, FAX (716) 652-4814

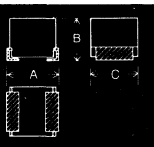
DELEVAN / SMD Divisions — AMERICAN PRECISION INDUSTRIES, Electronic Components Group



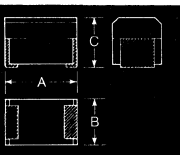
POWER CHOKES
Series 3443



MICRO-i® CHIPS
Series 103 & 105



SURFACE MOUNT
Series 1010 Unshielded



Series 1812

Delevan Part Number	Inductance Microhenries ± 10% @ 1KHz	Current Rating Max. (Amps)
3443-00	1.0	17.8
3443-04	1.5	16.2
3443-08	2.2	15.0
3443-12	3.3	14.0
3443-16	4.7	13.0
3443-20	6.8	12.5
3443-24	10.0	10.0
3443-28	15.0	8.5
3443-32	22.0	6.5
3443-36	33.0	5.5
3443-40	47.0	4.5
3443-44	68.0	4.0
3443-48	100	3.3
3443-50	120	3.0
3443-52	150	2.7
3443-56	220	2.2
3443-58	270	1.95
3443-60	330	1.7
3443-64	470	1.6
3443-68	680	1.3
3443-72	1000	1.0
3443-76	1500	.84
3443-80	2200	.69
3443-84	3300	.55
3443-88	4700	.45
3443-92	6800	.36
3443-94	10000	.33
3443-98	15000	.26

Physical Parameters

Letter	Inches	Millimeters
B	.600 Max.	[15.27] Max.
D	.870 Max.	[22.14] Max.
E	.515 Max.	[13.10] Max.
F	AWG #18 TCW	

Core Material: Ferrite
Current Rating: Based on continuous operation at room temperature. Derating is required at elevated ambient temperatures. Consult factory for details.

MICRO-i® INDUCTORS are available in a variety of inductance ranges. A number of low profile styles are provided for use on thick film hybrid packages. Inductive values with tighter tolerances and a variety of optional termination materials are available for specialized applications. Parts are available with ribbon leads, reflow solder pads or in a wire bondable pad configuration.

Series 103 & 105

Dim.	Inches	Millimeters
A	.100±.010	[2·54±·25] Max.
B	.100±.010	[2·54±·25]
C	.075 Max.	[1·91 Max.]

Mechanical Configuration:
1) Series 103 and Series 105 Units are epoxy encapsulated
2) Contact areas for reflow soldering are gold plated per MIL-G-45204 Type 1-Grade A
3) Internal connections are thermal compression bonded

Current Rating at 90°C AMB. 35°C Rise

Termination Finish Options Gold over Nickel (Standard). Tin/Lead over Nickel: Palladium/Silver

Delevan Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)
Series 103 Core Material — Phenolic			
103-100(*)	.010±(*)	60	
103-120K	.012±10%	57	
103-150(*)	.015±(*)	55	
103-180K	.018±10%	52	
103-220(*)	.022±(*)	50	
103-270K	.027±10%	49	
103-330(*)	.033±(*)	48	50
103-390K	.039±10%	45	
103-470(*)	.047±(*)	42	
103-560K	.056±10%	39	
103-680(*)	.068±(*)	36	
103-820K	.082±10%	34	
103-101(*)	.100±(*)	32	
Series 103 Core Material — Ferrite			
103-121K	.12 ±10%	30	
103-151K	.15 ±10%	25	
103-181K	.18 ±10%	25	
103-221K	.22 ±10%	25	
103-271K	.27 ±10%	25	
103-331K	.33 ±10%	25	25
103-391K	.39 ±10%	22	
103-471K	.47 ±10%	22	
103-561K	.56 ±10%	22	
103-681K	.68 ±10%	22	
103-821K	.82 ±10%	22	
103-102K	1.0 ±10%	22	
103-122K	1.2 ±10%	22	
103-152K	1.5 ±10%	22	
103-182K	1.8 ±10%	22	
103-222K	2.2 ±10%	22	7.9
103-272K	2.7 ±10%	24	
103-332K	3.3 ±10%	24	
103-392K	3.9 ±10%	24	
103-472K	4.7 ±10%	24	
103-562K	5.6 ±10%	22	
103-682K	6.8 ±10%	22	7.9
103-822K	8.2 ±10%	22	
103-103K	10.0 ±10%	24	
103-123K	12.0 ±10%	25	
103-153K	15.0 ±10%	25	
103-183K	18.0 ±10%	25	2.5
103-223K	22.0 ±10%	25	
103-273K	27.0 ±10%	25	
Series 105 Core Material — Iron			
105-121M	.12 ±20%	40	
105-151M	.15 ±20%	40	
105-181M	.18 ±20%	40	
105-221K	.22 ±10%	40	
105-271K	.27 ±10%	40	
105-331K	.33 ±10%	35	25
105-391K	.39 ±10%	35	
105-471K	.47 ±10%	35	
105-561K	.56 ±10%	35	
105-681K	.68 ±10%	35	
105-821K	.82 ±10%	30	
105-102K	1.0 ±10%	30	
105-122K	1.2 ±10%	25	
105-152K	1.5 ±10%	25	
105-182K	1.8 ±10%	25	
105-222K	2.2 ±10%	25	
105-272K	2.7 ±10%	25	
105-332K	3.3 ±10%	25	7.9
105-392K	3.9 ±10%	25	
105-472K	4.7 ±10%	30	
105-562K	5.6 ±10%	30	
105-682K	6.8 ±10%	30	
105-822K	8.2 ±10%	30	
105-103K	10.0 ±10%	30	

(*)-MS slash numbers available in 10% (Suffix "K") and 20% (Suffix "M") tolerances.

Military Specifications:
Series 103 MIL-C-83446/4
Series 105 MIL-C-83446

Notes:
1) Designed specifically for reflow soldering and other high temperature processes with metalized edges to exhibit solder fillet
2) Series 105 Micro-i inductors utilize a powdered iron core for improved temperature stability

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)
Core Material — Phenolic			
1010-120	.012	56	
1010-180	.018	52	
1010-270	.027	49	
1010-390	.039	45	
1010-560	.056	39	50
1010-820	.082	34	
Core Material — Ferrite			
1010-121	.12	30	
1010-151	.15	25	
1010-181	.18	25	25
1010-221	.22	25	
1010-271	.27	25	
1010-331	.33	25	
1010-391	.39	22	
1010-471	.47	22	
1010-561	.56	22	
1010-681	.68	22	
1010-821	.82	22	
1010-102	1.0	22	
1010-122	1.2	22	
1010-152	1.5	22	7.9
1010-182	1.8	22	
1010-222	2.2	22	
1010-272	2.7	24	
1010-332	3.3	24	
1010-392	3.9	24	
1010-472	4.7	24	
1010-562	5.6	22	
1010-682	6.8	22	7.9
1010-822	8.7	22	
1010-103	10.0	24	
1010-123	12.0	25	
1010-153	15.0	25	
1010-183	18.0	25	2.5
1010-223	22.0	25	
1010-273	27.0	25	

Series 1210 Shielded

Core Material — Iron			
1210-101K	.10	30	
1210-121K	.12	30	
1210-151K	.15	30	
1210-181K	.18	30	
1210-221K	.22	30	
1210-271K	.27	30	
1210-331K	.33	30	25.0
1210-391K	.39	30	
1210-471K	.47	30	
1210-561K	.56	30	
1210-681K	.68	30	
1210-821K	.82	30	
Core Material — Ferrite			
1210-102K	1.0	30	25.0
1210-122K	1.2	30	
1210-152K	1.5	30	
1210-182K	1.8	30	
1210-222K	2.2	30	
1210-272K	2.7	30	
1210-332K	3.3	30	7.9
1210-392K	3.9	30	
1210-472K	4.7	30	
1210-562K	5.6	30	
1210-682K	6.8	30	
1210-822K	8.2	30	
1210-103K	10.0	30	
1210-123K	12.0	30	
1210-153K	15.0	30	
1210-183K	18.0	30	
1210-223K	22.0	30	
1210-273K	27.0	30	
1210-333K	33.0	30	2.5
1210-393K	39.0	30	
1210-473K	47.0	30	
1210-563K	56.0	30	
1210-683K	68.0	30	
1210-823K	82.0	30	
1210-104K	100.0	30	

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)
Core Material — Phenolic			
1812-101K	.10	30	
1812-121K	.12	30	
1812-151K	.15	30	
1812-181K	.18	30	
1812-221K	.22	30	
1812-271K	.27	30	
1812-331K	.33	30	25.0
1812-391K	.39	30	
1812-471K	.47	30	
1812-561K	.56	30	
1812-681K	.68	30	
1812-821K	.82	30	
Core Material — Ferrite			
1812-102K	1.0	50	25.0
1812-122K	1.2	50	
1812-152K	1.5	50	
1812-182K	1.8	50	
1812-222K	2.2	50	
1812-272K	2.7	50	
1812-332K	3.3	50	7.9
1812-392K	3.9	50	
1812-472K	4.7	50	
1812-562K	5.6	50	
1812-682K	6.8	50	
1812-822K	8.2	50	
1812-103K	10.	50	
1812-123K	12.	50	
1812-153K	15.	50	
1812-183K	18.	50	
1812-223K	22.	50	
1812-273K	27.	50	
1812-333K	33.	50	2.5
1812-393K	39.	50	
1812-473K	47.	50	
1812-563K	56.	50	
1812-683K	68.	50	
1812-823K	82.	50	
1812-104K	100.	50	
1812-124K	120.	40	
1812-154K	150.	40	
1812-184K	180.	40	
1812-224K	220.	40	
1812-274K	270.	40	0.79
1812-334K	330.	40	
1812-394K	390.	40	
1812-474K	470.	40	
1812-564K	560.	30	

For values above 560µH, consult factory.

Series 1010 Physical Parameters*

Dimensions*	Inches	Millimeters
A	.100	[2.54]
B	.085	[2.16]
C	.095	[2.41]

Series 1210 Physical Parameters* (Shielded)

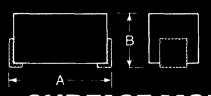
Dimensions*	Inches	Millimeters
A	.118	[3.0]
B	.081	[2.1]
C	.085	[2.2]

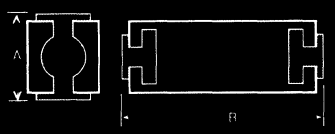
Series 1812 Physical Parameters*

Dimensions*	Inches	Millimeters
A	.17	[4.4]
B	.12	[3.2]
C	.12	[3.2]

Laser marking is used to identify all Delevan/SMD inductors
*Nominal dimensions over end caps are approximate and for reference only.

DELEVAN / SMD Divisions AMERICAN PRECISION INDUSTRIES
Electronic Components Group





SURFACE MOUNT INDUCTORS

Series 2510 Unshielded

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)	Core Material
2510-00K	.10	25	25.	PHENOLIC
2510-02K	.12	25	25.	
2510-04K	.15	25	25.	
2510-06K	.18	25	25.	
2510-08K	.22	25	25.	
2510-10K	.27	25	25.	
2510-12K	.33	25	25.	
2510-14K	.39	25	25.	
2510-16K	.47	25	25.	
2510-18K	.56	35	25.	IRON
2510-20K	.68	35	25.	
2510-22K	.82	35	25.	
2510-24K	1.0	35	25.	
2510-26K	1.2	25	7.9	
2510-28K	1.5	30	7.9	
2510-30K	1.8	30	7.9	
2510-32K	2.2	30	7.9	
2510-34K	2.7	30	7.9	
2510-36K	3.3	35	7.9	
2510-38K	3.9	35	7.9	
2510-40K	4.7	35	7.9	
2510-42K	5.6	35	7.9	
2510-44K	6.8	35	7.9	
2510-46K	8.2	35	7.9	
2510-48K	10.	35	7.9	
2510-50K	12.	25	2.5	
2510-52K	15.	25	2.5	
2510-54K	18.	25	2.5	
2510-56K	22.	25	2.5	
2510-58K	27.	25	2.5	
2510-60K	33.	25	2.5	
2510-62K	39.	25	2.5	
2510-64K	47.	25	2.5	
2510-66K	56.	25	2.5	
2510-68K	68.	25	2.5	
2510-70K	82.	25	2.5	
2510-72K	100.	25	2.5	
2510-74K	120.	15	.79	FERRITE
2510-76K	150.	15	.79	
2510-78K	180.	15	.79	
2510-80K	220.	15	.79	
2510-82K	270.	15	.79	
2510-84K	330.	15	.79	
2510-86K	390.	15	.79	
2510-88K	470.	15	.79	
2510-90K	560.	15	.79	
2510-92K	680.	15	.79	
2510-94K	820.	15	.79	
2510-96K	1000.	15	.79	

Series 1330 Unshielded

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)	Core Material
1330-94	.10	40	25.0	PHENOLIC (LT4K)
1330-96	.12	40	25.0	
1330-00	.15	38	25.0	
1330-02	.18	35	25.0	
1330-04	.22	33	25.0	
1330-06	.27	33	25.0	
1330-08	.33	30	25.0	
1330-10	.39	30	25.0	
1330-12	.47	30	25.0	
1330-14	.56	30	25.0	
1330-16	.68	28	25.0	
1330-18	.82	28	25.0	
1330-20	1.00	25	25.0	
1330-22	1.20	25	7.9	IRON (LT10K)
1330-24	1.50	28	7.9	
1330-26	1.80	30	7.9	
1330-28	2.20	30	7.9	
1330-30	2.70	37	7.9	
1330-32	3.30	45	7.9	
1330-34	3.90	45	7.9	
1330-36	4.70	45	7.9	
1330-38	5.60	50	7.9	
1330-40	6.80	50	7.9	
1330-42	8.20	55	7.9	
1330-44	10.0	55	7.9	
1330-46	12.0	45	2.5	
1330-48	15.0	45	2.5	
1330-50	18.0	45	2.5	
1330-52	22.0	45	2.5	
1330-54	27.0	45	2.5	
1330-56	33.0	35	2.5	
1330-58	39.0	35	2.5	FERRITE (LT10K)
1330-60	47.0	35	2.5	
1330-62	56.0	35	2.5	
1330-64	68.0	35	2.5	
1330-66	82.0	35	2.5	
1330-68	100.0	35	2.5	
1330-70	120.0	30	.79	
1330-72	150.0	30	.79	
1330-74	180.0	30	.79	
1330-76	220.0	30	.79	
1330-78	270.0	30	.79	
1330-80	330.0	30	.79	
1330-82	390.0	30	.79	
1330-84	470.0	30	.79	
1330-86	560.0	30	.79	
1330-88	680.0	30	.79	
1330-90	820.0	30	.79	
1330-92	1000.0	30	.79	

Series 1331 Shielded

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)	Current Rating Max. (mA)
1331-101	.10	45	25.0	670
1331-121	.12	45	25.0	635
1331-151	.15	45	25.0	610
1331-181	.18	45	25.0	585
1331-221	.22	45	25.0	545
1331-271	.27	45	25.0	530
1331-331	.33	44	25.0	495
1331-391	.39	42	25.0	485
1331-471	.47	41	25.0	460
1331-561	.56	41	25.0	440
1331-681	.68	39	25.0	430
1331-821	.82	38	25.0	405
1331-102	1.00	37	25.0	385
1331-122	1.20	40	7.9	247
1331-152	1.50	41	7.9	228
1331-182	1.80	43	7.9	217
1331-222	2.20	45	7.9	202
1331-272	2.70	48	7.9	193
1331-332	3.30	49	7.9	185
1331-392	3.90	50	7.9	173
1331-472	4.70	50	7.9	136
1331-562	5.60	50	7.9	124
1331-682	6.80	50	7.9	118
1331-822	8.20	50	7.9	111
1331-103	10.0	50	7.9	106
1331-123	12.0	36	2.5	122
1331-153	15.0	38	2.5	115
1331-183	18.0	40	2.5	108
1331-223	22.0	40	2.5	96
1331-273	27.0	40	2.5	88
1331-333	33.0	41	2.5	83
1331-393	39.0	42	2.5	75
1331-473	47.0	44	2.5	69
1331-563	56.0	44	2.5	64
1331-683	68.0	45	2.5	61
1331-823	82.0	45	2.5	59
1331-104	100.0	40	2.5	51
1331-124	120.0	31	.79	88
1331-154	150.0	33	.79	75
1331-184	180.0	33	.79	69
1331-224	220.0	35	.79	64
1331-274	270.0	35	.79	61
1331-334	330.0	35	.79	53
1331-394	390.0	35	.79	46
1331-474	470.0	35	.79	43
1331-564	560.0	35	.79	40

Series 2510 Unshielded

Dimensions	Inches	Millimeters
A	.235 to .255	[5.97 to 6.48]
B	.090 to .110	[2.29 to 2.79]

Dimensions "A" and "B" include measurements over end caps and are approximate for reference only.

Series 1330 Unshielded
Series 1331 Shielded

Dimensions	Inches	Millimeters
A	.125 to .145	[3.18 to 3.68]
B	.300 to .320	[7.62 to 8.13]

Dimensions "A" and "B" include measurements over end caps and are approximate for reference only.

Shielded
Coupling 3% Max.

Core Material	DASH NO.	CORE	SLEEVE
	-101 thru- 104	Iron	Iron
	-124 thru- 564	Ferrite	Ferrite

Dimensions in inches and [Millimeters]

SURFACE MOUNT INDUCTORS

Coils are available in unshielded designs with inductance values ranging from .010μH thru 1,000 μH ± 10%. Shielded versions to reduce magnetic coupling between components are available from .010μH to 560 μH ± 10%. Closer inductance tolerances are available on special order.

Their rectangular outline package with symmetrical orientation is ideal for automatic indexing and assembly methods. Their parallel flat surfaces are well adapted to all methods of vacuum pickup and indexing. Coils can be supplied in bulk or reel tape.

Delevan/SMD components are compatible with all state-of-the-art attachments and soldering methods. Standard metalized ends are solder coated copper.

They are molded in thermally stable flame retardant epoxy resin. High temperature solder is used for internal joints to insure maximum reliability during assembly and attachment operations.

Our inductors are made in accordance with the basic requirements of MIL-C-83446.

Many of the electrical parameters for new or prototype products have been calculated and are to be used for reference only. Please consult our current catalog or contact our factory when critical design data are required.

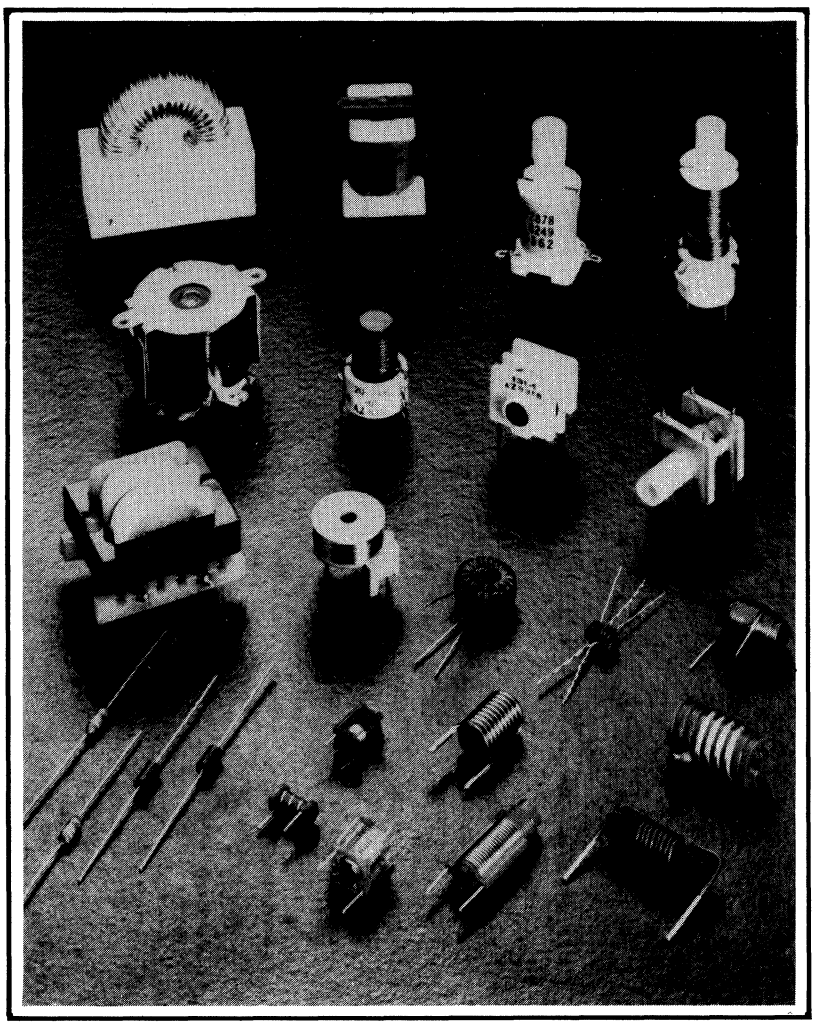
SMD Inductors are covered by
U.S. Patent Nos. 4,801,912; 4,914,804 and 4,934,048

Laser marking is used to identify all Delevan/SMD inductors

AMERICAN PRECISION INDUSTRIES
Electronic Components Group
DELEVAN/SMD DIVISIONS

For complete information on all Delevan/SMD Divisions inductive components call your local Delevan/SMD Distributor or Representative listed in the yellow pages or contact the factory direct **(716) 652-3600, FAX (716) 652-4814**

FRONTIER ELECTRONICS CO., LTD.



WE SPECIALIZE IN . . .

- RF Molded Chokes
- RF Coated Chokes
- Adjustable RF Coils
- Insert Molded Coils
- Ferrite Beads
- Horizontal Width Coils
- Toroid Coils

TRANSFORMERS

- Common Mode Filters
- Driver Transformers
- Switch Mode Transformers

RECTIFIERS

- General & High Voltage Diodes
- Bridge Assemblies
- Schottky Diodes
- Super Fast Recovery

COMMON MODE FILTER

- EE or EI Ferrite Core: 13m/m, 16m/m, 19m/m, 25m/m, 30m/m & 35m/m.
- UU Ferrite Core: 10.5m/m, 15m/m, 17m/m, & 20m/m.
- Withstand: 3750V AC between windings.

SWITCH MODE TRANSFORMER

- EE or EI Ferrite Core: 35m/m, 40m/m, & 42m/m.
- Frequency Range: 10-250 KHZ & up.
- Power Range: 1-300 watts

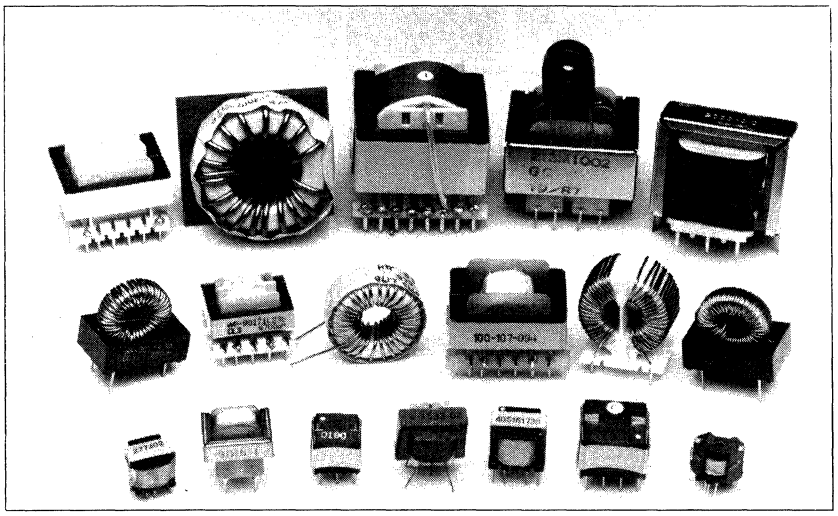
DRIVER TRANSFORMER

- EE or EI Ferrite Core: 13m/m, 16m/m, 19m/m, 25m/m, & 35m/m.
- Frequency Range: 10-250 KHZ & up.

ALL MEET VDE, IEC, UL & CSA.

9301-101 JORDAN AVENUE • CHATSWORTH, CA 91311 • TEL: (818) 709-9888 • FAX: (818) 709-9897

GC INTERNATIONAL, INC.



GC International is a worldwide manufacturer of custom and off the shelf inductive products. Our reputation has been built by offering our customers low prices, high quality and prompt service. Our trained technical sales staff is ready to assist in your design and component selection. Our engineers quickly and efficiently handle even the most complex designs. Our quality assurance people here in the States and offshore have won praises from many leading OEM customers. Our new, expanded headquarters allows us to better serve your needs by providing immediate sample and prototype design,short production run capability and an enlarged warehouse to stock your items for JIT delivery. When you are sourcing inductive products remember GC is "DEDICATED TO EXCELLENCE."

Products

- Chip Bead/Inductor
- High Q Chokes
- Molded RF Chokes
- Peaking Coils
- Balun Coils
- TelCom Transformers
- Audio Transformers
- Delay Lines
- Lan Filter/Transformer
- Ferrite Cores for Transformer
- Axial Leaded
- Molded Shielded
- Wide Band
- Wall Mount/Plug in Power Supply
- Power Transformers
- Power Chokes
- DC/DC Converter

Designed for:

- Switching Power Supplies
- EMI/RFI Filters
- Telecommunications Circuits
- Automotive Circuits
- Audio/Matching Circuits
- Basic Power Circuits

Ferrite Cords and Ferrite Beads

Ferrite is used as an attenuator of unwanted EMI/RFI. GC manufactures ferrite material in many forms including cores, its own ferrite material and therefore is the envy of the industry for low lead times. Raw material is also available to end users.

Power Supplies and Adapters

GC offers a full line of linear power supplies, single and multiple output, up to 300 watts. These include custom and off the shelf designs. GC also offers complete line of AC/DC adapters, most with UL and/or CSA approvals. Custom designs are also encouraged.

DC/DC Converters

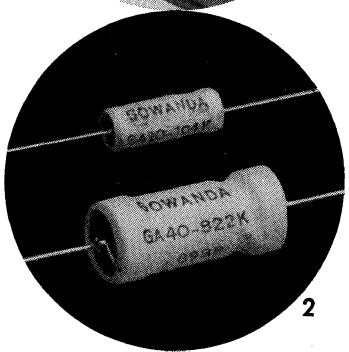
GC has a complete line of DC/DC converters for use in computer systems, telecommunication systems, precision control systems, microprocessor applications, and local area networks. Output powers range from 0.5 watts to 30 watts. Call us for your custom applications and designs.

GC INTERNATIONAL, INC.
610 Presidential Drive, Suite 102, P.O. Box 851198,
Richardson, Texas 75085-1198 Phone 214-234-3240 FAX 214-234-2563

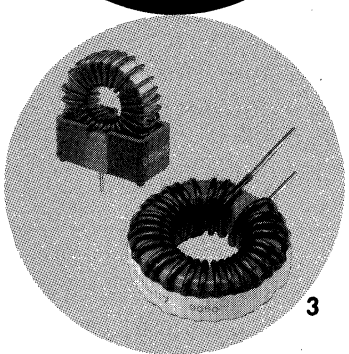
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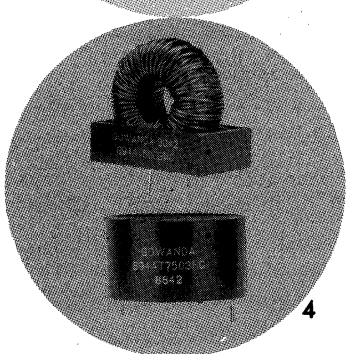
NEW Surface Mount Inductors ■ Miniature High Current Chokes ■ Low Cost Toroidal Inductors ■ Bobbin Core Chokes and an extensive line of custom and standard magnetic components.

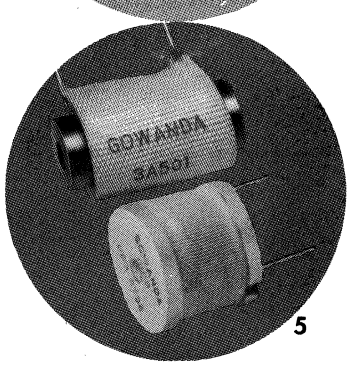

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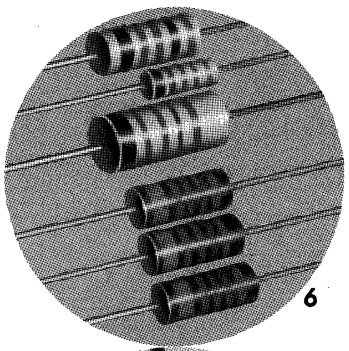
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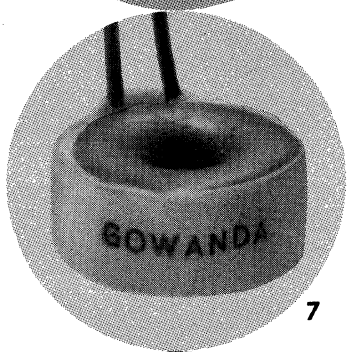

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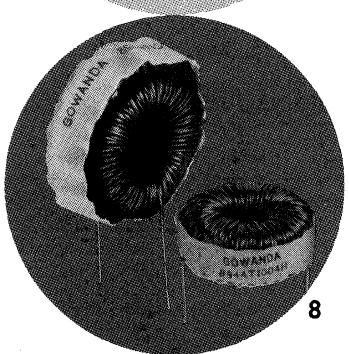


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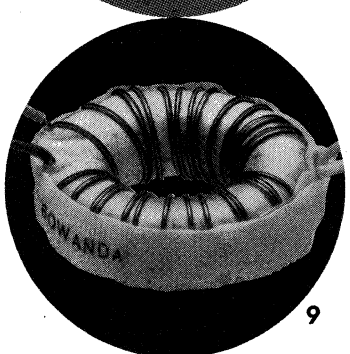

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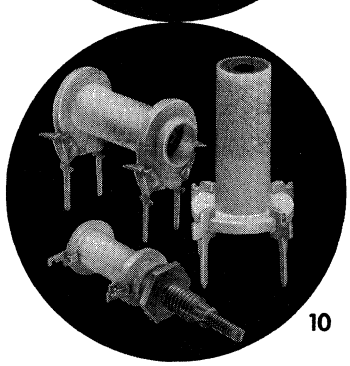
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8



9


10

1. SURFACE MOUNT INDUCTORS
Encapsulated SMIs of superior quality and high reliability. 93 inductance values available in both 10% and 5% tolerances, also close tolerances in all values. 8mm tape and reel packaging for automated applications.

2. MINIATURE HIGH CURRENT CHOKES
GA-10 series, 38 inductance values 10 μH to 100 mH. GA-30 series, 37 inductance values 10 μH to 10 mH. Manufactured with heat-shrinkable flame retardant tubing and high resistivity Ferrite coil form. GA-20 and GA-40 series, 37 inductance values 10 μH to 10 mH. Produced with heat shrinkable, flame retardant tubing and Ferrite coil form.

3. LOW COST TOROIDAL INDUCTORS
GT series, basic coil and mounting base models. Low loss powdered iron cores. Mounting base meets flame retardant requirements of UL 94V-0. Inductance values, 25 μH to 450 μH.

4. ENCAPSULATED TOROIDAL POWER CHOKES
MPP core, vertical and horizontal models designed for printed circuit mounting. Pre-tinned leads. Inductance rating from 10 μH to 1000 μH. Current rating from 1.0 amps to 10.0 amps.

5. BOBBIN CORE CHOKES
Epoxy insulated cores. Designed for switching power supply applications. Inductance range 3.3 μH to 15,000 μH. Current ratings from 0.80 amps to 27.0 amps.

6. RF MOLDED AND SHIELDED CHOKES
Manufactured to MIL-C-15305 standards. Inductance values from .10 μH to 10,000 μH. Standard series for both Q-meter and LCR bridge testing.

7. TOROIDAL INDUCTORS
Vinyl coated, non-flammable. Abrasion and moisture resistant. High Q and wide selection of Q vs. frequency ranges. Standard inductance TOL ± 2%. Other tolerances available. Custom designs available.

8. TOROIDAL POWER CHOKES
MPP core, high current filter chokes with printed circuit mounting and pre-tinned leads. Inductance values 10 μH to 1000 μH. Current rating 1.0 amps to 10.0 amps.

9. COMMON MODE INDUCTORS
Custom designed to your requirements. Open, partially or fully encapsulated construction in both toroidal or bobbin wound forms.

10. TUNABLE COIL FORMS
Wide range of printed circuit and chassis mount designs. Winding provided to your specifications.

For complete information, specifications and rating data, phone or FAX

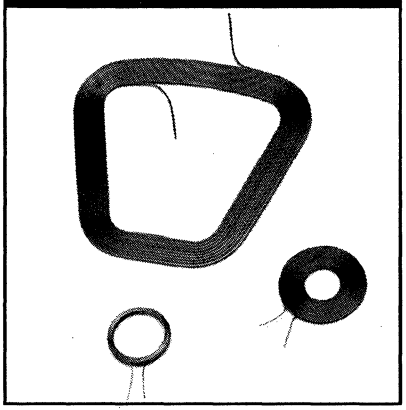
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GOWANDA ELECTRONICS CORP.
1 INDUSTRIAL PLACE □ GOWANDA, NY 14070
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MAGNELAB

COIL PRODUCTS

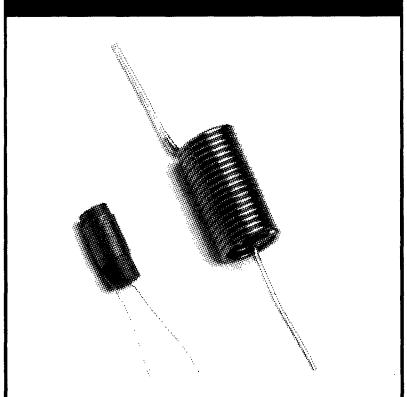
FREE-FORM COILS



Custom free-form bonded wire coils are a major activity at MAGNELAB. Precision fixturing is the key to this capability. Complex shapes are easily tooled with our complete array of machine tools including a computer-programmed milling machine. Applications include:

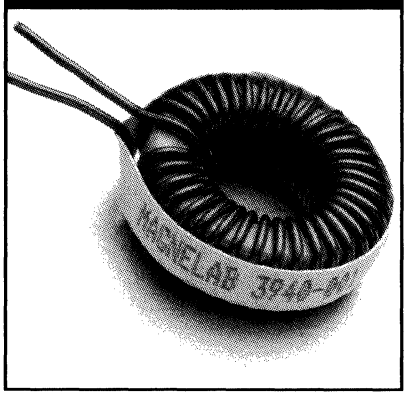
- Loop antennas
- Flat magnetic drive coils
- Planar inductors
- Bobbinless transformer windings
- Induction coils

SOLENOIDS



MAGNELAB is experienced in the tooling and volume manufacture of miniature solenoid coils for inductors, rod antennas, and flux sensors. Coils as small as .040 in. dia. using 50 AWG wire are manufactured at MAGNELAB.

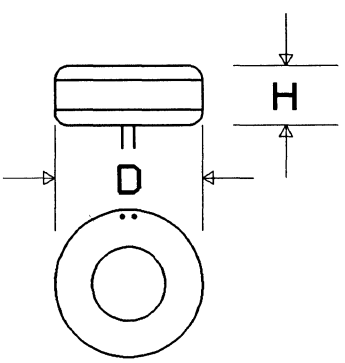
MPP



PRECISION TOROIDAL INDUCTORS FOR OSCILLATORS AND FILTERS

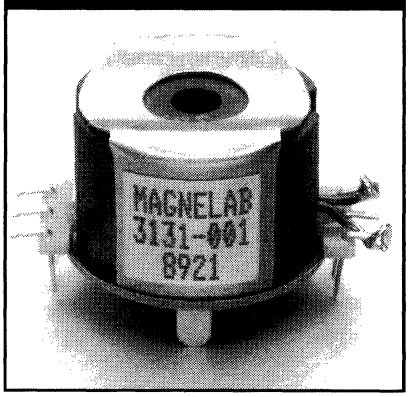
Size Code	Energy (a) (Microwatt-sec.)	Dimensions (in.) D	H
0140	.34	.16	.09
0180	.91	.22	.15
0250	1.78	.29	.16
0310	4.94	.35	.19
0380	9.55	.43	.20
0400	14.10	.45	.23
0500	28.90	.57	.30
0650	115.00	.74	.38
0800	161.00	.91	.41
0900	270.00	1.10	.48
1060	590.00	1.20	.63
1300	790.00	1.40	.56

(a) Calculated at 5% roll-off of inductance with current at 25°C. (uW - S = 1/2 mHy x Amp² x 10^3).
(b) Mounting options: Unmounted as shown, vertical pc mount, or horizontal pc mount.
(c) To order, specify: 1) Inductance and current, 2) Accuracy (2. 5. or 10%), 3) Size code (from graph), 4) Mounting option.



Please see our other pages in Section 5600 A•2253-A•2257

POT

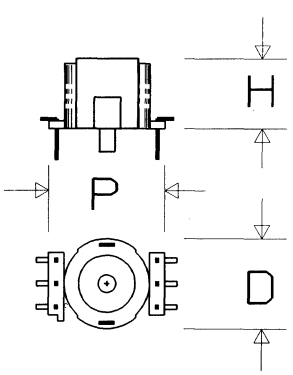


FERRITE HIGHLY-SHIELDED POT-CORE TRANSFORMERS AND INDUCTORS

Size Code	Rating (watts) (a) 20 Khz	50 Khz	100Khz	Inductor Energy (b) (milliwatt-sec.)
1408	1.5	2.4	3.9	.068
1811	5.0	8.0	13.0	.23
2213	15.0	22.0	32.0	.62
2616	19.0	30.0	48.0	1.26
3019	33.0	53.0	80.0	2.75
3622	110.0	190.0	280.0	5.33
4229	280.0	430.0	650.0	14.56

Size Code	Dimensions (in.) D	H	P	Pins Available
1408	.55	.380	.638	6
1811	.71	.460	.848	6
2213	.87	.585	.99	6
2626	1.04	.655	1.13	6
3019	1.21	.770	1.42	6
3622	1.43	.915	1.60	12
4229	1.70	1.230	no pins	0

(a) Power rating based on square-wave drive.
(b) Calculated at 20% reduction in inductance with current at 25°C.
(c) To order, specify: 1) Input voltage and range, frequency, and waveform, 2) Output voltages and currents, 3) Size code, 4) For inductor, inductance, current, and frequency.



MAGNELAB CORPORATION
DESIGN & MANUFACTURE OF TRANSFORMER PRODUCTS

7315 Red Deer Drive
Boulder, Colorado 80301
(303) 442-6700 FAX: (303) 447-1588

LODESTONE PACIFIC

lode-stone/lōd-stōn/n: *1: a rock or meteorite having the magnetic property of attraction. 2: something that strongly attracts.*

Phone: (714) 630-1343
Fax No: (714) 630-8480

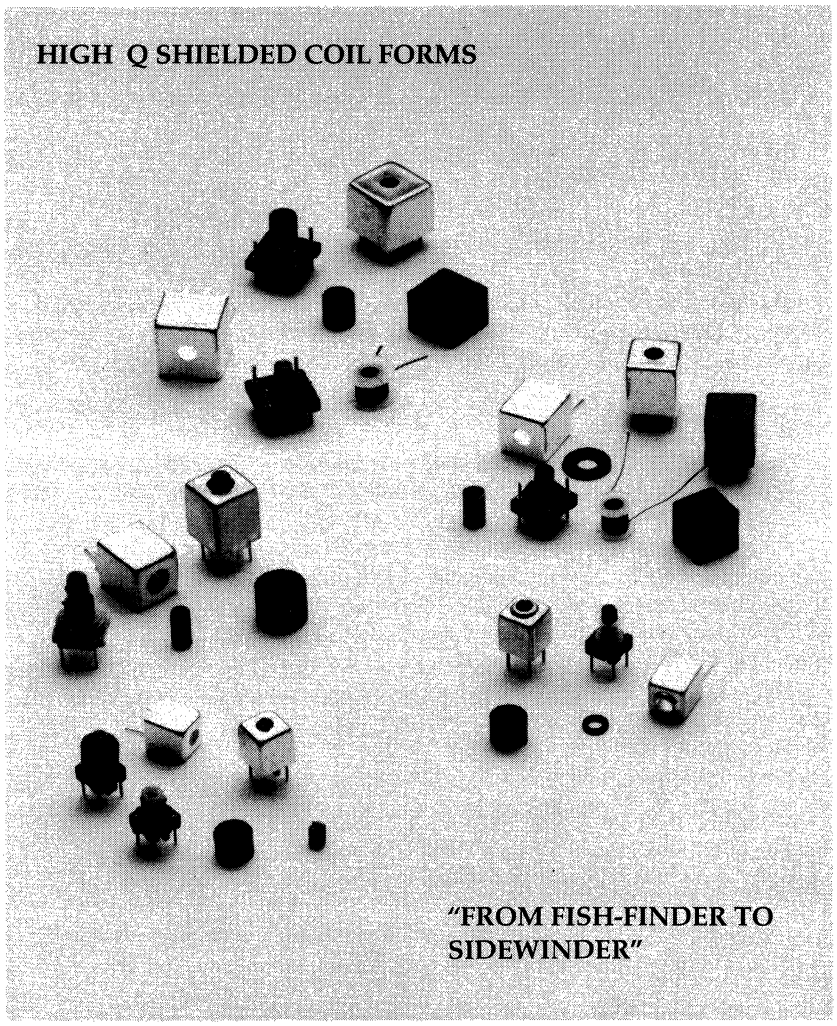
LODESTONE PACIFIC is both manufacturer and distributor of product and services for the magnetics segment of the electronics industry. The company is structured to offer the highest quality and service and is committed to quick shipment and scheduled delivery world-wide.

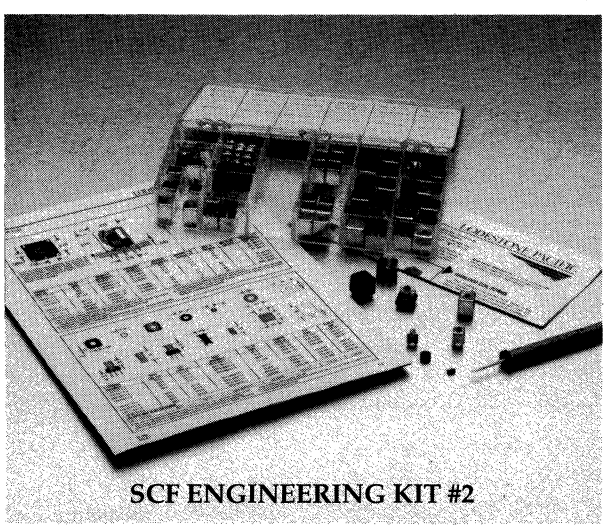
SHEILDED COIL FORMS

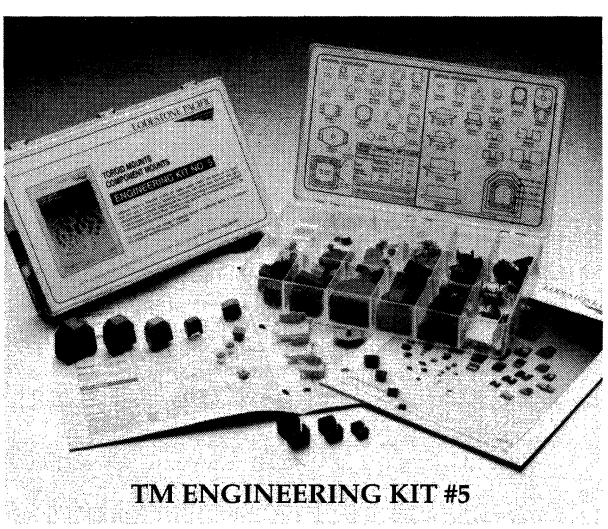
Lodestone Pacific manages the continued success of the series of Shielded Coil Forms formerly from Micrometals Catalog #2. Designed for high Q and high quality, the solderability, construction, handling and storage of these assemblies meets Mil-STD 2000.

ENGINEERING KITS

Lodestone Pacific offers an engineering kit for both the Shielded Coil Form and Toroid Mount product lines. These kits are ideal for engineering labs and prototype work.

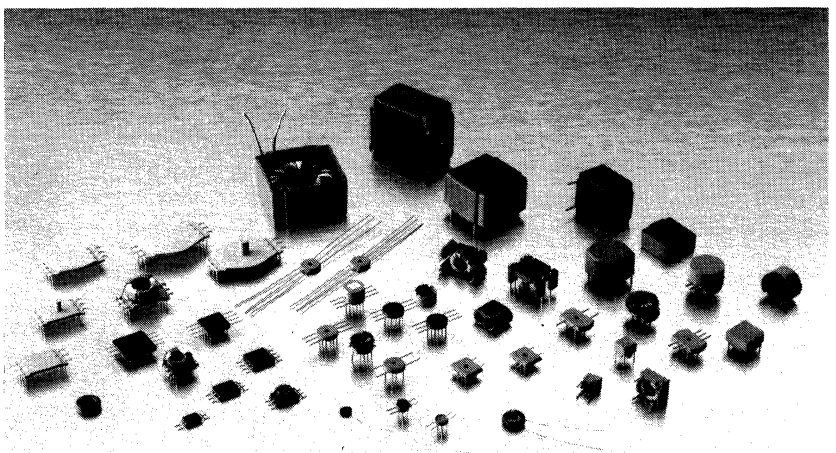



SCF ENGINEERING KIT #2


TM ENGINEERING KIT #5

LODESTONE PACIFIC

4065 E. La Palma Ave. Bldg. "G"
Anaheim, California, 92807



HORIZONTAL TOROID MOUNTS

TOROID AND COMPONENT MOUNTS

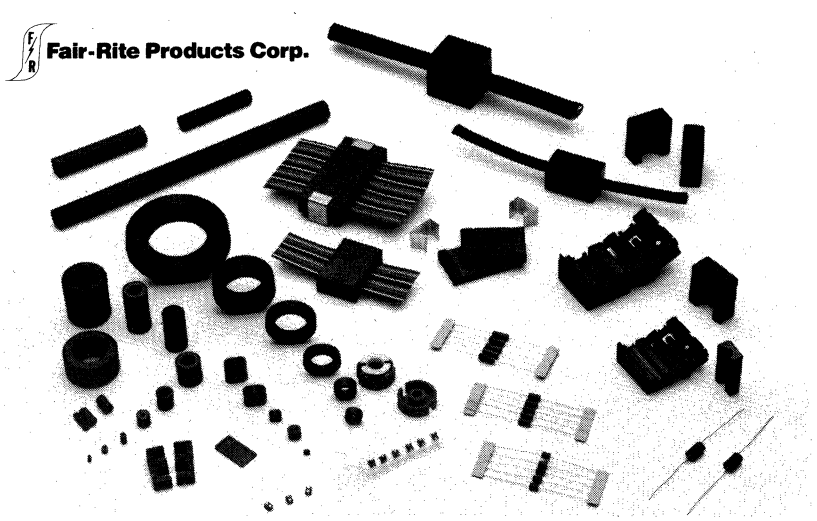
LODESTONE PACIFIC manages the continued growth of the family of component and toroid mounts formerly found in Micrometals Catalog #5. This dramatic product line offers a blend of industry standards and innovative mounting devices to keep pace with the rapidly changing electronics assembly industry.



VERTICAL TOROID MOUNTS

All mounting devices in the catalog are molded from materials rated UL94-VO and have terminals that meet MIL-STD 202 method 208 for solderability. In addition to stocking a standard line of mounting devices, LODESTONE PACIFIC is ideally positioned to find existing products elsewhere in the industry, develop joint tooling projects or help engineer new mounting configurations.

Fair-Rite Products Corp.



FERRITE CORES

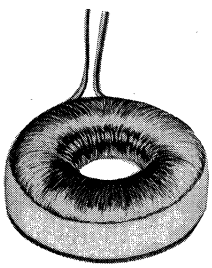
LODESTONE PACIFIC is the Southern California sales representative for Fair-Rite Products Corp. of Wallkill, New York. In addition to factory pricing, delivery information and technical support, Lodestone Pacific can offer immediate shipments and tightly scheduled delivery world-wide from our Anaheim warehouse. Look to Fair-Rite Products and Lodestone Pacific for ferrite cores.

MICROTRAN company, inc.

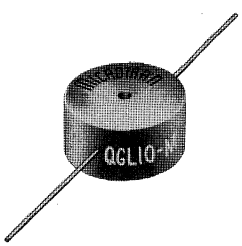
TOROIDAL INDUCTORS



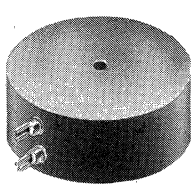
QE-M Molded



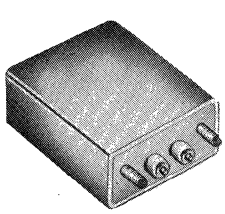
QG-F, QI-F, QK-F, QPL-F, QTL-F Open Frame



QG-M Molded



QI-M, QK-M, QPL-M, QTL-M Molded



QI-H, QK-H 2 studs, QPL-H, QTL-H 4 studs Hermetic

QE SERIES

Ultra miniaturized with low height design. Exceptionally high "Q" and wide frequency range. Frequency range of QEL Series 1 to 300 kHz; QEM, 3 to 500 kHz. Accuracy, ±2%. Molded in epoxy resin with .020" × 2" tinned copperweld leads. Size, .450" dia. × .285".

QEL-M SERIES				QEM-M SERIES			
Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF	Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF
QEL1-M	1 mH	2.1	25	QEM05-M	0.5 mH	2.1	20
QEL2-M	2	3.6	30	QEM1-M	1	3.8	30
QEL5-M	5	7.3	35	QEM2-M	2	6.2	35
QEL10-M	10	15.8	45	QEM5-M	5	15.9	45
QEL15-M	15	20	45	QEM10-M	10	19	50
QEL25-M	25	32	50	QEM15-M	15	42	55
QEL50-M	50	69	50	QEM25-M	25	88	60
QEL100-M	100	185	70	QEM50-M	50	193	70

QG SERIES

Frequency range of QGL Series, to 20kHz; QGM Series, 2 to 100 kHz. Accuracy, ±2%. **QG-F:** Open frame, microcrystalline wax dipped with 4" #28 AWG leads. Size .625" dia. × .281". **QG-M:** Molded in high temperature epoxy resin with .020" × 2" tinned copperweld leads. Leads may be bent downward for plug-in printed circuit use. Size, .875" dia. × .375".

QGL SERIES				QGM SERIES			
QGL5-	5 mH	2.5	30	QGM1-	1 mH	1.4	22
QGL10-	10	5	33	QGM2-	2	2.5	25
QGL15-	15	8	34	QGM5-	5	6	28
QGL30-	30	17	37	QGM10-	10	12	31
QGL50-	50	28	40	QGM15-	15	18	32
QGL100-	100	50	42	QGM25-	25	30	35
QGL250-	250	130	46	QGM50-	50	52	37
QGL500-	500	290	48	QGM100-	100	115	39
QGL1000-	1.0 H	530	51				
QGL1500-	1.5	825	53				

QI SERIES

Frequency range to 20 kHz; accuracy, ±2%. **QIL-M:** Molded in high temperature epoxy with silver plated turret lugs. Size, 1.187" dia. × .50". **QIL-H:** Hermetically sealed in metal case with Teflon terminals. Size, 1.062" × .50" × 1.219". **QIL-F:** Open frame. Microcrystalline wax dipped with 4" #28 plastic leads. Size, 1" dia. × .406".

QIL SERIES							
QIL3-	3 mH	.73	36	QIL150-	150 mH	34	50
QIL5-	5	1.1	38	QIL250-	250	55	53
QIL10-	10	2.1	40	QIL500-	500	95	55
QIL15-	15	3.3	42	QIL1000-	1.0 H	210	57
QIL25-	25	5.3	45	QIL1500-	1.5	335	59
QIL50-	50	11	47	QIL2500-	2.5	550	61
QIL100-	100	22	49				

QK SERIES

Frequency range of QKL Series to 10 kHz; QKM Series, 5 to 50 kHz. Accuracy, ±2%. **QK-F:** Open frame, microcrystalline wax dipped; 4" #28 AWG leads. Size, 1.25" dia × .625". **QK-H:** Hermetically sealed with Teflon terminals. Size, 1.469" × .781" × 1.734". **QK-M:** Molded in high temperature epoxy resin, silver plated turret lugs. Size, 1.375" dia. × .75"; #8 clearance hole.

QKL SERIES							
QKL5-	5 mH	.62	60	QKL250-	250 mH	28	87
QKL10-	10	1.1	66	QKL500-	500	63	91
QKL15-	15	1.7	68	QKL1000-	1.0 H	110	96
QKL25-	25	2.8	72	QKL1500-	1.5	175	98
QKL50-	50	6	76	QKL2500-	2.5	275	103
QKL100-	100	11	81	QKL5000-	5	645	106
QKL150-	150	17	83	QKL10,000-	10	1175	112
QKM SERIES							
QKM2-	2 mH	.45	52	QKM100-	100 mH	25	79
QKM5-	5	1.1	58	QKM250-	250	65	87
QKM10-	10	2.5	62	QKM500-	500	115	92
QKM25-	25	6.5	70	QKM1000-	1.0 H	250	97
QKM50-	50	11	74				

QP SERIES

Frequency range to 10 kHz; accuracy ±2%. **QPL-F:** Open frame, microcrystalline wax dipped; 4" #24 leads. Size, 1.938" × .875". **QPL-H:** Hermetically sealed with Teflon terminals. Size, 1.938" × 1.063" × 2.281". **QPL-M:** Molded in high temperature epoxy resin; silver plated turret lugs. Size, 2" dia. × 1".

QPL SERIES							
QPL25-	25 mH	1.5	100	QPL2500-	2.5 H	150	133
QPL50-	50	2.5	105	QPL5000-	5.0	350	138
QPL100-	100	6	110	QPL7500-	7.5	525	140
QPL250-	250	15	115	QPL10,000-	10	600	142
QPL500-	500	25	120	QPL15,000-	15	900	146
QPL1000-	1.0 H	60	125	QPL25,000-	25	1500	150
QPL1500-	1.5	90	130				

QT SERIES

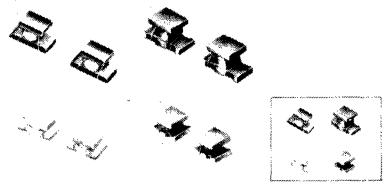
Frequency range to 15 kHz; accuracy, ±2%. **QTL-F:** Open frame, microcrystalline wax dipped; 4" #24 leads. Size, 2.438" dia. × 1". **QTL-H:** Hermetically sealed with Teflon terminals. Size, 2.563" × 1.313" × 2.813". **QTL-M:** Molded in epoxy resin. Size, 2.875" × 1.375".

QTL SERIES							
QTL25-	25 mH	0.85	127	QTL1500-	1.5 H	40	177
QTL50-	50	1.5	136	QTL2500-	2.5	70	184
QTL100-	100	2.8	144	QTL5000-	5	140	192
QTL150-	150	3.9	149	QTL10,000-	10	270	200
QTL250-	250	7	156	QTL15,000-	15	430	205
QTL500-	500	15	164	QTL25,000-	25	850	212
QTL1000-	1.0 H	27	173	QTL50,000-	50	1500	221

145 EAST MINEOLA AVENUE, P.O. BOX 236, VALLEY STREAM, NEW YORK 11582-0236 • TEL.: 516-561-6050 • FAX: 516-561-1117

MURATA ERIE NORTH AMERICA

chip inductors



A result of Murata Erie's new coil winding technology, these extremely small chip inductors are designed to permit high current capacitance, as well as superior frequency characteristics. Available in a wide range of inductance values ranging from .01μH to 2.2mH. Using Palladium Silver (Ag-Pd) material for electrodes, these chip inductors can be either flow soldered or reflow soldered. Their square shape permits utilization in any type of packaging for automated processes.

PACKAGING

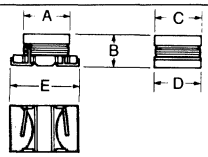
All products are taped in plastic tape and supplied on a reel that conforms with EIAJ-RC-1009B. Standard quantities: LQN1N/1C—2000 pcs. per reel, LQN2A—2500 pcs. per reel, LQH3N— 2000 pcs. per reel, LQH4N—500 pcs. per reel.

FEATURES

- Miniature size
- Available in ferrite and ceramic cores
- Tape packaged for universal mounting equipment (per EIAJ-RC-1009B)
- Wide standard inductance range—10mH to 2200μH
- High Q factor at frequencies to 100Mz for ferrite cores and to 1GHz for ceramic cores

DIMENSIONS: mm

LQN2A (ceramic)
LQH3N (ferrite)
LQH3C (ferrite)
LQH4N (ferrite)



	LQH1N	LQN2A	LQH3N LQH3C	LQH4N LQN4N
A	2.3±0.2	2.5±0.2	2.5±0.2	3.6±0.2
B	1.8±0.2	1.6±0.2	2.0±0.2	2.6±0.2
C	1.6±0.2	2.5±0.2	2.5±0.2	3.2±0.2
D	1.6±0.2	2.5±0.2	2.5±0.3	3.2±0.3
E	3.2±0.3	3.2±0.3	3.2±0.3	4.5±0.3

ELECTRICAL CHARACTERISTICS (PREFERRED VALUES)

Part Number	Nominal ※1 Inductance min. ※4	Nominal ※1 Inductance max.	Tolerance J	Tolerance K	Tolerance M	Q (min.)	DC ※3 Resistance (Ω) max.	Self ※3 Resonance Freq. (MHz) min.	Allowable ※3 Current (mA)
LQH1N○○○□04	0.15μH	8.2μH			◎	20	0.39±40%	250	160
	10μH	100μH		◎		30	2.5 ±30%	20	60
※1※2	1.0μH	8.2μH			◎	—	0.09±30%	96	800
LQH3C○○○□04	10μH	330μH		◎		—	0.44±30%	26	300
LQN2A○○○□03	10nH	82nH			◎	30	0.25	1000	100
	100μH	220nH		◎		30	0.40	400	100
LQH3N○○○□02	0.1μH	0.82μH			◎	20	0.25	200	120
LQH3N○○○□04	1.0μH	8.2μH			◎	20	0.5	100	100
	10μH	330μH	○	◎		35	1.8	20	50
LQH4N○○○□-TA	10μH	1.5μH	○	◎		35	0.56	23	400
LQN4N○○○□-TA	1.8mH	2.2μH	○	◎		40	45	1.5	35

※1 ···Inductance code is shown in ○○○ : 1.2μH→1R2, 10μH→100, 100μH→101
※2 ···Tolerance code is shown in"□" : ±5%=J, ±10%=K, ±20%=M
※3 ···DC resistance, self-resonant frequency and allowable current are shown with the minimum value of inductance.

PART NUMBERING SYSTEM

LQH 3 C 102 K 04 M00

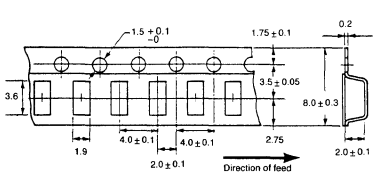
- TYPE: LQN = Non Coated; LQH = Epoxy Coated
- TYPE: LQH = Epoxy Coated on Wire; LQN = Non-Coated
- SIZE: 1, 2, 3
- CORE MATERIAL: A: Alumina Core; N: Ferrite Core; C: Ferrite Core for choke coil
- INDUCTANCE CODE: 1R0 = 1.0μH; 100 = 10μH; 331 = 330μH; 82N = 82nH
- TOLERANCE: K = ±10%; M = ±20%
- ELECTRODE MATERIAL: 03: NI Barrier; 04: NI Alloy Metallization; 92: Palladium Silver
- MARKING: M01: = Marked; M00: = Not Marked

LQH 4 N 102 K TA

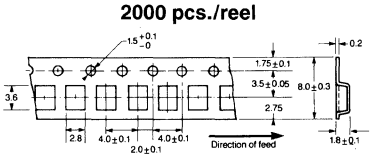
- TYPE: LQN = Non Coated; LQH = Epoxy Coated on Wire
- SIZE: 4
- MATERIAL: N: Ferrite
- INDUCTANCE CODE: 1R0 = 1.0μH; 100 = 10μH; 331 = 330μH; 102 = 1000μH; 1R2 = 1.2μH
- TOLERANCE: K = ±10%; M = ±20%
- PACKAGING: TA = Tape & Reel

DIMENSIONS OF PLASTIC TAPE: mm

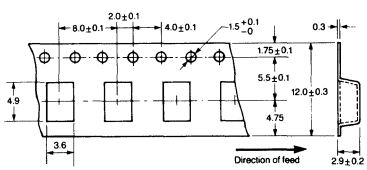
LQH1N/1C
2000 pcs./reel



LQN2A
2500 pcs./reel
LQH3N/3C
2000 pcs./reel



LQH4N
500 pcs./reel



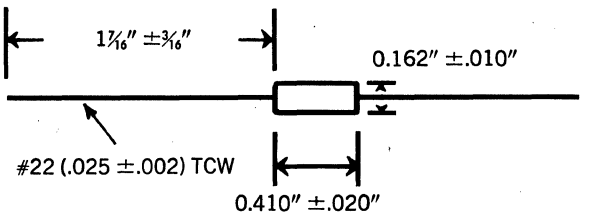
MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

NYTRONICS INDUCTORS

M39010/1, /2, /3 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010 (LATEST REVISION)



Magnetically Shielded

MIL-C-39010-1 (Phenolic Core - Iron Sleeve)

MIL-C-39010-2 (Iron Core - Iron Sleeve)

MIL-C-39010-3 (Ferrite Core - Ferrite Sleeve)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% and ±5% over the entire inductance range. Intermediate values per the MS slash sheet are available.

ELECTRICAL CHARACTERISTICS

Dielectric Strength: 1000 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Q: Measured on a Q-Meter.

Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches. **Weight:** 1.0 grams maximum.

Shielding: At the coupling test frequency two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

M39010	Dash Number	L µH	Q min	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
/1	AR10K*	0.10	50	25	250	0.025	1790	
	AR12K*	0.12	50	25	250	0.034	1530	
	AR15K*	0.15	50	25	250	0.037	1470	
	AR18K*	0.18	50	25	250	0.047	1300	
	AR22K*	0.22	49	25	250	0.067	1100	
	AR27K*	0.27	47	25	250	0.11	853	
	AR33K*	0.33	46	25	250	0.13	780	
	AR39K*	0.39	44	25	250	0.18	670	
	AR47K*	0.47	44	25	235	0.25	565	
	AR56K*	0.56	43	25	210	0.33	490	
	AR68K*	0.68	42	25	190	0.45	420	
	AR82K*	0.82	40	25	180	0.59	370	
/2	A1R0K*	1.0	44	25	140	0.070	1070	
	A1R2K*	1.2	44	7.9	130	0.10	895	
	A1R5K*	1.5	44	7.9	115	0.12	815	
	A1R8K*	1.8	44	7.9	105	0.14	775	
	A2R2K*	2.2	44	7.9	100	0.19	650	
	A2R7K*	2.7	44	7.9	92	0.28	535	
	A3R3K*	3.3	44	7.9	85	0.35	480	
	A3R9K*	3.9	44	7.9	75	0.40	450	
	A4R7K*	4.7	44	7.9	70	0.55	380	
	A5R6K*	5.6	44	7.9	65	0.72	335	
	A6R8K*	6.8	50	7.9	55	1.02	280	
	A8R2K*	8.2	50	7.9	50	1.32	245	
	A100K*	10	50	7.9	46	1.62	220	
	A120K*	12	55	2.5	44	2.00	200	
/3	A150K*	15	45	2.5	49	0.80	315	250
	A180K*	18	45	2.5	45	0.89	300	235
	A220K*	22	45	2.5	41	0.96	290	220
	A270K*	27	45	2.5	38	1.19	260	200
	A330K*	33	45	2.5	34	1.37	240	190
	A390K*	39	50	2.5	29	1.93	205	180
	A470K*	47	50	2.5	27	2.11	195	175
	A560K*	56	50	2.5	25	2.23	190	160
	A680K*	68	50	2.5	21	2.44	180	150
	A820K*	82	50	2.5	10.5	2.70	170	140

M39010	Dash Number	L µH	Q min	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
/3	A101K*	100	50	2.5	10.0	3.12	160	120
	A121K*	120	55	0.79	9.7	3.60	150	95
	A151K*	150	55	0.79	8.5	4.10	140	90
	A181K*	180	55	0.79	8.0	4.40	135	85
	A221K*	220	55	0.79	7.5	5.00	125	80
	A271K*	270	55	0.79	7.0	5.80	115	70
	A331K*	330	55	0.79	6.5	6.40	110	65
	A391K*	390	60	0.79	6.2	7.40	105	60
	A471K*	470	60	0.79	5.7	9.50	92	58
	A561K*	560	60	0.79	4.7	10.5	90	55
	A681K*	680	60	0.79	4.5	11.8	80	50
	A821K*	820	60	0.79	4.2	13.0	80	45
	A102K*	1000	60	0.79	3.8	17.5	70	40
	A122K*	1200	45	0.25	1.5	22.1	60	35
	A152K*	1500	45	0.25	1.2	26.5	55	33
	A182K*	1800	45	0.25	1.0	29.9	50	30
	A222K*	2200	45	0.25	0.97	33.8	50	27
	A272K*	2700	45	0.25	0.92	47.3	40	25
	A332K*	3300	45	0.25	0.84	53.0	40	22
	A392K*	3900	45	0.25	0.80	73.8	35	20
	A472K*	4700	45	0.25	0.74	81.6	31	19
	A562K*	5600	44	0.25	0.73	98.9	28	17
	A682K*	6800	40	0.25	0.66	111.0	27	16
	A822K*	8200	40	0.25	0.54	119.0	26	15
	A103K*	10,000	40	0.25	0.47	137.0	24	14
	A123K*	12,000	30	0.079	0.33	143.0	23	13
	A153K*	15,000	30	0.079	0.29	157.0	22	12
	A183K*	18,000	30	0.079	0.28	175.0	21	10
	A223K*	22,000	27	0.079	0.25	274.0	17	9
	A273K*	27,000	27	0.079	0.21	308.0	16	8
	A333K*	33,000	27	0.079	0.19	343.0	15	7.5
	A393K*	39,000	27	0.079	0.17	376.0	15	6.0
	A473K*	47,000	23	0.079	0.16	473.0	13	5.5
	A563K*	56,000	23	0.079	0.14	512.0	13	5.0
	A683K*	68,000	23	0.079	0.13	580.0	12	4.0
	A823K*	82,000	21	0.079	0.12	618.0	11	3.5
	A104K*	100,000	18	0.079	0.11	678.0	11	3.0

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† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/1 - /2 - /3 FAILURE RATE "S" .001%/1000 HRS.

NYTRONICS INDUCTORS

M39010/4, /5, /6, /7 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010 (LATEST REVISION)

MIL-C-39010-4 (Phenolic Core)
MIL-C-39010-5 (Iron Core)
MIL-C-39010-6 (Phenolic Core)
MIL-C-39010-7 (Iron Core)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 0.47uH ±20%; 0.56uH and up ±10%. ±5% and intermediate values per MS slash sheet are available.

Dielectric Strength: 1000 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

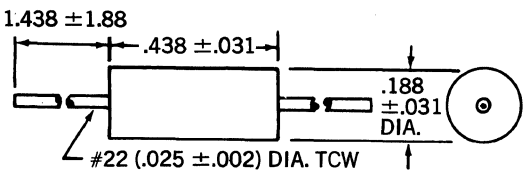
Rating: Maximum current based on: 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C phenolic core, −55°C to +105°C iron.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-39010.

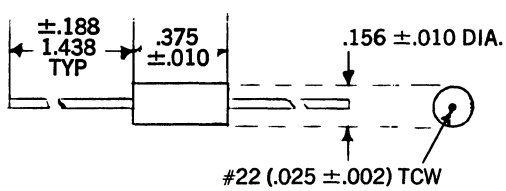
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.



ALL DIMENSIONS IN INCHES

Weight: 0.950 gram maximum.

M39010	Dash Number	Inductance µH	Q min	Test frequency MHz	Self-resonant frequency Min. MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/4	BR15L*	0.15	55	25.0	510	0.030	2,900
	BR22L*	0.22	50	25.0	415	0.035	2,700
	BR33L*	0.33	50	25.0	350	0.065	2,000
	BR47L*	0.47	50	25.0	300	0.085	1,700
	BR56K*	0.56	50	25.0	270	0.125	1,450
	BR68K*	0.68	45	25.0	250	0.150	1,300
	BR82K*	0.82	40	25.0	210	0.205	1,100
	B1R0K*	1.00	40	25.0	200	0.290	930
	B1R2K*	1.20	30	7.9	180	0.400	785
	B1R5K*	1.50	30	7.9	170	0.485	720
	B1R8K*	1.80	30	7.9	150	0.740	580
	B2R2K*	2.20	30	7.9	140	0.970	505
	B2R7K*	2.70	30	7.9	120	1.20	460
/5	A3R3K*	3.30	30	7.9	70	0.140	945
	A3R9K*	3.90	30	7.9	65	0.155	370
	A4R7K*	4.70	30	7.9	60	0.210	745
	A5R6K*	5.60	30	7.9	50	0.280	645
	A6R8K*	6.80	30	7.9	50	0.375	560
	A8R2K*	8.20	30	7.9	48	0.440	520
	A100K*	10.0	30	7.9	42	0.605	440
	A120K*	12.0	50	2.5	36	1.05	335
	A150K*	15.0	55	2.5	30	1.20	310
	A180K*	18.0	60	2.5	30	1.95	245
	A220K*	22.0	60	2.5	24	2.20	230
	A270K*	27.0	65	2.5	22	2.75	205



Weight: 0.90 gram maximum.

M39010	Dash Number	Inductance µH	Q min	Test frequency MHz	Self-resonant frequency Min. MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/6	BR15L*	0.15	50	25.0	525	0.030	2,450
	BR22L*	0.22	50	25.0	450	0.055	1,810
	BR33L*	0.33	45	25.0	360	0.090	1,400
	BR47L*	0.47	45	25.0	310	0.12	1,225
	BR56K*	0.56	50	25.0	280	0.135	1,150
	BR68K*	0.68	50	25.0	250	0.150	1,100
	BR82K*	0.82	50	25.0	220	0.220	900
	B1R0K*	1.00	50	25.0	200	0.290	785
	B1R2K*	1.20	33	7.9	180	0.420	650
	B1R5K*	1.50	33	7.9	160	0.500	600
	B1R8K*	1.80	33	7.9	150	0.650	525
	B2R2K*	2.20	33	7.9	135	0.950	435
	B2R7K*	2.70	33	7.9	120	1.20	385
	B3R3K*	3.30	33	7.9	110	2.00	300
	B3R9K*	3.90	33	7.9	100	2.30	280
	B4R7K*	4.70	33	7.9	90	2.60	260
/7	A5R6K*	5.6	45	7.9	60	0.32	495
	A6R8K*	6.8	50	7.9	55	0.50	395
	A8R2K*	8.2	50	7.9	50	0.60	360
	A100K*	10	55	7.9	45	0.90	290
	A120K*	12	65	2.5	42	1.10	265
	A150K*	15	65	2.5	40	1.40	240
	A180K*	18	75	2.5	34	2.25	185
	A220K*	22	75	2.5	30	2.50	175
	A270K*	27	60	2.5	25	2.60	170
	A330K*	33	65	2.5	19	3.00	165

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/4 - /5 - /6 - /7 FAILURE RATE "S" .001%/1000 HRS.

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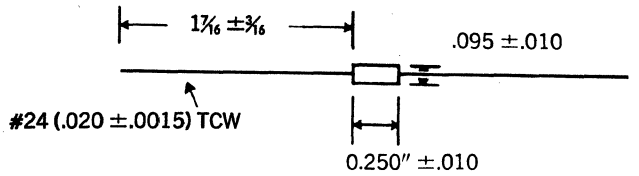
NYTRONICS INDUCTORS

M39010/8, /9, /10 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010
(LATEST REVISION)

MIL-C-39010-8 (Phenolic Core)
MIL-C-39010-9 (Iron Core)
MIL-C-39010-10 (Ferrite Core)



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% and ±5% over the entire range. Intermediate values per MS slash sheet are available.

Dielectric Strength: 1000 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Rating: Maximum current based on: 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron, and for ferrite core inductors.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches; **Weight:** 0.30 grams.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C phenolic core, −55°C to +105°C iron and ferrite core.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate direction.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:

EXAMPLE: M39010 /08 A1ROKS } - Military part number.
83125 - Manufacturer's source code.
J8711A - "JAN" marking, date code, and lot symbol.

M39010	Dash Number	Inductance μH	Q min	Test frequency MHz	Self-resonant frequency Min MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/8	BR10K*	.10	40	25.0	680	.08	1350
	BR12K*	.12	40	25.0	640	.09	1270
	BR15K*	.15	38	25.0	600	.10	1200
	BR18K*	.18	35	25.0	550	.12	1105
	BR22K*	.22	33	25.0	510	.14	1025
	BR27K*	.27	33	25.0	430	.16	960
	BR33K*	.33	30	25.0	410	.22	815
	BR39K*	.39	30	25.0	365	.30	700
	BR47K*	.47	30	25.0	330	.35	650
	BR56K*	.56	30	25.0	300	.50	545
	BR68K*	.68	28	25.0	275	.60	495
	BR82K*	.82	28	25.0	250	.85	415
	B1R0K*	1.00	25	25.0	230	1.00	385
/9	A1R2K*	1.2	25	7.9	150	.18	590
	A1R5K*	1.5	28	7.9	140	.22	535
	A1R8K*	1.8	30	7.9	125	.30	455
	A2R2K*	2.2	30	7.9	115	.40	395
	A2R7K*	2.7	37	7.9	100	.55	335
	A3R3K*	3.3	45	7.9	90	.85	270
	A3R9K*	3.9	45	7.9	80	1.00	250
	A4R7K*	4.7	45	7.9	75	1.20	230
	A5R6K*	5.6	50	7.9	65	1.80	185
	A6R8K*	6.8	50	7.9	60	2.00	175
	A8R2K*	8.2	55	7.9	55	2.70	155
	A100K*	10	55	7.9	50	3.70	130
	A120K*	12	45	2.5	40	2.70	155
	A150K*	15	40	2.5	35	2.80	150
	A180K*	18	50	2.5	30	3.10	145
	A220K*	22	50	2.5	25	3.30	140
	A270K*	27	50	2.5	20	3.50	135

M39010	Dash Number	Inductance μH	Q min	Test frequency MHz	Self-resonant frequency Min MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/10	A330K*	33	45	2.5	24	3.4	130
	A390K*	39	45	2.5	22	3.6	125
	A470K*	47	45	2.5	20	4.5	110
	A560K*	56	45	2.5	18	5.7	100
	A680K*	68	50	2.5	15	6.7	92
	A820K*	82	50	2.5	14	7.3	88
	A101K*	100	50	2.5	13	8	84
	A121K*	120	30	.79	12	13	66
	A151K*	150	30	.79	11	15	61
	A181K*	180	30	.79	10	17	57
	A221K*	220	30	.79	9	21	52
	A271K*	270	30	.79	8	25	47
	A331K*	330	30	.79	7	28	45
	A391K*	390	30	.79	6.5	35	40
	A471K*	470	30	.79	6	42	36
	A561K*	560	30	.79	5	46	35
	A681K*	680	30	.79	4	60	30
	A821K*	820	30	.79	3.8	65	29
	A102K*	1000	30	.79	3.4	72	28

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/8 - /9 - /10 FAILURE RATE "S" .001%/1000 HRS.

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NYTRONICS INDUCTORS

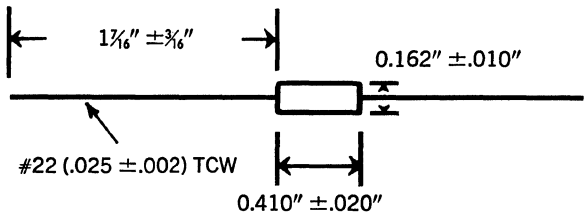
TYPE SWD
MS75087, 75088 & 75089
INDUCTORS

MS-INDUCTOR SERIES 75087, 75088, 75089 MOLDED SHIELDED INDUCTOR

GRADE 1 CLASS A

Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.

The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 1000 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on a Q-Meter.
Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At the test frequency, two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

Material	MS No.	NCG P/N	L uH	Q min	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
PHENOLIC	MS75087-1	SWD	0.10	50	25	250	0.025	1790	>2900
	MS75087-2	SWD	0.12	51	25	250	0.034	1530	>2800
	MS75087-3	SWD	0.15	51	25	250	0.037	1470	>2750
	MS75087-4	SWD	0.18	50	25	250	0.047	1300	>2200
	MS75087-5	SWD	0.22	49	25	250	0.067	1100	>1700
	MS75087-6	SWD	0.27	47	25	250	0.11	855	>1500
	MS75087-7	SWD	0.33	46	25	250	0.13	780	>1300
	MS75087-8	SWD	0.39	44	25	250	0.18	670	>1100
	MS75087-9	SWD	0.47	44	25	235	0.25	565	>1000
	MS75087-10	SWD	0.56	43	25	210	0.33	490	> 900
	MS75087-11	SWD	0.68	42	25	190	0.45	420	> 750
	MS75087-12	SWD	0.82	40	25	180	0.59	370	> 600
IRON	MS75088-1	SWD	1.0	44	25	140	0.070	1070	>1900
	MS75088-2	SWD	1.2	44	7.9	130	0.10	895	>1600
	MS75088-3	SWD	1.5	44	7.9	115	0.12	815	>1300
	MS75088-4	SWD	1.8	44	7.9	105	0.14	775	>1200
	MS75088-5	SWD	2.2	44	7.9	100	0.19	650	>1100
	MS75088-6	SWD	2.7	44	7.9	92	0.28	535	> 950
	MS75088-7	SWD	3.3	44	7.9	85	0.35	480	> 800
	MS75088-8	SWD	3.9	44	7.9	75	0.40	450	> 750
	MS75088-9	SWD	4.7	44	7.9	70	0.55	380	> 650
	MS75088-10	SWD	5.6	44	7.9	65	0.72	335	> 550
	MS75088-11	SWD	6.8	50	7.9	55	1.02	280	> 500
	MS75088-12	SWD	8.2	50	7.9	50	1.32	250	> 475
	MS75088-13	SWD	10	50	7.9	46	1.62	220	> 450
	MS75088-14	SWD	12	55	2.5	44	2.00	200	> 400
FERRITE	MS75089-1	SWD	15	45	2.5	49	0.80	315	250
	MS75089-2	SWD	18	45	2.5	45	0.89	300	235
	MS75089-3	SWD	22	45	2.5	41	0.96	290	220
	MS75089-4	SWD	27	45	2.5	38	1.19	260	200
	MS75089-5	SWD	33	45	2.5	34	1.37	240	190
	MS75089-6	SWD	39	50	2.5	29	1.93	205	180
	MS75089-7	SWD	47	50	2.5	27	2.11	195	175
	MS75089-8	SWD	56	50	2.5	25	2.23	190	160
	MS75089-9	SWD	68	50	2.5	21	2.70	170	150
	MS75089-10	SWD	82	50	2.5	10.5	2.44	180	140
FERRITE	MS75089-11	SWD	100	50	2.5	10.0	3.12	160	120
	MS75089-12	SWD	120	55	0.79	9.7	3.60	150	95
	MS75089-13	SWD	150	55	0.79	8.5	4.10	140	90
	MS75089-14	SWD	180	55	0.79	8.0	4.40	135	85
	MS75089-15	SWD	220	55	0.79	7.5	5.00	125	80
	MS75089-16	SWD	270	55	0.79	7.0	5.80	115	70
	MS75089-17	SWD	330	55	0.79	6.5	6.40	110	65
	MS75089-18	SWD	390	60	0.79	6.2	7.40	105	60
	MS75089-19	SWD	470	60	0.79	5.7	9.50	92	58
	MS75089-20	SWD	560	60	0.79	4.7	10.5	90	55
	MS75089-21	SWD	680	60	0.79	4.5	11.8	80	50
	MS75089-22	SWD	820	60	0.79	4.2	13.0	80	45
	MS75089-23	SWD	1000	60	0.79	3.8	17.5	70	40
	MS75089-24	SWD	1200	45	0.25	1.5	22.1	60	35
	MS75089-25	SWD	1500	45	0.25	1.2	26.5	55	33
	MS75089-26	SWD	1800	45	0.25	1.0	29.9	50	30
	MS75089-27	SWD	2200	45	0.25	0.97	33.8	50	27
	MS75089-28	SWD	2700	45	0.25	0.92	47.3	40	25
	MS75089-29	SWD	3300	45	0.25	0.84	53.0	40	22
	MS75089-30	SWD	3900	45	0.25	0.80	73.8	35	20
	MS75089-31	SWD	4700	45	0.25	0.74	81.6	31	19
	MS75089-32	SWD	5600	44	0.25	0.73	98.9	28	17
	MS75089-33	SWD	6800	40	0.25	0.66	111.0	27	16
	MS75089-34	SWD	8200	40	0.25	0.54	119.0	26	15
	MS75089-35	SWD	10,000	40	0.25	0.47	137.0	24	14
	MS75089-36	SWD	12,000	30	0.079	0.33	143.0	23	13
	MS75089-37	SWD	15,000	30	0.079	0.29	157.0	22	12
	MS75089-38	SWD	18,000	30	0.079	0.28	175.0	21	10
	MS75089-39	SWD	22,000	27	0.079	0.25	274.0	17	9
	MS75089-40	SWD	27,000	27	0.079	0.21	308.0	16	8
	MS75089-41	SWD	33,000	27	0.079	0.19	343.0	15	7.5
	MS75089-42	SWD	39,000	27	0.079	0.17	376.0	15	6.0
	MS75089-43	SWD	47,000	23	0.079	0.16	473.0	13	5.5
	MS75089-44	SWD	56,000	23	0.079	0.14	512.0	13	5.0
	MS75089-45	SWD	68,000	23	0.079	0.13	580.0	12	4.0
	MS75089-46	SWD	82,000	21	0.079	0.12	618.0	11	3.5
	MS75089-47	SWD	100,000	18	0.079	0.11	678.0	11	3.0

† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.
MS No. Electricals as shown.

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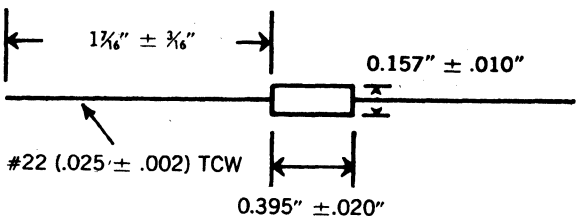
NYTRONICS INDUCTORS

TYPE SWD
MS90537
INDUCTORS

MS-INDUCTOR SERIES
90537
MOLDED SHIELDED INDUCTOR
(Manufactured per MS-90537)

Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.

The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.



GRADE 1 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on Q-Meter.
Maximum Current: Based on temperature rise not to exceed 35°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At the test frequency, two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305D, Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. **Shock:** 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

Material	MS Catalog No.	NCG P/N	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.** I mA
PHENOLIC	90537-1	SWD	0.10	50	25	250	0.025	2900	>2900
	90537-2	SWD	0.12	51	25	250	0.034	2800	>2800
	90537-3	SWD	0.15	51	25	250	0.037	2750	>2750
	90537-4	SWD	0.18	50	25	250	0.047	2200	>2200
	90537-5	SWD	0.22	49	25	250	0.067	1700	>1700
	90537-6	SWD	0.27	47	25	250	0.11	1500	>1500
	90537-7	SWD	0.33	46	25	250	0.13	1300	>1300
	90537-8	SWD	0.39	44	25	250	0.18	1100	>1100
	90537-9	SWD	0.47	44	25	235	0.25	1000	>1000
	90537-10	SWD	0.56	43	25	210	0.33	900	>900
	90537-11	SWD	0.68	42	25	190	0.45	750	>750
	90537-12	SWD	0.82	40	25	180	0.59	600	>600
IRON	90537-13	SWD	1.0	47	25	140	0.070	1900	>1900
	90537-14	SWD	1.2	46	7.9	130	0.093	1600	>1600
	90537-15	SWD	1.5	45	7.9	115	0.12	1300	>1300
	90537-16	SWD	1.8	43	7.9	105	0.14	1200	>1200
	90537-17	SWD	2.2	45	7.9	100	0.19	1100	>1100
	90537-18	SWD	2.7	46	7.9	92	0.28	950	>950
	90537-19	SWD	3.3	44	7.9	85	0.35	800	>800
	90537-20	SWD	3.9	44	7.9	75	0.40	750	>750
	90537-21	SWD	4.7	44	7.9	70	0.55	650	>650
	90537-22	SWD	5.6	47	7.9	65	0.72	550	>550
	90537-23	SWD	6.8	50	7.9	55	1.02	500	>500
	90537-24	SWD	8.2	50	7.9	50	1.32	475	>475
	90537-25	SWD	10	49	7.9	46	1.62	450	>450
	90537-26	SWD	12	55	2.5	44	2.00	400	>400
FERRITE	90537-27	SWD	15	44	2.5	49	0.80	620	250
	90537-28	SWD	18	45	2.5	45	0.89	610	235
	90537-29	SWD	22	46	2.5	41	0.96	600	220
	90537-30	SWD	27	49	2.5	38	1.19	500	200
	90537-31	SWD	33	45	2.5	34	1.37	490	190
	90537-32	SWD	39	53	2.5	29	1.93	410	180
	90537-33	SWD	47	52	2.5	27	2.11	400	175
	90537-34	SWD	56	49	2.5	25	2.23	380	160
	90537-35	SWD	68	51	2.5	21	2.70	370	150
	90537-36	SWD	82	45	2.5	10.5	2.44	360	140

Material	MS Catalog No.	NCG P/N	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.** I mA
FERRITE	90537-37	SWD	100	52	2.5	10.0	3.12	325	120
	90537-38	SWD	120	57	.79	9.7	3.60	290	95
	90537-39	SWD	150	56	.79	8.5	4.10	275	90
	90537-40	SWD	180	60	.70	8.0	4.40	260	85
	90537-41	SWD	220	58	.79	7.5	5.00	250	80
	90537-42	SWD	270	60	.79	7.0	5.80	240	70
	90537-43	SWD	330	54	.79	6.5	6.40	225	65
	90537-44	SWD	390	67	.79	6.2	7.40	200	60
	90537-45	SWD	470	60	.79	5.7	9.50	180	58
	90537-46	SWD	560	60	.79	4.7	10.5	174	55
	90537-47	SWD	680	60	.79	4.5	11.8	168	50
	90537-48	SWD	820	57	.79	4.2	13.0	152	45
	90537-49	SWD	1000	65	.79	3.8	17.5	135	40
	90537-50	SWD	1200	45	.25	1.5	22.1	115	35
	90537-51	SWD	1500	49	.25	1.2	26.5	110	33
	90537-52	SWD	1800	47	.25	1.0	29.9	105	30
	90537-53	SWD	2200	50	.25	0.97	33.8	99	27
	90537-54	SWD	2700	47	.25	0.92	47.3	83	25
	90537-55	SWD	3300	43	.25	0.84	53.0	80	22
	90537-56	SWD	3900	43	.25	0.80	73.8	67	20
	90537-57	SWD	4700	44	.25	0.74	81.6	63	19
	90537-58	SWD	5600	45	.25	0.73	98.9	56	17
	90537-59	SWD	6800	43	.25	0.66	111.0	54	16
	90537-60	SWD	8200	42	.25	0.54	119.0	52	15
	90537-61	SWD	10,000	39	.25	0.47	137.0	49	14
	90537-62	SWD	12,000	31	.079	0.33	143.0	46	13
	90537-63	SWD	15,000	31	.079	0.29	157.0	45	12
	90537-64	SWD	18,000	31	.079	0.28	175.0	41	10
	90537-65	SWD	22,000	27	.079	0.25	274.0	33	9
	90537-66	SWD	27,000	27	.079	0.21	308.0	31	8
	90537-67	SWD	33,000	27	.079	0.19	343.0	30	7.5
	90537-68	SWD	39,000	27	.079	0.17	376.0	27	6.0
	90537-69	SWD	47,000	23	.079	0.16	473.0	26	5.5
	90537-70	SWD	56,000	23	.079	0.14	512.0	25	5.0
	90537-71	SWD	68,000	23	.079	0.13	580.0	24	4.0
	90537-72	SWD	82,000	21	.079	0.12	618.0	23	3.5
	90537-73	SWD	100,000	18	.079	0.11	678.0	22	3.0

**INCREMENTAL CURRENT — The D.C. current required to cause a 5% reduction in the nominal inductance value. NCG and MS Part No. electricals as shown.

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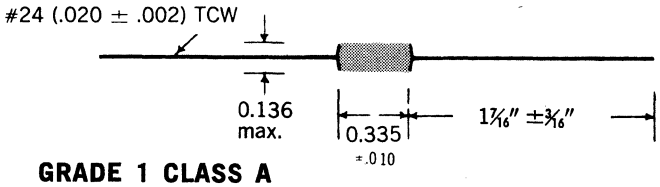
NYTRONICS INDUCTORS

TYPE SWWD
MS21399, 21400 & 21401
INDUCTORS

SUPER WEE-WEE-DUCTOR

An Ultra-Reliable molded shielded inductor. Subminiature size for high density circuits. Great Inductance-to-size ratio. .10 uH to 10,000 uH. 0.136" diameter x 0.335" length. 61 stock values.

The **SUPER WEE-WEE-DUCTOR,** a shielded miniaturized inductor, provides a greater inductance-to-size ratio in a molded epoxy envelope. Use of unique "T" lead construction on all values from 15 uH to 10,000 uH assures exceptional reliability in ranges where fine wire sizes are used. This MS inductor series is designed to meet the stringent requirements of MIL-C-15305 (latest revision). This provides the design engineer with utmost reliability, electrical performance, and minimum coupling in high density packaging.



GRADE 1 CLASS A

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% (Q-Meter) at specified frequency.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured with full length leads on Q-Meter.
Q: Measured on Q-Meter at specified frequency.
Rating: maximum based on 1/3 watt dissipation.

DENSITY CHARACTERISTICS

Volume: 0.0041 cubic inches.
Weight: 0.50 grams maximum.
Shielding: Less than 3% coupling with two units mounted side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.
Terminal Strength: Meets five pounds pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Moisture, Vibration and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High Frequency: 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes
Shock: 100G, 6 MS.
Marking: Color coded per MIL-C-15305 (latest revision).

SUPER WEE-WEE-DUCTOR STANDARD VALUES

Material	MS No.	NCG Part No.	L µH	Q Min.	Test Freq. MHz	min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.* I mA
PHENOLIC	MS21399-1	SW-W-D- 0.10	0.10	42	25	480	.087	1650	>1650
	MS21399-2	SW-W-D- 0.12	0.12	42	25	460	.090	1630	>1630
	MS21399-3	SW-W-D- 0.15	0.15	42	25	400	.098	1550	>1550
	MS21399-4	SW-W-D- 0.18	0.18	42	25	360	.117	1420	>1420
	MS21399-5	SW-W-D- 0.22	0.22	42	25	340	.141	1330	>1330
	MS21399-6	SW-W-D- 0.27	0.27	42	25	320	.157	1230	>1230
	MS21399-7	SW-W-D- 0.33	0.33	42	25	295	.178	1140	>1140
	MS21399-8	SW-W-D- 0.39	0.39	42	25	275	.208	1060	>1060
	MS21399-9	SW-W-D- 0.47	0.47	41	25	250	.257	960	> 960
	MS21399-10	SW-W-D- 0.56	0.56	39	25	238	.283	915	> 915
	MS21399-11	SW-W-D- 0.68	0.68	36	25	224	.337	840	> 840
	MS21399-12	SW-W-D- 0.82	0.82	35	25	205	.470	720	> 720
IRON	MS21400-1	SW-W-D- 1.0	1.0	38	25	135	.170	1180	>1180
	MS21400-2	SW-W-D- 1.2	1.2	38	7.9	124	.190	1150	>1150
	MS21400-3	SW-W-D- 1.5	1.5	38	7.9	114	.212	1050	>1050
	MS21400-4	SW-W-D- 1.8	1.8	38	7.9	105	.242	990	> 990
	MS21400-5	SW-W-D- 2.2	2.2	38	7.9	95	.263	950	> 950
	MS21400-6	SW-W-D- 2.7	2.7	38	7.9	85	.320	880	> 880
	MS21400-7	SW-W-D- 3.3	3.3	38	7.9	78	.345	820	> 820
	MS21400-8	SW-W-D- 3.9	3.9	42	7.9	74	.411	755	> 755
	MS21400-9	SW-W-D- 4.7	4.7	42	7.9	68	.562	650	> 650
	MS21400-10	SW-W-D- 5.6	5.6	42	7.9	62	.742	565	> 565
	MS21400-11	SW-W-D- 6.8	6.8	45	7.9	55	1.00	485	> 485
	MS21400-12	SW-W-D- 8.2	8.2	47	7.9	51	1.20	440	> 440
	MS21400-13	SW-W-D- 10	10	51	7.9	45	1.84	355	> 335
	MS21400-14	SW-W-D- 12	12	51	2.5	41	2.60	300	> 300
FERRITE "T" LEAD	MS21401-1	SW-W-D- 15	15	35	2.5	48	.635	610	200
	MS21401-2	SW-W-D- 18	18	35	2.5	44	.728	570	175
	MS21401-3	SW-W-D- 22	22	35	2.5	37	.825	530	160
	MS21401-4	SW-W-D- 27	27	35	2.5	32	.950	500	155
	MS21401-5	SW-W-D- 33	33	36	2.5	30	1.26	430	150
	MS21401-6	SW-W-D- 39	39	36	2.5	27	1.42	405	145
	MS21401-7	SW-W-D- 47	47	36	2.5	23	1.72	370	140
	MS21401-8	SW-W-D- 56	56	38	2.5	21	2.03	340	130
	MS21401-9	SW-W-D- 68	68	38	2.5	18.5	2.29	320	120
	MS21401-10	SW-W-D- 82	82	36	2.5	17.0	2.55	305	115
	MS21401-11	SW-W-D- 100	100	36	2.5	15.5	2.92	280	100
	MS21401-12	SW-W-D- 120	120	43	0.79	14.5	3.30	235	80
	MS21401-13	SW-W-D- 150	150	43	0.79	13.0	4.30	215	68
	MS21401-14	SW-W-D- 180	180	43	0.79	11.5	5.40	200	64
	MS21401-15	SW-W-D- 220	220	45	0.79	10.0	6.65	150	60
	MS21401-16	SW-W-D- 270	270	47	0.79	9.50	7.60	140	58
	MS21401-17	SW-W-D- 330	330	47	0.79	8.50	8.50	130	56
	MS21401-18	SW-W-D- 390	390	47	0.79	8.00	10.0	120	54
	MS21401-19	SW-W-D- 470	470	47	0.79	7.20	13.5	100	52
	MS21401-20	SW-W-D- 560	560	51	0.79	6.40	14.5	95	50
	MS21401-21	SW-W-D- 680	680	51	0.79	5.80	16.0	90	48
	MS21401-22	SW-W-D- 820	820	48	0.79	5.30	19.0	85	47
	MS21401-23	SW-W-D- 1000	1000	48	0.79	4.80	21.5	80	45
	MS21401-24	SW-W-D- 1200	1200	45	0.25	2.90	23	100	40
	MS21401-25	SW-W-D- 1500	1500	45	0.25	2.80	30	90	35
	MS21401-26	SW-W-D- 1800	1800	45	0.25	2.60	33	86	32
	MS21401-27	SW-W-D- 2200	2200	45	0.25	2.55	40	78	30
	MS21401-28	SW-W-D- 2700	2700	45	0.25	2.40	43	74	28
	MS21401-29	SW-W-D- 3300	3300	45	0.25	2.00	58	65	26
	MS21401-30	SW-W-D- 3900	3900	45	0.25	1.95	76	56	23
	MS21401-31	SW-W-D- 4700	4700	45	0.25	1.85	85	53	20
	MS21401-32	SW-W-D- 5600	5600	45	0.25	1.75	100	48	18
	MS21401-33	SW-W-D- 6800	6800	40	0.25	1.58	127	43	15
	MS21401-34	SW-W-D- 8200	8200	40	0.25	1.55	150	40	12
	MS21401-35	SW-W-D-10,000	10,000	40	0.25	1.45	190	37	10

*INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.
Ms. No. Electricals per actual MS sheet

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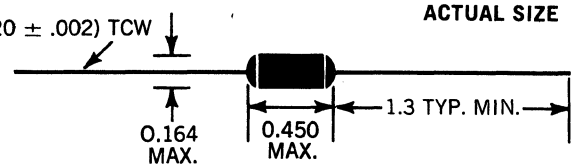
NYTRONICS INDUCTORS

TYPE WD INDUCTORS

WEE-DUCTOR

Miniature Shielded Inductor with high inductance-to-size ratio. 0.10uH to 180,000uH in 76 values

The **WEE-DUCTOR** was the first miniature shielded inductor that Nytronics standardized for stock delivery. This encapsulated non-flammable shielded unit in a 0.164" diameter by 0.450" long envelope offers the design engineer extremely high inductance for density packaging.



GRADE 2 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.1uH to 22uH ±10% (Q-Meter); 27uH to 1,000uH ±5% (1KC Bridge); 1,200uH to 56,000uH ±10% (1KC Bridge) 68,000uH to 180,000uH ±20% (1KC Bridge) measured at point on leads ¼ inch from body.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid DIP Meter.

Q: Measured on Q-Meter.

Maximum Current: Based on temperature rise not to exceed 40°C at 85°C ambient.

NCG Part No.	L	Q Min.		Min. SRF	Max. DCR	Max. I	Incr.* I	Material
	μH		MHz	MHz	Ω	mA	mA	
WEE- 0.10	0.10	55	25	487	0.020	4000	4000	PHENOLIC
WEE- 0.12	0.12	55	25	442	0.029	3350	3350	
WEE- 0.15	0.15	55	25	402	0.032	3000	3000	
WEE- 0.18	0.18	50	25	366	0.040	2850	2850	
WEE- 0.22	0.22	56	25	331	0.045	2700	2700	
WEE- 0.27	0.27	50	25	298	0.08	2000	2000	
WEE- 0.33	0.33	48	25	270	0.09	1900	1900	
WEE- 0.39	0.39	48	25	248	0.16	1420	1420	
WEE- 0.47	0.47	48	25	226	0.17	1400	1400	
WEE- 0.56	0.56	45	25	206	0.36	960	960	
WEE- 0.68	0.68	45	25	188	0.37	940	940	
WEE- 0.82	0.82	41	25	171	0.46	870	870	
WEE- 1.0	1.0	42	7.9	131	0.062	2300	2300	IRON
WEE- 1.2	1.2	43	7.9	120	0.067	2200	2200	
WEE- 1.5	1.5	41	7.9	108	0.16	1420	1420	
WEE- 1.8	1.8	42	7.9	99	0.17	1370	1370	
WEE- 2.2	2.2	42	7.9	90	0.19	1300	1300	
WEE- 2.7	2.7	41	7.9	86	0.20	1270	1270	
WEE- 3.3	3.3	40	7.9	73	0.31	1030	1030	
WEE- 3.9	3.9	40	7.9	68	0.33	1000	1000	
WEE- 4.7	4.7	40	7.9	61	0.58	750	750	
WEE- 5.6	5.6	40	7.9	56	0.64	710	710	
WEE- 6.8	6.8	40	7.9	51	0.68	680	680	
WEE- 8.2	8.2	45	7.9	46	1.3	500	500	
WEE- 10	10	46	2.5	42	1.4	480	480	
WEE- 12	12	47	2.5	38	1.5	460	460	
WEE- 15	15	47	2.5	34	1.7	440	440	
WEE- 18	18	45	2.5	43	0.88	610	235	FERRITE
WEE- 22	22	47	2.5	38	0.95	590	220	
WEE- 27	27	42	2.5	35	1.15	530	200	
WEE- 33	33	43	2.5	32	1.2	520	193	
WEE- 39	39	45	2.5	30	1.6	450	183	
WEE- 47	47	46	2.5	26	1.8	420	177	
WEE- 56	56	40	2.5	24	2.2	390	170	
WEE- 68	68	40	2.5	22	2.3	375	165	
WEE- 82	82	42	2.5	14	2.4	360	160	
WEE-100	100	63	.79	12	2.6	345	157	
WEE-120	120	62	.79	11	2.9	330	145	

* INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

DENSITY CHARACTERISTICS

Volume: 0.0087 cubic inches **Weight:** 0.75 grams maximum
Shielding: Less than 3% coupling with two units measured side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.
Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305B.
Marking: Printed with pertinent data.

Note: L & Q are not always tested at the same frequency.

NCG Part No.	L	Q Min.		Min. SRF	Max. DCR	Max. I	Incr.* I	Material
	μH		MHz	MHz	Ω	mA	mA	
WEE- 150	150	63	.79	10	3.3	315	126	FERRITE
WEE- 180	180	60	.79	9.2	3.6	300	110	
WEE- 220	220	57	.79	8.8	4.1	280	105	
WEE- 270	270	52	.79	8.0	4.8	260	91	
WEE- 330	330	50	.79	7.2	5.6	240	87	
WEE- 390	390	43	.79	6.8	6.2	230	72	
WEE- 470	470	66	.79	6.4	10.0	180	67	
WEE- 560	560	64	.79	6.0	11.5	170	65	
WEE- 680	680	71	.79	5.2	12.0	160	60	
WEE- 820	820	67	.79	4.8	13.8	150	55	
WEE- 1000	1000	62	.79	4.5	16.0	140	52	
WEE- 1200	1200	52	.250	1.3	18.2	135	50	
WEE- 1500	1500	51	.250	1.2	23.7	118	48	
WEE- 1800	1800	51	.250	1.1	30.2	105	42	
WEE- 2200	2200	50	.250	1.0	33.7	99	37	
WEE- 2700	2700	51	.250	.94	43.1	87	33	
WEE- 3300	3300	52	.250	.84	48.7	82	30	
WEE- 3900	3900	48	.250	.77	62.7	72	29	
WEE- 4700	4700	48	.250	.67	70.5	68	28	
WEE- 5600	5600	48	.250	.65	104	56	24	
WEE- 6800	6800	45	.250	.59	118	53	20	
WEE- 8200	8200	38	.250	.46	146	47	18	
WEE- 10,000	10,000	36	.079	.38	76.6	66	15	
WEE- 12,000	12,000	36	.079	.30	109	55	14	
WEE- 15,000	15,000	38	.079	.26	119	52	13	
WEE- 18,000	18,000	38	.079	.24	138	49	13	
WEE- 22,000	22,000	32	.079	.23	219	39	12	
WEE- 27,000	27,000	32	.079	.22	259	35	12	
WEE- 33,000	33,000	32	.079	.20	296	33	11	
WEE- 39,000	39,000	30	.079	.17	395	29	10	
WEE- 47,000	47,000	25	.079	.16	452	27	9	
WEE- 56,000	56,000	25	.079	.15	499	26	8	
WEE- 68,000	68,000	20	.079	.12	395	29	1.1	
WEE- 82,000	82,000	20	.079	.10	452	27	1.1	
WEE-100,000	100,000	20	.079	.09	499	26	1.1	
WEE-120,000	120,000	20	.070	.08	540	23	1.1	
WEE-150,000	150,000	20	.060	.07	750	20	1.0	
WEE-180,000	180,000	20	.050	.07	880	18	0.8	

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NYTRONICS INDUCTORS

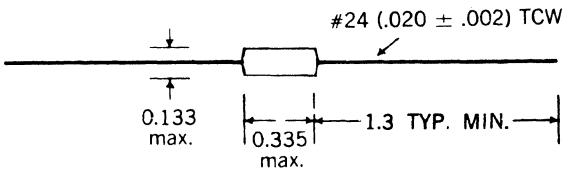
TYPE WWD INDUCTORS

WEE-WEE-DUCTOR SERIES

GRADE 2 CLASS B

The **WEE-WEE-DUCTOR** offers the Design Engineer a subminiature shielded inductor to solve special problems in density circuit application. This shielded inductor has great inductance-to-size ratio.

0.10 to 1,000uH
0.133" diameter x 0.335" length
49 stock values



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% (Q-Meter).

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid-Dip Meter.

Rating: I maximum based on ⅓ watt dissipation.

DENSITY CHARACTERISTICS

Volume: 0.0041 cubic inches.

Weight: 0.50 grams maximum.

Shielding: Less than 3% coupling with two units mounted side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Marking: Color coded per MIL-C-15305 (latest revision).

WEE-WEE-DUCTOR STANDARD VALUES

NCG Part No.	L	Q Min.		Min. SRF	Max. DCR	Max. I	Incr.* I	Material
	μH		MHz	MHz	Ω	mA	mA	
WEE-WEE- 0.10	0.10	42	25	>400	.112	1720	>1720	PHENOLIC
WEE-WEE- 0.12	0.12	42	25	>400	.126	1630	>1630	
WEE-WEE- 0.15	0.15	42	25	>400	.138	1550	>1550	
WEE-WEE- 0.18	0.18	42	25	366	.165	1420	>1420	
WEE-WEE- 0.22	0.22	42	25	331	.198	1330	>1330	
WEE-WEE- 0.27	0.27	42	25	298	.220	1230	>1230	
WEE-WEE- 0.33	0.33	42	25	288	.258	1140	>1140	
WEE-WEE- 0.39	0.39	42	25	271	.292	1060	>1060	
WEE-WEE- 0.47	0.47	41	25	247	.360	960	> 960	
WEE-WEE- 0.56	0.56	39	25	236	.397	915	> 915	
WEE-WEE- 0.68	0.68	36	25	216	.472	840	> 840	
WEE-WEE- 0.82	0.82	35	25	200	.638	720	> 720	
WEE-WEE- 1.0	1.0	42	25	136	.208	1260	>1260	IRON
WEE-WEE- 1.2	1.2	38	7.9	120	.225	1210	>1210	
WEE-WEE- 1.5	1.5	38	7.9	111	.265	1120	>1120	
WEE-WEE- 1.8	1.8	38	7.9	103	.285	1080	>1080	
WEE-WEE- 2.2	2.2	36	7.9	94	.330	1000	>1000	
WEE-WEE- 2.7	2.7	38	7.9	85	.381	935	> 935	
WEE-WEE- 3.3	3.3	38	7.9	78	.432	875	> 875	
WEE-WEE- 3.9	3.9	40	7.9	73	.576	755	> 755	
WEE-WEE- 4.7	4.7	42	7.9	66	.787	650	> 650	
WEE-WEE- 5.6	5.6	42	7.9	62	1.04	565	> 565	
WEE-WEE- 6.8	6.8	45	7.9	54	1.40	485	> 485	
WEE-WEE- 8.2	8.2	47	7.9	50	1.68	440	> 440	
WEE-WEE- 10	10	51	7.9	44	2.58	355	> 355	
WEE-WEE- 12	12	51	2.5	39	3.65	300	> 300	
WEE-WEE- 15	15	45	2.5	44	.862	620	200	FERRITE
WEE-WEE- 18	18	43	2.5	40	1.02	570	175	
WEE-WEE- 22	22	42	2.5	36	1.12	545	160	
WEE-WEE- 27	27	37	2.5	33	1.28	510	155	
WEE-WEE- 33	33	46	2.5	30	1.70	440	150	
WEE-WEE- 39	39	38	2.5	26	1.99	405	145	
WEE-WEE- 47	47	42	2.5	23	2.41	370	140	
WEE-WEE- 56	56	41	2.5	22	2.85	340	130	
WEE-WEE- 68	68	46	2.5	18	3.21	320	120	
WEE-WEE- 82	82	46	2.5	17	3.57	305	115	
WEE-WEE- 100	100	43	2.5	15	4.10	280	100	
WEE-WEE- 120	120	50	0.79	13	5.97	235	80	
WEE-WEE- 150	150	49	0.79	12	7.05	215	68	
WEE-WEE- 180	180	56	0.79	11	8.12	200	64	
WEE-WEE- 220	220	53	0.79	10	14.8	150	60	
WEE-WEE- 270	270	57	0.79	9	16.8	140	58	
WEE-WEE- 330	330	57	0.79	8.5	18.6	130	56	
WEE-WEE- 390	390	57	0.79	8	21.1	120	54	
WEE-WEE- 470	470	50	0.79	7	32.2	100	52	
WEE-WEE- 560	560	50	0.79	6	36.4	95	50	
WEE-WEE- 680	580	56	0.79	5.5	41.1	90	48	
WEE-WEE- 820	820	49	0.79	5	45.0	85	47	
WEE-WEE-1000	1000	49	0.79	4.5	52.0	80	45	

* INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

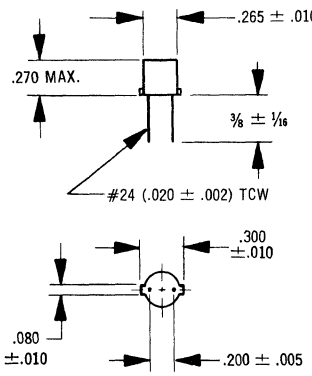
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NYTRONICS INDUCTORS

TYPE PC INDUCTORS

The PEE-CEE is designed to meet MIL-C-15305 (latest revision), Grade 1, Class B. Printed board mounting is facilitated by 0.200 grid spacing and unit has shielded construction to allow maximum density packaging. Standardized in 73 stock values.

Subminiature Shielded **Radial Lead Fixed Inductor**
High Q Values **0.10 to 100,000uH**
Unitized Epoxy-Molded Construction



All dimensions in inches

ELECTRICAL CHARACTERISTICS

Inductance: ±10% over entire range as measured per MIL-C-15305 (latest revision).

Q and SRF Values: Minimum not less than 80% of specified value

Dielectric Strength: 840 Volts R.M.S. at sea level.

Working Voltage: 300 Volts D.C.

Maximum Current: Based on temperature rise not to exceed 35°C at 90°C ambient.

Incremental Current: Defined as the DC current required to cause a five percent reduction in the nominal inductance value.

DENSITY CHARACTERISTICS

Weight: 1.5 grams maximum

Volume: .015 cubic inches

Shielding: 3% coupling maximum when two units are tested side by side.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Moisture, Vibration, and Shock Resistance: Meet requirements of MIL-C-15305 (latest revision). Low frequency 10 to 55 cps @ .06" maximum total excursion at rate of 1 linear sweep per minute for 2 hours repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS (body mounted)

Marking: Manufacturer data printed.

Terminal Pull: Three pounds.

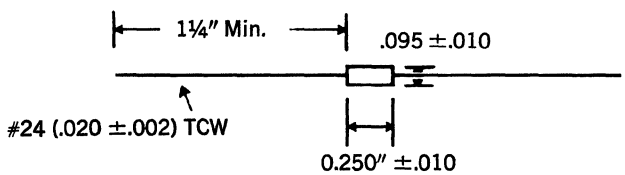
NCG Part No.	L µh	Test Freq. MHz	Q nom.	SRF nom. MHz	D. C. R. Max. ohms	Max. I m.a.	Incr. I m.a.
PC 0.10	.10	25	70	>250	0.030	2500	2500
PC 0.12	.12	25	70	>250	0.030	2500	2500
PC 0.15	.15	25	70	>250	0.030	2500	2500
PC 0.18	.18	25	70	>250	0.035	2400	2400
PC 0.22	.22	25	70	>250	0.038	2300	2300
PC 0.27	.27	25	80	>250	0.040	2200	2200
PC 0.33	.33	25	80	>250	0.040	2200	2200
PC 0.39	.39	25	80	250	0.045	2100	2100
PC 0.47	.47	25	80	230	0.045	2100	2100
PC 0.56	.56	25	80	220	0.050	2000	2000
PC 0.68	.68	25	80	190	0.055	1900	1900
PC 0.82	.82	25	85	180	0.060	1800	1800
PC 1.00	1.00	25	85	160	0.070	1700	1700
PC 1.2	1.2	7.9	90	170	0.085	1670	1670
PC 1.5	1.5	7.9	100	155	0.100	1540	1540
PC 1.8	1.8	7.9	115	135	0.110	1470	1470
PC 2.2	2.2	7.9	110	120	0.120	1410	1410
PC 2.7	2.7	7.9	110	104	0.125	1380	1380
PC 3.3	3.3	7.9	90	93.0	0.165	1200	1200
PC 3.9	3.9	7.9	90	87.0	0.180	1135	1135
PC 4.7	4.7	7.9	95	79.0	0.245	985	985
PC 5.6	5.6	7.9	95	72.0	0.265	950	950
PC 6.8	6.8	7.9	85	63.0	0.330	853	853
PC 8.2	8.2	7.9	95	60.0	0.460	720	720
PC 10	10	7.9	90	54.0	0.640	620	620
PC 12	12	2.5	120	37.0	0.800	545	545
PC 15	15	2.5	120	28.8	0.865	520	520
PC 18	18	2.5	115	23.8	0.940	504	504
PC 22	22	2.5	125	21.3	1.03	460	460
PC 27	27	2.5	115	20.6	1.18	418	418
PC 33	33	2.5	120	18.6	1.30	398	398
PC 39	39	2.5	120	17.7	1.41	385	385
PC 47	47	2.5	110	14.9	1.61	350	350
PC 56	56	2.5	115	13.9	2.08	330	333
PC 68	68	2.5	105	12.9	2.20	320	330
PC 82	82	2.5	105	11.7	2.42	300	320
PC 100	100	2.5	95	10.5	2.15	333	300
PC 120	120	0.790	95	5.60	2.38	316	190
PC 150	150	0.790	90	5.20	2.52	306	175
PC 180	180	0.790	95	4.90	2.88	288	150
PC 220	220	0.790	95	4.60	3.18	273	125
PC 270	270	0.790	100	4.20	3.50	260	120
PC 330	330	0.790	100	3.55	4.80	222	110
PC 390	390	0.790	100	3.45	5.44	209	105
PC 470	470	0.790	100	3.20	5.90	201	100
PC 560	560	0.790	95	2.90	6.30	194	90
PC 680	680	0.790	100	2.70	7.20	181	80
PC 820	820	0.790	90	2.50	8.00	172	70
PC 1,000	1,000	0 790	100	2.35	12.0	141	65
PC 1,200	1,200	0.250	95	2.20	13.5	132	60
PC 1,500	1,500	0.250	90	1.90	16.5	119	55
PC 1,800	1,800	0.250	100	1.80	18.0	114	47
PC 2,200	2,200	0.250	100	1.70	20.5	107	43
PC 2,700	2,700	0.250	95	1.50	22.5	102	39
PC 3,300	3,300	0.250	90	1.40	42.0	76	36
PC 3,900	3,900	0.250	85	1.27	47.5	71	35
PC 4,700	4,700	0.250	85	1.24	53.0	67	34
PC 5,600	5,600	0.250	85	0.93	62.5	65	31
PC 6,800	6,800	0.250	75	0.79	69.5	58	27
PC 8,200	8,200	0.250	80	0.75	75.0	56	26
PC 10,000	10,000	0.250	70	0.70	100.0	49	24
PC 12,000	12,000	0.079	70	.50	64	60	40
PC 15,000	15,000	0.079	70	.38	84	52	34
PC 18,000	18,000	0.079	70	.36	93	50	30
PC 22,000	22,000	0.079	70	.32	104	45	28
PC 27,000	27,000	0.079	70	.30	173	35	26
PC 33,000	33,000	0.079	70	.27	187	32	24
PC 39,000	39,000	0.079	70	.26	220	30	22
PC 47,000	47,000	0.079	70	.25	253	28	20
PC 56,000	56,000	0.079	70	.24	285	26	19
PC 68,000	68,000	0.079	60	.20	311	24	18
PC 82,000	82,000	0.079	60	.19	385	22	16
PC 100,000	100,000	0.079	60	.17	420	20	15

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NYTRONICS INDUCTORS

TYPE SDD INDUCTORS

SDD
MOLDED SHIELDED INDUCTOR
GRADE 1 CLASS A



ALL DIMENSIONS IN INCHES

The **SDD INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The SDD INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.

Dielectric Strength: 300 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).

Q: Measured on a Q-Meter.

Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets three pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements or MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 15 G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 50G, 11 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches **Weight:** 0.35 grams

NCG Part. No.	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ohms	Max I. mA	Incr. † I mA
SDD- 0.10	0.10	40	25	400	.10	1500	*
SDD- 0.12	0.12	40	25	384	.11	1400	*
SDD- 0.15	0.15	40	25	360	.12	1300	*
SDD- 0.18	0.18	40	25	344	.13	1200	*
SDD- 0.22	0.22	40	25	312	.15	1100	*
SDD- 0.27	0.27	40	25	272	.16	1000	*
SDD- 0.33	0.33	40	25	248	.18	950	*
SDD- 0.39	0.39	40	25	224	.19	900	*
SDD- 0.47	0.47	40	25	200	.21	800	*
SDD- 0.56	0.56	40	25	176	.25	750	*
SDD- 0.68	0.68	35	25	160	.27	700	*
SDD- 0.82	0.82	35	25	144	.36	600	*
SDD- 1.00	1.00	35	25	132	.40	525	*
SDD- 1.20	1.20	35	7.9	120	.73	425	*
SDD- 1.50	1.50	35	7.9	104	.86	400	*
SDD- 1.80	1.80	35	7.9	96	.95	350	*
SDD- 2.20	2.20	35	7.9	88	1.30	320	*
SDD- 2.70	2.70	35	7.9	80	1.80	275	*
SDD- 3.30	3.30	35	7.9	56	1.70	290	*
SDD- 3.90	3.90	35	7.9	52	1.80	275	*
SDD- 4.70	4.70	35	7.9	46	2.60	225	*
SDD- 5.60	5.60	35	7.9	43	2.90	210	*
SDD- 6.80	6.80	35	7.9	40	3.30	200	*
SDD- 8.20	8.20	35	7.9	38	4.50	170	*
SDD- 10.0	10.0	35	7.9	36	4.80	165	*
SDD- 12.0	12.0	45	2.5	40	2.0	250	230
SDD- 15.0	15.0	45	2.5	36	2.5	230	180
SDD- 18.0	18.0	45	2.5	31	3.5	195	150
SDD- 22.0	22.0	46	2.5	28	4.5	170	135
SDD- 27.0	27.0	48	2.5	25	5.0	160	115
SDD- 33.0	33.0	48	2.5	23	5.5	150	105
SDD- 39.0	39.0	48	2.5	22	7.0	140	100
SDD- 47.0	47.0	50	2.5	21	7.5	135	95
SDD- 56.0	56.0	52	2.5	19	8.0	130	90
SDD- 68.0	68.0	55	2.5	18	9.0	120	83
SDD- 82.0	82.0	55	2.5	16	14	95	65
SDD- 100	100	55	2.5	14	16	90	70
SDD- 120	120	34	.79	9.5	10	115	40
SDD- 150	150	34	.79	8.8	12	105	35
SDD- 180	180	34	.79	8.1	15	90	32
SDD- 220	220	36	.79	7.8	20	80	30
SDD- 270	270	36	.79	7.3	23	75	27
SDD- 330	330	36	.79	6.8	26	70	25
SDD- 390	390	36	.79	6.0	35	65	23
SDD- 470	470	38	.79	5.6	37	60	21
SDD- 560	560	40	.79	5.0	40	58	20
SDD- 680	680	40	.79	4.3	48	54	18
SDD- 820	820	40	.79	3.8	54	47	17
SDD-1000	1000	40	.79	3.5	65	43	15

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* GREATER THAN MAX. CURRENT.

† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.

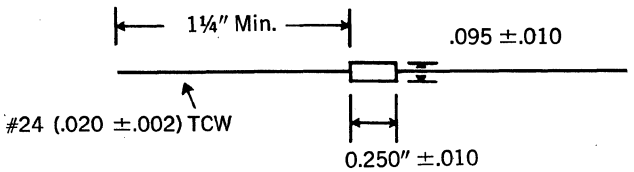
NYTRONICS INDUCTORS

TYPE DD INDUCTORS

DECI-DUCTOR

New Subminiature Inductor 0.10uH to 1000uH Range
0.100" diameter by 0.250" length 49 STANDARD VALUES

The **DECI-DUCTOR** offers the design engineer epoxy-molded reliability and uniformity in a subminiature R.F. Inductor. This Nytronics R.F. Inductor line is designed to meet all the environmental specifications of MIL-C-15305 (latest revision).



GRADE 1 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum Current based on 35°C rise in 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches **Weight:** 0.35 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C

Terminal Strength: Meets three pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 15 G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 50G, 11 MS.

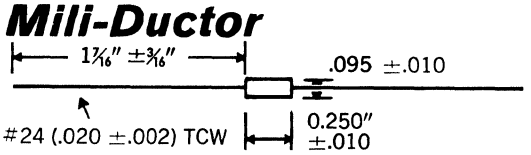
Marking: Color coded per MIL-C-15305 (latest revision).

	NCG Part. No.	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ohms	Max I. mA
PHENOLIC	DD-0.10	0.10	40	25	680	0.07	2000
	DD-0.12	0.12	40	25	640	0.08	1900
	DD-0.15	0.15	38	25	600	0.09	1750
	DD-0.18	0.18	38	25	550	0.10	1600
	DD-0.22	0.22	35	25	520	0.11	1550
	DD-0.27	0.27	35	25	430	0.15	1350
	DD-0.33	0.33	32	25	410	0.21	1150
	DD-0.39	0.39	32	25	365	0.29	970
	DD-0.47	0.47	32	25	330	0.35	820
	DD-0.56	0.56	32	25	300	0.48	700
	DD-0.68	0.68	33	25	275	0.65	600
	DD-0.82	0.82	30	25	250	0.82	500
	DD-1.00	1.00	30	25	230	1.10	475
IRON	DD-1.20	1.20	30	7.9	150	0.16	1200
	DD-1.50	1.50	32	7.9	140	0.20	1100
	DD-1.80	1.80	35	7.9	125	0.32	900
	DD-2.20	2.20	35	7.9	115	0.37	760
	DD-2.70	2.70	37	7.9	100	0.49	700
	DD-3.30	3.30	45	7.9	90	0.67	575
	DD-3.90	3.90	45	7.9	80	0.95	500
	DD-4.70	4.70	45	7.9	75	1.10	475
	DD-5.60	5.60	52	7.9	65	1.60	380
	DD-6.80	6.80	52	7.9	60	1.80	350
	DD-8.20	8.20	60	7.9	55	2.40	300
	DD-10.0	10.0	60	7.9	50	3.40	265
	DD-12.0	12.0	45	2.5	40	2.40	300
	DD-15.0	15.0	47	2.5	35	2.70	275
	DD-18.0	18.0	50	2.5	30	3.00	260
	DD-22.0	22.0	50	2.5	25	3.30	250
	DD-27.0	27.0	50	2.5	20	3.80	240
FERRITE	DD-33.0	33.0	50	2.5	24	3.80	260
	DD-39.0	39.0	50	2.5	22	4.10	240
	DD-47.0	47.0	50	2.5	20	4.40	210
	DD-56.0	56.0	50	2.5	18	5.70	205
	DD-68.0	68.0	52	2.5	15	6.50	180
	DD-82.0	82.0	52	2.5	14	7.30	175
	DD-100	100	50	2.5	13	8.20	165
	DD-120	120	28	0.79	12	14	110
	DD-150	150	28	0.79	11	16	105
	DD-180	180	28	0.79	10	18	100
	DD-220	220	26	0.79	9	25	90
	DD-270	270	26	0.79	8	33	75
	DD-330	330	26	0.79	7	37	70
	DD-390	390	25	0.79	6.5	51	60
	DD-470	470	27	0.79	6	56	58
	DD-560	560	27	0.79	5	61	55
	DD-680	680	28	0.79	4	70	50
	DD-820	820	28	0.79	3.8	91	45
	DD-1000	1000	28	0.79	3.4	102	40

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NYTRONICS INDUCTORS

TYPE MD INDUCTORS



—MS INDUCTOR SERIES 75083, 75084, 75085 MOLDED INDUCTOR/0.100 uH to 1000 uH

Markings: Color coded per MIL-C-15305 (Latest Rev.)

The MS Inductor Series are RF Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). This MS Series is Epoxy Molded enveloped features reliability and uniformity in a Subminiature Inductor.

ELECTRICAL CHARACTERISTICS
Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 1000 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum current based on; 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron and ferrite core inductors.

DENSITY CHARACTERISTICS
Volume: 0.002 cubic inches; **Weight:** 0.30 grams.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS
Operating Temperature: —55°C to +125°C phenolic core, —55°C to +105°C iron and ferrite core.
Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

MS No.	NCG Part No.	Inductance uh	Q Min.	Test Frequency (L & Q) MHz	Self-resonant Frequency, Min. MHz	DC Resistance Max. Ohms	Rated DC Current MA	Material
MS75083-1	MD	.10	40	25.0	680	.08	1350	PHENOLIC
MS75083-2	MD	.12	40	25.0	640	.09	1270	
MS75083-3	MD	.15	38	25.0	600	.10	1200	
MS75083-4	MD	.18	35	25.0	550	.12	1105	
MS75083-5	MD	.22	33	25.0	510	.14	1025	
MS75083-6	MD	.27	33	25.0	430	.16	960	
MS75083-7	MD	.33	30	25.0	410	.22	815	
MS75083-8	MD	.39	30	25.0	365	.30	700	
MS75083-9	MD	.47	30	25.0	330	.35	650	
MS75083-10	MD	.56	30	25.0	300	.50	545	
MS75083-11	MD	.68	28	25.0	275	.60	495	
MS75083-12	MD	.82	28	25.0	250	.85	415	
MS75083-13	MD	1.00	25	25.0	230	1.00	385	
MS75084-1	MD	1.2	25	7.9	150	.18	590	IRON
MS75084-2	MD	1.5	28	7.9	140	.22	535	
MS75084-3	MD	1.8	30	7.9	125	.30	455	
MS75084-4	MD	2.2	30	7.9	115	.40	395	
MS75084-5	MD	2.7	37	7.9	100	.55	355	
MS75084-6	MD	3.3	45	7.9	90	.85	270	
MS75084-7	MD	3.9	45	7.9	80	1.00	250	
MS75084-8	MD	4.7	45	7.9	75	1.20	230	
MS75084-9	MD	5.6	50	7.9	65	1.80	185	
MS75084-10	MD	6.8	50	7.9	60	2.00	175	
MS75084-11	MD	8.2	55	7.9	55	2.70	155	
MS75084-12	MD	10	55	7.9	50	3.70	130	
MS75084-13	MD	12	45	2.5	40	2.70	155	
MS75084-14	MD	15	40	2.5	35	2.80	150	
MS75084-15	MD	18	50	2.5	30	3.10	145	
MS75084-16	MD	22	50	2.5	25	3.30	140	
MS75084-17	MD	27	50	2.5	20	3.50	135	
MS75085-1	MD	33	45	2.5	24	3.4	130	FERRITE
MS75085-2	MD	39	45	2.5	22	3.6	125	
MS75085-3	MD	47	45	2.5	20	4.5	110	
MS75085-4	MD	56	45	2.5	18	5.7	100	
MS75085-5	MD	68	50	2.5	15	6.7	92	
MS75085-6	MD	82	50	2.5	14	7.3	88	
MS75085-7	MD	100	50	2.5	13	8	84	
MS75085-8	MD	120	30	.79	12	13	66	
MS75085-9	MD	150	30	.79	11	15	61	
MS75085-10	MD	180	30	.79	10	17	57	
MS75085-11	MD	220	30	.79	9	21	52	
MS75085-12	MD	270	30	.79	8	25	47	
MS75085-13	MD	330	30	.79	7	28	45	
MS75085-14	MD	390	30	.79	6.5	35	40	
MS75085-15	MD	470	30	.79	6	42	36	
MS75085-16	MD	560	30	.79	5	46	35	
MS75085-17	MD	680	30	.79	4	60	30	
MS75085-18	MD	820	30	.79	3.8	65	29	
MS75085-19	MD	1000	30	.79	3.4	72	28	

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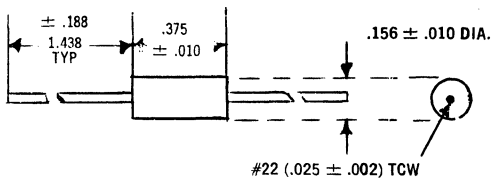
NYTRONICS INDUCTORS

TYPE RFC-SS MS18130, 14046 & 90538 INDUCTORS

RFC-SS SERIES

Molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance from 0.15 to 240uH.

GRADE 1 CLASS B (0.15-4.7)
CLASS A (5.6-240)



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 33 uH ±10%
36 to 240 uH ±5%
Measured on Q meter per MIL-C-15305 (latest revision).

Dielectric Strength: MS18130 & MS14046 = 1000
MS90538 = 700

Rated Current: Based on max. temp. rise of
35°C (ambient 90°C) for
RFC-SS-0.15 to -4.7
15°C (ambient 90°C) for
RFC-SS-5.6 to -240

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: Max. 125°C for
RFC-SS-0.15 to -4.7
Max. 105°C for
RFC-SS-5.6 to -240

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), high frequency 10 cps

Marking: Color banded.

MS NO.	NCG* PART NO.	L uH	Q Min.	@ MHz	Min. SRF MHz	Max. DCR Ω	Rated DC Cur. mA	Material
MS18130-1	RFC-SS- .15	0.15	50	25	525	0.03	2450	PHENOLIC
MS18130-2	RFC-SS- .22	0.22	50	25	450	0.05	1900	
MS18130-3	RFC-SS- .33	0.33	45	25	360	0.09	1400	
MS18130-4	RFC-SS- .47	0.47	45	25	310	0.12	1225	
MS18130-5	RFC-SS- .56	0.56	50	25	280	0.13	1220	
MS18130-6	RFC-SS- .68	0.68	50	25	250	0.15	1100	
MS18130-7	RFC-SS- .82	0.82	50	25	220	0.22	900	
MS18130-8	RFC-SS- 1.00	1.00	50	25	200	0.29	830	
MS18130-9	RFC-SS- 1.20	1.20	33	7.9	180	0.42	650	
MS18130-10	RFC-SS- 1.50	1.5	33	7.9	160	0.50	600	
MS18130-11	RFC-SS- 1.80	1.8	33	7.9	150	0.65	525	
MS18130-12	RFC-SS- 2.2	2.2	33	7.9	135	0.95	435	
MS18130-13	RFC-SS- 2.7	2.7	33	7.9	120	1.20	385	
MS18130-14	RFC-SS- 3.3	3.3	33	7.9	110	2.00	300	
MS18130-15	RFC-SS- 3.9	3.9	33	7.9	100	2.30	280	
MS18130-16	RFC-SS- 4.7	4.7	33	7.9	90	2.60	260	
MS14046-1	RFC-SS- 5.6	5.6	45	7.9	60	0.32	750	IRON
MS14046-2	RFC-SS- 6.8	6.8	50	7.9	55	0.50	600	
MS14046-3	RFC-SS- 8.2	8.2	50	7.9	50	0.60	545	
MS14046-4	RFC-SS- 10	10.0	55	7.9	45	0.90	445	
MS14046-5	RFC-SS- 12	12	65	2.5	42	1.10	404	
MS14046-6	RFC-SS- 15	15	65	2.5	40	1.40	370	
MS14046-7	RFC-SS- 18	18	75	2.5	34	2.25	280	
MS14046-8	RFC-SS- 22	22	75	2.5	30	2.50	265	
MS14046-9	RFC-SS- 27	27	60	2.5	25	2.60	260	
MS14046-10	RFC-SS- 33	33	65	2.5	19	3.00	250	
MS90538-1	RFC-SS- 36	36	60	2.5	15.5	2.50	180	
MS90538-2	RFC-SS- 39	39	60	2.5	14.5	2.60	176	
MS90538-3	RFC-SS- 43	43	60	2.5	13.7	2.70	172	
MS90538-4	RFC-SS- 47	47	55	2.5	13.0	2.75	170	
MS90538-5	RFC-SS- 51	51	55	2.5	12.7	2.85	167	
MS90538-6	RFC-SS- 56	56	55	2.5	12.0	3.00	164	
MS90538-7	RFC-SS- 62	62	55	2.5	11.5	3.15	160	
MS90538-8	RFC-SS- 68	68	55	2.5	11.0	3.30	156	
MS90538-9	RFC-SS- 75	75	55	2.5	10.5	3.70	147	
MS90538-10	RFC-SS- 82	82	50	2.5	10.3	3.9	143	
MS90538-11	RFC-SS- 91	91	50	2.5	10.0	4.3	136	
MS90538-12	RFC-SS-100	100	50	2.5	9.5	4.5	133	
MS90538-13	RFC-SS-110	110	60	0.79	8.9	4.9	128	
MS90538-14	RFC-SS-120	120	65	0.79	8.7	5.2	124	
MS90538-15	RFC-SS-130	130	65	0.79	8.5	5.45	121	
MS90538-16	RFC-SS-150	150	65	0.79	8.0	6.05	114	
MS90538-17	RFS-SS-160	160	65	0.79	7.5	6.40	111	
MS90538-18	RFC-SS-180	180	65	0.79	7.0	6.75	108	
MS90538-19	RFC-SS-200	200	65	0.79	6.5	7.10	106	
MS90538-20	RFC-SS-220	220	65	0.79	6.2	7.45	103	
MS90538-21	RFC-SS-240	240	65	0.79	5.9	7.8	101	

* NCG Part No. electricals and tolerances as shown,
MS No. electricals and tolerances per actual MS sheet.

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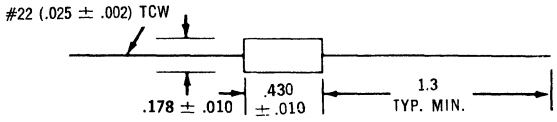
NYTRONICS INDUCTORS

TYPE RFC-S
MS21389 & 21390
INDUCTORS

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 0.1 to 1000uH.

GRADE 1 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.1 uH to 22uH ±10% on Q-Meter
27uH to 100uH ±5%
1,000 cps bridge
120uH to 1000uH ±5% on Q-Meter
Note: L & Q are not always tested at the same frequency. Inductance values that are tested on Q-Meter, are tested at standard test frequencies.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid-Dip Meter.

Q: Measured on Q-Meter.

Rating: ⅓ watt dissipation for series S

DENSITY CHARACTERISTICS

Volume: 0.012 cu. in.

Weight: 0.90 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 Grade 1, Class B. High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

RFC-S SERIES

MS NO.	NCG PART NO.*	L	Q min		min. SRF	Max. DCR	max. I	MATERIAL
		uH		MHz	MHz	Ω	mA	
MS21389-1	RFC-S- 0.10	0.10	75	50	400	.02	4000	PHENOLIC
MS21389-2	RFC-S- 0.12	0.12	75	50	400	.025	3500	
MS21389-3	RFC-S- 0.15	0.15	75	50	400	.03	3000	
MS21389-4	RFC-S- 0.18	0.18	75	50	400	.03	3000	
MS21389-5	RFC-S- 0.22	0.22	75	50	400	.03	3000	
MS21389-6	RFC-S- 0.27	0.27	70	45	376	.04	2700	
MS21389-7	RFC-S- 0.33	0.33	70	40	352	.05	2500	
MS21389-8	RFC-S- 0.39	0.39	65	40	320	.08	2000	
MS21389-9	RFC-S- 0.47	0.47	60	25	288	.08	2000	
MS21389-10	RFC-S- 0.56	0.56	55	25	264	.10	1700	
MS21389-11	RFC-S- 0.68	0.68	55	25	240	.12	1500	
MS21389-12	RFC-S- 0.82	0.82	50	25	220	.18	1300	
MS21389-13	RFC-S- 1.0	1.0	50	20	200	.24	1100	
MS21389-14	RFC-S- 1.2	1.2	45	20	176	.35	1000	
MS21389-15	RFC-S- 1.5	1.5	45	15	160	.43	850	
MS21389-16	RFC-S- 1.8	1.8	45	15	144	.65	720	
MS21389-17	RFC-S- 2.2	2.2	45	15	132	.80	610	
MS21390-1	RFC-S- 2.7	2.7	55	10	88	.12	1600	IRON
MS21390-2	RFC-S- 3.3	3.3	55	10	80	.15	1400	
MS21390-3	RFC-S- 3.9	3.9	60	10	76	.23	1200	
MS21390-4	RFC-S- 4.7	4.7	70	7.9	72	.30	1000	
MS21390-5	RFC-S- 5.6	5.6	65	7.9	64	.45	900	
MS21390-6	RFC-S- 6.8	6.8	65	7.9	56	.55	800	
MS21390-7	RFC-S- 8.2	8.2	60	7.9	52	.65	720	
MS21390-8	RFC-S- 10	10	60	5	48	.73	650	
MS21390-9	RFC-S- 12	12	65	5	42	1.1	590	
MS21390-10	RFC-S- 15	15	80	2.5	38	1.4	500	
MS21390-11	RFC-S- 18	18	75	2.5	34	1.6	460	
MS21390-12	RFC-S- 22	22	75	2.5	32	1.8	430	
MS21390-13	RFC-S- 27	27	75	2.5	29	2.7	360	
MS21390-14	RFC-S- 33	33	85	2.5	26	3.5	300	
MS21390-15	RFC-S- 39	39	80	2.5	21	3.8	290	
MS21390-16	RFC-S- 47	47	80	2.5	18	4.0	275	
MS21390-17	RFC-S- 56	56	75	2.5	15	4.4	265	
MS21390-18	RFC-S- 68	68	75	2.5	13	4.7	250	
MS21390-19	RFC-S- 82	82	75	2.5	10	5.3	235	
MS21390-20	RFC-S- 100	100	75	1.5	8	6.0	220	
MS21390-21	RFC-S- 120	120	65	0.79	5.7	5.0	170	
MS21390-22	RFC-S- 150	150	65	0.79	5.4	5.8	164	
MS21390-23	RFC-S- 180	180	65	0.79	5.0	6.6	158	
MS21390-24	RFC-S- 220	220	65	0.79	4.7	7.4	155	
MS21390-25	RFC-S- 270	270	65	0.79	4.5	8.0	150	
MS21390-26	RFC-S- 300	300	65	0.79	4.2	8.6	145	
MS21390-27	RFC-S- 330	330	65	0.79	4.0	8.9	142	
MS21390-28	RFC-S- 360	360	65	0.79	3.8	9.6	137	
MS21390-29	RFC-S- 390	390	65	0.79	3.6	9.9	135	
MS21390-30	RFC-S- 430	430	65	0.79	3.4	10.4	131	
MS21390-31	RFC-S- 470	470	65	0.79	3.2	10.9	128	
MS21390-32	RFC-S- 510	510	65	0.79	3.0	11.6	124	
MS21390-33	RFC-S- 560	560	65	0.79	2.9	11.8	123	
MS21390-34	RFC-S- 620	620	60	0.79	2.8	12.5	120	
MS21390-35	RFC-S- 680	680	60	0.79	2.7	13.5	115	
MS21390-36	RFC-S- 750	750	60	0.79	2.6	14.0	113	
MS21390-37	RFC-S- 820	820	60	0.79	2.5	15.0	110	
MS21390-38	RFC-S- 910	910	60	0.79	2.4	15.5	107	
MS21390-39	RFC-S-1000	1000	60	0.79	2.2	16.5	104	

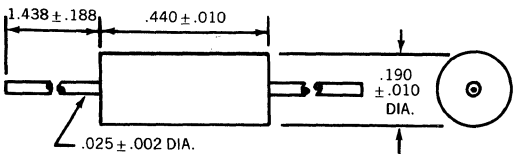
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NYTRONICS INDUCTORS

TYPE RFC-S
MS75008, 75101 & 90539
INDUCTORS

MS-INDUCTOR SERIES
75008-75101-90539
MOLDED INDUCTOR



ALL DIMENSIONS IN INCHES

Proven reliability molded inductors designed to meet MIL-C-15305 (latest revision).
Inductance 0.15 to 1000 uH.

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 0.47 uH ±20%; 0.56-27 uH ±10%; 270-1000 uH ±5%.
Dielectric Strength: MS90539 = 700 Volts
Max. Temp. Rise: 35°C (Class B devices)
15°C (Class A devices)

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C. (.15 thru 2.7 μH) −55°C to +105°C (3.3 μH thru 1000 μH).
Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.
Volume: S Type — 0.012 cu. in.
Weight: S Type — 0.95 grams
Marking: Color banded per MIL-C-15305 (latest revision).

	MS No.	NCG Part No.*	Inductance uH	Q Min.	Test Frequency MHz	Self-Resonant Frequency, Min. MHz	DC Resistance Maximum Ohms	Rated DC Current mA	Material
GRADE 1, CLASS B	MS75008-21	RFC-S	0.15 ±20%	55	25.0	510	0.030	3,000	PHENOLIC
	MS75008-22	RFC-S	0.22 ±20%	50	25.0	415	0.035	2,800	
	MS75008-23	RFC-S	0.33 ±20%	50	25.0	350	0.065	2,000	
	MS75008-24	RFC-S	0.47 ±20%	50	25.0	300	0.085	1,700	
	MS75008-25	RFC-S	0.56 ±10%	50	25.0	270	0.125	1,450	
	MS75008-26	RFC-S	0.68 ±10%	45	25.0	250	0.150	1,300	
	MS75008-27	RFC-S	0.82 ±10%	40	25.0	210	0.205	1,100	
	MS75008-28	RFC-S	1.00 ±10%	40	25.0	200	0.290	930	
	MS75008-29	RFC-S	1.20 ±10%	30	7.9	180	0.400	785	
	MS75008-30	RFC-S	1.50 ±10%	30	7.9	170	0.485	700	
	MS75008-31	RFC-S	1.80 ±10%	30	7.9	150	0.740	580	
	MS75008-32	RFC-S	2.20 ±10%	30	7.9	140	0.970	505	
	MS75008-33	RFC-S	2.70 ±10%	30	7.9	120	1.20	460	
GRADE 1, CLASS A	MS75101-1	RFC-S	3.30 ±10%	30	7.9	70	0.140	1,350	IRON
	MS75101-2	RFC-S	3.90 ±10%	30	7.9	65	0.155	1,250	
	MS75101-3	RFC-S	4.70 ±10%	30	7.9	60	0.210	1,100	
	MS75101-4	RFC-S	5.60 ±10%	30	7.9	50	0.280	935	
	MS75101-5	RFC-S	6.80 ±10%	30	7.9	50	0.375	810	
	MS75101-6	RFC-S	8.20 ±10%	30	7.9	48	0.440	750	
	MS75101-7	RFC-S	10.00 ±10%	30	7.9	42	0.605	640	
	MS75101-8	RFC-S	12.00 ±10%	50	2.5	36	1.05	490	
	MS75101-9	RFC-S	15.00 ±10%	55	2.5	30	1.20	460	
	MS75101-10	RFC-S	18.00 ±10%	60	2.5	30	1.95	360	
	MS75101-11	RFC-S	22.00 ±10%	60	2.5	24	2.20	335	
	MS75101-12	RFC-S	27.00 ±10%	65	2.5	22	2.75	300	
	MS90539-01	RFC-S	270 ±5%	65	.79	5.6	8.2	110	IRON
	MS90539-02	RFC-S	300 ±5%	65	.79	5.3	8.7	107	
	MS90539-03	RFC-S	330 ±5%	65	.79	5.0	9.1	105	
	MS90539-04	RFC-S	360 ±5%	65	.79	4.7	9.6	102	
	MS90539-05	RFC-S	390 ±5%	65	.79	4.5	10.0	100	
	MS90539-06	RFC-S	430 ±5%	65	.79	4.3	10.6	97	
	MS90539-07	RFC-S	470 ±5%	65	.79	4.0	11.1	95	
	MS90539-08	RFC-S	510 ±5%	65	.79	3.8	11.6	93	
	MS90539-09	RFC-S	560 ±5%	65	.79	3.6	12.3	91	
	MS90539-10	RFC-S	620 ±5%	60	.79	3.5	13.0	88	
	MS90539-11	RFC-S	680 ±5%	60	.79	3.4	13.7	85	
	MS90539-12	RFC-S	750 ±5%	60	.79	3.3	14.4	83	
	MS90539-13	RFC-S	820 ±5%	60	.79	3.1	15.1	81	
	MS90539-14	RFC-S	910 ±5%	60	.79	2.9	15.8	79	
	MS90539-15	RFC-S	1000 ±5%	60	.79	2.24	16.5	78	

MS No. electricals as shown.
NCG Part No. is reference only, see page 19 for RFC-S electricals.

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NYTRONICS INDUCTORS

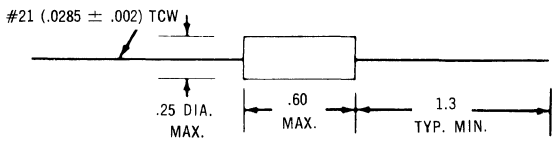
TYPE RFC-M
MS21388
INDUCTORS

RFC-M SERIES

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 1.0 to 2200uH.

GRADE 1 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 1.0 to 22uH ± 10% on Q-Meter
27uH to 2200 ± 5%
1,000 cps bridge
Note: L & Q are not always tested at the same frequency. Inductance Values tested on Q-Meter, are tested at standard test frequencies.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid-Dip Meter.

Q: Measured on Q-Meter.

Rating: ⅓ watt dissipation for series M

DENSITY CHARACTERISTICS

Volume: 0.029 cu. in.

Weight: 2.00 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test per MIL-C-15305.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

MS NO.	NCG PART NO.*	L	Q Min.		Min. SRF	Max. DCR	Max. I	MATERIAL
		uH		MHz	MHz	Ω	mA	
MS21388-1	RFC-M- 1.0	1.0	100	15	136	.04	2700	IRON
MS21388-2	RFC-M- 1.2	1.2	100	15	124	.04	2700	
MS21388-3	RFC-M- 1.5	1.5	100	10	112	.04	2700	
MS21388-4	RFC-M- 1.8	1.8	95	10	100	.05	2500	
MS21388-5	RFC-M- 2.2	2.2	95	10	88	.05	2500	
MS21388-6	RFC-M- 2.7	2.7	68	7.9	76	.05	2500	
MS21388-7	RFC-M- 3.3	3.3	60	7.9	72	.05	2500	
MS21388-8	RFC-M- 3.9	3.9	60	7.9	70	.07	2100	
MS21388-9	RFC-M- 4.7	4.7	60	7.9	60	.09	1800	
MS21388-10	RFC-M- 5.6	5.6	65	7.9	56	.14	1550	
MS21388-11	RFC-M- 6.8	6.8	70	7.9	52	.17	1300	
MS21388-12	RFC-M- 8.2	8.2	65	7.9	46	.25	1150	
MS21388-13	RFC-M- 10	10	65	5	40	.32	1000	
MS21388-14	RFC-M- 12	12	65	5	36	.47	870	
MS21388-15	RFC-M- 15	15	75	4	32	.62	730	
MS21388-16	RFC-M- 18	18	65	4	30	.72	660	
MS21388-17	RFC-M- 22	22	65	2.5	28	.8	600	
MS21388-18	RFC-M- 27	27	65	2.5	25	1.2	520	
MS21388-19	RFC-M- 33	33	80	2.5	22	1.5	450	
MS21388-20	RFC-M- 39	39	80	2.5	20	2.3	380	
MS21388-21	RFC-M- 47	47	100	2.5	19	3.0	300	
MS21388-22	RFC-M- 56	56	100	2.5	18	4.2	270	
MS21388-23	RFC-M- 68	68	100	2.5	16	5.2	250	
MS21388-24	RFC-M- 82	82	100	2.5	14	6.2	220	
MS21388-25	RFC-M- 100	100	100	1.5	13	7	200	
MS21388-26	RFC-M- 120	120	95	1.5	11	7.5	200	
MS21388-27	RFC-M- 150	150	90	1.0	9	8	190	
MS21388-28	RFC-M- 180	180	85	1.0	7	9	185	
MS21388-29	RFC-M- 220	220	85	1.0	5.5	10	180	
MS21388-30	RFC-M- 270	270	80	1.0	4.5	11	172	
MS21388-31	RFC-M- 330	330	80	.8	3.5	12	165	
MS21388-32	RFC-M- 390	390	75	.8	3.0	13	157	
MS21388-33	RFC-M- 470	470	75	.8	2.8	14	150	
MS21388-34	RFC-M- 560	560	65	.8	2.5	16	145	
MS21388-35	RFC-M- 680	680	65	.8	2.2	17	140	
MS21388-36	RFC-M- 820	820	65	.8	2.0	19	132	
MS21388-37	RFC-M-1000	1000	70	.5	1.8	21	125	
MS21388-38	RFC-M-1200	1200	60	.25	2.2	22	120	
MS21388-39	RFC-M-2200	2200	70	.25	1.6	30	100	

*.NCG Part No. electricals and tolerances as shown.
MS No. electricals and tolerances per actual MS sheet.

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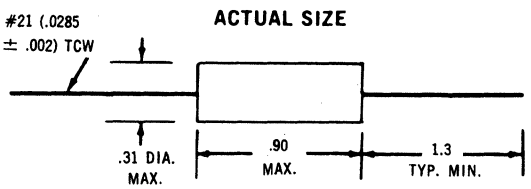
NYTRONICS INDUCTORS

TYPE RFC-L MS21380 INDUCTORS

RFC-L SERIES

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 1.0 to 10,000uH.

GRADE 1 CLASS B



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 1.0uH to 22uH ±10% on Q-Meter
27uH to 10,000uH ±5%
1,000 cps bridge
Note: L & Q are not always tested at the same frequency. Inductance Values tested on Q-Meter are tested at standard test frequencies.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF measured with full length leads on Grid-Dip Meter.

Q: Measured on Q-Meter.

Rating: ½ watt dissipation for L series.

DENSITY CHARACTERISTICS

Volume: 0.068 cu. in.

Weight: 4.10 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

MS NO.	NCG PART NO.*	L	Q min		Min. SRF	Max. DCR	max. I	MAT.
		µH		MHz	MHz	Ω	mA	
MS21380-1	RFC-L- 1.0	1.0	130	15	136	.03	4000	IRON
MS21380-2	RFC-L- 1.2	1.2	130	15	124	.03	4000	
MS21380-3	RFC-L- 1.5	1.5	130	10	112	.03	4000	
MS21380-4	RFC-L- 1.8	1.8	130	10	100	.03	4000	
MS21380-5	RFC-L- 2.2	2.2	130	10	92	.04	3500	
MS21380-6	RFC-L- 2.7	2.7	100	10	82	.04	3500	
MS21380-7	RFC-L- 3.3	3.3	100	7.9	72	.04	3500	
MS21380-8	RFC-L- 3.9	3.9	80	7.9	68	.05	3100	
MS21380-9	RFC-L- 4.7	4.7	75	7.9	64	.05	3100	
MS21380-10	RFC-L- 5.6	5.6	65	7.9	58	.06	3000	
MS21380-11	RFC-L- 6.8	6.8	65	7.9	52	.06	3000	
MS21380-12	RFC-L- 8.2	8.2	65	7.9	46	.11	2400	
MS21380-13	RFC-L- 10	10	75	5	40	.15	1800	
MS21380-14	RFC-L- 12	12	75	5	36	.23	1600	
MS21380-15	RFC-L- 15	15	75	5	32	.3	1300	
MS21380-16	RFC-L- 18	18	75	5	29	.4	1150	
MS21380-17	RFC-L- 22	22	75	2.5	26	.5	1000	
MS21380-18	RFC-L- 27	27	70	2.5	24	.6	900	
MS21380-19	RFC-L- 33	33	70	2.5	22	.7	850	
MS21380-20	RFC-L- 39	39	70	2.5	21	1.1	720	
MS21380-21	RFC-L- 47	47	75	2.5	20	1.3	620	
MS21380-22	RFC-L- 56	56	80	2.5	18	1.8	540	
MS21380-23	RFC-L- 68	68	100	2.5	16	2.4	450	
MS21380-24	RFC-L- 82	82	100	2.5	14	2.8	425	
MS21380-25	RFC-L- 100	100	100	1.5	13	3.2	400	
MS21380-26	RFC-L- 120	120	100	1.5	12	4.8	360	
MS21380-27	RFC-L- 150	150	100	1.0	11	6.4	280	
MS21380-28	RFC-L- 180	180	95	1.0	10	9.5	240	
MS21380-29	RFC-L- 220	220	95	1.0	9	12	200	
MS21380-30	RFC-L- 270	270	70	1.0	7	13	195	
MS21380-31	RFC-L- 330	330	65	.79	6	14	190	
MS21380-32	RFC-L- 390	390	65	.79	5	15.5	180	
MS21380-33	RFC-L- 470	470	60	.79	4	17	170	
MS21380-34	RFC-L- 560	560	75	.5	3	18.5	165	
MS21380-35	RFC-L- 680	680	75	.5	2.5	20	155	
MS21380-36	RFC-L- 820	820	75	.5	2.0	22	150	
MS21380-37	RFC-L- 1000	1000	75	.5	1.9	24	145	
MS21380-38	RFC-L- 1200	1200	75	.5	1.7	27	137	
MS21380-39	RFC-L- 1500	1500	75	.4	1.5	29	130	
MS21380-40	RFC-L- 1800	1800	65	.4	1.4	32	125	
MS21380-41	RFC-L- 2200	2200	65	.25	1.2	35	120	
MS21380-42	RFC-L- 2700	2700	65	.25	1.0	40	112	
MS21380-43	RFC-L- 3300	3300	65	.25	.95	45	105	
MS21380-44	RFC-L- 3900	3900	65	.25	.80	49	100	
MS21380-45	RFC-L- 4700	4700	65	.25	.75	53	95	
MS21380-46	RFC-L- 5600	5600	65	.25	.70	60	90	
MS21380-47	RFC-L- 6800	6800	65	.25	.60	67	85	
MS21380-48	RFC-L- 8200	8200	65	.25	.50	75	82	
MS21380-49	RFC-L-10000	10000	65	.15	.45	80	80	

MS91189-14 THRU -28, VALUES 1.2 THRU 18uH (ON PHENOLIC CORES) ARE AVAILABLE, AND MS75103-1 THRU -10, VALUES 22 THRU 120uH (ON IRON CORES) ARE ALSO AVAILABLE.

* NCG Part No. electricals and tolerances as shown.
MS No. electricals and tolerances per actual MS sheet.

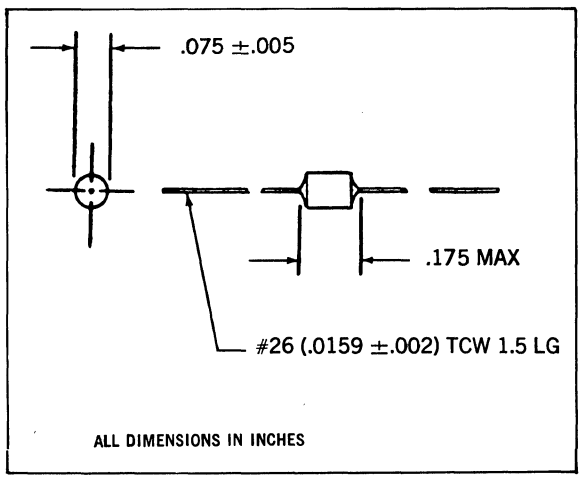
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NYTRONICS INDUCTORS

TYPE PD INDUCTORS

Pee Dee Ductor Series

Marking: EIA color coded



The Pee Dee Ductor is a microminiature, axial-leaded RF inductor for hybrid circuit applications.

This reliable, high performance inductor has a standard inductance tolerance of ±10%.

GRADE 2 CLASS A

ELECTRICAL CHARACTERISTICS:

Inductance Tolerance: ±10% (Std).

L,Q,F, values: Measurements per MIL-C-15305. (latest revision).

Dielectric Strength: 300 Volts RMS @ Sea Level.

DENSITY CHARACTERISTICS:

Volume: .0007 Cubic Inches

Weight: 0.12 Grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS:

Terminal pull: 3 lbs. minimum.

ELECTRICAL DATA

NCG Part No.	L uH	Q (Min.)	Test Freq. MHz	SRF Min. MHz	DCR Max. Ohms	Rated Current mA
PD-0.10	0.10	40	25	400	0.2	600
PD-0.12	0.12	40	25	360	0.2	600
PD-0.15	0.15	40	25	320	0.25	575
PD-0.18	0.18	40	25	304	0.25	575
PD-0.22	0.22	40	25	288	0.30	565
PD-0.27	0.27	40	25	240	0.30	565
PD-0.33	0.33	40	25	224	0.35	560
PD-0.39	0.39	40	25	208	0.37	550
PD-0.47	0.47	40	25	200	0.39	535
PD-0.56	0.56	40	25	192	0.40	525
PD-0.68	0.68	35	25	176	0.45	500
PD-0.82	0.82	35	25	144	0.50	480
PD-1.0	1.0	35	25	136	0.60	450
PD-1.2	1.2	35	7.9	120	0.70	425
PD-1.5	1.5	35	7.9	104	0.80	400
PD-1.8	1.8	35	7.9	96	0.90	350
PD-2.2	2.2	35	7.9	88	1.3	320
PD-2.7	2.7	35	7.9	84	1.8	275
PD-3.3	3.3	35	7.9	80	1.1	340
PD-3.9	3.9	35	7.9	72	1.4	310
PD-4.7	4.7	35	7.9	68	1.6	290
PD-5.6	5.6	35	7.9	56	1.8	275
PD-6.8	6.8	35	7.9	52	2.0	250
PD-8.2	8.2	35	7.9	50	2.2	245
PD-10	10	35	7.9	48	3.0	210
PD-12	12	35	2.5	28	2.0	250
PD-15	15	35	2.5	24	2.2	245
PD-18	18	35	2.5	20	2.5	230
PD-22	22	35	2.5	18	2.7	220
PD-27	27	35	2.5	17	3.8	195
PD-33	33	35	2.5	16	4.5	170
PD-39	39	35	2.5	13	6.0	150
PD-47	47	35	2.5	11	6.5	145
PD-56	56	35	2.5	10	7.8	135
PD-68	68	35	2.5	8	8.6	130
PD-82	82	35	2.5	7.2	9.8	120
PD-100	100	35	2.5	6.4	11.5	110
PD-120	120	28	.79	5.6	15.0	90
PD-150	150	28	.79	4.8	16.5	88
PD-180	180	25	.79	4.4	22	75
PD-220	220	24	.79	4.2	31	62
PD-270	270	24	.79	4.0	38	56
PD-330	330	24	.79	3.8	42	53
PD-390	390	24	.79	2.9	58	47
PD-470	470	24	.79	2.7	60	45
PD-560	560	24	.79	2.6	65	43
PD-680	680	22	.79	2.4	90	36
PD-820	820	23	.79	2.0	95	34
PD-1000	1000	21	.79	1.6	130	30

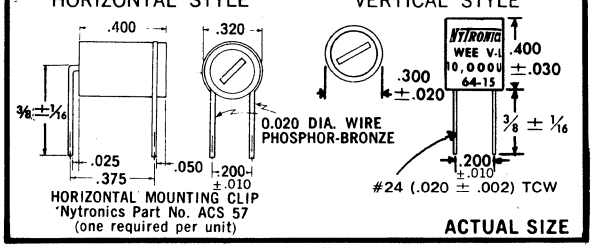
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NYTRONICS INDUCTORS

TYPE WEE-VL MS21381 & 21402 VARIABLE INDUCTORS

WEE V-L

NOW MIL APPROVED MIL-C-15305 (latest revision) — MS21381 & MS21402
Subminiature Shielded Adjustable Inductor
High Q Values
Vertical or Horizontal* Mounting
Unitized Epoxy-Molded Construction (MIL Style)
0.400" by 0.300"
0.10 to 100,000uH



The **WEE V-L** is designed to accommodate close inductance adjustments in high-density circuits that demand exceptional stability and high "Q" in the smallest size available. The **WEE V-L** is qualified MIL-C-15305 (latest revision). Printed board mounting is facilitated by 0.200 grid spacing and unit has shield construction to allow maximum density packaging. Standardized in 73 stock values.

ELECTRICAL CHARACTERISTICS

Adjustable Inductance Range:	Tunable range ±5% on 0.10uH thru 1.0uH and ±10% on 1.2uH thru 100,000uH.
Dielectric Strength:	840 Volts R.M.S. at sea level.
Working Voltage:	300 Volts D.C.
Maximum Current:	Based on temperature rise not to exceed 15°C at 90°C ambient.
Incremental Current:	Defined as the DC current required to cause a five percent reduction in the nominal inductance value.

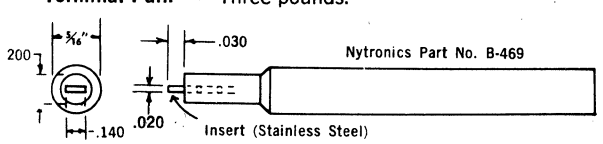
DENSITY CHARACTERISTICS

Weight:	1.5 grams maximum
Volume:	.0346 cubic inches
Shielding:	3% coupling maximum when two units are tested side by side.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Use Nytronics Tuning Tool No. B-469 or equal.

Torque:	0.40 to 6.0 inch-oz.
Operating Temperature:	−55°C to +105°C.
Moisture, Vibration, and Shock Resistance:	Meet requirements of MIL-C-15305 (latest revision).
Marking:	Manufacturer data printed.
Terminal Pull:	Three pounds.



MS GRADE 1 CLASS A
WVL GRADE 3 CLASS A

MS No.	NCG Part No.**	L nom. uH	f MHz	Q Min.	SRF Min. MHz	Max. DCR ohms	Max. I m.a.	Incr. I m.a.
MS21381-1	WEE V-L 0.10	.10	25	56	200	0.030	1510	NA
MS21381-2	WEE V-L 0.12	.12	25	56	200	0.030	1450	NA
MS21381-3	WEE V-L 0.15	.15	25	56	200	0.030	1400	NA
MS21381-4	WEE V-L 0.18	.18	25	56	200	0.035	1370	NA
MS21381-5	WEE V-L 0.22	.22	25	56	200	0.038	1340	NA
MS21381-6	WEE V-L 0.27	.27	25	64	200	0.040	1300	NA
MS21381-7	WEE V-L 0.33	.33	25	64	200	0.040	1260	NA
MS21381-8	WEE V-L 0.39	.39	25	64	200	0.045	1240	NA
MS21381-9	WEE V-L 0.47	.47	25	64	184	0.045	1200	NA
MS21381-10	WEE V-L 0.56	.56	25	64	176	0.050	1160	NA
MS21381-11	WEE V-L 0.68	.68	25	64	150	0.055	1100	NA
MS21381-12	WEE V-L 0.82	.82	25	68	144	0.060	1040	NA
MS21381-13	WEE V-L 1.00	1.00	25	68	128	0.070	986	NA
MS21381-14	WEE V-L 1.2	1.2	7.9	72	136	0.085	968	NA
MS21381-15	WEE V-L 1.5	1.5	7.9	80	124	0.100	893	NA
MS21381-16	WEE V-L 1.8	1.8	7.9	92	108	0.110	853	NA
MS21381-17	WEE V-L 2.2	2.2	7.9	88	96	0.120	817	NA
MS21381-18	WEE V-L 2.7	2.7	7.9	88	83	0.125	800	NA
MS21381-19	WEE V-L 3.3	3.3	7.9	77	74	0.165	696	NA
MS21381-20	WEE V-L 3.9	3.9	7.9	72	70	0.180	659	NA
MS21381-21	WEE V-L 4.7	4.7	7.9	76	63	0.245	571	NA
MS21381-22	WEE V-L 5.6	5.6	7.9	76	58	0.265	550	NA
MS21381-23	WEE V-L 6.8	6.8	7.9	68	50	0.330	493	NA
MS21381-24	WEE V-L 8.2	8.2	7.9	76	48	0.460	417	NA
MS21381-25	WEE V-L 10	10	7.9	72	43	0.640	359	NA
MS21381-26	WEE V-L 12	12	2.5	96	30	0.800	316	NA
MS21381-27	WEE V-L 15	15	2.5	96	23	0.865	301	NA
MS21381-28	WEE V-L 18	18	2.5	92	19	0.940	292	NA
MS21381-29	WEE V-L 22	22	2.5	100	17	1.03	267	NA
MS21381-30	WEE V-L 27	27	2.5	92	16	1.18	243	NA
MS21381-31	WEE V-L 33	33	2.5	96	15	1.30	231	NA
MS21381-32	WEE V-L 39	39	2.5	96	14	1.41	223	NA
MS21381-33	WEE V-L 47	47	2.5	88	12	1.61	203	NA
MS21381-34	WEE V-L 56	56	2.5	92	11	2.08	191	NA
MS21381-35	WEE V-L 68	68	2.5	84	10	2.20	185	NA
MS21381-36	WEE V-L 82	82	2.5	84	9	2.42	174	NA
MS21402-1	WEE V-L 100	100	2.5	76	8.4	2.15	333	333
MS21402-2	WEE V-L 120	120	0.790	76	4.5	2.38	316	190
MS21402-3	WEE V-L 150	150	0.790	72	4.0	2.52	306	175
MS21402-4	WEE V-L 180	180	0.790	76	3.9	2.88	288	150
MS21402-5	WEE V-L 220	220	0.790	76	3.7	3.18	273	125
MS21402-6	WEE V-L 270	270	0.790	80	3.4	3.50	260	120
MS21402-7	WEE V-L 330	330	0.790	80	2.8	4.80	222	110
MS21402-8	WEE V-L 390	390	0.790	80	2.7	5.44	209	105
MS21402-9	WEE V-L 470	470	0.790	80	2.6	5.90	201	100
MS21402 10	WEE V-L 560	560	0.790	76	2.3	6.30	194	90
MS21402-11	WEE V-L 680	680	0.790	80	2.2	7.20	181	80
MS21402-12	WEE V-L 820	820	0.790	72	2.0	8.00	172	70
MS21402-13	WEE V-L 1,000	1,000	0.790	80	1.9	12.0	141	65
MS21402-14	WEE V-L 1,200	1,200	0.250	76	1.8	13.5	132	60
MS21402-15	WEE V-L 1,500	1,500	0.250	72	1.5	16.5	119	55
MS21402-16	WEE V-L 1,800	1,800	0.250	80	1.4	18.0	114	47
MS21402-17	WEE V-L 2,200	2,200	0.250	80	1.3	20.5	107	43
MS21402-18	WEE V-L 2,700	2,700	0.250	76	1.2	22.5	102	39
MS21402-19	WEE V-L 3,300	3,300	0.250	72	1.1	42.0	76	36
MS21402-20	WEE V-L 3,900	3,900	0.250	68	1.0	47.5	71	35
MS21402-21	WEE V-L 4,700	4,700	0.250	68	.99	53.0	67	34
MS21402-22	WEE V-L 5,600	5,600	0.250	68	.74	62.5	65	31
MS21402-23	WEE V-L 6,800	6,800	0.250	60	.63	69.5	58	27
MS21402-24	WEE V-L 8,200	8,200	0.250	64	.60	75.0	56	26
MS21402-25	WEE V-L 10,000	10,000	0.250	56	.70	100.0	49	24
MS21402-26	WEE V-L 12,000	12,000	0.079	56	.40	64	60	40
MS21402-27	WEE V-L 15,000	15,000	0.079	56	.30	84	52	34
MS21402-28	WEE V-L 18,000	18,000	0.079	56	.29	93	50	30
MS21402-29	WEE V-L 22,000	22,000	0.079	56	.26	104	45	28
MS21402-30	WEE V-L 27,000	27,000	0.079	56	.24	173	35	26
MS21402-31	WEE V-L 33,000	33,000	0.079	56	.22	187	32	24
MS21402-32	WEE V-L 39,000	39,000	0.079	56	.21	220	30	22
MS21402-33	WEE V-L 47,000	47,000	0.079	56	.20	253	28	20
MS21402-34	WEE V-L 56,000	56,000	0.079	56	.19	285	26	19
MS21402-35	WEE V-L 68,000	68,000	0.079	48	.16	311	24	18
MS21402-36	WEE V-L 82,000	82,000	0.079	48	.15	385	22	16
MS21402-37	WEE V-L 100,000	100,000	0.079	48	.14	420	20	15

*For horizontal mounting use Nytronics mounting clip No. ACS-57 or order with prefix H (i.e. H WEE V-L 0.10).

** NCG Part No. cannot be used as the MS No.

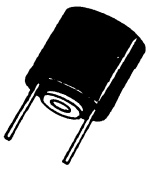
NOTE: MS 21381 -74 thru -85 are available.

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NYTRONICS INDUCTORS

VARIABLE INDUCTOR TYPE VIN

VARIABLE INDUCTOR, NEW (VIN)



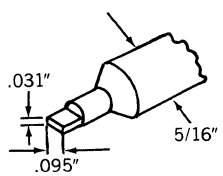
- Standard inductance values from 0.1μH to 4700μH.
- Epoxy-encapsulated windings.
- Excellent tuning torque control.

ELECTRICAL CHARACTERISTICS

Inductance Tuning Range:	0.1μH ±10% 0.15-0.47μH ±15% 0.68-4700μH ±20%
Q:	Measured at L NOM (L & Q measured on a Q-meter)
SRF:	Grid dip meter

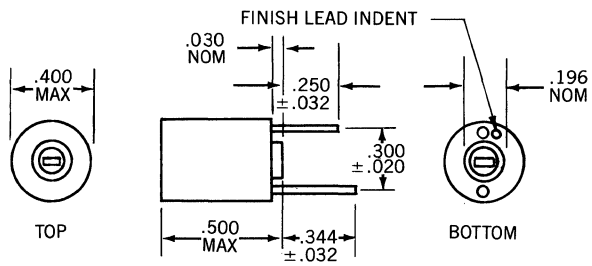
PHYSICAL & ENVIRONMENTAL CHARACTERISTICS

Volume:	.063 cubic inches
Weight:	2.0 grams
Torque:	0.75-5.0 inch-ounces
Operating Temperature:	−55°C to +105°C
Terminal Strength:	Meets 5 pound pull test
Core Material:	Iron
Marking:	NYT NYTRONICS XXX NOM. L (μH) 88XX Date Code



TYPICAL ALIGNING TOOL B-305

NCG PART NO.	L NOM.	MIN. Q AT L NOM.		MIN. SRF L NOM.	MAX. DCR	MAX. I
	μH		MHz	MHz	Ω	mA
VIN 0.10	0.10	65	25	360	.01	3500
VIN 0.15	0.15	75	25	340	.01	2600
VIN 0.22	0.22	78	25	290	.02	2500
VIN 0.33	0.33	80	25	250	.02	2500
VIN 0.47	0.47	70	25	220	.05	2200
VIN 0.68	0.68	72	25	185	.07	1850
VIN 1.0	1.0	70	25	150	.13	1350
VIN 1.5	1.5	56	7.9	130	.24	1000
VIN 2.2	2.2	55	7.9	100	.30	890
VIN 3.3	3.3	60	7.9	85	.45	730
VIN 4.7	4.7	60	7.9	72	.80	550
VIN 6.8	6.8	60	7.9	55	1.10	460
VIN 10	10.0	66	7.9	48	1.90	355
VIN 15	15.0	52	2.5	38	3.20	270
VIN 22	22.0	44	2.5	11	3.40	265
VIN 33	33.0	40	2.5	12	3.60	255
VIN 47	47.0	40	2.5	10.5	4.50	230
VIN 68	68.0	38	2.5	9.5	5.50	210
VIN 100	100.	40	2.5	8.5	6.70	190
VIN 150	150.	40	.79	2.4	11.0	150
VIN 220	220.	40	.79	2.2	13.0	135
VIN 330	330.	38	.79	1.8	16.0	120
VIN 470	470.	36	.79	1.5	18.0	115
VIN 680	680.	27	.79	1.2	21.0	105
VIN 1000	1000.	27	.79	1.1	38.0	80
VIN 1500	1500.	32	.25	0.9	54.0	65
VIN 2200	2200.	35	.25	0.8	66.0	60
VIN 3300	3300.	37	.25	0.7	85.0	54
VIN 4700	4700.	35	.25	0.6	99.0	49



LEADS: .025 ±.002 DIA. T.C.W.

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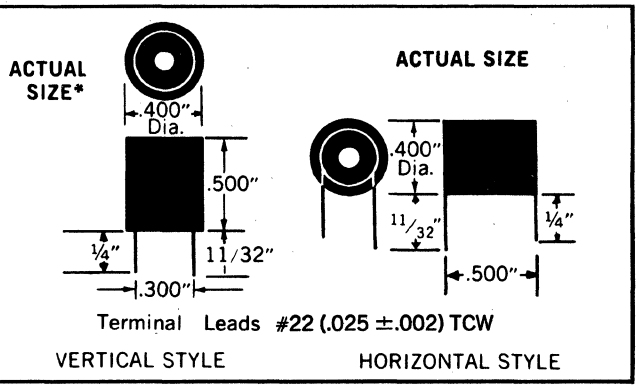
NYTRONICS INDUCTORS

TYPE VIV - VIH VARIABLE INDUCTORS

VIV-VIH

Miniature with inductance range of 0.10 to 4700uH in 29 values.
Encapsulated in epoxy resin for reliability.

*ALL DIMENSIONS ARE ±1/32 INCH



The **VARIABLE INDUCTOR** offers high reliability and exceptional stability over extreme temperature variations. This small lightweight unit is furnished in vertical and horizontal styles to facilitate mounting on printed circuit boards.

NCG PART NOS.		L nom.	Min. Q at L Nom.		Min. SRF, L Nom.	Max. DCR	Max. I
VIV	VIH	μH		MHz	MHz	Ω	mA
VIV-0.10	VIH-0.10	0.10	68	25.	300	0.02	3500
VIV-0.15	VIH-0.15	0.15	80	25.	300	0.035	2600
VIV-0.22	VIH-0.22	0.22	80	25.	300	0.04	2500
VIV-0.33	VIH-0.33	0.33	80	25.	267	0.04	2500
VIV-0.47	VIH-0.47	0.47	80	25.	228	0.05	2200
VIV-0.68	VIH-0.68	0.68	80	25.	190	0.07	1850
VIV-1.00	VIH-1.00	1.00	72	25.	164	0.13	1350
VIV-1.50	VIH-1.50	1.50	56	7.9	134	0.24	1000
VIV-2.20	VIH-2.20	2.20	58	7.9	108	0.30	890
VIV-3.30	VIH-3.30	3.30	64	7.9	90	0.45	730
VIV-4.70	VIH-4.70	4.70	60	7.9	80	0.80	550
VIV-6.80	VIH-6.80	6.80	64	7.9	64	1.1	460
VIV-10.0	VIH-10.0	10.0	66	7.9	54	1.9	355
VIV-15.0	VIH-15.0	15.0	52	2.5	43	3.2	270
VIV-22.0	VIH-22.0	22.0	44	2.5	14	3.4	265
VIV-33.0	VIH-33.0	33.0	43	2.5	12	3.6	255
VIV-47.0	VIH-47.0	47.0	41	2.5	10.5	4.5	230
VIV-68.0	VIH-68.0	68.0	44	2.5	9.5	5.5	210
VIV-100	VIH-100	100.0	40	2.5	8.5	6.7	190
VIV-150	VIH-150	150.	40	.79	2.4	11.0	150
VIV-220	VIH-220	220.	40	.79	2.2	13.0	135
VIV-330	VIH-330	330.	38	.79	1.8	16.0	120
VIV-470	VIH-470	470.	36	.79	1.5	18.0	115
VIV-680	VIH-680	680.	34	.79	1.4	21.0	105
VIV-1000	VIH-1000	1000.	32	.79	1.1	38.0	80
VIV-1500	VIH-1500	1500.	32	.25	.9	54.0	65
VIV-2200	VIH-2200	2200.	35	.25	.8	66.0	60
VIV-3300	VIH-3300	3300.	37	.25	.7	85.0	54
VIV-4700	VIH-4700	4700.	38	.25	.6	99.0	49

GRADE 2 CLASS B
ELECTRICAL CHARACTERISTICS

Inductance Range: 0.33 to 4700uH Tunable Range ±20%
0.15 to 0.22uH Tunable Range ±15%
0.1 Tunable Range ±10%
All measurements at 25°C on Q-Meter

Self-Resonant Frequency: Minimum SRF measured with Grid-Dip Meter.

DENSITY CHARACTERISTICS

Volume: 0.063 cubic inches
Weight: 2.6 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Torque: 0.75 to 5.0 inch-ounces
Use Nytronics Tuning Tool No. B-305 or equal.

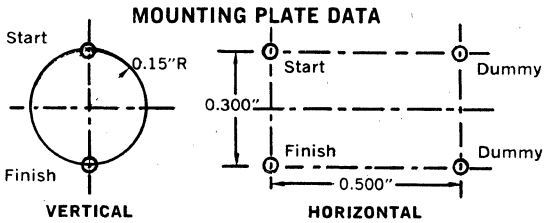
Operating Temperature: −55°C to +125°C

Terminal Strength: Meets five pound pull tests.

Core Material: Iron

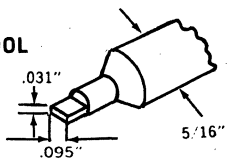
Marking: Manufactured data printed.

MOUNTING PLATE DATA



TYPICAL ALIGNING TOOL

B-305



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NYTRONICS INDUCTORS

POWER CHOKES
PL SERIES

HIGH CURRENT CHOKES PL SERIES

Inductance: Measured on general radio 1657 LRC bridge at 1 kHz.

Current (rated IDC): Based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.

Incremental Current (INCR I): The minimum current at which the inductance will be decreased by 5% from its initial (zero DC) value.

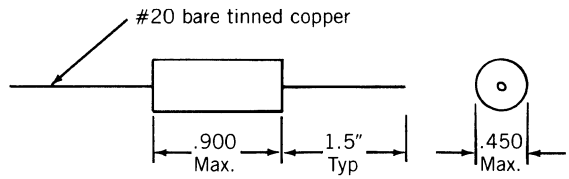
Dielectric Withstanding Voltage: 1000 VRMS

Operating Temperature Range: – 55°C to 105°C

Materials: Coil form — ferrite
Cover — flame retardant heat-shrink tubing
Magnet wire — per MIL-W-583 Type B

Marking: Printed with part number.

10μH TO 100mH, 20% TOLERANCE
RECOMMENDED MOUNTING PITCH: 1.25"



STANDARD VALUES (OTHER VALUES ARE AVAILABLE ON SPECIAL ORDER)

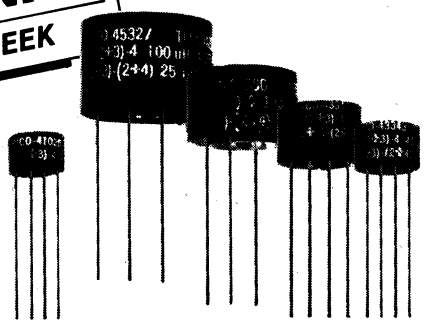
PART NUMBER	NOMINAL INDUCTANCE	MAXIMUM DCR (Ω)	RATED IDC (mA)	INCR I (mA)
PL 10	10μH	.023	4600	3200
PL 15	15μH	.030	4100	2600
PL 22	22μH	.035	3700	2200
PL 33	33μH	.043	3400	1800
PL 47	47μH	.054	3000	1500
PL 68	68μH	.068	2700	1200
PL 100	100μH	.100	2300	1000
PL 150	150μH	.18	1700	830
PL 220	220μH	.28	1400	680
PL 330	330μH	.35	1200	560
PL 470	470μH	.44	1050	460
PL 680	680μH	.63	890	390
PL 1000	1mH	.96	720	320
PL 1500	1.5mH	1.4	600	260
PL 2200	2.2mH	2.3	470	220
PL 3300	3.3mH	3.5	380	180
PL 4700	4.7mH	4.3	340	150
PL 6800	6.8mH	6.3	280	120
PL 10,000	10mH	9.7	220	100
PL 15,000	15mH	15	180	84
PL 22,000	22mH	24	140	68
PL 33,000	33mH	35	120	56
PL 47,000	47mH	50	100	47
PL 68,000	68mH	76	81	39
PL 100,000	100mH	99	71	32

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PICO's Miniaturized Power Inductors

PLUG-IN and SURFACE MOUNT UNITS

DELIVERY —STOCK TO ONE WEEK

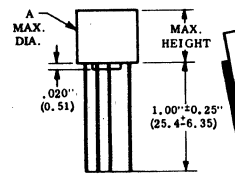


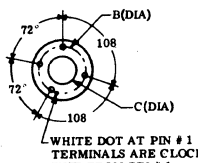
Plug-in units can be manufactured and tested to MIL-T-27/356. Contact Factory for price and delivery information and appropriate part numbers (MIL-T-27/356-01 thru MIL-T-27/356-63).

PLUG-IN

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Terminal Dia.
0	.250 (6.35)	.320 (8.13)	.21 (5.33)	.13 (3.30)	.012 (.31)
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)	.012 (.31)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)	.012 (.31)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)	.016 (.41)

ALL DIMENSIONS ARE IN INCHES, ( ) = MM

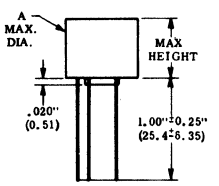


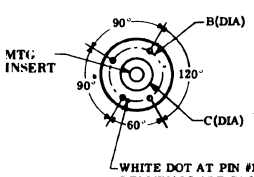


PLUG-IN

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert	Terminal Dia.
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	—	.016 (.41)
5	.650 (16.51)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep	.020 (.51)

ALL DIMENSIONS ARE IN INCHES, ( ) = MM





SPECIFICATIONS:

- All units manufactured to MIL-T-27 and are type TF5S04ZZ
- Inductance measured at 0.1 VRMS-10 kHz
- Temperature rise at rated D.C. current is less than 30°C
- Maximum ambient is 100°C
- Unit has magnetic shield

All inductors have split windings—ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-41020 will have 5 millihenry at .12 Amps DC with DC resistance of 13.5 Ohms

PLUG-IN

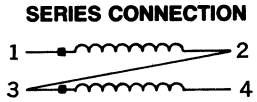
Inductance	I_{DC} (Amps)	R_{DC} (Ohms)	SRF MHz	Size	Model Number	*** Price 1–9
20 Milli-Henry	.06	54	0.275	1	41020	18.97
	.10	29	0.207	2	42105	18.97
	.14	20	0.230	3	43103	18.97
	.22	12.4	0.210	4	44500	22.70
	.29	10.2	0.180	5	45107	22.70
15 Milli-Henry	.07	40.5	0.320	1	41040	18.97
	.12	22	0.240	2	42125	18.97
	.16	15	0.235	3	43123	18.97
	.23	9.3	0.280	4	44520	22.70
	.33	7.7	0.245	5	45127	22.70
10 Milli-Henry	.05	60	0.400	0	40050	18.97
	.08	27	0.380	1	41060	18.97
	.14	14.6	0.390	2	42145	18.97
	.20	10	0.340	3	43143	18.97
	.31	6.2	0.290	4	44560	22.70
	.40	5.1	0.300	5	45147	22.70
7.5 Milli-Henry	.058	45	0.500	0	40070	18.97
	.10	20.3	0.450	1	41080	18.97
	.17	11	0.430	2	42165	18.97
	.24	7.5	0.390	3	43163	18.97
	.38	4.7	0.350	4	44580	22.70
	.49	3.8	0.340	5	45167	22.70
5 Milli-Henry	.071	30	0.650	0	40090	18.97
	.12	13.5	0.600	1	41100	18.97
	.21	7.3	0.490	2	42185	18.97
	.30	5	0.550	3	43183	18.97
	.47	3.1	0.460	4	44600	22.70
	.6	2.6	0.410	5	45187	22.70
3 Milli-Henry	.091	18	0.800	0	40110	18.97
	.16	8.1	0.710	1	41120	18.97
	.27	4.4	0.650	2	42205	18.97
	.38	3	0.570	3	43203	18.97
	.6	1.9	0.600	4	44620	22.70
	.78	1.5	0.550	5	45207	22.70

PLUG-IN

Inductance	I_{DC} (Amps)	R_{DC} (Ohms)	SRF MHz	Size	Model Number	*** Price 1–9
2 Mili-Henry	.112	12	1.000	0	40130	18.97
	.19	5.4	0.950	1	41140	18.97
	.33	2.9	0.850	2	42225	18.97
	.47	2	0.800	3	43223	18.97
	.74	1.3	0.700	4	44640	22.70
	.95	1	0.650	5	45227	22.70
1 Milli-Henry	.158	6	1.650	0	40150	18.97
	.27	2.7	1.500	1	41160	18.97
	.47	1.5	1.200	2	42245	18.97
	.66	1	1.100	3	43243	18.97
	1	.62	1.050	4	44660	22.70
	1.3	.5	1.000	5	45247	22.70
750 Micro-Henry	.182	4.5	1.700	0	40170	18.97
	.31	2	1.550	1	41180	18.97
	.54	1	1.400	2	42265	18.97
	.76	.75	1.400	3	43263	18.97
	1.2	.47	1.200	4	44680	22.70
	1.6	.38	1.150	5	45267	22.70
500 Micro-Henry	.224	3	2.300	0	40190	18.97
	.38	1.3	2.100	1	41200	18.97
	.66	.66	1.900	2	42285	18.97
	.93	.5	1.600	3	43283	18.97
	1.47	.31	1.500	4	44700	22.70
	1.9	.25	1.450	5	45287	22.70
250 Micro-Henry	.316	1.5	3.300	0	40210	18.97
	.53	.66	3.000	1	41220	18.97
	.93	.33	2.500	2	42305	18.97
	1.3	.25	2.400	3	43303	18.97
	2.08	.16	2.100	4	44720	22.70
	2.7	.13	2.010	5	45307	22.70
100 Micro-Henry	.50	.6	4.500	0	40230	18.97
	.78	.300	4.000	1	41240	18.97
	1.35	.170	3.900	2	42325	18.97
	1.95	.110	3.500	3	43323	18.97
	3.08	.070	3.300	4	44740	22.70
	3.88	.060	3.200	5	45327	22.70
40 Micro-Henry	.79	.24	5.500	0	40250	18.97
	1.18	.141	5.000	1	41260	18.97
	2.03	.070	4.500	2	42345	18.97
	2.68	.060	4.500	3	43343	18.97

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%, 50-99 less 23%; 100-499 less 30%

PLUG-IN TERMINAL ARRANGEMENT SERIES CONNECTION



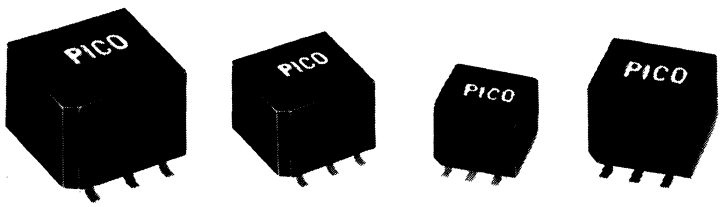
PLUG-IN PARALLEL CONNECTION



Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*For immediate engineering assistance or to place an order–**Call Toll Free 800-431-1064*** • FAX 914-699-5565

PICO Plug-In and Surface Mount Inductors are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators



- **Minimum possible size**
- **Manufactured to MIL-T-27 (TF5S04ZZ)**
- **Special high frequency core material to insure low losses**
- **All units have split windings**
- **Large selection of sizes available**

All inductors have split windings—ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-41320 will have 5 millihenry at .12 Amps DC with DC resistance of 13.5 Ohms

SURFACE MOUNT

Inductance	I_{DC} (Amps)	R_{DC} (Ohms)	SRF MHz	Size	Model Number	Price 1-9
20 Milli-Henry	.06	54	0.275	1	41320	20.87
	.10	29	0.207	2	42405	20.87
	.14	20	0.230	3	43403	20.87
15 Milli-Henry	.07	40.5	0.320	1	41340	20.87
	.12	22	0.240	2	42425	20.87
	.16	15	0.235	3	43423	20.87
10 Milli-Henry	.05	60	0.400	0	40350	20.87
	.08	27	0.380	1	41360	20.87
	.14	14.6	0.390	2	42445	20.87
	.20	10	0.340	3	43443	20.87
7.5 Milli-Henry	.058	45	0.500	0	40370	20.87
	.10	20.3	0.450	1	41380	20.87
	.17	11	0.430	2	42465	20.87
	.24	7.5	0.390	3	43463	20.87
5 Milli-Henry	.071	30	0.650	0	40390	20.87
	.12	13.5	0.600	1	41400	20.87
	.21	7.3	0.490	2	42485	20.87
	.30	5	0.550	3	43483	20.87
3 Milli-Henry	.091	18	0.800	0	40410	20.87
	.16	8.1	0.710	1	41420	20.87
	.27	4.4	0.650	2	42505	20.87
	.38	3	0.570	3	43503	20.87

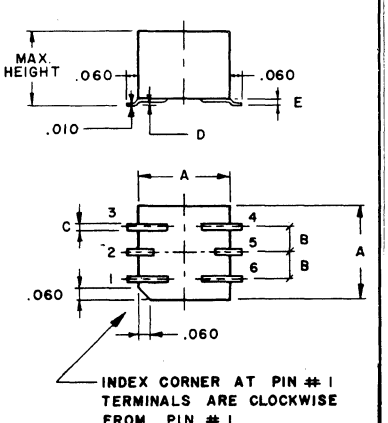
SURFACE MOUNT

Inductance	I_{DC} (Amps)	R_{DC} (Ohms)	SRF MHz	Size	Model Number	Price 1-9
2 Milli-Henry	.112	12	1.000	0	40430	20.87
	.19	5.4	0.950	1	41440	20.87
	.33	2.9	0.850	2	42525	20.87
	.47	2	0.800	3	43523	20.87
1 Milli-Henry	.158	6	1.650	0	40450	20.87
	.27	2.7	1.500	1	41460	20.87
	.47	1.5	1.200	2	42545	20.87
	.66	1	1.100	3	43543	20.87
750 Micro-Henry	.182	4.5	1.700	0	40470	20.87
	.31	2	1.550	1	41480	20.87
	.54	1	1.400	2	42565	20.87
	.76	.75	1.400	3	43563	20.87
500 Micro-Henry	.224	3	2.300	0	40490	20.87
	.38	1.3	2.100	1	41500	20.87
	.66	.66	1.900	2	42585	20.87
	.93	.5	1.600	3	43583	20.87
250 Micro-Henry	.316	1.5	3.300	0	40510	20.87
	.53	.66	3.000	1	41520	20.87
	.93	.33	2.500	2	42605	20.87
	1.3	.25	2.400	3	43603	20.87
100 Micro-Henry	.50	6	4.500	0	40530	20.87
	.78	.300	4.000	1	41540	20.87
	1.35	.170	3.900	2	42625	20.87
	1.95	.110	3.500	3	43623	20.87
40 Micro-Henry	.79	.24	5.500	0	40550	20.87
	1.18	.141	5.000	1	41560	20.87
	2.03	.070	4.500	2	42645	20.87
	2.68	.060	4.500	3	43643	20.87

SURFACE MOUNT

Size	Max. Height	A	B	C	D	E
0	.280 (6.96)	.325 (8.26)	.085 (2.16)	.020 (.51)	.012 (.30)	.025 (.64)
1	.310 (7.87)	.400 (10.16)	.115 (2.92)	.027 (.69)	.015 (.38)	.027 (.69)
2	.365 (9.27)	.495 (12.45)	.140 (3.56)	.027 (.69)	.015 (.38)	.027 (.69)
3	.460 (11.68)	.615 (15.62)	.185 (4.70)	.027 (.69)	.020 (.51)	.033 (.84)

All dimensions are in inches, ( ) = MM



NOTE: PINS 2 AND 5 ARE DUMMY PINS

SPECIFICATIONS:

- All units manufactured to MIL-T-27 and are type TF5S04ZZ
- Inductance measured at 0.1 VRMS-10 kHz
- Temperature rise at rated D.C. current is less than 30°C
- Maximum ambient is 100°C
- Unit has magnetic shield

SURFACE MOUNT TERMINAL ARRANGEMENT SERIES CONNECTION



SURFACE MOUNT PARALLEL CONNECTION



*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery—stock to one week

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

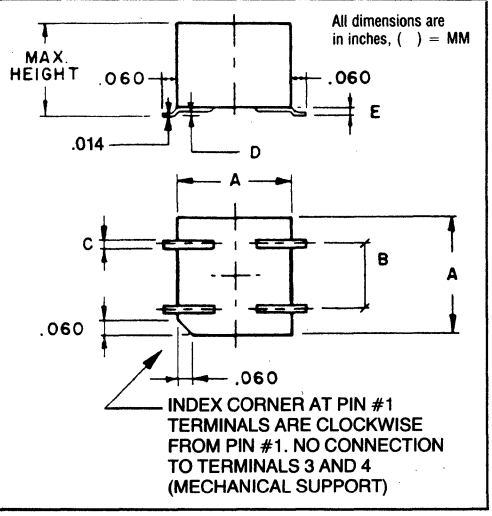
LOW PROFILE SURFACE MOUNT PICO POWER INDUCTORS



These inductors utilize special techniques to minimize cross coupling and give the utmost in shielding efficiency. They are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

- **Handle large transient DC currents**
- **Minimum possible size**
- **Manufactured to MIL-T-27 (TF5S04ZZ)**
- **Special high frequency core material to insure low losses**
- **Large selection of sizes available**

Size	Max. Height	A	B	C	D	E
1	.250	.450	.300	.027	.020	.033
2	.300	.550	.400	.037	.025	.040
3	.325	.650	.500	.037	.025	.040



SIZE 1

LODC MICROHY (µH)	IDC for 10% DROP in L AMPS	IDC for 20% DROP in L AMPS	IDC for 30% DROP in L AMPS	RDC OHMS	SRF MHz	PICO PART NUMBER	PRICE (1-9)
25	1.9	2.6	3.3	.032	4.5	73005	22.50
50	1.34	1.84	2.33	0.064	3.3	73010	22.50
75	1.10	1.50	1.91	0.096	2.7	73015	22.50
100	0.95	1.30	1.65	0.128	2.25	73020	22.50
250	0.60	0.82	1.04	0.320	1.5	73025	22.50
750	0.35	0.47	0.60	0.960	.85	73030	22.50
1000	0.30	0.41	0.52	1.280	.73	73035	22.50
1500	0.25	0.34	0.43	1.920	.6	73040	22.50
2500	0.19	0.26	0.33	3.20	.45	73045	22.50
5000	0.13	0.18	0.23	6.40	.33	73050	22.50

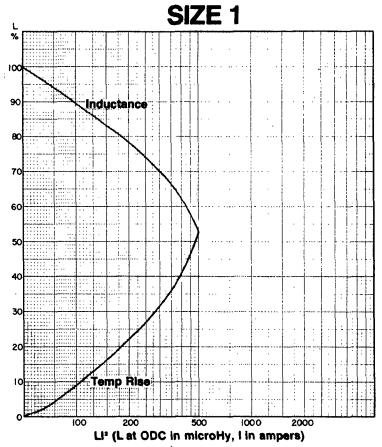
SIZE 2

LODC MICROHY (µH)	IDC for 10% DROP in L AMPS	IDC for 20% DROP in L AMPS	IDC for 30% DROP in L AMPS	RDC OHMS	SRF MHz	PICO PART NUMBER	PRICE (1-9)
25	2.5	3.7	4.7	.020	4.5	73115	22.50
50	1.77	2.61	3.30	0.040	3.3	73120	22.50
75	1.44	2.14	2.71	0.060	2.7	73125	22.50
100	1.25	1.85	2.35	0.080	2.25	73130	22.50
250	0.79	1.17	1.49	0.20	1.5	73135	22.50
750	0.46	0.68	0.86	0.60	.85	73140	22.50
1000	0.40	0.59	0.74	0.80	.73	73145	22.50
1500	0.32	0.48	0.61	1.20	.6	73150	22.50
2500	0.25	0.37	0.47	2.00	.45	73155	22.50
5000	0.18	0.26	0.33	4.00	.33	73160	22.50

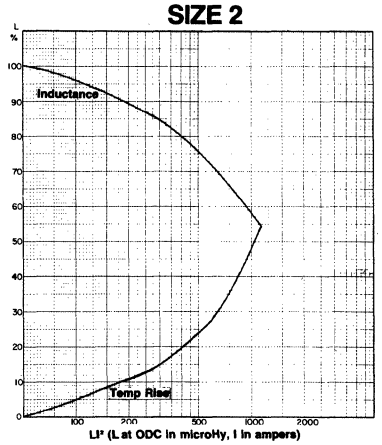
SIZE 3

LODC MICROHY (µH)	IDC for 10% DROP in L AMPS	IDC for 20% DROP in L AMPS	IDC for 30% DROP in L AMPS	RDC OHMS	SRF MHz	PICO PART NUMBER	PRICE (1-9)
25	3.0	4.4	5.6	.015	4.0	73205	22.50
50	2.12	3.11	4.00	0.03	3.0	73210	22.50
75	1.73	2.54	3.23	0.05	2.4	73215	22.50
100	1.50	2.20	2.80	0.06	2.0	73220	22.50
250	0.95	1.39	1.77	0.15	1.3	73225	22.50
750	0.55	0.80	1.02	0.45	.75	73230	22.50
1000	0.47	0.70	0.89	0.60	.65	73235	22.50
1500	0.39	0.57	0.72	0.90	.55	73240	22.50
2500	0.30	0.44	0.56	1.50	.40	73245	22.50
5000	0.21	0.31	0.40	3.00	.30	73250	22.50

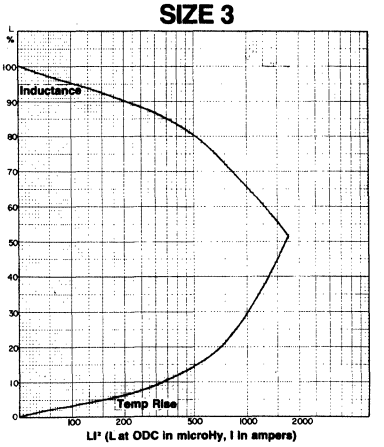
SIZE 1



SIZE 2



SIZE 3



*For immediate engineering assistance or to place an order–**Call Toll Free 800-431-1064***

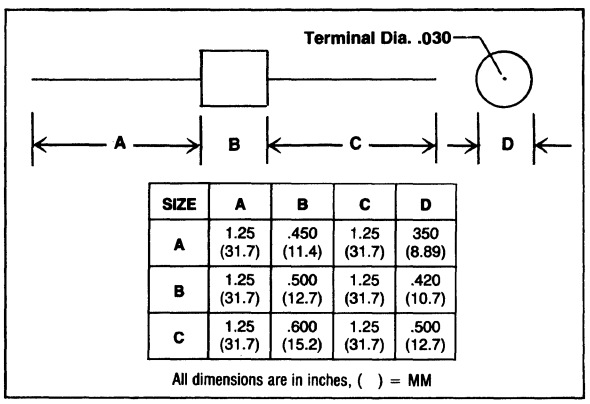
Delivery– stock to one week

PICO Electronics, Inc.
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Miniaturized Power Inductors with Axial Leads Shielded Construction

These inductors utilize special techniques to minimize cross coupling and give the utmost in shielding efficiency. They are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

- Minimum possible size
- Shielded construction
- Mountable through PC board or to posts
- Manufactured to MIL-T-27 (TF5S04ZZ)
- Suitable for reel-mounted assembly
- Low losses



SIZE	A	B	C	D
A	1.25 (31.7)	.450 (11.4)	1.25 (31.7)	350 (8.89)
B	1.25 (31.7)	.500 (12.7)	1.25 (31.7)	.420 (10.7)
C	1.25 (31.7)	.600 (15.2)	1.25 (31.7)	.500 (12.7)

All dimensions are in inches, ( ) = MM



SIZE A

LODC MICROHY (μH)	IDC FOR 10% DROP in L AMPS	IDC FOR 20% DROP in L AMPS	IDC FOR 30% DROP in L AMPS	RDC OHMS	SRF MHz	Q @ 100KHz	PICO PART NUMBER	PRICE (1–9)
500	.425	.640	.848	.74	1.4	45	72205	17.12
375	.490	.740	.98	.55	1.6	45	72215	17.12
250	.600	.906	1.2	.36	2.0	45	72225	17.12
150	.775	1.17	1.55	.22	2.5	45	72235	17.12
100	.950	1.43	1.90	.15	3.0	45	72245	17.12
75	1.01	1.65	2.2	.11	3.6	45	72255	17.12
50	1.34	2.02	2.7	.075	4.4	45	72265	17.12



SIZE B

1000	0.450	0.600	0.750	0.85	0.9	45	72310	17.12
750	0.52	0.693	0.866	0.64	1.04	45	72320	17.12
500	0.63	0.848	1.06	0.43	1.3	45	72330	17.12
375	0.73	0.980	1.22	0.32	1.5	45	72340	17.12
250	0.90	1.20	1.5	0.22	1.8	45	72350	17.12
150	1.16	1.550	1.93	0.13	2.3	45	72360	17.12
100	1.42	1.9	2.37	0.085	2.8	45	72370	17.12
75	1.64	2.2	2.73	0.064	3.3	45	72380	17.12
50	2.0	2.7	3.35	0.043	4.0	45	72390	17.12



SIZE C

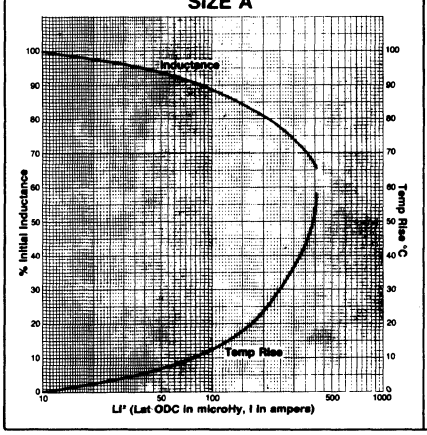
1000	0.500	0.750	1.0	.700	.85	45	72405	17.12
750	0.580	0.866	1.15	.520	1.0	45	72415	17.12
500	0.707	1.06	1.41	.350	1.2	45	72425	17.12
375	0.816	1.22	1.63	.260	1.4	45	72435	17.12
250	1.0	1.50	2.0	.175	1.7	45	72445	17.12
150	1.29	1.93	2.58	.105	2.2	45	72455	17.12
100	1.58	2.37	3.16	.070	2.7	45	72465	17.12
75	1.82	2.73	3.65	.053	3.1	45	72475	17.12
50	2.25	3.35	4.5	.035	4.0	45	72485	17.12

SPECIFICATIONS

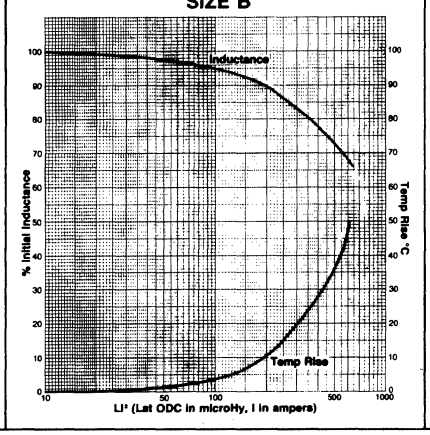
- All units meet MIL-T-27 (TF5S04ZZ)
- Inductance measured at 0.1VRMS–100KHz
- Maximum ambient plus temp. rise limited to 130°C

(i.e. temp. rise for 72205 at .425 AMPS will be 12°C, ambient should be limited to 118°C–at .64AMPS temp. rise is 30°C, ambient should be limited to 100°C)

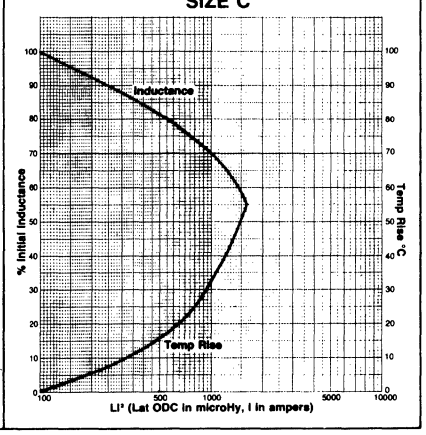
SIZE A



SIZE B



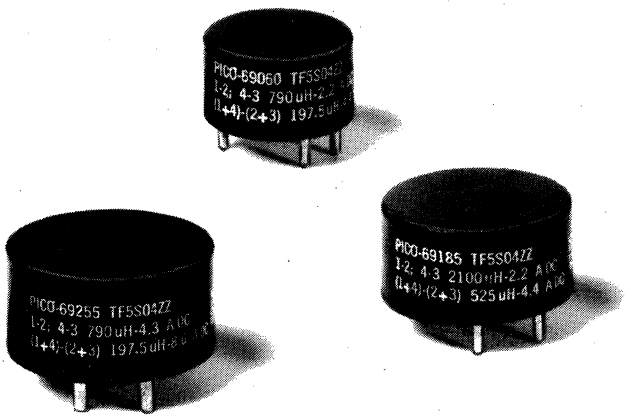
SIZE C



For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc. 453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

PICO's POWER INDUCTORS

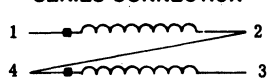


FOR MULTIPLE OUTPUT REGULATORS WE CAN SUPPLY ALL NECESSARY INDUCTANCE VALUES ON ONE CORE This technique provides minimum possible size and gives excellent dynamic and DC cross-regulation . . . Contact factory for these special inductors.

- **Handle large transient DC currents**
- **Minimum possible size**
- **Manufactured to MIL-T-27 (TF5S04ZZ)**
- **Special high frequency core material to insure low losses**
- **All units have split windings**
- **Large selection of sizes available**
- **All units are magnetically shielded**

All inductors have split windings (except size AA)— ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-69010 will have 32.5 microhenry with DC resistance of .015 Ohms at 6 Amps DC current (10% drop in L)

TERMINAL ARRANGEMENT SERIES CONNECTION



PARALLEL CONNECTION



SIZE AA

LODC MICROHY (μH)	IDC for 10% DROP in L AMPS	IDC for 20% DROP in L AMPS	IDC for 30% DROP in L AMPS	RDC OHMS	SRF MHz	PICO PART NUMBER	PRICE (1-9)
25	3.53	4.80	5.94	.012	4.0	69410	26.27
50	2.5	3.4	4.2	.024	3.0	69420	26.27
75	2.04	2.78	3.43	.036	2.4	69430	26.27
100	1.77	2.4	2.99	.048	2.0	69440	26.27
250	1.12	1.52	1.88	.12	1.3	69450	26.27
750	.65	.88	1.08	.36	.75	69460	26.27
1000	.56	.76	.94	.48	.65	69470	26.27
1500	.46	.62	.77	.72	.55	69480	26.27
2500	.35	.48	.59	1.2	.4	69490	26.27
5000	.25	.34	.42	2.4	.3	69500	26.27

SIZE A

130	3.0	4.5	5.5	.060	1.7	69010	26.27
210	2.5	3.5	4.5	.11	1.4	69020	26.27
260	2.2	3.2	3.9	.14	1.25	69030	26.27
315	2.0	2.9	3.5	.17	1.14	69040	26.27
525	1.6	2.2	2.7	.28	0.9	69050	26.27
790	1.2	1.8	2.2	.42	0.7	69060	26.27
1050	1	1.6	1.9	.56	0.6	69070	26.27
1300	.95	1.4	1.7	.7	0.4	69080	26.27

SIZE B

228	3.5	5.2	6.8	.070	1.1	69105	28.91
323	2.7	4.0	5.0	.105	0.9	69115	28.91
460	2.5	3.7	4.8	.15	0.8	69125	28.91
787	1.9	2.8	3.7	.26	0.6	69135	28.91
1050	1.6	2.4	3.2	.34	0.5	69145	28.91
1310	1.5	2.2	2.8	.43	0.45	69155	28.91
1600	1.3	2.0	2.6	.52	0.4	69165	28.91
1840	1.2	1.8	2.4	.60	0.38	69175	28.91
2100	1.1	1.7	2.2	.70	0.33	69185	28.91

SIZE C

165	5.0	7.0	9.5	.040	1.4	69205	31.76
191	4.7	7.0	8.8	.050	1.3	69215	31.76
262	4.0	5.6	7.5	.07	1.1	69225	31.76
390	3.3	4.6	6.2	.10	0.9	69235	31.76
525	2.8	4.0	5.3	.14	0.8	69245	31.76
790	2.3	3.2	4.3	.20	0.6	69255	31.76
1050	2.0	2.8	3.8	.27	0.55	69265	31.76
1310	1.8	2.5	3.4	.34	0.5	69275	31.76
1580	1.6	2.3	3.0	.41	0.45	69285	31.76
1838	1.5	2.1	2.8	.48	0.4	69295	31.76

SIZE D

150	6.35	9.23	11.5	.027	1.4	69310	34.95
250	4.9	7.15	9	.045	1.2	69320	34.95
500	3.5	5	6.32	.09	.8	69330	34.95
750	2.8	4.13	5.16	.135	.65	69340	34.95
1000	2.5	3.6	4.5	.18	.55	69350	34.95
2500	1.55	2.26	2.8	.45	.35	69360	34.95
5000	1.1	1.6	2	.9	.25	69370	34.95

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

Delivery— stock to one week

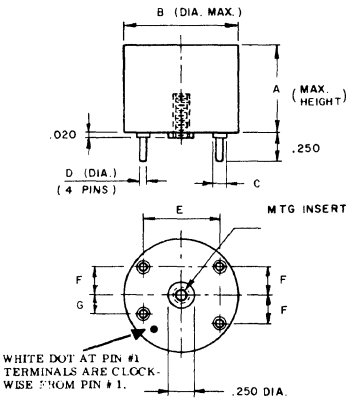
PICO Electronics, Inc.

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These PICO Power Inductors Can Handle Large Transient DC Currents

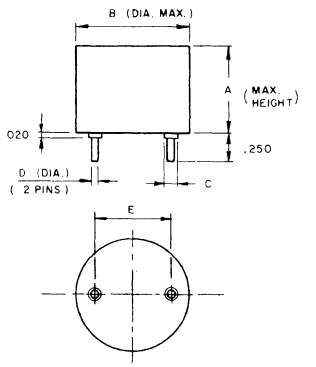
They are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

SIZE A, B, C, D

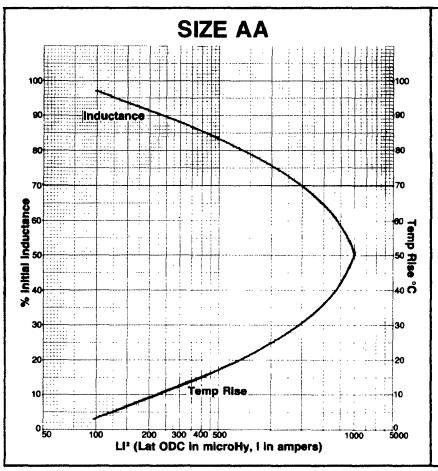


Size	A Max. Height	B Max. Dia.	C	D Terminal Dia.	E	F	G	Mtg. Insert	Wt. Nominal (Grams)
AA	.45"	.75	.1	.07	.5"	-	-	-	7
A	.56	.96	.1	.07	.6	.2	.1	4-40 UNC 5 Threads Deep	23
B	.635	1.215	.1	.07	.8	.25	.15	4-40 UNC 5 Threads Deep	44
C	.72	1.33	.125	.094	.9	.25	.15	6-32 UNC 8 Threads Deep	60
D	.76	1.5	.125	.094	1.1	.3	.2	6-32 UNC 8 Threads Deep	80

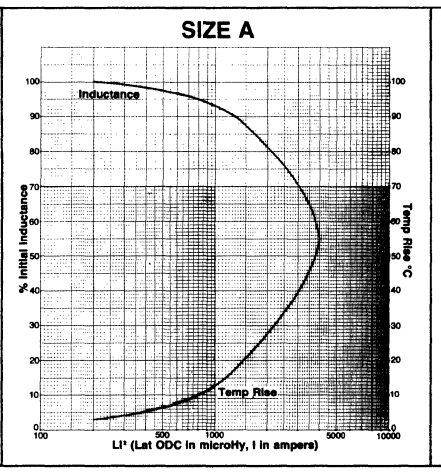
SIZE AA



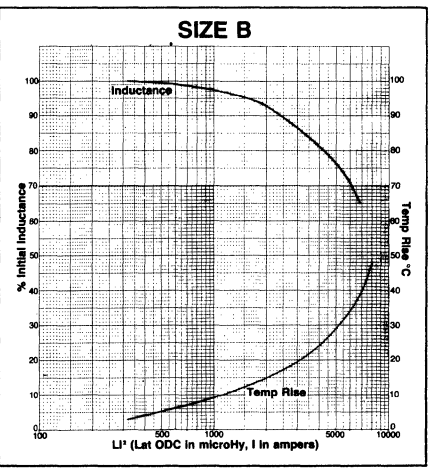
SIZE AA



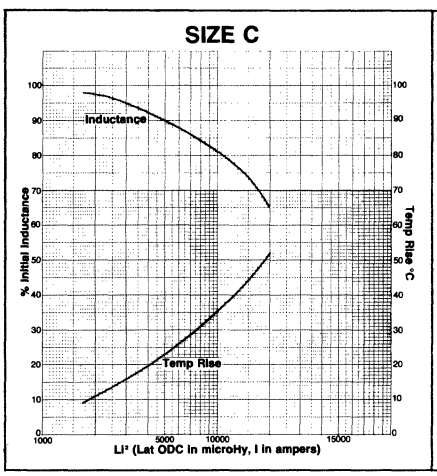
SIZE A



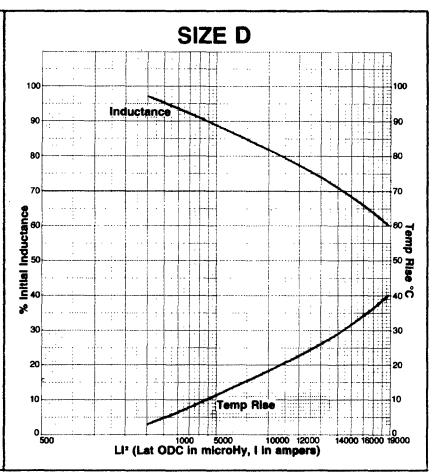
SIZE B

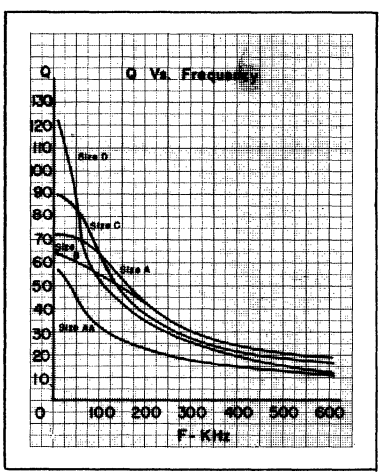


SIZE C



SIZE D





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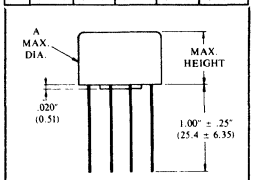
PLUG-IN
Delivery-Stock to 1 week
For Surface Mount see page A•1243

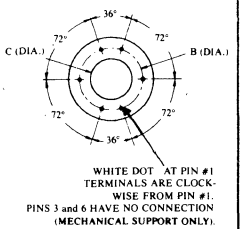
Common EMI Mode Suppression Inductors

- **Minimum possible size**
- **130°C operation (Ambient + Temp. Rise)**
- **Windings Balance ± 1%**
- **Dielectric Strength .... 1500 Volts RMS**
- **All units are magnetically shielded**

These Inductors are well suited for use in Switching Regulators, DC to DC Power Supplies and all types of Electrical Equipment where the elimination of line transmitted Electromagnetic Interference is important. Electrical equipment will generate noise due to switching operations of transistors, SCR's, relays, triacs, etc. By using these Inductors, noise being fed back to the power line is minimized to an acceptable level and this noise will not interfere with other equipment operating on the same power line.

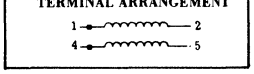
Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Terminal Dia.
1	280 (7.11)	410 (10.41)	260 (6.6)	160 (4.06)	012 (.31)
2	340 (8.63)	500 (12.7)	350 (8.89)	250 (6.35)	012 (.31)
3	415 (10.54)	630 (16.0)	440 (11.17)	340 (8.64)	016 (.41)



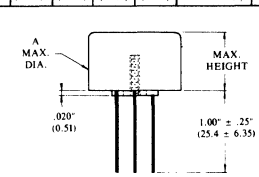


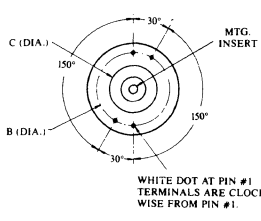
Dimensions are in inches (MM)

TERMINAL ARRANGEMENT



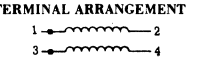
Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert	Terminal Dia.
4	500 (12.7)	800 (20.32)	560 (14.22)	460 (11.68)	2-56 UNC 8 Threads Deep	.016 (.41)
5	650 (16.51)	950 (24.13)	670 (17.0)	570 (14.48)	6-32 UNC 8 Threads Deep	.020 (.51)
6	745 (18.92)	1.125 (28.57)	800 (20.32)	700 (17.78)	6-32 UNC 8 Threads Deep	.020 (.51)





Dimensions are in inches (MM)

TERMINAL ARRANGEMENT

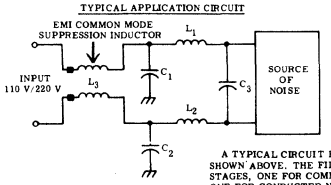


INDUCTANCE	IRMS (AMPS) TEMP. RISE 60°C	TEMP. RISE 40°C	TEMP. RISE 25°C	RDC. (OHMS) EACH WDG.	APPROX. LEAKAGE INDUCTANCE (MICRO-HENRY)	SIZE	MODEL NUMBER	PRICE 1-9
75	1.95	1.57	1.29	.051	3.5	1	46283	24.17
MICRO-	2.57	2.20	1.90	.033	3.5	2	47291	24.17
HENRY	4.43	3.79	3.23	.015	4	3	48381	29.01
	1.25	1.00	.959	.125	5	1	46263	24.17
185	1.61	1.39	1.19	.083	5	2	47271	24.17
MICRO-	2.80	2.39	2.04	.038	4.5	3	48361	29.01
HENRY	4.58	3.83	3.06	.019	4.5	4	49461	29.01
	.862	.691	.572	.263	9	1	46243	24.17
375	1.14	.986	.851	.163	8	2	47251	24.17
MICRO-	1.98	1.70	1.44	.075	8	3	48341	29.01
HENRY	3.23	2.70	2.16	.037	7.5	4	49441	29.01
	4.70	4.18	3.04	.021	6.5	5	50241	29.01
	.711	.568	.472	.31	10.3	1	46223	24.17
550	.924	.792	.686	.20	8.9	2	47231	24.17
MICRO-	1.62	1.38	1.18	.09	8.4	3	48321	29.01
HENRY	2.64	2.20	1.77	.045	7.7	4	49421	29.01
	3.80	3.39	2.46	.026	7.5	5	50221	29.01
	.619	.495	.410	.41	13.8	1	46203	24.17
	.814	.694	.601	.26	11.9	2	47211	24.17
750	1.40	1.20	1.02	.12	11.3	3	48301	24.17
MICRO-	2.29	1.91	1.53	.06	10.3	4	49401	29.01
HENRY	3.33	2.96	2.15	.034	10.0	5	50201	29.01
	5.10	4.23	3.77	.022	9.4	6	51303	31.85
	.437	.349	.290	.82	27.5	1	46183	24.17
	.575	.491	.425	.52	23.8	2	47191	24.17
1.5	.986	.847	.722	.24	22.5	3	48281	24.17
MILLI-	1.61	1.36	1.08	.12	20.6	4	49381	29.01
HENRY	2.31	2.06	1.50	.07	20	5	50181	29.01
	3.78	3.14	2.80	.04	18.8	6	51283	31.85
	.308	.246	.204	1.65	55	1	46163	24.17
	.405	.345	.299	1.05	47.5	2	47171	24.17
3	.708	.605	.516	.47	45.0	3	48261	24.17
MILLI-	1.14	.959	.766	.24	41.3	4	49361	29.01
HENRY	1.64	1.45	1.06	.14	40.0	5	50161	29.01
	2.53	2.09	1.86	.09	37.5	6	51263	31.85
	.205	.165	.136	3.71	123.8	1	46143	24.17
	.270	.231	.200	2.36	106.9	2	47151	24.17
6.75	.468	.401	.342	1.07	101.3	3	48241	24.17
MILLI-	.769	.643	.516	.53	92.8	4	49341	29.01
HENRY	1.10	.977	.711	.31	90.0	5	50141	29.01
	1.69	1.41	1.25	.20	84.4	6	51243	31.85
	.154	.123	.101	6.6	220	1	46123	24.17
12	.202	.172	.150	4.2	190	2	47131	24.17
MILLI-	.352	.299	.255	1.9	180	3	48221	24.17
HENRY	.572	.480	.378	.95	165	4	49321	29.01
	.827	.730	.528	.55	160	5	50121	29.01
	1.28	1.06	.942	.35	150	6	51223	31.85

SPECIFICATIONS

- **All units manufactured to MIL-T-27D and are type TF5S04ZZ**
- **Inductance measured at 0.1VRMS-10kHz**
- **Unit has magnetic shield**
- **Dielectric Strength .... 1500 Volts RMS**
- **Windings Balanced ± 1%**
- **Maximum ambient plus temp. rise limited to 130°C (ie maximum ambient of part no. 46283 would be 105°C if IRMS is 1.29 AMPS)**

TYPICAL APPLICATION CIRCUIT



A TYPICAL CIRCUIT FOR THE ELIMINATION OF NOISE IS SHOWN ABOVE. THE FILTER CONTAINS TWO STAGES, ONE FOR COMMON MODE NOISE (L_3, C_1, C_2) AND ONE FOR CONDUCTED NOISE (L_1, L_2, AND C_3).

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Delivery— stock to one week

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SURFACE MOUNT
Delivery-stock to one week

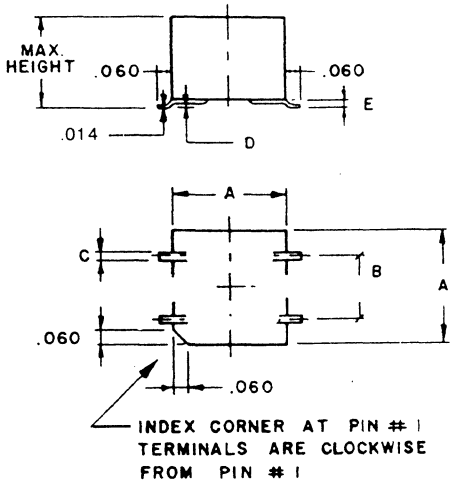
EMI Common Mode Suppression Inductors

- **Minimum possible size**
- **130°C operation (Ambient + Temp. Rise)**
- **Windings Balance ± 1%**
- **Dielectric Strength .... 1500 Volts RMS**

These Inductors are well suited for use in Switching Regulators, DC to DC Power Supplies and all types of Electrical Equipment where the elimination of line transmitted Electromagnetic Interference is important. Electrical equipment will generate noise due to switching operations of transistors, SCR's, relays, triacs, etc. By using these Inductors, noise being fed back to the power line is minimized to an acceptable level and this noise will not interfere with other equipment operating on the same power line.

Size	Max. Height	A	B	C	D	E
1	.330 (8.38)	.450 (11.4)	.300 (7.62)	.027 (.686)	.020 (.508)	.033 (.838)
2	.380 (9.65)	.550 (13.9)	.400 (10.1)	.037 (.940)	.025 (.635)	.040 (1.02)
3	.470 (11.9)	.650 (16.5)	.500 (12.7)	.037 (.940)	.025 (.635)	.040 (1.02)

All dimensions are in inches, ( ) = MM

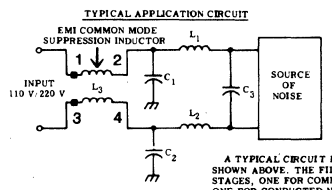


INDUCTANCE	IRMS (AMPS) TEMP. RISE 60°C	TEMP. RISE 40°C	TEMP. RISE 25°C	RDC. (OHMS) EACH WDG.	APPROX. LEAKAGE INDUCTANCE (MICRO-HENRY)	SIZE	MODEL NUMBER	PRICE 1-9
50	3.4	2.8	2.6	.0125	.40	1	46470	20.37
µH-	6.0	5.2	4.4	.0063	.34	2	47570	20.37
	9.9	8.2	7.2	.0033	.29	3	48670	22.40
75	2.6	2.1	1.9	.0212	.60	1	46465	20.37
µH	4.8	4.2	3.6	.0094	.54	2	47565	20.37
	8.0	6.7	5.9	.0049	.43	3	48665	22.40
100	2.3	1.8	1.7	.0288	.80	1	46460	20.37
µH	4.2	3.7	3.1	.0125	.68	2	47560	20.37
	6.9	5.7	5.0	.0066	.58	3	48660	22.40
250	1.4	1.1	1.1	.070	2.0	1	46455	20.37
µH	2.6	2.3	1.9	.0313	1.7	2	47555	20.37
	4.4	3.7	3.3	.0163	1.4	3	48655	22.40
500	1.1	.9	.8	.1250	4.0	1	46450	20.37
µH	1.8	1.7	1.4	.0625	3.4	2	47550	20.37
	3.1	2.6	2.3	.0325	2.9	3	48650	22.40
750	.8	.7	.6	.2125	6.0	1	46445	20.37
µH	1.5	1.3	1.1	.0938	5.1	2	47545	20.37
	2.6	2.1	1.8	.0488	4.3	3	48645	22.40
1.0	0.81	0.66	0.61	0.23	8.0	1	46440	20.37
mH	0.15	1.3	1.1	0.1	6.8	2	47540	20.37
	2.5	2.1	1.8	0.0530	5.750	3	48640	22.40
2.5	0.52	0.42	0.39	0.56	20	1	46435	20.37
mH	0.96	0.84	0.71	0.25	17	2	47535	20.37
	1.6	1.3	1.2	0.1310	14.400	3	48635	22.40
5.0	0.37	0.3	0.28	1.1	40	1	46430	20.37
mH	0.68	0.59	0.5	0.5	34	2	47530	20.37
	1.1	0.9	0.82	0.2630	28.800	3	48630	22.40
7.5	0.3	0.24	0.22	1.7	60	1	46425	20.37
mH	0.55	0.48	0.41	0.75	51	2	47525	20.37
	0.9	0.8	0.67	0.3940	43.100	3	48625	22.40
10	0.26	0.21	0.19	2.3	80.0	1	46420	20.37
mH	0.48	0.42	0.35	1.0	68.0	2	47520	20.37
	0.8	0.7	0.57	0.5300	57.5	3	48620	22.40
15	0.21	0.17	0.16	3.4	120	1	46415	20.37
mH	0.39	0.34	0.29	1.5	102	2	47515	20.37
	0.64	0.53	0.47	0.7900	86	3	48615	22.40
17.5	0.2	0.16	0.15	3.94	140	1	46410	20.37
mH	0.36	0.32	0.27	1.75	119	2	47510	20.37
	0.59	0.49	0.44	0.9190	101	3	48610	22.40
20	0.18	0.15	0.14	4.5	160	1	46405	20.37
mH	0.34	0.30	0.25	2.0	136	2	47505	20.37
	0.56	0.46	0.41	1.0500	115	3	48605	22.40

SPECIFICATIONS

- **All units manufactured to MIL-T-27 and are type TF5S04ZZ**
- **Dielectric Strength .... 1500 Volts RMS**
- **Windings Balanced ± 1%**
- **Maximum ambient plus temp. rise limited to 130°C**

TYPICAL APPLICATION CIRCUIT



A TYPICAL CIRCUIT FOR THE ELIMINATION OF NOISE IS SHOWN ABOVE. THE FILTER CONTAINS TWO STAGES, ONE FOR COMMON MODE NOISE (L_3, C_1, C_2) AND ONE FOR CONDUCTED NOISE (L_1, L_2, AND C_3).

*For immediate engineering assistance or to place an order—***Call Toll Free 800-431-1064**

Delivery—stock to one week

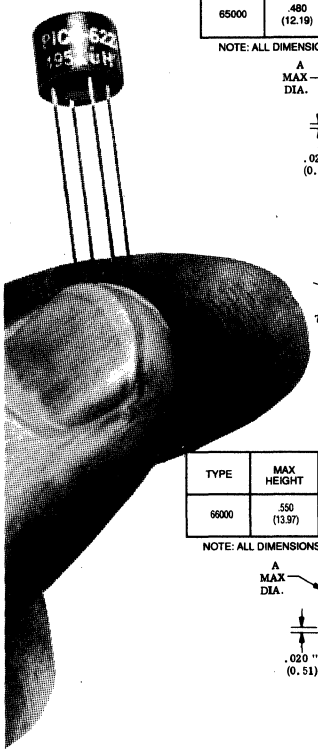
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PICO's miniature HIGH "Q" INDUCTORS

- ± 1% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Manufactured to Mil-T-27 (TF5R20ZZ)
- All units are magnetically shielded

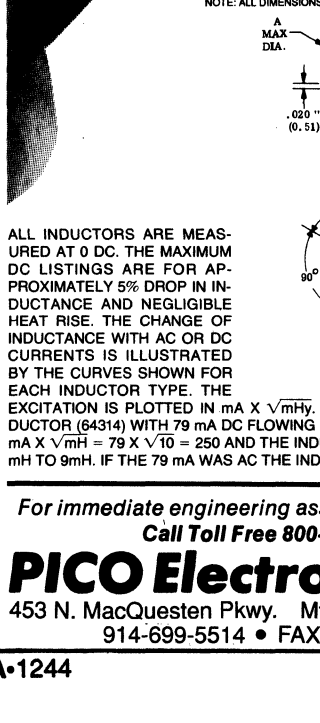
TYPE	MAX HEIGHT	A MAX. DIA.	B BOLT CIRCLE	C STAND-OFF
63000	.325 (7.87)	.430 (10.69)	.260 (6.6)	.160 (4.06)
64000	.360 (8.89)	.530 (13.5)	.350 (8.89)	.250 (6.35)
65000	.480 (12.19)	.670 (17.0)	.440 (11.17)	.340 (8.64)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM



TYPE	MAX HEIGHT	A MAX DIA	B BOLT CIRCLE	C STAND-OFF
66000	.550 (13.97)	.840 (21.34)	.560 (14.22)	.460 (11.68)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM



ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 5% DROP IN INDUCTANCE AND NEGLIGIBLE HEAT RISE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES SHOWN FOR EACH INDUCTOR TYPE. THE EXCITATION IS PLOTTED IN mA X $\sqrt{mHy}$. FOR EXAMPLE THE 10 mH INDUCTOR (64314) WITH 79 mA DC FLOWING WILL HAVE AN EXCITATION OF mA X $\sqrt{mH}$ = 79 X $\sqrt{10}$ = 250 AND THE INDUCTANCE WILL DROP FROM 10 mH TO 9mH. IF THE 79 mA WAS AC THE INDUCTANCE WOULD BE 9.65 mH.

For immediate engineering assistance or to order—
Call Toll Free 800-431-1064
PICO Electronics, Inc.
453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552
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"63000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
63120	1 Hy	1840	47	5.7	30 at (15 kHz)	35.88
63140	750 mH	1380	54	6.6	30 at (15 kHz)	34.63
63160	500 mH	920	66	8	30 at (15 kHz)	32.62
63180	200 mH	368	105	12.5	60 at (25 kHz)	32.62
63200	100 mH	185	148	18	60 at (25 kHz)	32.62
63220	75 mH	140	172	20.8	100 at (50 kHz)	32.62
63240	50 mH	90	210	25.5	100 at (50 kHz)	32.62
63260	30 mH	55	270	33	100 at (50 kHz)	32.62
63280	20 mH	37	332	40	100 at (50 kHz)	32.62
63300	15 mH	28	383	46	100 at (50 kHz)	32.62
63320	10 mH	18.5	470	57	100 at (50 kHz)	32.62
63340	5 mH	10	665	80	100 at (50 kHz)	32.62
63360	1 mH	2	1480	180	100 at (50 kHz)	35.88

"64000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
64114	5 Hy	3000	17	2.8	15 at (4 kHz)	39.05
64134	3 Hy	1800	22	3.6	30 at (6 kHz)	37.66
64154	2 Hy	1200	27	4.4	30 at (6 kHz)	35.88
64174	1 Hy	600	38	6.3	30 at (6 kHz)	32.62
64194	750 mH	450	44	7.3	30 at (6 kHz)	32.62
64214	500 mH	300	54	9	30 at (6 kHz)	32.62
64234	250 mH	150	76	13	65 at (15 kHz)	32.62
64254	100 mH	60	120	20	65 at (15 kHz)	32.62
64274	75 mH	45	139	23	120 at (25 kHz)	32.62
64294	50 mH	30	170	28	120 at (25 kHz)	32.62
64314	10 mH	6	380	63	200 at (50 kHz)	32.62
64334	5 mH	3	537	89	200 at (50 kHz)	32.62
64354	1 mH	.6	1200	200	200 at (50 kHz)	35.88

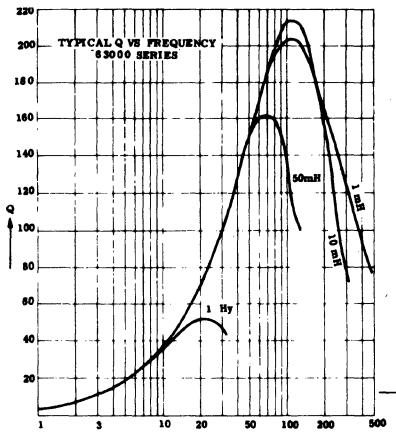
"65000" SERIES

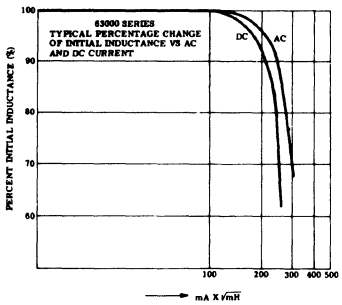
PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
65413	10 Hy	3800	11.7	2.8	28 at (4 kHz)	39.05
65433	5 Hy	1900	16.5	3.9	28 at (4 kHz)	37.66
65453	3 Hy	1140	21	5.1	28 at (4 kHz)	35.88
65473	2 Hy	760	26	6.3	56 at (6 kHz)	35.88
65493	1 Hy	380	37	8.8	56 at (6 kHz)	32.62
65513	500 mH	190	52	12.5	56 at (6 kHz)	32.62
65533	250 mH	95	74	17.7	140 at (15 kHz)	32.62
65553	100 mH	38	117	28	140 at (15 kHz)	32.62
65573	50 mH	19	165	39.6	240 at (25 kHz)	32.62
65593	10 mH	3.8	370	88.5	240 at (25 kHz)	32.62

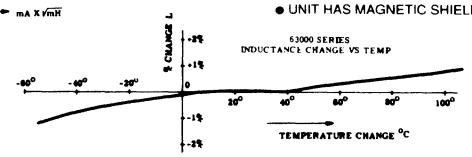
"66000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
66218	10 Hy	2200	11	4.2	40 at (4 kHz)	39.05
66238	5 Hy	1100	15.7	6	40 at (4 kHz)	37.66
66258	3 Hy	660	20	7.7	70 at (6 kHz)	37.66
66278	2 Hy	440	25	9.4	70 at (6 kHz)	32.66
66298	1 Hy	220	35	13	70 at (6 kHz)	32.66
66318	500 mH	110	49	18.8	70 at (6 kHz)	32.66
66338	250 mH	55	70	26.6	200 at (15 kHz)	32.66
66358	100 mH	22	110	42	200 at (15 kHz)	32.66
66378	50 mH	11	156	59	200 at (15 kHz)	32.66
66398	10 mH	2.2	350	133	200 at (15 kHz)	32.66

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instruction: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

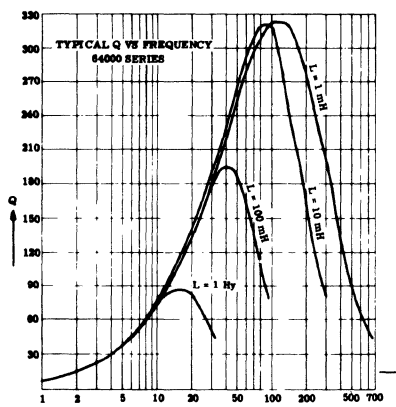


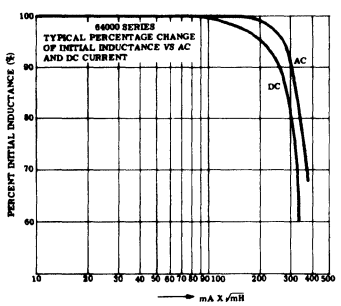


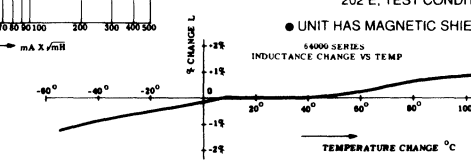


SPECIFICATIONS: **"63000" SERIES**

- INDUCTANCE TOLERANCE
  ± 3% AT .IV - 4 kHz.
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30° TO + 105°C
  + 1% - 55°C To + 105°C
  - 2%
- MANUFACTURED TO MIL-T-27 (MIL TYPE TF5R20ZZ)
- WEIGHT 3.5 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202 E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

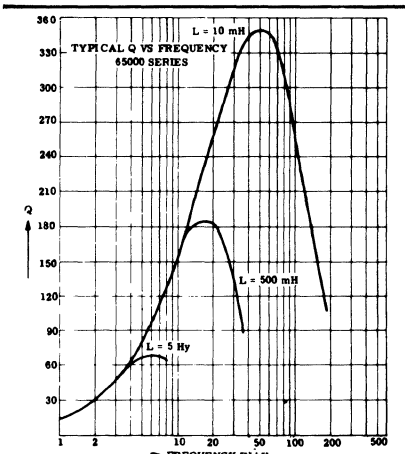


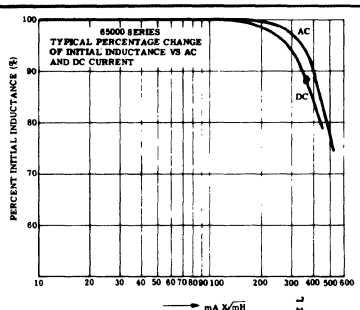


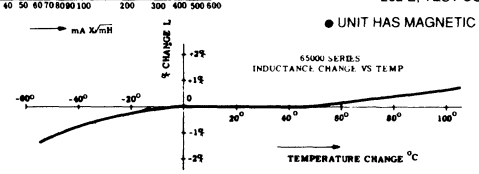


SPECIFICATIONS: **"64000" SERIES**

- INDUCTANCE TOLERANCE
  ± 3% AT .IV - 2 kHz.
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30° TO + 105°C
  + 1% - 55°C TO + 105°C
  - 2%
- MANUFACTURED TO MIL-T-27 (MIL TYPE TF5R20ZZ)
- WEIGHT 6 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202 E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

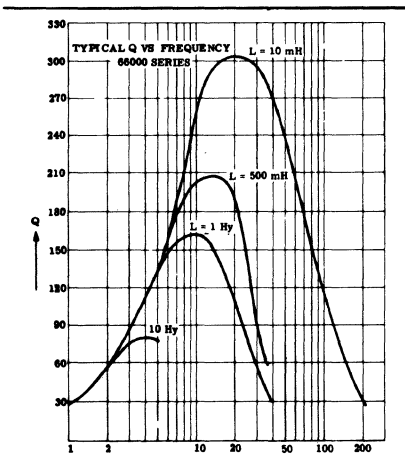


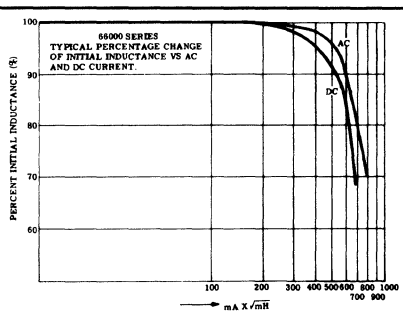


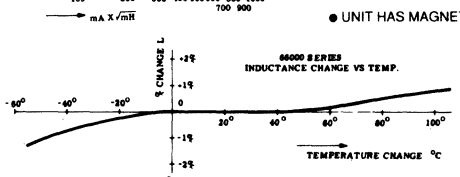


SPECIFICATIONS: **"65000" SERIES**

- INDUCTANCE TOLERANCE
  ± 3% AT .IV - 1 kHz.
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30° TO + 105°C
  + 1% - 55°C TO + 105°C
  - 2%
- MANUFACTURED TO MIL-T-27 (MIL TYPE TF5R20ZZ)
- WEIGHT 12 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202 E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD



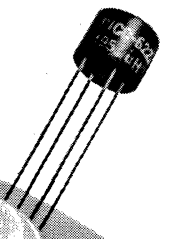




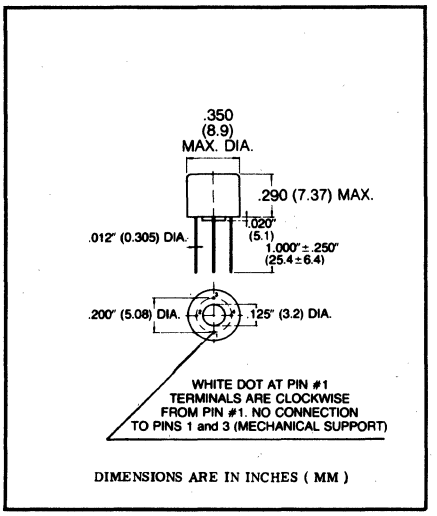
SPECIFICATIONS: **"66000" SERIES**

- INDUCTANCE TOLERANCE
  ± 3% AT .IV - 4 kHz.
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30° TO + 105°C
  + 1% - 55°C TO + 105°C
  - 2%
- MANUFACTURED TO MIL-T-27 (MIL TYPE TF5R20ZZ)
- WEIGHT 22 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202 E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

PICO's ultra-miniature HIGH "Q" INDUCTORS



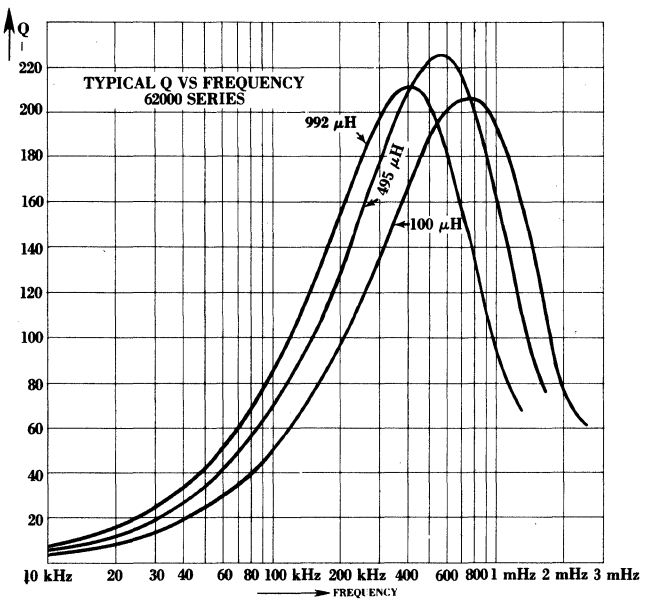
- ± 2% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Manufactured to Mil-T-27 (TF5R20ZZ)
- All units are magnetically shielded
- Non-standard inductance values available at 10% higher cost than nearest standard inductor.



Delivery— stock to one week

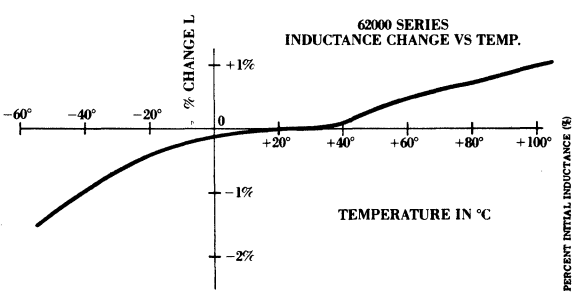
"62000" SERIES

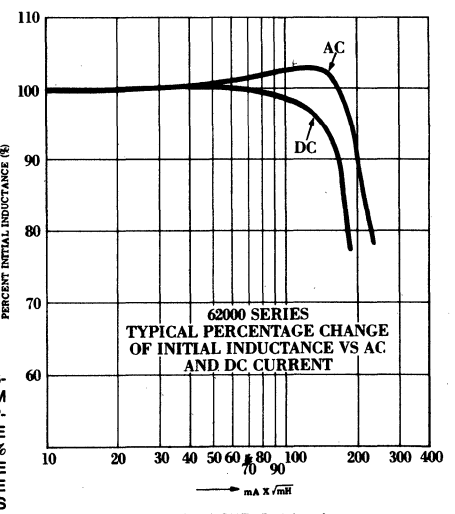
PART NUMBER	INDUCTANCE (MICRO-HENRYS)	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (MHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	PRICE (1-9)
62112	2500	18	1.15	80	130 at (400 kHz)	31.90
62132	1500	10	1.5	100	130 at (400 kHz)	31.90
62152	992	7	1.8	125	160 at (400 kHz)	31.90
62172	900	6.5	1.9	130	160 at (400 kHz)	31.90
62192	800	6.0	2.1	140	160 at (400 kHz)	31.90
62212	742	5.7	2.3	150	150 at (500 kHz)	31.90
62232	702	5.5	2.5	155	150 at (500 kHz)	31.90
62252	700	5.0	2.7	160	160 at (500 kHz)	31.90
62272	695	4.5	3	170	160 at (500 kHz)	31.90
62292	400	3.7	3.3	185	160 at (500 kHz)	31.90
62312	298	2.8	3.8	215	170 at (500 kHz)	31.90
62332	248	2.3	4.2	235	170 at (500 kHz)	31.90
62352	196	1.8	4.75	265	160 at (500 kHz)	31.90
62372	150	1.4	5.5	300	160 at (500 kHz)	31.90
62392	100	1.2	6.8	330	140 at (400 kHz)	31.90



SPECIFICATIONS

- **INDUCTANCE TOLERANCE**
  ±4% AT 0.1V-100KHZ
- **INDUCTANCE STABILITY VS TEMPERATURE**
  ±2% -55°C to 105°C
- **MANUFACTURED TO MIL-T-27**
  TF5R20ZZ
- **WEIGHT 2 GRAMS**
- **THERMAL SHOCK**
  100 CYCLES, METHOD 107D
  MIL-STD 202E
  TEST CONDITION A3
- **UNIT HAS MAGNETIC SHIELD**





ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 30°C HEAT RISE AND APPROXIMATELY 2% DROP IN INDUCTANCE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES. THE EXCITATION IS PLOTTED IN mA $\times\sqrt{mHy}$. FOR EXAMPLE THE 0.495 mH INDUCTOR (62272) WITH 170 mA DC FLOWING WILL HAVE AN EXCITATION OF mA $\times\sqrt{mHy}$ = 120, AND THE INDUCTANCE WILL DROP FROM 495 uH to 485 uH. IF THE 170 mA WAS AC, THE INDUCTANCE WOULD BE 510 uH.

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

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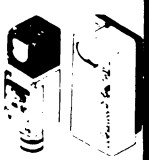
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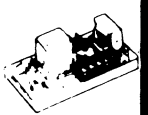
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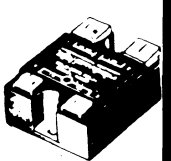
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TOGGLE SWITCHES

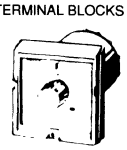

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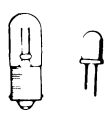
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Kulka
Magnum
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RDI
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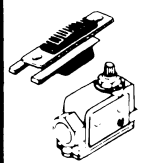
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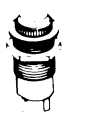

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PICONICS

Micro Inductor Products and Application

The principal application for Piconics' Inductors has traditionally been in linear hybrid amplifier, micro-strip and stripline circuits. These designs have been used in a wide range of systems from the Space Shuttle Program to commercial microwave applications. Major use is in military systems where excellence and tight quality controls are required.

Piconics' components feature excellent stability, high Q and controlled characteristics. They are packaged in various configurations with a wide range of lead materials. Internal connections are welded to avoid the problems associated with high temperature soldering. Encapsulation is mechanically interlocked to strengthen all surface (shear) bonds. The materials and methods used at Piconics are compatible with normal requirements in hybrid circuit manufacturing.

Piconics' custom design capability has led to the development of unique products. Should your inductor requirements be outside the parameters of our standard listings, contact Piconics directly for a prompt quotation to your needs.

Leaded Inductor Selection Table — Tunable/Fixed

MIL-C-15305

Series	Length	Width	Height	Inductance	Case	Adjustment	QPL
B	.325-.475	.110	.150	.025μH to 1mH	Molded	Screw (side)	Yes
G/SG	.180	.090	.105	.025μH to 1mH	Conformal Coating	Slide	In Process
ST	.200	.100	.275	.020μH to 1mH	Molded	Screw (top)	Yes
TT	.285	.110	.325-.450	.020μH to 1mH	Molded	Screw (top)	Yes

Series	Length	Width	Height	Inductance	NOTES	QPL
C	.200	.090	.105	.010μH to 1mH	Conformal Coating	In Process
D	.200	.085 or .095	.085 or .095	.010μH to 1mH	Molded Case	In Process
JA	.110 or .180	.060 or .075	.060 or .075	.007μH to 1mH	Epoxy Coated, Open Frame Case, Self-Leaded	In Process
JC	.180	.085	.085	.007μH to 1mH	Bonded, Open Frame Case Self-Leaded	In Process

Chip Inductor Selection Table — Tunable/Fixed

MIL-C-83446

Series	Length	Width	Height	Inductance	Case	Adjustment	QPL
PGV	.160	.125	.330	.016μH to 1mH	Molded	Screw (top)	Yes
PSV	.320	.165	.130	.016μH to 1mH	Molded	Screw (side)	Yes
PV	.180	.140	.065 or .095	.016μH to 1mH	Conformal Coating	Slide	Yes
PVW	.150-.300	.140	.065 or .095	.010μH to 1mH	Conformal Coating	Slide	Yes

Series	Length	Width	Height	Inductance	NOTES	QPL
P	.180	.140	.065 or .095	.010μH to 1mH	Conformal Coating	Yes
PA	.100	.100	.100	.010μH to 1mH	Molded Epoxy - Minimum Area Profile	Yes
PG	.160	.125	.130	.010μH to 1mH	Molded Diallyl Phthalate (DAP) Solder Fillet, Interlock Substrate Easily handled by automatic equipment	Yes
PK	.160	.125	.130	.010μH to 1mH	Molded Epoxy Case, Solder Fillet Interlock Substrate Easily handled by automatic equipment	Yes
PW	.180	.140	.065 or .095	.010μH to 1mH	Conformal Coating Bonding Pad Completes Connection	Yes

Leaded Inductor Selection Table — Fixed

Series	Length	Width	Height	Inductance	NOTES	QPL
M	.004-.170	.024	.024	6.3nH to 684nH	BONDED, SELF-LEADED AIR CORE HIGH FREQUENCY CHOKE, CONSTRUCTED OF 47AWG COPPER WIRE, INSULATED.	In Process
MG	.004-.170	.024	.024	6.3nH to 684nH	BONDED, SELF-LEADED AIR CORE HIGH FREQUENCY CHOKE, CONSTRUCTED OF 47AWG GOLD WIRE, INSULATED.	In Process
S	.200	.100	.100	5nH to 330nH	EPOXY CONFORMAL COATING SELF-LEADED TINNED AIR CORE HIGH FREQUENCY CHOKE.	In Process

Chip/Spiral Inductor Selection Table — Tunable/Fixed

Series	Length	Width	Ht/Th	Inductance	NOTES	QPL
MC	.100 or .160	.095 or .125	.045 or .060	6.3nH to 684nH	CHIP MOUNTED COIL	In Process
SP	.045	.045	.010	5.5nH to 100nH	QUARTZ AND 99.6% ALUMINA SUBSTRATE MATERIALS. $3\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{2}$, $8\frac{1}{2}$, TURNS AVAILABLE ON .045" X .045" OR .050" X .075". $11\frac{1}{2}$, $18\frac{1}{2}$, $22\frac{1}{2}$ TURNS ONLY ON .050" X .075" VALUES ABOVE 50nH AVAILABLE ON .050" X .075" ABOVE 100nH ON .075" X .075"	No
	.050	.075	.010			
	.075	.075	.010 or .030	50nH to 200nH		

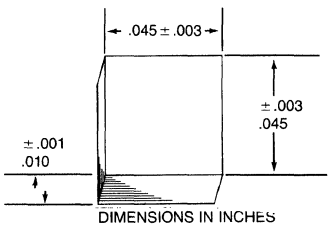
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PICONICS

SP SERIES/M/MG SERIES MC SERIES

SP Series Spiral Chip Inductor

This style inductor may be used where low inductance values are required and gold wire bonding is the method for making interconnections. When used as an r.f. choke, attach center pad to r.f. and outside pad to power supply. Custom designs available. Other ceramic materials having various dielectric constants are available.



DIMENSIONS IN INCHES

NOTES:

(1) Self-resonant frequency may be increased by mounting inductor on an insulating stand-off. These Stand-offs can be provided by Piconics.
(2) Inductors to 25 turns in this geometry are available on special order.
(3) Attachment is generally made using non-conductive epoxy such as EPO-TEK H-61 or EPO-TEK H-20.
(4) Thermosonic wire bonding using 1 mil gold wire is recommended for lead attachment to this style inductor. Gold ribbon may also be used.
(5) Resonances shown in the tables are the lowest self resonances encountered. Typical values are higher.
(6) Measurements are very dependent on fixturing and frequency.
(7) Quartz typically gives higher SRF and Q's than ceramic due to lower Dielectric Constant.
(8) Bonding area typically .005" in diameter.
(9) Other thicknesses, values, sizes available on request.

SP Series on Quartz

Part No.	Turns (2)	@200MHz Inductance (L) nH (6)	Q Min (7)	Series Resonance Min GHz (1-5-7)	Parallel Resonance Min GHz (5)	DCR MAX OHM
SP3P5-Q	3 1/2	7	3.5	17	9	2.5
SP4P5-Q	4 1/2	11	3.4	15	9	4
SP5P5-Q	5 1/2	15.7	3.2	11	7	6
SP8P5-Q	8 1/2	45	2.8	8	5	20
SP11P5-Q	11 1/2	80	2.5	3.5	3.5	28

SP Series on Ceramic

Part No.	Turns (2)	@200MHz Inductance (l) nH (6)	Q Min (7)	Series Resonance Min GHz (5)	Parallel Resonance Min GHz (5)	DCR MAX OHM
SP3P5-A	3 1/2	7	3.5	13	5	2.5
SP4P5-A	4 1/2	11	3.4	12	7	4
SP5P5-A	5 1/2	15.7	3.2	9	5	6
SP8P5-A	8 1/2	45	2.8	6	3.5	20
SP11P5-A	11 1/2	80	2.5	3	2.5	28

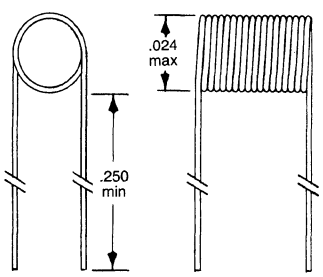
Microwave Components — M/MG Series

Piconics' M series is a miniature broadband air core choke with a high self-resonant frequency, suitable for microwave applications.

Piconics' M series chokes provide inductance values from 6.3nH to 684nH, operating frequencies from 100 MHz, and self-resonant frequencies from 1 GHz to 28GHz.

Constructed of 47 AWG insulated copper wire rated at 130°C. Piconics' M series chokes are available from 2 to 100 turns for standard models. Special models can also be provided.

Applications include oscillators, mixers, switches, stripline devices, broadband modulators, power supplies, filters and frequency multipliers.



PHYSICAL CHARACTERISTICS

- Air Core
- Self-Leaded
- Solder Strippable Leads (SS)
- Recommended operating and storage Temperature Range: −55°C to +125°C

OPTIONS AVAILABLE

- Axial Leads
- Tinned Leads (We recommend pre-tinning of leads prior to circuit insertion)
- Gold Plated Leads, M xxx 47GP
- Gold Coils, MG xxx 47SS, (99.99% Pure), bare or insulated.
- Higher temperature class insulation available upon request.

ELECTRICAL CHARACTERISTICS

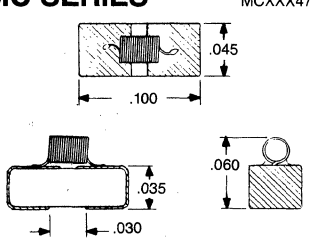
Piconics' Part Number	Length Nom. Inches	L nH ± 10%	Test Freq. MHz	Q Min	SRF Min GHz	DC Res. Ohms Max	Idc Max MA
M2T47SS	.004	6.3	200	36	28	0.14	250
M3T47SS	.005	9.6	200	34	25	0.18	250
M5T47SS	.010	30	200	32	15	0.26	250
M8T47SS	.014	35	100	24	14	0.33	250
M10T47SS	.017	47	100	24	13	0.43	250
M15T47SS	.026	72	100	24	11	0.55	250
M20T47SS	.034	113	100	18	8	0.78	250
M25T47SS	.043	147	25	16	6	0.90	250
M30T47SS	.050	178	25	18	6	1.1	250
M35T47SS	.060	213	25	18	5	1.3	250
M40T47SS	.068	234	25	16	4	1.4	250
M45T47SS	.077	282	25	18	3	1.6	250
M50T47SS	.085	320	25	18	3	1.8	250
M55T47SS	.095	343	25	18	2	1.9	250
M60T47SS	.102	388	25	18	2	2.0	250
M65T47SS	.112	406	25	17	2	2.2	250
M70T47SS	.120	442	25	18	1	2.3	250
M75T47SS	.128	470	25	18	1	2.5	250
M80T47SS	.136	533	25	18	1	2.7	250
M85T47SS	.145	552	25	18	1	2.9	250
M90T47SS	.153	618	25	18	1	3.0	250
M95T47SS	.162	651	25	18	1	3.2	250
M100T47SS	.170	684	25	18	1	3.4	250

The number of turns required are counted between the leads.

NOTE: Electrical characteristics are measured at a point on the leads .100" from the body of the coil.

MC SERIES

MCXXX47PW



FEATURES

- Minimum Height
- Surface Mountable
- Ease of Handling

ABSOLUTE MAXIMUM RATINGS

- Operating Temperature range: −55°C to +125°C
- Storage Temperature range: −55°C to +125°C
- Temperature rise (at 90°C): 35°C
- Maximum Operating Temperature: 125°C
- DC MA MAX: 100

PHYSICAL CHARACTERISTICS

- Air Core
- Alumina Substrate Base
- Gold Plated Contacts over Nickel
- Weight: 0.1 gram maximum

OPTIONS AVAILABLE

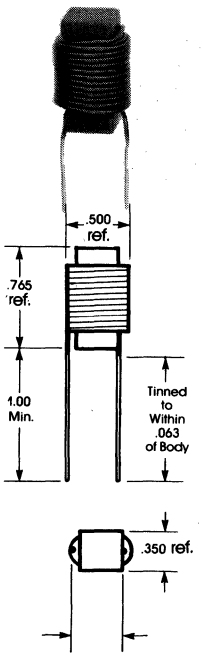
- Optional wire sizes available.
- Tinned terminations available.

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Economy High Current Inductors

Optional Base Mounting and Shielded Construction

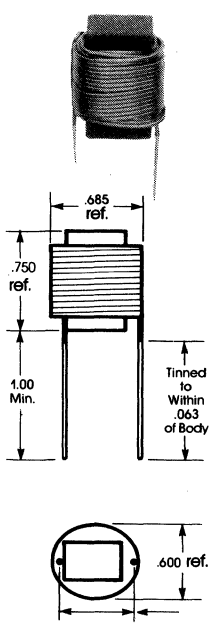
SPE 100-Series



Part No.	L µ HY	dc Amps	Nom DCR	Nom Lead Dia.
SPE 100	1.5	12	.003	.064
SPE 101	2	10	.004	.057
SPE 102	3	8.5	.005	.051
SPE 103	3.5	7.0	.006	.045
SPE 104	4.2	5.5	.007	.040
SPE 105	10	4.3	.010	.036
SPE 106	20	4.3	.017	.036
SPE 107	28	3.4	.024	.032
SPE 108	34	2.6	.031	.029
SPE 109	50	2.1	.046	.050
SPE 110	100	2.1	.069	.050
SPE 111	125	1.7	.090	.045
SPE 112	160	1.35	.120	.040
SPE 113	250	1.0	.189	.035
SPE 114	350	1.0	.235	.035
SPE 115	500	.850	.392	.032
SPE 116	600	.670	.453	.030
SPE 117	750	.530	.641	.025
SPE 118	1000	.420	.890	.025
SPE 119	.9	13	.003 max.	.064

Nominal lead spacing is .410; however, due to lead length, lead spacing is variable.

SPE 200-Series



Part No.	L µ HY	dc Amps	Nom DCR	Nom Lead Dia.
SPE 200	27	5.5	.020	.040
SPE 201	33	5.5	.022	.040
SPE 202	39	5.5	.025	.040
SPE 203	47	5.0	.030	.040
SPE 204	56	4.8	.036	.036
SPE 205	68	4.4	.040	.036
SPE 206	82	4.0	.052	.032
SPE 207	100	3.8	.061	.032
SPE 208	120	3.5	.066	.032
SPE 209	150	3.0	.075	.032
SPE 210	180	2.8	.100	.029
SPE 211	220	2.35	.110	.029
SPE 212	270	2.0	.150	.026

Nominal lead spacing is .600; however, due to lead length, lead spacing is variable.

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Options Available - A - B - C - D - E - O Option Table

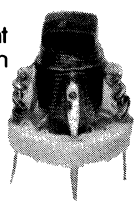
- A. Plastic dip coating.
- B. Mounted on 94 V-0 base, 3 terminals (2 used). Base dia. .780 max.
- C. Shield can supplied with unit.
- D. Mounted on 94 V-0 base and shield can supplied with unit.
- E. Pre-dipped core for high voltage applications.
- O. No options. Plain self leads as shown.

Note: Shield can will reduce "L" up to a maximum of 15% on the 100 and 200 series and 30% on the 300 series of the specified value depending upon which series is being evaluated.

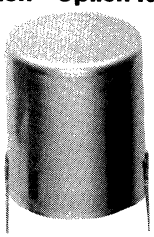
Ordering information example:

SPE-300-A.
Family Part Identification Option Identification

Base Mount Option



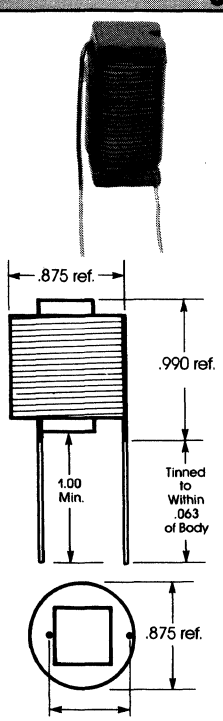
Shield Can Option



Base Option - B
- Base diameter .780 max.
- 3 terminals on .640 dia. circle
- .050 standoffs above board
- Base height above board .190 max.

Aluminum Shield Can Option - C for EMI Suppression
- Can height above board 1.07 max.
- Can diameter .900 max.
- Can lug mounting .895 ± .010 btn centers
- Can lugs .016 TK x .060 wide
- Can standoff above board .030

SPE 300-Series



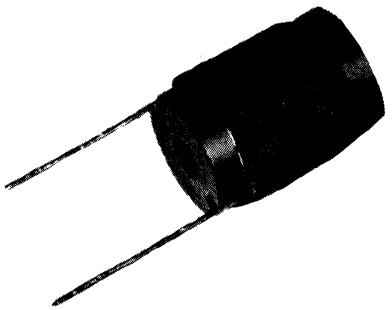
	Part No.	L µ HY	dc Amps	Nom DCR	Nom Lead Dia.
*	SPE 300	47	9.0	.019	.057
†	SPE 301	56	8.0	.024	.050
	SPE 302	68	6.0	.031	.045
†	SPE 303	82	6.0	.034	.045
†	SPE 304	100	6.0	.039	.045
	SPE 305	120	5.0	.048	.040
	SPE 306	150	5.0	.054	.040
	SPE 307	180	4.3	.072	.036
	SPE 308	220	4.3	.081	.036
†	SPE 309	270	4.3	.091	.036
	SPE 310	330	3.4	.120	.032
	SPE 311	390	3.4	.134	.032
*	SPE 312	470	3.4	.153	.032
	SPE 313	560	2.7	.196	.028
	SPE 314	680	2.5	.228	.028
	SPE 315	820	2.5	.300	.050
	SPE 316	1000	2.0	.332	.050
†	SPE 317	1200	2.0	.383	.050
	SPE 318	1500	1.5	.510	.045

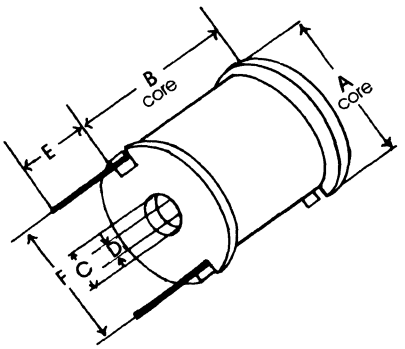
*option C not available
† option C available only without option A
Note: Options B and D not available on SPE 300 series units.

Nominal lead spacing is .700; however, due to lead length, lead spacing is variable.

Ferrite Power Inductors

Drum Core Type





Standard component ferrite core power inductors rated up to 12 amps dc for switch mode power supplies and other applications.

SPB-100 Series 2 μHY - 800 μHY

Part No.	Inductance	dc Amps	Nom DCR	Lead Size
SPB-100	2 μHY	12.0	.005	14 gauge
SPB-101	3 μHY	10.0	.007	15 gauge
SPB-102	4 μHY	8.5	.010	16 gauge
SPB-103	8 μHY	7.0	.012	17 gauge
SPB-104	18 μHY	7.0	.013	17 gauge
SPB-105	22 μHY	5.5	.016	18 gauge
SPB-106	30 μHY	4.3	.021	19 gauge
SPB-107	37 μHY	3.4	.032	20 gauge
SPB-108	50 μHY	2.6	.042	20 gauge
SPB-109	80 μHY	2.6	.059	20 gauge
SPB-110	100 μHY	2.1	.080	20 gauge
SPB-111	135 μHY	2.1	.093	20 gauge
SPB-112	160 μHY	1.7	.126	20 gauge
SPB-113	220 μHY	1.7	.154	20 gauge
SPB-114	300 μHY	1.7	.183	20 gauge
SPB-115	380 μHY	1.35	.252	20 gauge
SPB-116	450 μHY	1.35	.286	20 gauge
SPB-117	600 μHY	1.07	.406	20 gauge
SPB-118	800 μHY	1.07	.470	20 gauge

Dimensions

A .550 ref.
B .788 ref.
C .187 ref.
D .126 ref.
E .6875/.8125
F .540/.560

Mounts using a #4 screw

SPB-200 Series 4 μHY - 1.8 MHY

Part No.	Inductance	dc Amps	Nom DCR	Lead Size
SPB-200	4 μHY	12.0	.006	14 gauge
SPB-201	5 μHY	10.0	.008	15 gauge
SPB-202	20 μHY	8.5	.013	16 gauge
SPB-203	30 μHY	7.0	.019	17 gauge
SPB-204	40 μHY	5.5	.025	18 gauge
SPB-205	75 μHY	4.3	.042	19 gauge
SPB-206	120 μHY	4.3	.053	19 gauge
SPB-207	150 μHY	3.4	.072	20 gauge
SPB-208	200 μHY	2.6	.105	20 gauge
SPB-209	300 μHY	2.1	.158	20 gauge
SPB-210	400 μHY	2.1	.181	20 gauge
SPB-211	600 μHY	1.7	.272	20 gauge
SPB-212	800 μHY	1.7	.322	20 gauge
SPB-213	950 μHY	1.35	.433	20 gauge
SPB-214	1.5 MH	1.07	.683	20 gauge
SPB-215	1.8 MH	1.07	.760	20 gauge

Dimensions

A .710 ref.
B .866 ref.
C .187 ref.
D .126 ref.
E .6875/.8125
F .640/.660

Mounts using a #4 screw

SPB-300 Series 40 μHY - 2.5 MHY

Part No.	Inductance	dc Amps	Nom DCR	Lead Size
SPB-300	40 μHY	12.0	.013	14 gauge
SPB-301	60 μHY	10.0	.019	15 gauge
SPB-302	80 μHY	10.0	.022	15 gauge
SPB-303	120 μHY	8.5	.032	16 gauge
SPB-304	150 μHY	8.5	.038	16 gauge
SPB-305	175 μHY	7.0	.046	17 gauge
SPB-306	200 μHY	7.0	.049	17 gauge
SPB-307	300 μHY	5.5	.073	18 gauge
SPB-308	400 μHY	5.5	.086	18 gauge
SPB-309	475 μHY	4.3	.110	19 gauge
SPB-310	550 μHY	4.3	.120	20 gauge
SPB-311	700 μHY	3.4	.165	20 gauge
SPB-312	825 μHY	3.4	.183	20 gauge
SPB-313	900 μHY	3.4	.195	20 gauge
SPB-314	1.2 MHY	2.6	.281	20 gauge
SPB-315	1.5 MHY	2.6	.323	20 gauge
SPB-316	1.7 MHY	2.6	.343	20 gauge
SPB-317	2.0 MHY	2.1	.440	20 gauge
SPB-318	2.5 MHY	2.1	.525	20 gauge

Dimensions

A .945 ref.
B .946 ref.
C .187 ref.
D .126 ref.
E .6875/.8125
F SPB-300-310 .740/760
SPB-311-318 .940/.960

Mounts using a #4 screw

SPB-400 Series 100 μHY - 3.0 MHY

Part No.	Inductance	dc Amps	Nom DCR	Lead Size
SPB-400	100 μHY	12.0	.022	14 gauge
SPB-401	150 μHY	10.0	.034	15 gauge
SPB-402	200 μHY	10.0	.038	15 gauge
SPB-403	300 μHY	8.5	.056	16 gauge
SPB-404	375 μHY	8.5	.065	16 gauge
SPB-405	450 μHY	8.5	.070	16 gauge
SPB-406	500 μHY	7.0	.089	17 gauge
SPB-407	600 μHY	7.0	.098	17 gauge
SPB-408	700 μHY	5.5	.130	18 gauge
SPB-409	850 μHY	5.5	.145	18 gauge
SPB-410	1.0 MHY	5.5	.166	18 gauge
SPB-411	1.3 MHY	4.3	.218	19 gauge
SPB-412	1.6 MHY	4.3	.250	20 gauge
SPB-413	2.0 MHY	3.4	.340	20 gauge
SPB-414	3.0 MHY	3.4	.433	20 gauge

Dimensions

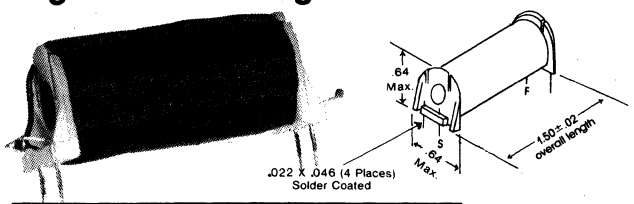
A 1.380 ref.
B .985 ref.
D .180-.285
E .6875/.8125
F 1.130-1.150

Mounts using a #8 screw

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3521 North Chapel Hill Road
McHenry, Illinois 60050
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FAX (815) 385-8578

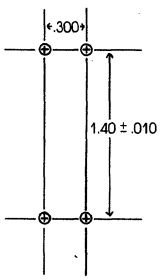
Ferrite Power Inductors

Slug Core PC Mounting

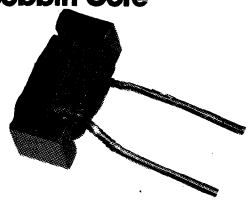


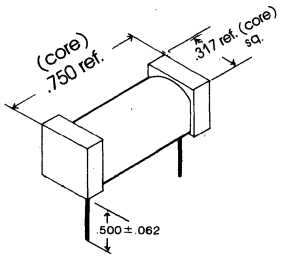
SPS-100 Series 110 μHY - 100 MHY

Part No.	Inductance	dc Amps	Nom DCR
SPS-100	110 μHY	4.9	.055
SPS-101	140 μHY	4.3	.075
SPS-102	300 μHY	3.0	.143
SPS-103	420 μHY	2.5	.210
SPS-104	600 μHY	2.1	.310
SPS-105	1.0 MHY	1.6	.500
SPS-106	1.3 MHY	1.35	.700
SPS-107	1.9 MHY	1.2	.900
SPS-108	3.0 MHY	.96	1.40
SPS-109	5.0 MHY	.75	2.35
SPS-110	8.0 MHY	.59	3.70
SPS-111	10.0 MHY	.52	5.20
SPS-112	18.0 MHY	.39	8.70
SPS-113	28.0 MHY	.31	13.70
SPS-114	45.0 MHY	.25	22.0
SPS-115	60.0 MHY	.21	31.0
SPS-116	100.0 MHY	.16	52.0



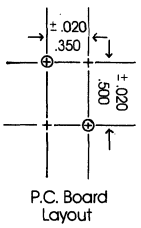
Bobbin Core





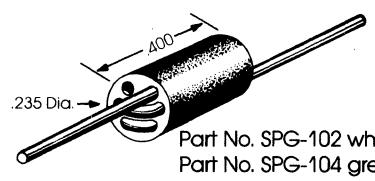
SPS-200 Series 1.5 μHY - 1.0 MHY

Part No.	Inductance	dc Amps	Nom DCR	Lead Size
SPS-200	1.5 μHY	12.0	.003	.065
SPS-201	2.0 μHY	10.0	.004	.057
SPS-202	3.0 μHY	8.5	.005	.051
SPS-203	3.5 μHY	7.0	.006	.045
SPS-204	4.2 μHY	5.5	.007	.040
SPS-205	10.0 μHY	4.3	.011	.036
SPS-206	20.0 μHY	4.3	.017	.036
SPS-207	28.0 μHY	3.4	.024	.032
SPS-208	34.0 μHY	2.6	.031	.032
SPS-209	50.0 μHY	2.1	.046	.032
SPS-210	100.0 μHY	2.1	.069	.032
SPS-211	125.0 μHY	1.7	.090	.032
SPS-212	160.0 μHY	1.35	.124	.032
SPS-213	250.0 μHY	1.0	.189	.032
SPS-214	350.0 μHY	1.0	.235	.032
SPS-215	500.0 μHY	.85	.392	.032
SPS-216	600.0 μHY	.67	.453	.032
SPS-217	750.0 μHY	.53	.641	.032
SPS-218	1.0 MHY	.42	.890	.032

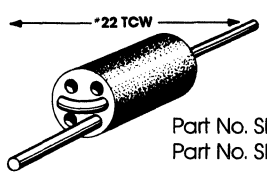


Wide Band Shield Bead Ferrite Chokes

Multi-Hole Construction



Part No. SPG-102 white
Part No. SPG-104 green



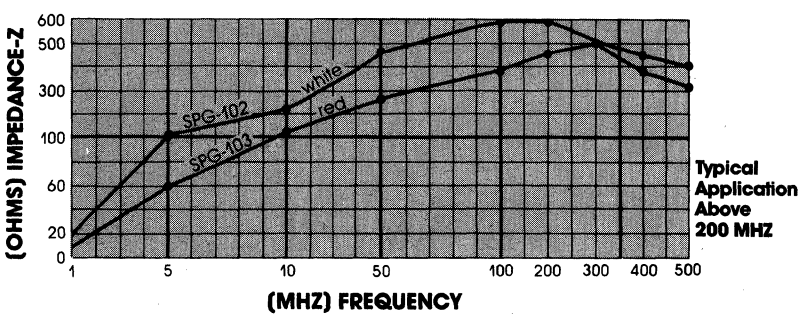
Part No. SPG-103 red
Part No. SPG-105 yellow

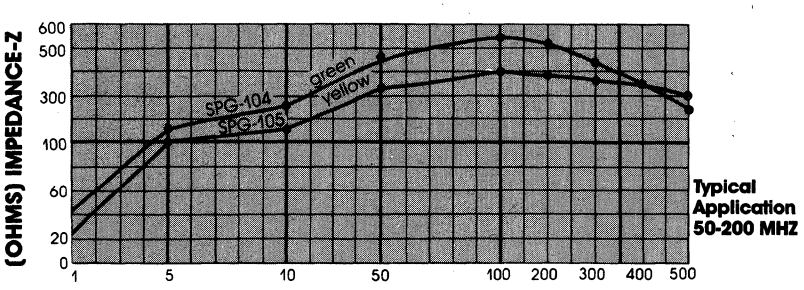
Impedances from 10 to 600 OHMS are available over frequency ranges from 1 MHZ to 500 MHZ

PREM offers a complete line of shield bead chokes for use in attenuating EMI and other unwanted signals in a circuit without contributing to power losses at lower frequencies or dc.

IMPEDANCE versus FREQUENCY

(Typical Readings)

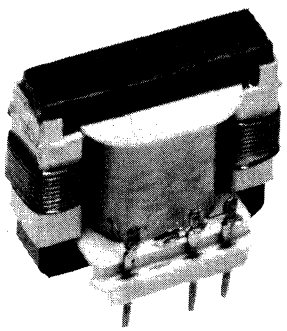




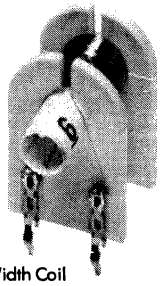
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For further information and pricing, contact Prem's Sales Services Department.

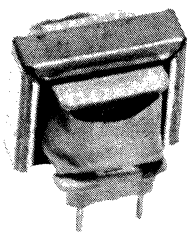
CRT Display Magnetics



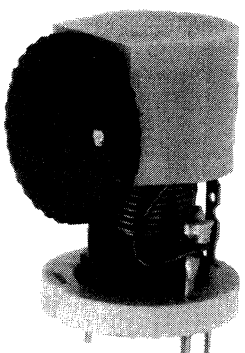
Pin Cushion Coil



Width Coil



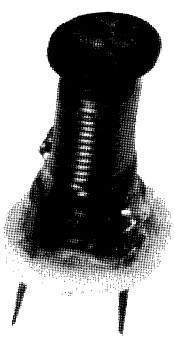
Horizontal Driver Transformer



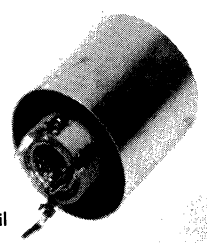
Variable Linearity Coil



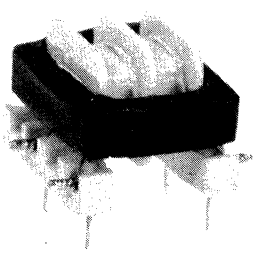
Width Coil



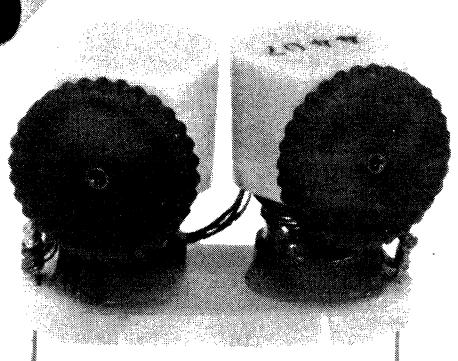
Linearity Coil



Horizontal Oscillator Coil



Horizontal Driver Transformer



Parabolic Variable Linearity Coil

For further information and pricing, contact Prem's Display Engineering Department.

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Prem Magnetics custom designs fixed linearity coils, variable linearity coils, pincushion coils, width coils, horizontal drive and oscillator coils for use in CRT display applications. Prem's engineers have vast experience in designing and manufacturing economical magnetic devices for display circuits.

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Inductor Chokes–0.05μH to 10mH



AL02–World's Smallest!
Ultra-miniature conformal coated inductors are the smallest in the industry, only 1/8" long! 0.1μH to 470μH, 5% and 10% tolerance.



AL03–Low Cost!
Miniature conformal coated inductor choke (1/4" long). Available from 0.1μH to 1000μH in 5%, 10%, 20% tolerance.



AL05–Delivery from Stock!
Conformal coated inductors offer performance similar to molded types at half the cost. Available from 0.1μH to 2200μH in 5%, 10%, 20% tolerance. Body size is .135" dia. x .35" long.



P0206–Miniature Molded
Molded construction offers performance per MIL-C-15305 at low cost due to automated production. Available from 0.1μH to 1000μH in 3%, 5%, 10%, 20% tolerance. Body size is .095" dia. x .250" long.



P0410–MIL Grade
Molded inductor per MIL-C-15305 offer excellent stabilty. Available from 0.15μH to 1000μH, in 3%, 5%, 10%, 20% tolerance. Body is .155" dia. x .375" long.



R0608–Radial Lead
Radial lead design enables significant space savings. Available from 1μH to 1000μH, in 5% and 10% tolerance. Size is .220" dia. x .300" high.

Shielded Inductor Chokes–0.1μH to 120mH



PFC0410–Economy
Conformal coated construction offers shielded performance equivalent to molded parts at a reduced cost. Wide inductance range from 0.1μH to 10mH, in tolerances of 5%-20%. Body size is .177" dia. x .440" long.



PF0410–Molded
Molded shielded construction per MIL-C-15305 offers excellent performance, wide inductance range from 0.22μH to 10mH, in tolerances of 5%-20%. Body size is .162" dia. x .410" long.



RS1014–Radial Lead
Shielded inductor in a radial lead version offers significant space savings. Wide inductance range from 10μH to 120mH, in tolerances of 5%-10%. Body size is .400" dia. x .55" high.

High Current Filter Chokes–1 Amp to 20 Amp



CA–Axial Lead
High-current power chokes are available with 1A-5A ratings, in values 5μH to 680μH, 10% tol.



CH–Radial Lead
High-current power chokes offer space savings in 3A-20A ratings, 5μH to 270μH, 10% tol.



CV–Vertical Mount
High-current power chokes require minimal PCB space due to vertical design. 1A-5A, 5μH to 680μH, 10% tol.

Surface Mount–Shielded and Unshielded



CI–Miniature
Available in 2 sizes (.080 x .100" and .100 x .160") in values .056μH to 33μH, 5% and 10%. Available on plastic Tape & Reel.

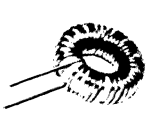


MCI–Molded
Molded chip inductors offer superior performance, 0.1μH to 1000μH, 5%-20%, 12mm plastic tape. Size is .177"L x .126"W x .126"H.

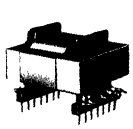


MSI–Molded Shielded
Shielded chip inductors minimize magnetic coupling, 1μH to 1000μH, 5%-20%, 12mm plastic tape. Size is .200"L x .145"W x .126"H.

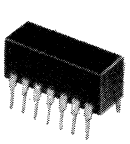
Custom Magnetics



Toroids



Transformers



Lan Networks



Variable RF Coils

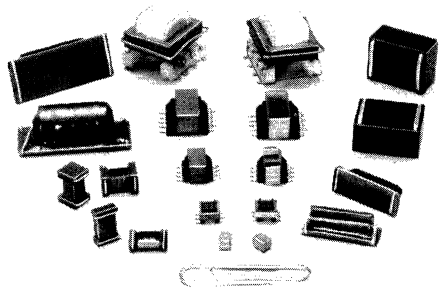
Refer to EEM section 2350 for RCD quality delay lines.
Refer to EEM section 4700 for RCD quality resistors and networks.

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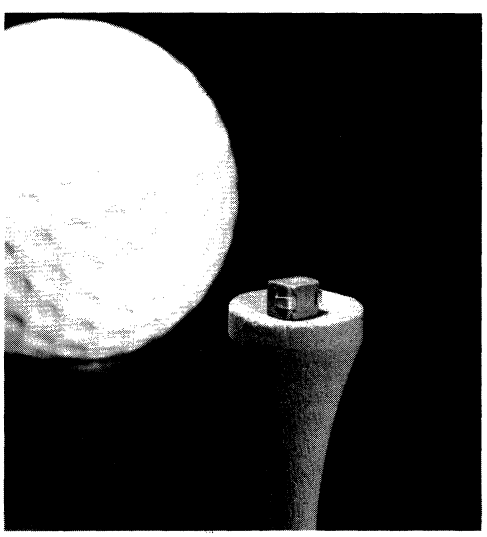
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Surface Mount Technology



- Open frame SMT Platforms and encapsulated SMT Modules allow standard and custom Renco chokes, inductors and transformers to be used in surface mount assemblies.
- SMT Modules and SMT Platforms with multiple inductors can be provided.
- Ideal for automated assembly.
- Open frame SMT Platforms can be supplied with conformal or open construction components.
- All terminals including gull wing, J hook, and butt joint available.
- Fully compatible with infrared and vapor phase reflow soldering.
- Flexible SMT Module and SMT Platform configurations.



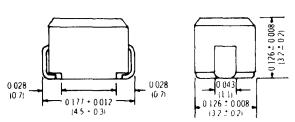
Chipductor Surface Mount Inductors

The RL-2525 CHIPDUCTOR Series offers over thirty-five standard values of miniature inductors that are designed specifically for compact assemblies requiring surface mount components. The RL-2525 can be supplied on reels for automated assemblies or in bulk packaging.

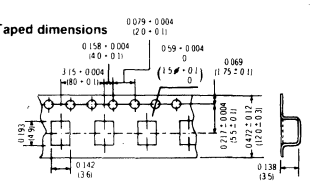
SPECIFICATIONS:
Nominal Inductance: 0.22 to 220.0 uH
Inductive Tolerance: +10% to +20%
Q: 40 to 50 Min.
DC Resistance: 0.10 to 9.8 Ohms
Maximum DC Current: 70 to 710 mA

Operating Temperature: −25°C to +85°C
Standard Packaging: 500 per reel or bulk packaging.

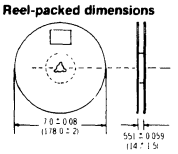
MECHANICAL DIMENSIONS



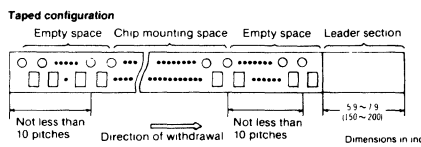
Taped dimensions



Reel-packed dimensions

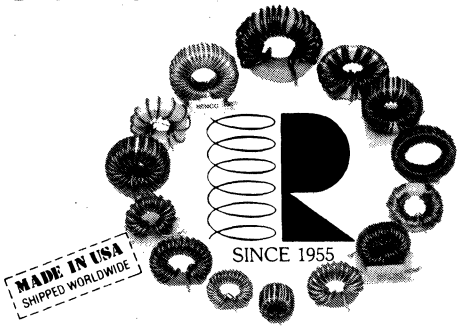


Taped configuration



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Due to our high speed winding equipment, use of robotics and high efficiency production techniques Renco Electronics can now offer CUSTOM WOUND TOROID COILS AT STANDARD PRICES.

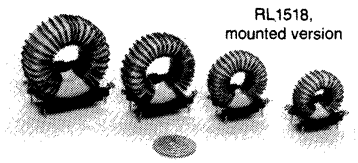
Renco can wind toroids with 8 gauge to 50 gauge wire on any size toroid core made of:
• Ferrite • Powdered Iron • Mollypermalloy • Tape Wound • Steel

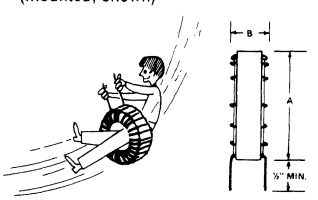
Your toroid coils can be supplied any way you want, such as:
• Encapsulated • Epoxy Coated • Hermetically Sealed
• Vacuum Varnish Impregnated • Taped

Swingductor™ RL1386 /RL1518

(unmounted) (mounted, shown)

185 values each version





Designed for applications requiring a known inductance change with changing current loads (as in power supplies). Although similar in appearance to conventional toroids, the special core material allows a "controlled saturation," so that a specific inductance value is repeatable at a specific current. The core material is effective up to 1 MHz. As a result of toroidal design, the Swingductor™ produces a closed magnetic field, resulting in low EMI. All are supplied with pretinned leads for easy PC board installation.

DIM. (IN)	"A" (MAX. DIA.)	"B" (MAX. WIDTH)
RL1386-1	1.10	0.500
RL1386-2	1.45	0.874
RL1386-3	1.80	0.900
RL1386-4	2.00	1.100
RL1386-5	2.60	1.500

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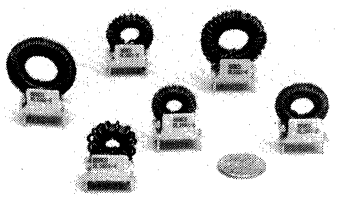
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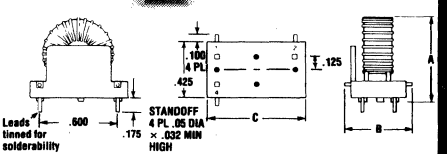
Magnetic Amplifier Toroids RL1661

A rugged series of low cost saturable mag-amp reactors uses low loss material allowing operation from 20kHz to over 100kHz. Simplifies control circuit design in switching power supplies. Increases power density by reducing component requirements. Especially useful in multiple output power supplies where outputs are tightly controlled.

Part Number	Dimensions A Max	B Max	C Max
RL-1661-1	.85 (21.59)	.65 (16.51)	.825 (20.96)
RL-1661-2	1.00 (25.40)	.65 (16.51)	.825 (20.96)
RL-1661-3	1.25 (31.75)	.65 (16.51)	1.150 (29.21)
RL-1661-4	.90 (22.86)	.55 (13.97)	.825 (20.96)
RL-1661-5	1.05 (26.67)	.55 (13.97)	.825 (20.96)
RL-1661-6	1.30 (33.02)	.55 (13.97)	1.150 (29.21)

Dimensions in inches (mm)





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Gary Dertinger

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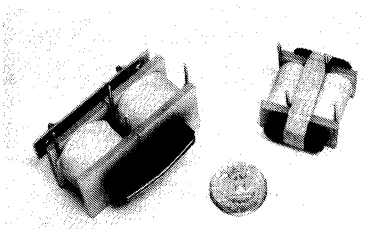
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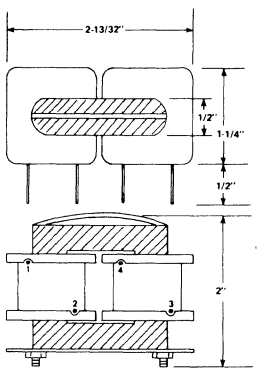
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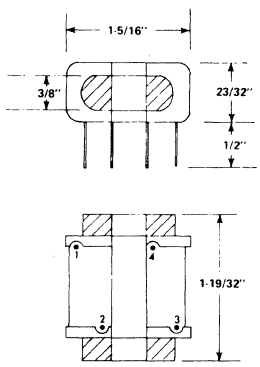
Common Mode Chokes RL1328/1329



Placed at the inputs of electrical equipment, these chokes help meet U.S. and international requirements for safety and EMI. These low priced Common Mode Chokes are available in a wide range of standard inductances, with current ratings to 35 Amps.



Series RL1328: (120 values)
Inductance: 47.0 to 39000.0 μH
Max DCR: 0.002 to 0.555 Ohms
Max leakage inductance:
4.0 to 3080.0 μH
Max interwinding capacitance:
2.0 to 9.4 pF
Hipot winding to winding and winding to core: 5000 VAC
Suggested rated current:
3 to 35 AC Amps

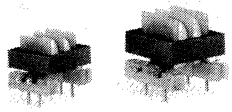


Series RL1329: (86 values)
Inductance: 6.8 to 22000.0 μH
Max DCR: 0.0028 to 0.555 Ohms
Max leakage inductance:
1.5 to 1430.0 μH
Max interwinding capacitance:
1.0 to 10.7 pF
Hipot winding to winding and winding to core: 5000 VAC
Suggested rated current:
2 to 22 AC Amps

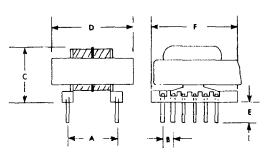
Common Mode Chokes RL1361-1/RL1361-2

Placed at the inputs of electrical equipment, these chokes help meet U.S. and international requirements for safety and EMI. Low-priced, they're available in a wide range of inductances and current ratings from 100mA to 5.5Amps. PC mounting. Low profile. Varnish impregnated. MTL Used Class B 130°C. MIL spec and encapsulation available.

STYLE NUMBER	TYPICAL DIMENSIONS						TERMINAL	
	A	B	C	D	E	F	SIZE	NO.
RL-1361-1	.515	.200	.622	.750	.175	.850	.025 SQ.	8
RL-1361-2	.630	.200	.797	.850	.175	1.100	.025 SQ.	10



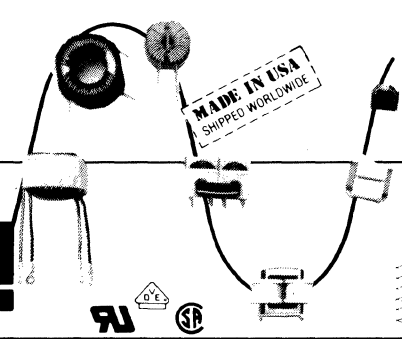
RL1361-1 RL1361-2



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DVE designs

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PRECISELY THE BEST HIGH DENSITY COMMON MODE CHOKES (Standard and Custom)

Stop electrical line noise and EMI! We give you the greatest selection of the smallest size, highest current/volume density Common Mode Chokes. Choose from almost 300 standard catalog models. If our standard models don't meet your needs, we'll make what you need.

Fast delivery!

Our Low Cost Common Mode Chokes feature:

- **Low Leakage**
- **Low Interwinding Capacitance**
- **Low R_{DC}**
- **Balanced to within 1%**
- **High Dielectric Strength**
- **High SRF**

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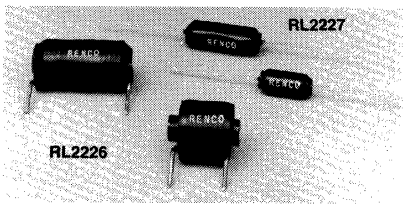
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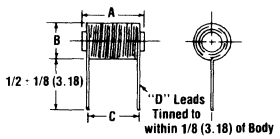
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High Current Filter Inductors RL-2226/2227

High performance, compact, low cost filter inductors available with radial or axial leads. High current capability makes them suitable for switching power supplies, filter networks, SCR and triac control circuits. Outer windings insulated and protected with PVC sleeve.

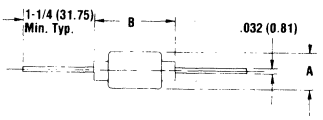


Series RL-2226: (24 values)
Inductance: 5 to 250uH
Max DCR: 0.010 to 0.090 Ohms
Max rated current: 3 to 15 Amps
Incremental current: 3 to 20 Amps



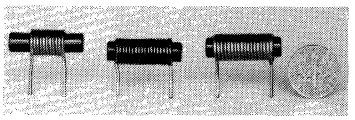
Dimensions RL-2226:
A (Max) 0.875 to 1.625
B (Max) 0.625 to 1.000
C (±.062) 0.500 to 1.125
D (±.005) .042 to .082

Series RL-2227: (20 values)
Inductance: 5 to 1000uH
Max DCR: 0.015 to 0.600 Ohms
Max rated current: 1 to 5 Amps

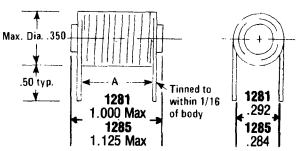


Dimensions RL-2227:
A (Max) .475 to .700
B (Max) .800 to 1.300

Low Cost Chokes RL1281/1285



Heavy duty, general purpose inductors use ferrite cores and offer a wide range of inductance values. Their compact size and pretinned leads make them easy to use in printed circuit boards.



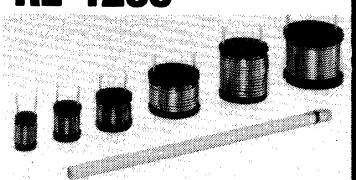
Series RL1281: (23 values)
Max current: 4 Amps
Inductance (±15%)*: 0.22 to 12.50 μH
Max DCR: 0.003 to 0.025 Ohms
Dimension "A": 0.187 to 0.875

Series RL1285: (19 values)
Max current: 6 Amps
Inductance (±15%)*: 0.22 to 10.20 μH
Max DCR: 0.002 to 0.015 Ohms
Dimension "A": 0.125 to 0.883

Measured at 1 KHz

Power Line Chokes RL-1256

Available in 406 standard values. High saturation flux density material makes these coils ideal wherever high current choke values in a small physical size are needed.



Series RL-1256-1: (34 values)
Inductance: 1.0 to 560.0 μH
Max DCR: 0.003 to 0.696 Ohms
Saturation current: 87.0 to 2.9 DC Amps
Suggested Rated current: 9.0 to 0.8 AC Amps
Dimension "E": 0.406 to 0.550

Series RL-1256-2: (41 values)
Inductance: 1.0 to 2200 μH
Max DCR: 0.003 to 1.54 Ohms
Saturation current: 108.0 to 2.90 DC Amps
Suggested Rated current: 11.4 to 0.8 AC Amps
Dimension "E": 0.590 to 0.671

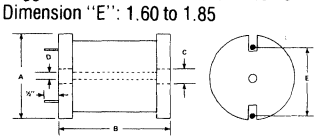
Series RL-1256-3: (45 values)
Inductance: 1.0 to 4700.0 μH
Max DCR: 0.003 to 1.86 Ohms
Saturation current: 116.0 to 1.7 DC Amps
Suggested Rated current: 21.0 to 1.0 AC Amps
Dimension "E": 0.750 to 0.800

Series RL-1256-4: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 3.39 Ohms
Saturation current: 150.0 to 1.5 DC Amps
Suggested Rated current: 27.0 to 1.3 AC Amps
Dimension "E": 1.11 to 1.87

Series RL-1256-5: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 2.17 Ohms
Saturation current: 155.0 to 1.5 DC Amps
Suggested Rated current: 35.0 to 2.0 AC Amps
Dimension "E": 1.11 to 1.28

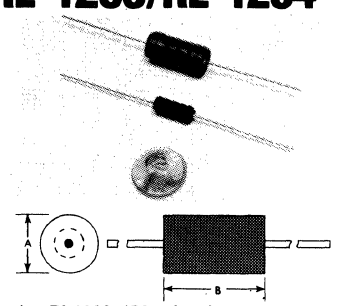
Series RL-1256-6: (49 values)
Inductance: 4.7 to 47000.0 μH
Max DCR: 0.002 to 6.19 Ohms
Saturation current: 149.9 to 1.2 DC Amps
Suggested Rated current: 35.0 to 1.4 AC Amps
Dimension "E": 1.31 to 1.53

Series RL-1256-7: (50 values) NEW SIZE
Inductance: 5.6 to 68000.0 μH
Max DCR: .0018 to 5.220 Ohms
Saturation current: 200.0 to 1.5 DC Amps
Suggested Rated current: 45.0 to 2.0 AC Amps
Dimension "E": 1.60 to 1.85



DIM (IN)	A	B	C	D
RL-1256-1	0.660	0.84	0.195	Clearance
RL-1256-2	0.825	0.84	0.195	Hole For
RL-1256-3	1.1	0.84	0.195	4/40 Screw
RL-1256-4	1.6	1.03	0.290	Clearance
RL-1256-5	1.6	1.45	0.290	Hole For
RL-1256-6	2.0	1.50	0.320	8/32 Screw
RL-1256-7	2.4	1.50	0.425	With Washer

Power Line Chokes RL-1283/RL-1284



Series RL1283: (54 values)
Inductance: 3.9 to 100000.0 μH
Max DCR: 0.007 to 89.7 Ohms
Saturation current: 15.5 to 0.081 DC Amps
Suggested rated current: 4.0 to 0.065 AC Amps

Series RL1284: (45 values)
Inductance: 3.9 to 18000.0 μH
Max DCR: 0.008 to 48.3 Ohms
Saturation current: 7.3 to 0.091 DC Amps
Suggested rated current: 1.28 to 0.039 AC Amps

DIM. RL-1283 (A) 0.453 max. **(B)** 0.900 max.
(IN) RL-1284 (A) 0.260 max. **(B)** 0.650 max.

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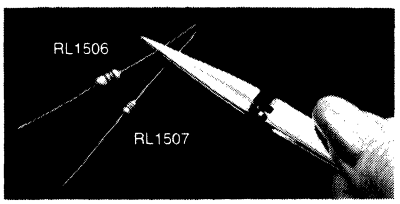
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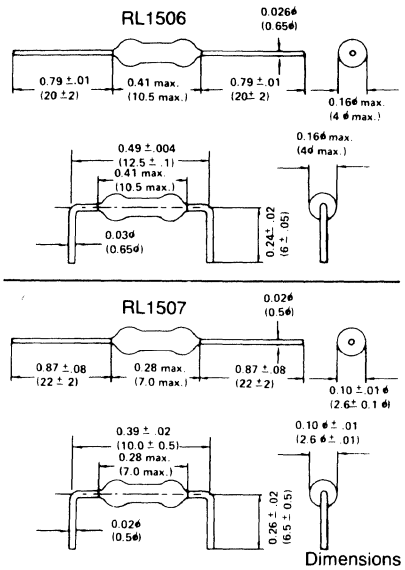
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Mini Inductor RL1506
Sub Mini Inductor RL1507



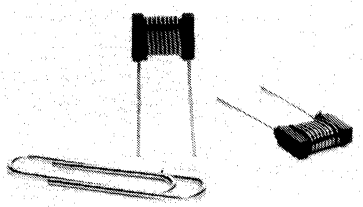
These rugged coils exhibit high Q and very low distributed capacity, all concentrated into an amazingly small package. Ideal where weight, space, Hi Q, and auto insertion are involved. Temperature range −25° to +85°C. Coils identified with industry standard color code.

OUTER DIMENSIONS Dimensions of Single Product
Temperature Range: −25°C to +85°C



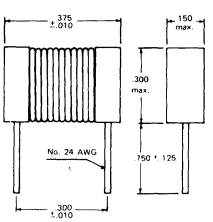
Dimensions in inches (mm)

Flat Coils RL1160 (45 values)

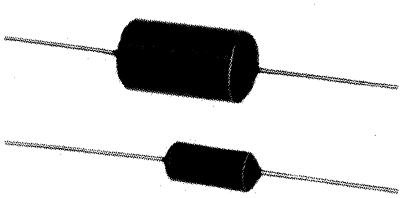


Unique flat coil configuration ideally suited to high density PCBs. Twice the inductance and Q values than axial lead inductors occupying the same space. Wide range of inductance and Q values for use at radio as well as audio frequencies.

Inductance:
1.0 to 4700.0 μH
Frequency:
7.9 MHz to 250.0 KHz
Min Q: 37.0 to 63.0
Max DCR:
0.010 to 29.9 Ohms
Saturation current:
7.0 to 0.11 DC Amps
Suggested rated current: 2.25 to 0.027 AC Amps



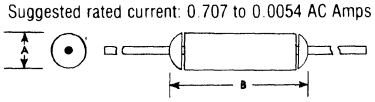
Shielded Inductors RL1123/RL1124



Low cost, miniature shielded coils, extremely useful in compact audio filters, tone control circuits, amplifiers, and wherever high inductance coils are needed. Excellent, low cost alternatives to fixed pot cores.

Series RL1123: (96 values)
Inductance: 1.0 μH to 47.0 H
Max DCR: 0.0066 to 5170.0 Ohms
Suggested rated current: 1.5 to 0.0054 AC Amps

Series RL1124: (80 values)
Inductance: 1.0 μH to 4.7 H
Max DCR: 0.011 to 1700.0 Ohms
Suggested rated current: 0.707 to 0.0054 AC Amps



DIM. (IN)		RL1123	RL1124
	A	.500 max.	.260 max.
	B	.950 max.	.700 max.

WEIGHT: RL1123 . . . 15 gm max. approx
RL1124 . . . 5 gm max. approx
LEADS: No. 20 tinned copper 1-1 4' long min

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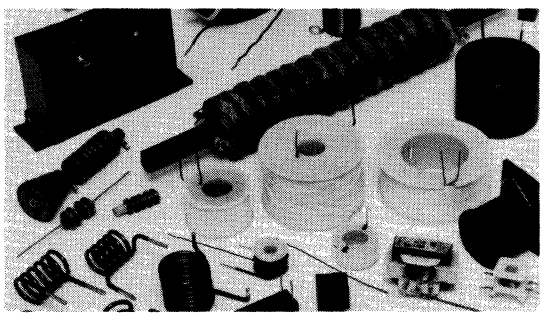
Making custom coils is not just an accommodation for an occasional customer. Custom coils have always been a major part of Renco's business. We have over 35 years experience in making custom designed inductors and transformers.

As for pot core assemblies, we've manufactured millions since 1955, and are thoroughly experienced with all standard cores and hardware, including Ferroxcube, Siemens, TDK, Magnetics Inc., Indiana General, etc. We stock all the popular bobbins, including printed circuit types.

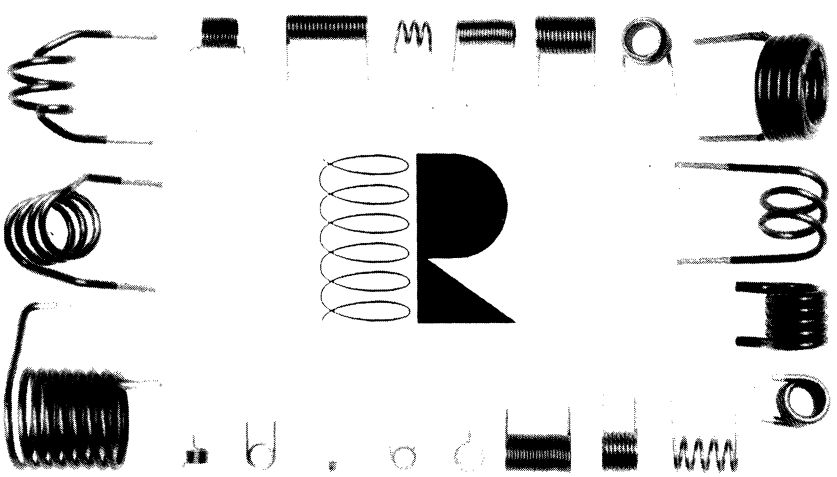
Let us assist you in your upcoming designs. Our fully independent sample and prototype department can usually ship a prototype within 10 days.

Send us your specifications and designs for your pot cores, coils, inductors, or transformers, and we'll respond promptly with very competitive prices. We have a reputation for keeping our delivery promises.

Try us!



Air Core Inductors



Low cost, self-supporting, air core inductors for use in a wide range of high frequency application wound to your specifications.

APPLICATIONS

- Satellite Communication Systems
- Microwave Equipment
- Television Circuits
- AM/FM Radio Receivers/Transmitters
- Test Equipment
- Band Pass Filters

SPECIFICATIONS

- Frequency: Up to 1000 MHz
- Current: Up to 50 Amps*
- Operating Temperatures: Up to 220°C

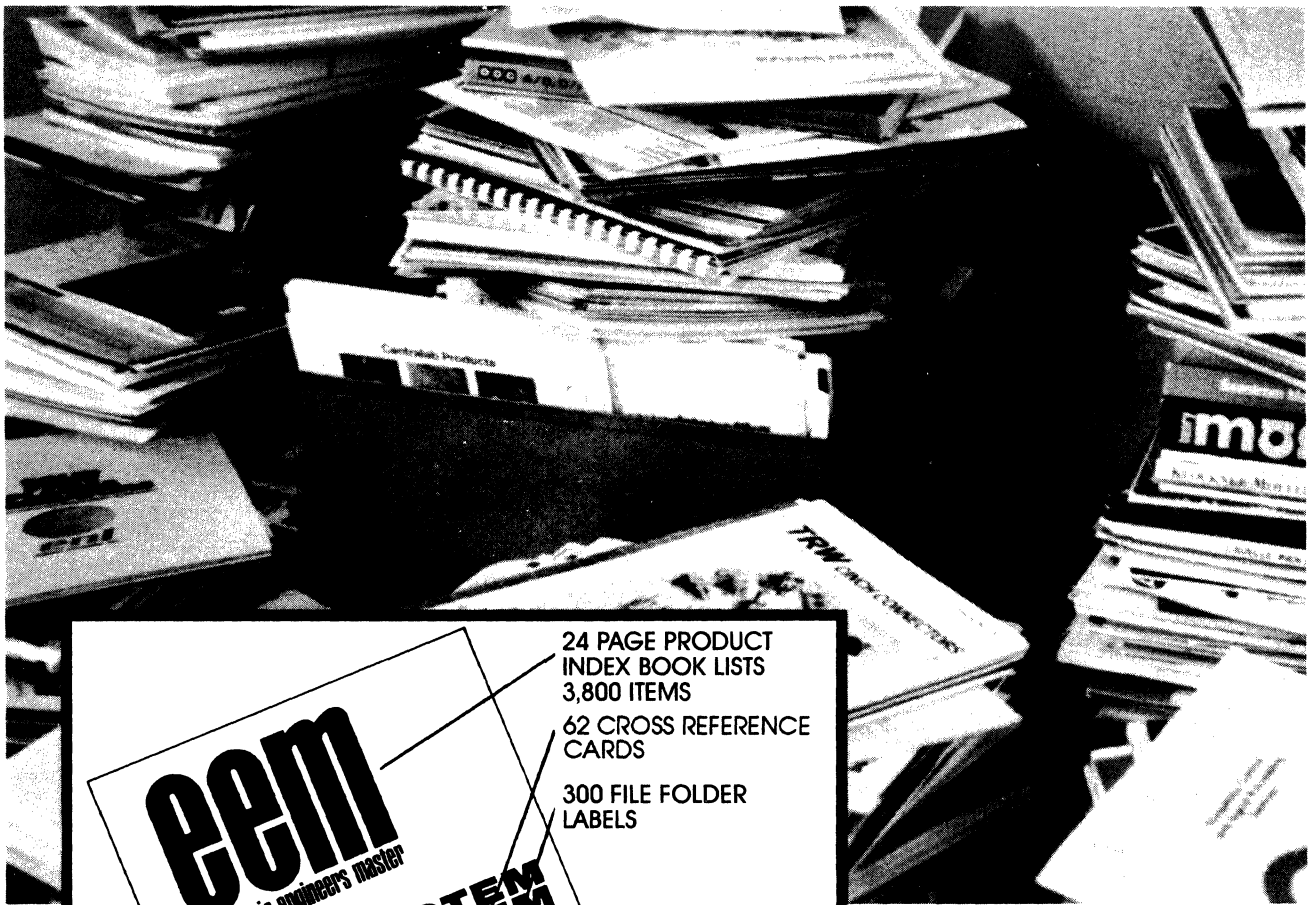
MECHANICAL

- Windings: Clockwise
  Counter Clockwise
  Variable Pitch and Length
- Wire Gauge: #8 to #32
- Leads: Pretinned
  Formed Leads
  Terminals*
- Coil Length: To Customer Specification

*Depending on wire gauge.

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Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with the System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

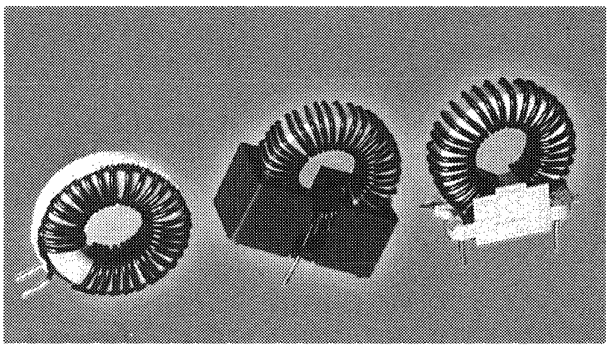
There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will be mailed to you under separate cover.

Don't waste any more time. Get organized now!

EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

Inductors for Power Supply and EMI/RFI Filter Applications



Typical DC Resistance in Ohms

	Current Rating in Amps				
	.5	1	2	3	5
CIE Series	.05 - .12	.02 - .08	.01 - .02	.002 - .005	.001 - .002
CIL Series	.09 - .23	.04 - .10	.02 - .04	.006 - .010	.001 - .004
CIR Series	.22 - .73	.12 - .22	.04 - .08	.02 - .03	.006 - .012
CIT Series	.50 - .92	.18 - .32	.10 - .12	.05 - .06	.015 - .031

Build Your Own Standard Part Number

To build your own part number, specify the series, inductance, current rating and case style. To optimize the inductance, size and current carrying capability, choose your part number from within the range of part numbers on the graphs below.

Example: **CIL 35 U E U**

- CIL — Series
- 35 — Inductance (a point is represented as 'R')
- U — Inductance Unit: U = Micro Henry, M = Milli Henry
- E — Current Rating: C = .5 amp, D = 1 amp, E = 2 amps, F = 3 amps, G = 5 amps
- U — Case Style (See options below)

Lead Diameter Dimensions			
Current Rating	Style U & K	Style T Series CIL, CIR & CIT	Style T Series CIE
.5	.020	.050	.040
1	.025	.050	.040
2	.032	.050	.040
3	.040	.050	.040
5	.050	.050	.050

CIE Series

Induct. in µH	Current Rating in Amps				
	.5	1	2	3	5
1	*	*	*	CIE1UFX	CIE1UGX
2	*	*	*	CIE2UFX	CIE2UGX
6	*	*	CIE6UEX	CIE6UFX	**
20	*	CIE20UDX	CIE20UEX	**	**
40	CIE40UCX	CIE40UDX	CIE40UEX	**	**
80	CIE80UCX	CIE80UCX	**	**	**
150	CIE150UCX	**	**	**	**

*Call factory **See CIL series

CIL Series

Induct. in µH	Current Rating in Amps				
	.5	1	2	3	5
2	*	*	*	*	CIL2UGX
8	*	*	*	CIL8UFX	CIL8UGX
20	*	*	CIL20UEX	CIL20UFX	**
50	*	CIL50UDX	CIL50UEX	**	**
100	CIL100UCX	CIL100UDX	CIL100UEX	**	**
300	CIL300UCX	CIL300UDX	**	**	**
500	CIL500UCX	**	**	**	**

*See CIE series **See CIR series

CIR Series

Induct.	Current Rating in Amps				
	.5	1	2	3	5
15µH	*	*	*	*	CIR15UGX
50µH	*	*	*	CIR50UFX	CIR50UGX
100µH	*	*	CIR100UEX	CIR100UFX	**
300µH	*	CIR300UDX	CIR300UEX	**	**
500µH	CIR500UCX	CIR500UDX	CIR500UEX	**	**
4.7mH	CIR4R7MCX	**	**	**	**

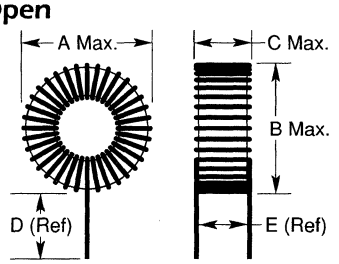
*See CIL series **See CIT series

CIT Series

Induct.	Current Rating in Amps				
	.5	1	2	3	5
50µH	*	*	*	*	CIT50UGX
200µH	*	*	*	CIT200UFX	CIT200UGX
350µH	*	*	CIT350UEX	CIT350UFX	**
1mH	*	CIT1MDX	*	**	**
1.5mH	*	CIT1R5MDX	**	**	**
5mH	CIT5MCX	**	**	**	**

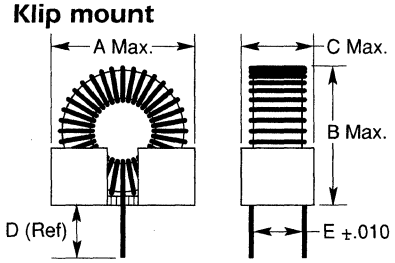
*See CIR series **Call factory

Style "U" Open



Size	CIE	CIL	CIR	CIT
A	.650	.900	1.500	1.800
B	.650	.900	1.500	1.800
C	.325	.425	.625	.750
D	.187	.187	.187	.187
E	.250	.300	.600	.750

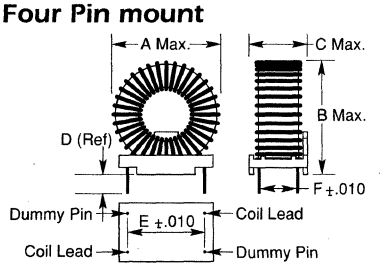
Style "K" Klip mount



Size	CIE	CIL	CIR
A	.687	.850	1.250
B	.700	.950	1.500
C	.500	.500	.750
D	.187	.187	.187
E	.300	.300	.500

Style K not available for 5 amp or CIT coils.

Style "T" Four Pin mount



Size	CIE	CIL	CIR	CIT
A	.765	1.100	1.120	1.600
B	.780	1.250	1.250	1.750
C	.440	.650	.650	.850
D	.187	.187	.187	.187
E	.600	.800	.800	.900
F	.250	.400	.400	.600

Note: Inductance tolerance is ± 20%; Dimensions are in inches.

Custom inductors and transformers are standard at Standex Electronics. Please call or write with any questions or requirement you may have.

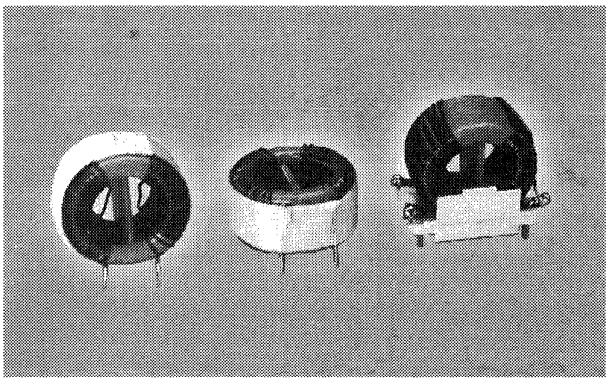
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Common Mode Chokes for EMI/RFI Filter Applications



Typical DC Resistance in Ohms

	Current Rating in Amps				
	.5	1	3	5	10
CME Series	.030 - .049	.012 - .039	.006 - .014	.004 - .006	.003
CMM Series	.032 - .070	.012 - .047	.007 - .015	.005 - .009	.003
CMP Series	.090 - .110	.040	.016 - .026	.007 - .010	.005
CMT Series	.100 - .140	.060 - .090	.030 - .050	.010 - .020	.010

Build Your Own Standard Part Number

To build your own part number, specify the series, inductance, current rating and case style. To optimize the inductance, size and current carrying capability, choose your part number from within the range of part numbers on the graphs below.

Example: **CMM 400 U F U**

- CMM — Series
- 400 — Inductance (a 'point' is represented as 'R')
- U — Inductance Unit: U = Micro Henry, M = Milli Henry
- F — Current Rating: B = .25 amp, C = .5 amp, D = 1 amp, F = 3 amps, G = 5 amps, H = 10 amps
- U — Case Style (See options below)

Lead Diameter Dimensions				
Current Rating	Style U & H Series CMM, CMP & CMT	Style U & H Series CME	Style T Series CME & CMM	Style T Series CMP & CMT
.25	.016	–	–	.050
.5	.020	.016	.040	.050
1	.025	.025	.040	.050
3	.032	.025	.040	.050
5	.040	.032	.040	.050
10	.050	.040	.040/.050	.050

CME Series

Induct. (Per Winding)	Current Rating in Amps				
	.5	1	3	5	10
100µH	*	*	CME100UFX	CME100UFX	CME100UGX
220µH	*	*	CME220UFX	CME220UFX	**
330µH	*	CME330UDX	CME330UFX	**	**
470µH	CME470UCX	CME470UDX	CME470UFX	**	**
680µH	CME680UCX	CME680UDX	**	**	**
1mh	CME1MCX	CME1MDX	**	**	**

*Call factory **See CMM series

CMM Series

Induct. (Per Winding)	Current Rating in Amps				
	.5	1	3	5	10
250µH	*	CMM250UDX	CMM250UFX	CMM250UGX	CMM250UHX
500µH	*	CMM500UDX	CMM500UFX	CMM500UGX	**
750µH	CMM750UCX	CMM750UDX	CMM750UFX	CMM750UGX	**
1mh	CMM1MCX	CMM1MDX	CMM1MUFX	**	**
2.5mH	CMM2R5MCX	CMM2R5MDX	**	**	**
3.6mH	CMM3R6MCX	**	**	**	**

*See CME series **See CMP series

CMP Series

Induct. (Per Winding)	Current Rating in Amps					
	.25	.5	1	3	5	10
500µH	*	*	*	*	CMP500UGX	CMP500UHX
1mh	*	*	*	CMP1MFX	CMP1MGX	**
2.5mH	*	*	CMP2R5MDX	CMP2R5MFX	**	**
5mH	CMP5MBX	CMP5MCX	**	**	**	**
7.5mH	CMP7R5MBX	CMP7R5MCX	**	**	**	**
10mH	CMP10MBX	**	**	**	**	**

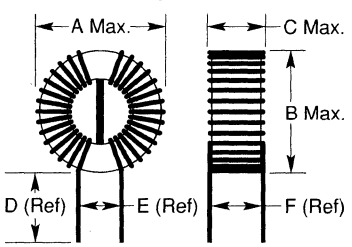
*See CMM series **See CMT series

CMT Series

Induct. (Per Winding)	Current Rating in Amps					
	.25	.5	1	3	5	10
1mh	*	*	*	*	CMT1MGX	CMT1MHX
2.5mH	*	*	*	CMT2R5MFX	CMT2R5MGX	CMT2R5MHX
5mH	*	CMT5MCX	CMT5MDX	CMT5MFX	**	**
7.5mH	*	CMT7R5MCX	CMT7R5MDX	CMT7R5MFX	**	**
10mH	CMT10MBX	CMT10MCX	CMT10MDX	**	**	**
25mH	CMT25MBX	**	**	**	**	**

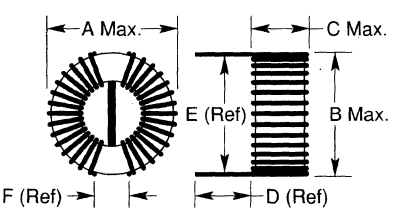
*See CMP series **Call factory

Style "U" Open (Vertical P.C. Board Mount)



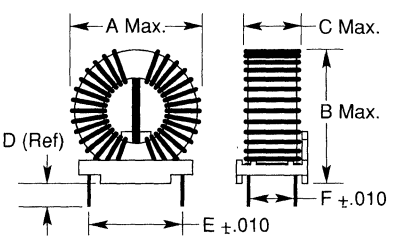
Size	CME	CMM	CMP	CMT
A	.700	1.100	1.500	1.750
B	.700	1.100	1.500	1.750
C	.400	.450	.675	.700
D	.187	.187	.187	.187
E	.300	.360	.400	.400
F	.400	.400	.600	.600

Style "H" Open (Horizontal P.C. Board Mount)



Size	CME	CMM	CMP	CMT
A	.700	1.100	1.500	1.750
B	.700	1.100	1.500	1.750
C	.400	.450	.675	.700
D	.187	.187	.187	.187
E	.600	1.000	1.000	1.600
F	.300	.300	.400	.400

Style "T" Four Pin Mount with Header



Size	CME	CMM	CMP	CMT
A	.765	1.100	1.120	1.600
B	.780	1.250	1.250	1.750
C	.440	.440	.650	.850
D	.187	.187	.187	.187
E	.600	.600	.800	.900
F	.250	.250	.400	.600

Note: Inductance tolerance is ± 20%; Dimensions are in inches

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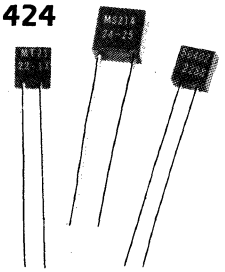
Custom inductors and transformers are standard at Standex Electronics. Please call or write with any questions or requirement you may have.

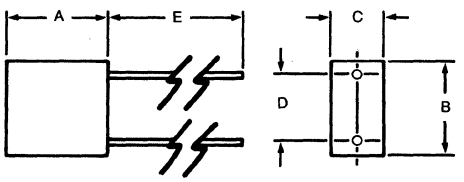
Standex Fixed Inductors

Series MT Toroidal Inductors Ref Mil. Spec. Series MS21422, MS21423 & MS21424

	MT2122 & 23	MT2124
A	.215/5.46	.285/7.24
B	.20/5.1	.27/6.9
C	.10/2.5	.15/3.8
D	.10/2.5	.20/5.1
E	1.0/25.4	1.0/25.4
Leads	#24	#22

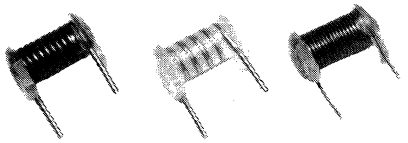
inches/millimeters

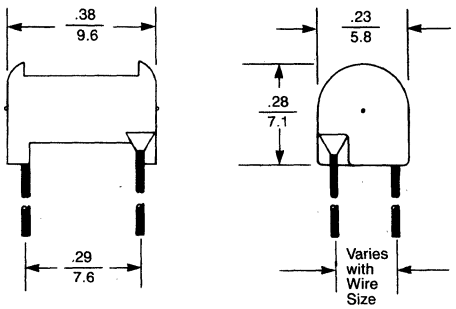




Series	Inductance Range	Q	Max Current
MT2123	.01µH to 1.0µH	60 to 80	700 to 3000mA
MT2122	.10µH to 10µH	55 to 70	280 to 2200mA
MT2124	10µH to 1000µH	45 to 80	110 to 550mA

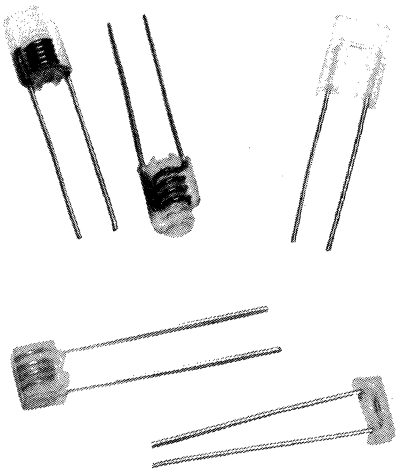
Series LM2

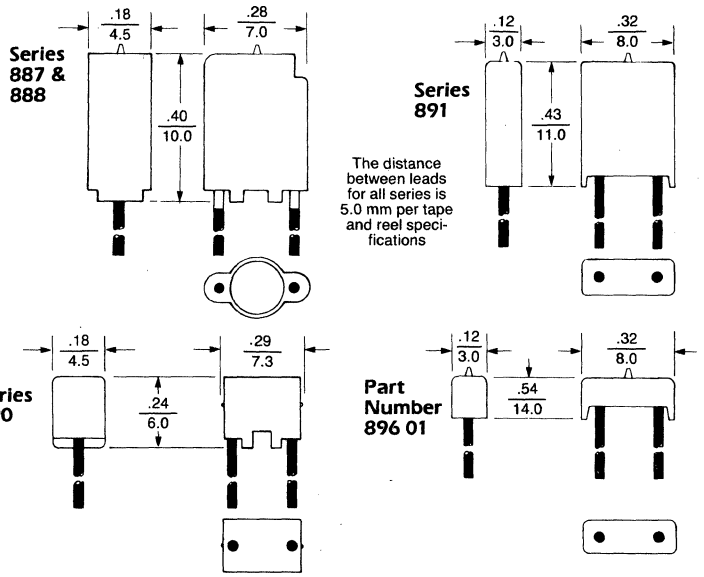




Inductance Range		Q	
No Core	With Core	No Core	With Core
.0264uH to .660uH ±5%	.69uH to 1.74uH ± 10%	80 to 100	40 to 55

Series 887, 888, 890, 891 & 896 Supplied "Tape and Reel" or "Fan Fold" for Automatic Insertion





Series	Inductance Range	Q	Test Freq
887	15nH to 115nH	100 to 105	100 to 150 MHz
888	15nH to 35nH	100 to 115	100 to 150 MHz

Series	Inductance Range	Q	Test Freq
890	16nH to 84nH	105 to 130	100 to 150 MHz
891	9.5nH to 17.1nH	155 to 180	270 MHz
896	P.C. Board Jumper		

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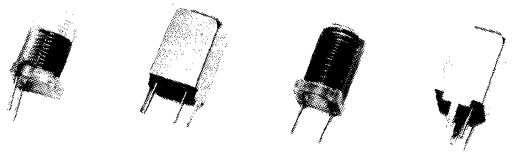
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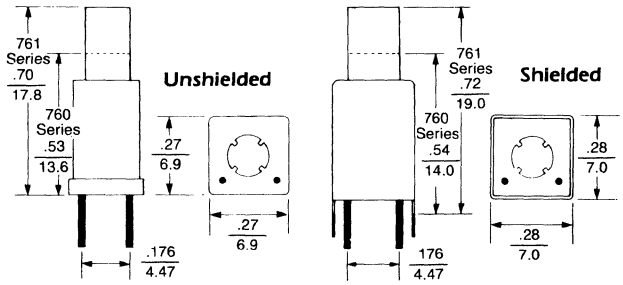
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Standex 7mm & 10mm Molded Variable Inductors

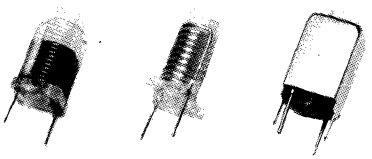
Series 760 and 761 — 7mm Coils

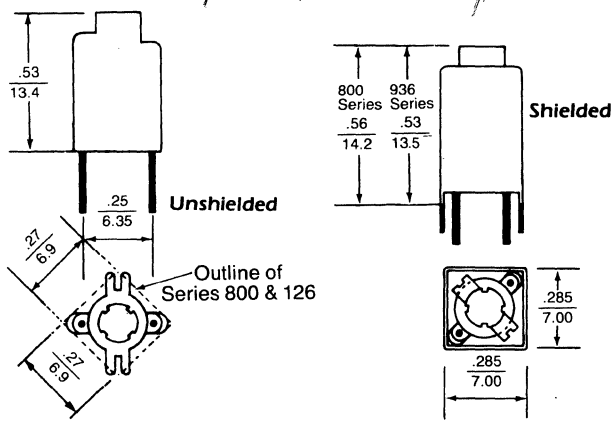




Series	Unshielded Inductance Range	Unshielded Q	Shielded Inductance Range	Shielded Q	Core
760	.064µH to .874µH	70 to 93	.059µH to .433µH	54 to 74	6-32
761	.062µH to .414µH	108 to 128	.056µH to .209µH	66 to 75	6-32

Series 800 and 936 — 7mm Coils

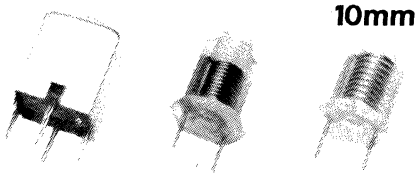


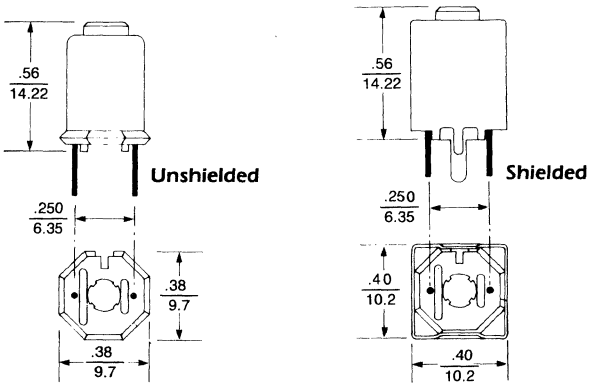


Series	Unshielded Inductance Range	Unshielded Q	Shielded Inductance Range	Shielded Q	Core
800	.069µH to .70µH	86 to 106	.063µH to .385µH	61 to 73	6-32
936 & 126	.051µH to .400µH	97 to 132	.048µH to .207µH	69 to 77	6-32

Series 936 & 126 are tapable

Series 925 and 926 — 7mm Coils with 10mm Shield Cans

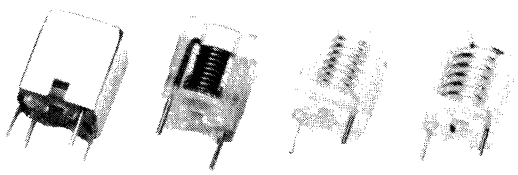


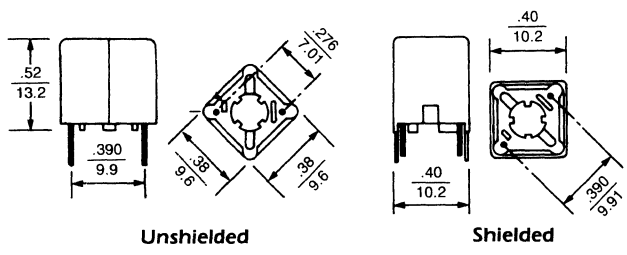


Series	Unshielded Inductance Range	Unshielded Q	Shielded Inductance Range	Shielded Q	Core
925	.069µH to .920µH	77 to 100	.067µH to .700µH	68 to 90	6-32
926	.052µH to .440µH	98 to 132	.051µH to .334µH	90 to 110	6-32

Series 926 is tapable

Series 957, 956 and 910 — 10mm Coils





Series	Unshielded Inductance Range	Unshielded Q	Shielded Inductance Range	Shielded Q	Core
910	.057µH to .268µH	111 to 156	.053µH to .172µH	86 to 101	10-32
956	.059µH to .380µH	107 to 159	.055µH to .234µH	87 to 102	10-32
957	.086µH to .885µH	97 to 123	.077µH to .501µH	68 to 90	10-32

Series 910 is tapable

Custom inductors and transformers are standard at Standex Electronics. Please call or write with any questions or requirement you may have.

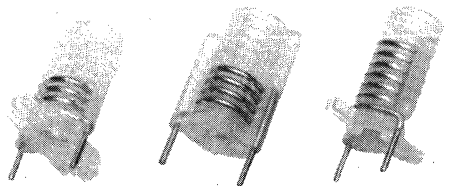
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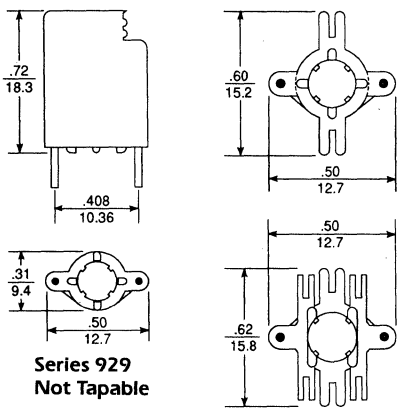
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513/871-3777 FAX 513/871-3779

Standex Molded Variable Inductors

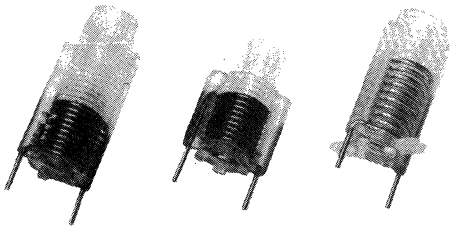
Series 928, 929, & 138

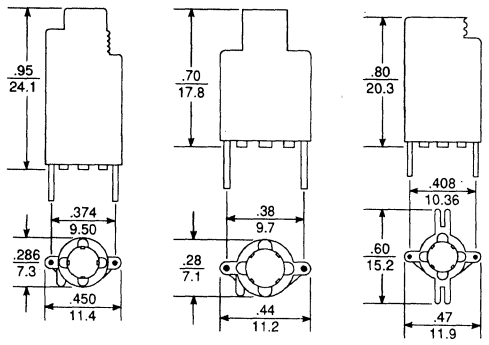




Inductance Range	Q	Core
.043µH to .419µH	90 to 160	10-32

Series 478, 707 & 752

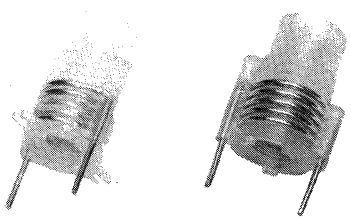


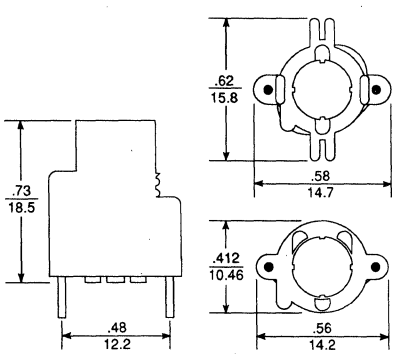


Series	Inductance Range	Q	Core
478	.38µH to 1.94µH	75 to 166	10-32
707	.042µH to 1.0µH	84 to 137	10-32
752	.042µH to .86µH	86 to 163	10-32

Series 752 is tapable

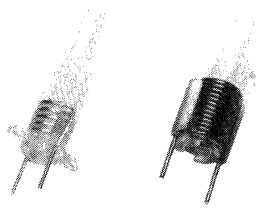
Series 308, 932, 408 & 933

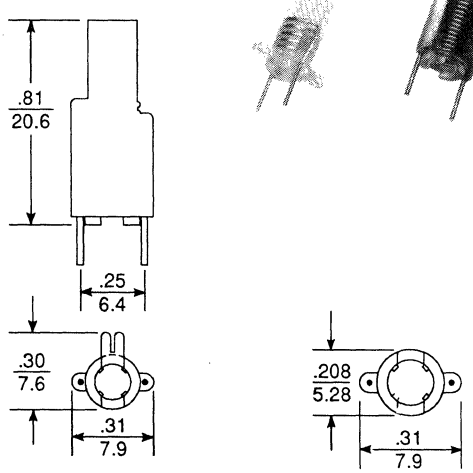




Series	Inductance Range	Q	Core
308 & 408	.046µH to .480µH	113 to 214	10-32
932 & 933	.045µH to .610µH	108 to 217	1/4" x 28

Series 426 & 425





Series	Inductance Range	Q	Core
425	.054µH to 1.18µH	71 to 119	6-32
426	.0216µH to .4568µH	62 to 190	6-32

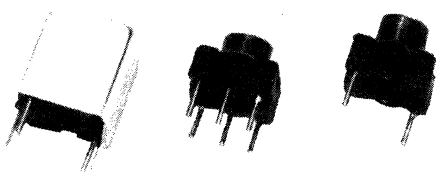
Custom inductors and transformers are standard at Standex Electronics. Please call or write with any questions or requirement you may have.

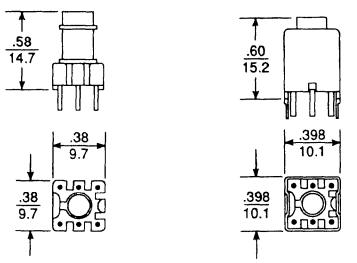
Standex Electronics

a Standex company 4538 Camberwell Road, Cincinnati, OH 45209
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Standex Variable Inductors

Series 950

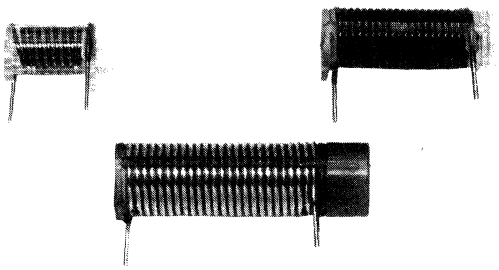


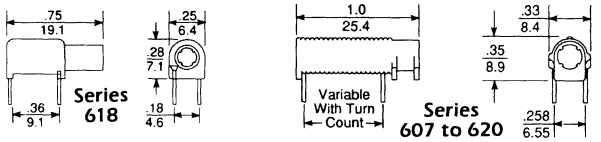


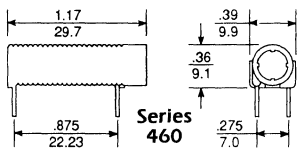
Unshielded Shielded

Unshielded		Shielded		
Inductance Range	Q	Inductance Range	Q	Core
1.12µH to 7.40µH	63 to 71	.97µH to 5.75µH	45 to 54	10-32

Series 618, 607 to 620, and 460

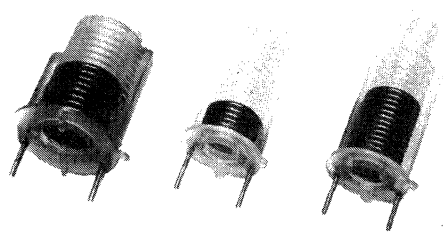


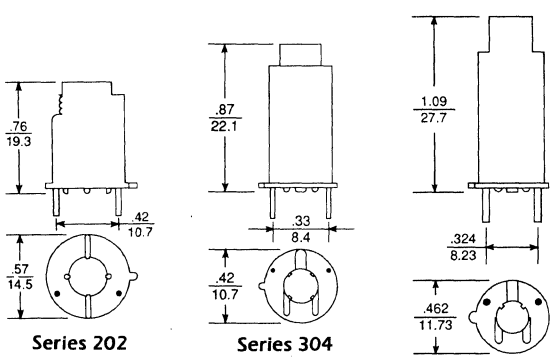




Series	Inductance Range	Q	Core
618	.023µH to .991µH	51 to 180	6-32
607-620	.138µH to 1.475µH	135 to 183	10-32
460	1.52µH to 3.45µH	95 to 125	1/4 x 28

Series 202, 304, & 511





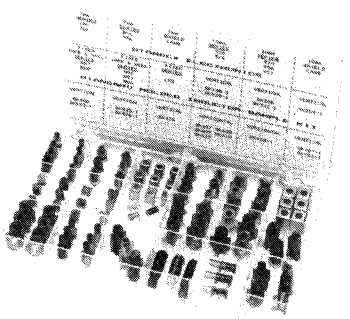
Series 202 Series 304 Series 511

Series	Inductance Range	Q	Core
202	.050µH to 1.46µH	70 to 195	1/4 x 28
304	.080µH to 1.60µH	80 to 180	10-32
511	.080µH to 1.80µH	80 to 180	10-32

Sample Kits

For Molded Fixed & Variable RF Coils

$49.00 each



"Standard" kit (pictured) contains a few pieces of most series offered in Standex's catalog of inductors. Approximately 80 coils total.

"7mm" kit contains 3 pieces each of most turn counts of series 760, 761, 800, and 936. Approximately 75 coils total.

"10mm" kit contains 3 pieces each of most turn counts of series 910, 956, and 957. Approximately 75 coils total.

"LM2" kit contains 3 pieces each of series LM2 coils turn count 1 1/2 through 20 1/2. Approximately 60 coils total.

"Tape & Reel" kit contains 5 pieces each of most turn counts available of series 887, 888, 890, 891, & 896. Approximately 145 coils total.

Call, fax or write us for any samples, standard or custom sample kits that you may require.

Custom inductors and transformers are standard at Standex Electronics. Please call or write with any questions or requirement you may have.

Standex Electronics

a Standex company

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SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Tecnicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

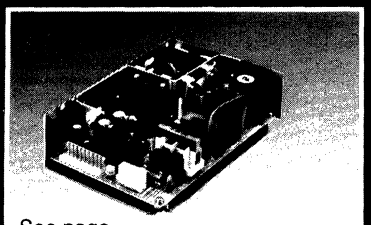
United States Underwriters Laboratories Inc.

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

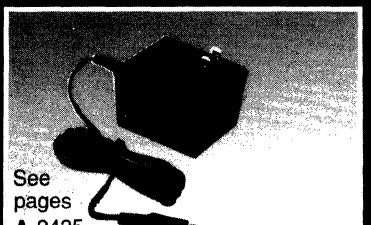
Yugoslavia Federal Institute of Standardization

TAMURA

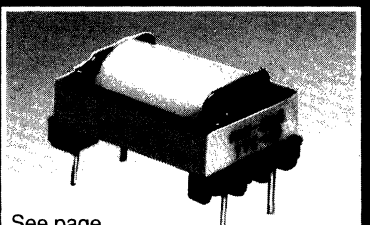
DELIVERS FROM STOCK



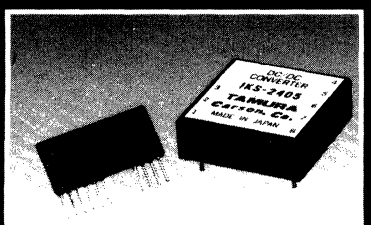
See page D•2062 **SINGLE AND MULTI-OUTPUT SWITCHERS**



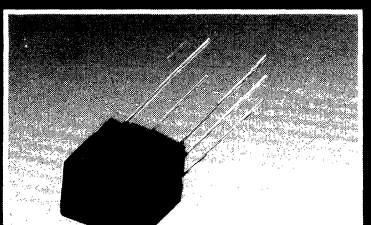
See pages A•2435, D•1495, D•2066 **WALL PLUG-IN, AC & DC POWER**



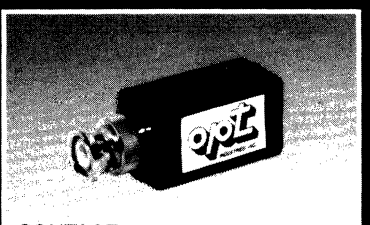
See page A•2428 **FCC PART 68 TELCOM LINE COUPLING**



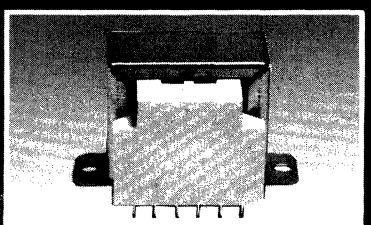
See page D•2059 **DC/DC CONVERTERS SIP & DIP PKG**



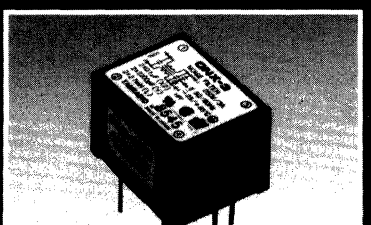
See page A•2430 **MINIATURE AUDIO & PART 68 COUPLING**



CONTACT FACTORY **COMPUTER NETWORKING BALUNS**



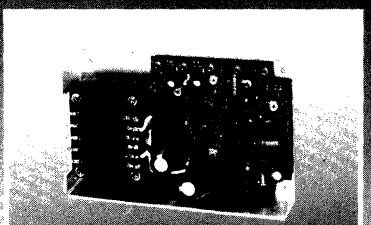
A•2432 **INT'L PCB POWER- UL 1411, IEC, VDE, & CSA**



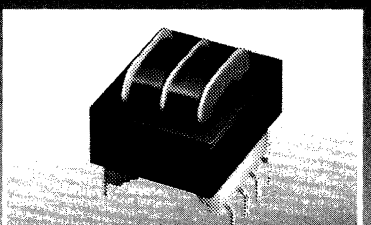
A•1643 **EMI LINE FILTERS**



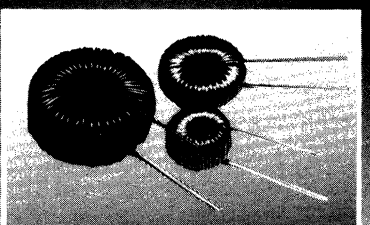
A•2431 **WIDE BAND PULSE- T1 & DIGITAL**



D-2064



A•2433 **UL/CSA PCB POWER**



A•1270

The strength of Tamura's AC and DC power conversion families lies in providing consistently dependable products. All Tamura power and magnetic devices are designed and manufactured to deliver lower AQL levels, guaranteeing you the lowest incoming rejection rates you've ever experienced. For example, last year we shipped over **100 million transformers**– most to customers using a **ship-to-stock** acceptance program.

At Tamura, we're already life testing (not just designing) tomorrow's products– today. Over 100 design engineers at our technology center are dedicated to this task, assuring you of having the most up-to-date technology in your products. Today we are already designing the robotics to build these quality products, in high volume and at low cost. Over 150 product support engineers at 16 Tamura factories see to it.

Satisfy your AC and DC requirements for today and tomorrow. Contact Tamura for your specific requirements.

Tamura quality circles the electron world.

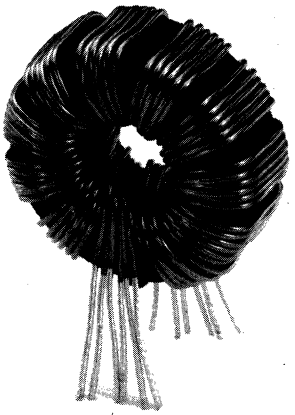
TAMURA CORPORATION OF AMERICA

1150 DOMINGUEZ ST. ❑ CARSON, CA 90746-3518 ❑ 213/638-1790 ❑ FAX: 213 6389956

TAMURA INDUCTORS FOR SWITCH-MODE POWER REGULATOR. CONTROL & ENERGY STORAGE CIRCUITS.

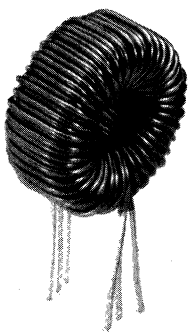
LINEAR INDUCTANCE TO 300kHz.
SMOOTHING AND ENERGY STORAGE COILS

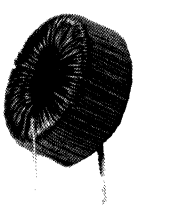
MODEL NO.	AMPS DC	"L" µH @ 20kHz		DCR (Ω)	DIMENSIONS (mm)			PRICE (qty)		
		RATED DC	0 DC		OD	HT	DIA	1-9	10-24	25-99
RS1-1	2	150	215	0.010	24	14	0.6	$7.00	$6.30	$6.00
RS1-2	3	100	160	0.060	24	14	0.8	7.10	6.40	6.00
RS1-3	5	30	45	0.025	24	14	1.0	6.20	5.60	5.30
RS2-1	3	200	325	0.105	29	15	0.8	10.20	9.20	8.70
RS2-2	5	100	190	0.055	29	15	1.0	9.50	8.60	8.10
RS2-3	7	30	45	0.020	29	15	1.3	8.70	7.80	7.40
RS3-1	3	250	400	0.145	31	17	0.8	12.20	11.00	10.40
RS3-2	5	150	280	0.085	33	18	1.0	11.70	10.50	9.90
RS3-3	7	75	135	0.035	33	19	1.3	11.40	10.30	9.70



LINEAR INDUCTANCE TO 100kHz.
SMOOTHING AND ENERGY STORAGE COILS

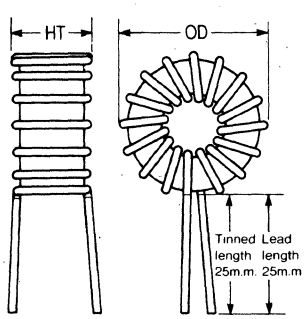
MODEL NO.	AMPS DC	"L" (µH) @ 1kHz	DCR (Ω)	DIMENSIONS (mm)			PRICE (qty)		
				OD	HT	DIAxL[1]	1-9	10-24	25-99
SKC-101	5-10	30	0.009	32	18	1.3x1	$10.70	$9.60	$9.10
SKC-102	5-10	50	0.011	32	18	1.3x1	11.70	10.50	9.90
SKC-103	5-10	100	0.017	32	18	1.3x1	13.50	12.20	11.50
SKC-104	5-10	150	0.023	32	18	1.3x1	14.70	13.20	12.50
SKC-105	5-10	200	0.024	37	20	1.3x1	15.40	13.90	13.10
SKC-106	5-7.5	400	0.048	37	20	1.3x2	20.10	18.10	17.10
SKC-107	5-7.5	600	0.056	44	26	1.3x2	22.70	20.40	19.30
SKC-108	5-7.5	800	0.044	54	25	1.3x2	27.80	25.00	23.60
SKC-109	5-6	1200	0.081	55	26	1.3x3	31.90	28.70	27.10
SKC-110	5-6	1800	0.099	55	26	1.3x3	35.00	31.50	29.80
SKC-201	10-15	30	0.005	32	18	1.3x2	13.80	12.40	11.70
SKC-202	10-15	50	0.007	37	20	1.3x2	15.40	13.90	13.10
SKC-203	10-15	100	0.012	37	20	1.3x2	20.10	18.10	17.10
SKC-204	10-15	150	0.014	44	26	1.3x2	22.70	20.40	19.30
SKC-205	10-15	200	0.011	54	25	1.3x2	27.80	25.00	23.60
SKC-206	10-12	400	0.024	55	26	1.3x4	33.30	30.00	28.30
SKC-207	10-12	600	0.032	56	27	1.3x4	39.40	35.50	33.50
SKC-208	10-12	800	0.032	56	33	1.3x4	44.90	40.40	38.20
SKC-301	15-25	30	0.004	37	20	1.3x3	17.30	15.60	14.70
SKC-302	15-25	50	0.006	39	21	1.3x3	20.70	18.60	17.60
SKC-303	15-25	100	0.006	54	25	1.3x3	28.50	25.70	24.20
SKC-304	15-20	150	0.009	55	26	1.3x3	31.90	28.70	27.10
SKC-305	15-20	200	0.011	55	26	1.3x3	35.00	31.50	29.80
SKC-306	15-20	400	0.016	56	33	1.3x6	46.10	41.50	39.20
SKC-401	20-30	30	0.004	41	23	1.3x4	22.70	20.40	19.30
SKC-402	20-30	50	0.005	46	25	1.3x4	24.80	22.30	21.10
SKC-403	20-28	100	0.006	55	26	1.3x4	33.30	30.00	28.30
SKC-404	20-25	150	0.008	56	27	1.3x4	39.40	35.50	33.50
SKC-405	20-25	200	0.008	56	33	1.3x4	44.90	40.40	38.20
SKC-501	25-35	30	0.003	45	24	1.3x5	24.50	22.10	20.80
SKC-502	25-35	50	0.003	55	26	1.3x5	31.80	28.60	27.00
SKC-503	25-35	100	0.004	55	33	1.3x5	41.00	36.90	34.90
SKC-504	25-30	150	0.006	57	34	1.3x5	46.70	42.00	39.70
SKC-601	30-40	30	0.002	54	25	1.3x6	30.30	27.30	25.80
SKC-602	30-40	50	0.003	55	26	1.3x6	35.10	31.60	29.80
SKC-603	30-35	100	0.004	56	33	1.3x6	46.10	41.50	39.20
SKC-801	40-50	30	0.002	55	33	1.3x8	40.00	36.00	34.00
SKC-802	40-50	50	0.002	54	34	1.3x8	48.00	43.20	40.80





NOTE 1: Wire diameter (DIA) by number of leads (L) in parallel.

DIMENSIONS



VARIABLE INDUCTANCE TO 100kH.
SMOOTHING AND ENERGY STORAGE COILS

MODEL NO.	AMPS DC	"L" µH @ 1kHz		DCR (Ω)	DIMENSIONS (mm)			PRICE (qty)		
		RATED DC	0 DC		OD	HT	DIAxL[2]	1-9	10-24	25-99
SKL-103	5	100	450	0.017	32	18	1.3x1	$13.60	$12.20	$11.60
SKL-105	5	200	1000	0.025	32	18	1.3x1	15.20	13.70	12.90
SKL-203	10	100	500	0.011	43	23	1.3x2	20.50	18.50	17.40
SKL-205	10	200	1000	0.015	54	29	1.3x2	27.00	24.30	23.00
SKL-303	15	100	500	0.008	55	26	1.3x3	30.50	27.50	25.90
SKL-305	15	200	1000	0.011	56	27	1.3x3	35.30	31.80	30.00
SKL-403	20	100	500	0.008	55	26	1.3x4	34.70	31.20	29.50
SKL-404	20	150	750	0.009	56	27	1.3x4	37.90	34.10	32.20
SKL-502	25	50	250	0.006	55	26	1.3x5	32.60	29.30	27.70
SKL-503	25	100	600	0.007	57	34	1.3x5	42.90	38.60	36.50

NOTE 2: Wire diameter (DIA) by number of leads (L) in parallel.

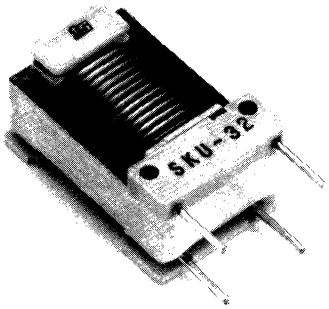
CONTACT TAMURA for ORDERING, STOCK, OEM PRICING, DETAILED DATA SHEETS or YOUR CUSTOM REQUIREMENTS by FAX: 310/638/9956 or CALL: (310) 638-1790

TAMURA INDUCTORS FOR SWITCH-MODE POWER REGULATOR. CONTROL & ENERGY STORAGE CIRCUITS.



EN, SKU INDUCTOR FEATURES*

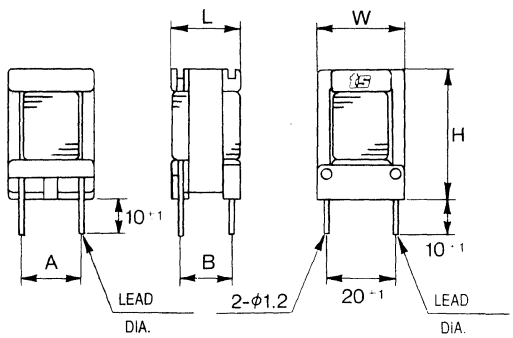
- Rated Current: Specified at 55°C temperature rise.
- Direct Current Resistance (DCR): Maximum values.
- Operating Temperature: -25°C to +60°C.



POWER INDUCTORS FOR ENERGY STORING AND SMOOTHING CIRCUITS TO 100kHz.

MODEL NO.	AMPS DC	"L" mH @ 1kHz 0A DC	DCR (Ω)	DIMENSIONS (mm) LEAD DIA	"A"	PRICE (qty) 1-9	10-24	25-99
SKU-071	5.0	0.20	0.037	1.10	16	$8.60	$7.70	$7.30
SKU-072	4.0	0.45	0.082	0.95	16	8.80	7.90	7.50
SKU-073	3.0	0.55	0.090	0.85	16	8.60	7.70	7.30
SKU-074	2.0	1.30	0.220	0.70	16	8.80	7.90	7.50
SKU-075	1.0	4.00	0.600	0.55	16	8.90	8.00	7.60
SKU-076	0.5	8.50	1.200	0.45	16	9.30	8.40	7.90
SKU-11P	10.0	0.065	0.012	1.60	16	8.60	7.70	7.30
SKU-12P	5.0	0.30	0.056	1.10	16	8.80	7.90	7.50
SKU-13P	2.5	1.00	0.170	0.80	16	8.80	7.90	7.50
SKU-14P	1.5	2.50	0.370	0.65	16	8.90	8.00	7.60
SKU-15P	1.0	5.00	0.750	0.55	16	9.30	8.40	7.90
SKU-16P	0.5	10.00	1.600	0.45	16	9.70	8.70	8.20
SKU-31P	10.0	0.12	0.013	1.60	16	12.00	10.80	10.20
SKU-32P	8.0	0.16	0.019	1.40	16	12.00	10.80	10.20
SKU-33P	7.0	0.20	0.024	1.30	16	11.80	10.60	10.00
SKU-34P	5.0	0.60	0.063	1.10	16	12.00	10.80	10.20
SKU-35P	4.0	0.85	0.090	0.95	16	12.00	10.80	10.20
SKU-36P	3.0	1.70	0.175	0.85	16	12.20	11.00	10.40

DIMENSIONS



HIGH FREQUENCY POWER INDUCTORS FOR ENERGY STORAGE CIRCUITS TO 300kHz.

MODEL NO.	AMPS DC	"L" µH @ 20kHz RATED DC	0 DC	DCR (Ω)	DIMENSIONS (mm) LEAD DIA	"A"	PRICE (qty) 1-9	10-24	25-99
EN4-1	5.0	150	210	0.060	1.10	13	$9.70	$9.20	$8.20
EN4-2	4.0	200	280	0.095	0.95	13	9.90	9.40	8.40
EN4-3	3.0	280	360	0.130	0.85	13	10.10	9.60	8.60
EN4-4	2.0	850	1200	0.360	0.70	13	10.20	9.70	8.70
EN4-5	1.0	2600	3400	0.960	0.55	13	10.50	10.00	8.90
EN4-6	0.5	4500	5000	1.630	0.45	13	10.70	10.20	9.10
EN5-1	10.0	100	130	0.030	1.60	18	12.90	12.30	11.00
EN5-2	8.0	150	180	0.040	1.40	18	12.70	12.10	10.80
EN5-3	7.0	200	240	0.050	1.30	18	12.60	12.00	10.70
EN5-4	5.0	500	650	0.120	1.10	17	12.90	12.30	11.00
EN5-5	3.0	1000	1200	0.250	0.85	15	12.60	12.00	10.70
EN6-1	15.0	75	80	0.015	2.00	21	20.90	19.90	17.80
EN6-2	13.0	150	175	0.025	1.80	21	17.50	16.60	14.90
EN6-3	10.0	200	230	0.035	1.60	20	17.10	16.20	14.50
EN6-4	7.0	350	380	0.650	1.30	18	16.80	16.00	14.30
EN6-5	5.0	900	1200	0.170	1.10	17	17.30	16.40	14.70

EN, SKU DIMENSIONS

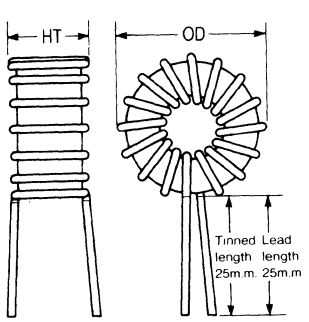
SERIES PREFIX	DIMENSIONS (mm max) H	W	L	B
EN-4	32.0	28.0	18.0	13.0
EN-5	38.0	38.0	27.0	19.0
EN-6	43.0	43.0	30.0	23.0
SKU-07	29.5	25.0	17.0	12.0
SKU-10	38.5	25.0	15.0	10.0
SKU-30	38.5	25.0	20.0	15.0

NORMAL MODE NOISE FILTERING TOROIDAL COILS

MODEL NO.	AMPS DC[1]	"L" µH @ 1kHz 1ma	DCR (Ω)	DIMENSIONS (mm) OD	HT	DIA	PRICE (qty) 1-9	10-24	25-99	100 up
SKP1-30	2	30	0.039	16.0	8.0	0.6	$2.30	$2.10	$2.00	$1.80
SKP1-40	2	55	0.050	16.0	8.0	0.6	2.30	2.10	2.00	1.80
SKP1-50	2	80	0.061	16.0	8.5	0.6	2.50	2.30	2.10	2.00
SKP2-30	2	50	0.051	16.0	11.0	0.6	2.50	2.30	2.10	2.00
SKP2-40	2	90	0.066	16.0	11.0	0.6	2.50	2.30	2.10	2.00
SKP2-50	2	130	0.082	16.0	11.5	0.6	2.60	2.30	2.20	2.10
SKP3-30	3	40	0.028	21.0	11.0	0.8	2.60	2.30	2.20	2.10
SKP3-40	3	80	0.037	21.0	11.0	0.8	2.70	2.40	2.30	2.20
SKP3-50	3	120	0.045	21.5	11.5	0.8	3.00	2.70	2.60	2.40
SKP4-40	5	65	0.023	25.0	12.0	1.0	3.40	3.10	2.90	2.70
SKP4-50	5	100	0.028	26.0	12.0	1.0	3.70	3.30	3.10	3.00
SKP5-40	5	100	0.033	27.5	14.0	1.0	4.30	3.90	3.70	3.40
SKP5-50	5	150	0.041	28.0	15.0	1.0	4.70	4.20	4.00	3.80

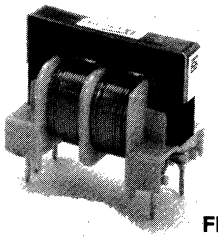
Note 1: SKP series "L" with DC amp rating is approximately 50% value shown.

DIMENSIONS

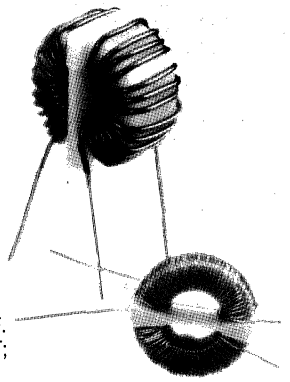


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TAMURA COMMON MODE COILS FOR AC LINE & EMI/RFI FILTERING, 0.1 to 50MHz.







FEATURES

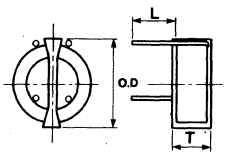
- Rated Voltage: 250VAC, 50/60 Hz.
- Rated Current: Spec'd at max. temp. rise.
- Insulation Resistance: 100 Megohms, 500VDC.
- Direct Current Resistance (DCR): Spec'd per line, input to output.
- Dielectric Voltage: 1.5kVAC (line to gnd); 2.0kVAC, CMF Series.
- Temperature Rise: ≤30°C, CMT; ≤55°C, CMF.
- Operating Temperature: -25°C to +85°C, CMT; -25° C to +60 °C, CMF.
- Creepage Distance: 3.2mm min., CMF series.

COMMON MODE NOISE FILTERING COILS

MODEL NO.	INDUCTANCE		DCR (Ω)	DIA mm	PRICE (qty)		
	AMPS	mH min			1-9	10-24	25-99
CMT-01102	1.0	2	0.25	0.4	$5.00	$4.50	$4.30
CMT-01104	1.0	4	0.35	0.4	5.70	5.10	4.80
CMT-01202	2.0	2	0.15	0.55	5.10	4.60	4.30
CMT-01301	3.0	1	0.10	0.7	4.70	4.20	4.00
CMT-02105	1.0	5	0.40	0.4	5.80	5.20	4.90
CMT-02107	1.0	7	0.50	0.4	6.00	5.40	5.10
CMT-02203	2.0	3	0.20	0.55	5.50	5.00	4.70
CMT-02302	3.0	2	0.10	0.7	5.10	4.60	4.30
CMT-03110	1.0	10	0.55	0.4	7.70	6.90	6.50
CMT-03305	3.0	5	0.15	0.7	7.20	6.50	6.10
CMT-03502	5.0	2	0.04	0.95	7.00	6.30	5.90
CMT-03801	8.0	1	0.02	1.2	6.70	6.00	5.70
CMF-0470	0.15	47	7.0	0.7	2.50	2.30	2.10
CMF-0330	0.2	33	6.0	0.7	2.50	2.30	2.10
CMF-0220	0.3	22	4.5	0.7	2.50	2.30	2.10
CMF-0100	0.45	10	3.0	0.7	2.50	2.30	2.10
CMF-0056	0.55	5.6	1.0	0.7	2.50	2.30	2.10
CMF-0033	0.8	3.3	0.7	0.7	2.50	2.30	2.10
CMF-6470	0.45	47	3.0	0.7	2.80	2.50	2.40
CMF-6330	0.5	33	2.5	0.7	2.80	2.50	2.40
CMF-6220	0.65	22	2.0	0.7	2.80	2.50	2.40
CMF-6100	0.9	10	0.6	0.7	2.80	2.50	2.40
CMF-6056	1.0	5.6	0.4	0.7	2.80	2.50	2.40
CMF-6033	2.0	3.3	0.3	0.7	2.80	2.50	2.40
CMF-8470	0.5	47	4.0	0.8	3.00	2.70	2.50
CMF-8330	0.65	33	3.0	0.8	3.00	2.70	2.50
CMF-8220	0.8	22	2.0	0.8	3.00	2.70	2.50
CMF-8100	1.0	10	0.7	0.8	3.00	2.70	2.50
CMF-8056	1.5	5.6	0.4	0.8	3.00	2.70	2.50
CMF-8033	2.0	3.3	0.3	0.8	3.00	2.70	2.50
CMF-2470	1.0	47	2.0	1.0	3.70	3.30	3.10
CMF-2330	1.2	33	0.8	1.0	3.70	3.30	3.10
CMF-2220	1.4	22	0.6	1.0	3.70	3.30	3.10
CMF-2100	2.2	10	0.3	1.0	3.70	3.30	3.10
CMF-2056	2.7	5.6	0.25	1.0	3.70	3.30	3.10
CMF-2033	4.0	3.3	0.08	1.0	3.70	3.30	3.10

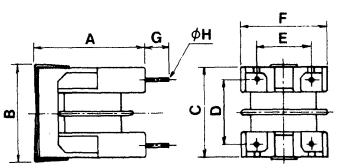
CMT SERIES (dim. mm)

SERIES PREFIX	O.D.	T	L±3mm
CMT-01	28	12.5	20
CMT-02	28	14.5	20
CMT-03	32	22	20



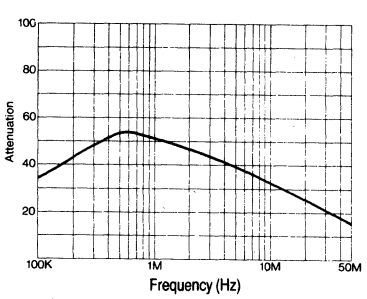
CMF SERIES (dim. mm)

SERIES PREFIX	A	B	C±1	D±1	E±.4	F±1	G±.8
CMF-0	20.5	17.5	18.0	12.5	10.0	16	4
CMF-6	28.0	22.5	18.0	12.5	10.0	18	4
CMF-8	31.0	24.0	22.0	16.0	10.0	20	4
CMF-2	33.5	38.5	37.0	30.0	12.5	21	4

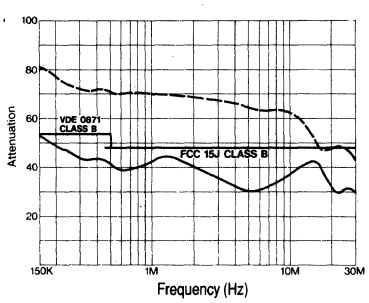


TYPICAL PERFORMANCE CHARACTERISTICS

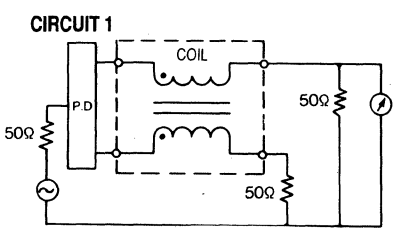
STATIC CHARACTERISTIC CMT-02105 IN CIRCUIT 1



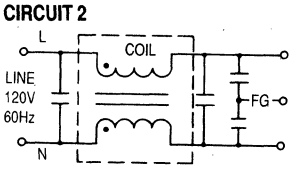
DYNAMIC CHARACTERISTIC CMT-02105 IN CIRCUIT 2



CIRCUIT 1



CIRCUIT 2



Switching Power Supply

Cy: 2200pf (line–to–FG)
Cx: 0.1μf (line–to–line)

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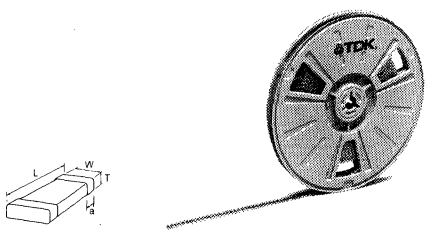
MULTILAYER CHIP INDUCTORS, TRANSFORMERS, IFT, LC TRAPS

TDK CORPORATION OF AMERICA 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: 708-803-6100 **INDIANAPOLIS** Phone: 317-872-0370 **NEW YORK** Phone: 516-625-0151 **LOS ANGELES** Phone: 213-539-6631 **DETROIT** Phone: 313-462-1210 **NEW JERSEY** Phone: 201-736-0023 **BOSTON** Phone 508-624-4262 **HUNTSVILLE** Phone: 205-464-0222 **GREENSBORO** Phone: 919-292-0012 **DALLAS** Phone: 214-506-9800 **SAN FRANCISCO** Phone: 408-437-9585
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MULTILAYER CHIP INDUCTORS (MLF SERIES)

TDK Multilayer Chip Inductors use magnetic materials and multilayer technology in producing epoch-making inductors which do not use any windings. TDK multilayer chip inductors use ferrite paste and electric conductor paste alternately layered in a completely monolithic structure. Inductor is obtained using a sintered closed magnetic circuit such as toroidal and a magnetic shield.

- No crosstalk between inductors due to magnetic shield. Perfect for high density installation.
- Unified automatic chip mounting shape with no directionality.



Dimensions in mm (inches)

Type	L	W	T	a
MLF2012	$2.0^{+0.3}_{-0.1}$ (.079)	1.25±0.2 (.049)	0.85±0.2 (.033) 1.25±0.2 (.049)	0.5±0.3 (.02)
MLF3216	3.2±0.2 (.126)	1.6±0.2 (.063)	0.6±0.2 (.024) 1.1±0.3 (.043)	0.5±0.3 (.02)
MLF3225	3.2±0.2 (.126)	2.5±0.2 (.098)	1.1±0.3 (.043) 2.5±0.3 (.098)	0.5±0.3 (.02)

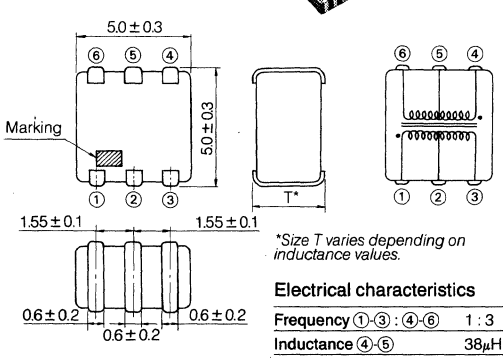
Type	Inductance (μH)	Tolerance (%)	Q min.	Rated current (mA) max.
MLF2012	0.047~33	±10~±20	15~50	5~300
MLF3216	0.047~33	±10~±20	20~50	5~300
MLF3225	39~220	±10~±20	35~55	5~10

MULTILAYER CHIP TRANSFORMERS (MTT5050 SERIES)

TDK Multilayer Chip Transformers have a magnetic shield type and of totally monolithic structure. Magnetic material processing and multilayer technology eliminate the need for wire winding.

- Volume is reduced by 1/5 compared to conventional transformer for a more compact structure.
- Closed magnetic circuit configuration for low leakage flux. Ideal for high density applications.
- Compatible with automatic mount machines. (12mm [.472 inches] wide tape)





*Size T varies depending on inductance values.

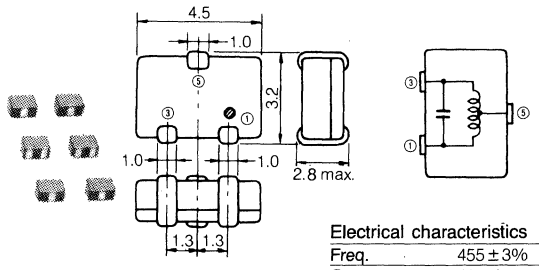
Dimensions in mm

Electrical characteristics	
Frequency ①-③ : ④-⑥	1 : 3
Inductance ④-⑤	38μH at 1 MHz
Q ④-⑥	60 min. at 1 MHz

MULTILAYER CHIP IFT FOR AM RADIO (MIA4532 SERIES)

TDK 4532 type multilayer chip IFT for AM radios can be taped for automated mounting processes. These are the first multilayer chip IFT in the world in which a non regulated portion (ferrite) and capacitor (dielectric material) are sintered into layers simultaneously.

- Usable in automatic surface mounting. (12mm wide tape).
- Compact, thin design.
- Closed magnetic circuit configuration eliminates crosstak. Usable in high density applications.



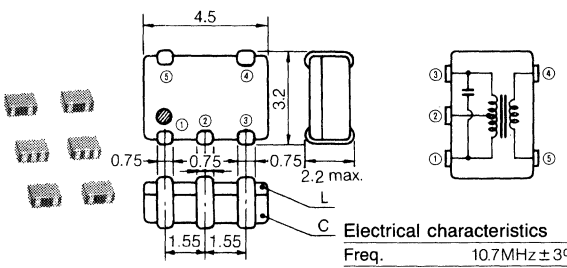
Dimensions in mm

Electrical characteristics	
Freq.	455±3%
Q	40 min.

MULTILAYER CHIP IFT FOR FM RADIO (MIF 4532 SERIES)

TDK 4532 type multilayer chip IFT for FM radios are the smallest in the world and can be used for automatic mounting. These are the first multilayer chip IFT in the world in which a non regulated portion (ferrite) and capacitor (dielectric material) are sintered simultaneously.

- Usable in automatic surface mounting. (12mm wide tape).
- Compact, thin design.
- Closed magnetic circuit configuration eliminates crosstalk. Usable in high density applications.



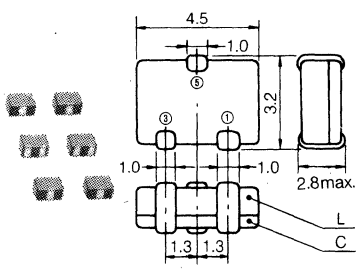
Dimensions in mm

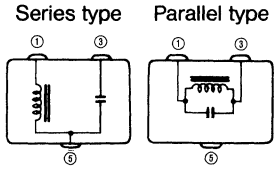
Electrical characteristics	
Freq.	10.7MHz±3%
Q	40 min.

MULTILAYER CHIP LC TRAPS (MXT4532 SERIES)

TDK multilayer LC chip traps are the first of their kind in the world. Ferrite material and dielectric ceramic material are sintered into monolithic configuration simultaneously.

- Ultracompact, lightweight configuration allows use in automatic surface mounting systems. (12mm wide tape).
- 700kHz to 10MHz applicable frequency range.





Dimensions in mm

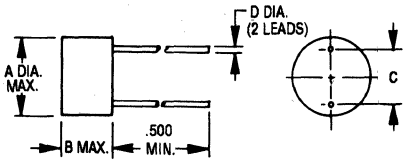
Electrical characteristics	
f_r	f_r±3%
Attenuation	20dB min.

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INDUCTORS

MINI-L

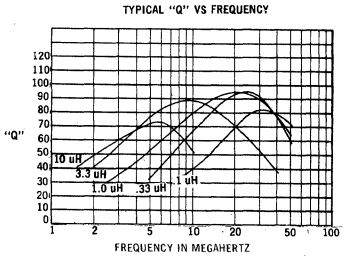
ENCAPSULATED RF INDUCTORS



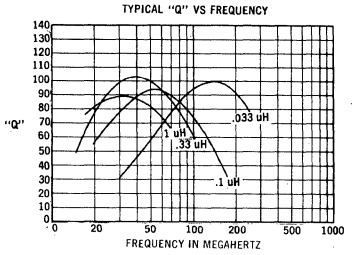
Type	A	B	C	D
PTA-PTF	.250	.155	.100	.020
PTB	.360	.300	.200	.025
PTD	.400	.230	.200	.025

Designed to meet the requirements of MIL-C-15305, Grade 1, Class B (−55°C to +125°C). The rated temperature rise is 35°C above an ambient of 90°C. Overload current should not exceed 1.4 times the rated current. Dielectric withstanding voltage is 700 volts rms. The powdered iron cores used in these items possess excellent temperature stability and result in an inductor with low external magnetic field. This allows mounting in close proximity to each other and to other circuit components without ill effects.

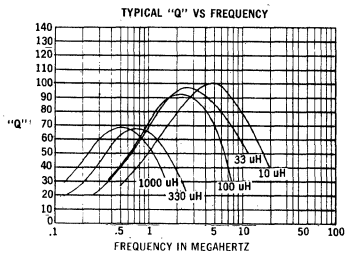
PTA



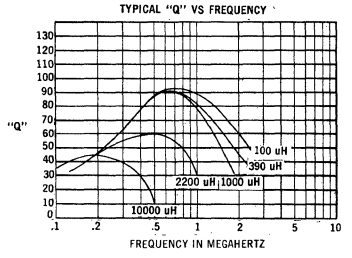
PTF



PTB



PTD



PTA SERIES

Frequency Range: 1 to 50 MHz.

Inductance Tolerances: Less than 1.0 uH, ±10%. Greater than or equal to 1.0 uH, ±5%. Closer tolerances available by special request.

Inductance TC: +50 PPM/°C maximum.

Maximum Power Dissipation: 0.2 watt.

Leads: 1 inch minimum AWG 24 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected 1/4 inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.01 uH should be subtracted from reading.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
PTA-1	0.10	60	25	450	0.04	2230
PTA-2	0.12	60	25	410	0.05	2000
PTA-3	0.15	65	25	350	0.06	1825
PTA-4	0.18	65	25	325	0.07	1675
PTA-5	0.22	65	25	300	0.08	1550
PTA-6	0.27	65	25	280	0.09	1475
PTA-7	0.33	65	25	260	0.10	1400
PTA-8	0.39	70	25	240	0.11	1325
PTA-9	0.47	70	25	220	0.15	1125
PTA-10	0.56	70	25	200	0.20	1000
PTA-11	0.68	70	25	180	0.25	900
PTA-12	0.82	70	25	165	0.30	810
PTA-13	1.0	70	25	150	0.35	750
PTA-14	1.2	65	7.9	130	0.25	875
PTA-15	1.5	65	7.9	120	0.30	800
PTA-16	1.8	65	7.9	110	0.50	600
PTA-17	2.2	65	7.9	100	0.75	500
PTA-18	2.7	65	7.9	90	0.90	450
PTA-19	3.3	65	7.9	70	1.0	425
PTA-20	3.9	65	7.9	60	1.2	400
PTA-21	4.7	60	7.9	50	1.5	350
PTA-22	5.6	60	7.9	45	1.7	325
PTA-23	6.8	60	7.9	40	2.0	300
PTA-24	8.2	60	7.9	37	2.4	290
PTA-25	10.0	60	7.9	35	2.6	280

PTB SERIES

Recommended Frequency Range: 50 KHz to 35 MHz.

Inductance Tolerance: ±5%. Closer tolerances available by special request.

Inductance TC: From +60 PPM/°C maximum to +300 PPM/°C maximum, depending upon inductance value.

Maximum Power Dissipation: .33 watt.

Leads: 1 inch minimum AWG 22 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected 1/4 inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.01 uH should be subtracted from reading.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
PTB-1	10	75	2.5	35	1.1	550
PTB-2	12	75	2.5	31	1.3	500
PTB-3	15	75	2.5	27	1.5	460
PTB-4	18	80	2.5	25	1.9	410
PTB-5	22	80	2.5	22	2.2	380
PTB-6	27	80	2.5	20	2.6	350
PTB-7	33	80	2.5	18	3.3	320
PTB-8	39	80	2.5	16	3.8	290
PTB-9	47	80	2.5	14	4.6	260
PTB-10	56	80	2.5	12	5.6	240
PTB-11	68	80	2.5	11	6.7	220
PTB-12	82	80	2.5	10	8.1	200
PTB-13	100	80	2.5	9.1	9.6	180
PTB-14	120	50	0.79	8.2	10.0	175
PTB-15	150	50	0.79	7.5	11.0	160
PTB-16	180	50	0.79	6.5	12.0	155
PTB-17	220	50	0.79	5.6	13.0	150
PTB-18	270	55	0.79	5.0	17.0	125
PTB-19	330	55	0.79	4.5	19.0	130
PTB-20	390	55	0.79	4.0	21.0	120
PTB-21	470	55	0.79	3.5	22.0	115
PTB-22	560	55	0.79	3.0	24.0	110
PTB-23	680	55	0.79	2.8	19.0	130
PTB-24	820	50	0.79	2.5	23.0	120
PTB-25	1000	55	0.79	2.2	26.0	110

PTF SERIES

Frequency Range: 15 to 300 MHz.

Inductance Tolerances: Less than 0.1 uH, ±20%. Greater than or equal to 0.1 uH, ±10%. Closer tolerances available by special request.

Inductance TC: +200PPM/°C maximum.

Maximum Power Dissipation: 0.2 watt.

Leads: 1 inch minimum AWG 24 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on Boonton 190-A "Q" meter with leads connected to 1/4 inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.0026 uH should be subtracted from value calculated from C and F readings.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
PTF-1	0.01	60	150	1000	0.02	3100
PTF-2	0.012	60	150	1000	0.02	3100
PTF-3	0.015	60	150	1000	0.02	3100
PTF-4	0.018	60	150	1000	0.02	3100
PTF-5	0.022	60	100	900	0.02	3100
PTF-6	0.027	60	100	800	0.02	3100
PTF-7	0.033	60	100	750	0.02	3100
PTF-8	0.039	60	100	700	0.02	3100
PTF-9	0.047	60	100	650	0.02	3100
PTF-10	0.056	60	100	600	0.02	3100
PTF-11	0.068	60	100	550	0.03	2500
PTF-12	0.082	60	100	500	0.03	2500
PTF-13	0.10	70	50	450	0.04	2200
PTF-14	0.12	70	50	400	0.05	2000
PTF-15	0.15	70	50	350	0.06	1800
PTF-16	0.18	70	50	320	0.07	1650
PTF-17	0.22	70	50	300	0.08	1500
PTF-18	0.27	70	50	280	0.10	1400
PTF-19	0.33	70	50	260	0.12	1300
PTF-20	0.39	60	50	240	0.15	1150
PTF-21	0.47	60	50	220	0.20	1000
PTF-22	0.56	60	50	200	0.25	900
PTF-23	0.68	60	50	180	0.30	800
PTF-24	0.82	60	50	160	0.35	750
PTF-25	1.0	60	50	150	0.40	700

PTD SERIES

Recommended Frequency Range: 50 KHz to 10 MHz.

Inductance Tolerance: ±5%. Closer tolerances available by special request.

Inductance TC: From +60 PPM/°C maximum to +300 PPM/°C maximum, depending upon inductance value.

Maximum Power Dissipation: .50 watt.

Leads: 1 inch minimum AWG 22 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected 1/4 inch from inductor body directly to "Q" meter terminals.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
PTD-1	100	75	790	8.4	6	280
PTD-2	120	75	790	7.5	7	260
PTD-3	150	75	790	6.8	8	240
PTD-4	180	75	790	6.1	10	220
PTD-5	220	80	790	5.4	12	200
PTD-6	270	80	790	4.7	14	180
PTD-7	330	80	790	4.2	17	165
PTD-8	390	80	790	3.8	20	150
PTD-9	470	75	790	3.4	24	140
PTD-10	560	75	790	3.1	28	130
PTD-11	680	75	790	2.8	33	120
PTD-12	820	75	790	2.5	40	110
PTD-13	1000	75	790	2.2	46	100
PTD-14	1200	45	250	1.9	30	120
PTD-15	1500	45	250	1.6	35	110
PTD-16	1800	50	250	1.4	40	105
PTD-17	2200	50	250	1.3	50	95
PTD-18	2700	50	250	1.2	60	85
PTD-19	3300	50	250	1.1	70	80
PTD-20	3900	50	250	1.0	80	75
PTD-21	4700	50	250	0.9	90	70
PTD-22	5600	45	250	0.8	100	65
PTD-23	6800	40	250	0.7	140	60
PTD-24	8200	40	250	0.6	160	55
PTD-25	10,000	40	250	0.6	175	50

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INDUCTORS

PK 356 SERIES

SEE MIL-T-27/356 QPL LISTING FOR QUALIFIED PARTS

Ideally suited as switching regulator and coupled inductors, common mode chokes, or in other power filtering applications.

The PK356 series is approved to MIL-T-27/356 Specification Sheet, and meets the requirements of MIL-T-27E, Grade 5, Class S (−55°C to 130°C). The temperature rise is less than 30°C when measured at an ambient temperature of 100°C, 0.1 v rms, 10 khz, and at rated DC current as shown in the following Table.

A large selection of sizes provides maximum performance for minimum size. Each unit is magnetically shielded.

CASE	A Max	B Max Dia	C ±.010	D ±.010	Insert	Terminal Arrangement	Terminal Diameter Inches
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)	—	A	.012
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)	—	A	.012
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)	—	A	.016
4	.500 (12.70)	.800 (20.32)	.560 (14.22)	.460 (11.68)	—	B	.016
5	.635 (16.12)	.950 (24.13)	.670 (17.0)	.570 (14.48)	.138-32 UNC-2B .200 Min Deep	B	.020

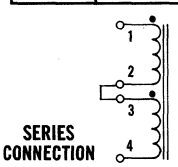
The ratings in the Table below are for a series-aided connection of both windings. The inductance of a parallel connection of these windings will result in 25% of the inductance at twice the rated current. The DCR will be 25% of the series connection.

PART NUMBER	Series Inductance (mH)*	Series dc current (max) (amps)	Series dc resistance ±25% (ohms)	CASE
PK356-01	20	.06	54	1
PK356-02	20	.10	29	2
PK356-03	20	.14	20	3
PK356-04	20	.22	12.4	4
PK356-05	20	.29	10.2	5
PK356-06	15	.07	40.5	1
PK356-07	15	.12	22	2
PK356-08	15	.16	15	3
PK356-09	15	.25	9.3	4
PK356-10	15	.33	7.7	5
PK356-11	10	.08	27	1
PK356-12	10	.14	14.6	2
PK356-13	10	.20	10	3
PK356-14	10	.31	6.2	4
PK356-15	10	.40	5.1	5
PK356-16	7.5	.10	20.3	1
PK356-17	7.5	.17	11	2
PK356-18	7.5	.24	7.5	3
PK356-19	7.5	.38	4.7	4
PK356-20	7.5	.49	3.8	5
PK356-21	5.0	.12	13.5	1
PK356-22	5.0	.21	7.3	2
PK356-23	5.0	.30	5	3
PK356-24	5.0	.47	3.1	4
PK356-25	5.0	.6	2.6	5
PK356-26	3.0	.16	8.1	1
PK356-27	3	.27	4.4	2
PK356-28	3	.38	3	3
PK356-29	3	.6	1.9	4
PK356-30	3	.78	1.5	5

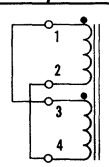
* Inductance Measured At 0.1 VRMS/10KHZ

PART NUMBER	Series inductance (mH)	Series dc current (max) (amps)	Series dc resistance ±25% (ohms)	CASE
PK356-31	2	.19	5.4	1
PK356-32	2	.33	2.9	2
PK356-33	2	.47	2	3
PK356-34	2	.74	1.3	4
PK356-35	2	.95	1	5
PK356-36	1	.27	2.7	1
PK356-37	1	.47	1.5	2
PK356-38	1	.66	1	3
PK356-39	1	1	.62	4
PK356-40	1	1.3	.5	5
PK356-41	.750	.31	2	1
PK356-42	.750	.54	1	2
PK356-43	.750	.76	.75	3
PK356-44	.750	1.2	.47	4
PK356-45	.750	1.6	.38	5
PK356-46	.500	.38	1.3	1
PK356-47	.500	.66	.66	2
PK356-48	.500	.93	.5	3
PK356-49	.500	1.47	.31	4
PK356-50	.500	1.9	.25	5
PK356-51	.250	.53	.66	1
PK356-52	.250	.93	.33	2
PK356-53	.250	1.3	.25	3
PK356-54	.250	2.08	.16	4
PK356-55	.250	2.7	.13	5
PK356-56	.100	0.78	.30	1
PK356-57	.100	1.35	.17	2
PK356-58	.100	1.95	.11	3
PK356-59	.100	3.08	.07	4
PK356-60	.100	3.88	.06	5
PK356-61	.040	1.18	.14	1
PK356-62	.040	2.03	.07	2
PK356-63	.040	2.68	.06	3

All inductors have split windings for versatility. They can be connected in series, parallel, or individually as in balanced filtering applications.

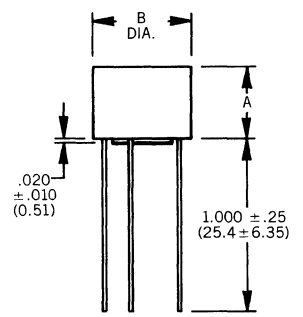


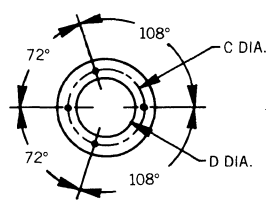
SERIES CONNECTION



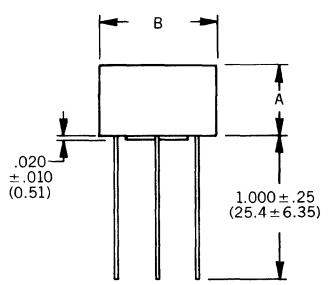
PARALLEL CONNECTION

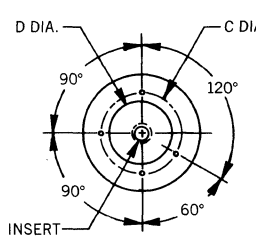
TERMINAL ARRANGEMENT A





TERMINAL ARRANGEMENT B





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INDUCTORS

FAX THIS PAGE OR CALL CATALOG DATA DEPARTMENT, FOR CATALOG DATA SHEETS ON OVER 1762 STANDARD INDUCTANCE VALUES AND TYPES

YOUR NAME _____ POSITION _____

COMPANY _____

ADDRESS _____

_____

PHONE _____

FAX _____

CHECK BOX TO REQUEST FAXED DATA SHEET OR CHECK HERE ☐ FOR ENTIRE CATALOG MAILING.

See Transformer Section 5600 for 201 Standard Audio & 736 Standard Power Transformers

Series	Approx. Size	Inductance Range Min.	Max.	Approx. Ohms/mh	Case Styles* Available	Check Box
TE	.26×.34	0.1MH	220MH	8.9	10	
TJ	.26×.34	0.1MH	220MH	8.9	10	
65	.36×.30	1mH	120mH	0.93	10	
TH	.365×.35	10µH	1mH	50	17	
TG	.365×.35	1mH	500mH	3.24	17	
29	.45×.29	0.05mH	10mH	19.1	6,9,12	
13	.45×.29	.5mH	100mH	2.8	6,9,12	
03	.45×.29	1mH	250mH	1.5	6,9,12	
82	.45×.29	1mH	250mH	1.23	6,9,12	
72	.45×.29	1.25mH	350mH	0.95	6,9,12	
52	.45×.29	2mH	500mH	0.65	6,9,12	
53	.65×.33	.05mH	15mH	10.1	1,2,4,5,6,8,13,14,15	
51	.65×.33	1mH	500mH	1.2	1,2,4,5,6,8,13,14,15	
50	.65×.33	1mH	3H	0.6	1,2,4,5,6,8,13,14,15	
55	.65×.33	1.2mH	3H	0.47	1,2,4,5,6,8,13,14,15	
56	.65×.33	1.5mH	3.6H	0.34	1,2,4,5,6,8,13,14,15	
57	.65×.33	2mH	5H	0.22	1,2,4,5,6,8,13,14,15	
68	.86×.40	.075mH	17.5mH	5.02	1,7,11	
89	.86×.40	1.5mH	600mH	0.67	1,7,11	
90	.86×.40	3mH	6H	0.38	1,7,11	
91	.86×.40	3mH	6H	0.28	1,7,11	
92	.86×.40	3.6mH	7.2H	0.2	1,7,11	
93	.86×.40	5mH	10H	0.16	1,7,11	
74	.98×.42	.1mH	20mH	3.08	1,3,7,11,16	
48	.98×.42	2mH	600mH	0.42	1,3,7,11,16	
06	.98×.42	5mH	7.2H	0.21	1,3,7,11,16	
24	.98×.42	6mH	8.5H	0.15	1,3,7,11,16	
23	.98×.42	7.2mH	10H	0.13	1,3,7,11,16	
21	.98×.42	10mH	15H	0.08	1,3,7,11,16	
59	1.15×.52	3mH	3.6H	0.31	1,11	
10	1.15×.52	5mH	8.6H	0.13	1,11	
08	1.15×.52	7.2mH	10H	0.12	1,11	
07	1.15×.52	10mH	12H	0.09	1,11	
05	1.15×.52	15mH	20H	0.07	1,11	
94	1.27×.63	5mH	860mH	0.21	1,3,7,11	
30	1.27×.63	5mH	17.5H	0.11	1,3,7,11	
28	1.27×.63	7.2mH	20H	0.09	1,3,7,11	
27	1.27×.63	8.6mH	24H	0.07	1,3,7,11	
25	1.27×.63	12mH	36H	0.04	1,3,7,11	
84	1.57×.70	5mH	20H	0.08	1,3,7	
54	1.84×.86	17.5mH	40H	0.05	1,3,7	
15	2.43×1.03	100mH	60H	0.03	1,7	

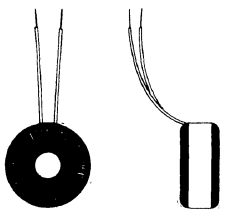
*Custom Case sizes available

TOROTEL PRODUCTS INC. 13402 South 71 Highway / Grandview, MO 64030 / (816) 761-6314 FAX (816) 763-2278

INDUCTORS

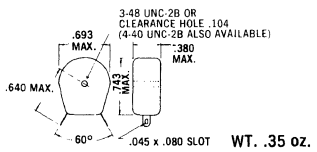
CASE STYLES AVAILABLE

UNCASED



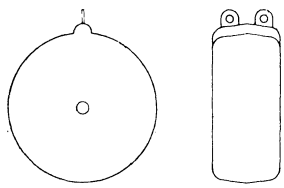
STYLE 1

COMPRESSION MOLDED



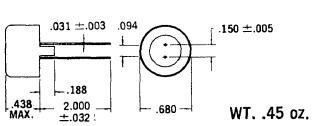
WT. .35 oz.

STYLE 2



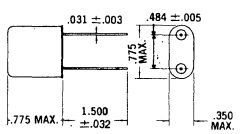
STYLE 3

METAL CASED



WT. .45 oz.

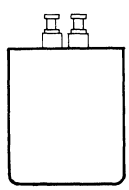
STYLE 4



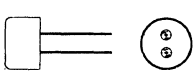
WT. .45 oz.

STYLE 5

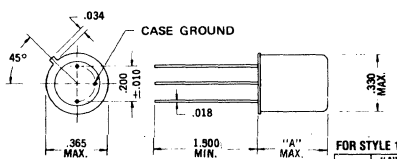




STYLE 7



STYLE 6

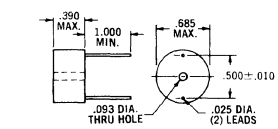


FOR STYLE 17

	"A"
TG	.390
TH	.350

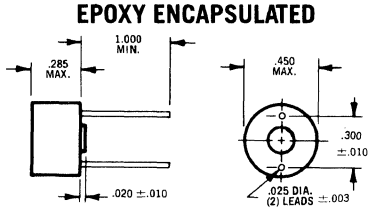
STYLE 17

EPOXY ENCAPSULATED



WT. .35 OZ.

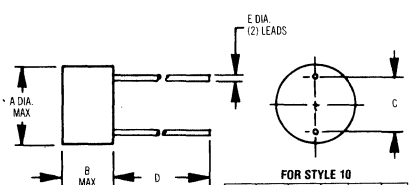
STYLE 8



WT. .08 oz.

P	PF
NO FOOT	WITH FOOT

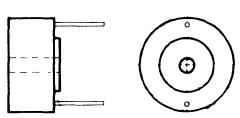
STYLE 9



FOR STYLE 10

CASE	MAX. A	MAX. B	C	D	E
TE	.250	.343	.200	1.625	.020
TJ	.250	.343	.100	1.625	.020
P65	.360	.300	.200	1.000	.025

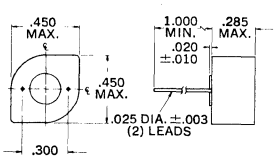
STYLE 10



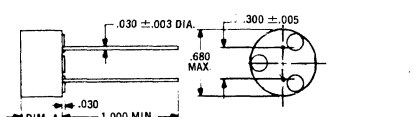
TYPE PREFIX TABLE

THREADED	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

STYLE 11



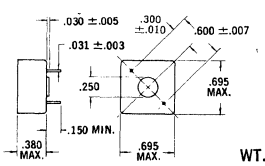
STYLE 12



WT. .35 oz.

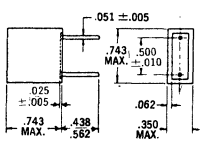
DIM. A		STYLE
.435	.390	
PS	PST	FEET
PW	PWT	NO FEET

STYLE 13



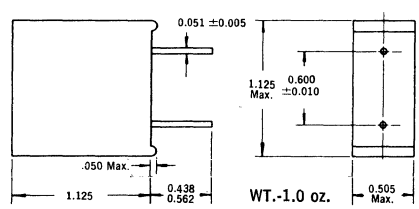
WT. .35 oz.

STYLE 14



WT. .35 oz.

STYLE 15



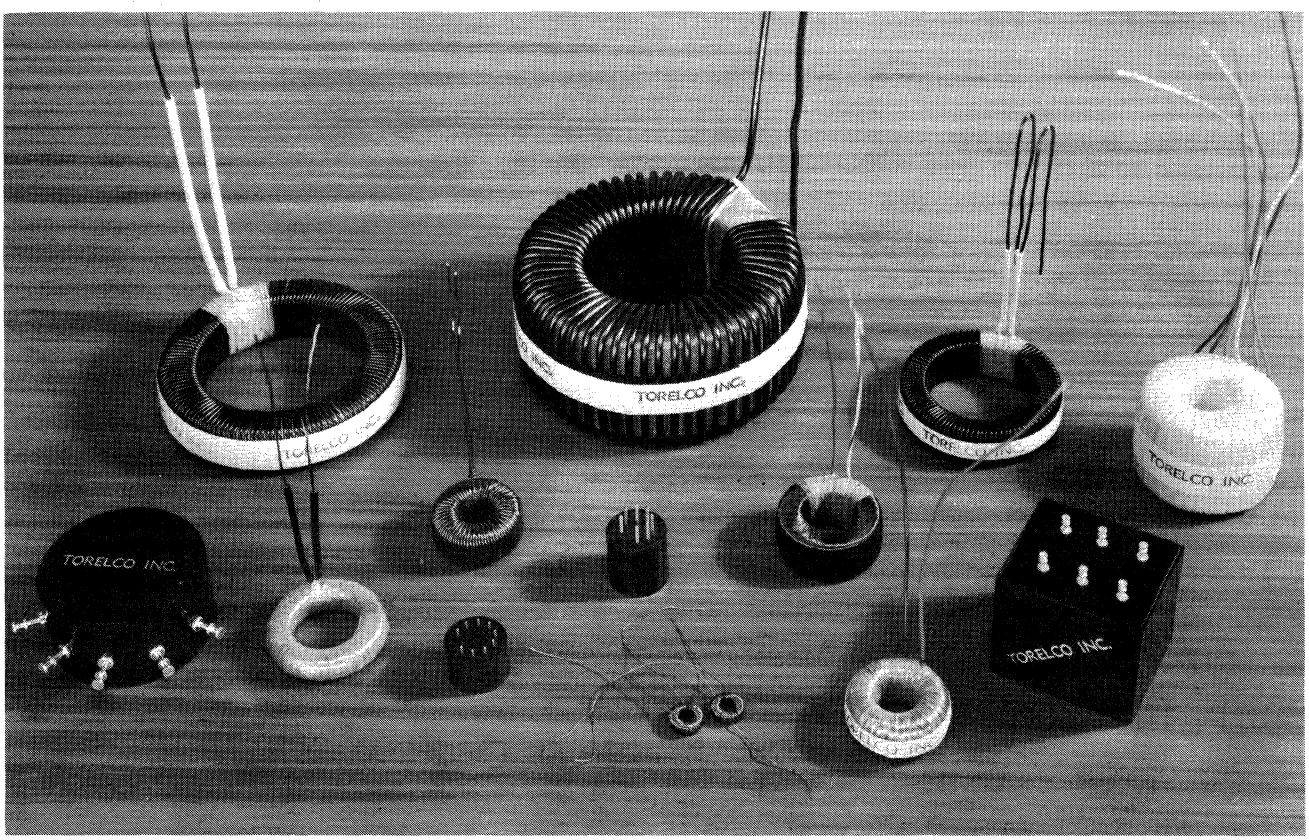
WT.-1.0 oz.

STYLE 16

TORELCO COILS

MAGNETIC AMPLIFIERS • TRANSFORMERS
CONVERTERS • REACTORS • INDUCTORS

Since 1962 Torelco, Inc. has been manufacturing toroidal coils of the highest quality and reliability. Our complete facilities allow us to handle production runs as well as offer custom coil winding to meet a wide variety of requirements. Prompt service, quality assurance and your satisfaction are the goals of our dedicated staff. **PROTECT YOUR PRODUCT'S REPUTATION** – Rely on quality coils from TORELCO, INC.

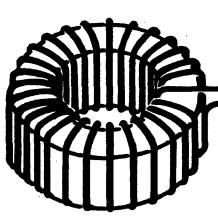


At present we are equipped to handle the following coil dimensions and wire sizes:

COILS: minimum finished I.D. – .093"
maximum finished O.D. – 10"

WIRES: single wire from #46 to #8 AWG
bifilar wire from #46 to #10 AWG

AVAILABLE FINISHES: lacquer or varnish impregnated, epoxy coated, taped, encapsulated



TORELCO INC.

14 PAINE AVENUE • P.O. BOX 560
IRVINGTON, NEW JERSEY 07111
(201)374-8641 • (201)374-8787
FAX (201) 374-7611

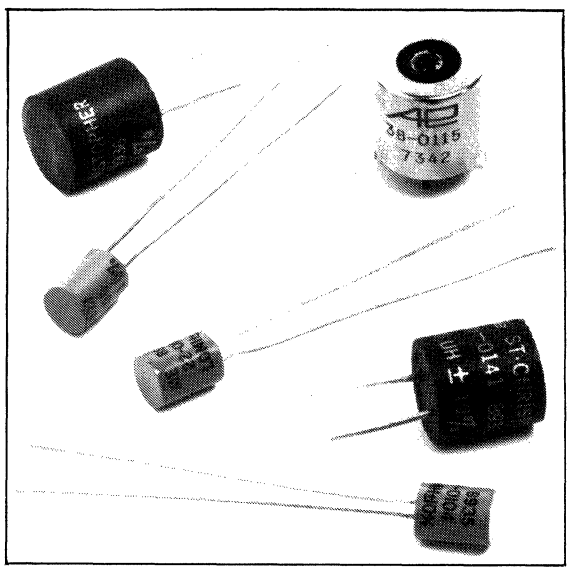
VERNITRON
CORPORATION

AIE MAGNETICS DIVISION

Transformers, Power Inductors, DC-DC Converters, SCR/Audio/Switch Mode and Surface Mount Magnetics.

2801 72nd St. N. • St. Petersburg, FL 33710 • (813) 347-2181 • FAX: (813) 347-3881

INDUCTORS



Fixed Inductors...Micro-Miniature and Miniature
AIE Magnetics fixed inductors offer the optimum in design efficiency and provide the highest inductances per unit of volume. These inductors provide your design solution in two distinct areas: (1) Small DC currents with non-critical temperature coefficient of inductance and (2) where DC current is a design factor and where a low temperature coefficient of inductance is desired.

TYPICAL APPLICATIONS
- *DECOUPLING NETWORKS*
- *FILTER CHOKES*
- *PEAKING AND COMPENSATING CIRCUITS*
- *TONE COLOR FILTERS*
- *OSCILLATORS*
- *TONE DECODING*

FEATURES
- *MICRO-MINIATURE & MINIATURE SIZES*
- *LOW TEMPERATURE COEFFICIENT OF INDUCTANCE*
- *ENCAPSULATED*
- *MIL-C-15303 FEATURES*
- *SOLDERABLE LEADS*
- *WELDABLE LEADS (Optional)*

Switching Regulator Inductors
AIE Magnetics manufactures a line of inductors for DC-DC converters, lower current outputs or switching power supplies. These inductors have been designed to operate with switching regulators, available from several semiconductor manufacturers, which operate in the 40-100 Khz range.

TYPICAL APPLICATIONS
- *BOOST CONVERTERS*
- *BUCK CONVERTERS*
- *BUCK-BOOST CONVERTERS*

FEATURES
- *REQUIRE MINIMAL CIRCUIT BOARD SPACE*
- *SHIELDED FROM RADIATING NOISE*
- *SEALED TO WITHSTAND ALL BOARD CLEANING PROCESSES*

Variable Inductors...Miniature
AIE Magnetics variable inductors are typical of our miniaturization efforts for high Q's and high inductances in a minimum of space. These printed circuit mount, shielded inductors offer top tuning for easy access. If your packaging demands dictate side tuning, we can modify our Series 38 for this purpose.

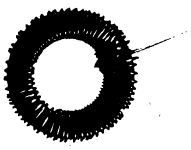
TYPICAL APPLICATIONS
- *HIGH Q TUNED CIRCUITS*
- *FILTER NETWORKS*
- *TANK CIRCUITS*
- *BLOCKING*
- *DECOUPLING*
- *PULSE WIDTH CONTROL*
- *CONTROL OF RL OR LC CONSTANT*

FEATURES
- *MINIATURE SIZE*
- *TEMPERATURE STABILITY*
- *20 KHZ TO 100 MHZ*
- *PRINTED CIRCUIT MOUNTING*
- *± 20% MINIMUM TUNING RANGE*
- *L'S FROM .10 MICROHENRIES TO 22 MILLIHENRIES*

■ Inductors ■ Chokes ■ Coils

QUICK DELIVERY AT COMPETITIVE PRICES

■ **Toroidal Inductors--**
Designed specifically for:
Switching Power Supplies
High Current Filters



■ **"EE" Core Transformers--**
Core configurations, size range, and ferrite mix provide one of the most cost effective designs available.



■ **Ferrite Drum Cores--**
Designed for:
High Current Applications
Power Line Chokes



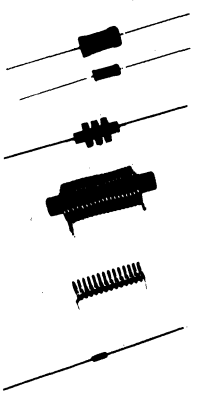
■ **Pot Core Assemblies--**
High degree of repeatability, high Q's, stable inductance, and tunability



Wilco has the answers to your inductor needs.

Choose from a complete line of over 20 standard inductor types, each with superior production quantity deliveries - or call with your specifications for custom inductors and be assured of reliable performance, modified to your requirements in only 72 hours!

For immediate action, call: (317) 293-9300, or write today. Ask for a FREE copy of our latest catalog!



■ **High Current Ferrite Bobbin Chokes--**
A wide range of inductances in a small package.

■ **Multi-Pi--**
High L and High Q

■ **Hash Chokes--**
Power Line Filters

■ **Air Coils--**
High Frequency Applications

■ **Single Layer Wound--**
Varnish or Conformal Coated

YOUR SINGLE-SOURCE SUPPLIER

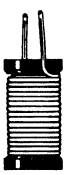
CORPORATION
6451 SAGUARO COURT
INDIANAPOLIS, IN 46268

FAX YOUR REQUIREMENTS TODAY. FAX: (317) 293-9462

"DC" SERIES • POWER LINE INDUCTORS

The use of high saturation flux density ferrite drum cores make these inductors ideal for use in switching power supply applications.

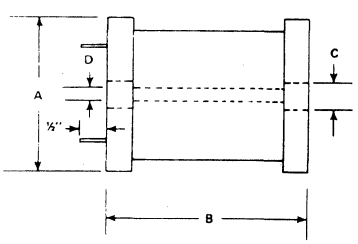
MAXIMUM PHYSICAL DIMENSIONS:				
	A	B	C	D
DC1	.660	.840	.195	Clearance Hole
DC2	.825	.840	.195	For 4/40
DC3	1.1	.840	.195	Screw



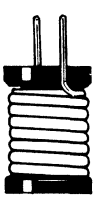
DC1

Typical Applications Are:

- Power Supplies
- Switching Regulators
- SCR and Triac Controls
- RFI Suppression
- Filters

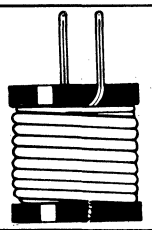


WILCO Part#	Inductance at O DC (µH)	Max. DCR (Ohms)	Saturation Current (DC Amps)	Rated Current (AC Amps)
DC1-10G	1.0	.003	87.0	9.0
DC1-12G	1.2	.003	68.0	9.0
DC1-15G	1.5	.004	56.0	9.0
DC1-18G	1.8	.004	56.0	9.0
DC1-22G	2.2	.005	47.0	9.0
DC1-27G	2.7	.005	47.0	9.0
DC1-33G	3.3	.005	40.0	9.0
DC1-39G	3.9	.006	36.0	9.0
DC1-47G	4.7	.007	32.0	9.0
DC1-56G	5.6	.007	29.0	9.0
DC1-68G	6.8	.008	26.0	9.0
DC1-82G	8.2	.009	24.5	9.0
DC1-100	10.0	.010	21.2	9.0
DC1-120	12.0	.011	19.0	9.0
DC1-150	15.0	.015	17.5	7.2
DC1-180	18.0	.016	16.5	7.2
DC1-220	22.0	.020	15.8	5.5
DC1-270	27.0	.030	14.4	4.5
DC1-330	33.0	.040	13.2	4.0
DC1-390	39.0	.046	11.8	4.0
DC1-470	47.0	.062	11.0	2.8
DC1-560	56.0	.069	10.0	2.8
DC1-680	68.0	.077	8.9	2.8
DC1-820	82.0	.083	8.2	2.8
DC1-101	100.0	.095	7.5	2.8
DC1-121	120.0	.127	5.8	2.0
DC1-151	150.0	.181	5.6	1.6
DC1-181	180.0	.217	5.1	1.6
DC1-221	220.0	.240	4.3	1.6
DC1-271	270.0	.300	4.1	1.6
DC1-331	330.0	.336	3.8	1.3
DC1-391	390.0	.460	3.3	1.0
DC1-471	470.0	.636	3.2	0.8
DC1-561	560.0	.696	2.9	0.8



DC2

WILCO Part#	Inductance at O DC (µH)	Max. DCR (Ohms)	Saturation Current (DC Amps)	Rated Current (AC Amps)
DC2-10G	1.0	.003	108.0	11.4
DC2-12G	1.2	.003	108.0	11.4
DC2-15G	1.5	.003	83.0	11.4
DC2-18G	1.8	.003	68.0	11.4
DC2-22G	2.2	.004	68.0	11.4
DC2-27G	2.7	.005	58.0	11.4
DC2-33G	3.3	.005	58.0	11.4
DC2-39G	3.9	.005	50.0	11.4
DC2-47G	4.7	.005	50.0	11.4
DC2-56G	5.6	.006	44.0	11.4
DC2-68G	6.8	.007	39.0	11.4
DC2-82G	8.2	.007	36.0	11.4
DC2-100	10.0	.009	30.0	11.4
DC2-120	12.0	.009	27.0	11.4
DC2-150	15.0	.013	25.0	9.4
DC2-180	18.0	.018	22.0	7.2
DC2-220	22.0	.019	21.0	7.2
DC2-270	27.0	.026	20.5	5.5
DC2-330	33.0	.029	18.6	5.5
DC2-390	39.0	.030	17.0	5.5
DC2-470	47.0	.035	15.1	5.5
DC2-560	56.0	.039	13.6	5.5
DC2-680	68.0	.053	12.7	4.8
DC2-820	82.0	.060	11.3	4.8
DC2-101	100.0	.080	10.4	4.0
DC2-121	120.0	.090	9.4	4.0
DC2-151	150.0	.980	8.6	4.0
DC2-181	180.0	.110	7.8	4.0
DC2-221	220.0	.150	7.0	2.8
DC2-271	270.0	.213	6.3	2.0
DC2-331	330.0	.305	5.2	1.6
DC2-391	390.0	.320	4.9	1.6
DC2-471	470.0	.355	4.5	1.6
DC2-561	560.0	.388	4.1	1.6
DC2-681	680.0	.430	3.7	1.6
DC2-821	820.0	.590	3.4	1.3
DC2-102	1000.0	.818	3.1	1.0
DC2-122	1200.0	1.14	2.7	0.8
DC2-152	1500.0	1.26	2.4	0.8
DC2-182	1800.0	1.39	2.2	0.8
DC2-222	2200.0	1.54	2.0	0.8



DC3

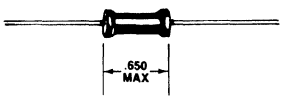
WILCO Part#	Inductance at O DC (µH)	Max. DCR (Ohms)	Saturation Current (DC Amps)	Rated Current (AC Amps)
DC3-10G	1.0	.003	116.0	21.0
DC3-12G	1.2	.003	116.0	21.0
DC3-15G	1.5	.003	116.0	21.0
DC3-18G	1.8	.003	90.0	21.0
DC3-22G	2.2	.003	90.0	21.0
DC3-27G	2.7	.003	74.0	21.0
DC3-33G	3.3	.003	74.0	21.0
DC3-39G	3.9	.003	62.0	21.0
DC3-47G	4.7	.003	54.0	21.0
DC3-56G	5.6	.003	54.0	21.0
DC3-68G	6.8	.004	47.0	21.0
DC3-82G	8.2	.004	42.0	21.0
DC3-100	10.0	.006	38.0	17.0
DC3-120	12.0	.008	35.0	13.5
DC3-150	15.0	.009	32.0	13.5
DC3-180	18.0	.010	29.0	13.5
DC3-220	22.0	.011	25.0	13.5
DC3-270	27.0	.012	23.0	13.5
DC3-330	33.0	.017	20.0	13.5
DC3-390	39.0	.022	19.0	11.4
DC3-470	47.0	.024	19.1	9.0
DC3-560	58.0	.026	17.5	9.0
DC3-680	68.0	.029	15.6	9.0
DC3-820	82.0	.032	14.0	9.0
DC3-101	100.0	.034	13.2	9.0
DC3-121	120.0	.046	12.1	7.2
DC3-151	150.0	.064	10.8	5.5
DC3-181	180.0	.072	9.7	5.5
DC3-221	220.0	.080	8.7	5.5
DC3-271	270.0	.110	7.9	4.5
DC3-331	330.0	.122	7.1	4.5
DC3-391	390.0	.169	6.7	4.0
DC3-471	470.0	.187	6.0	4.0
DC3-561	560.0	.205	5.5	4.0
DC3-681	680.0	.256	5.0	2.8
DC3-821	820.0	.288	4.5	2.8
DC3-102	1000.0	.426	4.1	2.0
DC3-122	1200.0	.462	3.7	2.0
DC3-152	1500.0	.518	3.4	2.0
DC3-182	1800.0	.705	2.8	1.6
DC3-222	2200.0	1.02	2.5	1.3
DC3-272	2700.0	1.14	2.3	1.3
DC3-332	3300.0	1.27	2.0	1.3
DC3-392	3900.0	1.67	1.8	1.0
DC3-472	4700.0	1.86	1.7	1.0

NOTES:

- Saturation current lowers inductance 5%.
- Inductance ±10% measured at 1 KHz.
- Leads for PC mounting tinned to within 1/16" of body.
- Non-listed values available on request.
- Coils finished with sleeving (Polyolefin shrink tube).
- Center hole for mechanical mounting.
- RDC measured @ 20°C.
- Values below 10uH ±20%.

"SFB" SERIES • SMALL FERRITE Bobbin Coils

- Leads No. 20 Tinned Copper 1.5" long
- Coils Finished with Polyolifin Shrink Tube
- Nonstandard Values Available
- Saturation Current Lowers Inductance 5%

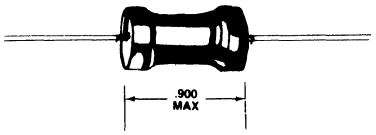


WILCO PART #	L uh ±15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
SFB 39G	3.9	.019	7.3	1.28	.260	1 kHz
SFB 47G	4.7	.022	6.3	1.28	.260	1 kHz
SFB 56G	5.6	.024	5.6	1.28	.260	1 kHz
SFB 68G	6.8	.026	5.3	1.28	.260	1 kHz
SFB 82G	8.2	.028	4.5	1.28	.260	1 kHz
SFB 100	10	.033	4.1	1.28	.260	1 kHz
SFB 120	12	.037	3.6	1.28	.260	1 kHz
SFB 150	15	.040	3.3	1.28	.260	1 kHz
SFB 180	18	.044	3.0	1.28	.260	1 kHz
SFB 220	22	.050	2.7	1.28	.260	1 kHz
SFB 270	27	.058	2.5	1.28	.260	1 kHz
SFB 330	33	.075	2.2	1.008	.260	1 kHz
SFB 390	39	.094	2.0	.804	.260	1 kHz
SFB 470	47	.109	1.8	.804	.260	1 kHz
SFB 560	56	.140	1.7	.804	.260	1 kHz
SFB 680	68	.131	1.5	.804	.260	1 kHz
SFB 820	82	.152	1.4	.804	.260	1 kHz
SFB 101	100	.208	1.2	.632	.260	1 kHz
SFB 121	120	.283	1.1	.508	.260	1 kHz
SFB 151	150	.340	1.0	.508	.260	1 kHz
SFB 181	180	.362	.95	.508	.260	1 kHz
SFB 221	220	.430	.86	.508	.260	1 kHz
SFB 271	270	.557	.77	.400	.260	1 kHz

WILCO PART #	L uh ±15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
SFB 331	330	.665	.70	.400	.260	1 kHz
SFB 391	390	.712	.64	.400	.260	1 kHz
SFB 471	470	1.15	.59	.315	.260	1 kHz
SFB 561	560	1.27	.54	.315	.260	1 kHz
SFB 681	680	1.61	.49	.250	.260	1 kHz
SFB 821	820	1.96	.44	.200	.260	1 kHz
SFB 102	1000	2.30	.40	.200	.260	1 kHz
SFB 122	1200	2.65	.35	.200	.260	1 kHz
SFB 152	1500	3.45	.33	.158	.260	1 kHz
SFB 182	1800	4.03	.29	.158	.260	1 kHz
SFB 222	2200	4.48	.27	.158	.260	1 kHz
SFB 272	2700	5.40	.24	.125	.260	1 kHz
SFB 332	3300	6.56	.22	.125	.260	1 kHz
SFB 392	3900	8.63	.20	.100	.260	1 kHz
SFB 472	4700	9.66	.18	.100	.260	1 kHz
SFB 562	5600	13.9	.166	.082	.260	1 kHz
SFB 682	6800	16.3	.151	.082	.260	1 kHz
SFB 822	8200	20.8	.138	.065	.260	1 kHz
SFB 103	10000	26.4	.125	.050	.260	1 kHz
SFB 123	12000	29.9	.114	.050	.260	1 kHz
SFB 153	15000	42.5	.098	.039	.260	1 kHz
SFB 183	18000	48.3	.091	.039	.260	1 kHz

"LFB" SERIES • LARGE FERRITE Bobbin Coils

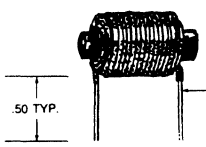
- Leads No. 20 Tinned Copper 1.5" long
- Coils Finished with Polyolifin Shrink Tube
- Nonstandard Values Available
- Saturation Current Lowers Inductance 5%



WILCO PART #	L uh ±15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
LFB 39G	3.9	.007	15.5	4.0	.450	1 kHz
LFB 47G	4.7	.008	13.9	4.0	.450	1 kHz
LFB 56G	5.6	.009	12.6	4.0	.450	1 kHz
LFB 68G	6.8	.011	11.5	4.0	.450	1 kHz
LFB 82G	8.2	.013	9.89	4.0	.450	1 kHz
LFB 100	10	.017	8.70	4.0	.450	1 kHz
LFB 120	12	.019	8.21	4.0	.450	1 kHz
LFB 150	15	.022	7.34	4.0	.450	1 kHz
LFB 180	18	.023	6.64	4.0	.450	1 kHz
LFB 220	22	.026	6.07	4.0	.450	1 kHz
LFB 270	27	.027	5.36	4.0	.450	1 kHz
LFB 330	33	.032	4.82	4.0	.450	1 kHz
LFB 390	39	.033	4.36	4.0	.450	1 kHz
LFB 470	47	.035	3.98	4.0	.450	1 kHz
LFB 560	56	.037	3.66	3.2	.450	1 kHz
LFB 680	68	.047	3.31	2.5	.450	1 kHz
LFB 820	82	.060	3.10	2.0	.450	1 kHz
LFB 101	100	.080	2.79	1.6	.450	1 kHz
LFB 121	120	.090	2.54	1.6	.450	1 kHz
LFB 151	150	.107	2.22	1.6	.450	1 kHz
LFB 181	180	.123	1.98	1.6	.450	1 kHz
LFB 221	220	.150	1.89	1.6	.450	1 kHz
LFB 271	270	.162	1.63	1.6	.450	1 kHz
LFB 331	330	.183	1.51	1.6	.450	1 kHz
LFB 391	390	.212	1.39	1.6	.450	1 kHz
LFB 471	470	.281	1.24	1.2	.450	1 kHz
LFB 561	560	.380	1.17	1.0	.450	1 kHz

WILCO PART #	L (µH) ·15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
LFB 681	680	.420	1.05	1.0	.450	1 kHz
LFB 821	820	.548	.97	0.8	.450	1 kHz
LFB 102	1000	.655	.87	0.8	.450	1 kHz
LFB 122	1200	.884	.79	0.6	.450	1 kHz
LFB 152	1500	1.04	.70	0.6	.450	1 kHz
LFB 182	1800	1.18	.64	0.6	.450	1 kHz
LFB 222	2200	1.56	.58	0.5	.450	1 kHz
LFB 272	2700	2.06	.53	0.4	.450	1 kHz
LFB 332	3300	2.53	.47	0.4	.450	1 kHz
LFB 392	3900	2.75	.43	0.4	.450	1 kHz
LFB 472	4700	3.19	.39	0.4	.450	1 kHz
LFB 562	5600	3.92	.359	.315	.450	1 kHz
LFB 682	6800	5.69	.322	.250	.450	1 kHz
LFB 822	8200	6.32	.293	.250	.450	1 kHz
LFB 103	10000	7.30	.266	.250	.450	1 kHz
LFB 123	12000	9.21	.241	.200	.450	1 kHz
LFB 153	15000	10.5	.214	.200	.450	1 kHz
LFB 183	18000	14.8	.198	.158	.450	1 kHz
LFB 223	22000	21.8	.180	.125	.450	1 kHz
LFB 273	27000	22.7	.162	.125	.450	1 kHz
LFB 333	33000	25.7	.146	.125	.450	1 kHz
LFB 393	39000	31.8	.135	.100	.450	1 kHz
LFB 473	47000	36.1	.122	.100	.450	1 kHz
LFB 563	56000	40.9	112	100	.450	1 kHz
LFB 683	68000	57.3	.101	082	.450	1 kHz
LFB 823	82000	79.3	090	065	.450	1 kHz
LFB 104	100000	89.7	081	065	.450	1 kHz

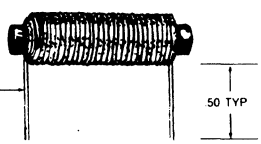
"HCS" SERIES



RADIAL LEAD HASH CHOKES
WOUND ON .250 x 1.00
FERRITE RODS

WILCO Part #	L uh	R.D.C. Ohms Max	Rated Current Suggested Max (amps)	Lead Spacing Typ	Lead Dia. Nom	Body Dia. Max
HCS 100	10	.016	10.00	.260	.050	.590
HCS 200	20	.017	11.00	.560	.050	.590
HCS 300	30	.021	11.00	.610	.050	.590
HCS 500	50	.043	7.00	.625	.039	.550
HCS 101	100	.086	6.00	.750	.030	.550
HCS 151	150	.107	5.00	.565	.030	.600
HCS 201	200	.140	4.00	.620	.030	.600
HCS 251	250	.184	4.00	.750	.030	.600

"HCL" SERIES



RADIAL LEAD HASH CHOKES
WOUND ON .250 x 1.50
FERRITE RODS

WILCO Part #	L uh	R.D.C. Ohms Max	Rated Current Suggested Max (amps)	Lead Spacing Typ	Lead Dia. Nom	Body Dia. Max
HCL 101	100	.061	8.00	1.143	.050	.590
HCL 201	200	.110	6.00	1.103	.039	.550
HCL 301	300	.140	5.00	1.145	.030	.550
HCL 401	400	.167	4.00	.775	.030	.600
HCL 501	500	.192	4.00	.880	.030	.600
HCL 601	600	.237	4.00	1.080	.030	.600
HCL 701	700	.257	4.00	1.115	.030	.600
HCL 801	800	.291	4.00	1.285	.030	.600

L = ± 15% @ 1KHz Measured with zero D.C. current

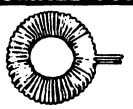
OPTIONS AVAILABLE:

- Intermediate values
- Shrink tube sleeving
- Formed leads
- Tight "L" tolerances

Compact size and pretinned leads for fast & easy PCB insertion in:

- Filters for switching regulators
- SCR/TRIAC control circuits
- Power supplies
- Hash filters
- RF circuits

" ITS" SERIES • SMALL TOROIDAL INDUCTORS



• ACTUAL SIZE •

- The Toroidal core design produces a closed magnetic field resulting in low EMI.

TYPICAL APPLICATIONS:

- Switching Power Supplies
- Output Chokes
- Hash Filters
- EMI/RFI Filtering

WILCO PART NUMBER	L UH ±15%	MAX RDC (OHMS)	RATED DC AMPS	OD (NOM)	ID (NOM)	H (NOM)	LEAD LENGTH (NOM)
ITS10G	1	.004	10	.58	.25	.262	.5
ITS12G	1.2	.004	10	.58	.25	.262	.5
ITS15G	1.5	.005	10	.58	.25	.262	.5
ITS18G	1.8	.005	10	.58	.25	.262	.5
ITS22G	2.2	.007	10	.58	.25	.262	.5
ITS27G	2.7	.007	10	.58	.25	.262	.5
ITS33G	3.3	.008	10	.58	.25	.262	.5
ITS39G	3.9	.009	10	.58	.25	.262	.5
ITS47G	4.7	.01	10	.60	.22	.28	.5
ITS56G	5.6	.011	9	.60	.22	.28	.5
ITS68G	6.8	.012	9	.60	.22	.28	.5
ITS82G	8.2	.013	9	.60	.22	.28	.5
ITS100	10	.014	9	.60	.22	.28	.5
ITS120	12	.018	8	.60	.22	.28	.5
ITS150	15	.02	8	.60	.22	.28	.5
ITS180	18	.025	7	.60	.22	.28	.5
ITS220	22	.029	7	.60	.22	.28	.5
ITS270	27	.035	5.5	.60	.22	.28	.5
ITS330	33	.04	5.5	.60	.22	.28	.5
ITS390	39	.06	5.5	.60	.22	.28	.5
ITS470	47	.095	5	.60	.22	.28	.5
ITS560	56	.120	5	.56	.23	.24	.5
ITS680	68	.125	4	.56	.23	.24	.5
ITS820	82	.200	3.5	.56	.23	.24	.5
ITS101	100	.223	3.5	.56	.23	.24	.5
ITS121	120	.331	3	.56	.23	.24	.5
ITS151	150	.402	3	.56	.23	.24	.5
ITS181	180	.479	3	.56	.23	.24	.5
ITS221	220	.583	2	.56	.23	.24	.5
ITS271	270	.632	2	.56	.23	.24	.5
ITS331	330	.652	1.5	.56	.23	.24	.5
ITS391	390	.731	1.5	.56	.23	.24	.5
ITS471	470	.872	1.5	.56	.23	.24	.5
ITS561	560	.984	1.5	.56	.23	.24	.5
ITS681	680	1.01	1	.56	.23	.24	.5
ITS821	820	1.22	1	.56	.23	.24	.5
ITS102	1000	1.59	1	.56	.23	.24	.5

- Inductance measured@ 1khz with zero DC current
- Toroids are self leaded for PCB insertion

Options Available: • Intermediate Values • Custom Mounts • Encapsulation

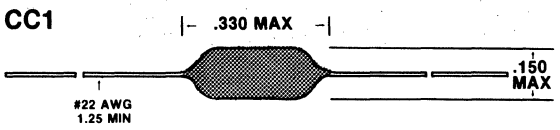
WILCO CORPORATION

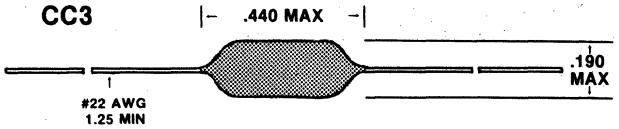
6451 SAGUARO COURT 317-293-9300 INDIANAPOLIS, IN 46268

FAX 317 / 293-9462

"CC" SERIES • EPOXY CONFORMAL COATED INDUCTORS • RF CHOKES

FEATURES
- Equivalent in Quality to Molded Chokes—at a Lower Price
- Same Electrical Characteristics as Many Standard Molded Lines
- Superior Environmental & Mechanical Protection
- Uniform Coating is Excellent for Automatic Insertion
- Custom Designs Available Upon Request





CC1 Series

TOL. of 0.1 uh to .82 uh = +/-15%
1.0 uh to 27 uh = +/-10%

WILCO PART NUMBER	L uh	Q Min	Test Freq. MHz	DCR Max (Ohms)	I,dc Max MA
CC1-10S	0.10	40	25	0.08	1350
CC1-12S	0.12	40	25	0.09	1270
CC1-15S	0.15	38	25	0.10	1200
CC1-18S	0.18	35	25	0.12	1105
CC1-22S	0.22	33	25	0.14	1025
CC1-27S	0.27	33	25	0.16	960
CC1-33S	0.33	30	25	0.22	815
CC1-39S	0.39	30	25	0.30	700
CC1-47S	0.47	30	25	0.35	650
CC1-56S	0.56	30	25	0.50	545
CC1-68S	0.68	28	25	0.60	495
CC1-82S	0.82	28	25	0.85	415
CC1-10G	1.00	25	25	1.00	385
CC1-12G	1.20	25	7.9	0.18	590
CC1-15G	1.50	28	7.9	0.22	535
CC1-18G	1.80	30	7.9	0.30	455
CC1-22G	2.20	30	7.9	0.40	395
CC1-27G	2.70	37	7.9	0.55	355
CC1-33G	3.30	45	7.9	0.85	270
CC1-39G	3.90	45	7.9	1.00	250
CC1-47G	4.70	45	7.9	1.20	230
CC1-56G	5.60	50	7.9	1.80	185
CC1-68G	6.80	50	7.9	2.00	175
CC1-82G	8.20	55	7.9	2.70	155
CC1-100	10.0	55	7.9	3.70	130
CC1-120	12.0	45	2.5	2.70	155
CC1-150	15.0	40	2.5	2.80	150
CC1-180	18.0	50	2.5	3.10	145
CC1-220	22.0	50	2.5	3.30	140
CC1-270	27.0	50	2.5	3.50	135

COMMERCIAL & INDUSTRIAL APPLICATIONS AVAILABLE IN BULK OR TAPED AND REELED

CC3 Series

Tol. of .15 uh to .82 uh = +/-15%
1.0 uh to 100 uh = +/-10%

WILCO PART NUMBER	L uh	Q Min	Test Freq. MHz	DCR Max (Ohms)	I,dc Max MA
CC3-15S	0.15	50	25	.030	2450
CC3-22S	0.22	50	25	.055	1810
CC3-33S	0.33	45	25	.090	1400
CC3-47S	0.47	45	25	.120	1225
CC3-56S	0.56	50	25	.135	1150
CC3-68S	0.68	50	25	.150	1100
CC3-82S	0.82	50	25	.220	900
CC3-10G	1.00	50	25	.290	785
CC3-12G	1.20	33	25	.420	650
CC3-15G	1.50	33	25	.500	600
CC3-18G	1.80	33	25	.650	525
CC3-22G	2.20	33	7.9	.950	435
CC3-27G	2.70	33	7.9	1.20	385
CC3-33G	3.30	33	7.9	2.00	300
CC3-39G	3.90	33	7.9	2.30	280
CC3-47G	4.70	33	7.9	2.60	260
CC3-56G	5.60	45	7.9	.320	495
CC3-68G	6.80	50	7.9	.500	395
CC3-82G	8.20	50	7.9	.600	360
CC3-100	10.0	55	7.9	.900	290
CC3-120	12.0	65	7.9	1.10	265
CC3-150	15.0	65	7.9	1.40	240
CC3-180	18.0	75	7.9	2.25	185
CC3-220	22.0	75	2.5	2.50	175
CC3-270	27.0	60	2.5	2.60	170
CC3-330	33.0	65	2.5	3.00	165
CC3-360	36.0	60	2.5	2.50	180
CC3-390	39.0	60	2.5	2.60	176
CC3-430	43.0	60	2.5	2.70	172
CC3-470	47.0	55	2.5	2.75	170
CC3-510	51.0	55	2.5	2.85	167
CC3-560	56.0	55	2.5	3.00	164
CC3-620	62.0	55	2.5	3.15	160
CC3-680	68.0	55	2.5	3.30	155
CC3-750	75.0	55	2.5	3.70	147
CC3-820	82.0	50	2.5	3.90	143
CC3-910	91.0	50	2.5	4.30	136
CC3-101	100	50	0.79	4.50	133

WILCO CORPORATION
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"ML" SERIES MINIATURE LAYER Choke Coils

All choke coils in this series are wound on .095x¼ size forms. Leads are of No.21 tinned wire. Values from .68 uh to 5.6 uh are wound on phenolic forms. Values from 6.8 uh to 33 uh are wound on iron core forms. Tolerances are ± 15% for ML10S through ML82S: ± 10% from ML10G through ML270. All units are impregnated with thermosetting varnish and are EIA color coded.

• ¼ WATT RESISTOR SIZE CHOKES •



WILCO PART # ML Series	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX.	DIA. NOM.	TEST FREQ. (MHz)
ML 10S	.10	45	750+	.06	1824	.107	25
ML 12S	.12	47	"	.07	1824	.109	"
ML 15S	.15	48	712	.08	1824	.111	"
ML 18S	.18	44	607	.09	1379	.107	"
ML 22S	.22	46	541	.09	1490	.111	"
ML 27S	.27	44	475	.13	1154	.107	"
ML 33S	.33	44	428	.14	1054	.107	"
ML 39S	.39	45	410	.16	975	.107	"
ML 47S	.47	43	387	.21	912	.107	"
ML 56S	.56	44	365	.24	1012	.111	"
ML 68S	.68	46.9	308	.25	942	.109	"
ML 82S	.82	45.6	279	.32	816	.109	"
ML 10G	1.0	30.3	253	.33	635	.106	7.9
ML 12G	1.2	30.1	234	.42	563	"	"
ML 15G	1.5	31.3	208	.58	479	.104	"
ML 18G	1.8	31.0	187	.68	443	"	"
ML 22G	2.2	32.1	169	1.17	337	.102	"
ML 27G	2.7	32.3	153	1.42	306	"	"
ML 33G	3.3	33.3	137	2.68	223	.100	"
ML 39G	3.9	34.4	126	2.92	214	"	"
ML 47G	4.7	33.5	114	3.44	197	"	"
ML 56G	5.6	32.1	106	3.92	184	"	"
ML 68G	6.8	42.7	54.0	.43	557	.104	"
ML 82G	8.2	40.8	49.6	.56	488	"	"
ML 100	10	39.1	48.6	.72	430	"	"
ML 120	12	62.5	40.3	1.18	336	.102	2.5
ML 150	15	64.5	36.5	1.43	300	"	"
ML 220	22	63.2	29.2	3.11	207	.100	"
ML 270	27	64.8	27.0	3.54	194	"	"

"MP" SERIES • MULTI-PI Choke Coils



These Coils use 3-Pi Universal windings to insure low distributed capacity and High "Q".

WILCO PART NO.	L±5% uH	Q (MIN)	TEST FREQ. MHz	S.R.F. MIN. MHz	RDC OHMS (MAX)	I MA (MAX)	COIL DIA.	CORE LENGTH	CORE MATERIAL
MP101	100	49	.79	11	5.4	160	.41	.75	Phenolic
MP151	150	53	.79	8.8	6.5	160	.41	.75	Phenolic
MP241	240	56	.79	7.2	8.5	160	.44	.75	Phenolic
MP391	390	57	.79	5.6	11	160	.5	.75	Phenolic
MP551	550	58	.79	4.8	13	160	.5	.75	Phenolic
MP621	620	59	.79	4.5	15	160	.53	.75	Phenolic
MP751	750	56	.79	4	16	160	.53	.75	Phenolic
MP102	1000	83	.25	2.6	8.6	160	.47	.875	Powdered Iron
MP152	1500	82	.25	2.1	11	160	.47	.875	Powdered Iron
MP242	2400	80	.25	1.7	15	160	.53	.875	Powdered Iron
MP392	3900	73	.25	1.4	20	160	.56	.875	Powdered Iron
MP552	5500	69	.25	1.1	25	160	.59	.875	Powdered Iron
MP622	6200	89	.25	1	37	100	.53	.875	Powdered Iron
MP822	8200	83	.25	.94	46	100	.56	.875	Powdered Iron
MP103	10000	108	.079	.71	31	100	.53	.875	Ferrite
MP253	25000	102	.079	.47	82	65	.53	.875	Ferrite
MP503	50000	113	.079	.33	127	65	.63	.875	Ferrite

Leads: 1.5 inch. AWG 20 TCW
Coils finished with Thermosetting Varnish

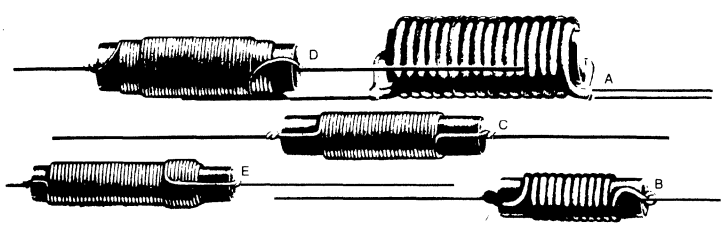
"W" SERIES Single Layer Solenoid Type Choke Coils

All choke coils in this series are wound on .156x⅛ size forms. Leads are of No. 20 tinned wire. Values from 1 uh to 18 uh are wound on phenolic forms. Values from 22 uh to 100 uh are wound on iron core forms. Tolerances are ± 20% for W10G through W22G: ± 10% from W27G through W101. All units are impregnated with thermosetting varnish and are EIA color coded.



WILCO PART #	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	COLOR CODE	I (MA) MAX	DIA. NOM.	TEST FREQ (MHz)
W 10 G	1.0	45	238	.11	Br Blk Gld	1965	.179	7.90
W 12 G	1.2	45	218	.12	Br Rd Gld	1882	.179	"
W 15 G	1.5	45	200	.14	Br Gr Gld	1742	.179	"
W 18 G	1.8	45	180	.24	Br Gry Gld	1330	.175	"
W 22 G	2.2	45	165	.26	Rd Rd Gld	1278	.175	"
W 27 G	2.7	45	149	.34	Rd Vi Gld	1118	.175	"
W 33 G	3.3	45	136	.52	Or Or Gld	904	.172	"
W 39 G	3.9	45	127	.61	Or Wh Gld	835	.172	"
W 47 G	4.7	50	114	.80	Yel Vi Gld	729	.170	"
W 56 G	5.6	50	104	1.15	Gr Blu Gld	608	.170	"
W 68 G	6.8	50	94.8	1.35	Blu Gry Gld	561	.169	"
W 82 G	8.2	50	86.1	1.75	Gry Rd Gld	493	.168	"
W 100	10	50	78.5	2.50	Br Blk Blk	412	.167	"
W 120	12	30	71.6	2.90	Br Rd Blk	383	.166	2.50
W 150	15	30	63.9	5.10	Br Gr Blk	288	.165	"
W 180	18	30	57.5	6.60	Br Gry Blk	254	.164	"
W 220	22	85	36.1	1.10	Rd Rd Blk	622	.170	"
W 270	27	80	33.2	1.22	Rd Vi Blk	590	.169	"
W 330	33	80	30.6	1.38	Or Or Blk	555	.169	"
W 390	39	90	26.6	2.04	Or Wh Blk	456	.167	"
W 470	47	90	24.9	2.32	Yel Vi Blk	428	.167	"
W 560	56	90	23.6	2.50	Grn Blu Blk	412	.167	"
W 680	68	90	21.6	3.00	Blu Gry Blk	376	.166	"
W 820	82	100	19.0	4.70	Gry Rd Blk	300	.165	"
W 101	100	100	17.8	5.40	Br Blk Br	280	.165	"

"LF" SERIES • HIGH CURRENT HASH CHOKES



WILCO Part #	Inductance ± 20% (μH)	DC Resistance Max. (Ω)	DC Current Max. (Amps)	Coil Diameter	Lead Wire Size	Lead Lengths Min.	Body Length Min.	Refer To Figure	Core Material
MEASURED ON Q-METER AT 7.9 MHz									
LF 335G	3.35	.01	20	.6	12 AWG	1.25	1.25	A	IRON
LF 49G	4.9	.016	15	.6	14 AWG	1.25	1.25	A	IRON
LF 88G	8.8	.021	10	.56	16 AWG	1.25	1.25	A	IRON
LF 40G	4	.012	8	.38	20 AWG	1.25	1.00	B	FERRITE
MEASURED ON 1KHz BRIDGE									
LF 400	40	.082	3	.31	20 AWG	1.25	1.25	C	FERRITE
LF 680	68	.054	5	.56	20 AWG	1.25	1.25	D	"
LF 101	100	.216	2	.38	20 AWG	1.25	1.25	E	"
LF 125	125	.08	3.5	.5	20 AWG	1.25	1.25	D	"
LF 251	250	.17	2.5	.44	20 AWG	1.25	1.25	D	"
LF 501	500	.26	2	.56	20 AWG	1.25	1.25	D	"
LF 102	1000	.55	1	.5	20 AWG	1.25	1.25	D	"

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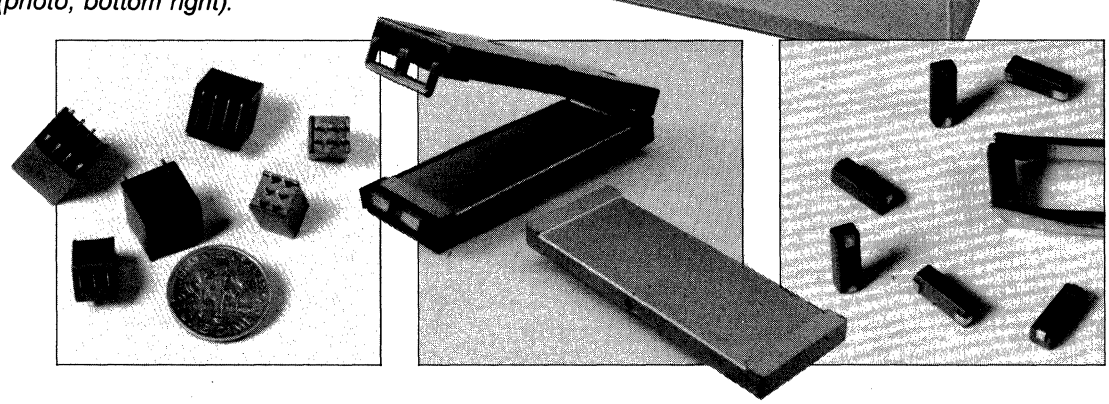


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- Nylon 6/6 cases with flat cable beads for 20, 40 and 60 conductor cable sizes. *(See photo insert, center).*
- SM Beads - Surface Mount Shield Beads. Two sizes provide 45 and 90 ohms impedance at 100 MHz. *(photo, bottom right).*



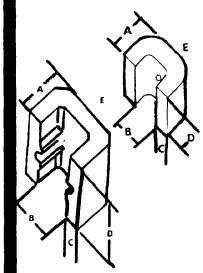
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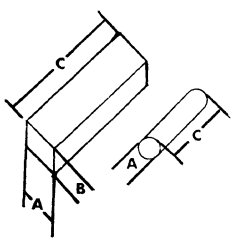
STOCK JOBMASTER MAGNETS



POWER MAGNET

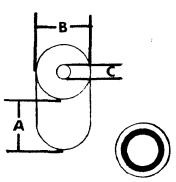
Cat No	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	E mm	E ins	Weight gr	Weight oz
811	19	¾	14.2	9/16	7.9	5/16	19	¾	4	5/32	71	2½
812	25.4	1	19	¾	9.5	⅜	25.4	1	4.7	3/16	142	5
813	28.6	1⅛	22.2	⅞	11.1	7/16	28.6	1⅛	4.7	3/16	226	8
814	35	1⅜	35	1⅜	11	7/16	44.5	1¾	8	5/16	368	13
815	41	1⅝	41	1⅝	14.3	9/16	57	2¼	8	5/16	709	25
816	54	2⅛	47.6	1⅞	16	⅝	82.5	3¼	9.5	⅜	1446	51

Hole centres 814 31 75 mm 1¼" 815 38 mm 1½" 816 43 mm 1 11/16"



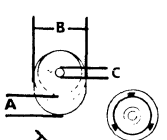
BAR MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	Weight gr	Weight oz
805	6	¼ diameter			20	13/16	4	15
806	8	5/16 diameter			25	1	8	30
807	10	⅜ diameter			30	1 3/16	16	58
844	10	⅜	5	3/16	20	13/16	11	38
845	12.5	½	5	3/16	40	1 9/16	21	75
846	15	⅝	5	3/16	60	2⅜	56	2
842	15	⅜	10	⅜	50	2	70	2½
843	15	⅝	10	⅜	75	3	100	3½



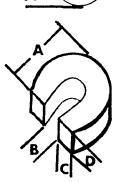
POT MAGNET

Cat No	A mm	A ins	B mm	B ins	C	Weight gr	Weight oz
831	15.8	⅝	17.5	11/16	Tapped Hole	28	1
832	19.0	¾	20.6	13/16	OBA/6 SI	47	1¾
833	25.4	1	27	1 1/16	or 10 NF	100	3½
834	30.1	1 3/16	35	1⅜		198	7



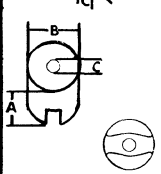
SHALLOW POT MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	Weight gr	Weight oz
826	8	5/16	19	¾	3.5	9/64	14	½
827	9.5	⅜	28.6	1⅛	4.7	3/16	50	1¾
828	11.1	7/16	38	1½	4.7	3/16	100	3½



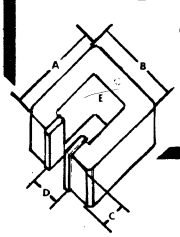
POCKET MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	Weight gr	Weight oz
802	25.4	1	6.35	¼	7.9	5/16	7.9	5/16	28.3	1



BUTTON MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	Weight gr	Weight oz
821	9.5	⅜	12.7	½	4.4	11/64	10	⅓
822	12.7	½	19	¾	4.8	3/16	28	1
823	15.9	⅝	25.4	1	4.8	3/16	56	2
824	25.4	1	31.7	1¼	6.4	¼	113	4



MAJOR MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	E mm	E ins	Weight gr	Weight oz
862	111	4⅜	103	4 1/16	52	2 1/16	40	1 9/16	6.3	¼	2835	100

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Shielding beads are made in different materials. The material selection is determined by the desired impedance levels at the frequency of interest. As is evident from Figure 1, for frequencies up to 20 MHz, the 3E2A bead will provide more attenuation than an equivalent bead in 3B material. By using more than one bead, the impedance will increase at close to the same ratio as the increase in beads. Combining beads of different materials can lead to improved frequency response. See Figure 3 for a combination of a 3E2A and a 4B bead.

The beads 56 590 65 in 3E2A, 3B, 4A, 4A6 and 4B material can also be supplied on wire, taped and reeled.

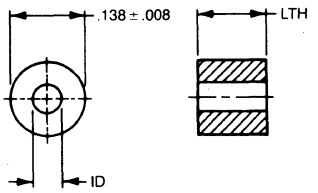


Figure A

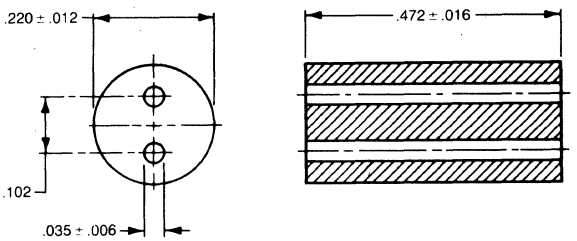


Figure B

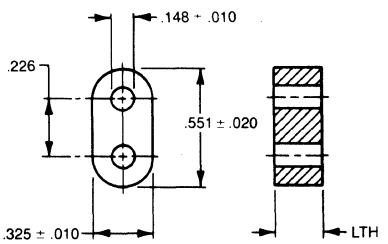


Figure C

MATERIAL CHARACTERISTICS

	3E2A	3B	4A	4A6	4B	3S1	4S2	6B1	
Initial Permeability (μ_i)	5000	900	600	1000	250	4000	700	250	
Saturation Flux Density (Bs) at H=10 Oersted, 25°C	3700	3400	2900	3800	3300	3600	3000	3300	gauss
Curie Temperature (Tc)	≥170	≥150	≥125	≥150	≥250	≥125	≥125	≥250	°C
DC Resistivity	>10	>20	$>10^5$	$>10^5$	$>10^5$	>10	$>10^5$	$>10^3$	Ω-Cm

Part No.	Core Material	ID	LTH	Fig.
56 590 65-3E2A	3E2A	.051 ± .004	.128 ± .010	A
56 590 65-3B	3B			
56 590 65-4A	4A			
56 590 65-4A6	4A6			
56 590 65-4B	4B			
K5 001 00-3B	3B	.063 ± .004	.128 ± .010	A
56 390 31-4B	4B	See Figure B.		
280 65-4B	4B		.315 ± .012	C
285 65-4B	4B		.551 ± .016	C

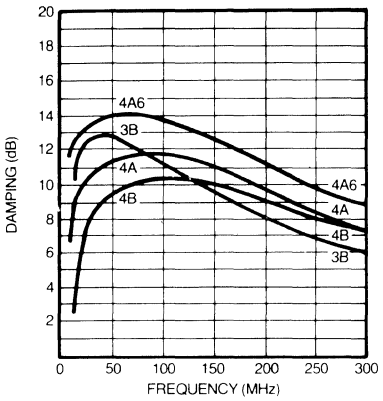
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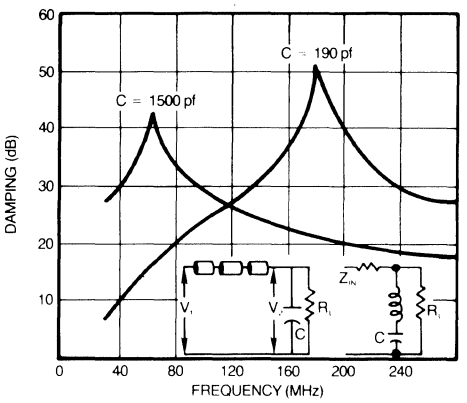
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Insertion loss in a 60 ohm circuit from a 2.4-inch length of beads



Typical damping curves for three 56 590 65/3B beads with additional parallel ceramic capacitor.

Typical impedance vs. frequency curves for the 56 590 65 beads.

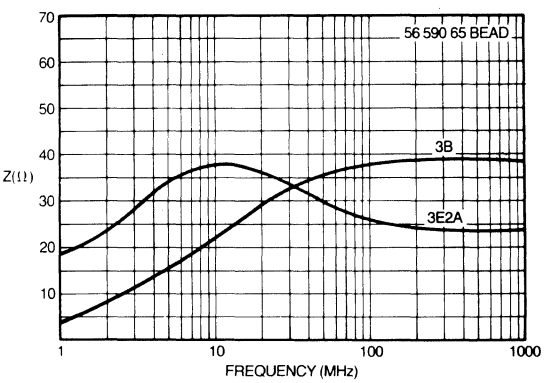


Figure 1

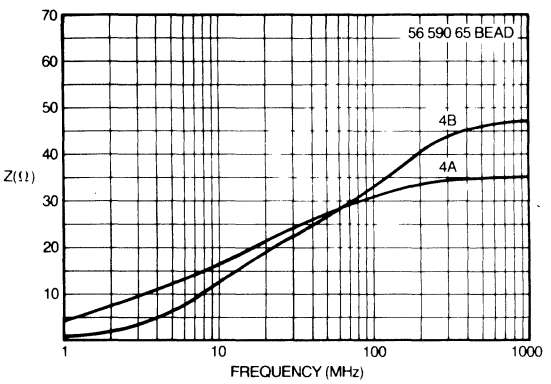


Figure 2

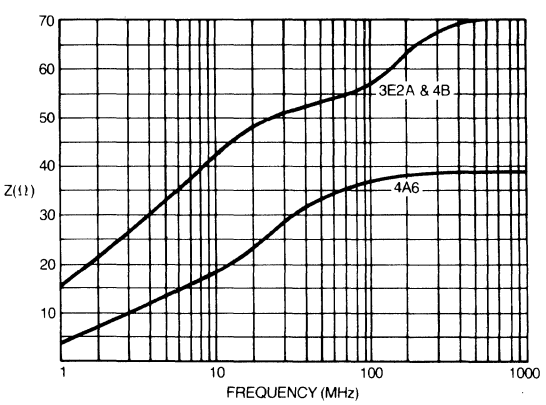


Figure 3

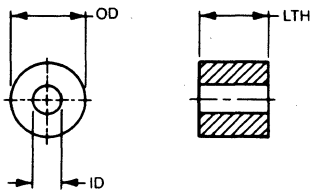
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Discrete Products Division
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SHIELDING BEADS

SHIELDING BEADS

A new line of shielding beads with a guaranteed specified performance over a wide frequency range. Parts listed in table are organized by increasing hole diameter.



Part No.	OD	ID	LTH	Min. Z (Ω) at Frequency (MHz)					
				1	3	10	30	100	300
30704-3S1	.118 ± .008	.031 ± .003	.157 ± .008	19	38	39	31	26	23
50704-3S1	.197 ± .008	.031 ± .003	.157 ± .008	27	52	53	42	36	32
30710-3S1	.118 ± .008	.031 ± .003	.394 ± .012	58	95	97	77	66	58
50710-3S1	.197 ± .008	.031 ± .003	.394 ± .012	70	125	128	90	70	50
31004-3S1	.118 ± .008	.042 ± .003	.157 ± .008	14	29	30	24	20	18
31010-3S1	.118 ± .008	.042 ± .003	.394 ± .012	33	72	73	58	50	44
51504-3S1	.197 ± .008	.062 ± .003	.157 ± .008	15	25	32	26	22	20
51510-3S1	.197 ± .008	.062 ± .003	.394 ± .012	40	72	80	64	55	48
52004-3S1	.197 ± .008	.083 ± .004	.157 ± .008	10	18	24	20	17	15
52010-3S1	.197 ± .008	.083 ± .004	.394 ± .012	29	51	61	49	42	37
30704-4S2	.118 ± .008	.031 ± .003	.157 ± .008	2	8	22	32	50	54
50704-4S2	.197 ± .008	.031 ± .003	.157 ± .008	5	15	30	44	68	77
30710-4S2	.118 ± .008	.031 ± .003	.394 ± .012	9	30	55	81	125	135
50710-4S2	.197 ± .008	.031 ± .003	.394 ± .012	12	40	75	110	170	190
31004-4S2	.118 ± .008	.042 ± .003	.157 ± .008	3	9	18	25	38	43
31010-4S2	.118 ± .008	.042 ± .003	.394 ± .012	7	23	43	61	95	107
51504-4S2	.197 ± .008	.062 ± .003	.157 ± .008	3	10	20	27	41	47
81504-4S2	.315 ± .008	.062 ± .003	.157 ± .008	4	14	27	38	57	65
51510-4S2	.197 ± .008	.062 ± .003	.394 ± .012	7	25	45	68	104	116
81510-4S2	.315 ± .008	.062 ± .003	.394 ± .012	10	34	70	93	145	161
52004-4S2	.197 ± .008	.083 ± .004	.157 ± .008	2	8	15	20	32	36
82004-4S2	.315 ± .008	.083 ± .004	.157 ± .008	4	10	20	31	49	55
52010-4S2	.197 ± .008	.083 ± .004	.394 ± .012	6	15	30	51	80	89
82010-4S2	.315 ± .008	.083 ± .004	.394 ± .012	9	28	55	77	121	134
83004-4S2	.315 ± .008	.118 ± .008	.157 ± .008	2	8	15	22	34	38
83010-4S2	.315 ± .008	.118 ± .008	.394 ± .012	6	20	40	55	85	95

*Part number includes core material designation.

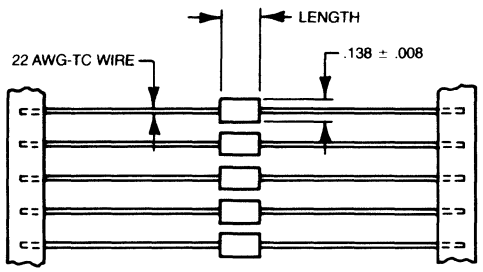
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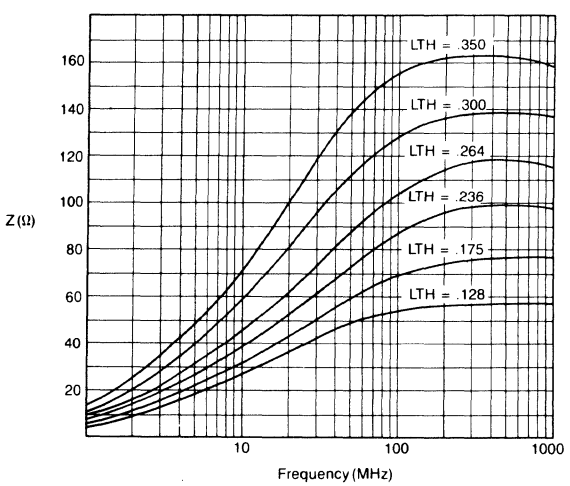
WIRED BEADS

WIRED BEADS

To facilitate the use of ferrite shielding beads with automated component insertion equipment, beads are available assembled on copper wire.
The beads are cemented onto 22 AWG tinned copper wire and taped per EIA Standard RS-296-D. Inside tape spacing is 52.4 ± 1.5 mm. Missing component criteria per level 1.
Each 50th bead is identified by a marking of the tape. The wired beads, taped, are wound on a reel containing a maximum of 3500 beads.



Part No.	Core Material	Bead Length	Min. Z (Ω)	Freq. (MHz)	Bead Part No.
11413-3E2A	3E2A	.128 ± .010	30	10	56 590 65-3E2A
11413-3B	3B	.128 ± .010	34	100	56 590 65-3B
11413-4A	4A	.128 ± .010	35	100	56 590 65-4A
11413-4A6	4A6	.128 ± .010	46	100	56 590 65-4A6
11413-4B	4B	.138 ± .010	54	250	56 590 65-4B
11418-4A6	4A6	.175 ± .010	60	100	—
11424-4A6	4A6	.236 ± .010	80	100	—
11426-4A6	4A6	.264 ± .015	88	100	—
11430-4A6	4A6	.300 ± .015	105	100	—
11435-4A6	4A6	.350 ± .015	117	100	—



Typical impedance vs. frequency curves for beads in 4A6 material.

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WIDE-BAND CHOKES

WIDE-BAND CHOKES

Wide-band chokes are wound 6 hole ferrite slugs, made in 3B and 4B material, with 1, 5, 2.5 or 2 × 1.5 turns of tinned copper wire. These wide-band chokes are used for interference suppression in a multitude of applications.

Figure 1 shows the performance curves of these choke types. Above approximately 60 MHz, the impedance is substantially resistive and nearly constant. The wideband chokes may be used with small ceramic capacitors. The self resonance of the capacitor will provide additional attenuation. See Figure 2 below. The influence of a DC bias upon the performance is shown for the 2.5 turn chokes in Figures 3 and 4.

Note that where twin leads are accessible, double chokes (2 × 1.5 turns) may be used to take advantage of the mutual inductance.

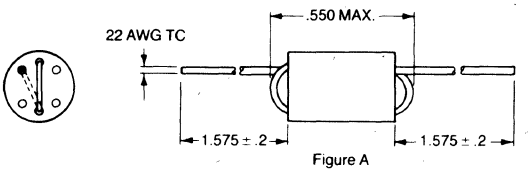
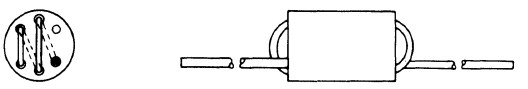
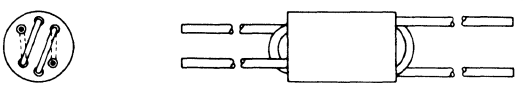


Figure A


Figure B


Figure C

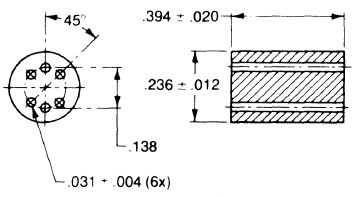


Figure D

Part No.	Core Material	No. of Turns	Min. Z (Ω)	Freq. (MHz)	Fig.
VK 21107-3B	3B	—	—	—	D
VK 21117-4B	4B	—	—	—	D
VK 20009-3B	3B	1½	300	120	A
VK 20019-4B	4B	1½	350	250	A
VK 20010-3B	3B	2½	600	50	B
VK 20020-4B	4B	2½	700	180	B
VK 20011-3B	3B	2 × 1½	700*	50	C
VK 20021-4B	4B	2 × 1½	800*	110	C

*Measured with the two 1½ turn windings in series.

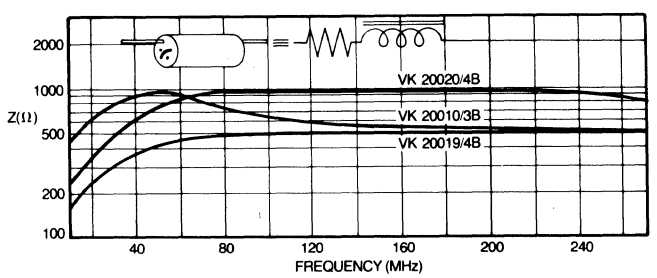


Figure 1. Impedance curves of wide-band chokes.

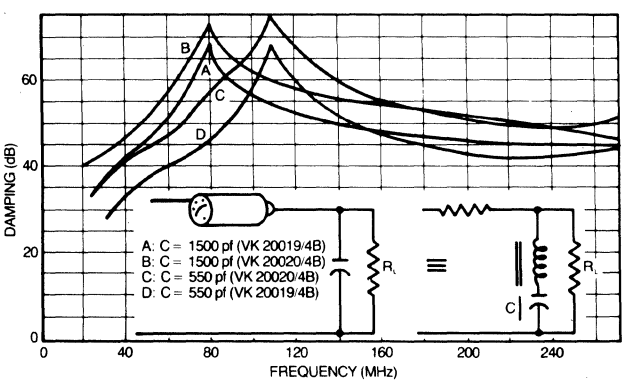


Figure 2. Typical damping curves for VK chokes with additional parallel ceramic capacitors

Effect of DC bias upon the damping characteristics of 2½ turn chokes.

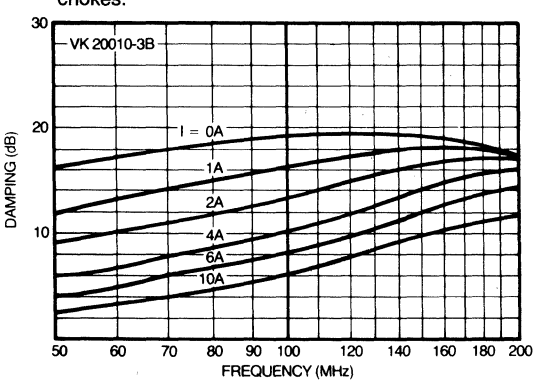


Figure 3. 2½ Turn choke, 3B material

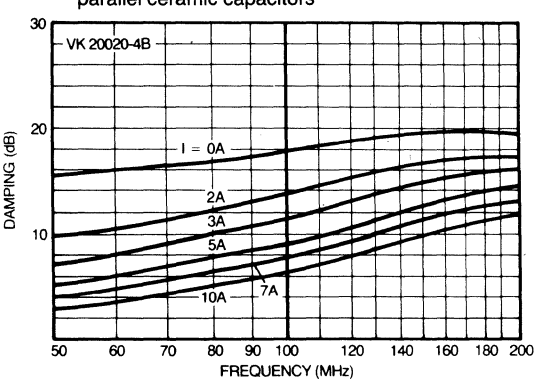


Figure 4. 2½ Turn choke, 4B material

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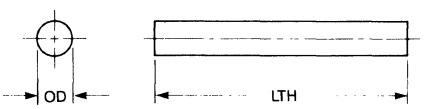
RODS

RODS

Rods are used as a low cost solution in applications where a low effective permeability is acceptable. Flux concentrators such as antenna's and impeder cores are classical ferrite rod applications. However, in power designs, such as output chokes and differential-mode chokes, ferrite rods can be used as well.

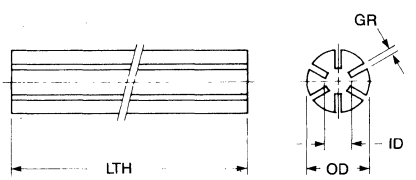
*Part No.	*Part No.	OD	LTH
R210-3B	R210-6B1	.078 ± .002	.382 ± .012
R215-3B	R215-6B1	.078 ± .002	.575 ± .016
R220-3B	R220-6B1	.078 ± .002	.770 ± .018
R315-3B	R315-6B1	.117 ± .002	.575 ± .016
R320-3B	R320-6B1	.117 ± .002	.770 ± .018
R325-3B	R325-6B1	.117 ± .002	.965 ± .020
R415-3B	R415-6B1	.156 ± .002	.575 ± .016
R420-3B	R420-6B1	.156 ± .002	.770 ± .018
R425-3B	R425-6B1	.156 ± .002	.965 ± .020
R520-3B	R520-6B1	.196 ± .002	.770 ± .018
R525-3B	R525-6B1	.196 ± .002	.965 ± .020
R530-3B	R530-6B1	.196 ± .002	1.157 ± .024
R630-3B	R630-6B1	.234 ± .003	1.157 ± .024
R640-3B	R640-6B1	.234 ± .003	1.543 ± .032
R650-3B	R650-6B1	.234 ± .003	1.969 ± .040
R850-3B	R850-6B1	.307 ± .008	1.969 ± .040
R8150-3B	R8150-6B1	.307 ± .008	5.90 ± .12
R8200-3B	R8200-6B1	.307 ± .008	7.87 ± .16
R10200-3B	R10200-6B1	.384 ± .010	7.87 ± .16

*Part number includes core material designation.



*Part No.	OD	LTH	ID	GR	**N
GR6200-3D3	.236 ± .008	7.87 ± .2	.118	.024	6
GR6200-3C85	.236 ± .008	7.87 ± .2	.118	.024	6
GR8125-3D3	.305 ± .010	4.92 ± .15	.118	.024	6
GR8200-3C85	.315 ± .010	7.87 ± .2	.118	.024	6
GR10170-3D3	.384 ± .010	6.69 ± .2	.177	.024	6
GR10200-3C85	.394 ± .010	7.87 ± .2	.177	.024	6
GR12170-3D3	.459 ± .014	6.69 ± .2	.217	0.28	8
GR12200-3C85	.472 ± .014	7.87 ± .2	.217	0.28	8
GR14170-3D3	.547 ± .016	6.69 ± .2	.256	0.31	8
GR14200-3C85	.563 ± .016	7.87 ± .2	.256	0.31	8

*Part number includes core material designation. **Number of grooves.



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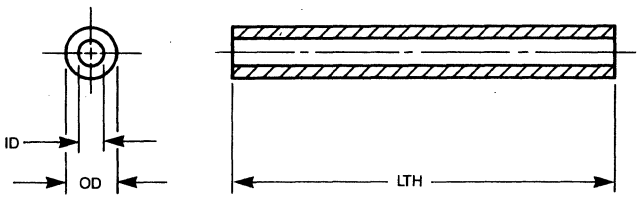
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TUBES

TUBES

In many applications ferrite tubes can be used as an equivalent for ferrite rods. In addition, the shorter length tubes can be used for RFI suppression applications.



Part No.*	Part No.*	Part No.*	OD	ID	LTH
T31005-3B	T31005-3C85	T31005-6B1	.133 ± .005	.050 ± .003	.191 ± .006
T31015-3B	T31015-3C85	T31015-6B1	.133 ± .005	.050 ± .003	.575 ± .016
T42015-3B	T42015-3C85	T42015-6B1	.153 ± .005	.066 ± .003	.575 ± .016
T42040-3B	T42040-3C85	T42040-6B1	.153 ± .005	.066 ± .003	1.543 ± .031
T52015-3B	T52015-3C85	T52015-6B1	.191 ± .006	.083 ± .004	.575 ± .016
T52050-3B	T52050-3C85	T52050-6B1	.191 ± .006	.083 ± .004	1.969 ± .040
T63020-3B	T63020-3C85	T63020-6B1	.230 ± .006	.122 ± .004	.770 ± .018
T63030-3B	T63030-3C85	T63030-6B1	.230 ± .006	.122 ± .004	1.157 ± .024
T84020-3B	T84020-3C85	T84020-6B1	.307 ± .008	.163 ± .006	.770 ± .018
T84040-3B	T84040-3C85	T84040-6B1	.307 ± .008	.163 ± .006	1.543 ± .031
—	T84200-3C85	—	.307 ± .008	.163 ± .006	7.87 ± .16
T104020-3B	T104020-3C85	T104020-6B1	.384 ± .010	.171 ± .006	.770 ± .018
T104045-3B	T104045-3C85	T104045-6B1	.384 ± .010	.171 ± .006	1.736 ± .035
—	T105200-3C85	—	.384 ± .010	.205 ± .008	7.87 ± .16
T107020-3B	T107020-3C85	T107020-6B1	.384 ± .010	.264 ± .008	.770 ± .018

*Part number includes core material designation.

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THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE

Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al_2O_3	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

FERRITE MATERIALS

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For Yoke cores and U cores

Characteristics*	μiac	Tc	Bms	Brms	Hcms	ℓ	d
Material	—	°C	G {mT}	G {mT}	A/m	Ω•cm	g•cm³
HV22	1800	>200	5100 {510}	1700 {170}	16	30	4.8
HV38	2300	>200	4800 {480}	1300 {130}	16	50	4.8
H4M	320	>150	2100 {210}	1500 {150}	40	10^6	4.4
H4H	500	>150	2800 {280}	1900 {190}	30	10^5	4.7

**Measured with toroidal cores at room temperature.*

For high frequency inductors

Characteristics	Practical frequency	μiac	tanδ/μiac	αμr*	Bms	Tc	ϱ*	d*
Material	MHz	—	$\times 10^{-6}$	$\times 10^{-6}$/°C (+20°C to +60°C)	G	°C	Ω·cm	g/cm³
L4	0.1 to 1.5	400±25%	<30 (0.1 MHz)	3 to 9	3300 (20 Oe)	>150	10^7	5.0
L4N	0.1 to 1.5	300±25%	<45 (0.1 MHz)	−3 to −1	2600 (20 Oe)	>150	10^7	5.1
L5	0.1 to 1.5	750±25%	<15 (0.1 MHz)	1 to 3	3100 (20 Oe)	>120	10^7	4.9
L5N	0.1 to 1.5	500±25%	<50 (0.1 MHz)	−1 to 1	2900 (20 Oe)	>100	10^7	5.1
L5T	0.1 to 1.5	500±25%	<30 (0.1 MHz)	−4 to −1	3000 (20 Oe)	>120	10^7	4.9
L6	0.01 to 0.5	1500±25%	<10 (0.01 MHz)	1 to 3	2800 (20 Oe)	>100	10^7	4.8
L6E	0.01 to 0.5	1200±25%	<10 (0.01 MHz)	6 to 10	2900 (20 Oe)	>100	10^7	4.9
L6H	0.05 to 0.5	1000±25%	<10 (0.05 MHz)	3 to 7	3500 (20 Oe)	>150	10^7	5.0
L7M	0.01 to 0.5	1500±25%	<10 (0.01 MHz)	1 to 3	3700 (20 Oe)	>150	10^2	4.8
L8H	0.05 to 1.5	650±25%	<15 (0.05 MHz)	10 to 20	4200 (50 Oe)	>200	10^7	5.1
L9	0.1 to 1.5	210±25%	<40 (0.1 MHz)	0 to 2	2500 (20 Oe)	>150	10^7	4.8
L9H	0.05 to 3	200±25%	<35 (0.05 MHz)	20 to 30	5000 (150 Oe)	>300	10^7	5.2
D1B	0.3 to 7.0	200±25%	<350 (0.3 MHz)	15 to 35	3100 (20 Oe)	>180	10^6	5.1
D1C	0.3 to 7.0	230±25%	<350 (0.3 MHz)	30 to 70	3500 (20 Oe)	>200	10^6	5.2
D1F	0.1 to 2.0	400±25%	<400 (0.1 MHz)	15 to 25	3200 (20 Oe)	>150	10^6	5.1
D1L	0.1 to 2.0	350±25%	<500 (0.1 MHz)	25 to 35	3500 (20 Oe)	>150	10^5	5.1
D3B	0.1 to 2.0	300±25%	<20 (0.1 MHz)	10 to 30	3300 (20 Oe)	>150	10^7	4.9
D8	0.3 to 7.0	200±25%	<160 (0.3 MHz)	20 to 50	3700 (20 Oe)	>250	10^7	5.0
Q1C	0.1 to 2.0	250±25%	<35 (0.1 MHz)	9 to 15	2900 (20 Oe)	>125	10^7	5.0
Q1D	0.3 to 15	100±25%	<400 (0.3 MHz)	15 to 35	3800 (50 Oe)	>300	10^5	4.8
Q2	0.1 to 5.0	200±25%	<25 (0.1 MHz)	25 to 65	3600 (20 Oe)	>150	10^7	4.6
Q2M	0.1 to 2.0	350±25%	<20 (0.1 MHz)	4 to 12	2600 (20 Oe)	>150	10^7	4.7
Q5B	0.4 to 20	100±25%	<25 (0.4 MHz)	5 to 12	3400 (50 Oe)	>300	10^4	4.7
Q5M	0.4 to 30	90±25%	<25 (0.4 MHz)	5 to 13	3200 (50 Oe)	>300	10^4	4.7
M5E	10 to 120	17±25%	<450 (10 MHz)	40 to 120	3000 (100 Oe)	>300	10^7	4.6
M5M	10 to 120	12±25%	<500 (10 MHz)	30 to 90	2400 (100 Oe)	>300	10^7	4.8
M5N	10 to 120	12±25%	<550 (10 MHz)	−10 to 10	2300 (100 Oe)	>300	10^7	4.8
M8B	0.5 to 20	50±25%	<140 (0.5 MHz)	4 to 12	3000 (50 Oe)	>300	10^7	5.1
M8C	0.5 to 15	70±25%	<90 (0.5 MHz)	5 to 15	3600 (50 Oe)	>300	10^7	4.8
M8L	0.5 to 15	65±25%	<110 (0.5 MHz)	3 to 9	3000 (50 Oe)	>300	10^7	4.8
M8N	0.5 to 20	70±25%	<130 (0.5 MHz)	−3 to 3	3600 (50 Oe)	>300	10^7	4.8
M9	0.5 to 30	50±25%	<90 (0.5 MHz)	25 to 65	3500 (50 Oe)	>300	10^7	4.8
M9D	1.0 to 50	55±25%	<150 (1.0 MHz)	30 to 80	3900 (50 Oe)	>300	10^7	4.8
M9E	0.5 to 60	55±25%	<150 (0.5 MHz)	35 to 100	3500 (50 Oe)	>300	10^7	4.8
M9M	0.5 to 30	45±25%	<130 (0.5 MHz)	5 to 15	3200 (50 Oe)	>300	10^7	4.8
M9N	0.5 to 30	45±25%	<200 (0.5 MHz)	−5 to 5	3200 (50 Oe)	>300	10^7	4.7
M11	3.0 to 80	25±25%	<220 (3 MHz)	30 to 70	2900 (50 Oe)	>300	10^7	4.6
M11E	3.0 to 80	30±25%	<250 (3 MHz)	40 to 120	3400 (50 Oe)	>300	10^7	4.7
M11M	3.0 to 80	25±25%	<200 (3 MHz)	10 to 30	2800 (50 Oe)	>300	10^7	4.6
F3T	10 to 120	18±25%	<500 (10 MHz)	15 to 25	3100 (100 Oe)	>300	10^7	4.8
F4N	10 to 120	12±25%	<550 (10 MHz)	−5 to 5	2500 (200 Oe)	>300	10^7	4.7
F5N	10 to 120	10±25%	<850 (10 MHz)	−5 to 5	2200 (200 Oe)	>300	10^7	4.7
F6T	10 to 120	7±25%	<1000 (10 MHz)	−7 to 7	1900 (200 Oe)	>300	10^7	4.7
V1F	10 to 80	17±25%	<400 (10 MHz)	2 to 7	2700 (100 Oe)	>300	10^7	4.7
V2F	10 to 70	30±25%	<210 (10 MHz)	25 to 75	3200 (100 Oe)	>300	10^7	4.8
V3F	10 to 80	10±25%	<500 (10 MHz)	−40 to −10	2100 (200 Oe)	>300	10^7	4.7
V3N	10 to 80	10±25%	<500 (10 MHz)	−65 to −35	2100 (200 Oe)	>300	10^7	4.6
V4F	10 to 200	8±25%	<650 (10 MHz)	5 to 15	2100 (200 Oe)	>300	10^7	4.8
V5F	10 to 250	9±25%	<550 (10 MHz)	25 to 65	1800 (200 Oe)	>300	10^7	4.9

**Average values*

1 gauss: 10 mT.; 1 Oe: 7.95775 × 10 A/m

FERRITE MATERIALS

TDK CORPORATION OF AMERICA 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: 708-803-6100 **INDIANAPOLIS** Phone: 317-872-0370 **NEW YORK** Phone: 516-625-0151 **LOS ANGELES** Phone: 213-539-6631 **DETROIT** Phone: 313-462-1210 **NEW JERSEY** Phone: 201-736-0023 **BOSTON** Phone 508-624-4262 **HUNTSVILLE** Phone: 205-464-0222 **GREENSBORO** Phone: 919-292-0012 **DALLAS** Phone: 214-506-9800 **SAN FRANCISCO** Phone: 408-437-9585
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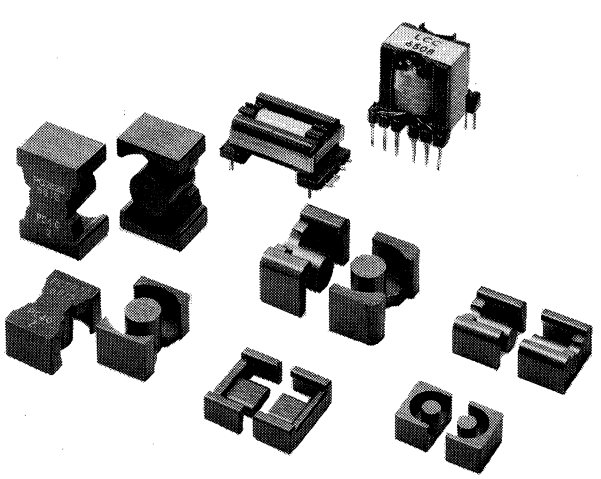
For industrial use

Material				H_{5A}	H_{5B}	H_{5B2}	H_{5C2}	H_{5D}	H_{5E}	HP3	HP4	HP5	H_{6A3}	H_{6B}	H_{6F}
Initial permeability		μiac		3300$^{+40}_{-0}$%	5000$^{+40}_{-0}$%	7500±25%	10000±30%	15000±30%	18000±30%	3000±20%	4000±20%	5000±20%	1500±20%	2000±20%	800±20%
Relative loss factor		tanδ/μiac	$\times10^{-6}$	<2.5 (10kHz) <10 (100kHz)	<6.5 (10kHz) <40 (100kHz)	<6.5 (10kHz)	<7.0 (10kHz)	<15 (10kHz)		<3.5 (10kHz)	<3.5 (10kHz)	<3.5 (10kHz)	<6 (100kHz)	<2.5 (100kHz)	<13 (0.5MHz) <17 (1MHz)
Temperature factor of permeability	−30 to 20°C 0 to 20°C 20 to 55°C 20 to 70°C	$\alpha\mu r$	$\times10^{-6}$	−0.5 to 2.0 −0.5 to 2.0	−0.5 to 2.0 −0.5 to 2.0	0 to 1.8 0 to 1.8	−0.5 to 1.5 −0.5 to 1.5	−1.5 to 1.5 −0.5 to 2.0	0 to 2.0 −0.5 to 2.0	 ±7.5% ±7.5%	 ±10% ±10%	 ±12.5% ±12.5%	0.8 to 2.0 0.8 to 2.0 0.8 to 2.0 0.8 to 2.0	0.5 to 2.0 0.5 to 1.3 0.5 to 1.3 0.5 to 1.5	 0 to 2.5 0 to 2.5 0 to 2.5
Curie temperature		Tc	°C	>130	>130	>130	>120	>120	>115	>140	>140	>140	>130	>130	>200
Saturation flux density H = 1194A/m (15 Oe)		Bms	G	4100	4200	4200	4000	3200	4400	3700	4000	4000	3600	3500	4000
			mT	410	420	420	400	320	440	370	400	400	360	350	400
Remanence		Br	G	1000	1350	400	900	1000	1200	700	650	650	950	800	1600
			mT	100	135	40	90	100	120	70	65	65	95	80	160
Coercivity		Hc	Oe	0.1	0.1	0.07	0.09	0.034	0.035	0.15	0.09	0.09	0.4	0.25	1.0
			A/m	8.0	8.0	5.6	7.2	2.7	2.8	12	7.2	7.2	32	20	80
Hysteresis material constant		$\frac{\eta B}{mT}$	10^{-6}	<0.8	<0.8	<0.3	<0.6	<0.52	<1.0	<0.4	<0.4	<0.4	<0.8	<0.3	<1.0
		h_{10}		<40 (10kHz)	<40 (10kHz)	<50 (10kHz)	<70 (10kHz)	<100 (10kHz)	<100 (10kHz)	<20 (10kHz)	<20 (10kHz)	<20 (10kHz)	<70 (0.1MHz)	<20 (0.1MHz)	<90 (0.1MHz)
Disaccommodation factor (1 to 10 minutes)		DF	$\times10^{-6}$	<3	<3	<3	<2	<1	<1	<3	<3	<3	<3	<3	<12
Resistivity		ρ	Ω-m	1	1	0.1	0.15	0.02	0.05	0.2	0.2	0.15	50	45	4
Density		δ	g/cm^3	4.8	4.8	4.9	4.9	4.9	5.0	4.8	4.8	4.8	4.6	4.5	4.6

Material				H_{6H3}	H_{6K}	H_{6Z}	H_{7A}	H_{7B}	K_5	K_{7A}	K_8
Initial permeability		μiac		1300±15%	2200±20%	2200±20%	4500$^{+30}_{-20}$%	3700±25%	290$^{+30}_{-20}$%	25±20%	16
Relative loss factor		tanδ/μiac	$\times10^{-6}$	<1.2 (100kHz)	<3.5 (100kHz)	<3.0 (100kHz)	<4 (100kHz) <20 (100kHz)	<12 (100kHz)	<28 (1MHz) <105 (5MHz)	<150 (10MHz) <300 (30MHz)	<150 (50MHz) <250 (100MHz)
Temperature factor of permeability	−30 to 20°C 0 to 20°C 20 to 55°C 20 to 70°C	$\alpha\mu r$	$\times10^{-6}$	0.3 to 2.0 0.5 to 1.1 0.5 to 2.5 0.3 to 2.0	0.4 to 1.2 0.4 to 1.0 0.4 to 1.0 0.4 to 1.0	 −0.6 to 0.6 −0.6 to 0.6	0 to 2.5 −2.5 to 0	 	−4.0 to 2.0 0 to 4.0	 5 to 15 5 to 15	
Curie temperature		Tc	°C	>200	>130	>150	>190	>200	>280	>450	>500
Saturation flux density H = 1194A/m (15 Oe)		Bms	G	4650	3900	3800	4650	4600	3300	2600 (80 Oe)	2700 (80 Oe)
			mT	465	390	380	465	460	330	260 (6368A/m)	270 (6368A/m)
Remanence		Br	G	1000	450	800	1100	1500	2500	1500	1650
			mT	100	45	80	110	150	250	150	165
Coercivity		Hc	Oe	0.45	0.15	0.3	0.2	0.2	1.0	14	15
			A/m	36	12	24	15.9	15.9	80	1110	1190
Hysteresis material constant		ηB	10^{-6}	<0.12	<0.5	<0.4	<0.6				
		h_{10}		<40 (0.1MHz)	<50 (0.1MHz)	<45 (0.1MHz)	<30 (50kHz)				
Disaccommodation factor (1 to 10 minutes)		DF	$\times10^{-6}$	<5	<2	<3	<3		<30	<20	
Resistivity		ρ	Ω-m	25	8	8	1	2	20×10^5	10×10^5	1.0×10^5
Density		δ	g/cm^3	4.8	4.5	4.6	4.8	4.8	4.4	4.1	4.4

Material characteristics for power supplies

Material				PC30	PC40	PC50
Initial permeability	μ_{iac}			2500 ± 25%	2300 ± 25%	1400 ± 25%
Amplitude permeability at 2000 G (200mT) 25kHz	μa	25°C		3200 min.	3000 min.	
		60°C		3200 min.		
		100°C		3200 min.		
Core loss at 200 G (200mT) sine wave	Pc	25°C	kW/m^3	130 max } at 25kHz	600 } at 100kHz	130
		60°C		90 max. } at 25kHz	450 } at 100kHz	80
		100°C		100 max } at 25kHz	410 } at 100kHz	80
		120°C			500	
Saturation flux density at 15 Oe (1194A/m)	Bms	25°C	Gauss	5100	5100	4700
			mT	510	510	470
		60°C	Gauss	4500	4500	
			mT	450	450	
		100°C	Gauss	3900	3900	
			mT	390	390	
Remanence	Br	25°C	Gauss	1170	950	1900
			mT	117	95	190
		60°C	Gauss	800	650	
			mT	80	65	
		100°C	Gauss	830	550	
			mT	83	55	
Coercivity	Hcв	25°C	Oersted	0.15	0.18	
			A/m	12	14	
		60°C	Oersted	0.10	0.13	
			A/m	80	10	
		100°C	Oersted	0.10	0.11	
			A/m	8.0	8.8	



FERRITE CORES
for switching – mode power supplies

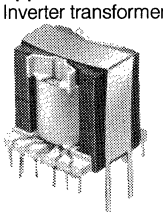
TDK CORPORATION OF AMERICA 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: 708-803-6100 **INDIANAPOLIS** Phone: 317-872-0370 **NEW YORK** Phone: 516-625-0151 **LOS ANGELES** Phone: 213-539-6631 **DETROIT** Phone: 313-462-1210 **NEW JERSEY** Phone: 201-736-0023 **BOSTON** Phone 508-624-4262 **HUNTSVILLE** Phone: 205-464-0222 **GREENSBORO** Phone: 919-292-0012 **DALLAS** Phone: 214-506-9800 **SAN FRANCISCO** Phone: 408-437-9585
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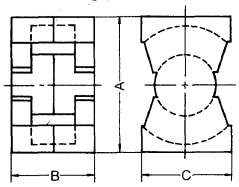
PQ CORES

TDK PQ cores are ferrite cores for switching power supplies which have the most appropriate shape for performing analysis of transformer iron and copper loss when used as a power supply transformer and driven at a high frequency. They are also appropriate for performing temperature rise and inductance analysis.

Features
- Cores for uses ranging from 50W to 1kW (100kHz); and employ the most appropriate shapes.
- Installation volume and on-board installation area are reduced.
- Pin equipped bobbins are employed to permit easy terminal handling.
- Permit various safety standards to be easily maintained.

Applications
Inverter transformers and choke coils for switching power supplies.





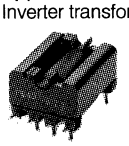
Type	Dimensions in mm (inches) A	B	C	Material	AL-value (μe) (nH/N²)
PQ20/16Z-12	20.5 (.80)	16.2 (.638)	14.0 (.55)	PC30	3880 (1868)
				PC40	3880 (1868)
PQ20/20Z-12	20.5 (.80)	20.2 (.793)	14.0 (.55)	PC30	3310 (1944)
				PC40	3150 (1850)
PQ26/20Z-12	26.5 (1.04)	20.2 (.793)	19.0 (.75)	PC30	6170 (1920)
				PC40	6170 (1920)
PQ26/25Z-12	26.5 (1.04)	24.8 (.947)	19.0 (.75)	PC30	5250 (1972)
				PC40	5250 (1972)
PQ32/20Z-12	32.0 (1.26)	20.6 (.809)	22.0 (.87)	PC30	7310 (1896)
				PC40	7310 (1896)
PQ32/30Z-12	32.0 (1.26)	30.4 (1.19)	22.0 (.87)	PC30	5140 (1898)
				PC40	5140 (1898)
PQ35/35Z-12	35.1 (1.38)	34.8 (1.37)	26.0 (1.02)	PC30	4860 (1733)
				PC40	4860 (1733)
PQ40/40Z-12	40.5 (1.59)	39.8 (1.57)	28.0 (1.1)	PC30	4300 (1738)
				PC40	4300 (1738)
PQ50/50Z-12	50.0 (1.97)	49.9 (1.97)	32.0 (1.26)	PC30	6720 (1650)
				PC40	6720 (1850)

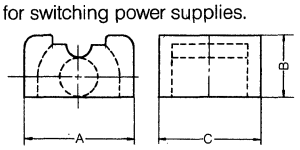
LP CORES

LP cores are products developed for extremely thin, flat type switching power supplies.

Features
- Maximum installation height: LP23/8 12.7mm (0.5 inches), LP22/13 17.78mm (0.7 inches), LP32/13 17.78mm (0.7 inches).
- Pin equipped bobbins are employed to permit easy terminal handling.
- Allows various safety standards to be easily maintained.

Applications
Inverter transformers and choke coils for switching power supplies.





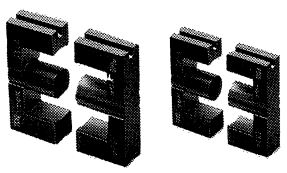
Type	Dimensions in mm (inches) A	B	C	Material	AL-value (μe) (nH/N²)	Σℓ/A (cm⁻¹)	Ae (cm²)
LP23/8	16.5 (.650)	8.7 (.343)	23.4 (.921)	PC30	1600 (1795)	14.1	0.313
				PC40	1600 (1795)		
LP22/13	25.0 (.984)	12.9 (.508)	22.4 (.882)	PC30	3500 (2008)	7.21	0.679
				PC40	3310 (1899)		
LP32/13	25.0 (.984)	12.9 (.508)	31.8 (1.252)	PC30	2750 (1989)	9.09	0.703
				PC40	2630 (1902)		

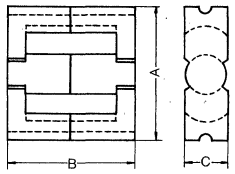
EC CORES

These ferrite cores are designed based on IEC PUb.647. They are in wide use as cores for switching power supplies.

Features
- Center leg is round making winding easy.
- Winding area is large and permits the design of high output transformers.

Applications
Transformers and choke coils for switching power supplies.



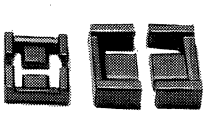


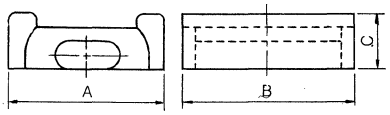
Part No.	Dimensions in mm (inches) A	B	C	Material	AL-value (nH/N²)	Σℓ/A (cm⁻¹)	Ae (cm²)
EC35	34.5 (1.36)	34.6 (1.36)	9.5 (.37)	PC30	2400±25%	9.18	0.843
				PC40	2400±25%		
EC41	40.6 (1.60)	39.0 (1.54)	11.6 (.46)	PC30	3200±25%	7.35	1.21
				PC40	3200±25%		
EC52	52.2 (2.01)	48.4 (1.91)	13.4 (.53)	PC30	4200±25%	5.81	1.80
				PC40	4200±25%		
EC70	70.0 (2.76)	69.0 (2.72)	16.4 (.65)	PC30	4800±25%	5.14	2.79
				PC40	4800±25%		
EC90	90.0 (3.54)	90.0 (3.54)	30.0 (1.18)	PC30	6000 min.	3.46	6.24
				PC40	5550 min.		
EC120	120.0 (4.72)	101.0 (3.98)	30.0 (1.18)	PC30	6800 min.	3.32	7.53
				PC40	6300 min.		

• Dimensions of E core + I core

EPC CORES

EPC cores are designed for thin (approximately 1 inch) power supply and have an installation height of 12 to 16mm, an elliptic center leg for easy winding, and 10 to 12 terminals for easy designing.
High-performance power ferrite PC40 employed in these cores enables a user to design a power supply for high frequency with less heat generation.

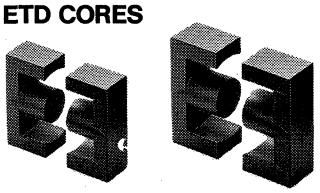


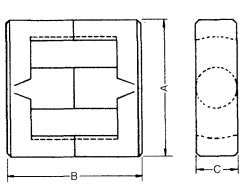


Part No.	Dimensions in mm (inches) A	B	C	Material	AL-value* (nH/N²)	Σℓ/A (cm⁻¹)	Ae (cm²)
EPC13	13.2 (.52)	13.2 (.52)	4.6 (.18)	PC40	870±25%	0.246	0.125
EPC17	17.5 (.69)	17.1 (.67)	6.0 (.24)	PC40	1150±25%	0.176	0.228
EPC19	19.0 (.75)	19.5 (.77)	6.0 (.24)	PC40	940±25%	0.203	0.227
EPC25	25.0 (.98)	25.0 (.98)	8.0 (.32)	PC40	1560±25%	0.128	0.464
EPC27	27.0 (1.06)	32.0 (1.26)	8.0 (.32)	PC40	1540±25%	0.134	0.546
EPC30	30.0 (1.18)	35.0 (1.38)	8.0 (.32)	PC40	1570±25%	0.132	0.610

**100 Ts, 1 kHz, 0.5 mA*

ETD CORES





Part No.	Dimensions in mm (inches) A	B	C	Material	AL-value (nH/N²)	Σℓ/A (cm⁻¹)	Ae (cm²)
ETD34	34.2 (1.35)	34.6 (1.36)	10.88 (.43)	PC30	2850±25%	8.10	0.971
				PC40	2780±25%		
ETD39	39.1 (1.54)	39.6 (1.56)	12.58 (.50)	PC30	3240±25%	7.37	1.25
				PC40	3150±25%		
ETD44	44.0 (1.73)	44.6 (1.76)	14.9 (.59)	PC30	4110±25%	5.89	1.75
				PC40	4000±25%		
ETD49	48.7 (1.92)	49.4 (1.94)	16.4 (.65)	PC30	4570±25%	5.34	2.13
				PC40	4440±25%		

FERRITE MAGNETS

TDK CORPORATION OF AMERICA 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: 708-803-6100 **INDIANAPOLIS** Phone: 317-872-0370 **NEW YORK** Phone: 516-625-0151 **LOS ANGELES** Phone: 213-539-6631 **DETROIT** Phone: 313-462-1210 **NEW JERSEY** Phone: 201-736-0023 **BOSTON** Phone 508-624-4262 **HUNTSVILLE** Phone: 205-464-0222 **GREENSBORO** Phone: 919-292-0012 **DALLAS** Phone: 214-506-9800 **SAN FRANCISCO** Phone: 408-437-9585
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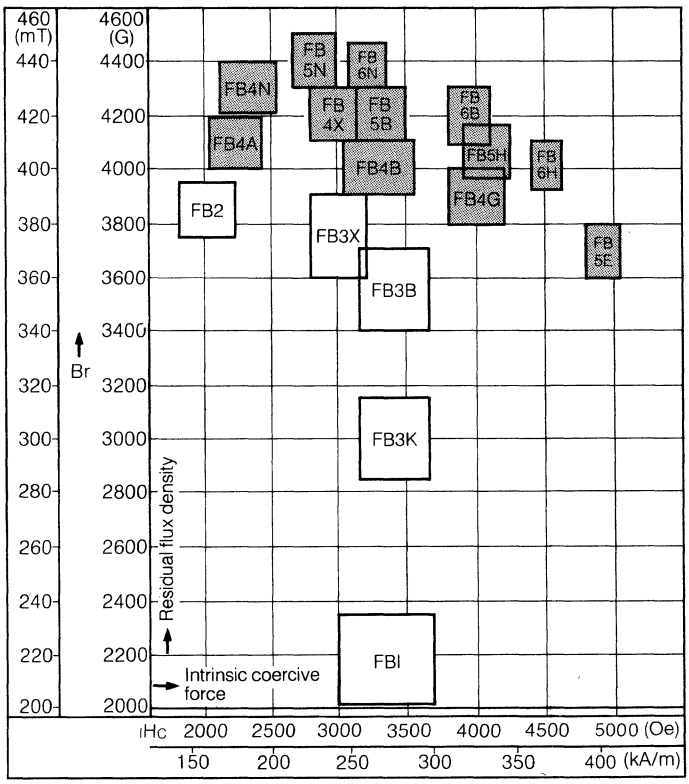
FERRITE MAGNETS

TDK ferrite magnets are oxide magnets composed of iron oxide, barium, strontium and several other elements. TDK as the leading ferrite manufacturer has a widest choice of the material to meet every demand from High Br to High Hc. The following reflects part of the most popular shapes and dimensions.

Wet pressed materials: FB4A, FB4B, FB4X, FB4G, FB4N, FB5N, FB5B, FB5H, FB5E, FB6H, FB6B, FB6N

Dry pressed materials: FB1, FB2, FB3B, FB3X, FB3K





Material characteristics

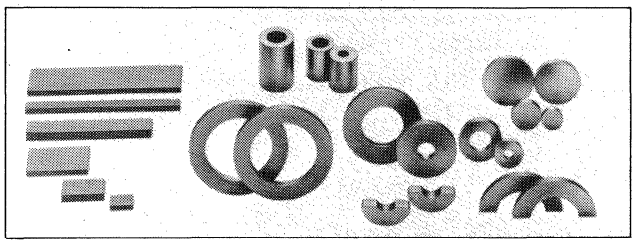
TDK Material		FB6H	FB6B	FB6N	FB5N	FB5B	FB5H	FB5E	FB4A	FB4B
MMPA standard									Ceramic 5	Ceramic 8
Residual magnetic flux density Br (G {mT})	Max.	4,100 {410}	4,300 {430}	4,450 {445}	4,500 {450}	4,300 {430}	4,150 {415}	3,750 {375}	4,200 {420}	4,100 {410}
	Typical	4,000 {440}	4,200 {420}	4,400 {440}	4,400 {440}	4,200 {420}	4,050 {405}	3,650 {365}	4,100 {410}	4,000 {400}
	Min.	3,900 {390}	4,100 {410}	4,300 {430}	4,300 {430}	4,100 {410}	3,950 {395}	3,550 {355}	4,000 {400}	3,900 {390}
Coercive force bHc (Oe {kA/m})	Max.	3,900 {311}	3,900 {311}	3,400 {271}	3,000 {239}	3,450 {275}	3,800 {302}	3,550 {282}	2,400 {191}	3,400 {271}
	Typical	3,800 {302}	3,800 {302}	3,250 {259}	2,850 {227}	3,300 {263}	3,650 {290}	3,400 {271}	2,200 {175}	3,200 {255}
	Min.	3,700 {295}	3,700 {295}	3,100 {247}	2,700 {215}	3,150 {250}	3,500 {278}	3,250 {259}	2,000 {159}	3,000 {239}
Intrinsic coercive force iHc (Oe {kA/m})	Max.	4,650 {370}	4,150 {330}	3,450 {275}	3,030 {241}	3,500 {278}	4,200 {334}	5,000 {398}	2,420 {193}	3,550 {282}
	Typical	4,500 {358}	4,000 {318}	3,300 {263}	2,880 {229}	3,350 {226}	4,050 {334}	4,850 {386}	2,220 {177}	3,300 {263}
	Min.	4,350 {346}	3,850 {306}	3,150 {250}	2,730 {217}	3,200 {255}	3,900 {310}	4,700 {374}	2,020 {161}	3,050 {243}
Maximum energy product BHmax. (MG Oe {kJ/m³})	Max.	4.0	4.4	4.8	4.7	4.5	4.0	3.3	4.2	4.1
	Typical	3.8 {30}	4.2 {33}	4.7 {37}	4.5 {36}	4.3 {34}	3.8 {30}	3.1 {25}	4.0 {32}	3.8 {30}
	Min.	3.6	4.0	4.5	4.3	4.1	3.6	2.9	3.8	3.5
Curie temperature (°C)		460	460	460	460	460	450	450	450	460
Material composition		SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	BaO $6Fe_2O_3$	SrO $6Fe_2O_3$

TDK Material		FB4X	FB4G	FB4N	FB3B	FB3X	FB3K	FB2	FB1
MMPA standard			Ceramic 7		Ceramic 6				
Residual magnetic flux density Br (G {mT})	Max.	4,300 {430}	4,000 {400}	4,400 {440}	3,700 {370}	3,900 {390}	3,150 {315}	3,950 {395}	2,350 {235}
	Typical	4,200 {420}	3,900 {390}	4,300 {430}	3,550 {355}	3,750 {375}	3,000 {300}	3,850 {385}	2,200 {220}
	Min.	4,100 {410}	3,800 {380}	4,200 {420}	3,400 {340}	3,600 {360}	2,850 {285}	3,750 {375}	2,000 {200}
Coercive force bHc (Oe {kA/m})	Max.	3,100 {247}	3,750 {298}	2,500 {199}	3,200 {255}	3,100 {247}	2,950 {235}	2,200 {175}	2,000 {159}
	Typical	2,950 {235}	3,600 {286}	2,300 {183}	3,000 {239}	2,950 {235}	2,750 {219}	2,000 {159}	1,900 {151}
	Min.	2,800 {223}	3,450 {275}	2,100 {167}	2,800 {223}	2,800 {223}	2,550 {203}	1,800 {143}	1,800 {143}
Intrinsic coercive force iHc (Oe {kA/m})	Max.	3,200 {255}	4,200 {334}	2,520 {201}	3,650 {290}	3,200 {255}	3,650 {290}	2,220 {177}	
	Typical	3,000 {239}	4,000 {318}	2,320 {185}	3,400 {271}	3,000 {239}	3,400 {271}	2,020 {161}	3,500 {279}
	Min	2,800 {223}	3,800 {302}	2,120 {169}	3,150 {251}	2,800 {223}	3,150 {251}	1,820 {145}	3,000 {239}
Maximum energy product BHmax. (MG Oe {kJ/m³})	Max.	4.4	3.8	4.6	3.2	3.5	2.4	3.7	1.2
	Typical	4.2 {33}	3.6 {29}	4.4 {35}	3.0 {24}	3.2 {26}	2.1 {17}	3.5 {28}	1.1 {8.9}
	Min.	4.0	3.4	4.2	2.8	2.9	1.8	3.3	0.9
Curie temperature (°C)		460	460	460	460	460	460	450	450
Material composition		SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	SrO $6Fe_2O_3$	BaO·(SrO) $6Fe_2O_3$	BaO $6Fe_2O_3$

RARE EARTH COBALT MAGNETS

TDK CORPORATION OF AMERICA 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: 708-803-6100 **INDIANAPOLIS** Phone: 317-872-0370 **NEW YORK** Phone: 516-625-0151 **LOS ANGELES** Phone: 213-539-6631 **DETROIT** Phone: 313-462-1210 **NEW JERSEY** Phone: 201-736-0023 **BOSTON** Phone 508-624-4262 **HUNTSVILLE** Phone: 205-464-0222 **GREENSBORO** Phone: 919-292-0012 **DALLAS** Phone: 214-506-9800 **SAN FRANCISCO** Phone: 408-437-9585
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RARE EARTH COBALT MAGNETS (REC MAGNETS)

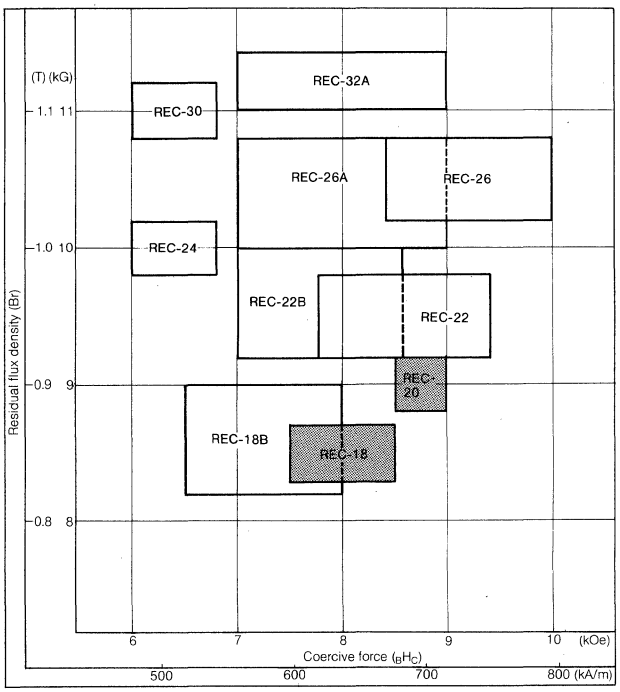


Demand for rare earth cobalt (REC) magnets has been increasing as that for smaller sized, higher efficient electronic equipment has never ceased to be active. TDK has a wide choice of REC magnets, including 2-17 series ones, whose excellent temperature characteristics compare Alnico. The conveniently small, easy-to-use TDK REC Magnets include the highest performing REC-32A and REC-30, REC-26A, REC-26, REC-24, REC-22, REC-22B and REC-18B, all power-efficient and high-performing.

Applications

Speakers, headphones, cartridges, microphones, printers, magnetic and optical disks, coreless motors, stepping motors, klystrons, magnetrons, isolators, circulators, various meters, noncontacting switches, sensors, watches, clocks, magnetic couplings, tools, magnetic medical instruments, etc.

Characteristic distribution figure



Material characteristics

			Series 2-17 [Sm2 (Co, Cu, Fe, Zr)17]								Series 1-5 [SmCo5]	
			REC-32A	REC-30	REC-26A	REC-26	REC-24	REC-22	REC-22B	REC-18B	REC-20	REC-18
(Magnetic characteristics)												
Residual flux density	Br	(kG) {T}	11 to 11.6 1.10 to 1.16	10.8 to 11.2 1.08 to 1.12	10 to 10.8 1.00 to 1.08	10.2 to 10.8 1.02 to 1.08	9.8 to 10.2 0.98 to 1.02	9.2 to 9.8 0.92 to 0.98	9.2 to 10.0 0.92 to 1.00	8.2 to 9.0 0.82 to 0.90	8.8 to 9.2 0.88 to 0.92	8.3 to 8.7 0.83 to 0.87
Coercive force	BHc	(kOe) {kA/m}	7 to 9 557.2 to 716.4	6.0 to 6.8 477.5 to 541.1	7 to 9 557.2 to 716.4	8.4 to 10.0 668.5 to 795.8	6.0 to 6.8 477.5 to 541.1	7.8 to 9.4 620.7 to 748.0	7.0 to 8.6 557.0 to 684.4	6.4 to 8.0 509.3 to 636.6	8.5 to 9.0 676.4 to 716.2	7.5 to 8.5 596.8 to 676.4
	IHc	(kOe) {kA/m}	8 min. 636.8 min.	6.2 to 7.0 493.4 to 557.0	8 min. 636.8 min.	10.0 min. 795.8 min.	6.2 to 7.0 493.4 to 557.0	10.0 min. 795.8 min.	8.0 to 10.0 636.6 to 795.8	8.0 to 10.0 636.6 to 795.8	12.0 to 20.0 954.9 to 1591.6	12.0 to 20.0 954.9 to 1591.6
Maximum energy product (BH) max.		(MG·Oe) {kJ/m^3}	28 to 32 222 to 254	29 to 31 231 to 247	23 to 27 183 to 215	25 to 27 192 to 224	22 to 24 175 to 191	20 to 24 159 to 191	20 to 24 159 to 191	16 to 20 127 to 159	19 to 21 151 to 167	17 to 19 135 to 151
(Physical characteristics)												
Curie temperature		°C {K}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	800 to 850 {1073 to 1123}	750 to 800 {1023 to 1073}	750 to 800 {1023 to 1073}	700 to 750 {973 to 1023}	700 to 750 {973 to 1023}
*Thermal expansion coefficient	C//	1/°C {1/K}	8×10^{-6} $\{8\times10^{-6}\}$	8×10^{-6} $\{8\times10^{-6}\}$	8×10^{-6} $\{8\times10^{-6}\}$	8×10^{-6} $\{8\times10^{-6}\}$	8×10^{-6} $\{8\times10^{-6}\}$	8×10^{-6} $\{8\times10^{-6}\}$	8×10^{-6} $\{8\times10^{-6}\}$	8×10^{-6} $\{8\times10^{-6}\}$	6×10^{-6} $\{6\times10^{-6}\}$	6×10^{-6} $\{6\times10^{-6}\}$
	C⊥	1/°C {1/K}	11×10^{-6} $\{11\times10^{-6}\}$	11×10^{-6} $\{11\times10^{-6}\}$	11×10^{-6} $\{11\times10^{-6}\}$	11×10^{-6} $\{11\times10^{-6}\}$	11×10^{-6} $\{11\times10^{-6}\}$	11×10^{-6} $\{11\times10^{-6}\}$	11×10^{-6} $\{11\times10^{-6}\}$	11×10^{-6} $\{11\times10^{-6}\}$	13×10^{-6} $\{13\times10^{-6}\}$	13×10^{-6} $\{13\times10^{-6}\}$
Thermal conductivity		(kcal/mhr °C) {W/mK}	10 {12}	10 {12}	10 {12}	10 {12}	10 {12}	10 {12}	10 {12}	10 {12}	11 {13}	11 {13}
Specific heat		(cal/g·°C) {J/kg·K}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	8×10^{-2} {335}	9×10^{-2} {377}	9×10^{-2} {377}
Specific resistivity		(Ω-cm)	8.6×10^{-5}	8.6×10^{-5}	8.6×10^{-5}	8.6×10^{-5}	8.6×10^{-5}	8.6×10^{-5}	9.0×10^{-5}	9.0×10^{-5}	5.3×10^{-5}	5.3×10^{-5}
Density		(g/cm^3)	8.3 to 8.5	8.3 to 8.5	8.3 to 8.5	8.3 to 8.5	8.3 to 8.5	8.3 to 8.5	8.2 to 8.4	8.2 to 8.4	8.1 to 8.3	8.1 to 8.3
(Mechanical characteristics)												
Deflection strength		(kgf/mm^2) {N/m^2}	15 $\{1.5\times10^8\}$	15 $\{1.5\times10^8\}$	15 $\{1.5\times10^8\}$	15 $\{1.5\times10^8\}$	15 $\{1.5\times10^8\}$	15 $\{1.5\times10^8\}$	15 $\{1.5\times10^8\}$	15 $\{1.5\times10^8\}$	18 $\{1.8\times10^8\}$	18 $\{1.8\times10^8\}$
Compressive strength		(kgf/mm^2) {N/m^2}	82 $\{8\times10^8\}$	82 $\{8\times10^8\}$	82 $\{8\times10^8\}$	82 $\{8\times10^8\}$	82 $\{8\times10^8\}$	82 $\{8\times10^8\}$	82 $\{8\times10^8\}$	82 $\{8\times10^8\}$	102 $\{10\times10^3\}$	102 $\{10\times10^8\}$
Tensile strength		(kgf/mm^2) {N/m^2}	3.6 $\{3.5\times10^7\}$	3.6 $\{3.5\times10^7\}$	3.6 $\{3.5\times10^7\}$	3.6 $\{3.5\times10^7\}$	3.6 $\{3.5\times10^7\}$	3.6 $\{3.5\times10^7\}$	3.6 $\{3.5\times10^7\}$	3.6 $\{3.5\times10^7\}$	4.1 $\{4\times10^7\}$	4.1 $\{4\times10^7\}$
Young's modulus		(kgf/mm^2) {N/m^2}	1.2×10^4 $\{1.2\times10^{11}\}$	1.2×10^4 $\{1.2\times10^{11}\}$	1.2×10^4 $\{1.2\times10^{11}\}$	1.2×10^4 $\{1.2\times10^{11}\}$	1.2×10^4 $\{1.2\times10^{11}\}$	1.2×10^4 $\{1.2\times10^{11}\}$	1.2×10^4 $\{1.2\times10^{11}\}$	1.2×10^4 $\{1.2\times10^{11}\}$	1.6×10^4 $\{1.6\times10^{11}\}$	1.6×10^4 $\{1.6\times10^{11}\}$
Vickers hardness		(Hv)	500 to 600	500 to 600	500 to 600	500 to 600	500 to 600	500 to 600	500 to 600	500 to 600	450 to 500	450 to 500

Tooling is available for various shapes and dimensions. Please contact TDK for further information.
**C// is the value measured in the easy magnetization direction while C⊥ is the value measured in the direction vertical to the easy magnetization direction.*

MAGNETIC HEADS

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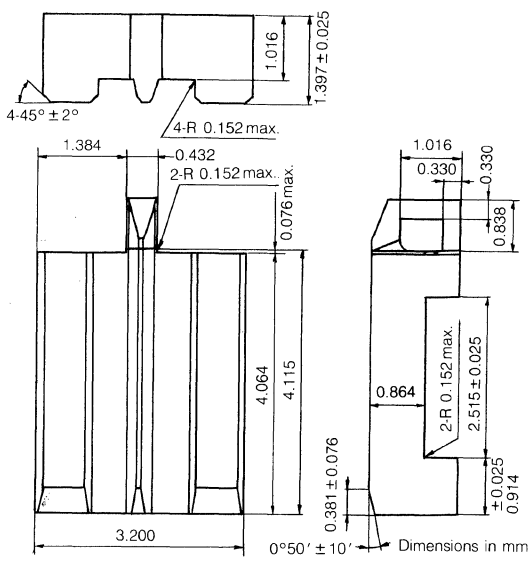
MINI MONOLITHIC HARD SLIDERS FOR HARD DISK DRIVES



A small monolithic type head for use in magnetic disk devices.
High density, high flux density Mn-Zn ferrite is used to satisfy the need for high density recording. This material has been developed through TDK's untiring efforts of ferrite development.

Features
- High flux density Mn-Zn ferrite (HR52).
- Hole rate <0.03 because of high density ferrite.
- Ultra small head. 50% less in size than previous monolithic head sliders.
- Excellent wear resistance.

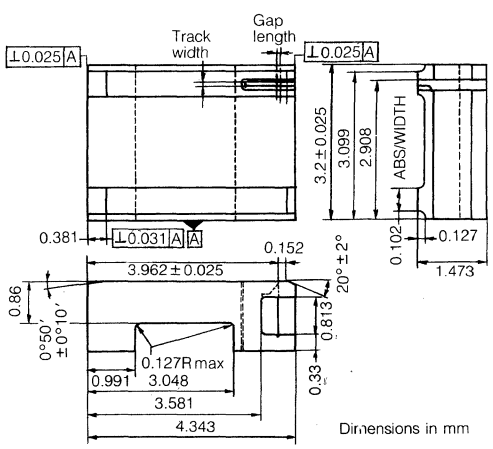
Applications
Hard disk drives.



MINI COMPOSITE HEAD SLIDERS FOR HARD DISK DRIVES

Features
- Durable narrow track embeded in hard glass.
- Asymmetrical configuration enables the use of outer portion of disk.
- Improved durability by TDK original glass.

Applications
Hard disk drives.



3.5 INCH FLOPPY DISK DRIVE MAGNETIC HEAD

TDK's unique manufacturing process and newly developed construction compact high-capacity floppy disks technology have produced magnetic heads that can cope effectively with small, large capacity floppy disks. TDK's 1 MB and 1.6 MB high-density recording magnetic heads are very reliable.

Features
- Mn-Zn ferrite developed for high-density recording.
- Track accuracy highly improved by TDK's unique mechanical technology.
- Heads employ only glass bonding to ensure high workability in varied circumstances.

Applications
3.5 inch, 135TPI 1 MB, 1.6 MB, and 1.6/1 MB multiple use floppy disk drives.

Basic characteristics (for 1 MB)			
Inductance	R/W	mH	1.5±20%
	ER	μH	31±20%
DC resistance	R/W	Ω	39±20%
	ER	Ω	1.4±20%
Resonant frequency		kHz	450 min.

Operating characteristics (for 1 MB)			
Output	Tr00	mVp-p	5 max.(1F)
	Tr79	mVp-p	1.2 min.(2F)
Resolution		%	68 min.
Overwrite		dB	−26 max.

5.25 INCH FLOPPY DISK DRIVE MAGNETIC HEAD

These tunnel erase type heads (48 TPI, 96 TPI) are made of very dense Mn-Zn ferrite with TDK's ferrite technology and precision mechanical technology developed over many years of experience.

Features
- High electromagnetic conversion characteristics provided by R/W core made of high-density Mn-Zn ferrite.

5.25 INCH 48 TPI, FDD MAGNETIC HEAD

Applications
5.25 inch, 0.5 MB floppy disk drives.

Basic characteristics			
Inductance	R/W	mH	1.1±20%
	ER	μH	10.0±20%
DC resistance	R/W	Ω	15.0±20%
	ER	Ω	1.5±20%
Resonant frequency		kHz	450 min.

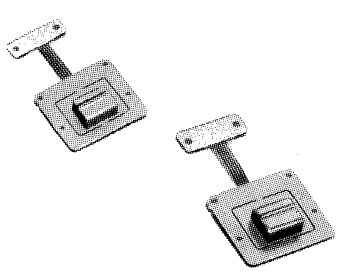
Operating characteristics			
Output	Tr00	mVp-p	20 max. (1F)
	Tr39	mVp-p	2.5 min. (2F)
Resolution		%	65 min.
Overwrite		dB	−28 max.

5.25 INCH 96 TPI, FDD MAGNETIC HEAD

Applications
5.25 inch, 1 MB, 1.6 MB, and 1.6/1MB, multiple use floppy drives.

Basic characteristics (for 1 MB)			
Inductance	R/W	mH	1.0±20%
	ER	μH	7.0±20%
DC resistance	R/W	Ω	20.0±20%
	ER	Ω	1.0±20%
Resonant frequency		kHz	500 min.

Operating characteristics (for 1 MB)			
Output	Tr00	mVp-p	7 max. (1F)
	Tr76	mVp-p	1.2 min. (2F)
Resolution		%	65 min.
Overwrite		dB	−26 max.



CRYSTALS

Manufacturer	Starting EEM Page No.	Crystal Blanks	Microprocessor	Quartz	Quartz (Watches)	Crystal Holders
Anderson Electronics Inc.	A•1304	√	√§	√§		√§
Bliley Electric Co.	A•1308			√§*		
Bomar Crystal	A•1318		√			
Colorado Crystal	A•1322	√*	√*	√*		
CTS Corp./Knights Div.	A•1328	√*	√§*	√§*		
Epson America Inc.	A•1358		√§	√§	√	
Fox Electronics	A•1364		√§	√§	√§	
Frequency Electronics	A•1368		√*	√*	√*	
Hybrids International Ltd.	A•1372	√§	√§	√§	√§	√§
Hy-Q International	A•1375		√§	√§		
KDS America	A•1379		√§*		√§*	
McCoy Electronics	A•1380			√§*		
MF Electronics	A•1388		√§*			
Micro Crystal Div./SMH	A•1395		√§	√§	√§	
Microsonics	A•1401	√§*		√§*		
Monitor Products	A•1402	√§*	√§*	√§*		
M-Tron	A•1408	√*	√§*			
NDK - America	A•1416	√	√	√		
NEL Frequency Controls Inc.	A•1425	√	√			
Pletronics Inc.	A•1437		√	√	√	
Q-Tech Corp.	A•1444		√§*	√§		
Reeves Hoffman Div.	A•1448	√*				√*
RXD, Inc.	A•1452		√§	√§	√	
Saronix	A•1455		√§	√§		
Seiko Instruments	A•1461		√§	√§	√§	
Standard Crystal Corp.	A•1469	*√		√§*		
Statek Corp.	A•1470		√	√	√	
Toyocom USA Inc.	A•1472		√§	√§		√

* MIL Spec. §Surface Mount

CRYSTAL FILTERS

Manufacturer	Starting EEM Page No.	Active	AF	IF	UHF/ VHF	RF	Micro-wave	LC	Comb	Single Side-band	Vesti-gial Side-band	Band pass	Low pass	High pass	Notch (Band Elim.)	Linear Phase	Equal-izer	Hybrid	Other
EDO	A•1357																		Piezo electric ceramics
Epson America	A•1358						√												
Fox Electronics	A•1364				√	√						√							
Frequency Electronics	A•1368						√*	√*	√*	√*	√*	√*	√*			√*	√*	√*	
Frequency Selective Networks	A•1370	√*		√*	√*			√*	√*	√*	√*	√*	√*	√*	√*	√*	√*		
Hybrids Int'l.	A•1372																		Monolithic Crystal Filters
Hy-Q International	A•1375			√		√		√		√	√	√							
McCoy Electronics	A•1380					√				√		√			√				
Microsonics	A•1401				√§*	√§*	√§*	√§*	√§*	√		√§*	√§*	√§*	√				
Murata Erie	A•1410			√§	√§	√§	√	√				√	√	√					Piezo Ceramic Filters
NDK - America	A•1416			√	√	√				√		√	√	√		√			
Toyocom USA Inc.	A•1472	√§				√§						√§	√						

* MIL Spec. §Surface Mount

TIME & FREQUENCY INSTRUMENTATION

Manufacturer	Starting EEM Page No.	Standards	Clocks	Distribution Amplifier	Systems	Test Sets	Other
Ball, Efratom Div.	A•1307	√	√	√	√		
Comclock Inc.	A•1323		√				
CTS Corp./Knights Div.	A•1328	√*	√*				
Epson America Inc.	A•1358		√				
Frequency Electronics	A•1368	√*	√*	√*	√*	√*	
FTS/Austron Inc.	A•1371	√*	√*	√	√*	√	
Hybrids International	A•1372		√*				Clocks Commercial
KDS America	A•1379		√				
MF Electronics	A•1388		√*				
Micronics Tech.	A•1399				√		
Murata Erie	A•1410						Dielectric & Ceramic Resonators
NDK - America	A•1416	√					
Q-Tech Corp.	A•1444		√*				

* MIL Spec.

OSCILLATORS

Manufacturer	Starting EEM Page No.	AF	LF	RF	Ultra-sonic	Micro-wave	Sinu-soidal	Square Wave	Pulse	UHF/ VHF	Crys-tal Con-trol Mod-ule	Tun-ing Fork Con-trol	Oven-ized	Volt-age Con-trol VCXO	Temp. Com-pen-sated TCXO	Volt-age Con-trol/ Temp. Comp.	Clock	LC	RC	Other
Anderson Electronics	A•1304		√§	√§							√§						√§			
Ball Corp., Efratom Div.	A•1307			√*			√*	√*			√		√*	√*						Rb Atomic Osc
Bomar Crystal	A•1318																√			
Bliley Electric Co.	A•1308												√*	√*	√*	√*	√*			
Champion Technologies	A•1321						√	√§			√			√	√		√§			
Comclok Inc.	A•1323							√§*			√§*									
Connor - Winfield Corp.	A•1324						√§*	√§*		√§*	√§*		√§*	√§*	√§*	√§*	√§*			
CTS Corp./Knights Div.	A•1328	√§*	√§*	√§*			√§*	√§*		√§*	√§*		√§*	√§*	√§*	√§*	√§*			Digitally compensated Cristal Osc. DCX0
Dale Electronics	A•1352			√			√	√	√	√	√						√			
Epson America Inc.	A•1358			√§					√§	√§	√§						√§			
Fox Electronics	A•1364							√§			√§			√	√	√	√§			
Frequency Electronics	A•1368					√*	√*	√*	√*	√*	√*		√*	√*	√*	√	√*	√*	√*	
FTS/Austron	A•1371			√*			√*	√*			√*		√§*	√§*						
Hybrids Int'l.	A•1372			√§		√§	√§*	√§*			√§	√§		√§*	√§*	√§*	√§*	√§	√§	ECL High Freq.
Hy-Q Int'l.	A•1375			√			√				√			√	√	√	√§			
Isotemp Research Inc.	A•1376			√§							√§		√§	√§	√§	√§				
KDS America	A•1379										√*						√§*			

* MIL Spec. §Surface Mount

OSCILLATORS (continued)

Manufacturer	Starting EEM Page No.	AF	LF	RF	Ultra-sonic	Micro-wave	Sinu-soidal	Square Wave	Pulse	UHF/ VHF	Crys-tal Con-trol Mod-ule	Tun-ing Fork Con-trol	Oven-ized	Volt-age Con-trol VCXO	Temp. Com-pen-sated TCXO	Volt-age Con-trol/ Temp. Comp.	Clock	LC	RC	Other
McCoy Electronics	A•1380						√§*	√§*			√		√§*	√§*	√*	√*	√§*			
MF Electronics Corp.	A•1388										√§*				√§*	√§*	√§*			
Micro Crystal/Div. of SMH	A•1395							√§			√§	√§					√§			
Micronics Technology Inc.	A•1399					√														
Monitor Products	A•1402		√	√			√§*		√§*	√§*	√§*		√§*	√§*	√§*		√			
M-Tron Inds. Inc.	A•1408			√§*				√*			√§*	√		√			√§*			
Murata Erie North America Inc.	A•1410	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√			
NDK - America	A•1416			√			√	√		√	√		√	√	√	√	√			
NEL Frequency Controls	A•1425							√§				√					√§			
Oscillatek Corp.	A•1426			√§*			√	√§*	√		√		√	√	√	√	√§*			
Ovenaire-Audio-Carpenter	A•1432			√			√	√			√		√	√	√	√				
Pletronics Inc.	A•1437						√	√§			√						√§			
Q-Tech Corp.	A•1444			√§*				√§*		√§*	√§*			√§*			√§*			
Reeves Hoffman Div.	A•1448		√*	√*			√*	√*			√*	√*	√*	√*	√*	√*	√*			
RXD, Inc.	A•1452		√*	√*				√*			√*			√	√	√	√*			
Saronix	A•1455													√	√	√	√			
Seiko Instruments	A•1461							√§			√§	√§			√§		√§			
Spectrum Technology Inc.	A•1462							√*			√*		√*	√*	√*	√*	√§*			
Standard Crystal Corp.	A•1469							√§*				√		√§*			√§*			
Statek Corp.	A•1470										√									
Toyocom USA Inc.	A•1472												√*	√*	√*	√*	√*			
Vectron Laboratories Inc.	A•1484	√§*	√§*	√§*			√*	√§*		√§*	√*		√*	√§*	√*	√*	√§*			
Xsis Electronics Inc.	A•1491							√§*									√§*			

* MIL Spec. §Surface Mount

MADE IN THE U.S.A. ***CUSTOM DESIGNS AVAILABLE***

Over 30 Years of Service to Quartz Crystal users.

ANDERSON ELECTRONICS, INC.

Manufacturer of Quartz Crystals
and Crystal Oscillators

Crystal Blanks:

AT cut crystal blanks are available in fundamental, 3rd overtone and 5th overtone modes for oscillator and sensor applications. Blanks can be supplied in sizes ranging from .200″ to .600″ diameters and can be supplied with silver, gold or aluminum electrodes or without electrodes.

Crystals:

Anderson Electronics domestically manufactures a wide variety of crystals for the computer and communications markets. Fundamental, 3rd overtone and 5th overtone mode AT cut crystals are available in package styles to fit many applications. Also, crystals made to the MIL-Specs are available.

Frequency Stabilities Available:

± 5 PPM (± .0005%)
± 10 PPM (± .001%)
± 20 PPM (± .002%)
± 30 PPM (± .003%)
± 50 PPM (± .005%)
± 100 PPM (± .01%)

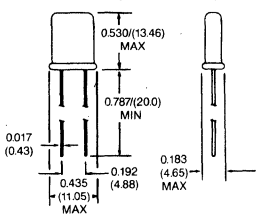
Temperature Ranges Include:

0 to +70 Degrees C
−30 to +60 Degrees C
−40 to +85 Degrees C
−55 to +125 Degrees C

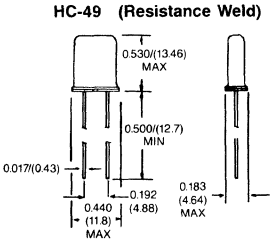
General Crystal Specifications

PACKAGE TYPE		FREQUENCY RANGE MHZ	MODE
RESISTANCE WELD	SOLDER SEAL		
HC49/U HC50/U	HC18/U HC25/U	1.8 to 30 30 to 75 75 to 125	Fundamental 3rd Overtone 5th Overtone
HC51/U HC48/U	HC33/U HC 6/U	1.8 to 25	Fundamental
HC45/U		10 to 30 30 to 75 75 to 125	Fundamental 3rd Overtone 5th Overtone
Minidip		1.8 to 30 30 to 75 75 to 125	Fundamental 3rd Overtone 5th Overtone

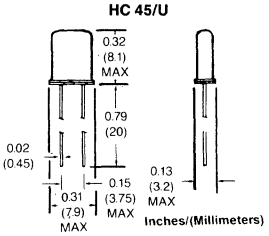
HC-18 (Solder Seal)



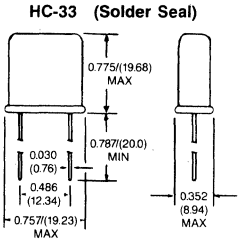
HC-49 (Resistance Weld)



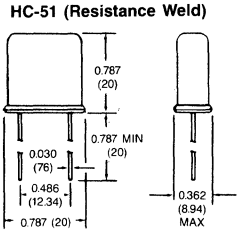
HC 45/U



HC-33 (Solder Seal)



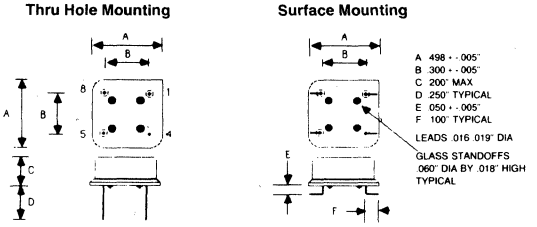
HC-51 (Resistance Weld)



MINIDIP

Thru Hole Mounting

Surface Mounting



Anderson Electronics maintains a complete customer cross reference list.

100% domestic production provides for some of the best deliveries in the industry.

Ask about our premium delivery service available for many of our crystals and oscillators.

CONTACT FACTORY FOR YOUR SPECIAL REQUIREMENTS

ANDERSON ELECTRONICS INC.

P.O. BOX 89
SCOTCH VALLEY ROAD
HOLLIDAYSBURG, PA 16648
PHONE: 814-695-4428

FAX 814-696-0403

MADE IN THE U.S.A. ***CUSTOM DESIGNS AVAILABLE***

Over 30 Years of Service to Quartz Crystal users.

ANDERSON ELECTRONICS, INC.

Manufacturer of Quartz Crystals and Crystal Oscillators

Crystal Clock Oscillators:

Anderson Electronics offers clock oscillators in a wide range of frequency stabilities and temperature ranges. Packages include the standard metal DIP and MINI-DIP.

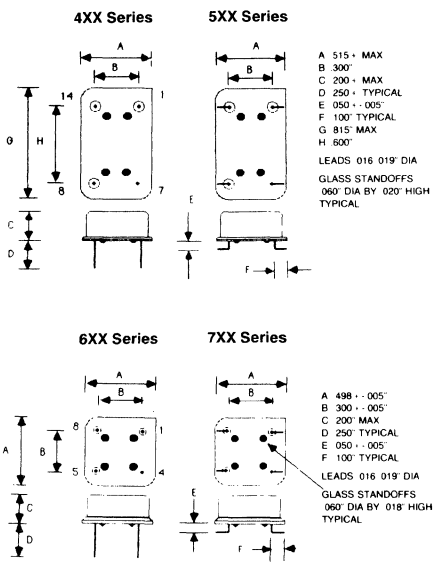
*Frequency Stabilities Available:**

± .05% (± 500 ppm)
± .01% (± 100 ppm)
± .005% (± 50 ppm)
± .0025% (± 25 ppm)
± .002% (± 20 ppm)
± .001% (± 10 ppm)

*Temperature Ranges Available:**

0°C to +70°C
−40°C to +85°C
−55°C to +125°C

* Not all frequency stabilities are available at all temperature ranges.



Crystal Oscillators General Specifications

OUTPUT	SERIES	FREQUENCY RANGE	INPUT VOLTAGE	INPUT CURRENT	SYMMETRY	LOGIC 1	LOGIC 0	RISE/FALL TIME	LOAD
TTL	404 /504	10 Hz–10 MHz	+ 5 VDC to ± 0.5 VDC	35 mA Typical 60 mA Max. Frequency Dependent	40/60 Min. 60/40 Max. @ 1.4VDC	2.4 VDC Min.	0.4 VDC Max.	20 nS Max @ 0.4– 2.4 VDC Level < 1.0 MHz 15 nS Max. @ 0.4– 2.4 VDC Level > 1.0 MHz.	10 TTL Loads Max.
TTL	405 /505	8 MHz–80 MHz		35 mA Typical, 100 mA Max. Frequency Dependent.				5 nS Max. @ 0.4–2.4 VDC Level.	
TTL Enable Function	435 /535	8 MHz–40 MHz		35 mA Typical 60 mA Max.				5 nS Max @ 0.4–2.4 VDC Level.	
TTL Tri-State Enable	438 /538	8 MHz–40 MHz		55 mA Typical 75 mA Max.					
HCMOS	401 /501	32 KHz–50 MHz		12 mA Typical Frequency Dependent		VCC −0.5 VDC	0.4 VDC max.	Typical 3 nS @ 0.4 to 2.4 VDC Level.	
CMOS	400 /500	200 Hz–5 MHz	+ 5 to 15 VDC	10 mA Typical Frequency Dependent	40/60 min. 60/40 max. @ 50% Level	4.5 V	0.2 V	Frequency Dependent.	15 pf.
ECL (10K ECL Compatible)	407 /507	10–115 MHz	−5.5 VDC ±0.5 VDC	60 mA Max.	40/60 min. 60/40 max. @ −1.3 VDC	−1.02 to −0.74 V	−1.95 to −1.60 V	3 nS max 20 to 80%	Open emmiter must be loaded. 50 Ohms to −2V or 270 Ohms to −5.2V
ECL 2 Output Complimentary	427 /527								
HCMOS Mini DIP	601 /701	4 to 50 MHz	+ 5 VDC ±0.5 VDC	12 mA Typical Frequency Dependent	40/60 min. 60/40 max.@ 1.4 VDC	4.5VDC min.	0.2VDC max.	8 nS max. 0.4 to 2.4 VDC	10 TTL Loads
TTL Mini DIP	604 /704	3.5 to 20 MHz		25 mA Max Frequency Dependent		3.6VDC min.	0.4 VDC max.		

Specifications are subject to change without notice.

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100% domestic production provides for some of the best deliveries in the industry.

Ask about our premium delivery service available for many of our crystals and oscillators.

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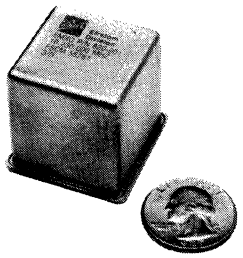
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

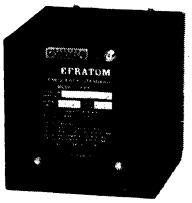
Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
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Opto Semiconductors, Miniglossary **B**•1334
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Power Supplies, DC, Product Selection Guide **D**•1501
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Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
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Wire Gauges—Diameter, Area, Copper Weight **C**•1864

Efratom Division

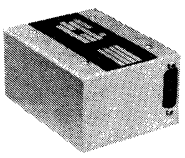
time and frequency systems



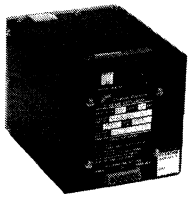
EMXO
Sub-Min Mil Crystal Osc.



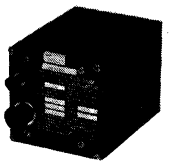
FRK
Com. Rb. Osc.



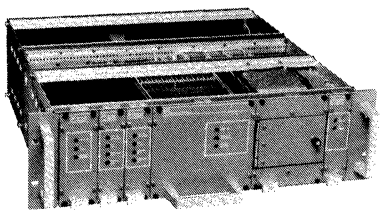
FRS-N
Min. Com'l Rb Osc.



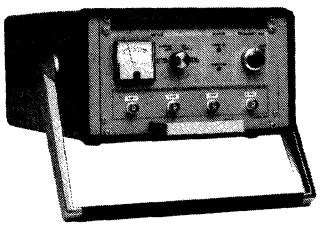
M-100
Mil Rb. Osc.



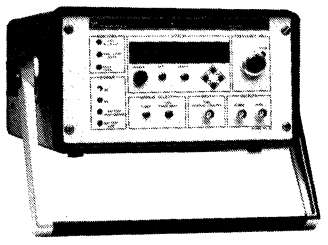
M-3000
Min. Mil Rb. Osc.



MODEL MFS
MODULAR FREQUENCY SYSTEM



MODEL MRT
RUBIDIUM FREQUENCY STANDARD



MODEL PC-10
PORTABLE CLOCK

EFRATOM is the recognized world leader in rubidium atomic precision time and frequency systems for military/aerospace and commercial applications. Utilizing state-of-the-art atomic oscillator technology, EFRATOM has conceived and developed a family of time and frequency references for radio navigation, geophysical survey positioning systems, satellite tracking and control, communication systems employing PCM and spread spectrum techniques and standard time and interval generation and transfer.

EFRATOM's Model M-3000 is a miniature military atomic oscillator measuring just 3.25 in × 3.25 in × 4.5 in (83 mm × 83 mm × 114 mm), yet this instrument has excellent long term stability and fast warm-up performance. Model M-100 and M-3000 rubidium oscillators are radiation hardened and offer unparalleled performance in the toughest of airborne and ground environments.

EFRATOM also offers modular frequency components, Model MFS in a 19 inch rack, permitting the user to configure unique time and frequency systems specifically for his application.

EFRATOM has also entered into quartz technology with a line of very high end crystal oscillators achieving state of the art specifications in terms of power (≤500mw @ −55°C), weight (≤40 gms) and size (≤2.2in^3) at aging rates of ≤5 × 10^{-10} per day. Model EMXO is the MIL-Spec unit and ECXO is commercial.

Model PC-10 is a rubidium based portable clock which can transfer time and frequency within 200 to 300 nanosec over an entire day of a clock trip.

MODEL	FRS-N	FRK-H	MRT-H	PC-10	M-100	M-3000	EMXO
Output Frequency	5/10MHz 10MHz TTL	5/10MHz	2ea10; 5; 1; 0.1MHz	10; 5; 1; 0.1MHz and 1PPS	5/10MHz	5/10MHz	10/10.23MHz Sine/TTL
Long Term Drift/Mo	5E-11	1E-11	1E-11	1E-11	6E-11/Opt1E-11	3E-11	<1E-8
Short Term (100s)	5E-12	1E-12	1E-12	1E-12	3E-12	3E-12	5E-12(1s)
Phase Noise (1HzBW) SSB	−110dBc (100Hz)	−120dBc @ 100Hz −145dBc @ 1KHz			−130dBc @ 100 Hz −140dBc @ 1KHz	−140dBc @ 100Hz −150dBc @ 1KHz	−120dBc @ 10Hz −155dBc @ 10KHz
		Low Noise Option −155dBc (100Hz)					
Warm-Up at 25°C	6 min/1E-9	<10 Min. for 2E-10*				<6 Min to 5E-10	4 Min to ±1E-8
Operations Temperature	−55°C to +65°C Baseplate	−25°C to +65°C Baseplate	−10°C to +50°C Ambient	−10°C to +45°C	−55°C to +68°C Baseplate +75°C Option	-55°C to +74°C Baseplate	−55°C to 95°C Ambient
Power at 25°C	12W	22VDC to 32VDC/13W	110/220 VAC/50W	6 Hrs. of Battery Ops	22.5 to 32 VDC/18W	22 to 32 VDC/15W	≤0.3W(TTL)
Dimensions	2×3×4 inches	4×4×4.4 inches	6×9×15 inches	6×10×15 inches	~4×4×4.8 inches	3.25×3.25×4.5 inches	1.3×1.3×1.3 inches
Weight	1.2 lbs	2.9 lbs	35 lbs	35 lbs	<4 lbs	<4 lbs	<40 gms

*5 min warm-up available on M-100

USA/3 Parker; Irvine, CA 92718/Telephone 714/770-5000/Telex 68-5635/Fax 714/770-2463
Germany/Fichtenstr 25/8011 Hofolding/Phone 08104-9040/Telex 529701/Fax 08104-9918
England/P.O. Box 325, Bromley, Kent, BR1 2WX, Phone 081-313-1078/Fax 081-290-6948

For further information call (814) 838-3571 • FAX 814-833-2712
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2545 W. GRANDVIEW BOULEVARD
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CRYSTAL BLANKS

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QUALITY QUARTZ PRODUCTS

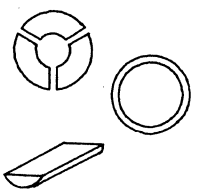
ALL CRYSTALS AND BLANKS ARE MANUFACTURED FROM PURE Z GROWTH CULTURED QUARTZ GROWN IN THE USA BY BLILEY ELECTRIC COMPANY.

THE QUARTZ IS AVAILABLE IN THREE GRADES:
STANDARD Q OF 2.0M MINIMUM
PREMIUM Q OF 2.5M MINIMUM
SWEPT

ANGLE ORIENTATION IS ESTABLISHED BY X-RAY AND ONE MINUTE ANGLE GROUPS ARE TYPICAL.

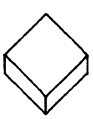
Transducer and Specialty Blanks:

ORIENTATION: X-CUT & Z-CUT TYPICAL, OTHER ORIENTATIONS AS REQUIRED
SIZE: 0.070" TO 1.400" OUTSIDE DIAMETER
0.010" TO 0.100" THICK



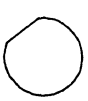
INSIDE DIAMETER AS NEEDED
OTHER SHAPES AND SIZES TO SPECIFICATION
PLATING: GOLD OR ALUMINUM

Rough Lapped AT Cut Blanks:



SQUARE: 0.300" TO 0.650"
ROUND: 0.180" TO 0.590"
THICKNESS: 0.007" TO 0.100"
REFERENCE: FLAT OR NOTCH AS REQUIRED

Finish Lapped AT Cut Blanks:



DIAMETER: 0.180" TO 0.590"
REFERENCE: FLAT OPTIONAL
LAPPED TO 25 MHz AF, 75 MHz A3 OR 125 MHz A5
POLISHED TO 25 MHz AF, 75 MHz A3 OR 125 MHz A5
PLANO – CONVEX AVAILABLE IN WIDE DIOPTER RANGE.

Plating Monitor Crystals:



FREQUENCY: 5 MHz, 6 MHz OR AS SPECIFIED
DESIGN: PLANO – CONVEX 0.550" DIAMETER
PLATING: GOLD OVER CHROME (ALSO AVAILABLE UNPLATED)

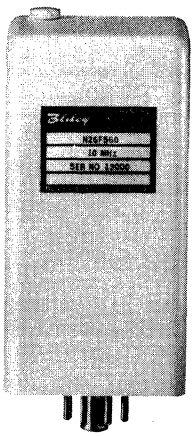
Call/Fax Your Inquiries & Requirements

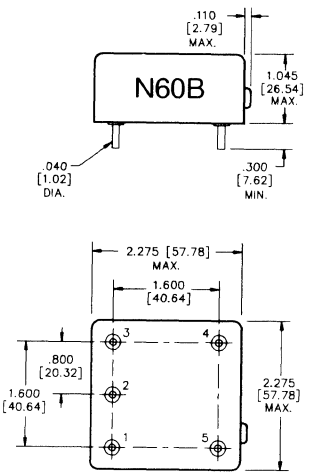
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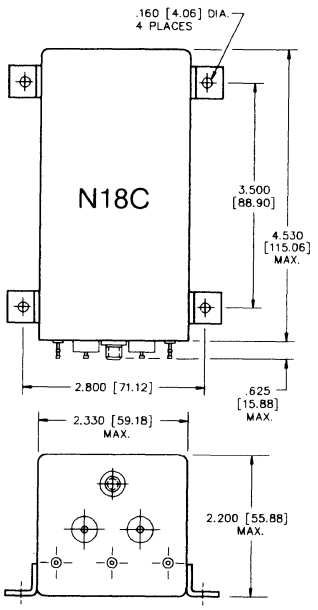
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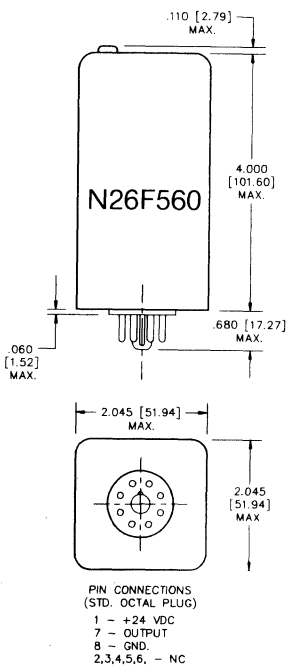
CRYSTAL OSCILLATORS

Oven Controlled (OCXO)









Bliley Oven Controlled Crystal Oscillators provide excellent frequency stability and time base reference, with a compatible phase noise level.

	N60B	N18C	N26F560
FREQUENCY:	5 MHz or 10 MHz standard; 5 MHz to 15 MHz available	5 MHz and 10 MHz	10 MHz standard; 5 MHz to 10 MHz available
FREQUENCY STABILITY:	$\pm 5 \times 10^{-9}$ 0°C to +50°C standard; $\pm 1 \times 10^{-8}$ –20°C to +70°C optional	$\pm 1 \times 10^{-9}$ 0°C to +55°C	$\pm 5 \times 10^{-9}$ 0°C to +50°C standard; $\pm 1 \times 10^{-8}$ –20°C to +60°C optional
AGING:	1×10^{-9}/day standard; 5×10^{-10}/day optional	1×10^{-10}/day after 30 days	1×10^{-9}/day
OUTPUT:	Sine Wave 0 dBm minimum with 50 ohm load standard; Sine Wave up to +7 dBm with 50 ohm load optional TTL or HCMOS optional	Sine Wave +7 dBm with 50 ohm load	Sine Wave 0 dBm minimum with 50 ohm load standard; Sine Wave up to +7 dBm with 50 ohm load optional TTL or HCMOS optional
FREQUENCY ADJUSTMENT:	$\pm 1 \times 10^{-6}$ minimum and settable to $\pm 1 \times 10^{-6}$	$\pm 5 \times 10^{-7}$ by voltage control in the range 0 to 10 Vdc	Mechanical adjustment standard; electrical tuning optional
SINGLE SIDEBAND PHASE NOISE: (Sine Wave)	–155 dB/Hz at 10 kHz; –160 dB/Hz noise floor	–135 dB/Hz at 10kHz; –140 dB/Hz noise floor	–150 dB/Hz at 10 kHz; –160 dB/Hz noise floor
POWER SUPPLY:	+15 Vdc ±5% standard Fixed value between +12 Vdc and +28 Vdc optional 6 watt maximum at turn on; 1.5 watt typical at 25°C Logic output requires +5.0 Vdc ±10%	+24 Vdc 6 watt maximum at turn on	+24 Vdc ±10% standard Fixed value between +12 Vdc and +30 Vdc optional 6 watt maximum at turn on; 3 watt typical at 25°C
MOUNTING:	Standard 0.040" terminals	Four brackets	Octal plug standard; other configurations optional
SIZE: (Maximum Dimensions)	2.275" x 2.275" x 1.045"	4.530" x 2.330" x 2.200"	2.045" x 2.045" x 4.000"

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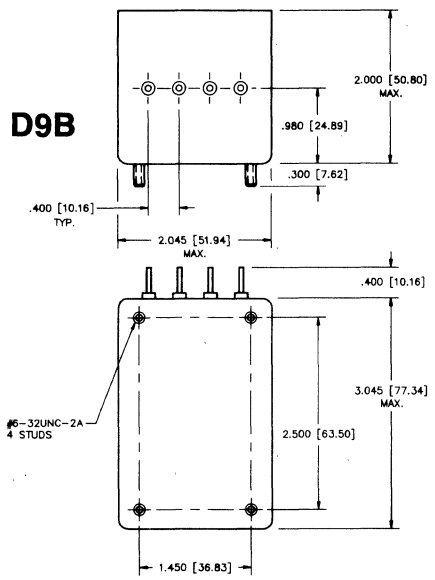
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CRYSTAL OSCILLATORS

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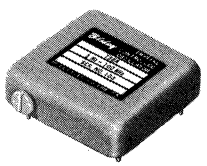
BLILEY TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS are designed to integrate the characteristics of high quality coldweld sealed crystals with temperature compensated circuitry to achieve improved frequency stability without temperature control and low aging to assure long term reliability.

D9B

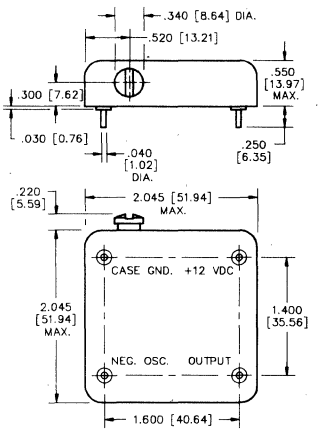


Digitally Compensated (DCXO)

Frequency:	5 MHz or 10 MHz standard; 10 KHz to 20 MHz optional
Frequency Stability:	$\pm 5 \times 10^{-8}$ 0°C to +60°C
Aging:	3×10^{-9}/day standard; 1×10^{-9}/day optional
Output:	High Speed CMOS standard; Sine Wave and TTL optional
Frequency Adjustment:	$\pm 3 \times 10^{-6}$ minimum by multi-turn trimmer
Power Supply:	+15 Vdc ±10%, 30 mA typical Fixed voltage between +12 Vdc and +24 Vdc optional
Mounting:	Four #6-32 Studs
Size:	3″ x 2″ x 2″



T26A



Temperature Compensated (TCXO)

STOCK OSCILLATORS - FAST DELIVERY					
BLILEY TYPE NO.	FREQ. (MHz)	FREQ. STABILITY	SUPPLY (DC) VOLTS	REG.	mA
T26A411	1	$\pm 1 \times 10^{-6}$ OVER 0°C to +50°C	+ 5	± 1%	35 (MAX.)
T26A412			+12	±10%	
T26A413/440*	5/10*		+ 5	± 1%	
T26A414/441*			+12	±10%	

TTL LOGIC OUTPUT: "0": +0.4V MAX., "1": +2.4V MIN.,
Tr & Tf: 12 NS MAX., SYMMETRY: 60/40, LOAD: 10 TTL GATES.
FREQ. ADJUST. RANGE: $\pm 5 \times 10^{-6}$ MIN. AGING RATE: 1×10^{-6}/YR.

CUSTOM OSCILLATORS	BLILEY TYPE T26A SERIES	
FREQUENCY RANGE/ OUTPUT WAVEFORM	FREQUENCY STABILITY vs TEMPERATURE RANGE	
1 MHz - 20 MHz SINE WAVE OR 50 kHz - 20 MHz TTL LOGIC	$\pm 1 \times 10^{-6}$	0°C to +60°C
	$\pm 5 \times 10^{-7}$	
	$\pm 1 \times 10^{-6}$	−20°C to +70°C
	$\pm 5 \times 10^{-7}$	
	$\pm 1 \times 10^{-6}$	−40°C to +70°C
	$\pm 2 \times 10^{-6}$	−55°C to +70°C
	$\pm 1 \times 10^{-7}$	+20°C to +40°C

SUPPLY REQUIREMENTS:
+12 VDC ±10% REG. AGING RATE: 1×10^{-6}/YR.
Options available:
- HCMOS logic output from 1 Hz - 20 MHz
- Sine Wave output to 100 MHz
- TTL logic output to 50 MHz
- Other Supply Voltages

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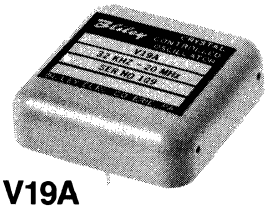
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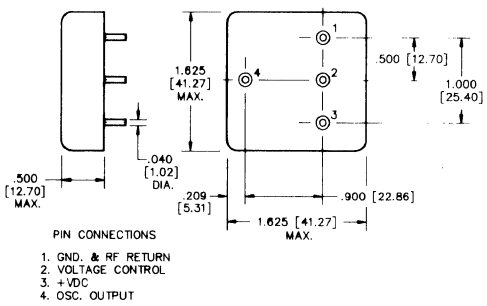
CRYSTAL OSCILLATORS

Voltage Controlled (VCXO)

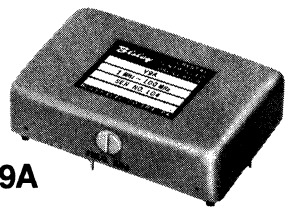
BLILEY VOLTAGE CONTROLLED CRYSTAL OSCILLATORS combine inherent crystal stability and voltage controlled frequency deviation in a single solid state device.



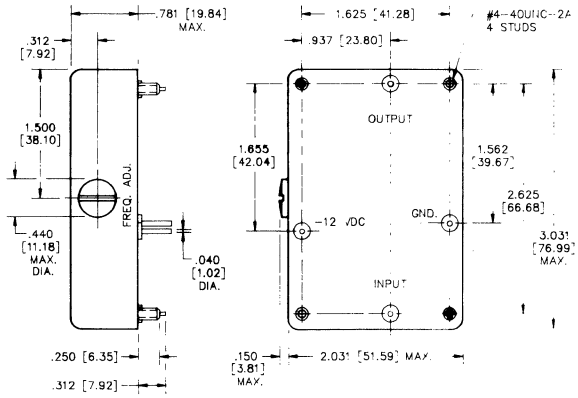
V19A



Frequency Range:	32 kHz to 20 MHz
Frequency Stability:	±.0015%
Operating Temperature Range:	0°C to +70°C
Frequency Deviation:	±.004% minimum
Linearity:	±20% maximum
Modulation Voltage:	+1V to +4V
Transfer Function:	positive
Output:	TTL compatible
Supply Voltage:	+5 Vdc ±5%
Mounting:	PC board mount using 4 terminals
Size:	1.625″ x 1.625″ x .500″ maximum
Options:	High Speed CMOS Output



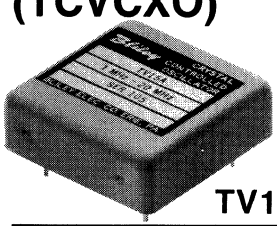
V9A



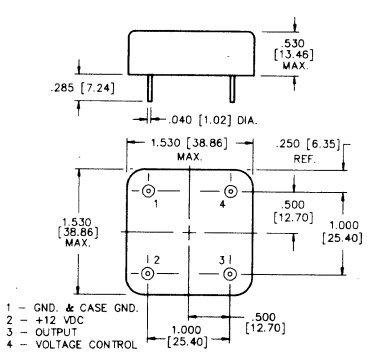
FREQUENCY DEVIATION	FREQUENCY STABILITY	TEMPERATURE RANGE
± .01%	± .001% ± .002%	0°C to +50°C −20°C to +70°C
± .05%	± .002% ± .005%	0°C to +50°C −20°C to +70°C
± 1%	± .004% ± .008%	0°C to +50°C −20°C to +70°C
± 2%	± .005% ± .01%	0°C to +50°C −20°C to +70°C

- Center frequency range from 1 to 100 MHz.
- Standard design parameters are based on operation with − 12 Vdc; 25 mA supply. Other voltages may be specified as a custom option.
- Standard output is Sine Wave, typical 1V rms into 1000 ohms or .25V rms into 50 ohms.
- Mechanical trim is provided for center frequency adjustment.
- Typical modulation voltage is ± 5V with a modulating input impedance of 10K ohms and modulation rate from DC to 20 kHz.
- Linearity: ± 1% to ± 5% dependent upon frequency deviation.

Temperature Compensated Voltage Controlled (TCVCXO)



TV15A



Frequency Range:
1 MHz to 20 MHz
Frequency Stability:
± 1 ppm with voltage control equal to OV; ± 2 ppm at any control voltage
Operating Temperature Range:
0°C TO 60°C
Frequency Deviation:
± 10 ppm minimum; ± 15 ppm maximum
Voltage Control:
± 5V
Transfer Function:
Negative
Linearity:
± 10% maximum
Input Impedance:
10K ohms minimum
Aging:
1 ppm/year typical
Supply Voltage:
+ 12 Vdc ± 10%
Output:
TTL or HCMOS (optional)
Size:
1.53″ x 1.53″ x 0.5″ maximum
Mounting:
PC board mount using four terminals

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CRYSTAL OSCILLATORS

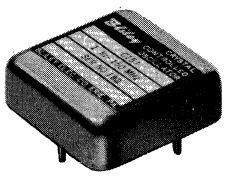
CRYSTAL OSCILLATORS

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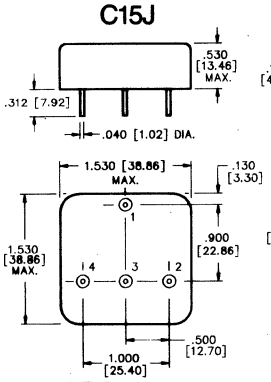
General Purpose-Clock Oscillators

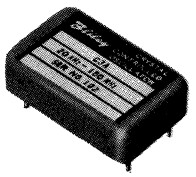
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DESIGNED WITH PRIMARY EMPHASIS ON QUALITY — BACKED UP BY TOP TECHNOLOGY

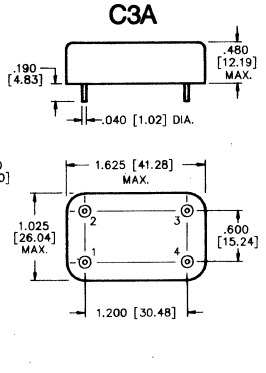


C15J



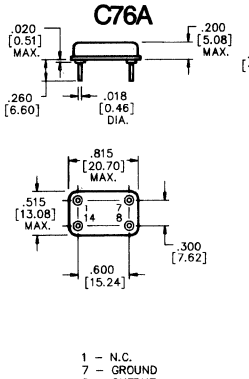


C3A



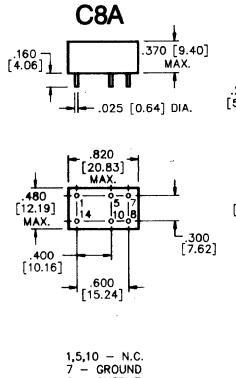


C76A



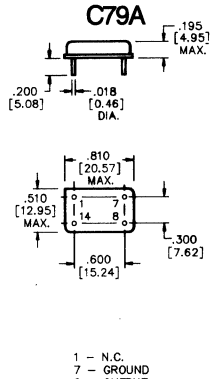


C8A





C79A



BLILEY TYPE	FREQUENCY RANGE	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				OUTPUT
		0 to +50	0 to +70	−20 to +70	−40 to +70	
C15J	1 Hz — 2 MHz	±.001	±.0015	±.002	±.0025	TTL LOGIC
	50 kHz — 70 MHz	±.001	±.0012	±.0015	±.002	
	3 MHz — 150 MHz					SINE WAVE
C3A	20 kHz — 25 MHz	±.001	±.0012	±.0015	±.002	TTL LOGIC
	25 MHz — 50 MHz	±.001	±.0012	±.002	—	
	3 MHz — 100 MHz	±.001	±.0012	±.0015	±.002	SINE WAVE
C76A	1 MHz — 20 MHz	—	±.01	—	—	TTL LOGIC
C8A	4 MHz — 60 MHz	±.004	±.005	±.01	—	
C79A*	1 MHz — 20 MHz	—	±.01	—	—	

*(CASE DESIGN INCORPORATES AN ALL METAL RESISTANCE – WELD HERMETIC SEAL ENCLOSURE.)

GENERAL SPECIFICATIONS

SUPPLY: +5 VDC
OUTPUT: TTL LOGIC "1" +2.4 V MIN., LOGIC "0" +0.4 V MAX.
SYMMETRY: 60/40 DUTY CYCLE WORST CASE
LOAD: 10 TTL GATES
SINE WAVE: 0.7 VRMS (1000 Ω LOAD), 800 kHz – 25 MHz
0.2 VRMS (50 Ω LOAD), 1 – 150 MHz
CUSTOM OPTIONS AVAILABLE: HCMOS LOGIC, COMPLEMENTARY OUTPUTS, DUAL-FREQUENCY OUTPUTS
FREQUENCY ADJUSTMENT: ELECTRICAL OR MECHANICAL AVAILABLE ON C15J AS A CUSTOM OPTION
HERMETIC ENCLOSURES: C15J, C3A AND C79A

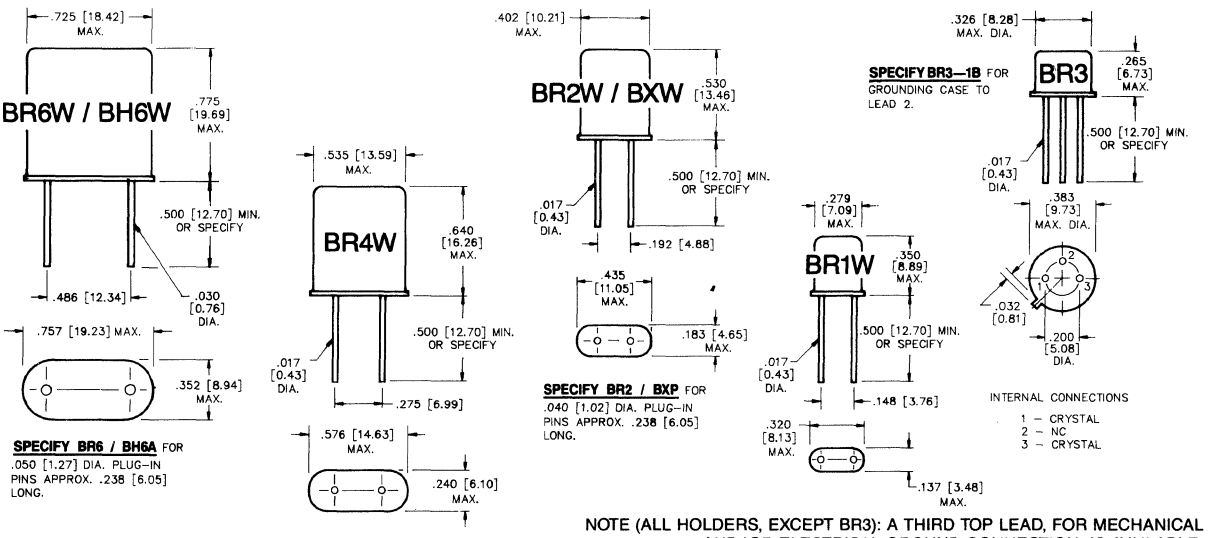
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CRYSTALS

General Purpose and Mil-Spec.

Holder options include Mil-Spec. resistance-weld seal (BR Series) or solder seal (BH & BX Series).



NOTE (ALL HOLDERS, EXCEPT BR3): A THIRD TOP LEAD, FOR MECHANICAL AND/OR ELECTRICAL GROUND CONNECTION, IS AVAILABLE.

BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C)				MAX. SERIES RES. (Ω)	CUT	AGING (PPM)		MAX. DRIVE (mW)
		0 to +50	0 to +75	−40 to +70	−55 to +105			1ST MO.	NEXT 12 MOS.	
BR6/BH6	1-2	±.002	±.0025	±.003	±.005	400	A_f	3	3	5
BR6/BH6 & BR4W	2-3					200				
	3-4					100				
BR6/BH6 BR4W & BR2/BX	4-7					60				
	7-10					30				
	10-20					25				
	20-60					40	A_3			2
BR1W	10-30					25	A_f			5
	30-90					40	A_3			
BR2/BX & BR1W	60-87					60	A_5			2
	87-100					75				
	100-150					90	A_7			
BR3	7-9.9	±.0015	±.002	±.0025	±.003	40	A_f	3	3	0.5
	10-25					25				
	25-75					40	A_3			
	75-125					60	A_5			
	125-150					100	A_7			

ALL FREQUENCY TOLERANCES INCLUDE INITIAL CALIBRATION AT +25°C.
AGING VALUES ARE BASED UPON CONTINUOUS OPERATION AT +85°C AND DRIVE LEVELS AS INDICATED.

BLILEY TYPE	BR6W	BR6	BH6W	BH6A	BR4W	BR2W	BR2	BXW	BXP	BR1W	BR3
MIL-H-10056 HOLDER DESIGNATION	HC-51/U	HC-48/U	HC-33/U	HC-6/U	HC-46/U SIZE	HC-49/U	HC-50/U	HC-18/U	HC-25/U	HC-52/U	HC-35/U SIZE
VIBRATION	10 G FROM 10 TO 2000 Hz										
SHOCK	100 G FOR 11 ms										

INTERNALLY RUGGEDIZED DESIGNS ARE AVAILABLE FOR HIGHER LEVEL SHOCK AND VIBRATION.

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CRYSTALS

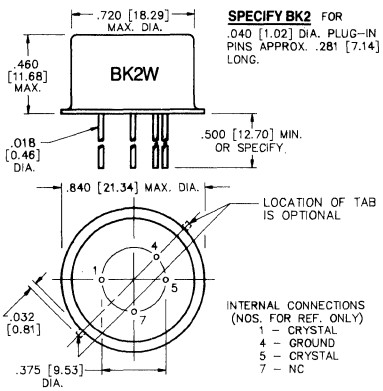
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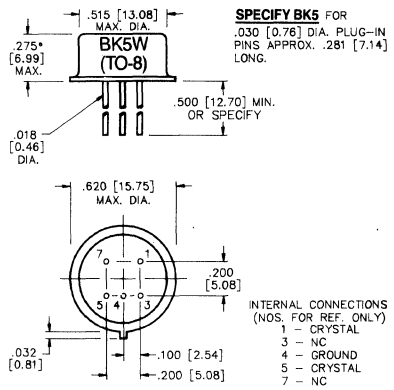
Bliley

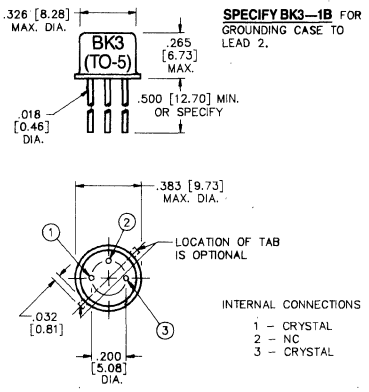
first name in frequency | control

Coldweld Vacuum Sealed Transistor Case Styles

Unmatched performance during extreme shock and vibration combined with superior aging and high reliability have firmly established this style as first choice in advanced military and space systems. Ease of mounting and moderate cost also attract quality commercial usage.







BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT-AT (MODE)	TYPICAL DRIVE LEVEL (mW)
		0 to +50	0 to +70	−40 to +70	−55 to +105			
BK2W	1 – 1.9	±.0015	±.002	±.0025	±.003	150	FUNDAMENTAL	1.0
	2 – 2.9					100		
	3 – 6.0					25		
BK5W	2 – 2.9					250		
	3 – 3.9					120		
	4 – 4.9					60		
	5 – 5.9					30		
	6 – 7.9					22		
	8 – 15					15		
BK3	7 – 9.9					40		0.5
	10 – 25					25		
	25 – 75					40	3RD	
	75 – 125					60	5TH	
	125 – 200					125	7TH	

BLILEY TYPE	BK2W	BK5W	BK3-1B
MIL-H-10056 HOLDER DESIGNATION	HC-40/U	HC-37/U	HC-35/U
AGING GUIDELINES: 1ST MONTH	1 PPM	1 PPM	1 PPM
FOLLOWING YEAR	1 PPM	1.5 PPM	2 PPM
VIBRATION	20G FROM 10 - 2000 Hz		
SHOCK	150G FOR 7 ms		

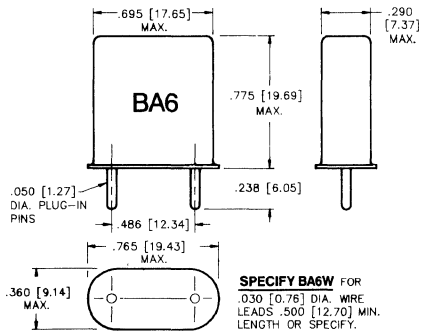
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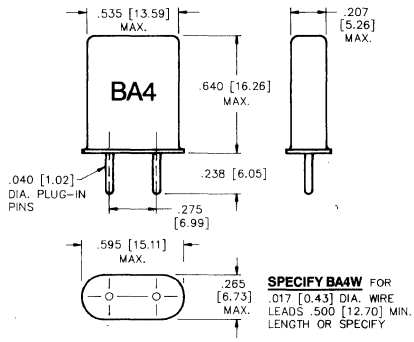
Bliley
first name in frequency control

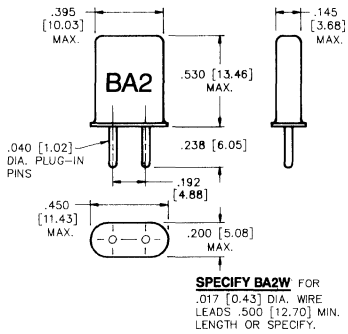
CRYSTALS

Coldweld Vacuum Sealed

Although similar in appearance and configuration to a commonly used solder-sealed counterpart, Bliley's **BA** series features unexcelled process cleanliness and flux-free sealing in vacuum to minimize contamination. Improved aging and reliability result at a modest cost premium. The data following is suggested for general guidance. Superior performance in temperature stability and aging can be provided if required.







BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM)		MAX. DRIVE LEVEL (mW)
		0 to +50	0 to +75	−40 to +70	−55 to +105			1ST MONTH	NEXT 12 MONTHS	
BA6	1-2	±.0015	±.002	±.0025	±.004	350	A_f	2	2	5
BA6 & BA4	2-3					175				
	3-4					75				
BA6, BA4, & BA2	4-7					50				
	7-10					30				
	10-20					25				
	20-60					40	A_3			2
BA2	60-87					50	A_5			1
	87-100					60				
	100-200					125	A_7			

AGING VALUES ARE BASED UPON CONTINUOUS OPERATION AT +85°C AND DRIVE LEVELS AS INDICATED.
A_f, A_3, A_5, A_7 DENOTE AT CUT-FUNDAMENTAL MODE, 3RD OVERTONE MODE, ETC.

BLILEY TYPE	BA6	BA6W	BA4	BA4W	BA2	BA2W
MIL-H-10056 HOLDER DESIGNATION	HC-36/U	HC-47/U	HC-46/U	—	HC-42/U	HC-43/U
VIBRATION	10G FROM 10–2000 Hz					

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CRYSTALS

CRYSTALS

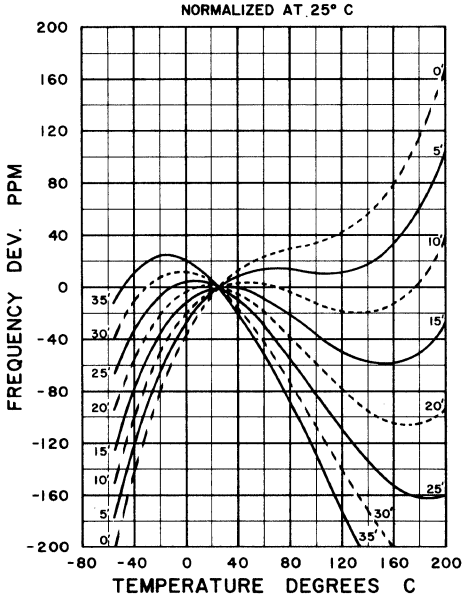
Bliley
first name in frequency | control

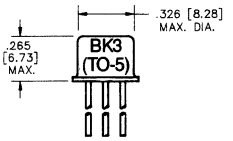
Stress Compensated Double Angle Rotation

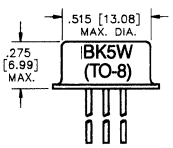
- Improved Frequency Stability During Acceleration and Vibration
- High Drive Capability — Several Times Typical AT Cut Levels
- Low Phase Noise
- Low Aging Rate
- Fast Warm-up

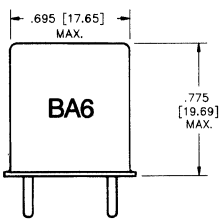
SC CUT

GENERALIZED TEMP./FREQ. CHARACTERISTICS
NORMALIZED AT 25° C









SEE PAGES 8 & 9 FOR COMPLETE DIMENSIONS

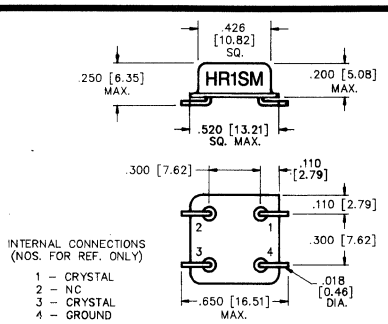
BLILEY TYPE	FREQUENCY RANGE (MHz)	MODE
BK5/BK5W	5–15	FUND.
BK3/BK3-1B	15–33	
BA6/BA6W	5–45	3RD
BK5/BK5W	33–45	
BK3/BK3-1B	45–100	
	75–140	5TH

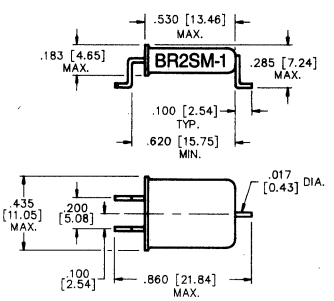
TEMPERATURE RANGE (°C)	FREQUENCY TOL.* (%)
0 to +50	±.0018
−10 to +60	±.0023
−40 to +85	±.0048
−55 to +85	±.006
−55 to +105	±.007
−55 to +125	±.0075
−55 to +200	±.01
+20 to +85	±.0023
+60 to +90	±.001

*INCLUDES STABILITY OVER TEMP. RANGE & CALIBRATION TOLERANCE.

Surface Mount Designs

Bliley SM Style Crystals combine our traditional performance and reliability with the design advantages of surface mounting. Available in "gull wing" lead configuration. Holder style is resistance-weld seal, a volume production process which reduces cost and minimizes contamination.





BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM)		MAX. DRIVE LEVEL (mW)
		0 to +50	0 to +75	−40 to +75	−55 to +105			1ST MONTH	NEXT 12 MONTHS	
HR1SM BR2SM-1	4 - 7	±.002	±.0025	±.003	±.005	60	A_f	3	3	5
	7 - 10					30				
	10 - 20					25				
	20 - 60					40	A_3			2
	60 - 87					60	A_5			
	87 - 100					75				
	100 - 150					90	A_7			

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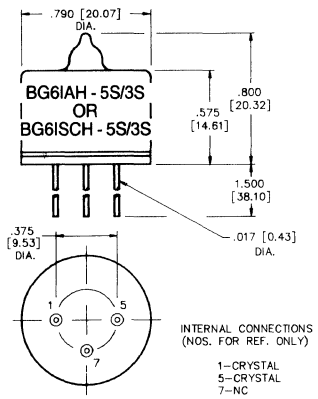
Bliley
first name in frequency control

CRYSTALS

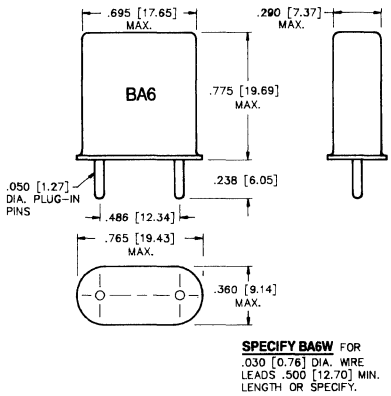
Vacuum Sealed Ultra High Stability

Designed for optimum performance with temperature control

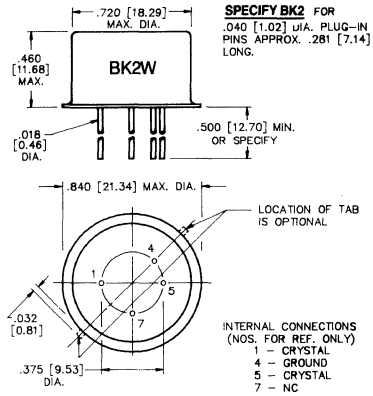
This outstanding group incorporates the technology and craftsmanship that has made Bliley famous for quality without compromise. Exceptionally low aging and high Q characteristics provide precision reference for frequency standards, synthesizers and ultra stable system clocks.



BG6IAH - 5S/3S OR BG6ISCH - 5S/3S
(GLASS ENCLOSURES)



BA6/BA6W



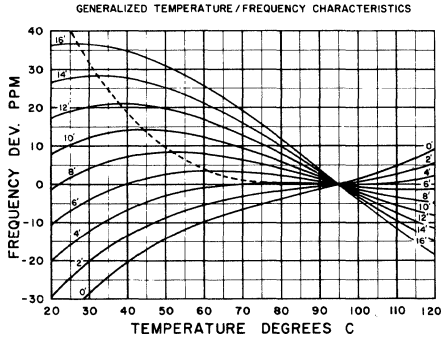
BK2/BK2W

(COLDWELD SEALED METAL ENCLOSURES)

	5TH OVERTONE (AT CUT)	3RD OVERTONE (AT CUT)				
BLILEY TYPE	BG61AH-5S	BG61AH-3S	BA6/BA6W		BK2/BK2W	
FREQ.MHz	5	3.8 – 6.0	3.8 – 7.9	8 – 12	3.8 – 6.0	6.1 – 10.9	11 – 15
AVERAGE Q (10^6)	2.5	1.5		0.6	1.0	0.6	0.4
MAX SERIES RESISTANCE (Ω)	140	50		35	50	40	35
FREQ. TOL. AT TURNING POINT	± 1 PPM	± 4 PPM	± 5 PPM				
TURNING POINT	AVAILABLE AT ANY TEMPERATURE (±5°C) FROM +45°C TO +90°C (TOLERANCE OF ±3°C OR ±4°C AVAILABLE UPON REQUEST)						
TEMPERATURE COEFFICIENT	$< 1 \times 10^{-7}$/°C FOR 1° EACH SIDE OF TURNING POINT						
AGING AT +75°C	5×10^{-10}/DAY AFTER 3 DAYS, 7×10^{-10}/WEEK AFTER 1 MONTH	2×10^{-9}/DAY AFTER 3 DAYS, 2×10^{-9}/WEEK AFTER 1 MONTH	2×10^{-8}/WEEK AFTER 1 WEEK				
DRIVE LEVEL	70µA ± 20%	15µW MAX.	25µW MAX.				
FREQ. CHANGE 50G SHOCK OR 10G VIBRATION	$< \pm 1 \times 10^{-8}$	$< \pm 2 \times 10^{-8}$					
	10 – 200 Hz		10 – 1500 Hz		10 – 2000 Hz		

SC CUT

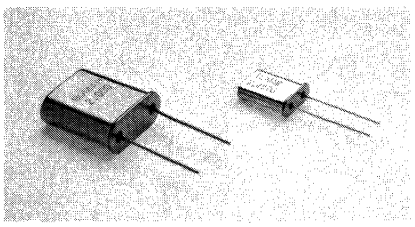
GENERALIZED TEMPERATURE/FREQUENCY CHARACTERISTICS



	STRESS COMPENSATED – DOUBLE ANGLE ROTATION				
	5TH OVERTONE (SC CUT)	3RD OVERTONE (SC CUT)			
BLILEY TYPE	BG61SCH-5S	BG61SCH-3S		BA6/BA6W AND BK2/BK2W	
FREQ. (MHz)	5	5	10	5	10
AVERAGE Q (x 10^6)	2.5	2.2	1.2	2.0	1.0
MAX SERIES RESISTANCE (Ω)	350	110	65	120	70
FREQ.TOL. (PPM) AT TURNING POINT	±0.5	±1.5	±1.5	±1.5	±1.5
TURNING POINT	WITHIN ±7.5°C OF ANY TEMP. IN THE RANGE OF +50°C TO +75°C			WITHIN ±7.5°C OF ANY TEMP. IN THE RANGE OF +30°C TO +75°C	
AGING AT +75°C	7×10^{-10}/WEEK AFTER 1 MO.	2×10^{-9}/WEEK AFTER 1 MO.		2×10^{-8}/WEEK AFTER 1 WEEK	

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Microprocessor Quartz Crystals

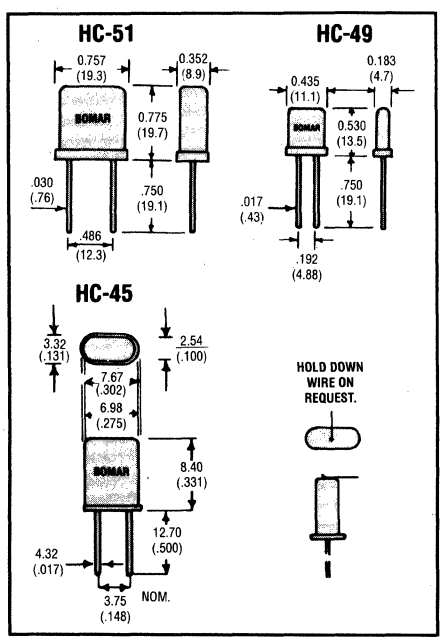


The crystals featured on this table are the standard frequencies most requested within the industry for microprocessor applications. They are finished to the following specifications:

Specifications for Standard Microprocessor Crystals

Frequency Tolerance:
±50ppm @ 25°C
±50ppm -20°C to +70°C
Drive Level: 1 M.W. Max.
Shunt Capacitance: <7 pF
Holder Type: HC-51 or HC-49
Sealing Method: Resistance Weld
Grounding or Hold-Down Leads Available

Typical MP Crystal Holders



FREQUENCY MHZ	BOMAR PART #	HOLDER TYPE	MAX. SERIES RESISTANCE OHMS	LOAD CAPACITY	MODE
1.000000	BR100L	HC51	500	13PF	FUND
1.843200	BR184L	HC51	220	13PF	FUND
1.843200	BR184	HC49	500	13PF	FUND
2.000000	BR200L	HC51	200	20PF	FUND
2.000000	BR200	HC49	400	20PF	FUND
2.097152	BR209	HC49	400	20PF	FUND
2.457600	BR245L	HC51	200	32PF	FUND
2.457600	BR245	HC49	300	32PF	FUND
2.500000	BR250L	HC51	150	20PF	FUND
2.500000	BR250	HC49	275	20PF	FUND
3.000000	BR300L	HC51	80	32PF	FUND
3.000000	BR300	HC49	150	32PF	FUND
3.276800	BR327L	HC51	60	15PF	FUND
3.579545	BR357	HC49	100	18PF	FUND
3.686400	BR368	HC49	100	SERIES	FUND
4.000000	BR400	HC49	75	20PF	FUND
4.194304	BR419	HC49	75	20PF	FUND
4.915200	BR491	HC49	60	SERIES	FUND
5.000000	BR500	HC49	50	20PF	FUND
5.068800	BR506	HC49	50	SERIES	FUND
5.714300	BR571	HC49	50	20PF	FUND
5.760000	BR576	HC49	50	20PF	FUND
5.860000	BR586	HC49	50	32PF	FUND
5.990400	BR599	HC49	50	20PF	FUND
6.000000	BR600	HC49	50	SERIES	FUND
6.144000	BR614	HC49	50	SERIES	FUND
7.372800	BR737	HC49	50	20PF	FUND
8.000000	BR800	HC49	50	SERIES	FUND
9.216000	BR921	HC49	30	SERIES	FUND
10.000000	BR1000	HC49	30	SERIES	FUND
11.000000	BR1100	HC49	30	SERIES	FUND
11.059200	BR1105	HC49	30	SERIES	FUND
11.200000	BR1120	HC49	30	SERIES	FUND
12.000000	BR1200	HC49	30	SERIES	FUND
14.318180	BR1431	HC49	30	SERIES	FUND
14.912000	BR1491	HC49	30	32PF	FUND
15.000000	BR1500	HC49	30	SERIES	FUND
16.000000	BR1600	HC49	30	SERIES	FUND
18.000000	BR1800	HC49	25	SERIES	FUND
18.432000	BR1843	HC49	25	SERIES	FUND
20.000000	BR2000	HC49	20	SERIES	FUND
24.000000	BR2400	HC49	20	SERIES	FUND
25.000000	BR2500	HC49	20	SERIES	FUND

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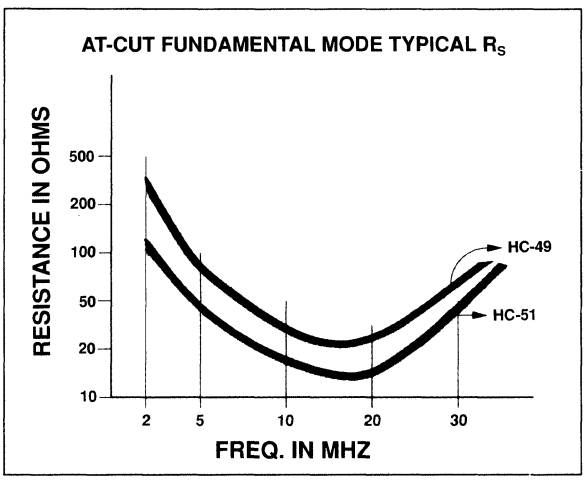
Custom Crystals

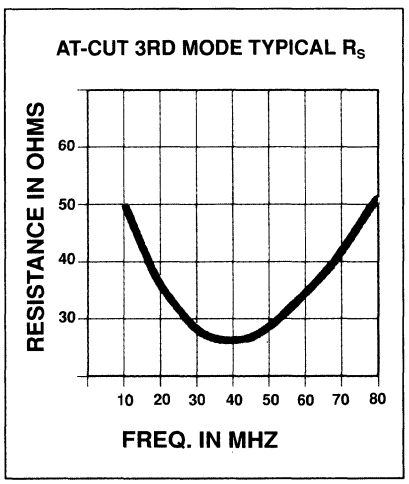
Bomar can provide AT Cut Crystals from 1 MHz to 160 MHz. The AT Cut operates on the fundamental and all odd overtones (3,5,7,9). This cut maintains the lowest of all temperature coefficients; supplies an extremely high Q, plus it offers an economical cost which makes it the standard for most oscillators such as temperature controlled as well as non-controlled types, and in filter applications. The frequency may be multiplied up or down as needed.

Product applications are in mobile, portable and base station communications; radio transceiver filters, modems, satellite frequency converters, and in any field where truly clean, drift-free reception is required.

Bomar features quick turnaround service–available for quantities up to 500 units per frequency. Please call for specific information on this program.

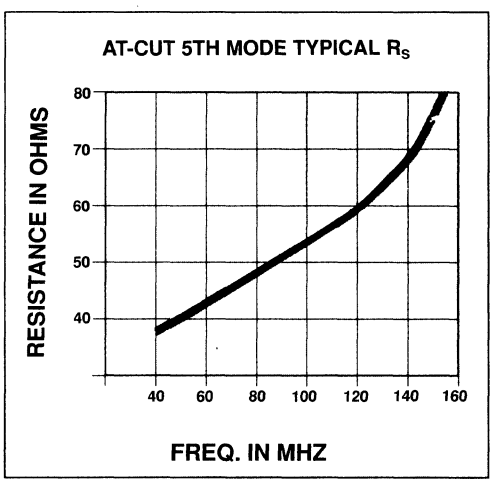
Typical Resistance VS. Frequency Characteristics





Specifications for Custom Crystals

Calibration Tolerance:	±.0025% at 25°C ±.001% at 25°C
Frequency Stability Over Temperature Range:	± .0025% From -20°C To +60°C ± .001% From -20°C To +60°C
Resistance:	See Graphs
Holder Type:	HC-51, HC-49, HC-45
Sealing Method:	Resistance Weld



CALL TOLL FREE

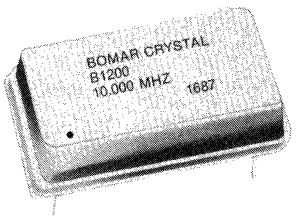
FOR PROMPT QUOTATIONS ON YOUR CRYSTAL REQUIREMENTS :

Toll Free Phone **800-526-3935**

Toll Free Fax **800-777-2197**

BOMAR CRYSTAL COMPANY
201 Blackford Avenue • Middlesex, New Jersey 08846
(908) 356-7787 • PHONE TOLL FREE - 800-526-3935 • FAX TOLL FREE - 800-777-2197

TTL Crystal Clock Oscillators



Features

- 0.800" (L) x .500" (W) x 0.240" (H)*
- Dual In Line Spacing
- TTL Compatible Output
- High Reliability
- Resistance Welded

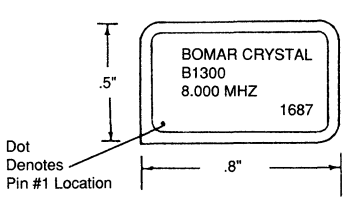
* INCLUDES INSULATED STAND OFFS

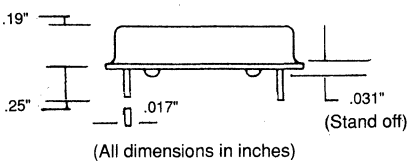
Models

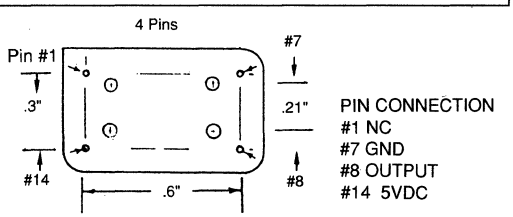
- B1200 (100 ppm)
- B1250 (50 ppm)
- B1225 (25 ppm)

Specifications

Frequency Range	250KHz to 70MHz		
Frequency Stability	±0.01% over operating temperatures and voltage		
Operating Temperature Range	0°C to 70°C		
Storage Temperature Range	-55°C to 125°C		
Input Voltage	+5VDC ±0.5V		
Input Current		Max. at 25°C	Max. over operating Temp.
	250KHz to 3.199MHz	70mA	90mA
	3.200 to 24.999MHz	30mA	40mA
	25.000 to 70.000MHz	50mA	70mA
TTL Output			
Symmetry	60/40% to 40/60% 1.4VDC		
Rise and Fall Times	250KHz to 8.999MHz	15nS max.	
(0.4-2.4V DC Level)	9.000 to 31.999MHz	10nS max.	
	32.000 to 70.000MHz	6nS max.	
"0" Level	+0.4V max. 250KHz to 31.999MHz		
"0" Level	+0.5V max. 32.000 to 70.000MHz		
"1" Level	+2.4V min. 250KHz to 70.000MHz		
"0" Sink Current	16mA min. 250KHz to 20.000MHz (1.6mA/Gate)		
	20mA min., 20.000 to 70.000MHz (2.0mA/Gate)		
"1" Source Current	-0.4mA min. 250KHz to 20.000MHz		
	-0.5mA min. 20.000 to 70.000MHz		
Output Load	1 to 10 TTL Gate		
Environmental Test			
Temperature Cycle	±6ppm max. 0°C. to 120°C. 3 cycles, 2 hours max. each, 25± 2°C. reference		
Humidity	85% relative humidity, 85°C. 250 hours		
Mechanical Test			
Gross Leak Test	At units 100% leak tested in deionized H_2O		
Hermetically Sealed	Leak rate less than $2x10^{-6}$ atom, cc/sec of helium		
Seal Strength	20 lbs. max. force perpendicular to top & bottom		
Bend Test	Will withstand max. bend of 90° reference to base for 2 bends		
Marking Ink	Epoxy heat cured		
Solvent Resistance	Isopropyl-alcohol, trichloroethane		

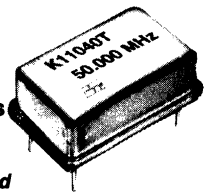






Champion Oscillators

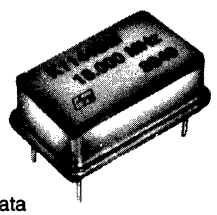
40 to 70 MHz Clock Driver For 32-Bit Microprocessors



- *1.7 ns Rise Time*
- *1.6 ns Fall Time*
- *Tri-State Standard*
- *47.5/52.5% Symmetry*

The K11040T data clock oscillator, designed to drive Motorola MC68030, MC68040 and Intel i486 microprocessors, is TTL compatible (CMOS model available) with 60pF load capability, ±100 ppm stability from 0°C to +70°C.

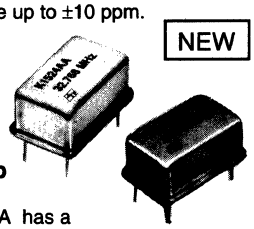
±20 PPM Crystal Clock Oscillator for Telecom Use



For tight stability data clock applications in telecommunications or data communications logic, the K1144BM drives either TTL or CMOS from 1.75 to 35 MHz, has 5 ns max rise and fall times, optional enable/disable. Model K1144AM (35 to 60 MHz) drives up to 5 TTL gates. Tighter stabilities available up to ±10 ppm.

NEW

Voltage Controlled Oscillators For Phase-Locked Loop



Model K1524AA has a frequency range of 3 to 35 MHz, stability ±50 ppm, and features a total deviation of ±300 ppm for applications in which more pullability is required.

Model K1523BA has a frequency range of 2 to 55 MHz, stability ±25 ppm, and deviation ±50 to ±75 ppm per volt. Tighter stabilities, wider deviation, higher frequencies available.

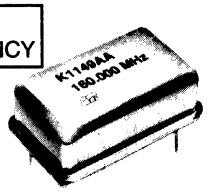
MSO Surface Mount Oscillators



Designed for automated assembly, MSO oscillators measure only 0.560" by 0.360" (14,22 x 9,14 mm). In "C" lead configuration, packaged in anti-static tubes or in 24 mm tape and reel. TTL and CMOS compatible, frequency range 1.5 to 40 MHz. Enable/disable optionally available for both CMOS and TTL.

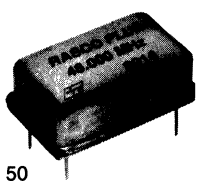
HIGHER FREQUENCY

ECL Compatible Oscillator at 40 - 220 MHz (K1149 Series)



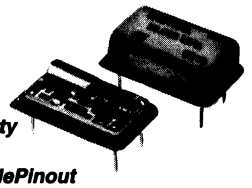
MECL 10KH design for improved rise and fall times, duty cycle, noise margin, and power supply rejection. Open emitter output for user selection of load. Dual complementary outputs, internal pull-downs and various pin-outs available. Frequency range 40 to 220 MHz, stability ±100 ppm. Rise and fall times 1.0 ns typical, 2.0 ns max.

CMOS/TTL To 50 MHz With RASCO® PLUS Oscillators



Available from 1.25 to 50 MHz, drives high speed microprocessors (MC68020, MC68030, 80386, etc.), with ±0.01% stability from 0°C to +70°C. TTL compatible (up to 10 gates) or CMOS compatible (50 pF load). Extended temperature range available. Optional ±0.005% stability, enable/disable. Optional tight symmetry to 50 MHz in TTL, or to 20 MHz in CMOS.

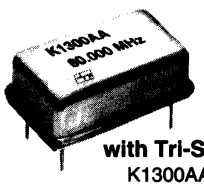
DIP-Size TCXOs



- *Inclusive ±5 ppm Stability*
- *10 - 20 MHz*
- *DIP-CompatiblePinout*

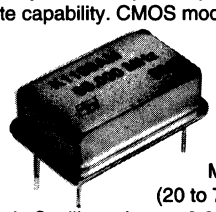
Enclosed in all-metal, welded packages for full hermetic seal, K1519 Series TCXOs feature ±5 ppm stability over a temperature range of -30 to +70°C. Standard frequencies are 10.000, 14.500, 14.512, and 20.000 MHz; others optionally available.

NEW



TTL Clock From 50 MHz To 125 MHz with Tri-State Capability

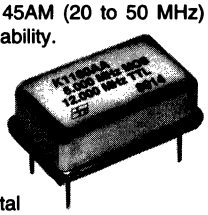
K1300AA TTL Compatible Crystal Clock Oscillator is available from 50 MHz to 125 MHz, has ±0.01% all-inclusive stability, 45/55% symmetry, and features tri-state capability. CMOS model available.



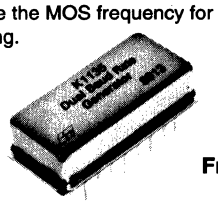
TTL Clock From 20 MHz To 70 MHz

Model K1100AM (20 to 70 MHz) Crystal Clock Oscillator has ±0.01% all-inclusive stability. Model K1145AM (20 to 50 MHz) features ±0.005% stability.

Dual Output Clock For 8-Bit µP's



The K1160AA Crystal Clock Oscillator provides a 2.5 to 10 MHz MOS output to drive Zilog or equivalent microprocessors; it also has a TTL output at twice the MOS frequency for other systems timing.



Baud Rate Generators Operate From +5V DC

K1135 Series generators provide the stable reference frequencies needed by serial interface devices (UARTs, modems, teletype, cassettes, etc). Direct UART/ USRT compatibility, choice of 2x16 output frequencies, full duplex communication. Available with zero error at 19,200 baud.

Champion Oscillators Overview

Product	Freq. Range	Symmetry	Logic	Stability	Options
RASCO PLUS	1.25 - 50 MHz	40/60%	TTL/CMOS	±0.01%	1,2,3,4
K1100AM	20 - 70 MHz	40/60%	TTL	±0.01%	
K1300AA	50 - 125 MHz	45/55%	TTL	±0.01%	1,8
K1144BM	1.75 - 35 MHz	40/60%	TTL/CMOS	±0.002%	1,4
K1144AM	35 - 60 MHz	40/60%	TTL	±0.0025%	1
K1145AM	20 - 50 MHz	40/60%	TTL	±0.005%	
K1149 Series	40 - 220 MHz	40/60%	ECL	±0.01%	1,5,6,7
MSO (Surf. Mnt.)	1.5 - 40 MHz	40/60%	TTL/CMOS	±0.01%	2,4
K1160AA (Dual Output)	2.5 - 10 MHz (2X TTL)	40/60% 40/60%	TTL CMOS	+0, -.02%	
K1523BA VCXO	2 - 55 MHz	40/60%	TTL	±0.0025%	3
K1524AA VCXO	3 - 35 MHz	40/60%	TTL	±0.005%	3
K11040T	40 - 70 MHz	47.5/52.5%	TTL/CMOS	±0.01%	3
K1135 Series	Dual Baud Rate Generator (50 - 19,200 Baud)			±0.01%	
K1519 Series	TCXO, 10 - 20 MHz, Sinewave Output ±0.0005%				

Options: 1. Tighter Stability 2. Tighter Symmetry 3. Extended Temperature Range 4. Enable/Disable 5.Various Pinouts 6. Complementary Output 7. Internal Pull-Downs 8. Tri-State Operation
Note: 0.01% = 100 ppm, 0.005% = 50 ppm, etc.

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2553 N. Edgington Street
Franklin Park, IL 60131
708/451-1000 FAX: 708/451-7585

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CORPORATION

QUARTZ CRYSTAL PRODUCTS

TAKE ANOTHER LOOK AT CCC. WE ARE GETTING EVEN BETTER.

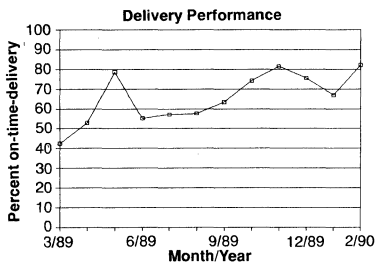
Changes implemented at CCC during the past two years have already begun to pay dividends, and these dividends are passed on to our customers in terms of:

- Higher Quality
- Shorter Lead Times
- More Competitive Pricing
- Unsurpassed Customer Service

Customer returns have been reduced by 22%. Our SPC program has reduced line losses and enhanced product quality, consistency, and reliability.

Our standard lead time has reduced from 10 weeks to 6 weeks.

Most customer inquiries can be responded to the same day, and if not, within one working day.



ON TIME DELIVERY

ON-TIME-DELIVERY has improved from 50% to over 75% and we are continuing to make improvements in an effort to reach our goal of 100% ON-TIME-DELIVERY. Presently 46% of our shipments are to customers with whom we have developed stringent JIT criteria.

QUARTZ CRYSTAL PRODUCTS

Frequency : 1.0 to 250.0 Mhz
Overtone : Fundamental, 3rd, 5th, 7th, and 9th.
Angle of cut: AT, SC, and other doubly rotated cuts with inflection temperatures at any temperature above +25 degree C.
Holders : Glass, Coldweld, Resistance weld, and Solderseal.

SOME AREAS OF SPECIALIZATION

Low aging
Short Term Stability
Low Allen Deviation
Low G (Vibration) Sensitivity
Doubly Rotated Cuts
Minimized activity dips for TCXO applications.

PARAMETER		CCSC-303001	CCSC-303003	CCSC-505010	CCAT-303159	CCAT-505083
Frequency	MHz	5.000	10.000	10.000	10.000	10.000
Cut		SC	SC	SC	AT	AT
Vibration Mode		3rd	3rd	5th	3rd	5th
Holder		HC-27/U	HC-27/U	HC-27/U	HC-27/U	HC-27/U
Load Capacitance	pF	22	22	22	22	22
Co Nominal	pF	3.6	5.2	3.3	5.0	3.6
C_1 Nominal	fF	0.18	.30	.045	1.4	.22
L Nominal	mH	5600	840	5700	185	1100
R Nominal	Ohms	85	55	290	15	60
Q Nominal	(millions)	2.0	1.0	1.3	0.900	1.25
Q Minimum	(millions)	—	—	1.2	—	1.1
*Trimability	(ppm/pF)	0.15	.21	.035	0.7	0.2
Inflection Temperature	°C	+98	+95	+95	+25	+25
Turning Point Range	°C	+30 to +95	+30 to +95	+30 to +95	+60 to +90	+60 to +90
Turning Point Tolerance	°C	±5	±5	±5	±5	±5
Max Slope for LTP from +75°C to Inflection Temperature	($°C^{-1}$)	$\pm 8\times10^{-8}$	$\pm 8\times10^{-8}$	$\pm 8\times10^{-8}$	—	—
Calibration at LTP	(ppm)	±1.5	±1.5	±1.5	±4	±1.5
Max T.C. ±1°C from LTP of +82°C	($°C^{-1}$)	$\pm 4\times10^{-9}$	$\pm 4\times10^{-9}$	$\pm 4\times10^{-9}$	—	—
"C" Mode Inharmonics	(Resistance Ratio)	2:1	2:1	2:1	—	—
"B" Mode (Freq above "C")		10%	10%	10%	—	—
Drive Level (Recommended Maximum)	uW	10	10	10	10	10

*Trimability: $\frac{df}{dC_1}$ | 22pF (ppm/pF)

Telephone: (303) 667-9248 Fax: (303) 667-3500

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WHEN YOU NEED CLOCK OSCILLATORS IN A HURRY THINK OF COMCLOK

- Fast service – 3 weeks or less
- Special frequencies our speciality
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- A quality product

Half Size and Surface Mount also Available

TTL Clock Oscillators

Models:

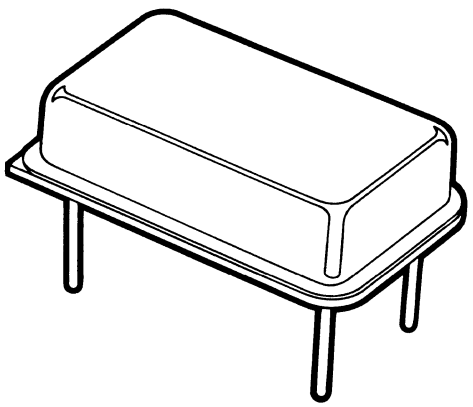
- ❑ CCO 100A (100 ppm)
- ❑ CCO 50A (50 ppm)
- ❑ CCO 25A (25 ppm)

Features:

- ❑ Dual In Line Spacing
- ❑ TTL Compatible Output
- ❑ High Reliability
- ❑ Resistance Welded

Specifications:

- ❑ Frequency Range 250KHz - 70MHZ



HCMOS Clock Oscillators

Models:

- ❑ CCM 100A (100 ppm)
- ❑ CCM 50A (50 ppm)
- ❑ CCM 25A (25 ppm)

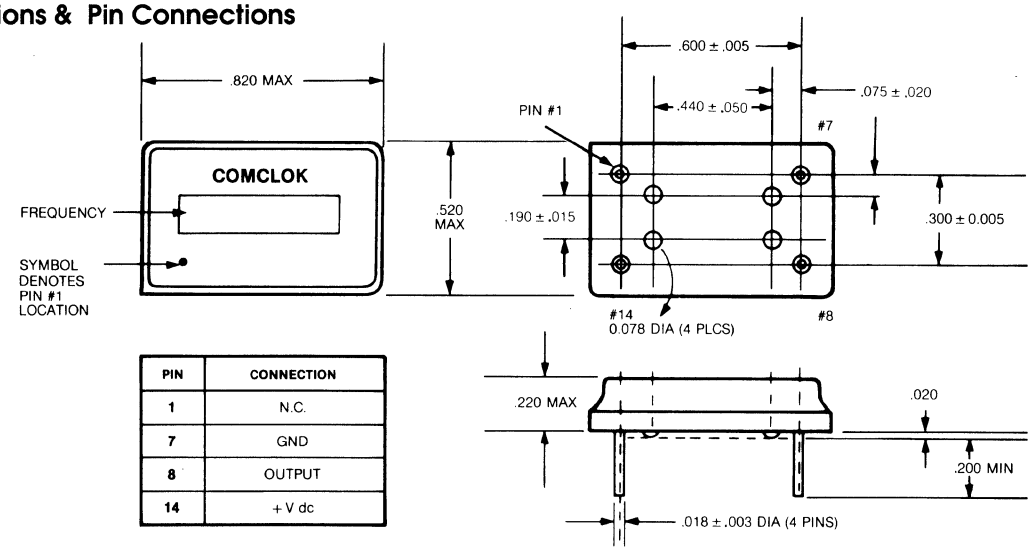
Features:

- ❑ Dual In Line Spacing
- ❑ High Reliability
- ❑ Resistance Welded

Specifications:

- ❑ Frequency Range 3.50MHz - 50MHz

Dimensions & Pin Connections



PIN	CONNECTION
1	N.C.
7	GND
8	OUTPUT
14	+ V dc

Comclok supplies a complete line of clock oscillators for your timing applications. You can be assured of a high quality product, produced with the most modern equipment. The crystal clock oscillators are hermetically sealed by resistance welding, in a pure dry nitrogen filled chamber, after a high temperature vacuum bakeout.

Comclok's very flexible manufacturing operation enables us to provide our customers with superior service. Whether your requirement is for a few pieces on a special frequency for engineering purposes or large volume production quantities, Comclok can meet your needs fast! We have no minimum order size, and our normal delivery time on orders from one unit to one thousand is three weeks. If that's not fast enough, we also offer one week or less emergency service.

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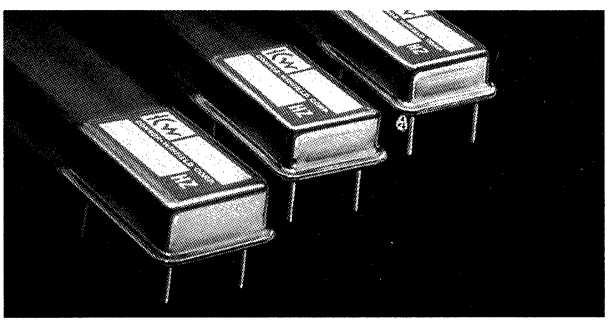
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High Quality Oscillators!

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NEW PRODUCT HIGHLIGHTS FOR 1991/1992. Call for details!

- ➜ Tri-State Gated models in 14-pin package to 140 MHz
- ➜ Tri-State Gated models in 8-pin package to 70 MHz
- ➜ ECL Clock oscillator at 600 MHz in 16-pin DIP (see page ❸)
- ➜ ECL Clock oscillator to 150 MHz in 8-pin DIP (see page ❸)
- ➜ Tight Symmetry models for microprocessor applications (Model MPH53)
- ➜ VCXO models to 90 MHz (see page ❹)
- ➜ Advanced CMOS clocks above 100 MHz in 8-pin DIP (Model A53)

The Best Oscillators For *Fast* Times



Immediate delivery on Hybrid Clock Oscillators at these stock frequencies:

TTL Clocks

Model S15R8 at these frequencies is available for immediate delivery:

1 MHz	1.024 MHz	1.2288 MHz	1.8432 MHz
2 MHz	2.048 MHz	2.4576	3 MHz
3.6864 MHz	4 MHz	4.096 MHz	4.9152 MHz
5 MHz	6 MHz	8 MHz	8.064 MHz
8.192 MHz	10 MHz	11 MHz	11.0592 MHz
12 MHz	12.288 MHz	12.5 MHz	14.31818 MHz
15.36 MHz	16 MHz	16.384 MHz	18.0 MHz
19.968 MHz	20 MHz	24 MHz	25 MHz
25.175 MHz	28.322 MHz	30 MHz	32 MHz
33.333 MHz	40 MHz	44.736 MHz	48 MHz
50 MHz	44.9 MHz	60 MHz	64 MHz
66 MHz	66.666 MHz	70 MHz	80 MHz

HCMOS Clocks

Model HC15R8 at these frequencies is available for immediate delivery:

4 MHz	4.608 MHz	4.9152 MHz	5 MHz
6.176 MHz	6.4 MHz	7.3728 MHz	8 MHz
8.192 MHz	9.5445 MHz	9.8304 MHz	10 MHz
12 MHz	12.355 MHz	14.31818 MHz	16 MHz
16.384 MHz	16.67 MHz	20 MHz	24 MHz
25 MHz	27 MHz	30 MHz	32 MHz
36 MHz	40 MHz	48 MHz	50 MHz

Reduced Size 8-pin HCMOS Clocks

Model S53 at these frequencies is available for immediate delivery:

1.8432 MHz	2.688 MHz	3.024 MHz	3.6864 MHz
4. MHz	4.608 MHz	4.9152 MHz	5 MHz
6 MHz	8 MHz	10 MHz	12 MHz
14.31818 MHz	16 MHz	16.128 MHz	18.432 MHz
20 MHz	20.48 MHz	24 MHz	25 MHz
25.175 MHz	28.322 MHz	30 MHz	32 MHz
33.333 MHz	36.864 MHz	40 MHz	40.96 MHz
48 MHz	50 MHz	60 MHz	64 MHz
65 MHz	66 MHz	66.666 MHz	

Now available to 70 MHz with Tri-state Gating Function, and 140 MHz with Enable / Disable

Hybrid Clock Oscillators

HCMOS General Specifications

Wave Form	HCMOS logic Squarewave
Supply Voltage	5 Vdc ± 10%
Supply Current (@ 25° C)	25 mA max. (typ. 1 Hz to 20 MHz 7mA)
Output Load	CMOS: Capacitance load = 50 pf max.
Output Driving Ability	TTL Equivalent: 2 TTL gates LSTTL Equivalent: 10 LSTTL gates ALS: 20 ALS gates Fast: 6 fast gates S & AS: 2 S & AS gates
Symmetry	50 / 50 ± 10% (typ. 52 / 48%)
Voltage "0" Level	0.5 V max. 10% VDD
Voltage "1" Level	4.5 V min. 90% VDD
Rise / Fall Time	10 nS max. (typ. 6 nS) at CL = 15 pf

14-pin DIP

Model	HC13R8	HC14R8	HC15R8
Frequency Range	4 MHz to 50 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm

Package Outline 3 Pin 1: N/C Pin 7: Case Ground
Pin 8: Output Pin 14: +5 Vdc

Tri-State Gating Models

8-pin DIP*	S51R	S52R	S53R
14-pin DIP**	HC13R8R	HC14R8R	HC15R8R
Frequency Range	1.8432 MHz to 70 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm

*Package Outline 2 Pin 1: N/C Pin 4: Case Ground
Pin 5: Output Pin 8: +5 Vdc
**Package Outline 1 Pin 1: Enable / Disable Pin 7: Case Ground
Pin 8: Output Pin 14: +5 Vdc

Enable / Disable

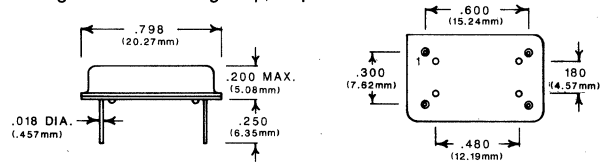
Pin 1: Input	Pin 8: Output
Low Level: .8 V max.	High Impedence (disable)
High Level: 2.2 V min	Active (enable)
Open	Active (enable)

Other Available HCMOS Models

Type Description	Frequency Range	Model	Package Outline
Independent Dual Frequency	1.8432 MHz to 48 MHz	S53DF	1
Tight Symmetry 47.5 / 52.5 max.	1 MHz to 70 MHz	MPH53*	1
Low Frequency, 14-pin	1 Hz to1 KHz	HC15R6	1
Custom Frequency, 14-pin	1 KHz to 50 MHz	HC15R5	1
Custom Frequency, 8-pin	250 Hz to 50 MHz	H53	2
Tight Tolerance, ±10 ppm	50 KHz to 50 MHz	H10C	5

*Also available with Tri-state Gating Function

Package Outline 1: .2" high cap, 14-pin DIP



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Hybrid Clock Oscillators

Frequency Tolerance / Temperature Range Options

Designator:	14-pin models	8-pin* models	Option	
	13	51	± 25 ppm;	0°C to +70°C
	14	52	± 50 ppm;	0°C to +70°C
***Standard* ⟶**	***15***	***53***	***± 100 ppm;***	***0°C to +70°C***
	16	63	± 100 ppm;	-40°C to +85°C
	17	73	± 100 ppm;	-55°C to +125°C

* Also designator for Dual Frequency, High Speed Sinewave, and Advanced CMOS models.

TTL General Specifications

Output Load	1 to 10 TTL gates, Squarewave
Symmetry	50 / 50 ± 10%
Supply Voltage	5 Vdc ± 5%
Supply Current	85 mA max. (30 to 50 mA typ.)
Logic "0" Level	1Hz to 80 MHz +.4V max. 25 MHz to 80 MHz +.5V max.
Logic "1" Level	1 Hz to 80 MHz 2.4V min.
Rise / Fall Time	1 Hz to 8.999 MHz 15 ns 9 MHz to 31.999 MHz 10 ns 32 MHz to 80 MHz 7 ns

TTL 14-pin DIP

Model	**S13R8**	**S14R8**	**S15R8**
Frequency Range	1 MHz to 80 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm

Package Outline 1 Pin 1: N/C Pin 7: Case Ground
Pin 8: Output Pin 14: +5 Vdc

Other Available TTL Models:

Model Description	Frequency Range	**Model**	Package Outline
Low Frequency, 14-pin	1 Hz to 250 KHz	**S15R7**	1
Custom Frequency, 14-pin	250 KHz to 50 MHz	**S15R6**	1
Tight Tolerance, ± 10 ppm	50 Khz to 50 MHz	**S10C**	5

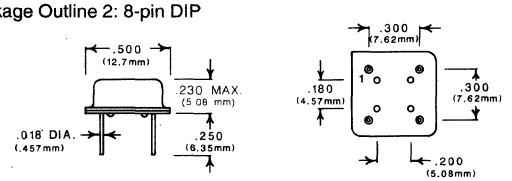
CMOS Low Current 4000 Series

Wave Form	CMOS logic Squarewave
Supply Voltage	+5 Vdc to +15 Vdc inclusive
Output Load	1 Hz to < 4 MHz CL = 40 pf @ +5 to 15 Vdc
Supply Current	3 to 20 mA (3 mA @ 5 Vdc and 20 mA @15 Vdc)
"L" Suffix Option	2 mA max. @ 5 Vdc ; 15 mA max. @ 15 Vdc
Symmetry	1 Hz to 3 MHz 50 / 50 ± 2%

CMOS Models

Model Description	Frequency Range	**Model**	Package Outline
Low Frequency	1 Hz to 200 Hz	**C15R6****	1
High Frequency	201 Hz to 4 MHz	**C15R5****	1
Reduced Size	250 Hz to 4 MHz	**C53**	2

Package Outline 2: 8-pin DIP



High Frequency Clocks

ACMOS Squarewave General Specifications

Output	Advanced CMOS Logic Squarewave
Supply Voltage	+5 Vdc ± 10%
Output Voltage Voh Vol Io	3.7 V min. .44 V max. 24 mA max.
Symmetry	50 / 50 ± 5% (52 / 48 typ.)
Rt / Ft	3nS max. (15 pf load)
Supply Current	20 mA @ 16 MHz ; 100 mA @ 150 MHz

ACMOS Models

14-pin DIP*	**AC51**	**AC52**	**AC53**
8-pin DIP**	**A51**	**A52**	**A53**
Frequency Range	24 MHz to 150 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	±100 ppm

*Package Outline 5 Pin 1: N/C Pin 7: Case Ground
Pin 8: Output Pin 14: +5 Vdc
**Package Outline 2 Pin 1: N/C Pin 4: Case Ground
Pin 5: Output Pin 8: +5 Vdc

Special Function ACMOS Models

Tri-state Gating	**AC51R**	**AC52R**	**AC53R**
Tight Symmetry*	**MPA51**	**MPA52**	**MPA53**
Frequency Range	24 MHz to 150 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	±100 ppm

Package Outline 5 Pin 1: Enable / Disable Pin 8: Output
Pin 7: Case Ground Pin 14: +5 Vdc

*Symmetry better than 2% max. (typ. 1%).
Also available with Tri-state Gating: Add "R" to model number.

HCMOS Ceramic SMD Clock NEW PRODUCT!

Model	**HSM531**	**HSM536**
Frequency Range*	1.8432 MHz to 70 MHz	
Frequency Stability	± 100 ppm ; 0°C to +70°C	
Drive Io	15 pf	50 pf
Symmetry	50 / 50 ± 10%	
Rise / Fall Time	7 nS	
Supply Voltage	+5 Vdc ± 5%	
Supply Current	50 mA max.	70 mA max.

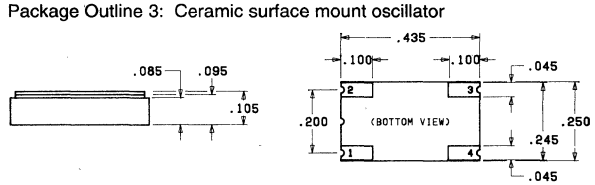
Package Outline 3 Pin 1: Enable / Disable Pin 2: ground
Pin 3: Output Pin 4: Vdd (+5 Vdc)

*Many standard frequencies are available. Please call for details.

Tri-state Gating Function Description

Input Pin	Output Pin
Low Level: .8 V max.	High Impedence (disable)
High Level: 2.2 V min.	Active (enable)
Open	Active (enable)

Package Outline 3: Ceramic surface mount oscillator



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High Frequency Hybrid Oscillators

ECL Squarewave General Specifications

Output	10K ECL	100K ECL
Supply Voltage	-5.2 V	-4.5 V
Output Voh Voltage Vol	-1.04 V min., -.95 V typ., -.85 V max. -1.90 V min., -1.80 V typ., -1.60 V max.	
Symmetry Rt / Ft	50 / 50 ± 10% 2 nS max.	
Supply Current	75 mA max. (55 mA typ.)	

Standard Model	**ECLB-1**	**ECLB-2**	**E15R8**
Frequency Range	10 MHz to 357 MHz		30MHz - 200 MHz
Temperature Range	0°C to +70°C		
Frequency Stability	± 100 ppm		
Output	10K ECL	100K ECL	10K ECL
Supply Voltage	-5.2 V	-4.5 V	-5.2 V

Package Outline 5 Pin 1: Internally Connected Pin 7: Vee (-)
Pin 8: Output Pin 14: Vcc (Case Ground)

Standard Options:
Stability Options
- *A ± 50 ppm Stability over temperature range
- D ± 100 ppm Stability (-40°C to +85°C)
- E ± 25 ppm Stability (0° to +70°C)
- F ± 10 ppm Stability (0°C to +50°C)

Output Options
- *Q Pin 1: Complementary Output
- G Pin 1: Enable / Disable: Enable to Low Level (Vil) Disable to High Level (Vih)

Pin Connect Options
- *P Pin 1: Internally Connected Pin 7: Vee (Case Ground) Pin 8: Output Pin 14: Vcc

*Options available on E15R8 Low Cost model to 170 MHz

ECL 8-pin DIP NEW PRODUCT!

Model	**E531***	
Frequency Range	24 to 150 MHz	
Temperature Range	0°C to +70°C	
Frequency Stability	± 100 ppm	
*Output	-1 10K ECL	-2 100K ECL
Supply Voltage	-5.2 V	-4.5 V

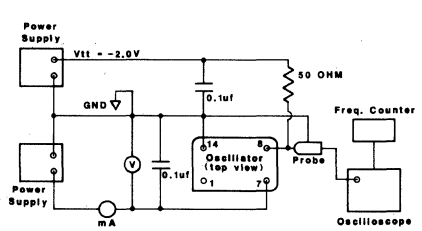
Package Outline 2 Pin 1: Vee Pin 4: Vee (Case ground)
Pin 5: Output Pin 8: Vcc
(Not available with Complementary Output)

High Frequency ECL NEW PRODUCT!

Model	**ED01-353**	**ED02-353**
Frequency Range	200 MHz to 600 MHz	
Temperature Range	0°C to +70°C	
Frequency Stability	± 100 ppm	
Output	10K ECL	100K ECL
Supply Voltage	-5.2 V	-4.5 V

Package Outline 4 Pins 1 and 8: Vee Pin 9: Output
Pin 10: Complementary Output Pin 16: Vcc (Case Ground)

Test Circuit



Sinewave Low Frequency

Model	**DPS1**	**DPS3**	**DPS2**	**DPS4**
Fixed Frequencies	1 KHz to 75 KHz		100 Hz to 100 KHz	
Frequency Tolerance	± .01%	± .005%	± .01%	± .005%
Output, 10K Load T.H.D. ≤ 5%	1 Vrms min. DC coupled		1.5 Vrms min. @ 8 Vdc 3.0 Vrms min. @15 Vdc DC coupled	
Supply Voltage	5 Vdc ± 10%		+8 to +15 Vdc (must specify) ± 10%	
Supply Current	50 mA max.		35 mA max.	

Package Outline 5 Temperature range: 25°C to + 75°C Output wave: Sinewave.
Option: Adding "D" option to end of model number calls out ≤ 1% T.H.D.

High Frequency

Model**	**SW53**
Frequency Range	100 KHz to 60 MHz
Output*	10 dBm
Load*	50 ohm; Output AC coupled
Supply Voltage	5 Vdc ± 10%
Supply Current	50 mA max.; 25 mA typ.

Package Outline 5 Pin 7: Ground Pin 8: Output Pin 14: +5V
Distortion (THD): ≤ 5% *Output voltage dependent upon frequency and fixed load. Consult factory for details.

Very High Frequency

Model	**SW44-1**	**SW44-2**
Fixed Frequency Range	30 MHz to 130 MHz	
Supply Voltage	+5 Vdc ± 5%	+12 Vdc ± 5%
Output	0 dBm into 50 W	10 dBm into 50 W

Frequency Tolerance: .01%. Temperature Range: 0°C to +70°C.
Supply Current: 20 mA max. Package: 14-pin DIP, .44" height, epoxy encapsulated

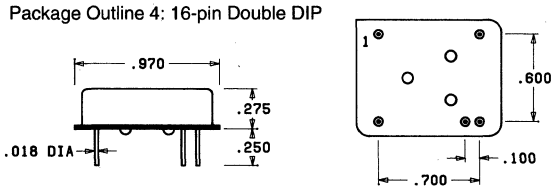
** See page ❷ for frequency tolerance / temperature range options.

High Frequency Sinewave NEW PRODUCT!

Model	**SD01-353**
Frequency Range	24 MHz to 500 MHz
Temperature Range	0°C to +70°C
Frequency Stability	± 100 ppm
Output	Sinewave, AC Coupled
Output Load	50 Ohm
Output Amplitude	0 dBm ± 3 dBm @ 5V, 10 dBm ± 3 dBm @ 12V
Distortion	-25 dBm max., -35 dBm typ.
Supply Voltage	+5 Vdc ± 5%
Supply Current	70 mA max. (30 mA typ.)

Package Outline 4 Pin 1: No Connection Pin 8: Case Ground
Pin 9: Output Pin 10: Omit from drawing
Pin 16: Vcc

Package Outline 4: 16-pin Double DIP



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VCXOs / VCOs

Low Cost DIP VCXO

Model	VC523
Fixed Frequencies	10 MHz to 35 MHz
Stability	± 25 ppm; 0°C to +70°C
Output: Wave Load Rise / Fall Time	Squarewave; 50 / 50 ± 10% 10 TTL 10 ns max.
Deviation	± 100 ppm min; 0 to 5 V to pin 1
Supply Voltage	+5 Vdc ± 5%
Package Outline 5	Pin 1: Control Voltage Input (Fo = 2 to 3 V) Pin 7: Case Ground Pin 8: Output Pin 14: +5 Vdc

REPLACES MOTOROLA K1523 MODELS

High Frequency VCXO NEW PRODUCT!

Model	HV51	HV52	HV53	HV55
Frequency Range	12 MHz to 90 MHz			
Temperature Range	0°C to +70°C			
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm	± 10 ppm
Output	ACMOS Squarewave			
Drive Io Symmetry Rise / Fall Time	AC Series 24 mA 50 / 50 ± 5% (52 / 48 typ.) 6 nS (2 nS typ.)			
Deviation	± 10 ppm to ± 100 ppm (depending upon frequency) .5 V to 5 Vdc (positive transfer function)			
Supply Voltage	+5 Vdc ± 5%			
Supply Current	70 mA max.			
Package Outline 5	Pin 1: Control Voltage Input (Fo = 2 to 3 V) Pin 7: Case Ground Pin 8: Output Pin 14: +5 Vdc			

Reduced Size VCXO 8-pin DIP

Model	V51	V52	V53
Frequency Range	8 MHz to 25 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm
Output	HCMOS Squarewave		
Drive Io Symmetry Rise / Fall Time	4 mA 50 / 50 ± 10% 6 nS (15 pf load)		
Deviation	± 50 ppm max. .5 V to 4.5 Vdc		
Supply Voltage	+5 Vdc ± 5%		
Supply Current	25 mA max., 10 mA typ.		
Package Outline 2	Pin 1: Control Voltage Input (Fo= 2 to 3 V) Pin 4: Case Ground Pin 5: Output Pin 8: +5Vdc		

DIP VCO 14-pin DIP

Model	PL14R1	PL14R2	PL14R3
Fixed Frequencies	100 KHz to 80 MHz (please specify center frequency)		
Frequency Stability 0°C to +70°C	± 1%	± 1%	± 2%
Output: Wave Load Symmetry	TTL Squarewave 10 TTL max. 50 / 50 ± 10%		
Deviation from F (nominal)	± 2% min. ± 3% max.	± 10% min. ± 15% max.	± 20% min. ± 30% max.
Control Voltage	0 V min. to +5 V max. F (nominal) at 2 to 3 V Positive transfer characteristic		
Package Outline 5	Pin 1: Control Voltage Input (Fo = 2 to 3 V) Pin 7: Case Ground Pin 8: Output Pin 14: +5 Vdc		

TCXOs



Call or write for more information on Connor-Winfield's line of DIP TCXOs, VCXOs, and VCOs.

HCMOS TCXO 14-pin DIP

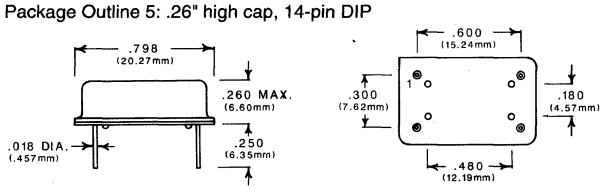
Model	HTV1	HTV2	HTV3	HTV4
Frequency Range	100 KHz to 32.768 MHz			
Temperature Range	+20° to +40°C	0° to +50°C	0° to +70°C	-30° to +70°C
Frequency Stability	± .5 ppm	± 1 ppm	± 2.5 ppm	± 5 ppm
Output	HCMOS Squarewave			
Drive Io Symmetry Rise /Fall Time	4 mA 50 / 50 ± 10% 6 nS			
Frequency Trim Range	±10 ppm min. / .5 V to 4.5 V			
Supply Voltage	± 5 Vdc ± 1%			
Supply Current	25 mA max., 10 mA typ.			
Package Outline 5	Pin 1: Control Voltage Input (Fo = 2 to 3 V) Pin 7: Case Ground Pin 8: Output Pin 14: +5 Vdc			

DIP TCXO ± 5 ppm

Model	H10BV	HV56
Frequency Range	100 KHz to 35 MHz	12 MHz to 75 MHz
Temperature Range	0°C to +70°C	
Frequency Stability	± 5 ppm	
Output	HCMOS Squarewave	
Drive Io Symmetry Rise / Fall Time	4 mA 50 / 50 ± 10% 6 nS	
Frequency Adjust.	± 10 ppm min., .5 Vdc to 4.5 Vdc	
Supply Voltage	+5 Vdc ± 5%	
Supply Current	30 mA max. (20 mA typ.)	
Package Outline 5	Pin 1: Control Voltage Input (Fo = 2 to 3 V) Pin 7: Case Ground Pin 8: Output Pin 14: +5 Vdc	

Engineering Notes on Connor-Winfield's TCXO Series
The above TCXO models require a stable DC voltage on Pin 1. Fo is set at a Pin 1 voltage of 2.5 Vdc nominal. For accurate frequency adjustment, use a potentiometer between Pins 14 and 7 with a wiper to Pin 1.

Package Outline 5: .26" high cap, 14-pin DIP



CTS® CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS

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Engineering Data

IV. MECHANICAL/ENVIRONMENTAL CAPABILITIES

A. MECHANICAL ENCLOSURES—CTS Knights uses flux-free sealing techniques (resistance weld and cold weld) for improved cleanliness, superior hermeticity, and long term reliability. CTS Knights manufactures crystals in 16 standard packages. One half inch hold-down wire (for mechanical support and/or grounding case) are available on the oval packages.

Enclosure vs Frequency (MHz)

ENCLOSURE	FUNDAMENTAL FREQ.							3rd O.T.					5th O.T.			7th O.T.				9th O.T.			
	1.0	1.8	2.4	6.0	10.0	20.0	30.0	10.0	18.0	30.0	60.0	75.0	50	80	130	75	100	150	180	150	175	200	225
HC-48, 51, 36, 47	■	■	■	■	■	■		■	■	■	■												
HC-40	■	■	■	■	■																		
HC-49, 50, 42, 43 R3W-SM, DIP, DIP-SM		■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
HC-37		■	■	■	■	■			■	■	■												
HC-46, K5, R5W, R5		■	■	■	■	■			■	■	■												
HC-35, HC-45 (sim.) R2W-SM				■	■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■

B. ENVIRONMENTAL TESTING—CTS Knights has its own MIL-QPL approved test lab capable of all normal environmental testing. In addition to performing any qualification testing necessary, the Q.C. organization is involved in monitoring key process control points, as well as sampling outgoing product for specification compliance, in compliance with MIL-I-45208 and MIL-Q-9858. Complete environmental testing capabilities per MIL-STD-202 include:

a. Mechanical Shock Method 213
b. High Frequency Vibration Method 204
c. Random Vibration Method 214
d. Moisture Resistance Method 106
e. Salt Spray Method 101
f. Seal Method 112
g. Static and dynamic aging
h. Drive linearly and reduced drive level testing capabilities
i. Complete crystal parameter temperature testing capability (−55°C to +125°C)
j. Insulation Resistance Method 302

Package Outline and Specifications

HC-49 GROUP

RESISTANCE WELD

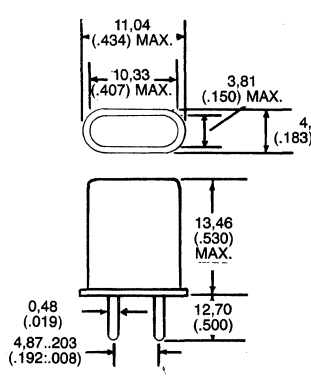


FIG. 8
R3W (HC-49/U)

R3 (HC-50/U)
Leads .238
Dia. .040

COLDWELD

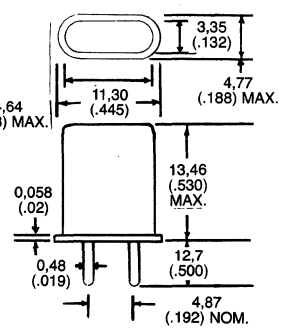


FIG. 9
K3W (HC-43/U)

K3 (HC-42/U)
Leads .238
Dia. .040

HC-48 GROUP

RESISTANCE WELD

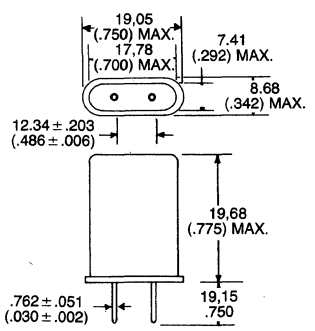


FIG. 10
R17W (HC-51/U)

R17 (HC-48/U)
Leads .238
Dia. .050

COLDWELD

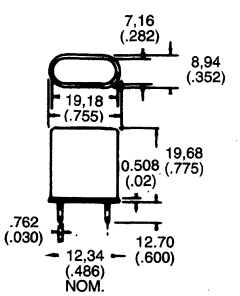


FIG. 11
K17W (HC-47/U)

K17 (HC-36/U)
Leads .238
Dia. .050

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Package Outline and Specifications

SPECIAL PACKAGES

RESISTANCE WELD
R5W

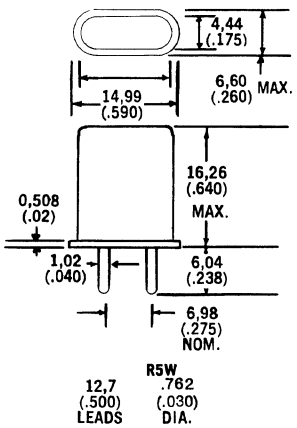


FIG. 12

R-2W (Similar to HC-45/U-2)
RESISTANCE WELD
R-2W

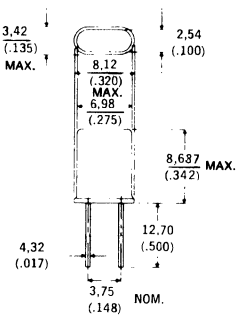


FIG. 13

TOP WIRE

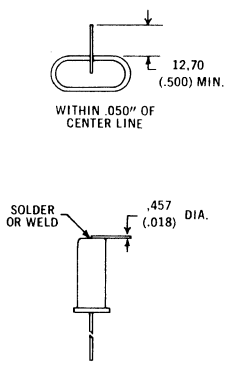


FIG. 14

TO-8 (HC-37/U)

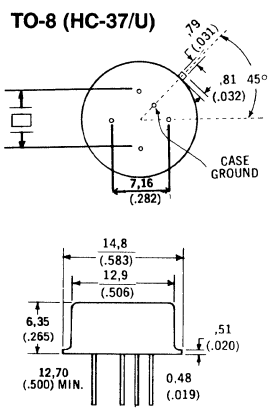


FIG. 15

RESISTANCE WELD
TO5 (HC-35/U)

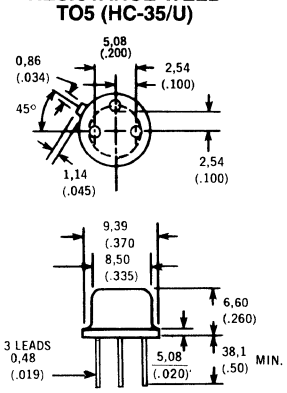


FIG. 16

DIP (.5 x .5)

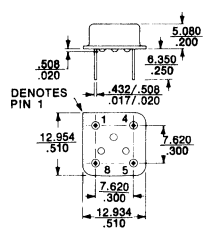


FIG. 17

SURFACE MOUNT PACKAGES

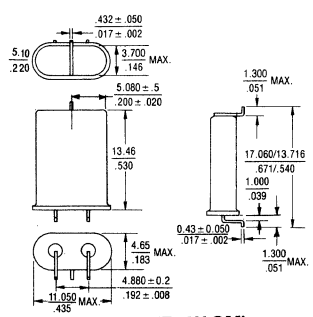


FIG. 18 (R3W-SM)

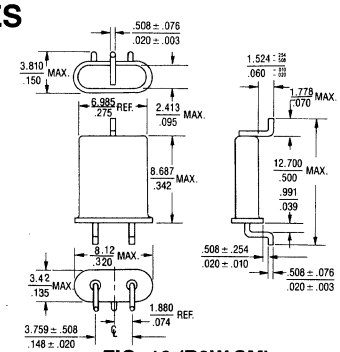


FIG. 19 (R2W-SM)

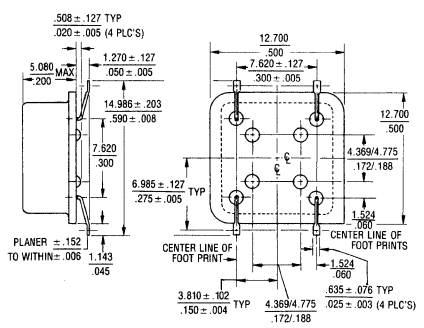


FIG. 20 (DIP-SM)

CTS — QUALITY, FREQUENCY CONTROL COMPONENTS FOR RELIABLE ELECTRONICS

CTS® CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS

FREQUENCY CONTROL DIVISION 400 Reimann Ave., Sandwich, IL 60548 • 815/786-8411 • FAX 815-786-9743

Precision Quartz Crystal Resonators

I. DESCRIPTION

CTS High Stability Precision Resonators are used where specific tight parameter control is required. These crystals are used in communication, instrumentation, and military applications where specialized performance, documentation, or testing demands extra attention. These crystals are either calibrated at room temperature, or at elevated temperature for ovenized oscillator applications. Holder types see Fig. 8 and Fig. 9.

II. ELECTRICAL PERFORMANCE

A. Q-VALUE $\left[\frac{1}{2\pi C_1 f_s R_s}\right]$	Normal	Custom Designs	Optimum Designs
Fund. 1-50 MHz	75K	200K	750K
3rd O.T. 5-30	100K	200K	750K
3rd 30-85	60K	100K	125K
5th, 7th, 9th 50-200	40K	75K	100K

B. FREQUENCY TOLERANCE

Calibration Tolerance	±15 ppm	±5 ppm	±3ppm @ T.P.
Temperature Tolerance (Freq. Dev. from 25°C reading)			
0 +50°C	±6 PPM	±3 PPM	±2 PPM
−40° +85°C	±20 PPM	±15 PPM	±11 PPM
−55° +105°C	±30 PPM	±24 PPM	±20 PPM
T.P. @ 85°C (Ovenized Application)	±5°C	±3°C	±2°C

C. AGING

@ Room Temp.	≤1 PPM/yr	≤½ PPM/yr	—
@ Turning Point (Ovenized Application)	≤1 PPM/yr	≤½ PPM/yr	≤2 x 10^{-7}/yr ≤1 x 10^{-9}/day

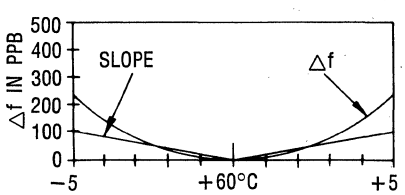
D. INHARMONIC MODES (SPURS)

	6 db (min) (2:1 R ratio)	15 db (min)	30 db (min) (Funds)

III. ENVIRONMENTAL PERFORMANCE (MIL-STD 202F)

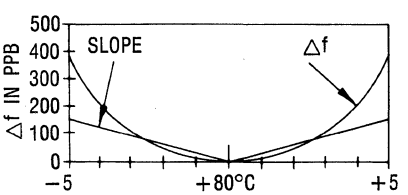
	Typical	Custom Designs	Optimum Designs
Mech. Shock 213B	100g/6 msec	1000g/1 msec	10,000g/5 msec
Vibration 204D	10g; 10-500 Hz	20g; 20-2000 Hz	50g; 20-5000 Hz
Hermeticity (≤ 1 x 10^{-8}cc/sec/atm)	All Designs	All Designs	All Designs

IV. CRYSTAL FREQUENCY STABILITY NEAR TURNING POINT— OVENIZED APPLICATIONS



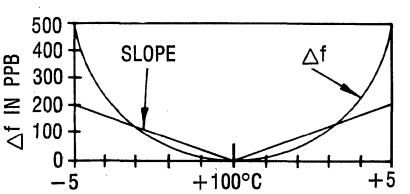
$\frac{\Delta f}{f}$ = (9.6 PPB/°C²) x ΔT^2

SLOPE = (19 PPB/°C) x ΔT



$\frac{\Delta f}{f}$ = (15.6 PPB/°C²) x ΔT^2

SLOPE = (31 PPB/°C) x ΔT



$\frac{\Delta f}{f}$ = (21.6 PPB/°C²) x ΔT^2

SLOPE = (43 PPB/°C) x ΔT

CTS® CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS

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Military Crystals

CTS KNIGHT'S test lab is government approved for qualification testing to military specification MIL-C-3098G, and includes equipment for environmental testing such as humidity, shock, vibration and aging.

Production test equipment conforms to maintenance and periodic re-calibration required by U.S. Government calibration system requirements in MIL-C-45662A.

CTS KNIGHTS is QPL Approved On The Following Military Types:

CR-18A/U (1-5, 10-20 MHz)
CR-19A/U (1-5, 10-20 MHz)
CR-52A/U (19-61 MHz)
CR-54A/U (50-110 MHz)
CR-55A/U
CR-56A/U (50-110 MHz)
CR-58A/U (1-20 MHz)
CR-60A/U
CR-64/U (2.9-20 MHz)
CR-67A/U
CR-72/U
CR-75/U (50-110 MHz)
CR-76A/U (17-61 MHz)
CR-77A/U
CR-78A/U (4.2-20 MHz)
CR-79/U (3.2-20 MHz)
CR-80/U (50-125 MHz)
CR-81/U (17-62 MHz)
CR-82/U (50-110 MHz)
CR-83/U (50-110 MHz)
CR-89/U
CR-97/U
CR-106/U
CR-111/U
CR-114/U
CR-117/U (30-62 MHz)
CR-124/U
CR-128/U
CR-139/U (20 MHz)
CR-140/U
CR-141/U (50-90 MHz)
CR-157/U (1-20 MHz)

MIL-Equivalent Crystals

MIL-C-3098G requires special testing to ensure compliance with the entire specification. Any crystal marked with the "CR" number must receive this testing.

If your required crystal details match those of a mil spec in general parameters, but your commercial application does not demand the exhaustive testing, you can order a mil equivalent crystal. The design will be the same. The crystal **will not** receive the detailed testing. Marking will be standard commercial marking. The "CR" number will not appear on the crystal.

A mil vs commercial cross reference is shown below:

SPEC SHEET MIL-C-3098	MIL TYPE	MIL HOLDER	CTS HOLDER	FREQUENCY RANGE - MHz	VIBRATION MODE	OPERATING TEMPERATURE RANGE (°C)	FREQ. TOL. VS. TEMP. (%)	LOAD CAP. OR SERIES
/3	CR-18A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/4	CR-19A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	Series
/30	CR-52A/U	HC-6/U	R17	15.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/32	CR-54A/U	HC-6/U	R17	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/33	CR-55A/U	HC-18/U	R3W	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/34	CR-56A/U	HC-18/U	R3W	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/36	CR-58A/U	HC-17/U	R17 Mod.	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/38	CR-60A/U	HC-18/U	R3W	5.0-20.0	Fund.	−55 to +105	±.005	Series
/42	CR-64/U	HC-18/U	R3W	2.9-20.0	Fund.	−55 to +105	±.005	30 pf
/45	CR-67A/U	HC-18/U	R3W	17.0-61.0	3rd O.T.	−55 to +105	±.0025	Series
/50	CR-72/U	HC-25/U Mod.	R3 Mod.	17.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/52	CR-75/U	HC-6/U	R17	50.0-125.0	5th O.T.	−55 to +70 −(80 to 90) & +(70 to 80)	±.008	Series
/53	CR-76A/U	HC-18/U	R3W	17.0-61.0	3rd O.T.	−40 to +90 −(55 to 40) & +(90 to 105)	±.002 ±.003	Series
/55	CR-77/U	HC-25/U	R3	17.0-62.0	3rd O.T.			Series
/62	CR-78A/U	HC-25/U	R3	4.2-20.0	Fund.	−55 to +105	±.005	30 pf
/63	CR-79/U	HC-25/U	R3	3.2-20.0	Fund.	−55 to +105	±.005	Series
/57	CR-80/U	HC-18/U	R3W	50-125.0	5th O.T.	−40 to +90 −(55 to 40) & +(90 to 105)	±.002 ±.003	Series
/58	CR-81/U	HC-25/U	R3	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/59	CR-82/U	HC-25/U	R3	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/60	CR-83/U	HC-25/U	R3	50.0-110.0	5th O.T.	−40 to +90 −(55 to 40) & +(90 to 105)	±.002 ±.003	Series
/67	CR-89/U	HC-32/U	R5	2.12-6.2	Fund.	−55 to +90	±.005	30 pf
/72	CR-97/U	HC-18/U	R3W	8.0-10.0	Fund.	−40 to +85	±.005	32 pf
/82	CR-106/U	HC-18/U	R3W	10.5-11.5	Fund.	−55 to +105	±.005	32 pf
/87	CR-111/U	HC-18/U	R3W	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/90	CR-114/U	HC-25/U Mod.	R3 Mod.	2.9-3.85	Fund.	−55 to +105	±.005	32 pf
/93	CR-117/U	HC-25/U	R3	30.0-63.0	3rd O.T.	Ref. 25°C −40 to +65	±.001 ±.0015	Series
/101	CR-124/U	HC-18/U	R3W	2.9-3.8	Fund.	−55 to +100	±.005	32 pf
/108	CR-128/U	HC-18/U	R3W	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/118	CR-139/U	HC-18/U	R3W	20.0-22.0	Fund.	−55 to +105	±.005	30 pf
/119	CR-140/U	HC-6/U	R17	9.5-12.5	Fund.	−55 to +90	±.005	60 pf
/122	CR-141/U	HC-18/U Mod.	R3W Mod.	50.0-90.0	5th O.T.	−30 to +55 −(55 to 30) & +(55 to 65)	±.0025 ±.0045	Series
/137	CR-157/U	HC-33/U	R17W	1.0-20.0	Fund.	−55 to +105	±.005	Series

CTS CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS

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Custom Crystals (CHART A)

Custom CTS Crystals can be ordered in a variety of tolerances in almost any package style to suit every application.

CHART A shows standard part numbers which can be purchased by specifying the Part Number and Frequency. Each of the following options must be specified: Calibration Tolerance, Load Capacity and Holder Style. If you don't see what you need just ask. NOTE: −0 Tolerance not available at all frequencies in all packages.

CHART A

CALIBRATION TOLERANCE (@ 25°C) Temperatures other than 25°C must be specified.	**HOLDER STYLE*** *See Outline Dwgs	**LOAD CAPACITY**
0—±.0005% (±5ppm) 1—±.001% (±10ppm) 2—±.002% (±20ppm) 3—±.003% (±30ppm) 4—±.004% (±40ppm) 5—±.005% (±50ppm) 6—±.01% (±100ppm)	A HC-50 (Fig. #8), R3 B HC-49 (Fig. #8), R3W C HC-48 (Fig. #10), R17 D HC-51 (Fig. #10), R17W E HC-45 (Similar) (Fig. #13) F R3W-SM (Fig. #18) G R2W-SM (Fig. #19) L HC-37 (Fig. #15), RTO-8 M HC-40 (Fig. #12) S HC-32 (Fig. #12), R5W T HC-35 (Fig. 16), RTO-5 H DIP .5×.5 (Fig. #17) J DIP-SM (Fig. #20)	A—20 pF B—32 pF C—Series D—Other (Specify) E—18 pF F—30 pF

FREQUENCY MHz	MAX SERIES RESISTANCE	P/N	CAL. TOL.	HOLDER	LOAD CAPACITY
1.0-1.699 (Fund)	650/300	R1853-			
1.7-2.999 (Fund)	300/150	R1753-			
2.5-2.999 (Fund)	250/210	R1535-			
3.0-3.699 (Fund)	200/130 (HC-49) 130/75 (HC-51)	R1735- R1640-			
3.7-3.999 (Fund)	130/100 (HC-49) 75/60 (HC-51)	R1735- R1640-			
4.0-5.499 (Fund)	100/60 (HC-49) 75/50 (HC-51)	R1635-			
5.5-9.999 (Fund)	60/30 (HC-49) 40/25 (HC-51)	R1635-			
10.0-15.00 (Fund)	30	R1032-			
16.0-25.0 (Fund)	25	R1027-			
17.0-19.999 (3rd O.T.)	60	R3335-			
20.0-56.999 (3rd O.T.)	50	R3032-			
57.0-75.0 (3rd O.T.)	45	R3127-			
50.0-59.999 (5th O.T.)	80	R5132-			
60.0-125.0 (5th O.T.)	80	R5127-			
110.0-200.0 (7th O.T.)	130	R7127-			

Standard Stability: ±.003% of 25°C frequency from −40 to +85°C.

Other stabilities and Temperature Ranges must be specified.

Part Number Example: Specifications 12.0 MHz, ±.002% @ 25°C, HC-49 (R3W), Series P/N, R1032-2BC @ 12.0 MHz.

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CTS Standard Microprocessor Crystals

CTS Knight offers 43 standard microprocessor crystals to use with many of the popular microprocessors on the market. CTS microprocessor crystals feature low start-up resistance. Reliability is assured by use of a MIL-approved Quality Control process. These are solder seal and resistance weld crystals with 0.5" minimum lead lengths.

Microprocessor crystals are available as "off-the-shelf" items from authorized CTS distributors.

Top wires and/or insulating sleeving can be ordered special with minimal cost and leadtime.

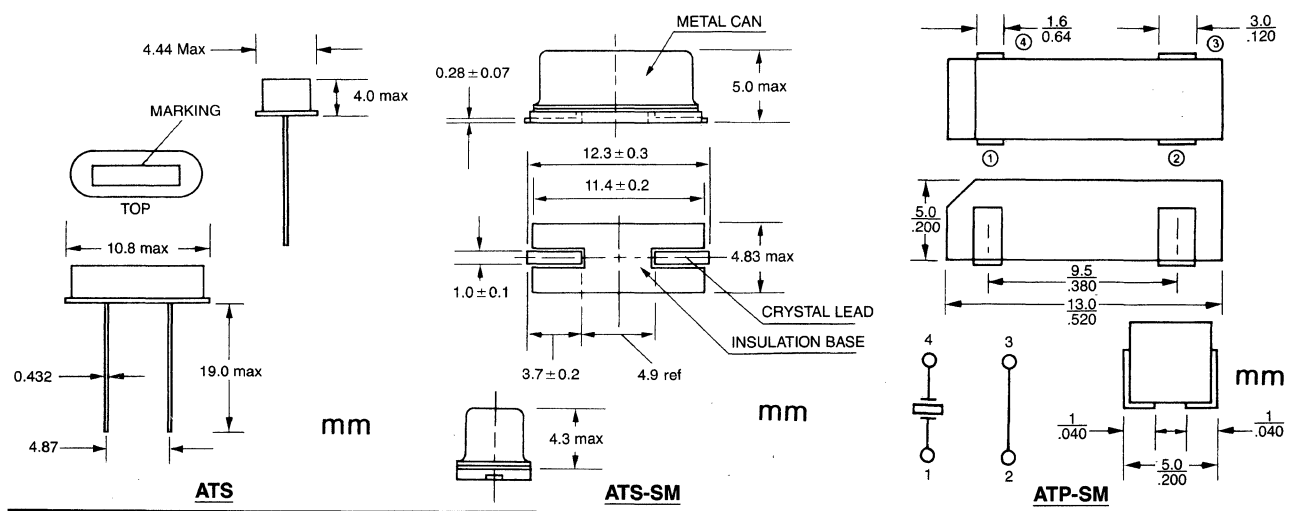
Standard Tolerance is ±.005% at 25°C and ±.005% over 0 to 70°C.

CTS Part Number	Frequency (Megahertz)	Holder	Correlation	Maximum Series Resistance (Ohms)
MP010	1.000000	HC/33-51	13 pf	750
MP018	1.843200	HC/33-51	13 pf	540
MP018S	1.843200	HC/49	13 pf	540
MP020	2.000000	HC/33-51	20 pf	250
MP020S	2.000000	HC/49	20 pf	300
MP024	2.457600	HC/33-51	32 pf	250
MP024S	2.457600	HC/49	32 pf	300
MP030	3.000000	HC/33-51	18 pf	100
MP032	3.276800	HC/33-51	15 pf	100
MP036	3.579545	HC/33-51	18 pf	100
MP036S	3.579545	HC/49	18 pf	150
MP037	3.686400	HC/49	20 pf	150
MP040	4.000000	HC/49	20 pf	75
MP04A	4.000000	HC/49	Series	75
MP041	4.194304	HC/49	12 pf	75
MP042	4.915200	HC/49	20 pf	75
MP05A	5.000000	HC/49	20 pf	50
MP05B	5.000000	HC/49	Series	50
MP050	5.068800	HC/49	Series	50
MP060	6.000000	HC/49	20 pf	50
MP061	6.144000	HC/49	20 pf	50
MP073	7.372800	HC/49	Series	45
MP080	8.000000	HC/49	Series	45
MP080A	8.000000	HC/49	20 pf	45
MP098	9.830400	HC/49	20 pf	45
MP100	10.000000	HC/49	Series	35
MP101	10.000000	HC/49	30 pf	35
MP107	10.738635	HC/49	32 pf	35
MP110	11.000000	HC/49	18 pf	35
MP111	11.059200	HC/49	Series	35
MP120	12.000000	HC/49	Series	35
MP122	12.288000	HC/49	32 pf	35
MP143	14.318180	HC/49	Series	35
MP147	14.745600	HC/49	Series	35
MP150	15.000000	HC/49	Series	35
MP160	16.000000	HC/49	Series	35
MP184	18.432000	HC/49	Series	35
MP196	19.660800	HC/49	Series	35
MP200	20.000000	HC/49	Series	35
MP221	22.118400	HC/49	Series	35
MP240	24.000000	HC/49	Series	35
MP245	24.576000	HC/49	Series	35
MP250	25.000000	HC/49	Series	35

CTS AT-Strip Crystals

CTS Knights offers AT-Strip Crystals at Frequencies Tooled between 3.5M and 40.0MHz for use with microprocessors. The AT Strip Crystals offer improved shock and vibration performance with their reduced size.

AT Strip Crystals are offered in 3 package styles. The "ATS" Package has the same pin spacing as the Std. HC-49 with a lower profile. The "ATS-SM" is the surface mount version of the "ATS" and the "ATP" is a plastic surface mount package. The ATP-SM is available in tape & reel for volume applications. Contact the factory or your local distributor for list of frequencies and specification details.



CTS — QUALITY, FREQUENCY CONTROL COMPONENTS FOR RELIABLE ELECTRONICS

CTS CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS

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Standard Distributor Hybrid Clock Oscillators

Choice of Three Logic Types:
TTL, H-CMOS, ECL
Fully Hermetic

Resistance Weld package, 14 PIN DIP Compatible.

FREQUENCY STABILITY: Inclusive of calibration tolerance @ 25°C, operating temperature range, environmental conditions, input voltage, aging and load change; ±.01%.
Other stabilities available upon request.

OPERATING CONDITIONS:
Supply Voltage: 5.0V ± 10% (EXO-55: −5.2V ±5%)
Operating Temperature: 0 to 70°C
Storage Temperature: −55 to +125°C
Popular frequencies of CTS Hybrid Clock Oscillators are available as "off-the-shelf" items from authorized CTS distributors under the following part numbers:

OUTLINE DRAWING

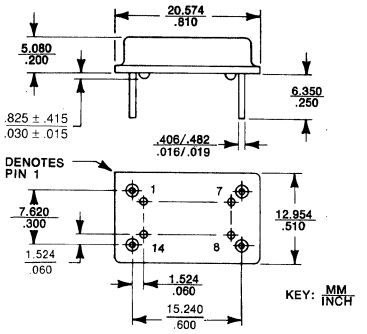


FIG. 9 MXO-55 PACKAGE

MX0-55 SERIES

TTL Logic ±.01% Stability

CTS P/N	FREQUENCY
MX055GB-2C	1.8432 MHz
MX055GB-2C	3.6864 MHz
MX055GB-2C	4.0000 MHz
MX055GA-2C	4.9152 MHz
MX055GA-2C	5.0688 MHz
MX055GA-2C	7.3728 MHz
MX055GA-2C	8.0000 MHz
MX055GA-2C	10.0000 MHz
MX055GA-2C	12.0000 MHz

CTS P/N	FREQUENCY
MX055GA-2C	14.31818 MHz
MX055GA-2C	16.0000 MHz
MX055GA-2C	16.257 MHz
MX055GA-2C	18.432 MHz
MX055GA-2C	19.6608 MHz
MX055GA-2C	20.0000 MHz
MX055GA-2C	24.0000 MHz
MX055GA-2C	32.0000 MHz
MX055GA-2C	40.0000 MHz

CX065 SERIES

HCMOS Logic ±.01% Stability

FREQUENCY	PART NUMBER
4.0000 MHz	CX065GA-2C-4.0 MHz
4.9152 MHz	CX065GA-2C-4.9152 MHz
8.0000 MHz	CX065GA-2C-8.0 MHz
10.0000 MHz	CX065GA-2C-10.0 MHz
12.0000 MHz	CX065GA-2C-12.0 MHz
16.0000 MHz	CX065GA-2C-16.0 MHz
20.0000 MHz	CX065GA-2C-20.0 MHz
24.0000 MHz	CX065GA-2C-24.0 MHz

EX055 SERIES

10KH ECL Logic ±0.01% Stability

FREQUENCY	PART NUMBER
80.0 MHz	EX055GO-2C-80.0 MHz
100.0 MHz	EX055GO-2C-100.0 MHz
110.0 MHz	EX055GO-2C-110.0 MHz
120.0 MHz	EX055GO-2C-120.0 MHz

MX0-55L SERIES

TTL LOGIC, ±.01% STABILITY

CTS P/N	FREQUENCY
MX0-55LGB-2C	2.4576 MHz
MX0-55LGB-2C	3.6864 MHz
MX0-55LGB-2C	4.0000 MHz
MX0-55LGA-2C	4.9152 MHz
MX0-55LGA-2C	5.0688 MHz
MX0-55LGA-2C	6.0000 MHz
MX0-55LGA-2C	6.1440 MHz
MX0-55LGA-2C	7.3728 MHz
MX0-55LGA-2C	8.0000 MHz
MX0-55LGA-2C	10.0000 MHz
MX0-55LGA-2C	11.0592 MHz
MX0-55LGA-2C	12.0000 MHz
MX0-55LGA-2C	14.3181 MHz

CTS P/N	FRQUENCY
MX0-55LGA-2C	16.0000 MHz
MX0-55LGA-2C	16.2570 MHz
MX0-55LGA-2C	18.4320 MHz
MX0-55LGA-2C	19.6608 MHz
MX0-55LGA-2C	20.0000 MHz
MX0-55LGA-2C	24.0000 MHz
MX0-55LGA-2C	25.0000 MHz
MX0-55LGA-2C	25.1750 MHz
MX0-55LGA-2C	28.3220 MHz
MX0-55LGA-2C	32.0000 MHz
MX0-55LGA-2C	40.0000 MHz
MX0-55LGA-2C	48.0000 MHz
MX0-55LGA-2C	64.0000 MHz

See Data Sheets to Follow for Pin Connections and Complete Electrical Specifications.
Consult factory for new frequencies available in HCMOS logic.

CTS® CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS

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CMOS/10 TTL COMPATIBLE CRYSTAL OSCILLATOR

MX045 SERIES

The MX045 is a dual drive CMOS/TTL compatible oscillator contained in a rugged 14-Pin DIP compatible package. This CTS oscillator will drive a 10 TTL load or 50 PF CMOS load. It is the perfect choice for those applications requiring reliable performance at low cost. Standard Frequencies are available from stock at authorized CTS distributors.

- Frequency range 1 MHz to 80 MHz
- Dual drive capability
- Drives up to a 50 PF CMOS/10 std. TTL load
- Fully hermetic resistance weld package
- 14-Pin DIP compatible
- Consult factory for 8 Pin DIP compatible package.

ORDERING INFORMATION

OUTPUT FREQUENCY (MHz)

MX045— [ ] • [ ]

STANDARD MX045 FREQUENCIES			
1.000 MHz	5.0688 MHz	16.000 MHz	32.000 MHz
1.8432 MHz	6.000 MHz	18.432 MHz	40.000 MHz
2.000 MHz	6.144 MHz	19.6608 MHz	50.000 MHz
2.4576 MHz	7.3728 MHz	20.000 MHz	64.000 MHz
3.6864 MHz	8.000 MHz	24.000 MHz	66.6666 MHz
4.000 MHz	10.000 MHz	25.000 MHz	80.000 MHz
4.9152 MHz	12.000 MHz	25.175 MHz	
5.000 MHz	14.31818 MHz	28.322 MHz	
FREQUENCIES AVAILABLE FROM 1 MHz TO 80 MHz			

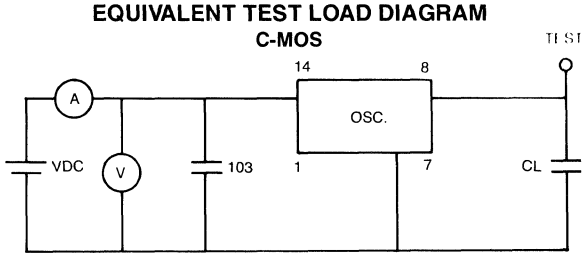
ELECTRICAL CHARACTERISTICS (Over 0° to 70°C Temperature Range)

Frequency Range:	1.000 MHz to 80.000 MHz
Frequency Stability:*	± .01% (100ppm)
Operating Temperature:	0° to +70°C
Storage Temperature:	−55° to +125°C
Supply Voltage:	5.0 VOLTS (DC) ± 10%
Supply Current:	30 mA max. (1-30 MHz) 40 mA max. (30-70 MHz)
Duty Cycle (Symmetry:)	40%/60 @ 1.4 VDC
Rise and Fall Time:	5 nS max. (TTL) 10 nS max. (CMOS)
Output Level:	TTL VOL = +.4V max. VOH = +2.4 min. C-MOS VOL = +.5V max. VOH = Vdd − .5V min.
Output Load:	1 to 10 TTL Gates (C-MOS) 15 PF typical 50 PF max.

*Inclusive of 25°C tolerance, operating temperature range, input voltage change, load change, first year of aging, shock, and vibration.

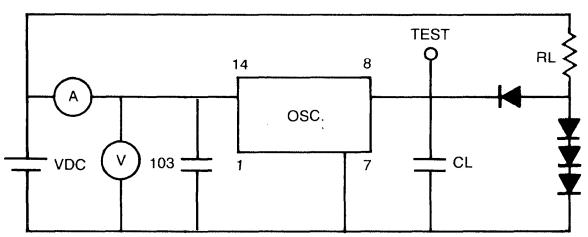
EQUIVALENT TEST LOAD DIAGRAM

C-MOS



CL:15 pF TYP.
(INCLUDING PROBE AND FIXTURE CAPACITANCE)

TTL



Diode : 1S953 or equivalent
RL : 390Ω
CL : 15pF TYP.
(INCLUDING PROBE AND FIXTURE CAPACITANCE)

MECHANICAL SPECIFICATIONS

Vibration: 20 Gs rms, 20 to 2000 Hz
Humidity: 85% relative humidity, 85°C, 250 hrs.
Shock: 1000 G'S, .35 mS, ½ Sinwave, 3 Shocks each plane

Hermeticity: Max leak rate equal to or less than 5×10^{-8} atoms cc/sec
Solderability: 90% coverage, using RMA flux with a solder bath temperature of 245° ± 5°C. Solder composition 63% Sn/37% Pb

Note: MX045 oscillators are tested to an acceptable quality level (AQL) of .65%. Consult factory for tighter AQL requirements.

CTS® CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS

FREQUENCY CONTROL DIVISION 400 Reimann Ave., Sandwich, IL 60548 • 815/786-8411 • FAX 815-786-9743

Hybrid Clock Oscillators

MXO-55L SERIES

True TTL logic outputs
Stocked through authorized distributors
2.4576 MHz to 70 MHz

PIN CONNECTIONS

Pin 1: N/C, enable, or output
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

ORDERING INFORMATION

MXO-55L [ ] [ ] [ ] [ ] • [ ]
OUTPUT FREQUENCY (PIN 8)

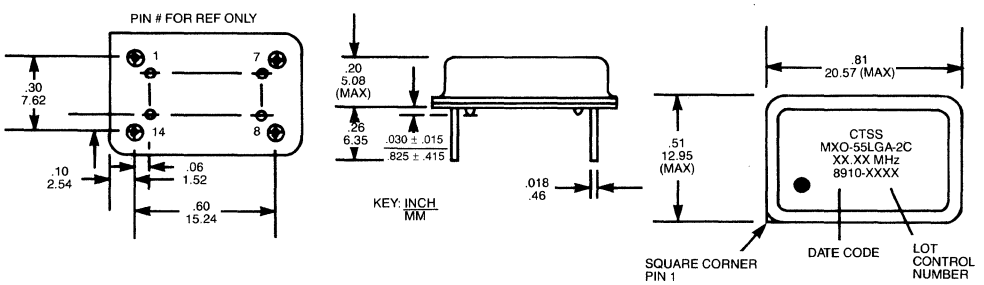
FREQUENCY RANGE	CODE
4.9152 MHz TO 70 MHz BASIC OSCILLATOR (NO ENABLE)	GA
4.9152 MHz TO 70 MHz BASIC OSC WITH ENABLE (NOTE)	GAE
2.4576 MHz to >4.9152 MHz BASIC OSCILLATOR WITH DIVIDERS	GB
4.9152 MHz TO 25 MHz COMPLEMENTARY OUTPUTS	GC

FREQUENCY TOLEARANCE (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
–40 to 85 C REQUIRES ±5% SUPPLY TOL.	I

NOTE: SEE MODEL MX055GAE ON NEXT PAGE FOR ENABLE TRUTH TABLE.
25.0 TO 70.0 MHz WILL BE AVAILABLE 11/91.

MX055L OUTLINE DRAWING



ELECTRICAL CHARACTERISTICS (Over –40 to 85°C Temperature Range)

SPECIFICATION	MODEL	FREQ. RANGE	SYMBOL	MIN.	TYP.	MAX.	UNITS
OPERATING VOLTAGE*	A,B,C	2.4576 to 70 MHz	Vcc	4.50	5.00	5.50	V
MAXIMUM SUPPLY VOLTAGE			Vcc max.			7.00	
SUPPLY CURRENT	A	4.9152 to 25 MHz	Icc		20	35	mA
		>25 to 70 MHz			33	65	
	B	2.4576 to <4.9152 MHz			30	50	
	C	4.9152 to 25 MHz			22	35	
OUTPUT VOLTAGE—HI	A,B,C,	2.4576 to 70 MHz	Voh	2.40	3.60		V
OUTPUT VOLTAGE—LO			Vol		0.30	0.40	
RISE & FALL TIME (MEASURED BETWEEN 0.5V & 2.4V)	A	4.9152 to 25 MHz	t_R & t_F		3	5	nS
		>25 to 70 MHz			2	4	
	B	2.4576 to <4.9152 MHz			3	5	
	C	4.9152 to 25 MHz			3	5	
START-UP TIME	A,B,C,	2.4576 to 11 MHz	t_S		8	15	mS
	A,C,	>11 to 25 MHz			2	5	
	A	>25 to 70 MHz			8	15	
DUTY CYCLE (UPTIME) (MEASURED @ 1.5V)	A	4.9152 to 70 MHz		40	50	60	
	B	2.4576 to <4.9152 MHz		45	50	55	
	C	4.9152 to 25 MHz		40	60	60	
PHASE DELAY (MEASURED @ 1.5V)	C	4.9152 to 25 MHz	$t\delta_1$ & $t\delta_2$		6	10	nS
ENABLE INPUT LOAD FACTOR	AE	4.9152 to 70 MHz	FI			1	
FANOUT (PER OUTPUT)	A,B,C	2.4576 to 25.0 MHz	F_O			10	TTL GATES
		>25.0 MHz				5	

***NOTE:** SUPPLY VOLTAGE TOLERANCE OF ±10% APPLIES FOR 0 TO 70 TEMP RANGE ONLY. FOR –40 TO +85 C TEMP RANGE SUPPLY VOLTAGE TOLERANCE IS ±5%.

MECHANICAL SPECIFICATIONS

Case
Metal, hermetically sealed

Leads
Kovar, nickel plated with solder coating

Sealing
Resistance welding method gross leak test

Fine Leak Test
Mass spectrometer leak rate less than 5×10^{-8} atmosphere-cc/sec of helium

Solderability
95% solder coverage, using RMA flux at 245°C ±5°C temp solder bath 63 Sn/37 Pb

Temperature
Operating: 0 to 70°C
Storage: –55 to 125°C

Vibration
20 Gs rms, 20 to 2000 Hz

Mechanical Shock
1000G, 0.5ms pulse (3 shocks/plane)

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Hybrid Clock Oscillators

MXO-55 SERIES

True TTL logic outputs
14 pin DIP compatible
19.2 KHz to 100 MHz

PIN CONNECTIONS

Pin 1: N/C, enable, or output
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

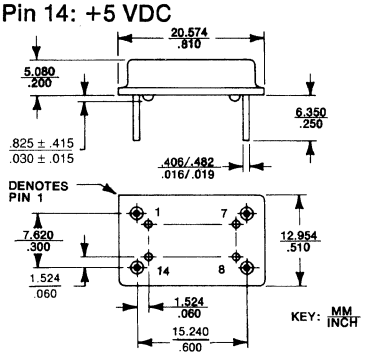


FIG. 10 MXO-55 PACKAGE

ORDERING INFORMATION

MXO-55 [ ] [ ] [ ] [ ] • [ ] SEE NOTE 1
OUTPUT FREQUENCY (PIN 8)

FREQUENCY, MODEL & OPTIONS	CODE
4.9152 MHz to 100 MHz Basic oscillator No enable	GA
4.9152 MHz to 70 MHz Basic oscillator with enable & pull-up (NOTE 3, 5)	GAU
19.2 KHz to 4.9151 MHz Basic oscillator w/dividers	GB
307.2 KHz to 4.9151 MHz Divider output with enable & pull-up	GBU
2.4576 MHz to 25 MHz Complementary outputs	GC
Dual outputs Pin 8: 307.2 KHz to 1.25 MHz Pin 1: 16X Pin 8	GD16
Dual outputs Pin 8: 614 KHz to 2.5 MHz Pin 1: 8X Pin 8	GD18
Dual outputs Pin 8: 1.228 MHz to 5 MHz Pin 1: 4X Pin 8	GD28
Dual outputs Pin 8: 2.457 MHz to 10 MHz Pin 1: 2X Pin 8	GD48

FREQUENCY TOLERANCE (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

NOTE:

1. When ordering screening similar to MIL-O-55310, Class B, add -MLB after frequency.
2. Tolerances includes 25°C accuracy, changes in operating temperature, supply voltage, load, environmental conditions, and first year aging.
3. ENABLE FUNCTION (50 nsec max response time)
   HI or Floating: Enables Oscillators
   LO: Disables oscillator (output latches HI)
4. On frequencies below 307.2 KHz the crystal frequency will be on Pin 1.
5. See MX053 Series for TRISTATE Output option.
6. Short Circuit Output current = 100ma max and 5 minutes max duration at RMT.
7. 45/55 symmetry available for frequencies above 25 MHz. Consult factory.

ELECTRICAL SPECIFICATIONS (MXO-55 SERIES)

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B, C, D	19.2 KHz to 100 MHz	−55°C to +125°C	V_{CC}	4.75	5.00	5.25	V
			−40°C to +85°C		4.50	5.00	5.50	
Maximum Supply Voltage			−55°C to +125°C	V_{CC} Max.			7.00	
Supply Current	A	4.9152 to 25 MHz	−55°C to +125°C	I_{CC}		20	35	ma
		>25 to <70 MHz				33	65	
		70 to 100 MHz				60	110	
	B	2.4576 to <4.9152 MHz				30	50	
		307.2 KHz to <2.4576 MHz				45	75	
		19.2 to <307.2 KHz				70	125	
	C	>12 to 25 MHz			15	22	75	
		2.4576 to 12 MHz				30	50	
	D	307.2 KHz to 10 MHz				45	75	
Output Voltage — HI	A, B, C, D	19.2 KHz to 100 MHz	−55°C to +125°C	V_{OH}	2.40	3.60		V
Output Voltage — LO				V_{OL}		0.30	0.50	
			−40°C to +85°C			0.25	0.40	
Rise & Fall Time (measured between 0.5V & 2.4V) (Note 7)	A	4.9152 to 25 MHz	−55°C to +125°C	t_R & t_F		3	5	nS
		>25 to 100 MHz				2	4	
	B	2.4576 to <4.9152 MHz				3	5	
		19.2 KHz to <2.4576 MHz				8	18	
	C	2.4576 to 25 MHz				3	5	
	D	307.2 KHz to 10 MHz				8	18	
Start-up Time	A, B, C, D	19.2 KHz to 25 MHz	−55°C to +125°C	t_S		2	5	mS
	A	>25 to 100 MHz				8	15	
Duty Cycle (uptime) (measured @ 1.5V) See Note 7	A	4.9152 to 25 MHz	0°C to +70°C		45	50	55	%
			−55°C to +125°C		40	50	60	
		>25 to 100 MHz			35	50	65	
	B	2.4576 to <4.9152 MHz	−55°C to +125°C		45	50	55	
		19.2 KHz to <2.4576 MHz			45	50	55	
			0°C to +70°C		45	50	55	
	C	2.4576 to 12 MHz	−55°C to +125°C		45	50	55	
		>12 MHz to 25 MHz			35	50	65	
			0°C to +70°C		40	50	60	
	D	307.2 KHz to 10 MHz	−55°C to +125°C		40	50	60	
			0°C to +70°C		45	50	55	
Phase Delay (measured @ 1.5V)	C	>12 to 25 MHz	0°C to +70°C	$t\delta_1$ & $t\delta_2$		6	10	nS
			−55°C to +125°C			6	12	
		2.4576 to 12 MHz	0°C to +70°C			3	5	
			−55°C to +125°C			3	8	
Enable Input Load Factor	AE, BE	4.9152 to 70 MHz	−50°C to +125°C	F_1			2	
Fanout (per output)	A, B, C	2.4576 to 70 MHz	−55°C to +125°C	F_0			10	S-TTL Gates
		>70 MHz to 100 MHz					2	
			−40°C to +85°C				5	
	B	19.2 KHz to <2.4576 MHz	−55°C to +125°C				10	TTL Gates
	D	307.2 KHz to 10 MHz	−55°C to +125°C				10	

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JKTO-79 SERIES

True TTL logic outputs
"A" MODELS are electrically similar to MXO55GA Models
"B" MODELS are electrically similar to MXO55GB Models from 307.2 KHZ to <2.4576 MHZ
TO-8 compatible
500 KHz to 70 MHz

ENABLE FUNCTION

4 MHz to 12 MHz:
HI: Enables oscillator
LO: Disables oscillator (Q_A latches LO, Q_B latches HI)
500 KHz to <4 MHz:
LO: Enables oscillator
HI: Disables oscillator (Q_A & Q_B latch LO)

CE MODEL
Enable and latch as above *except* from 12.01 to 25.0 MHZ
HI: Enables oscillator
LO: Disables oscillator
Q_A latches HI
Q_B latches LO

ORDERING INFORMATION

JKTO-79 [ ] – [ ] [ ] – [ ] • [ ]
OUTPUT FREQUENCY

FREQUENCY AND MODEL AND OPTION	CODE
7.0 MHz to 70.0 MHz Basic oscillator No enable	A
500 KHz to 7.0 MHz Oscillator with divider No enable	B
3.5 MHz to 25 MHz Oscillator with Complementary output – No enable	C
Oscillator with dual outputs and no enable Q_A = 4X Q_B Q_B = 1 to 3 MHz	D28
Oscillator with dual outputs and no enable Q_A = 2X Q_B Q_B = 1 to 3 MHz	D48
Any of above (below 12 MHz) with enable For CE MODEL see note at left	AE BE D28E D48E
3.5 MHz to 25 MHz	CE

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

NOTE 2:
Tolerance includes 25°C accuracy, changes in operating temperature, supply voltage, load, environmental conditions, and aging.

PIN	CONNECTION
1	Enable/disable option (otherwise NC)
2	Internal connection
3	Output A (Q_A) (For D option only)
4	Ground
5	Output B (Q_B)
6	Internal connection
7	NC (Model A) Internal connection (Model B, C, D) Crystal frequency (Model C, D)
8	V_{CC}

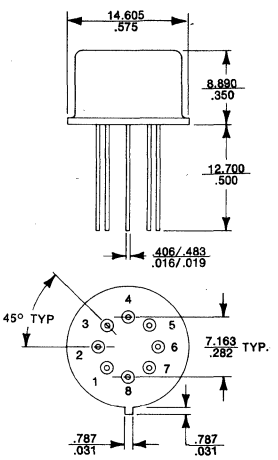


FIG. 11 TO-8 PACKAGE

NOTE: Screening Similar to MIL-0-55310, Class B Available by Adding -MLB to the End of the P/N.

JKTO-81 SERIES

True TTL logic outputs
"A" MODELS are electronically similar to MXO55GA Models
"B" MODELS are electrically similar to MXO55GB Models from 307.2 KHZ to <2.4576 MHZ
TO-5 compatible
1 MHz to 25 MHz

PIN CONNECTION

Pin 1: N/C
Pin 2: Internal connection
Pin 3: N/C
Pin 4: Ground/case
Pin 5: Output
Pin 6: Internal connection
Pin 7: N/C
Pin 8: +5 VDC

ORDERING INFORMATION

JKTO-81 [ ] – [ ] [ ] – [ ] • [ ]
OUTPUT FREQUENCY

FREQUENCY AND MODEL AND OPTION	CODE
12 to 25MHz Basic oscillator	A
1 to <12 MHz Basic oscillator with dividers	B

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I

See NOTE 2 above.

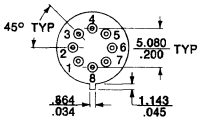
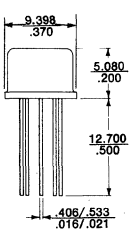


FIG. 12 TO-5 PACKAGE



NOTE: Screening Similar to MIL-0-55310, Class B Available by Adding -MLB to the End of the P/N.

CTS® CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS

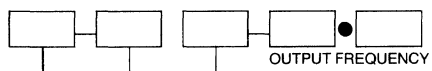
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C-MOS Compatible Clock Oscillators

CXO HG SERIES

Allows Choice of Standard, Enable or 3-State Output Options
Able to Drive CMos OR TTL Loads
14 Pin DIP or 8 Pin DIP Compatible
50 KHz to 41.5 MHz
(Higher frequencies to be released 3rd Qtr 1991, consult factory for details)

ORDERING INFORMATION



PACKAGE TYPE / OPTION	MODEL
14 Pin DIP / STD OUTPUT	CXO-65HG
14 Pin DIP / STD OUTPUT W/ ENABLE	CXO-65HGE
14 Pin DIP / TRISTATE OUTPUT	CXO-63HG
8 Pin DIP / STD OUTPUT	CXO-25HG
8 Pin DIP / STD OUTPUT W/ ENABLE	CXO-25HGE
8 Pin DIP / TRISTATE OUTPUT	CXO-23HG

FREQUENCY TOL. (NOTE 2)	CODE
± .1% (1000 ppm)	1
± .01% (100 ppm)	2
± .005% (50 ppm)	3
± .05% (500 ppm)	4
± .0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I

TRISTATE / ENABLE TRUTH TABLE:

CONTROL INPUT	OUTPUT
OPEN or HIGH	OSC. OUTPUT
LOW	HIGH Z or LOGIC 1

NOTE: SEE PAGE 18 FOR 14 PIN PACKAGE OUTLINE DRAWING
SEE PAGE 24 FOR 8 PIN PACKAGE OUTLINE DRAWING

ELECTRICAL SPECIFICATIONS (−40 to +85°C)

SPECIFICATION	UNITS	SYMBOL	MODEL	FREQUENCY RANGE	MINIMUM	TYPICAL	MAXIMUM	CONDITION*
Operating Voltage	V	Vcc	HG	50.0 KHz to 41.5 MHz	4.5	5	5.5	
Max Oper. Voltage	V	Vcc max	HG	50.0 KHz to 41.5 MHz			7	
Supply Current	mA mA/MHz	Icc	HG HG	50.0 KHz to 10.0 MHz >10.0 to 41.5 MHz		24 2 1.8	30 2.4 2.0	CMOS or TTL 50 PF CMOS 15 PF CMOS or TTL
Start Up Time	mS	Ts	HG	50.0 KHz to 41.5 MHz		5	15	CMOS or TTL
Output Voltage—HI	V	Voh	HG	50.0 KHz to 41.5 MHz	Vcc-.4V	Vcc-.3V		CMOS or TTL
Output Voltage—LO	V	Vol	HG	50.0 KHz to 41.5 MHz		0.3	0.4	CMOS or TTL
Rise and Fall Time	nS	Tr & Tf	HG HG	50.0 KHz to 25.0 MHz >25.0 MHz to 41.5 MHz		5 4	8 5	CMOS or TTL CMOS or TTL
Duty Cycle (up time)	%	Sym	HG	50.0 KHz to 41.5 MHz	45	50	55	CMOS or TTL
Output Current–HI	mA	Ioh	HG	50.0 KHz to 41.5 MHz			−16	Voh = Vcc-.4V
Output Current–LO	mA	Iol	HG	50.0 KHz to 41.5 MHz			16	Vol = .4V
Fanout	pF lds	Fo	HG	50.0 KHz to 41.5 MHz			50 10	CMOS TTL
Enable Input Load	pF	Fi	HG	50.0 KHz to 41.5 MHz			10	
Enable Voltage–HI	V	Vih	HG	50.0 KHz to 41.5 MHz	2		5.5	
Enable Voltage–LO	V	Vil	HG	50.0 KHz to 41.5 MHz	−.05		0.8	
High Impedance Output Current	mA	Ioff	HG	50.0 KHz to 41.5 MHz			.05	

*TEST CONDITIONS	CMOS (50 pF)	TTL
Symmetry	50% of waveform	1.5 V Level
Load	50 pF (unless noted)	10 TTL Loads
Rise & Fall Time	10 to 90% of waveform	.4V to 2.4V

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C-MOS Compatible Hybrid Clock Oscillators

CXO-65 SERIES

High speed CMOS logic output
14-pin DIP compatible
(MXO-55 style)
200 Hz to 70 MHz

PIN CONNECTIONS
Pin 1: N/C or Enable or ITP
Pin 7: Ground/Case
Pin 8: Output
Pin 14: +5 VDC

ENABLE INPUT	OUTPUT
Open or High	Oscillator Output
Low	Latches High

ORDERING INFORMATION

CXO-65 [ ] – [ ] [ ] – [ ] • [ ]

OUTPUT FREQUENCY

FREQUENCY AND MODEL	CODE
3.0 to 50 MHz Basic oscillator	GA
200 Hz to <3.0 MHz Basic oscillator with dividers	GB
3.0 to 50.0 MHz Basic oscillator with enable (active high)	GAE

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

NOTE: Screening Similar to MIL-O-55310, Class B Available by Adding -MLB to the End of the P/N.

CX065G SERIES ELECTRICAL CHARACTERISTICS

SPECIFICATION	MODEL	FREQ. RANGE	TEMP. RANGE	CONDITIONS	SYMBOL	MIN.	TYPICAL	MAX.	UNITS
Operating Voltage	A, B	200 Hz – 70 MHz	−40°C to + 85°C		V_{DD}	4.50	5.00	5.50	VDC
	A, B	200 Hz – 70 MHz	−55°C to +125°C			4.75		5.25	
Max. Supply Voltage	A, B	200 Hz – 70 MHz			V_{DD} (max.)			7.00	
Input Current vs. Frequency	A, B	200 Hz – <15 MHz	−55°C to +125°C	C_L = 50 pf/ FO = 10 LS TTL	I_{DD}		16.0	20.0	mA
	A	15 MHz – 70 MHz				0.4	1.0	1.2	mA/MHz
Output Voltage - Hi	A, B	200 Hz – 70 MHz	−55°C to +125°C	C_L = 50 pf	V_{OH}	V_{DD} - 0.4	V_{DD} - 0.1		V
				FO = 10 LS TTL		3.5	4.5		
Output Voltage - Lo	A, B			C_L = 50 pf	V_{OL}		0.1	0.2	V
				FO = 10 LS TTL			0.2	0.4	
Rise & Fall Times	B	200 Hz – 2.9 MHz	−40°C to +85°C	C_L = 50 pf 10% to 90% of Waveform	t_R & t_F		14	20	nS
			−55°C to +125°C					25	
	A	3 MHz – 25 MHz	−40°C to +85°C				9	12	
			−55°C to +125°C					15	
		>25 MHz – 70 MHz	−40°C to +85°C				5	8	
			−55°C to +125°C					10	
(FO = Fan Out)	A, B	200 Hz – 70 MHz	−55°C to +125°C	FO = 10 LS TTL 0.5V to 2.4V			2	5	
Duty Cycle (% Uptime)	B	200 Hz – <3 MHz	−55°C to +125°C	C_L = 50 pf @50% of Waveform		45	50	55	%
	A	3 MHz – 70 MHz	0 to +70°C					60	
			−55°C to +125°C			40			
	A, B	200 Hz – 70 MHz	−55°C to +125°C	10 LS TTL @ 1.5V Level		40	51	60	
Output Current - Hi	A,B	200 Hz – 70 MHz	−55°C to +125°C	V_{OH} = 3.7V	I_{OH}			−4.0	mA
Ouput Current - Lo				V_{OL} = 0.4V	I_{OL}			4.0	
Fan Out	A, B	200 Hz – 70 MHz	−55°C to +125°C		C_L			50	pf
					FO			10	LS TTL
Enable Input Volt	AE	3 MHz – 70 MHz	−55°C to +125°C		V_{IH}	3.20		5.50	V
Disable Input Volt					V_{IL}	−0.50		1.30	

CXO-55 SERIES

Low power consumption
CMOS logic output
14-pin DIP compatible
(MXO-55 style)
200 Hz to 5 MHz

PIN CONNECTIONS
Pin 1: N/C or ITP
Pin 7: Ground/Case
Pin 8: Output
Pin 14: +5 VDC to + 15 VDC

ORDERING INFORMATION (SEE NOTE)

CXO-55 [ ] – [ ] [ ] – [ ] • [ ]

OUTPUT FREQUENCY (PIN 8)

FREQUENCY AND MODEL	CODE
3 to 5 MHz Basic oscillator	GA
200 Hz to <3 MHz Basic oscillator with dividers	GB

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQ. RANGE	TEMP. RANGE	CONDITIONS		SYMBOL	MIN.	TYPICAL	MAX.	UNITS
Operating Voltage	A, B	200 Hz to 5 MHz	−55°C to +125°C			V_{DD}	4.50	5.00	15.50	V
Max. Supply Voltage						V_{DD} Max.			18	
Supply Current	A	3 MHz to 5 MHz	−55°C to +125°C	V_{DD} = 5V	C_L = 15 pf	I_{DD}			3	mA
				V_{DD} = 10V					6	
				V_{DD} = 15V					9	
	B	200 Hz to <3 MHz		V_{DD} = 5V					4	
				V_{DD} = 10V					9	
				V_{DD} = 15V					15	
Output Voltage—HI	A, B	200 Hz to 5 MHz	−55°C to +125°C	C_L = Max.		V_{OH}	V_{DD} −.5	V_{DD} −.1		V
Output Voltage—LO						V_{OL}		.1	.5	
Rise & Fall Times (measured from 10% to 90% waveform)	A, B	200 Hz to 5 MHz	−55°C to +125°C	V_{DD} = 5V	C_L = Max.	t_R & t_F			130	nS
				V_{DD} = 10V					70	
				V_{DD} = 15V					45	
Duty Cycle (uptime) (@ 50% of waveform)	A, B	200 Hz to 5 MHz	−55°C to +125°C	C_L = Max.			40	50	60	%
Output Load	B	200 Hz to <3.0 MHz	−55°C to +125°C			C_L			50	pf
	A	3.0 MHz to 5 MHz							15	
Output Current—HI (source)	A, B	200 Hz to 5 MHz	−55°C to +125°C	V_{DD} = 5V	V_{OH} = 4.5V	I_{OH}			−100	µA
				V_{DD} = 10V	V_{OH} = 9.5V				−250	
				V_{DD} = 15V	V_{OH} = 14.5V				−800	
Output Current—Lo (Sink)	A, B	200 Hz to 5 MHz	−55°C to +125°C	V_{DD} = 5V		I_{OL}			300	
				V_{DD} = 10V	V_{OL} = .5V				900	
				V_{DD} = 15V					2000	

NOTE: Frequency stability is guaranteed for ±10% supply voltage tolerance. Although the CXO-55 may operate from 5 to 15 VDC, standard frequency calibration is done at V_{DD}=5 VDC. If your application requires V_{DD} to be other than 5 VDC, please specify nominal V_{DD}, when ordering, to insure proper frequency accuracy and stability.

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ECL Compatible Hybrid Clock Oscillators

EXO-55 SERIES

10KH ECL logic output
14-pin DIP compatible
8 MHz to 130 MHz
Standard Frequencies Available thru Franchised Distributors.
Complementary Designs Available

ORDERING INFORMATION

EXO-55 [ ] – [ ] [ ] [ ] • [ ]
OUTPUT FREQUENCY

CASE GROUND	CODE
ISOLATED CASE	G0
PIN 1 CASE	G1
PIN 7 CASE	G7
PIN 14 CASE	G14

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

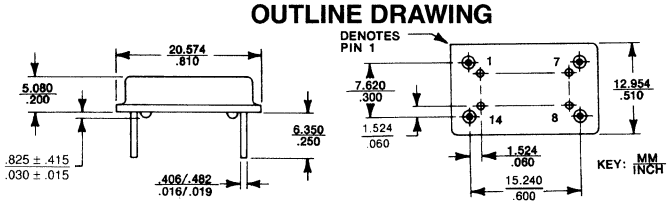
OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I

ELECTRICAL CHARACTERISTICS (INTO 50 Ω TO −2.0 VDC LOAD)

FREQUENCY RANGE	OPERATING TEMPERATURE	SPECIFICATION	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
8.0 to 130 MHz	−40°C to +85°C	Operating Voltage	V_{EE}	−4.94	−5.20	−5.46	V
		Max. Supply Voltage	V_{EE} Max.			−7.0	
		Supply Current	I_{EE}		70	110	mA
		Output Voltage—HI	V_{OH}	−1.07	− .95	− .75	V
		Output Voltage—LO	V_{OL}	−2.05	−1.80	−1.60	
		Rise & Fall Times (measured between 20% & 80%)	t_R & t_F		1.5	2.5	nS
		Duty Cycle (uptime) (measured @ 50%)		40	50	60	%
		Output Current—HI @ − .95V	I_{OH}	−19.0	−22.0		mA
		Output Current—LO @ −1.75V	I_{OL}	−1.0	−5.0		
		Output Load		50 Ω to −2.0 VDC			

PIN CONNECTIONS				
	STANDARD	(OPTIONAL)		
PIN	EX055G0	EX055G1	EX055G7	EX055G14
1	N/C	CASE	N/C	N/C
7	-Vee	-Vee	GND/CASE	-Vee
8	OUTPUT	OUTPUT	OUTPUT	OUTPUT
14	GROUND	GROUND	-Vee	GND/CASE

OUTLINE DRAWING



EXO-65 SERIES

100K ECL logic output
14-pin DIP compatible
25 MHz to 250 MHz
Complementary Designs Available

ORDERING INFORMATION

EXO-65 [ ] [ ] [ ] [ ] • [ ]
OUTPUT FREQUENCY

CASE GROUND	CODE
ISOLATED CASE	G0
PIN 1 CASE	G1
PIN 7 CASE	G7
PIN 14 CASE	G14

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

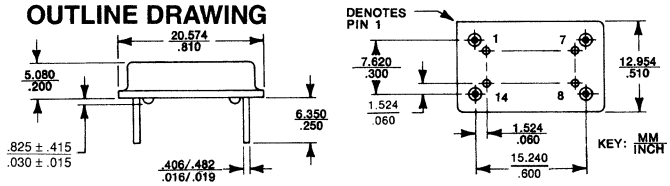
OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C 25 to 130 MHz only	I

ELECTRICAL CHARACTERISTICS (INTO 50 Ω TO −2.0 VDC LOAD)

FREQUENCY RANGE	OPERATING TEMPERATURE	SPECIFICATION	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
25.0 to 130 MHz >130 to 250 MHz (0 to 70° C only)	−40°C to +85°C	Operating Voltage	V_{EE}	−4.20	−4.50	−4.8	V
		Max. Supply Voltage	V_{EE} Max.			−5.70	
		Supply Current	I_{EE}		85	100	mA
		Output Voltage—HI	V_{OH}	−1.04	− .95	− .85	V
		Output Voltage—LO	V_{OL}	−1.90	−1.80	−1.60	
		Rise & Fall Times (measured between 20% & 80%)	t_R & t_F		1.0	1.5	nS
		Duty Cycle (uptime) (measured @ 50%)		40	50	60	%
		Output Current—HI @ −1.0V	I_{OH}	−19.2	−21.0		mA
		Output Current—LO @ −1.7V	I_{OL}	−2.0	− 6.0		
		Output Load		50 Ω to −2.0 VDC			

PIN CONNECTIONS				
	STANDARD	(OPTIONAL)		
PIN	EX065G0	EX065G1	EX065G7	EX065G14
1	N/C	CASE	N/C	N/C
7	-Vee	-Vee	GND/CASE	-Vee
8	OUTPUT	OUTPUT	OUTPUT	OUTPUT
14	GROUND	GROUND	-Vee	GND/CASE

OUTLINE DRAWING



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Voltage Controlled Hybrid Clock Oscillator

VXO-55 SERIES

TTL logic output*
14 pin DIP compatible
(MXO-55 style/.290" Max Height)
765 KHz to 25 MHz
*HCMOS Logic Models also available, consult factory for VXO65 Model

PIN CONNECTIONS
Pin 1: Frequency control voltage
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

ORDERING INFORMATION

VXO-55 [ ] – [ ] [ ] [ ] – [ ] • [ ]
OUTPUT FREQUENCY

FREQUENCY AND MODEL	CODE
12.25 to 25.0 MHz Basic Oscillator	GA
765 KHz to <12.25 MHz Basic oscillator with dividers	GB

FREQUENCY DEVIATION*	CODE
±120 ppm min.	1
±200 ppm min.	2

* Positive slope

FREQUENCY TOLERANCE Vc = 2.50V	CODE
±.01% (100 ppm)	2
±.005% (50 ppm)	3

OPERATING TEMPERATURE RANGE	CODE
0°C to 70°C	C
−40°C to 85°C	I

ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQUENCY RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B	765 KHz to 25 MHz	Vcc	4.50	5.00	5.50	V
Maximum Supply Voltage			Vcc Max.			7.00	
Supply Current	A	12.25 MHz to 25 MHz	Icc		18	25	mA
	B	3.0625 MHz to <12.25 MHz			30	60	
		765 KHz to <3.0625 MHz			45	75	
Output Voltage—HI	A, B	765 KHz to 25 MHz	VOH	2.40	3.60		V
Output Voltage—LO			VOL		0.25	0.40	
Rise & Fall Time	A, B	3.0625 MHz to 25 MHz	tR, tF		3	5	nS
(measured between 0.5V to 2.4V)		765 KHz to <3.0625 MHz			8	18	
Duty Cycle	A, B	12.25 MHz to 25 MHz		40	50	60	%
(measured @ 1.5V)		765 KHz to <12.25 MHz		45	50	55	
Control Voltage	A, B	765 KHz to 25 MHz	Vc	0.0	2.5	5.0	V
Start-up Time	A, B	765 KHz to 25 MHz	tS		5	15	mS
Control Voltage Input Impedance	A, B	765 KHz to 25 MHz		100K			Ω
Fanout	A, B	765 KHz to 25 MHz	Fo	1		10	
Linearity	A, B	765 KHz to 25 MHz		−25	±10	+25	%

Tri-State Hybrid Clock Oscillators

MXO-53 SERIES

3-state, True TTL logic outputs*
14-pin DIP compatible
(MXO-55 style)
200 Hz to 60 MHz
*HCMOS Logic also available to 100 MHz
See CXO63 Model.

PIN CONNECTIONS
Pin 1: Enable
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

ENABLE FUNCTION
HI: Enables oscillator*
LO: Disables oscillator
(HI impedance output)

Designed for automated, in-circuit, and functional board test applications where a high impedance output state is required to allow the injection of external test signals.

ORDERING INFORMATION

MXO-53 [ ] [ ] [ ] – [ ] • [ ]
OUTPUT FREQUENCY (PIN 8)

FREQUENCY & MODEL	CODE
4.9152 to 60 MHz Basic 3-state oscillator	GA
200 Hz to 4.9151 MHz 3-state oscillator with dividers	GB
4.9152 to 60 MHz Basic oscillator w/Pull-up	GAU
200 Hz to 4.9 MHz Divided output w/Pull-up	GBU

FREQUENCY TOLERANCE	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I

ELECTRICAL SPECIFICATIONS (SIMILAR TO MXO-55 EXCEPT AS NOTED BELOW)

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Supply Current	A	4.9152 to 25 MHz	−40°C to +85°C	Icc		35	55	mA
		>25 to 60 MHz				50	80	
	B	200 Hz to <4.9151 MHz				60	100	
Duty Cycle (uptime) (measured @ 1.5V)	A, B	200 Hz to 60 MHz	−40°C to +85°C		40	50	60	%
High Impedance Output Current	A, B	200 Hz to 60 MHz	−40°C to +85°C	Io (OFF)			50	μA

*U option allows Oscillator to be Enabled with Floating Conditions.

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Surface Mount Hybrid Clock Oscillators

■SURFACE MOUNT APPLICATIONS—CTS Knights presently offers a number of options to suit your surface mount needs. Besides the CCXO series, leadless chip carriers, we are offering the MXO-55 style package in an economical surface mountable configuration, through a simple lead formation operation. The surface mount option is specified by adding an "S" to the part number (eg. SMXO-55, SCXO-65). Coplanarity for lead formed packages is ± .006" (max).

■VAPOR PHASE REFLOW—CTS Knights' standard hybrid oscillators are capable of withstanding hand and wave soldering processes, but are not manufactured to survive vapor phase reflow profiles without degradation to device reliability. All surface mountable products are built with a special, high-temperature construction process to allow vapor phase reflow.

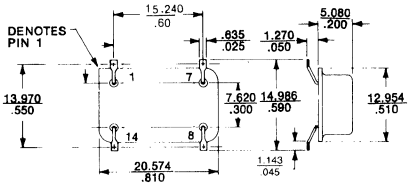


FIG. 13 SMXO-55

Standard DIP SERIES

The Standard DIP surface mount series squarewave crystal oscillator is contained in a rugged, economical .500" × .800", hermetically sealed metal package. The leads are shaped for surface mounting in a Gullwing design.

AVAILABLE MODELS:

SURFACE MOUNT	EQUIVALENT STANDARD SERIES	LOGIC	FREQUENCY RANGE
SMX055	MX055	TTL	19.2 KHz TO 100 MHz
SCX065	CX065	HCMOS	1 MHz TO 50 MHz
SVX055	VX055	TTL VCXO	765 KHz TO 25 MHz
SEX055	EX055	10K	25 MHz TO 125 MHz
SEX065	EX065	100K ECL.	25 MHz TO 150 MHz
SCX063	CX063	HCMOS TRI-STATE	1 MHz TO 70 MHz
SMX053	MX053	TTL TRI-STATE	765 KHz TO 60 MHz

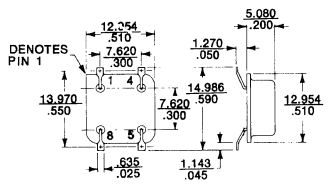


FIG. 14 SMXO-25

Mini-DIP SERIES

The Mini-DIP surface mount series of squarewave crystal oscillators are contained in a rugged, economical .500" × .500", hermetically sealed metal package. The leads are shaped for surface mounting in a gullwing design.

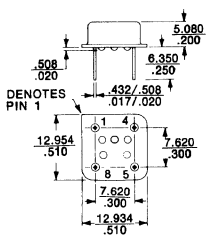
AVAILABLE MODELS:

SURFACE MOUNT	ELECTRICALLY EQUIVALENT STANDARD SERIES	LOGIC	FREQUENCY RANGE
SMX025	MX055	TTL	307.2 KHz TO 70 MHz
SCX025	CX065	HCMOS	307.2 KHz TO 70 MHz

MINIATURE DUAL-IN-LINE OSCILLATORS

MX0-25 SERIES
TTL logic output
electrically similar to MX0-55
310 KHz to 70 MHz

CX0-25 SERIES
Hi-speed CMOS logic output
Electrically similar to CX0-65
200 Hz to 50 MHz



Pin 1—N/C
Pin 4—Ground/case
Pin 5—Output
Pin 8—+5 VDC supply

FIG. 15 Mini-DIP PACKAGE

NOTE: Tristate Minidip Oscillators are Also Available. Consult Factory for Info

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Military Hybrid Clock Oscillators

CTS Knights is a Qualified Products List (QPL) supplier for **MIL-O-55310/8, 10, 14, 16, 17, 18, 19**
14-pin dual-in-line package
TTL logic output
Frequencies from 50 Hz to 60 MHz
Class B screening

PIN CONNECTIONS
In accordance with appropriate slash sheet

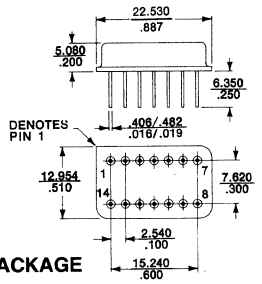


FIG. 16 MILITARY PACKAGE

CTS Knights also supplies product equivalent to the following MIL-O-55310 specification with qualification anticipated soon:

SPECIFICATION	TYPE
M55310/9	TTL, TO-5
M55310/11	CMOS, 14-pin DIP
M55310/15	CMOS, 14-pin DIP
M55310/20	TTL, 44-pin LCC

M55310/16 SERIES
ORDERING INFORMATION M55310/16-□□□ -(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE	
CODE	FREQUENCY
0	50 Hz to <250 Hz
1	250 Hz to <150 KHz
2	150 KHz to <5.0 MHz
3	4.0 MHz to <20 MHz
4	20 MHz to 60MHz

TOLERANCE (PPM)				
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.	AGING (PER YEAR)
1A	−55°/125°C	15 ppm	50	5 ppm
1B	−55°/105°C		40	
1C	−20°/70°C		25	
4A	−55°/125°C	25 ppm	100	10 ppm
4B	−55°/105°C		80	
4C	−20°/70°C		50	

M55310/08 SERIES
ORDERING INFORMATION M55310/08-□□□ -(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE		AGING (PER YEAR)
CODE	FREQUENCY	
01	1.0 KHz to <150.0 KHz	5ppm
02	150.0 KHz to <300.0 KHz	
03	300.0 KHz to <600.0 KHz	
04	600.0 KHz to <2.5 MHz	
05	2.5 MHz to <5.0 MHz	
06	5.0 MHz to <10.0 MHz	10ppm
07	10.0 MHz to <20.0 MHz	
08	20.0 MHz to <30.0 MHz	
09	30.0 MHz to <50.0 MHz	
10	50.0 Hz to <1.0 KHz	

TOLERANCE (PPM)			
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.
A	−55 to +125°C	15 ppm (TYP)	±50ppm
B	−55 to +105°C		±40ppm
C	−20 to +70°C		±25ppm

M55310/14 SERIES
ORDERING INFORMATION M55310/14-□□□ -(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE	
CODE	FREQUENCY
01	50 Hz to <1.0 KHz
02	1.0 KHz to <150.0 KHz
03	150.0 KHz to <300.0 KHz
04	300.0 KHz to <600.0 KHz
05	600.0 KHz to <2.5 MHz
06	2.5 MHz to <5.0 MHz
07	5.0 MHz to <10.0 MHz
08	10.0 MHz to <15.0 MHz
09	15.0 MHz to ≤25.0 MHz

TOLERANCE (PPM)				
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.	AGING (PER YEAR)
A	−55 to +125°C	15 ppm	±50 ppm	5 ppm
B	−55 to +105°C		±40 ppm	
C	−20 to +70°C		±25 ppm	

M55310/17 SERIES
ORDERING INFORMATION M55310/17-□□□ -(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE	
CODE	FREQUENCY
0	250.0 KHz to <5.0 MHz
1	4.0 MHz to <20.0 MHz
2	20.0 MHz to ≤50.0 MHz

TOLERANCE (PPM)				
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.	AGING (PER YEAR)
1A	−55°/125°C	15 ppm*	50	5 ppm
1B	−55°/105°C		40	
1C	−20°/70°C		25	
4A,BorC	as above	25 ppm	100	10 ppm

*01 is 10 ppm

NOTE:
■ **HIGH RELIABILITY SCREENING**—All hybrid oscillators, at your option, can be screened similar to the Class B requirements of MIL-0-55310. To request this option, add "MLB" after the part number (e.g. MXO-55GA-2C-16.0 MHz-MLB).

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Military Hybrid Clock Oscillators

CCXO SERIES

Leadless chip carrier package
TTL logic output
Low Profile
Excellent Environmental Performance
1.0 to 60.0 MHz*
Electrically similar to MXO-55 as follows:
"A" MODELS are electrically similar to MXO55GA Models
"B" MODELS are electrically similar to MXO55GB Models from 307.2 KHZ to <2.4576 MHZ
* <CCXO-150 1.0 to 25 MHz

PACKAGE OUTLINES

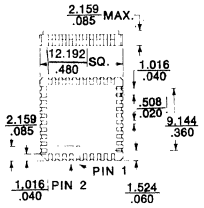


FIG. 17 CCXO-140

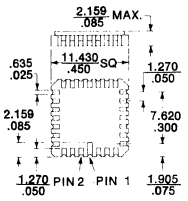


FIG. 18 CCXO-150

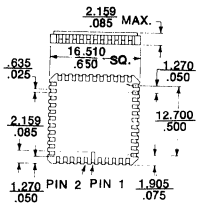


FIG. 19 CCXO-250

ORDERING INFORMATION

CCXO- [ ] [ ] [ ] [ ] [ ] [ ]

OUTPUT FREQUENCY

PACKAGE STYLE	CODE
40-pin, .040" spaced	140
28-pin, .050" spaced	150
44-pin, .050" spaced	250

FREQUENCY AND MODEL	CODE
12 to 45 MHz Basic oscillator	A
1 to <12 MHz Oscillator with dividers	B

FRQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

STANDARD PIN ASSIGNMENT

CCXO-140 PINS	CCXO-150 PINS	CCXO-250 PINS	FUNCTION FOR FREQUENCY 1-45 MHz
1	2	1	NC
4	4	6	+5 VDC
5	15		NC
10	8	12	+5 VDC
15	12	18	NC
25	18	28	NC
31	22	34	GND
35			NC
37	26	40	GND
39	28	42	Output
40	1	44	NC

NOTES:
1. NC — Indicates internal connection. No external electrical connection allowed.
2. Tolerance includes 25°C accuracy, changes in operating temperature, supply voltage, load, environmental conditions and aging.
3. Multiple +5 VDC and GND pins are internally connected and redundant.
4. Non-standard pin assignments may be possible. Consult factory with requirements.
5. Screening similar to MIL-O-55310, Class B available by adding -MLB to end of P/N.
6. Unspecified pins may have external electrical connections.

Engineering Data For Hybrid Oscillators

TYPICAL CHARACTERISTICS

- STORAGE TEMPERATURE: −65°C to +150°C.
- TEMPERATURE CYCLE: 25 cycles, −55°C to +125°C, per method 1010 of MIL-STD-883.
- CONSTANT ACCELERATION: 5000 G, Y1 direction, per method 2001 of MIL-STD-883.
- MECHANICAL SHOCK: 1500 G, 0.5 mS, 3 shocks per direction, per method 2002 of MIL-STD-883.
- SINUSOIDAL VIBRATION: 0.06" D.A., 10 to 55 Hz and 20 G, 55 to 2000 Hz, 3 cycles per direction, per method 2007 of MIL-STD-883.
- RANDOM VIBRATION: 20 G, 20 to 2000 Hz, per method 2026 of MIL-STD-883.
- LEAD INTEGRITY: Per conditions B1 and B2 in method 2004 of MIL-STD-883.
- HERMETICITY: 3 × 10^8 ATM-cc/sec, per conditions A1 and C in method 1014 of MIL-STD-883.
- MOISTURE RESISTANCE: 10 cycles, per method 1004 of MIL-STD-883 with step 7 subcycle omitted.
- CORROSION RESISTANCE: 24 hours, per condition A in method 1009 of MIL-STD-883.
- SOLDERABILITY: Per method 2003 of MIL-STD-883, or method 208 of MIL-STD-202, except 1 hour steam aging.
- QUALITY: In accordance with MIL-I-45208.
- RESISTANCE TO SOLDERING HEAT: Per conditions A and C in method 210 of MIL-STD-202.
- MARKING PERMANENCE: Per method 2015 of MIL-STD-883.
- THERMAL RESISTANCE: Per method 1012.1 of MIL-STD-883.
  14 pin dip style package = 12°C/watt typical.
  TO-5/TO-8 style package = 8°C/watt typical.
  CCXO style package = 7°C/watt typical.
- ELECTROSTATIC DISCHARGE SENSITIVITY: Per method 3015 of MIL-STD-883:
  TTL output models—Class 3
  ECL output models—Class 3
  (100K ECL models Class 2)
  CMOS output models—Class 1
  HCMOS Output—Class 1
- STEADY-STATE LIFE: 1000 hrs. @ 125°C per method 1005 of MIL-STD-883, disregarding frequency shift.
- FREQUENCY AGING: <10ppm shift in 30 days @ 85°C ambient.
- No External Connection Allowed on N/C Pinouts.

SPECIAL REQUIREMENTS

- ELECTROMAGNETIC INTERFERENCE PROTECTION
  The metal package construction, used extensively on CTS Knights hybrid oscillators, effectively reduces radiated EMI due to the oscillator circuitry. Further reduction can be accomplished by connecting the case to circuit ground, which is standard on MXO and CXO series oscillators. Case grounding is specified by a "G" in the part number (eg. MXO-55GA, CXO-65GA). CTS Knights has also gained considerable experience in reducing conducted EMI in specific customer applications. Contact CTS with your EMI problems or requirements, we'll offer a solution.
- CUSTOM DESIGN CAPABILITIES—CTS Knights' in-house capabilities include circuit design and artwork generation, crystal and hybrid thick film manufacturing facilities, manual and automated manufacture and test techniques, and mechanical and environmental testing. This gives CTS a unique flexibility to design and manufacture to your custom hybrid oscillator specifications. Consult the innovative staff at CTS Knights with your special requirements.

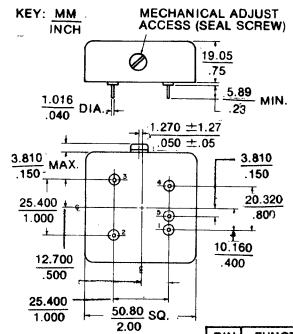
CTS — QUALITY, FREQUENCY CONTROL COMPONENTS FOR RELIABLE ELECTRONICS

CTS® CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS

FREQUENCY CONTROL DIVISION 400 Reimann Ave., Sandwich, IL 60548 • 815/786-8411 • FAX 815-786-9743

Precision Crystal Oscillators

JKVXO-220
HIGH STABILITY TCVCXO



TOLERANCE	
.XX	.XXX
±.76 MM	±.381 MM
±.03	±0.15

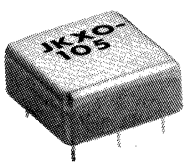
PIN	FUNCTION
1	OUT
2	Vcc 12 V
3	0 VOLTS, CASE
4	VCXO INPUT
5	RF RETURN, CASE

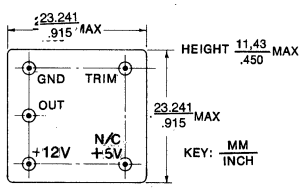
Designed for telecommunications use in phase locked and digital frequency locked loop applications where tight stability is needed during unlocked operation. Deviation range, temp. stability and aging rate combine to provide a highly stable TCVCXO with excellent free running stability and reference locking capability over an extremely long life.

SPECIFICATIONS

- Frequency range: 1 MHz to 25 MHz
- Excellent long term Aging: <4 ppm in 20 yrs.
- Operating range: 0 to +50°C or 0 to +70°C.
- ±3 x 10^{-7} △F vs. temp. at any deviation voltage setting.
- Deviation: ±10 to ±15 ppm for 0 to +10V input, centered at +5 VDC.
- TTL or HCMOS output.
- Available with or without trim access port.
- +12V supply (other voltages available).

JKXO-105
HYBRID TCXO



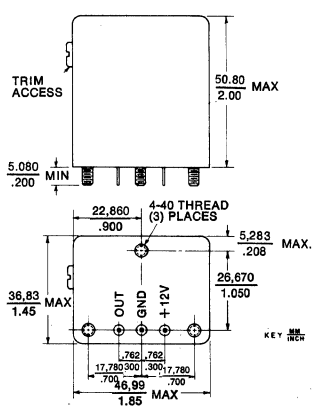


SPECIFICATIONS

The JKXO-105 is a subminiature TCXO designed to meet the requirements of modern Communication Systems. Its small size (0.38 cubic inches) and frequency stability combine to form state-of-the-art TCXO performance for industry and military applications.

- Frequency range: 1 MHz to 20 MHz
- Temp. Stability: —1) ±1 x 10^{-6}, 0 to +70°C.
  —2) ±2 x 10^{-6}, −28 to +70°C.
  —3) ±2 x 10^{-6}, −55 to +85°C.
- Input: +12 VDC ±5% and +5V ±10%
- Output: HCMOS or TTL
- Stability vs time: ±1 x 10^{-6}/yr.
- External trim sufficient for 10 yrs. aging via external resistor.

JKXO-200
HIGH STABILITY TCXO — 5 MHz*



* CONTACT FACTORY FOR OTHER FREQUENCIES.

The JKXO-200 is a precision TCXO designed to maintain state-of-the-art stability during variations in environment and electrical inputs. Temperature hysteresis, temperature slew, trim adjust effects and aging have been minimized. The very low power consumption and rugged construction make this oscillator ideal for battery operated portable use. The JKXO-200 can be manufactured using Hi-Rel military components providing an ultra stable TCXO capable of surviving the harshest of military environments.

CONDENSED SPECIFICATIONS

	−2
Frequency vs. temp. −55°C to +85°C including hysteresis	±5 x 10^{-7}
1°C/min temp. slew −55°C to +85°C including trim adjust effect	±7 x 10^{-7}
Stability vs. time	±3 x 10^{-7} 1st yr ±8 x 10^{-7}/5 yrs
Stability vs. voltage (12V ±1V)	±5 x 10^{-9}
Output level: 50Ω load	50 mV RMS
1000Ω load	150 mV RMS
Warm up to within ±5 x 10^{-8}	10 seconds max.
Input power at +12V	50 mW max.

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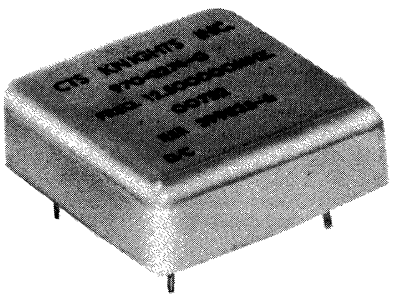
Precision Oscillators—TCXO/TCVCXO

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO's) VOLTAGE CONTROLLED - TEMPERATURE COMPSENSATED CRYSTAL OSCILLATORS (TCVCXO's)

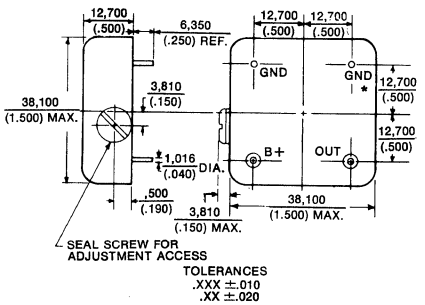
Low power consumption, high stability over wide temperature extremes, and small physical size characterize CTS Knights' TCXO and TCVCXO crystal oscillators. Add excellent environmental characteristics including immunity to humidity, vibration and shock, satisfying the requirements of the instruments and communications industries.

High reliability and stringent long term qualities common in military applications are available in a variety of designs. Note the options and modifications, the flexibility of design which offers the user choices to fulfill specific needs.

JKXO-12 (TCXO) JKVXO-12 (TCVCXO)



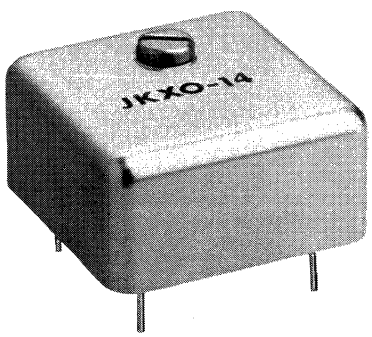
FEATURES:
- Low profile
- Solder seal
- Vibration 15G's, to 10-2000 Hz



* VCO INPUT ON TCVCO MODELS

Fig. 21

JKXO-14 (TCXO)



FEATURES:
- Top access hex drive trim adjustment
- Sine or TTL output
- Solder seal

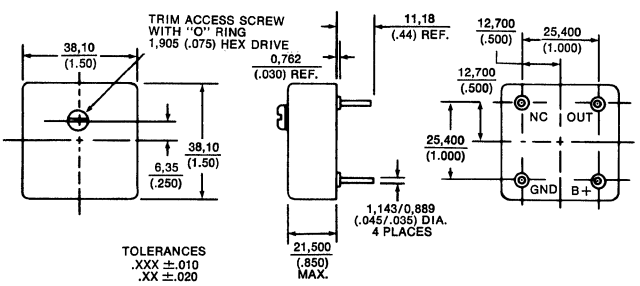
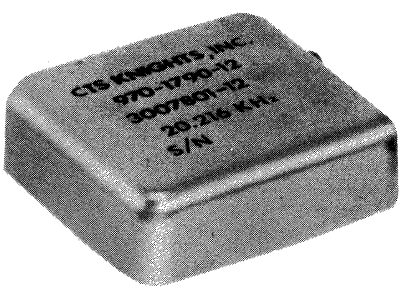
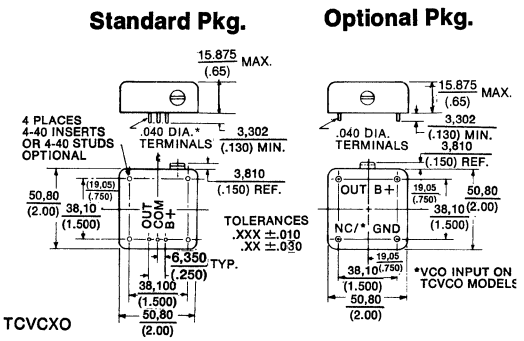


Fig. 22

JKXO-16 (TCXO) JKVXO-16 (TCVCXO)



FEATURES:
- Solder seal
- Wide frequency range
- Specialized outputs available



* 4 PINS FOR TCVCXO

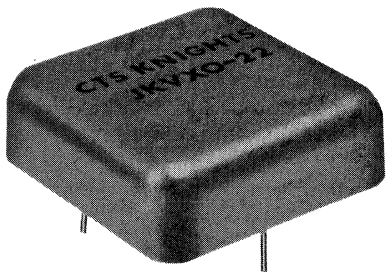
Fig. 23

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Precision Crystal Oscillators — TCXO/TCVCXO

JKVXO-22



FEATURES:

- Available as VCXO or TCVCXO. Temperature stability and deviation are customized per application. 5 volt supply, Mod voltage range 0 to +5 VDC.

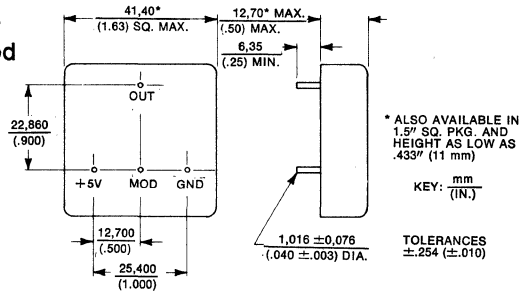
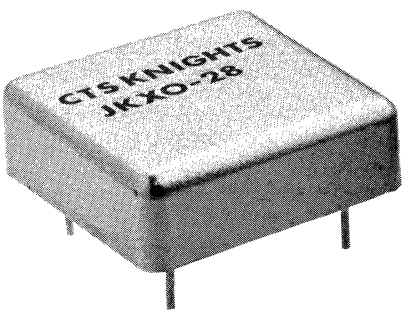


Fig. 24

JKXO-28 (TCXO)



FEATURES:

- Frequency range: 8 MHz to 20 MHz
- 5 VDC supply
- ±1 ppm, 0°C to +70°C
- TTL or HCMOS output
- <±3 ppm aging in 10 yrs.

The JKXO-28 is a low cost design providing excellent long term stability without need for re-calibration over a long life.

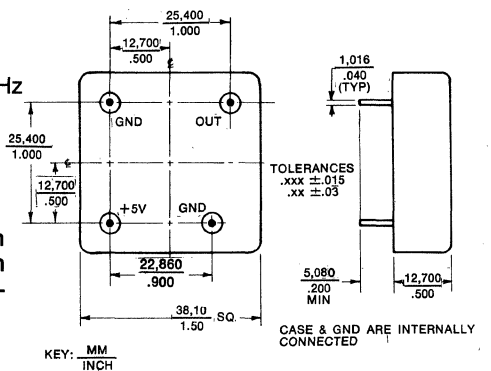


Fig. 25

FIG.	MODEL	*FREQUENCY RANGE	SUPPLY VOLTAGE OPTIONS (VDC)	STABILITY WITH TEMPERATURE	VCXO DEVIATION OPTIONS	MAX. AGING 1st YR.	OUTPUT OPTIONS
21	JKXO-12A	3-30 MHz	12-20	±2 ppm, −55 to +85°C	NONE	1 ppm	Sine Wave, TTL, HCMOS, CMOS (Below 10 MHz)
	JKXO-12B	3-30 MHz	12-20	±1 ppm, −40 to +75°C	NONE	1 ppm	
	JKXO-12C	3-50 MHz	12-20	±.5 ppm, 0 to +70°C	NONE	1 ppm	
22	JKXO-14A	3-30 MHz	12-28	±.5 ppm, 0 to +50°C	NONE	1 ppm	TTL or Sine
	JKXO-14B	3-30 MHz	12-28	±1 ppm, 0 to +70°C	NONE	1 ppm	
23	JKXO-16A	1 Hz to 30 MHz	12-28	±1 ppm, −40 to +75°C	NONE	1 ppm	Sine (Above 500 KHz) ECL, TTL, HCMOS CMOS (Below 10 MHz)
	JKXO-16B	1 Hz to 30 MHz	12-28	±1 ppm, −55 to +85°C	NONE	1 ppm	
	JKXO-16C	1 Hz to 30 MHz	12-28	±2 ppm, −40 to +75°C	NONE	1 ppm	
	JKXO-16D	30 to 100 MHz	15-28	±2 ppm, −20 to +70°C	NONE	1 ppm	
	JKXO-16E	1 KHz to 30 MHz	5	±2 ppm, −20 to +70°C	NONE	1 ppm	
25	JKXO-28	8-20 MHz	5	±1 ppm, 0 to +70°C	NONE	.75 ppm	TTL or HCMOS
21	JKVXO-12A	8-30 MHz	9-20	±10 ppm, 0 to +70°C	±100 ppm, ±5V Input	1 ppm	TTL
	JKVXO-12B	30 to 50 MHz	12-20	±5 ppm, 0 to +70°C	±15 ppm, ±3V Input	1 ppm	Sine Wave
	JKVXO-12C	8 to 35 MHz	12-20	±2 ppm, 0 to +70°C	±40 ppm, ±3V Input	1 ppm	Sine, TTL
23	JKVXO-16A	1 KHz to 30 MHz	5-20	±10 ppm, 0 to +70°C	±40 ppm, 0 to 5 VDC	1 ppm	TTL, ECL, HCMOS CMOS (Below 10 MHz) Sine (Above 500 KHz)
	JKVXO-16B	1 KHz to 30 MHz	9-20	±20 ppm, −20 to +70°C	±100 ppm, ±5V Input	1 ppm	
	JKVXO-16C	1 MHz to 30 MHz	5	±30 ppm, −55 to +85°C	±100 ppm, 0 to 5V Input	1 ppm	
	JKVXO-16D	30 MHz to 150 MHz	12-20	±5 ppm, 0 to +50°C	±15 ppm, ±5V Input	1 ppm	Sine, ECL
24	JKVXO-22A	1 MHz to 30 MHz	5	±10 ppm, 0 to +50°C	±40 ppm, 0 to +5 VDC	2 ppm	TTL, CMOS
	JKVXO-22B	30 MHz to 50 MHz	5	±5 ppm, 0 to +50°C	±12 ppm, 0 to +5 VDC	1 ppm	TTL ECL (−5V Supply Req.)
	JKVXO-22C	1 MHz to 30 MHz	5	±15 ppm, −20 to +70°C	±100 ppm, 0 to +5 VDC	2 ppm	

* Consult factory for available standard frequencies.

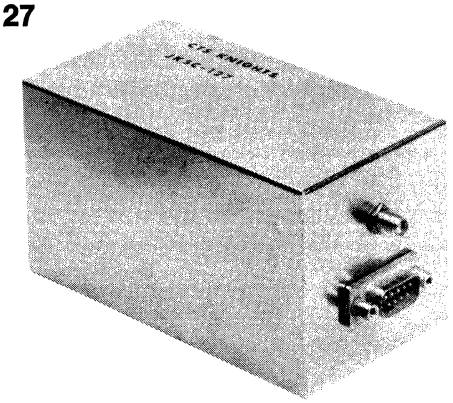
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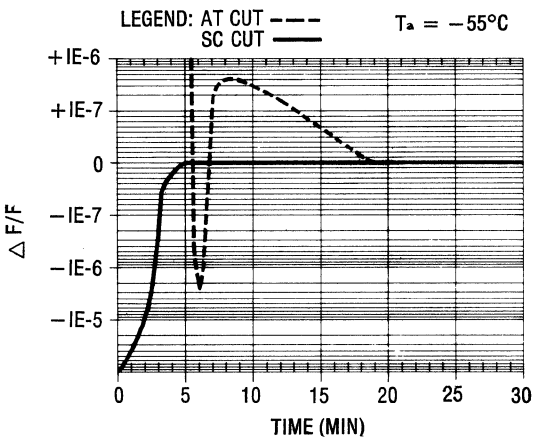
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Fast Warm-Up SC Cut Ovenized Oscillator

JKSC-127





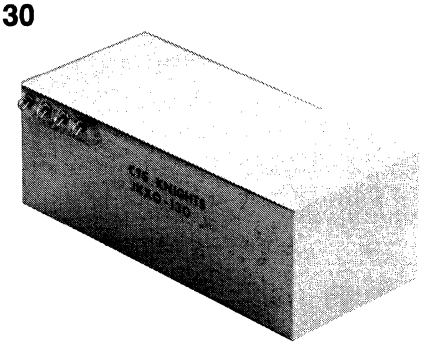
The JKSC-127 offers ultra fast warm-up with excellent long term, short term and phase noise characteristics. The design utilizes a 10 MHz coldweld sealed SC cut overtone crystal along with a uniquely designed proportionally controlled double oven which minimizes stabilized power consumption. The JKSC-127 is available fully militarized with an MTBF of greater than 100,000 hours in ground mobile and airborne environments.

GENERAL SPECIFICATIONS

FREQUENCY: 10.0 MHz or 10.230 MHz
INPUT VOLTAGE: Oven +28 VDC ±5%
Oscillator +15 VDC ±5%
INPUT CURRENT: Oven @ turn-on 1.2 amps maximum
@ −25°C 125 mA typical
@ −55°C 240 mA typical
Oscillator 20 mA maximum
FREQUENCY STABILITY VS. TEMPERATURE:
$\pm 5 \times 10^{-9}$ from −55°C to +71°C
FREQUENCY STABILITY VS. TIME:
$\pm 5 \times 10^{-12}$ RMS/sec
$\pm 5 \times 10^{-10}$/day at shipment
$\pm 3 \times 10^{-8}$/year
WARM UP: @ −55°C $< 5 \times 10^{-9}$ in 7 minutes
@ −32°C $< 5 \times 10^{-9}$ in 5 minutes
@ +25°C $< 5 \times 10^{-9}$ in 3 minutes
PHASE NOISE (1 HzBW): @ 10 Hz offset −120 dbc
@ 100 Hz offset −140 dbc
@ 1 KHz offset −150 dbc
@ 100 KHz offset −150 dbc
RF OUTPUT: +5 dbm minimum into 50 ohms
FREQUENCY ADJUSTMENT:
Coarse (mechanical) $\pm 5 \times 10^{-7}$ minimum
Fine (electrical) $\pm 5 \times 10^{-8}$ minimum for ±5 VDC
SIZE: 2.5″ x 4.5″ x 2.5″ H.
Modifications of the JKSC-127 available.

Ovenized Crystal Oscillator

JKXO-130



The JKXO-130 offers excellent long and short term stabilities at an economical price. The design utilizes a cold weld precision overtone crystal with a proportional oven controller.

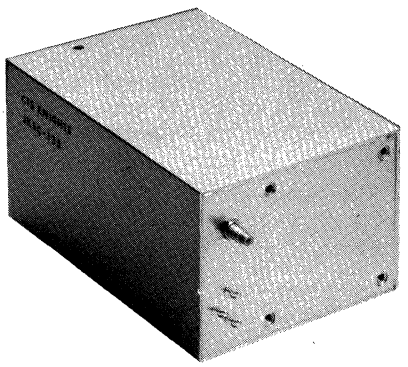
GENERAL SPECIFICATIONS

FREQUENCY RANGE: 256 KHz to 12.5 MHz
STANDARD FREQUENCIES AVAILABLE: 5, 6, 10, 12.352 MHz
INPUT VOLTAGE AND POWER: +15 VDC ±5%
10 Watts maximum at turn on 4.5 Watts typical at room temperature.
RF OUTPUT: TTL compatible 2 loads
FREQUENCY STABILITY VS. TIME:
5×10^{-11} RMS/10 seconds
$\pm 5 \times 10^{-10}$/day at shipment
$\pm 3 \times 10^{-8}$/year
FREQUENCY STABILITY VS. TEMPERATURE:
$\pm 1 \times 10^{-8}$ from 0°C to +60°C
SSB PHASE NOISE (measured in a 1 Hz bandwidth):
@ 10 Hz offset −114 dbc
@ 100 Hz offset −130 dbc
@ 1 KHz offset −135 dbc
@ 10 KHz offset −140 dbc
FREQUENCY ADJUSTMENT: Coarse $>1 \times 10^{-6}$
Fine $>1 \times 10^{-8}$
Resolution $<1 \times 10^{-10}$
FREQUENCY RETRACE:
(After 48 hours off at room temperature)
$<\pm 1 \times 10^{-8}$ of the turn off frequency 1 hour after turn on.
SIZE: 1.6″ x 4.5″ x 2.11″ H.
Numerous modification of the JKXO 130 available — consult factory to discuss your application.

CTS® CORPORATION KNIGHTS CRYSTALS AND OSCILLATORS
FREQUENCY CONTROL DIVISION 400 Reimann Ave., Sandwich, IL 60548 • 815/786-8411 • FAX 815-786-9743

Precision Crystal Oscillators

JKSC-135

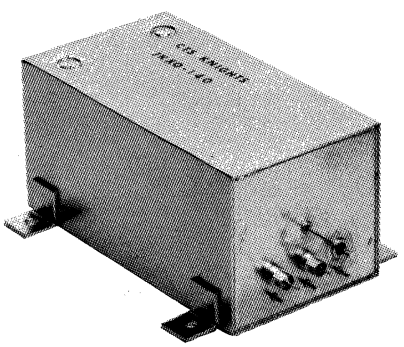


The JKSC-135 is an ultra stable 5 MHz double oven oscillator. Its utilization of a 5 MHz overtone SC cut crystal helps produce excellent long and short term stabilities. The JKSC-135 is well suited for portable battery operated systems.

SPECIFICATIONS

- FREQUENCY: 5.0 MHz
- INPUT VOLTAGE: +15 VDC
- INPUT POWER: 7 Watts maximum at turn on
  2.5 Watts @ 25°C
- FREQUENCY STABILITY:
  VS. TEMPERATURE: $\leq 1 \times 10^{-9}$ peak to peak
  −25°C to +60°C
  VS. TIME: 8×10^{-12} RMS/100 sec.
  $\pm 5 \times 10^{-10}$/day
  $\pm 2 \times 10^{-8}$/year
- OUTPUT: Sine, 1V RMS into 50 ohms
- Size: 5.0″ x 2.38″ x 3.20″ H

JKXO-140



The JKXO-140 is designed to meet the stringent frequency control requirements of modern telecommunications systems. Commonly used telecommunication output frequencies are standard.

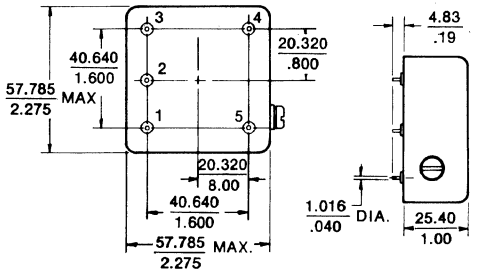
SPECIFICATIONS

CENTER FREQUENCIES (MHz): 5.0, 5.12, 6.176, 10.0, 10.24, 12.352
INPUT VOLTAGE: +24 VDC
INPUT POWER: 8 Watts maximum at turn on
3.5 Watts stabilized @ +25°C

- FREQUENCY STABILITY:
  VS. TEMPERATURE: 3×10^{-10}/15°C (0°C to +55°C)
  VS. TIME: $\pm 3 \times 10^{-10}$/day after 30 days
  $\pm 2 \times 10^{-8}$/year
  $\pm 5 \times 10^{-8}$/20 years
- OUTPUT: 2 TTL loads
- ELECTRICAL ADJUSTMENT: $\pm 5 \times 10^{-8}$ minimum for ±5 VDC
- SIZE: 2.30″ x 4.50″ x 2.10″ H

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Precision Crystal Oscillators



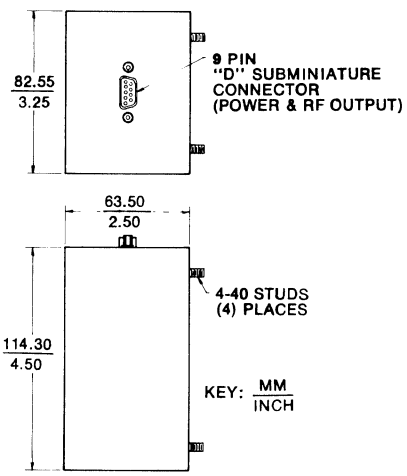
PIN	FUNCTION
1	N/C
2	+5 VDC
3	RF OUTPUT
4	GROUND
5	+15 VDC

JKXO-141

Designed primarily for the telecommunication market, the JKXO-141 series of OCXO's offers a wide range of stabilities. It's small size and low power consumption makes the JKXO-141 an excellent choice for "on card" requirements. Advanced construction techniques are used to make this oscillator the economical solution to your high volume needs.

FREQUENCY		5.0 MHz*		
OUTPUT LEVEL		TTL with fanout of 10 LSTTL loads		
FREQUENCY ADJUSTMENT		Sufficient for 20 Yrs. aging		
OPERATING TEMPERATURE RANGE		0°C to +60°C		
FREQUENCY STABILITY VS.		JKXO-141-1	JKXO-141-2	JKXO-141-3
TEMPERATURE	(0°C −60°C)	8×10^{-8}	3×10^{-8}	3×10^{-9}
	Any 15°C Change	—	6×10^{-9}	1.4×10^{-9}
AGING	Per Day	1×10^{-8}	3×10^{-9}	5×10^{-10}
	Per Year	1.5×10^{-6}	5×10^{-7}	1.5×10^{-7}
	Per 20 Years	3×10^{-6}	1×10^{-6}	5×10^{-7}
SUPPLY VOLTAGE		5×10^{-9}/%	5×10^{-10}/%	5×10^{-11}/%
WARM UP	20 minutes	1×10^{-7}	1×10^{-7}	1×10^{-7}
	8 Hours	—	—	1×10^{-9}
INPUT POWER		+5Vdc +5%	@ 50ma MAX	
		+15Vdc +5%	@500ma MAX (Cold Start)	
			@150ma Hot (35°C) Typ.	
SIZE		2.25" x 2.25" x 1" H		
RELIABILITY		Better than 250,000 Hrs MTBF		
VIBRATION/SHOCK		2 G, 10-500 Hz/30 G, 11ms		

*Consult factory for other frequencies and options



JKSC-142

The JKSC-142 meets the stringent requirements of the "Stratum II" telecommunications specification. The use of a precision over-tone SC Cut crystal along with custom designed double oven results in exceptional stability performance over time and temperature.

OUTPUT FREQUENCY: 5.0 MHz*

DC INPUT REQUIREMENTS:
+15 VDC and +5 VDC (±5% regulated to ±1%)

INPUT POWER REQUIREMENTS (TYPICAL):

	+15VDC	+5VDC
@ turn-on	9 watts	0.18 watts
@ +35°C	3 watts	0.18 watts

OPERATING TEMPERATURE RANGE: 0°C to +60°C

RF OUTPUT CHARACTERISTICS:
Square wave
10 LS TTL Loads
Duty Cycle 45/55 to 55/45

WARM UP (+25°C): Less than $+1 \times 10^{-7}$ in 25 minutes from frequency at one hour on

STABILITY: $\pm 1 \times 10^{-7}$ for 20 years without adjustment
(After Stabilization): $\pm 1 \times 10^{-10}$ per day with any 15°C ambient temperature change and a 0.3% input voltage change

INPUT/OUTPUT CONNECTOR: 9 pin "D" sub-miniature

MTBF: greater than 250,000 hours

SIZE: 4.50" x 3.25" x 2.5" H

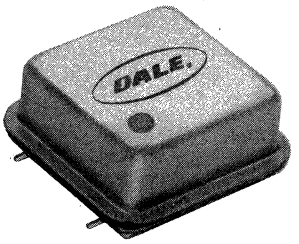
*Consult factory for other frequencies and options

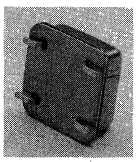
CTS — QUALITY FREQUENCY CONTROL COMPONENTS FOR RELIABLE ELECTRONICS

A COMPANY OF VISHAY DALE

SURFACE MOUNT, HYBRID CRYSTAL CLOCK OSCILLATORS

Model XOSM-52B, 240 Hz to 72 MHz
Model XOSM-52BE, 500 KHz to 40 MHz





ACTUAL SIZE

FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Enabled tri-state output optional
- Hermetically sealed package

ELECTRICAL SPECIFICATIONS

Operating Temperature Range: 0°C to 70°C

Frequency Stability: (Inclusive of calibration tolerance at 25°C temperature change, input voltage change, load change, aging, shock and vibration): ± .01% (± 100 PPM)

Input Voltage (Vdd): + 5.0 ± 0.5 VDC

Input Current: 5 to 50 mA typ. (see graph)

Rise Time: 10nS max. (CMOS levels), 6nS max. (TTL levels)

Fall Time: 10nS max. (CMOS levels), 6nS max. (TTL levels)

Logic '0' Level: 0.1 Vdd max. CMOS, 0.4V max. TTL

Logic '1' Level: 0.9 Vdd min. CMOS, 2.4V min. TTL

Logic '0' Sink Current: 16 mA min.

Logic '1' Source Current: 0.4 mA min.

Output Waveform: Squarewave, HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible, waveform symmetry (0.5 Vdd CMOS or 1.4V TTL levels): 50 ± 10%

Output Load: 50 pF HCMOS or 1-10 TTL loads

Enable Input Voltage: 3.5V min.

Disable Input Voltage: 0.8V max.

Enable Input Current: 10µA max.

Disable Input Current: 150µA min.

MECHANICAL SPECIFICATIONS

Hermetically Sealed Package: Leak rate less than 2 x 10^{-8} atmosphere cc/sec. of helium

Marking Ink: Epoxy, solvent resistant

Solvent Resistance: Isopropyl alcohol, trichloroethane, Freon TMC

Terminal Solderability: Per MIL-STD-202, Method 208C

ENVIRONMENTAL SPECIFICATIONS

Temperature Cycle: -55°C to + 85°C, 3 cycles

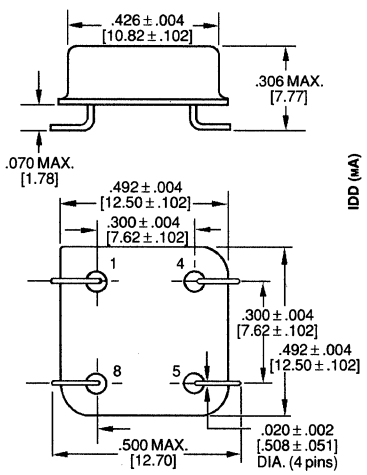
Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane

Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz

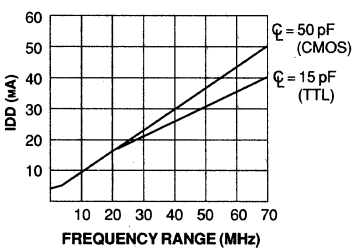
Humidity: 85% relative humidity @ 85°C, 240 hours

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



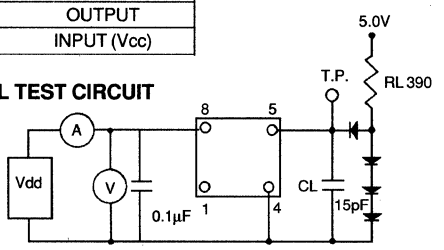
FREQ — IDD CHARACTERISTICS
(TYPICAL @ VDD = 5.0 VDC)



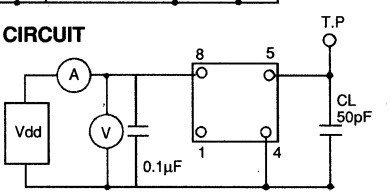
Pin 1 identified by square corner/dot
CAUTION: Unit can be damaged if plugged in backwards

PIN	CONNECTION
1	N.C. or E/D
4	Circuit/Case Ground
5	OUTPUT
8	INPUT (Vcc)

TTL TEST CIRCUIT



CMOS TEST CIRCUIT



CL — To include probe and fixture capacitance

HOW TO ORDER

PART MARKING
– Model
– Frequency
– Pin identifier
– DALE

XOSM-52	B		10
PART NO. CODE	FREQ. ACCURACY	ENABLE/DISABLE FUNCTION	FREQ./MHz
	A = .005% **B** = .01% (Std. Tol.)	**E:** With Function **BLANK:** #1 Pin Open	

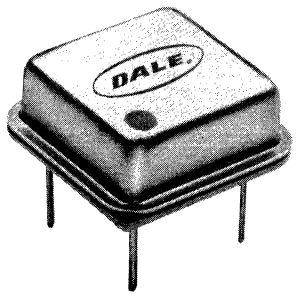
Contact factory for other models, logic families, stabilities and temperature ranges.

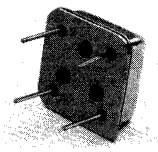
CONTACT: **DALE ELECTRONICS, INC.** 1155 West 23rd St., Tempe, AZ 85282-1883 • Phone (602) 967-7874

A COMPANY OF VISHAY DALE

HYBRID CRYSTAL CLOCK OSCILLATORS

Model XO-52B, 240 Hz to 72 MHz
Model XO-52BE, 500 KHz to 40 MHz





ACTUAL SIZE

FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Enabled tri-state output optional
- Hermetically sealed package

ELECTRICAL SPECIFICATIONS

Operating Temperature Range: 0°C to 70°C

Frequency Stability: (Inclusive of calibration tolerance at 25°C temperature change, input voltage change, load change, aging, shock and vibration): ± .01% (± 100 PPM)

Input Voltage (Vdd): + 5.0 ± 0.5 VDC

Input Current: 5 to 50 mA typ. (see graph)

Rise Time: 10nS max. (CMOS Levels), 6nS max. (TTL levels)

Fall Time: 10nS max. (CMOS Levels), 6nS max. (TTL levels)

Logic '0' Level: 0.1 Vdd max. CMOS, 0.4V max. TTL

Logic '1' Level: 0.9 Vdd min. CMOS, 2.4V min. TTL

Logic '0' Sink Current: 16 mA min.

Logic '1' Source Current: 0.4 mA min.

Output Waveform: Squarewave, HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible, waveform symmetry (0.5 Vdd CMOS or 1.4V TTL Levels): 50 ± 10%

Output Load: 50 pF HCMOS or 1-10 TTL loads

Enable Input Voltage: 3.5V min.

Disable Input Voltage: 0.8V max.

Enable Input Current: 10µA max.

Disable Input Current: 150µA min.

MECHANICAL SPECIFICATIONS

Hermetically Sealed Package: Leak rate less than 2×10^{-8} atmosphere cc/sec. of helium

Marking Ink: Epoxy, solvent resistant

Solvent Resistance: Isopropyl alcohol, trichloroethane, Freon TMC

Terminal Solderability: Per MIL-STD-202, Method 208C

ENVIRONMENTAL SPECIFICATIONS

Temperature Cycle: -55°C to + 85°C, 3 cycles

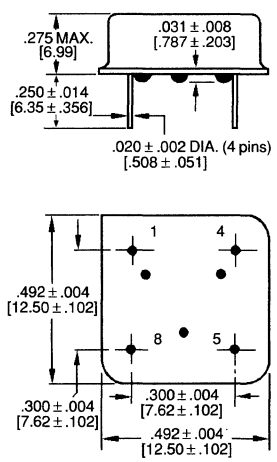
Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane

Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz

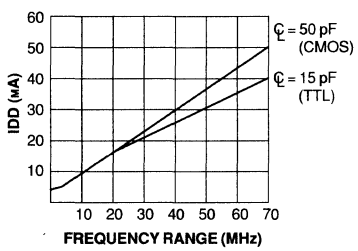
Humidity: 85% relative humidity @ 85°C, 240 hours

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



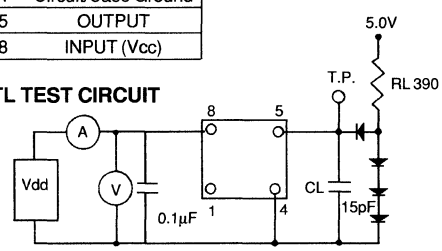
FREQ — IDD CHARACTERISTICS
(TYPICAL @ VDD = 5.0 VDC)



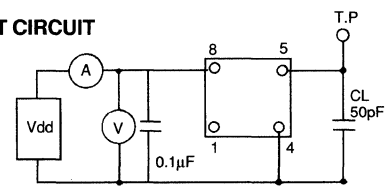
Pin 1 identified by square corner/dot
CAUTION: Unit can be damaged if plugged in backwards

PIN	CONNECTION
1	N.C. or E/D
4	Circuit/Case Ground
5	OUTPUT
8	INPUT (Vcc)

TTL TEST CIRCUIT



CMOS TEST CIRCUIT



CL — To include probe and fixture capacitance

HOW TO ORDER

PART MARKING
- Model
- Frequency
- Pin identifier
- DALE

XO-52	B		10
PART NO. CODE	FREQ. ACCURACY	ENABLE/DISABLE FUNCTION	FREQ./MHz
	A = .005% **B** = .01% (Std. Tol.)	**E:** With Function **BLANK:** #1 Pin Open	

Contact factory for other models, logic families, stabilities and temperature ranges.

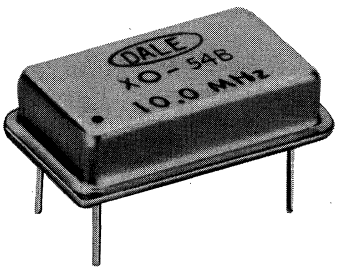
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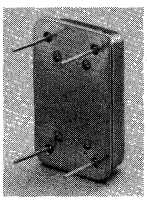
A COMPANY OF VISHAY DALE

HYBRID CRYSTAL CLOCK OSCILLATORS

Model XO-54B, 250 KHz to 72 MHz

Low Profile, Resistance Welded Metal Package





ACTUAL SIZE

FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Enabled tri-state output optional
- Hermetically sealed package

ELECTRICAL SPECIFICATIONS

Operating Temperature Range: 0°C to 70°C

Frequency Stability: (inclusive of calibration tolerance at 25°C temperature change, input voltage change, load change, aging, shock and vibration): ± .01% (± 100 PPM)

Input Voltage (Vdd): + 5.0 ± 0.5 VDC

Input Current: 5 to 50 mA typ. (see graph)

Rise Time: 10nS max. (CMOS levels), 6nS max. (TTL levels)

Fall Time: 10nS max. (CMOS levels), 6nS max. (TTL levels)

Logic '0' Level: 0.1 Vdd max. CMOS, 0.4V max. TTL

Logic '1' Level: 0.9 Vdd min. CMOS, 2.4V min. TTL

Logic '0' Sink Current: 16 mA min.

Logic '1' Source Current: 0.4 mA min.

Output Waveform: Squarewave, HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible, waveform symmetry (0.5 Vdd CMOS or 1.4V TTL levels): 50 ± 10%

Output Load: 50 pF HCMOS or 1-10 TTL loads

Enable Input Voltage: 3.5V min.

Disable Input Voltage: 0.8V max.

Enable Input Current: 10µA max.

Disable Input Current: 150µA min.

MECHANICAL SPECIFICATIONS

Hermetically Sealed Package: Leak rate less than 2 x 10^{-8} atmosphere cc/sec. of helium

Marking Ink: Epoxy, solvent resistant

Solvent Resistance: Isopropyl alcohol, trichloroethane, Freon TMC

Terminal Solderability: Per MIL-STD-202, Method 208C

ENVIRONMENTAL SPECIFICATIONS

Temperature Cycle: -55°C to + 85°C, 3 cycles

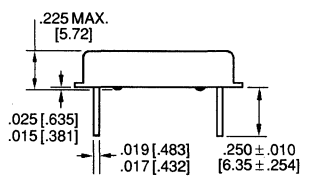
Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane

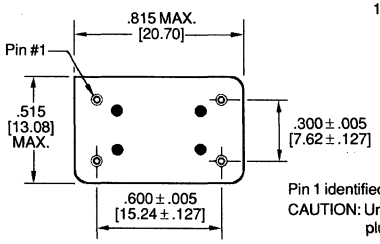
Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz

Humidity: 85% relative humidity @ 85°C, 240 hours

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



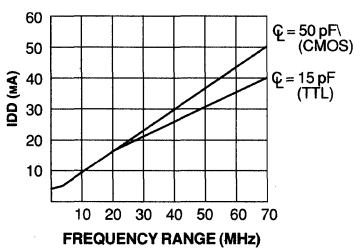


Pin 1 identified by square corner/dot

CAUTION: Unit can be damaged if plugged in backwards

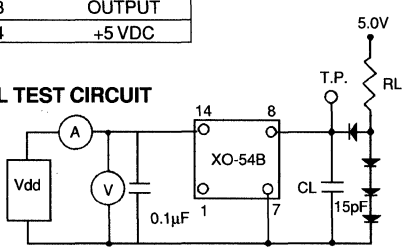
FREQ — IDD CHARACTERISTICS

(TYPICAL @ VDD = 5.0 VDC)

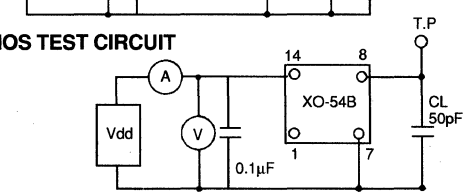


PIN	CONNECTION
1	N.C. or E/D
7	GND
8	OUTPUT
14	+5 VDC

TTL TEST CIRCUIT



CMOS TEST CIRCUIT



CL — To include probe and fixture capacitance

HOW TO ORDER

XO-54	B		10
PART NO. CODE	FREQ. ACCURACY	ENABLE/DISABLE FUNCTION	FREQ./MHz
	A = .005% B = .01% (Std. Tol.) C = .05%	E: With Function BLANK: #1 Pin Open	

PART MARKING

- Model
- Frequency
- Pin identifier
- DALE

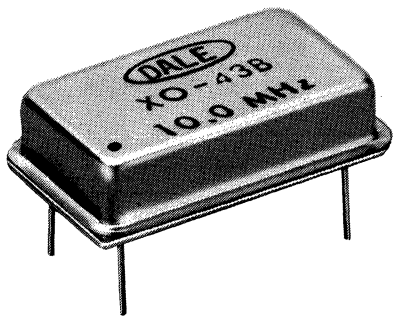
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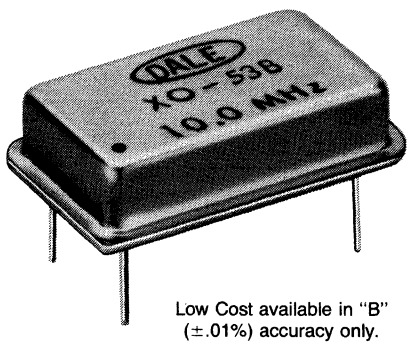
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A COMPANY OF VISHAY DALE

HYBRID CRYSTAL CLOCK OSCILLATOR

MODEL XO-43, XO-53B
250 KHz to 60 MHz





Low Cost available in "B" (±.01%) accuracy only.

FEATURES

- Able to withstand flow soldering
- Wide range of standard frequencies available from stock (listed below)
- Hermetically sealed package
- Low profile .225 inches [5.72] max. seating height
- Metal Case - corrosion resistant and grounded for EMI shielding
- Glass standoffs for spacing from mounting surface

SPECIFICATIONS

Input Voltage: +5 VDC ±0.5V

Frequency Range: 250 KHz to 60 MHz

Operating Temperature Range: 0°C to 70°C

TTL Compatible: Will drive 1-10 TTL Gates

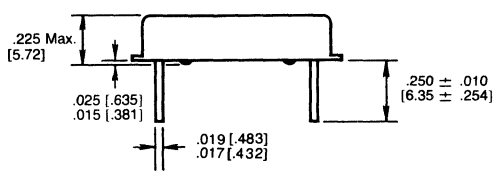
Environmental:
Temperature Cycle: −55°C to +85°C, 3 cycles
Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane
Vibration: .06" D.A., 10-55 Hz, 35 G, 55-2000 Hz
Humidity: 85% relative humidity @ 85°C, 240 Hours

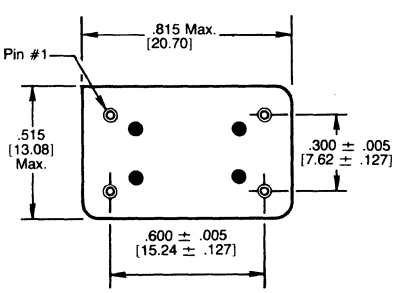
Mechanical:
Hermetically Sealed Package: Leak rate less than 2 x 10^{-8} atmosphere cc/sec. of helium
Marking Ink: Epoxy, solvent resistant
Solvent Resistance: Isopropyl alcohol, Trichloroethane, Freon TMC

Terminal Solderability: Per MIL-STD-202, Method 208C

Package: Cold Rolled Steel (CRS), Nickel-Plated Base with Resistance Welded Stainless Steel Cover

DIMENSIONS
[Numbers in brackets indicate millimeters]





Pin #1 is identified by square corner

STOCKING FREQUENCIES (MHz) "B" accuracy only

1.0	4.0	9.8304*	16.384	30.0
1.2288	4.9152	10.0	18.432	32.0
1.8432*	5.0	12.0	19.6608	40.0
2.0	5.0688	14.31818*	20.0	50.0
2.4576	6.0	16.0	24.0	
3.6864*	8.0	16.257*	25.0	

*XO-53 model only

FREQ. ACCURACY (All Conditions)

A = ±.005% (±50 PPM)
***B** = ±.01% (±100 PPM)
C = ±.05% (±500 PPM)
D = ±.1% (±1000 PPM)
H = ±1%

*XO-53B available in "B" (±.01%) accuracy only.

MODEL	FREQUENCY RANGE	INPUT CURRENT (mA)	WAVEFORM SYMMETRY @ 1.4 VDC	TTL OUTPUT RISE & FALL TIME (From Zero to One Level)	"ZERO" LEVEL SINKING 16 mA	"ONE" LEVEL SOURCING 0.4 mA
XO-43	250 KHz to 3.99 MHz	65 max.	55/45	15 nS max.	0.4 volts max.	2.4 volts min.
	4.0 MHz to 24.99 MHz	40 max.	60/40	10 nS max.	0.4 volts max.	2.4 volts min.
	25.0 MHz to 60.0 MHz	50 max.	60/40	6 nS max.	0.4 volts max.	2.4 volts min.
XO-53B	250 KHz to 3.999 MHz	90 max.	60/40	15 nS max.	0.4 volts max.	2.4 volts min.
	4.0 MHz to 8.999 MHz	40 max.	60/40	15 nS max.	0.4 volts max.	2.4 volts min.
	9.0 MHz to 24.999 MHz	40 max.	60/40	10 nS max.	0.4 volts max.	2.4 volts min.
	25.0 MHz to 31.999 MHz	70 max.	60/40	10 nS max.	0.5 volts max.	2.4 volts min.
	32.0 MHz to 60.0 MHz	70 max.	60/40	6 nS max.	0.5 volts max.	2.4 volts min.

Contact factory for other models, logic families, stabilities and temperature ranges.

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eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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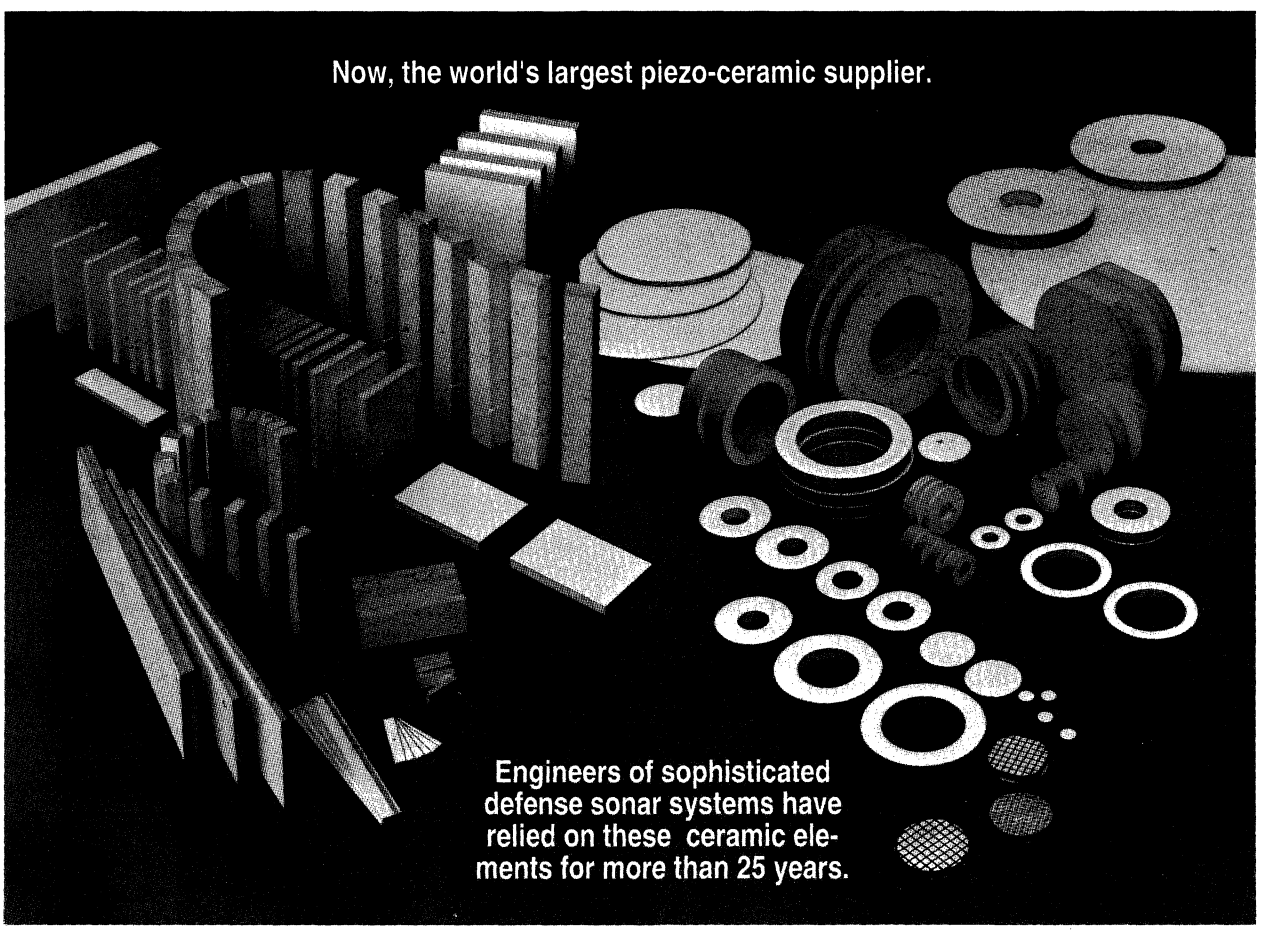
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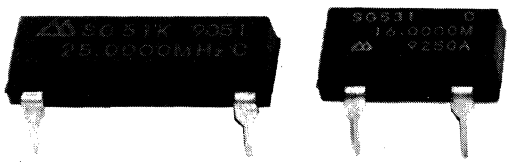
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PLASTIC DIP OSCILLATORS

EPSON

SG-51K-14 PIN DIP
SG-531P-8 PIN DIP



FEATURES

- Low Cost
- Auto Insertable Plastic DIP
- Replaces Metal Can Type
- Available with Tristate Output
- 5ns Rise-Fall Time (TYP)

SPECIFICATIONS

Frequency Range		1.5-55 MHz
Frequency Stability	5v±0.5v (−10°C~+70°C)	C=±100 PPM, B=±50 PPM
Temperature Range	Operating Storage	−10°C~+70°C −55°C~125°C
Input Voltage		5v±0.5v
Current Consumption		35mA MAX, TYP 10mA (12 MHz)
Output (−10°C~+70°C)	Duty Rise & Fall Time Output Load Start Up Time "O" Level "I" Level	40/60 MAX, TYP 45/55 @½V_{DD} or 1.4V LEVEL 8nsec MAX, TYP 5nsec 10TTL Gate/50pF CMOS 10msec MAX, TYP 0.5msec +0.4 V MAX (16 mA) V_{DD}−0.4V MIN (−400μA)
Aging	@25°C, V_{DD}=5V	±5 PPM MAX, TYP±1 PPM

FREQUENCY LIST

Frequency / Model	2.5MHz	25MHz	30MHz	50MHz	66.667MHz
K, P	○	○			
T, PT		○	○		
H, PH			○	○	○

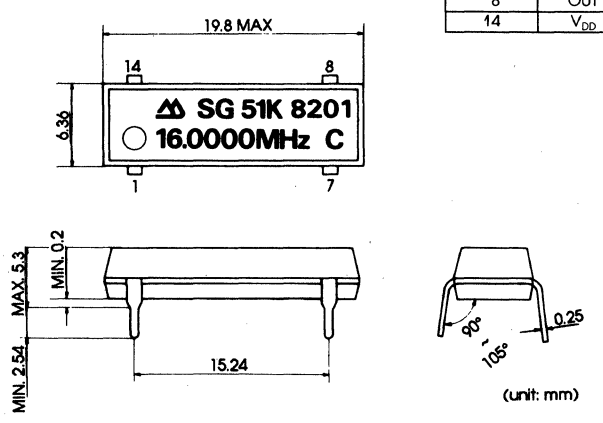
FUNCTION LIST

Model SG-51/531	Terminal		Load Condition		Output Control Function	
	DIP14PIN	DIP 4PIN	C-MOS	TTL-10	OE Function	ST Function
SG-51K/531		○	○	○		
SG-51/531P		○	○	○	○	
SG-51/531PH		○	○		○	
SG-51KT		○		○		
SG-51KH		○	○			
SG-51/531PT		○		○	○	

DIMENSIONS

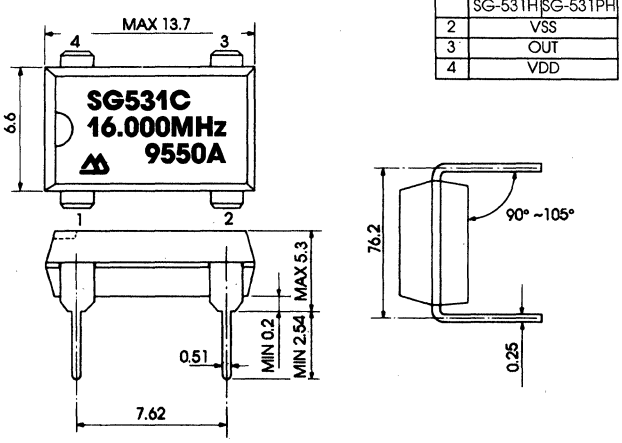
SG-51K

No.	PIN OUT
1	NC
7	GND
8	OUT
14	V_{DD}



SG-531

PIN	CONNECTION	
1	NC SC-531 SG-531T SG-531H	OE SG-531P SG-531PT SG-531PH
2	VSS	
3	OUT	
4	VDD	



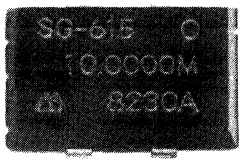
(Unit: MM)

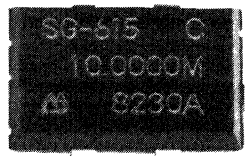
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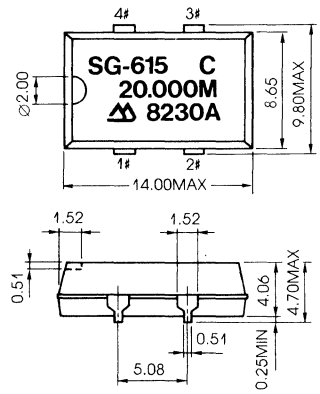
SMD CRYSTAL OSCILLATOR

EPSON

SG-615 OSCILLATOR







NO.	PIN CONNECTION
1#	NC (OE)
2#	GND
3#	OUT
4#	V_{DD}

( ) indicates P type

SPECIFICATIONS (Characteristics)

Item		Symbol	SG-615/615P	SG-615T/615PT		Remarks
			Specifications			
Output frequency range		fo	1.0250MHz to 26.0000MHz	26.0000MHz to 36.0000MHz	36.0001MHz to 50.3500MHz	
Power source voltage	Max. supply voltage	V_{DD}–GND	−0.3V to +7.0V	−0.3V to +7.0V	−0.3V to +7.0V	
	Operating voltage	V_{DD}	5.0V±0.5V	5.0V±0.5V	5.0V±0.5V	
Temperature range	Storage temp.	T_{STG}	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	Stored without Tape & Reel
	Operating temp.	T_{OPR}	−40°C to +85°C	−40°C to +85°C	−10°C to +70°C	
Soldering condition		T_{SOL}	Under 260°C within 10 sec×2 or under 230°C within 3 min.			
Frequency stability		Δf/fo	B: ±50PPM, C: ±100ppm	B: ±50ppm, C: ±100ppm	B: ±50ppm, C: ±100ppm	−10°C to +70°C
Current consumption		Iop	25mA MAX.	35mA MAX.	50mA MAX.	No load condition
Duty		Tw/T	40% to 60% ✻ (45% to 55% ✻1)	40% to 60% ✻✻ (45% to 55% ✻1)	40% to 60% ✻✻	✻ :1.4V or 1/2 V_{DD} level ✻✻ :1.4V level
Output voltage		V_{OH}	V_{DD}−0.4V MIN.	V_{DD}−0.4V MIN.	2.4V MIN.	I_{OH}=−400μA
		V_{OL}	0.4V MAX. ✻	0.4V MAX. ✻	0.4V MAX. ✻	✻: I_{OL}=16mA, ✻✻: I_{OL}=8mA
Output load condition (fan out)	TTL	N	10 TTL (30pF)	10 TTL (30pF) MAX.	5 TTL (15pF) MAX.	( ): Capacitance of circuit
	C-MOS	CL	50pF MAX.			
Output enable input voltage		V_{IH}	2.0V MIN.	2.0V MIN.	2.0V MIN.	
		V_{IL}	0.8V MAX.	0.8V MAX.	0.8V MAX.	
Output disable current		I_{OE}	12mA MAX.	12mA MAX.	25mA MAX.	OE=GND
Output rise time		t_{TLH}	8nsec. MAX.	10nsec. MAX.	6nsec. MAX.	Refer to output waveform chart (page 9)
Output fall time		t_{THL}	8nsec. MAX.	8nsec. MAX.	6nsec. MAX.	

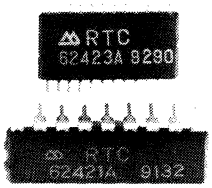
Item		Symbol	SG-615H		SG-615PH	
			Specifications	Remarks	Specifications	Remarks
Output frequency range		fo	30.0000MHz to 55.0000MHz		36.0000MHz to 66.6667MHz	
Power source voltage	Max. supply voltage	V_{DD}–GND	−0.3V to +7.0V		−0.5V to +7.0V	
	Operating voltage	V_{DD}	5.0V±0.5V		5.0V±0.5V ✻2	
Temperature range	Storage temp.	T_{STG}	−55°C to +125°C	Stored without Tape & Reel	−55°C to +125°C	Stored without Tape & Reel
	Operating temp.	T_{OPR}	−40°C to +85°C		−10°C to +70°C	
Soldering condition		T_{SOL}	Under 260°C within 10 sec. ×2 or under 230°C within 3 min.		Under 260°C within 10 sec. ×2 or under 230°C within 3 min.	
Frequency stability		Δf/fo	B: ±50ppm, C: ±100ppm	−10°C to +70°C	C: ±100ppm	−10°C to +70°C
Current consumption		Iop	32mA MAX.	No load condition	35mA MAX.	No load condition
Duty		Tw/T	40% to 60% (45% to 55% ✻1)	1/2 V_{DD} level	40% to 60%	1/2 V_{DD} level
Output voltage		V_{OH}	V_{DD}−0.4V MIN.	I_{OH}=−4mA	V_{DD}−0.4V MIN.	I_{OH}=−4mA
		V_{OL}	0.4V MAX.	I_{OL}=4mA	0.4V MAX.	I_{OL}= 4mA
Output load condition (fan out)	TTL	N				
	C-MOS	CL	50pF MAX.	C-MOS load	50pF MAX.	C-MOS load
Output enable input voltage		V_{IH}			2.0V MIN.	
		V_{IL}			0.8V MAX.	
Output disable current		I_{OE}			20mA MAX.	OE=GND
Output rise time		t_{TLH}	7nsec. MAX.	Refer to output waveform chart (page 9)	7nsec. MAX. ✻2	Over 45 MHz: 5nsec. MAX. Refer to output waveform chart (page 9)
Output fall time		t_{THL}	7nsec. MAX.		7nsec. MAX. ✻2	

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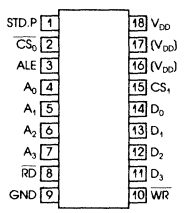
CMOS REAL TIME CLOCK MODULES

EPSON

REAL TIME CLOCK MODULE 62421/62423



TERMINAL CONNECTIONS



FEATURES

- **The built-in quartz oscillator makes regulation unnecessary and allows for easy design**
- Direct bus-compatibility (120 nano second access time).
- ALE INPUT terminal available for 8048, 8051, and 8085 series.
- Incorporates built-in Time (hour, minute, second), and Date (year, month, week, day) counters.
- 11hr/24hr clock switchover function and automatic leap year setting.
- Interrupt masking.
- 30 seconds error adjustment function.
- READ, WRITE, HOLD, STOP, RESET, and CHIP SELECT INPUTS.
- The C-MOS IC boasts low current consumption and features a backup function.
- 18 pin dual in line package.
- Pin and funtion are compatible with the OKI-6242/62X42

SPECIFICATIONS—Operating Range

Item	Symbol	Conditions	Value	Unit
Power Supply	V_{DD}	—	4.5~5.5	V
Data-holding	V_{DH}	—	2.0~5.5	V
Crystal Frequency	fo	Ta=25°C	32.768	kHz
Operating Temp.	T_{OPR}	—	−10~+70	°C

Frequency Characteristics

Item		Conditions	MAX. Value	Unit
Frequency Tolerance	A	Ta=25°C	±10	ppm
	B	V_{DD}=5V	±50	
Frequency Temp. Characteristics		(−10~+70°C at 25°C=0ppm)	+10/−120	ppm
Aging		V_{DD}=5V Ta=25°C First year	±5	ppm/year

Note) Data-holding voltage guarantees clock operations, though it does not guarantee operations outside the IC and data input/output.

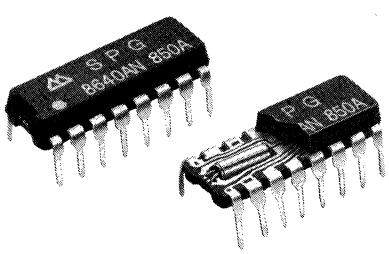
Electrical Characteristics

Item	Symbol	Conditions	MIN	TYP	MAX	UNIT	Terminal
H. Input Voltage	V_{IH1}	—	2.2	—	—		All input except CS_1
L. Input Voltage	V_{IL1}	—	—	—	0.8		
Input Leak 1	I_{LK1}	$V_I=V_{DD}$/0V	—	—	1/−1	μA	Inputs except D_0~D_3
Input Leak 2	I_{LK2}		—	—	10/−10		D_0~D_3
L. Output Voltage 1	V_{OL1}	I_{OL}=2.5mA	—	—	0.4	V	D_0~D_3
H. Output Voltage	V_{OH}	I_{OH}=−400μA	2.4	—	—		
L. Output Voltage 2	V_{OL2}	I_{OL}=2.5mA	—	—	0.4	V	STD-P
Off Leak Current	I_{OFFLK}	$V_I=V_{DD}$/0V	—	—	10	μA	
Input Capacitance 1	C_{I1}	Input freq. 1MHz	—	5	—	pF	Inputs except D_0~D_3
Input Capacitance 2	C_{I2}		—	5	—		D_0~D_3, STD.P
Current Consumption 1	I_{DD1}	CS_1=0V, V_{DD}=5V	—	—	30	μA	V_{DD}
Current Consumption 2	I_{DD2}	CS_1=0V, V_{DD}=2V	—	—	10		
H. Input Voltage 2	V_{IH2}	V_{DD}=2~5.5V	4/5V_{DD}	—	—	V	CS_1
L. Input Voltage 2	V_{IL2}		—	—	1/5V_{DD}		

(V_{DD}=5V±0.5V, Ta=−10~70°C

Note
- This device is made with C-MOS circuitry. Pleast take precautions to prevent damage due to static discharge.
- We recommend placing a 0.1μF capacitor and a 1 to 10μF capacitor next to RTC-72421 to protect agains power line ripple. And start-up time of input voltage is greater than 1msec.
- Standard ultrasonic cleaning can be used on the RTC-62421, but please exercise caution in choosing a cleaning solution as the RTC-72421 could be damaged.

PROGRAMMABLE STANDARD PULSE GENERATOR SPG 8600 SERIES

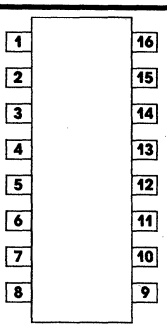


SPG 8600 Series high precision, time-base frequency generators contain a miniature quartz crystal element integrated with a CMOS monolithic chip. They provide low power consumption, high quality and low cost for a broad range of OEM applications.

TERMINAL CONNECTIONS

No.	Pin Out	No.	Pin Out
1	NC	16	V_{DD}
2	CTL_3	15	NC
3	CTL_2	14	RESET
4	CTL_1	13	NC (CSEL)
5	CTL_6	12	NC (EXC)
6	CTL_5	11	FOUT
7	CTL_4	10	TEST
8	V_{SS}	9	OUT

NC: Not connected.



SPECIFICATIONS

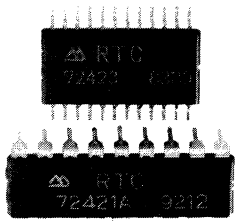
UNIT	RANGE
8640AN	600 KHz to 0.0005 Hz
8640BN	1 MHz to 1/120 Hz
8650A	60 KHz to 0.0005 Hz
8650B	60 KHz to 1/1200 Hz
8650E	32.768 KHz to 0.00027 Hz
8651A	1 MHz to 0.0005 Hz
8651B	100 KHz to 1/1200 Hz
8651E	32.768 KHz to 0.00027 Hz

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CMOS REAL TIME CLOCK MODULES

EPSON

REAL TIME CLOCK MODULE RTC-72421/72423



FEATURES

- **The built-in quartz oscillator makes regulation unnecessary and allows for easy design.**
- Direct bus-compatibility (120 nano second access time).
- ALE INPUT terminal available for 8048, 8051, and 8085 series.
- Incorporates built-in Time (hour, minute, second), and Date (year, month, week, day) counters.
- 12hr/24hr clock switchover function and automatic leap year setting.
- Interrupt masking.
- 30 seconds error adjustment function.
- READ, WRITE, HOLD, STOP, RESET, and CHIP SELECT INPUTS.
- The C-MOS IC boasts low current consumption and features a backup function.
- 18 pin dual in line package.
- Pin and function are compatible with the SMC 5242C.

TERMINAL CONNECTIONS



SPECIFICATIONS — Operating Range

Item	Symbol	Conditions	Value	Unit
Power Supply	V_{DD}	—	4.5 ~ 5.5	V
Data-holding	V_{DH}	—	2.0 ~ 5.5	V
Crystal Frequency	fo	Ta = 25°C	32.768	kHz
Operating Temp.	T_{OPR}	—	−10 ~ +70	°C

Note) Data-holding voltage guarantees clock operations, though it does not guarantee operations outside the IC and data input/output.

Frequency Characteristics

Item		Conditions	MAX. Value	Unit
Frequency Tolerance	A	Ta = 25°C	±10	ppm
	B	V_{DD} = 5V	±50	
Frequency Temp. Characteristics		(−10 ~ + 70°C at 25°C = 0ppm)	+10/−120	ppm
Aging		V_{DD} = 5V Ta = 25°C First year	±5	ppm/year

Electrical Characteristics

Item	Symbol	Conditions	MIN	TYP	MAX	UNIT	Terminal
H. Input Voltage	V_{IH1}	—	2.2	—	—	V	All inputs except CS_1
L. Input Voltage	V_{IL1}	—	—	—	0.8		
Input Leak 1.	I_{LK1}	$V_I = V_{DD}$/OV	—	—	1/−1	μA	Inputs except $D_0 \sim D_3$
Input Leak 2.	I_{LK2}		—	—	10/−10		$D_0 \sim D_3$
L. Output Voltage 1	V_{OL1}	I_{OL} = 2.5mA	—	—	0.4	V	$D_0 \sim D_3$
H. Output Voltage	V_{OH}	I_{OH} = −400μA	2.4	—	—		
L. Output Voltage 2	V_{OL2}	I_{OL} = 2.5mA	—	—	0.4	V	STD.P
Off Leak Current	I_{OFFLK}	$V_I = V_{DD}$/OV	—	—	10	μA	
Input Capacitance 1	C_{I1}	Input freq. 1MHz	—	10	—	pF	Inputs except $D_0 \sim D_3$
Input Capacitance 2	C_{I2}		—	20	—		$D_0 \sim D_3$, STD.P
Current Consumption 1	I_{DD1}	CS_1 = 0V, V_{DD} = 5V	—	—	10	μA	V_{DD}
Current Consumption 2	I_{DD2}	CS_1 = 0V, V_{DD} = 2V	—	—	5		
H. Input Voltage 2	V_{IH2}	V_{DD} = 2 ~ 5.5V	$\frac{4}{5} V_{DD}$	—	—	V	CS_1
L. Input Voltage 2	V_{IL2}		—	—	$\frac{1}{5} V_{DD}$		

(V_{DD} = 5V ± 0.5V, Ta = −10 ~ 70°C)

Note • This device is made with C-MOS circuitry. Please take precautions to prevent damage due to static discharge.
• We recommend placing a 0.1μF capacitor and a 1 to 10μF capacitor next to RTC-72421 to protect against power line ripple. And start-up time of input voltage is greater than 1msec.
• Standard ultrasonic cleaning can be used on the RTC-72421, but please exercise caution in choosing a cleaning solution as the RTC-72421 could be damaged.

8-bit REAL TIME CLOCK MODULE RTC-64611/64613

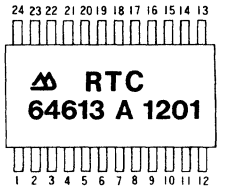
- Built-in quartz crystal allows adjustment-free and efficient operation
- 8-bit data bus and high speed access. (85nsec. MAX.)
- Provided with the same interface as of S RAM and battery backup function
- Interruption of alarm of sec.—day and day of week and carry interruption
- Reference signal selectable in a range of 1Hz–64Hz (binary)
- Leap year automatically adjustable. (Gregorian calendar)
- With 1Hz ouput terminal
- provided with START/STOP 30 sec. ADJUST function
- RTC-64613: Almost same mounting method as of universal type SMD IC

4-bit MULTIFUNCTIONAL REAL TIME CLOCK MODULE RTC-63421/63421M/63423

- Built-in quartz crystal allows adjustment-free and efficient operation
- Alarm interruption of sec.—month and day of week possible
- Provided with microcomputer compatible bus interface
- Standard signal output selectable in a range of 10min. to 1024Hz
- Either sec.-hour and day of week or sec.-year and day of week is selectable
- Reference area of time/alarm register is settable. Provided with RAM bits (marked on "✻" which is shown resister table)
- Provided with START/STOP 30 sec. adjusting function
- Almost the same mounting method (RTC-63423) as of universal type SMD IC

Model	Applicable CPU
RTC-63421	Intel bus system
RTC-6342IM	Motorola bus system
RTC-63423	Motel bus system

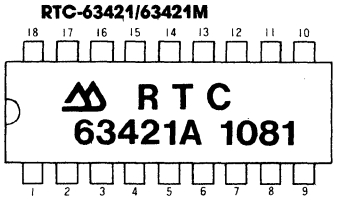
Terminal Connection



1. GND
2. H-START $\overline{STOP}$
3. $\overline{IRQ}$
4. 1Hz
5. A_3
6. A_2
7. A_1
8. A_0
9. I/O_1
10. I/O_2
11. I/O_3
12. GND
24. V_{DD}
23. (NC)
22. (NC)
21. NC
20. $\overline{WE}$
19. $\overline{OE}$
18. $\overline{CS}$
17. I/O_8
16. I/O_7
15. I/O_6
14. I/O_5
13. I/O_4

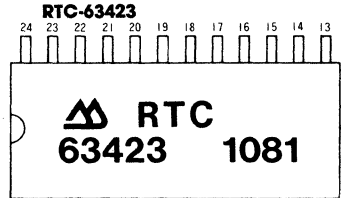
(NC) is to be same level of V_{DD}
Do not connect NC terminals to any external terminals.

RTC-63421/63421M



1. INTERRUPT
2. $\overline{CS_0}$
3. ALE
4. A_0
5. A_1
6. A_2
7. A_3
8. (E)$\overline{RD}$
9. GND
18. V_{DD}
17. (NC)
16. (NC)
15. CS_1
14. D_0
13. D_1
12. D_2
11. D_3
10. $\overline{WR}$(R/$\overline{W}$*)

RTC-63423



1. INTERRUPT
2. CS_0
3. ALARM
4. ALE
5. A_0
6. 30secAJS
7. A_1
8. 68/$\overline{80}$
9. A_2
10. A_3
11. (E)$\overline{RD}$
12. GND
24. V_{DD}
23. (NC)
22. (NC)
21. NC
20. STOP/$\overline{START}$
19. CS_1
18. D_0
17. 1Hz
16. D_1
15. D_2
14. D_3
13. $\overline{WR}$(R/$\overline{W}$)

(NC) is to be same level of V_{DD} * = 63421M
Do not connect NC terminals to any external terminals.

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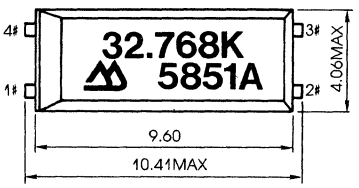
SMD CRYSTALS

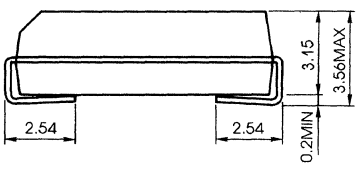
EPSON

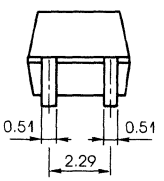
MC-405-CRYSTAL











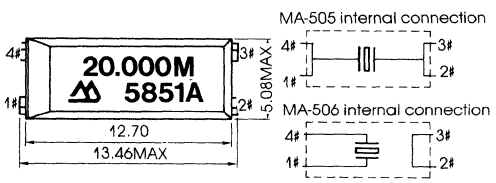
SPECIFICATIONS (Characteristics)

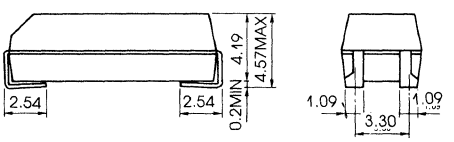
Item		Symbol	Specifications					Remarks
Nominal frequency		f	32.768KHz	Over 20KHz Under 99KHz	Over 100KHz Under 200KHz	Over 200KHz Under 400KHz	Over 400KHz Below 600KHz	Please consult us
Temperature range	Storage temperature	T_{STG}	−55°C ~ +125°C					Stored without Tape & Reel
	Operating temperature	T_{OPR}	−40°C ~ +85°C					
Maximum drive level		GL	1.0μW MAX.					
Soldering condition		T_{SOL}	Two times at under 260°C within 10 sec. or under 230°C within 3 min.					
Frequency tolerance (standard)		Δf/f	±20ppm or ±50ppm	±100ppm				Ta=25°C

MA-505/506-CRYSTAL









SPECIFICATIONS (Characteristics)

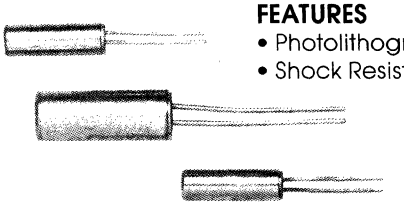
Item		Symbol	Specifications	Remarks
Nominal Frequency Range		f	4.0MHz ~ 26.0MHz	Fundamental mode ※1
			26.0MHz ~ 60.0MHz	3rd overtone mode
Temperature range	Storage temperature	T_{STG}	−55°C ~ +125°C	Stored as naked product after unpacking
	Operating temperature	T_{OPR}	−20°C ~ +70°C	
Drive level	Maximum drive level	GL	2mW MAX.	Only crystal oscillation is guaranteed
	Recommended level	DL	10μW ~ 100μW TYP.	
Soldering condition		T_{SOL}	Two times at less than 260°C within 10 sec. or under 230°C within 3 min.	
Frequency tolerance (standard)		Δf/f	±50ppm	Ta=25°C, DL=100μW
Frequency temperature characteristics			Below: 5.3MHz: ±50ppm	−20°C ~ +70°C, DL=100μW
			Over 5.5MHz: ±30ppm	−20°C ~ +70°C, DL=100μW
Load capacitance		CL	Fundamental: 10pF ~ ∞, Overtone: 5pF ~ ∞	According to customer's requirement

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CRYSTALS

EPSON

C-TYPE



FEATURES
- Photolithography Process
- Shock Resistant

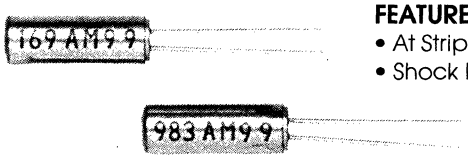
C2-TYPE

Item	Unit	Frequency *30KHz ~ 99KHz	100KHz ~ 199KHz	200KHz ~ 399KHz
Frequency Tolerance (25°C)	ppm	±100		
Series Resistance	KΩ	32 ~ 15	12 ~ 8	8 ~ 4
Motional Capacitance	fF	2.1 ~ 0.9	0.9 ~ 0.6	1.2 ~ 0.9
Shunt Capacitance	pF	1.0 ~ 0.8	0.9 ~ 0.6	1.2 ~ 1.0
Drive Level	µW	MAX 1.0		
Turn over Temperature	°C	25±5		25±10
Temperature Coefficient	ppm/°C²	MAX −0.04		
Aging (25°C)	ppm/Year	MAX ±5		

Item	Unit	Frequency 400KHz ~ 599KHz	768KHz ~ 1 MHz	
Frequency Tolerance (25°C)	ppm	±100		
Series Resistance	KΩ	6 ~ 4	3	
Motional Capacitance	fF	0.9 ~ 0.8	1.0	
Shunt Capacitance	pF	1.0 ~ 0.9	0.5	
Drive Level	µW	MAX 1.0	MAX 10	
Turn over Temperature	°C	25±15		
Temperature Coefficient	ppm/°C²	MAX −0.04		
Aging (25°C)	ppm/Year	MAX ±5		

*Below 30kHz is available on request.

CA-301

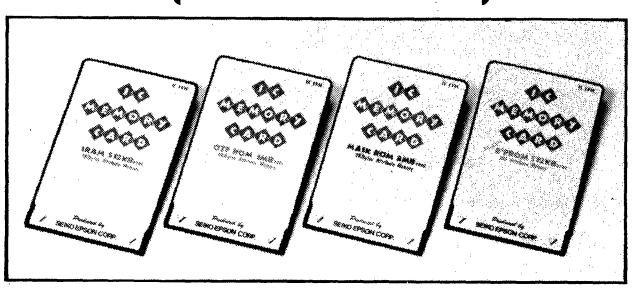


FEATURES
- At Strip Cyrstal
- Shock Resistant

CA-301

Item	Unit	Specification	Remarks
Frequency	MHz	4 ~ 25 25 ~ 64MHz	Fundamental 3rd overtone
Load Capacitance	pF	Standard grade 18pF	Load capacitances is available on request
Frequency Tolerance	ppm	±30	25°C±3
Temperature Characteristics	ppm	±30	−20°C ~ +70°C
Series Resistance	Ω	It depends on the below-mentioned list	−20°C ~ +70°C
Shunt Capacitance	pF	MAX.5	
Aging	ppm/Year	±5	@25°C
Shock Resistance	ppm	±10	75cm x 3 times drop on to a hard wooden board.
Operating Temperature	°C	−20°C ~ +70°C	
Storage Temperature	°C	−40°C ~ +85°C	
Drive Level	µW	100µW	

IC CARDS (JEIDA—CARD EDGE)

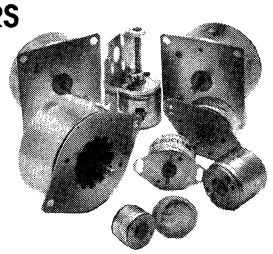


Epson offers a selection of high-quality, low cost IC cards in standard configurations. These include:

SRAM Card with Battery . . . . . (8 ~ 1024 K Bytes)
One Time PROM Card . . . . . (8 ~ 1024 K Bytes)
Mask ROM Card . . . . . (8 ~ 2048 K Bytes)
EEPROM Card . . . . . (8 ~ 32 K Bytes)
Flash EEPROM Card . . . . . (64K ~ 1024 K Bytes)

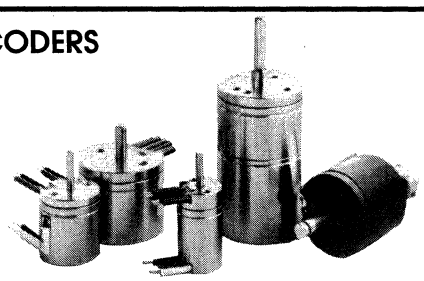
A shutter mechanism protects the terminals. Card and connector are polarized to prevent incorrect insertion. A Write Protect Switch protects the SRAM card from overwriting the recorded data, and an internal, replaceable battery preserves the data.

STEPPING MOTORS



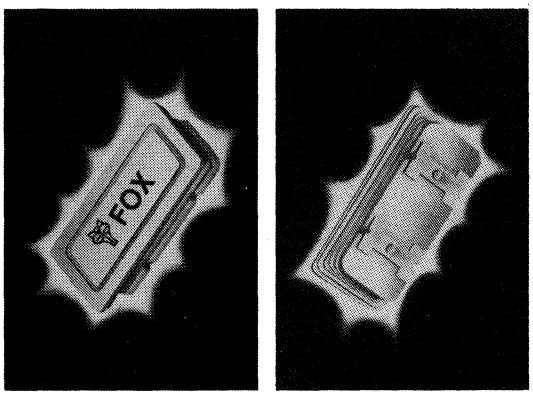
Epson's stepping motors, in sizes from 15mm to 55 mm, afford exceedingly high output torque, rotor design flexibility and operating reliability. Three series are offered. STP Series comes in standard, high resolution and thin configurations. SST Series provides a lead screw.

ENCODERS



Epson's micro optical encoders combine high density resolution in a ultra compact design to deliver reliable products to fit your encoding needs. They are available in 3 sizes 9, 12, 18mm and with sine and square wave.

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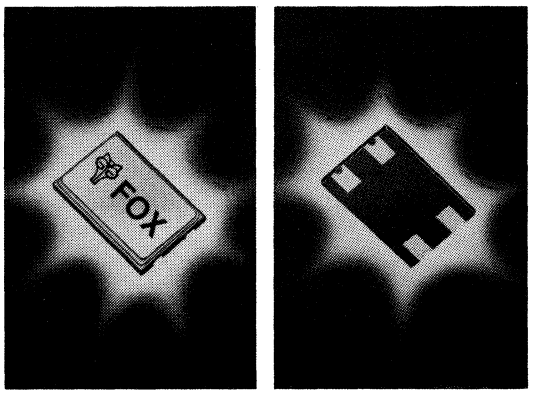


NEW! SMALLER

SMD CRYSTAL

FOX FC

FEATURES
New Ceramic Surface Mount Crystal
Lower Profile - Reduced Package Size
High Reliability - Competitive Pricing
Compatible with existing SMD Designs
Tape & Reel

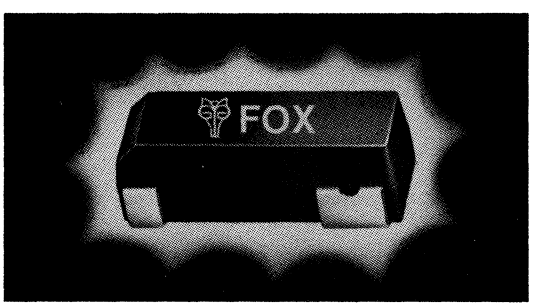


NEW! 16 to 110MHz

SMD CRYSTAL

FOX FD

FEATURES
Highest Frequency SMD Crystal
Lowest Profile SMD Crystal
Smallest SMD Crystal Package
High Reliability - Tight Tolerance
Tape & Reel

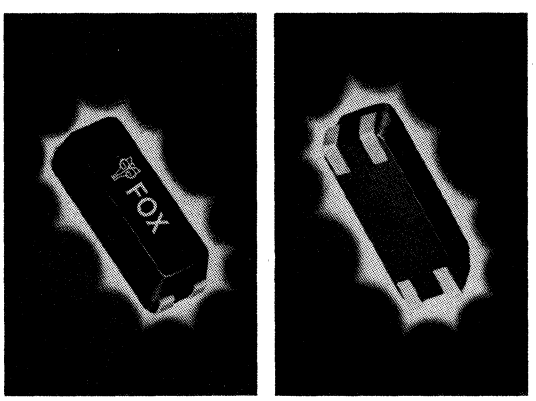


3.5 - 50MHz

SMD CRYSTAL

FOX FPX

FEATURES
Surface Mount "AT Strip" Crystal
Low Profile SMD Crystal
High Reliability - Competitive Pricing
Compatible with existing SMD Designs
Tape & Reel



32.768kHz

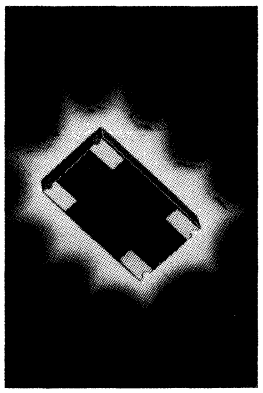
SMD CRYSTAL

FOX FSM327

FEATURES
Surface Mount Tuning Fork Crystal
Low Profile SMD Crystal
For Accurate Timing - of Clocks and Calendars
Tape & Reel

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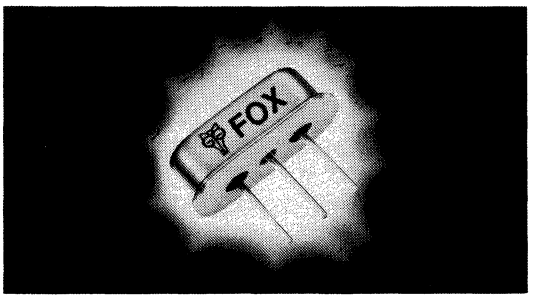
NEW!

SMALLER SMD OSCILLATOR FOX F3160

FEATURES

New Ceramic Surface Mount Clock Oscillator
Lower Profile - Reduced Package Size
50pF Load for "386" Applications

FOX FSO Model SMD Oscillator
also available from stock

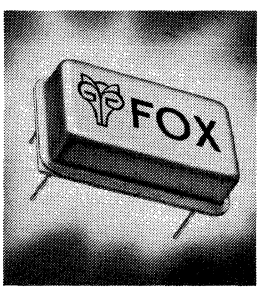


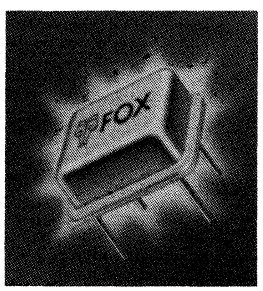
NEW SMALLEST CLOCK OSCILLATOR FOX F3240 & F3260

FOR NOTEBOOK OR PALM TOP COMPUTERS
OR
ANY SMALL PACKAGE APPLICATION

FEATURES

Industry Compatible Pinout
Gold Flashed Leads
F3240 50pF
F3260 45/55 Symmetry

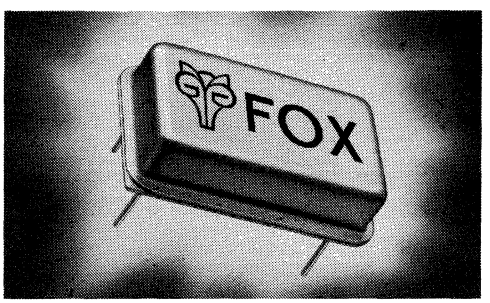




FOX F3000/F3020 OSCILLATOR FOR 386 & 486 APPLICATIONS

FEATURES 1.5 - 70MHz

10 TTL OR 50pF
Tri-State Enable/Disable
14 Pin or 8 Pin Packages
Low Power Consumption



TTL TRI-STATE OSCILLATOR FOX F3120

FEATURES 4 - 50MHz

True TTL Tri-State
10 TTL Gates
Low Noise
40/60 Symmetry
14 Pin Package

Introducing a New Design

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FOX CRYSTALS

FD -- Surface Mount 16 - 100MHz

FC -- Surface Mount 10 -50MHz

FSM-327 -- Surface Mount 32.768kHz

FPX-SM -- Surface Mount 3.579545 - 50MHz

HC49M -- 3.579545 - 75MHz - SM Option HC49MG-2

HC49S -- 3.2 - 50MHz - SM Option HC49SG-2

HC49U -- 1.5 - 175MHz - SM Option HC49U-W

NC26 -- Tuning Fork 32.768kHz

NC26S -- Tuning Fork 20kHz to 1MHz

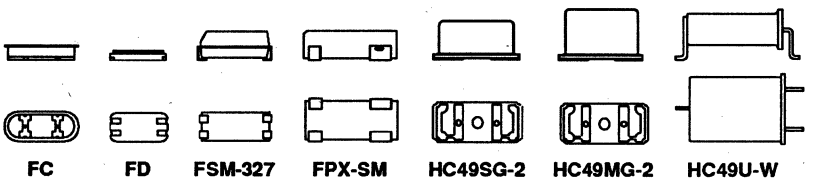
NC38 -- Tuning Fork 32.768kHz

FX-3 -- 3.2 - 50MHz

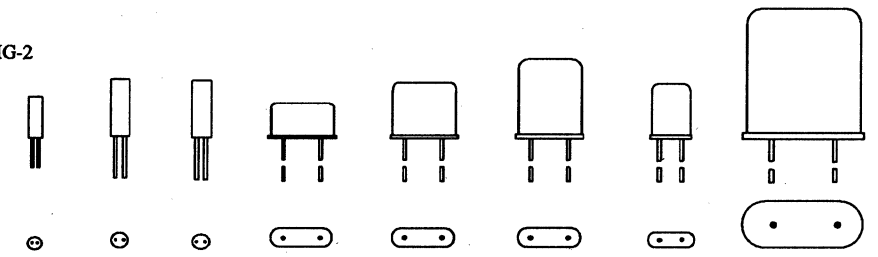
HC80 -- 1 - 1.048576MHz, 3.579545 - 175MHz

HC51U -- 245kHz - 4.8MHz

Surface Mount at Fox



FC FD FSM-327 FPX-SM HC49SG-2 HC49MG-2 HC49U-W



NC26 NC26S NC38 FX3 HC49S HC49M HC49U HC50U HC18U HC25U HC80 HC51U HC33U HC6U

FOX OSCILLATORS

F1100H -- TTL 4 - 80MHz 14 Pin Metal Pkg

F1100E -- TTL 1.0 - 65MHz 14 Pin Metal Pkg

F3120 -- TTL Tri-State 4 - 50MHz 14 Pin Metal Pkg

P5C -- HCMOS & TTL 1.5 - 55MHz
4 & 14 Pin Plastic Pkg

F5C -- HCMOS 4 - 50MHz 14 Pin Metal Pkg

F5C-2 -- HCMOS Tri-State '1' Enable/Disable
14 Pin Metal Pkg 1.5 - 50MHz

F5C-3 -- HCMOS Tri-State '0' Enable/Disable
14 Pin Metal Pkg .5 - 50MHz

F5C-5 -- HCMOS Gate '1' Enable/Disable
14 Pin Metal Pkg 1 - 50MHz

F5C-7 -- HCMOS Independent Dual
14 Pin Metal Pkg 1.5 - 50MHz

F3000 / F3020 -- HCMOS / TTL Tri-State
Enable/Disable -- Heavy Load 1.5 -70MHz
14 Pin Metal Pkg & Half Size 8 Pin Metal Pkg

H5C Series -- HCMOS 1 - 50MHz
Half Size 8 Pin Metal Pkg

FSO -- HCMOS & TTL 1.5 - 55MHz
Surface Mount Plastic Pkg

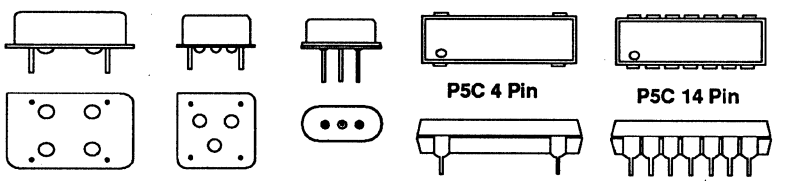
F3160/F3165 -- 1.8432 - 70MHz Surface Mount Ceramic Pkg

F3240/F3260 -- 1.8432 - 70MHz Smallest Clock Oscillator

F5L -- ECL 30 - 200MHz 14 Pin Metal Pkg

VCXO-B -- Voltage Controlled 1 - 24MHz 14 Pin Metal Pkg

Surface Mount at Fox



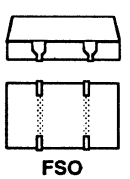
F1100H F1100E F3120 F5C Series F3000 F5L VCXO

H5C Series F3020

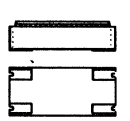
F3240 F3260

P5C 4 Pin

P5C 14 Pin



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F3160 & F3165

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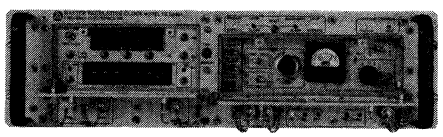
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From the basic quartz crystal, to complete time and frequency systems.

Timekeeper for Outer Space... Ask anyone who knows anything about this nation's deep space probe and satellite programs to mention any 10. Our instruments or equipment are aboard at least 8.

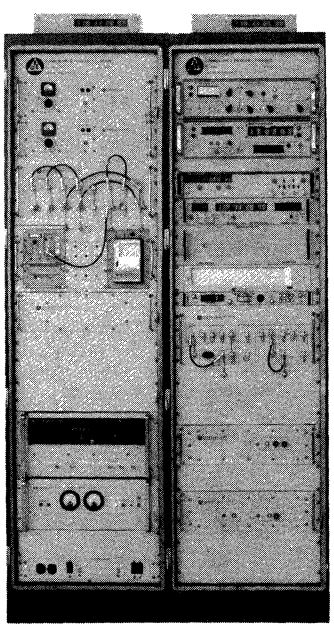
Hybridized Cesium Beam Primary Frequency Standard

Model FE-5440A, Option FH
Military Nomenclature (0-1824A/U)



High Reliability, Militarized Cesium Beam Frequency Standards for aerospace, shipboard, laboratory and mobile applications.

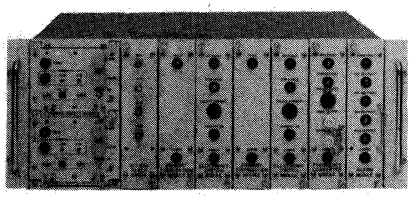
Systems Capability



Communication Time and Frequency Standards
Model FE-5054A
(CTFS)

Frequency Distribution Systems

Models FE-798A/FE-799A



A militarized, high reliability RF distribution system for satellite ground stations, and shipboard, mobile, and laboratory applications.

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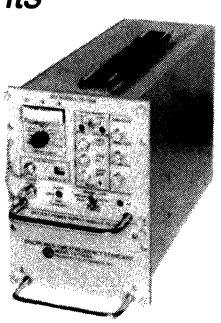
- MIL-E-5400, Class II
- Fast Warm-up
- MIL-SPEC Power
- Low g Sensitivity

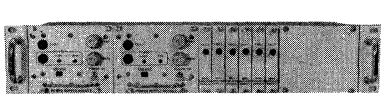
Model FE-5600A



Instruments

Disciplined Time Frequency Standard
Model FE-1050A
(AN/URQ-23)





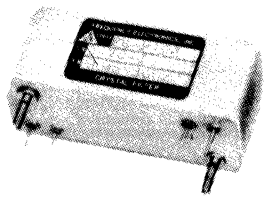
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Model FE-7914A

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MCXO

Microcomputer Compensated Crystal Oscillator



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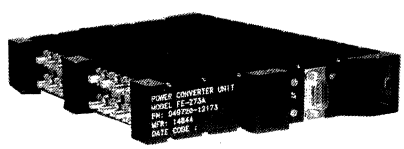
- Power as low as 20 mW
- Stability to 3 x 10^{-8}
- Operating Temp. −55°C to +85°C

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Frequency synthesis, processing, and distribution of low noise reference signals have been applied to the development of high reliability hardware for satellite applications. Precision oscillators and distribution equipment configured as redundant assemblies are presently being used on a wide variety of space programs. FEI's high reliability hybrid techniques result in light weight and low power consumption.

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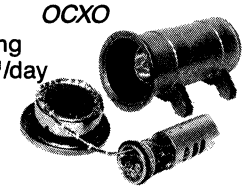


- S Level
- 1 W-100W Output Power
- Multiple Output Capability
- Custom Designs

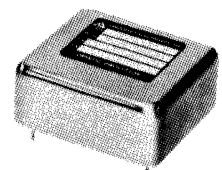
High Reliability Crystal Oscillators

OCXO

Daily Aging
<1 x 10^{-11}/day

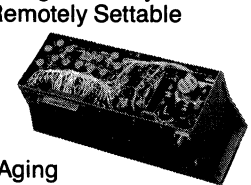


TCXO and TCVCXO



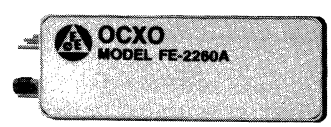
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High Stability
Remotely Settable



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< 2 to 3x10^{-11}/day

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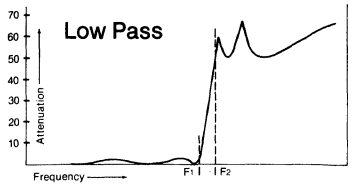
Filters and Networks

LC Filters • Crystal Filters Delay Lines • Discriminators from FSN FREQUENCY SELECTIVE NETWORKS, INC.

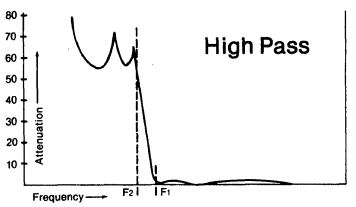
FSN is a filter and network house. We are strong in engineering. We are able and willing to work with system designers to apply state-of-the-art filter technology to optimize not just the filter but the application of filters to help our customers optimize their systems.

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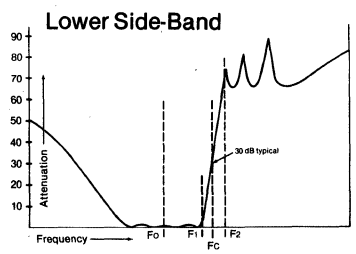
We also design and manufacture such other networks as delay lines, attenuators, phase and delay equalizers, discriminators, matching networks, etc.



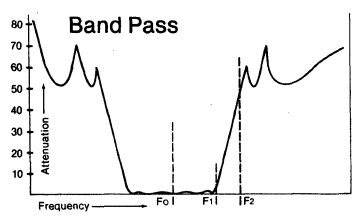
Shape Factor = $\frac{F_2}{F_1}$ As Low as 1.03



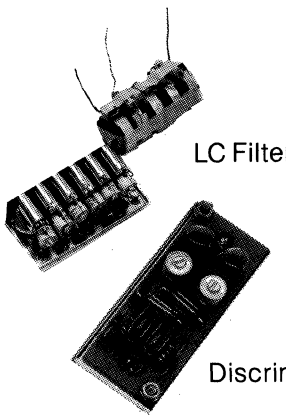
Shape Factor = $\frac{F_1}{F_2}$ As Low as 1.03

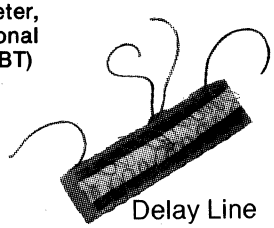


Shape Factor = $\frac{F_2 - F_0}{F_1 - F_0}$ As Low as 1.05

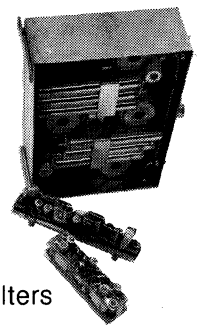


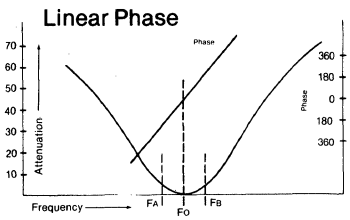
Shape Factor = $\frac{F_2 - F_0}{F_1 - F_0}$ As Low as 1.05



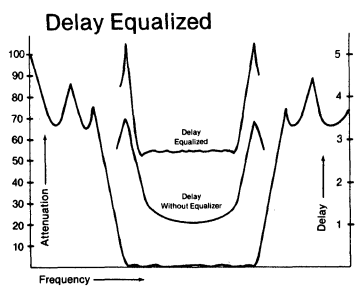


Representative Network Packages

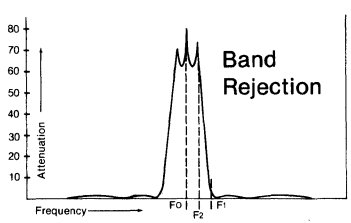




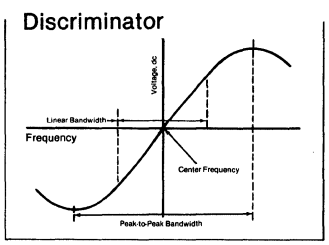
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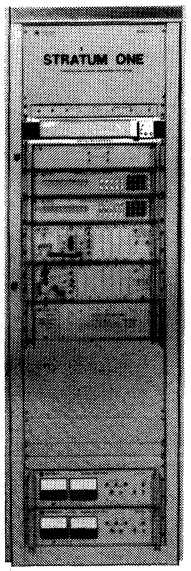
NEW

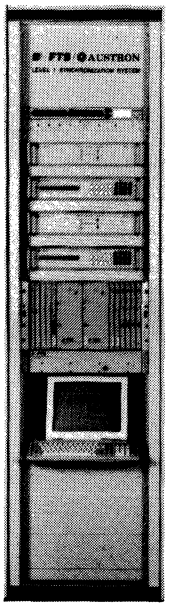
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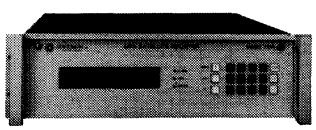




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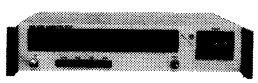




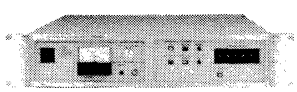
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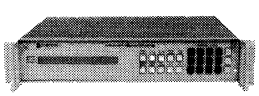




TRANSFER STANDARDS

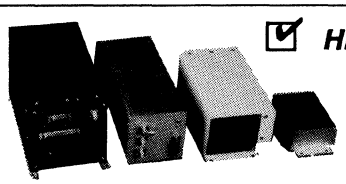


- Cesium
- Rubidium
- Crystal



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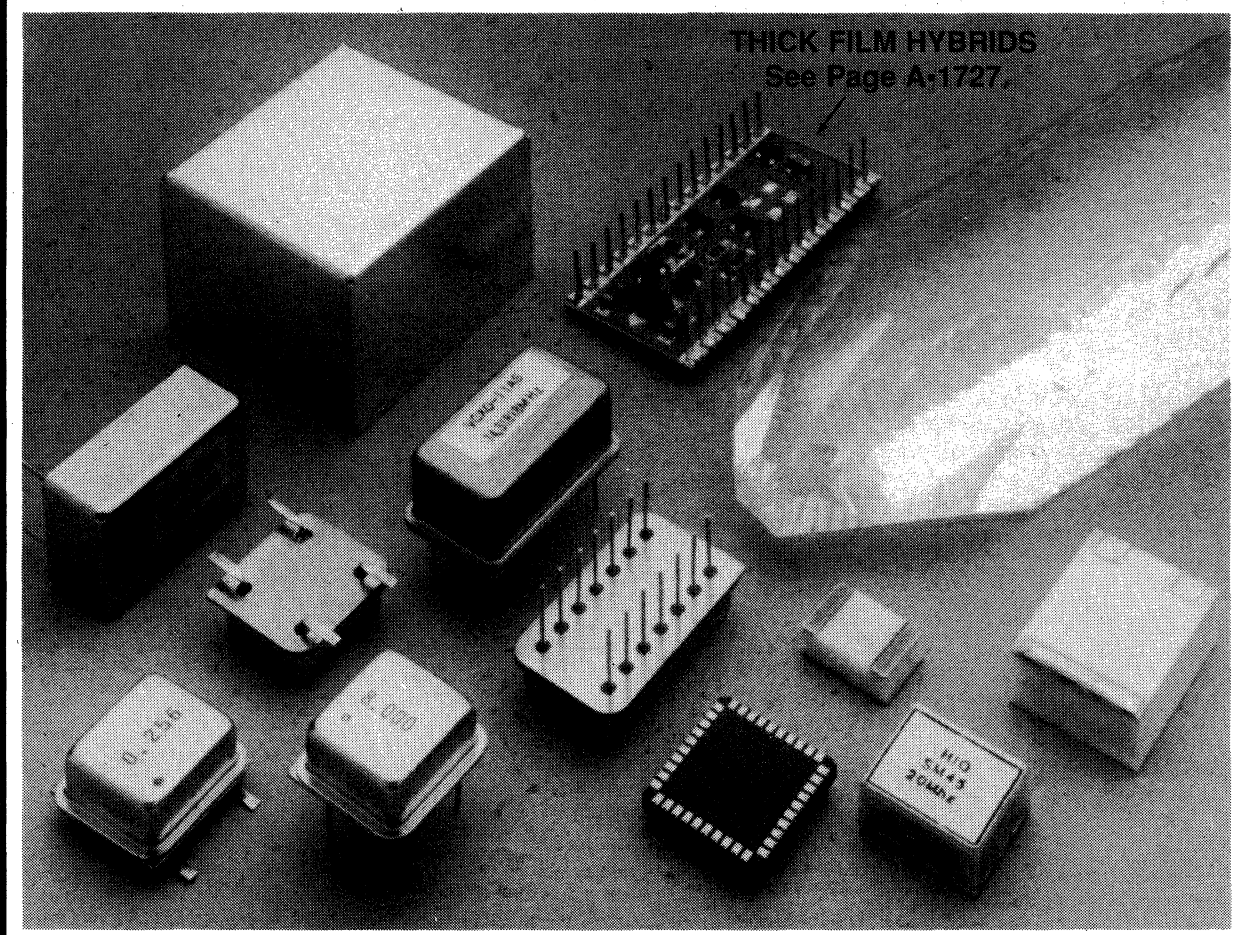
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PRODUCT COMPATIBILITY — THRU-HOLE — WELL ESTABLISHED

P/N SERIES MECHANICAL	ELECTRICAL / FUNCTIONAL
145STF, X CUT, D = 1.5, L = 5.0 mm	32.768 KHz, ±20 ppm at 25°C, CL=12.5 pF, 50K ohms, (AVAILABLE - 200 KHz)
26STF, X CUT, D = 2.0, L = 6.0 mm	25-760 KHz, ±20 ppm at 25°C, CL=12.5 pF, 50K ohms, (AVAILABLE - AT CUT 14.2 - 17.7 MHz)
38STF, X CUT, D = 3.0, L = 8.0 mm	25-760 KHz, ±20 ppm at 25°C, CL=12.5 pF, 30K ohms
39M, AT CUT, D = 3.0, L = 9.0 mm	3.5-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C) (AVAILABLE 3RD OT 25-64 MHz)
HC-45/UM-1, AT CUT, L=7.8, W=3.1, H=8.0 mm	1.0-200 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C)
HC-49/u-M, AT CUT, L=11.2, W=4.8, H=7.7 mm	3.5-75 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C)
HC-49/u, AT CUT, L=11.2, W=4.8, H=13.5 mm	1.0-200 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C)
HC-49/U-4H, AT CUT, L=11.2, W=4.8, H=3.5 mm	3.27-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C)
MONOLITHIC CRYSTAL FILTERS HC-49/u, 45/UM-1	10.7, 21.4, 36, 45, 55, 58, 70, 90 MHz

CUSTOMER SERVICE — SURFACE MOUNT — ENGINEERING EXCELLENCE

32SMX, X CUT, L=10.41, W=4.01, H=3.56 mm	32.768 KHz, ±100 ppm, CL=12.5 pf, 50K ohms
86SMX, AT CUT, L=13.1, W=5.0, H=5.0 mm	3.57-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 - +70°C) (HIGHER FREQ. AVAILABLE 3RD OT)
49USMX(4H-SB), AT CUT, L=11.6, W=5.7, H=4.5 mm	3.57-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 - +70°C) (HIGHER FREQ. AVAILABLE 3RD OT)
49USMX(4L-LB), AT CUT, L=11.4, W=5.7, H=4.0 mm	3.57-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 - +70°C) (HIGHER FREG. AVAILABLE 3RD OT)
53SMX, AT CUT, L=10.7, W=4.7, H=2.5 mm	3.50-25 MHz, ±30 ppm at 25°C, ±100 ppm (-20 - +70°C)
83SMX, AT CUT, L=7.7, W=7.7, H=2.3 mm	4.0-175 MHz, ±30 ppm at 25°C, ±50 ppm (-20 - +70°C)

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THRU-HOLE

HT/C/E11XX-F FULL SIZE L=20.8, W=11.0, H=5 mm LOW PROFILE AVAILABLE SEATED H=4.5 mm 14 PIN DIP METAL PACKAGE	LOW POWER CMOS ..... 1 Hz to 2 MHz STANDARD CMOS ..... 1 Hz to 12 MHz HIGH SPEED HCMOS ..... 1 Hz to 120 MHz TTL ..... 1 Hz to 120 MHz ECL ..... 20 MHz to 650 MHz ECL HALF SIZE ..... 20 MHz to 150 MHz INDEPENDENT DUAL ... 1 Hz to 120 MHz (F/S ONLY) TRI-STATE, ENABLE/DISABLE - REF. HIGH OR LOW
HT/C/E11XX-H HALF SIZE L=13.2, W=13.2, H=5 mm 8 PIN DIP METAL PACKAGE	

DISCIPLINED QUALITY — SURFACE MOUNT — COST EFFECTIVE

HT/C/E11XX-F FULL SIZE GULL WING L=20.8, W=11.0, H=5.0 mm 14 PIN DIP METAL PACKAGE	LOW POWER CMOS ..... 1 Hz to 2 MHz STANDARD CMOS ..... 1 Hz to 12 MHz HIGH SPEED HCMOS ..... 1 Hz to 120 MHz TTL ..... 1 Hz to 120 MHz ECL ..... 20 MHz to 650 MHz ECL HALF SIZE ..... 20 MHz to 150 MHz INDEPENDENT DUAL ... 1 Hz to 120 MHz (F/S ONLY) TRI-STATE, ENABLE/DISABLE - REF. HIGH OR LOW
HT/C/E11XX-H HALF SIZE GULL WING L=13.2, W=13.2, H=5.0 mm 8 PIN DIP METAL PACKAGE	
HT/C11XX-SJ L=14.0, W=9.80, H=4.70 mm SURFACE MOUNT PLASTIC PACKAGE	TTL 1.5 MHz to 36 MHz HCMOS 1.5 MHz to 55 MHz TRI-STATE, ENABLE/DISABLE - REF. HIGH OR LOW

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HT/C13XX-FULL SIZE VCXO L=20.8, W=11.0, H=5.0 mm (GULL WING AVAILABLE)	TTL OR HCMOS, 1-40 MHz. DEVIATION (50: ±50 ppm) (100: ±100 ppm) (150: ±150 ppm)
HT/14XX-FULL SIZE TCXO L=20.8, W=11.0, H=5.0 mm (GULL WING AVAILABLE)	TTL OR HCMOS, 1-40 MHz ±10 ppm (0 - 70°C) to ±1 ppm (0 to 50°C)
HT/HC/HEI"XI":SQUARE SIZE TCXO L=25.4, W=25.4, H=12.7 mm	TTL, HCMOS OR ECL, 500 Hz to 40 MHz, ±1 ppm w/5V, ±2 ppm w/10V, ±5 ppm w/12V

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Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

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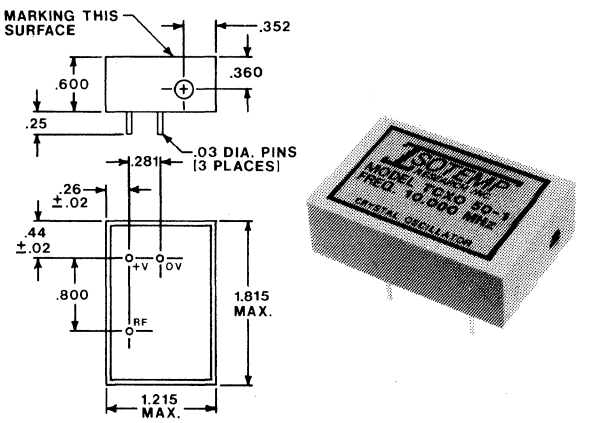
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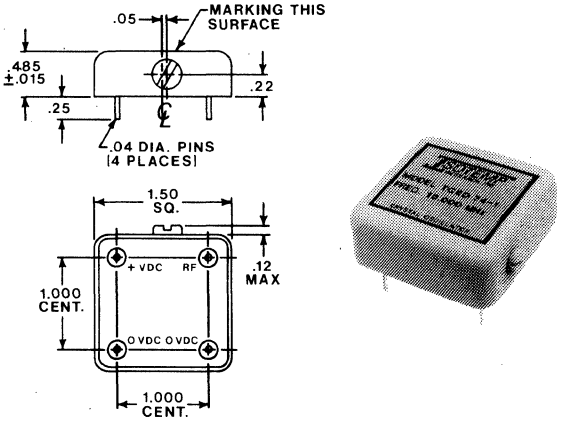
TCXO 50 SERIES

FREQUENCY RANGE	TTL OUTPUT 100 KHz to 20 MHz SINE WAVE OUTPUT 4 MHz to 20 MHz CMOS OUTPUT 100 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +70°C
AMBIENT STABILITIES	±1.0 ppm from -30°C to +70°C ±0.5 ppm from 0°C to +70°C
AGING	1.0 ppm/year to 0.5 ppm/year
VOLTAGE STABILITY	$3x10^{-8}$/1% to $1x10^{-8}$/1% change
SHORT TERM STABILITY	$5x10^{-9}$/10 seconds rms to $1x10^{-9}$/10 seconds rms



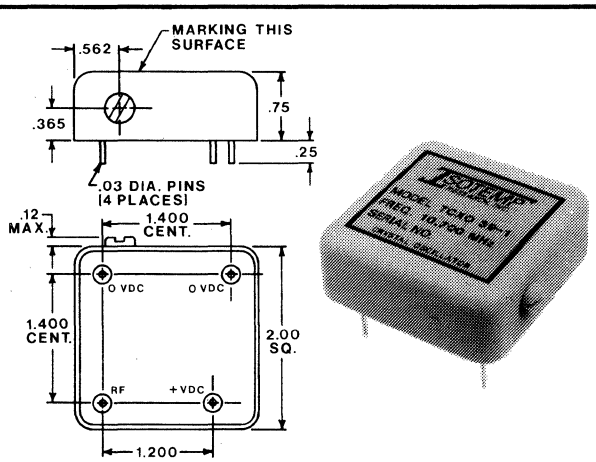
TCXO 74 SERIES

FREQUENCY RANGE	TTL OUTPUT 100 KHz to 30 MHz SINE WAVE OUTPUT 2 MHz to 50 MHz CMOS OUTPUT 100 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +85°C
AMBIENT STABILITIES	±1.0 ppm from -30°C to +85°C ±0.5 ppm from 0°C to +70°C
AGING	1.0 ppm/year to 0.5 ppm/year
VOLTAGE STABILITY	$3x10^{-8}$/1% to $1x10^{-8}$/1% change
SHORT TERM STABILITY	$5x10^{-9}$/10 seconds rms to $5x10^{-10}$/10 seconds rms



TCXO 39 SERIES

FREQUENCY RANGE	TTL OUTPUT 1 KHz to 30 MHz SINE WAVE OUTPUT 2 MHz to 50 MHz CMOS OUTPUT 1 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +85°C
AMBIENT STABILITIES	±1.0 ppm from -30°C to +85°C ±0.5 ppm from 0°C to +70°C ±0.25 ppm from 0°C to +55°C
AGING	1.0 ppm/year to 0.5 ppm/year
VOLTAGE STABILITY	$3x10^{-8}$/1% to $5x10^{-9}$/1% change
SHORT TERM STABILITY	$5x10^{-9}$/10 seconds rms to $5x10^{-10}$/10 seconds rms



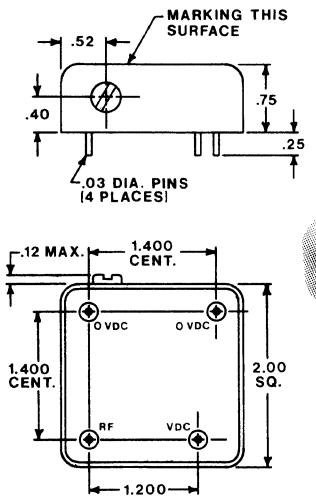
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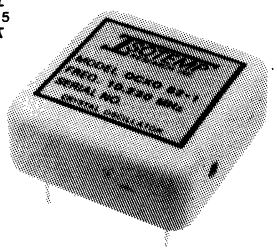
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OCXO 82 SERIES

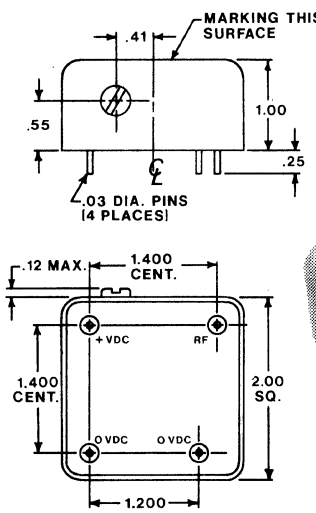
FREQUENCY RANGE	TTL OUTPUT	1 KHz to 30 MHz
	SINE WAVE OUTPUT	4 MHz to 50 MHz
	CMOS OUTPUT	1 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +70°C	
AMBIENT STABILITY	$\pm 3.5 \times 10^{-7}$ to $\pm 1 \times 10^{-7}$ over ambient referenced to +25°C	
AGING	1.0 ppm/year to 0.5 ppm/year	
VOLTAGE STABILITY	1×10^{-8}/1% to 2×10^{-9}/1% change	
SHORT TERM STABILITY	5×10^{-9}/10 seconds rms to 5×10^{-10}/10 seconds rms	
POWER	Turn on	3.5 Watts (-30°C to +70°C)
		2.5 Watts (0°C to +70°C)
	Steady state at +25°C	1.2 Watts

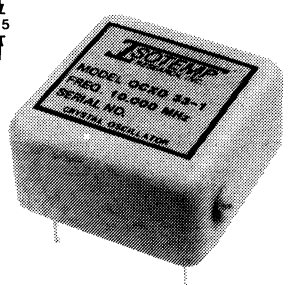




OCXO 33 SERIES

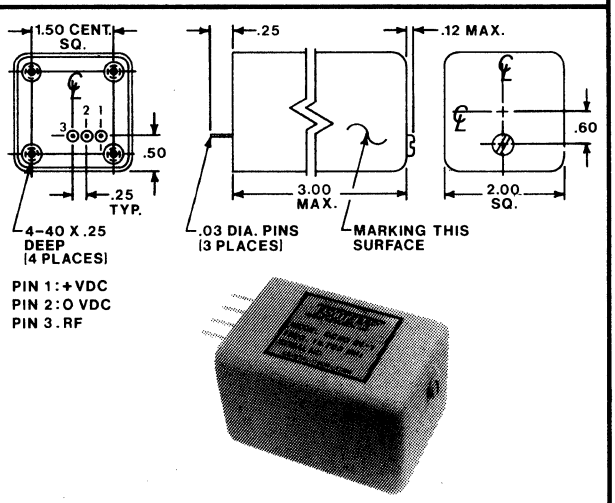
FREQUENCY RANGE	TTL OUTPUT	1 KHz to 30 MHz
	SINE WAVE OUTPUT	2 MHz to 50 MHz
	CMOS OUTPUT	1 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +70°C	
AMBIENT STABILITY	$\pm 1 \times 10^{-7}$ to $\pm 5 \times 10^{-8}$ over ambient referenced to +25°C	
AGING	1.0 ppm/year to 0.5 ppm/year	
VOLTAGE STABILITY	5×10^{-9}/1% to 2×10^{-9}/1% change	
SHORT TERM STABILITY	1×10^{-9}/10 seconds rms to 2×10^{-10}/10 seconds rms	
POWER	Turn on	3.5 Watts (-30°C to +70°C)
		2.5 Watts (0°C to +70°C)
	Steady state at +25°C	1.2 Watts





OCXO 36 SERIES

FREQUENCY RANGE	TTL OUTPUT	1 KHz to 30 MHz
	SINE WAVE OUTPUT	2 MHz to 50 MHz
	CMOS OUTPUT	1 KHz to 15 MHz
TEMPERATURE RANGE	Choice of 5°C increments over any temperature range from -30°C to +70°C	
AMBIENT STABILITY	$\pm 5 \times 10^{-8}$ to $\pm 5 \times 10^{-9}$ over ambient referenced to +25°C	
AGING	1.0 ppm/year to 1×10^{-7}/year	
VOLTAGE STABILITY	3×10^{-9}/1% to 2×10^{-10}/1% change	
SHORT TERM STABILITY	1×10^{-10}/10 seconds rms to 5×10^{-12}/10 seconds rms	
POWER	Turn on power	12 Watts
	Steady state at +25°C	2.2 Watts



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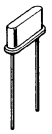
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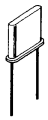
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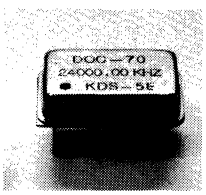




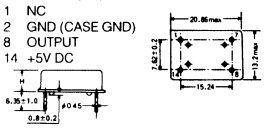
Frequency range	1.8432-200.0 MHz	3.57954-50.000 MHz	3.579545-50.000 MHz	3.579545-50.000 MHz (surface mounted)	3.579545-50.000 MHz (surface mounted)	3.579545-25.000 MHz (surface mounted)	10.00-200.0 MHz	32.768 KHz	15.0-150KHz
KDS Type	HC-49	AT-49	AT-38	SMD-49	DMX-38	SX-1	UM-1	DT-26 DT-38 DT-14	DT-261 DT381
Maximum Dimensions in Millimeters Unless Noted									
Package Height	13.5	3.5	8.8	4.5	5.0	2.5	8.0	6.0 8.3 5.0	6.0 8.3
Package Width	11.5	11.5	Ø3.1	12.1±0.3	13.5	11.8	8.0	Ø2.0 Ø3.0 Ø1.4	Ø2.0 Ø3.0
Package Thickness	5.0	5.0	–	4.8	5.4	5.5	3.5	–	–

Clock Oscillators DOC-2, DOC-20, DOC-70, DOC-100

ITEM \ TYPE		DOC-2	DOC-20	DOC-70	DOC-100AS
Output		TTL			
Frequency Range		0.25~4.0MHz	4.01~23.9MHz	24~70MHz	50~100TTL
Frequency Tolerance*		±50ppm, ±100ppm			
Operating Temperature Range		0~+70°C			
Storage Temperature Range		-55~+125°C			
OUTPUT	"0" Level	+0.5Vmax.	+0.5Vmax. or +0.4V max.	+0.4V max./24.0~32.0MHz +0.5V max./32.1~70.0MHz	+0.5V max
	"1" Level	+2.4V min.			
	Symmetry	60/40~40/60% at 1.4V DC Level			
	Rise and Fall Time	15ns max.	15 ns. max/4.01~8.99MHz 10ns max./9.0~23.9MHz	10ns max./24.0~32.0Mhz 6ns. max./32.1~70.0MHz	5ns max.
	Output Load	10 TTL STD GATES			
Power Supply voltage		+5V DC±0.25V	+5V DC ±0.25V	+5V DC ±0.5V	+5V DC ±0.25V
Current consumption		30mA max./+5V 25° C		35mA max./+5V 25°C	80mA max./+5V 25°
Dimensions		Fig-1			



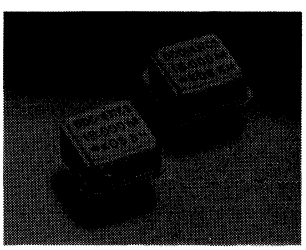
PIN CONNECTION
1 NC
2 GND (CASE GND)
8 OUTPUT
14 +5V DC

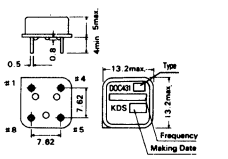


	H
DOC-2	5.08 max.
DOC-20	5.08 max.
DOC-70	5.08 max.
DOC-100AS	8.0 max.

Clock Oscillators DOC-431 Series

TYPE		DOC-431CS	DOC-431CC	DOC-431TB	DOC-431TC
Output		CMOS or TTL	CMOS or TTL	TTL	TTL
Output Frequency		625KHz~29.0MHz	25.0~50.0MHz	4.0~23.9MHz	24.0~70.0MHz
Frequency Tolerance		±100ppm (including Operating Temperature Range)			
Operating Temperature Range		0°C~70°C			
Storage Temperature Range		-55°C~+125°C			
OUTPUT	"O" Level	+0.5V max.		+0.4V max.	+0.4V max./24.0~32MHz +0.5V max./32.01~70MHz
	"1" Level	+4.5V max.		+2.4V max.	
	Rise & Fall Time (Tr, Tf)	15ns max. (10~90% Vdd)	6ns max. (10~90% Vdd)	4.00~8.99MHz 15ns max. (0.4~2.4V)	
		10ns max. (0.5~2.4V)	5ns max. (0.5~2.4)	9.00~23.99MHz 10ns max. (0.4~2.4V)	
				24.00~32.00MHz 10ns max. (0.4~2.4V)	
				32.01~70.00MHz 6ns max. (0.4~2.4V)	
	Output Load	CL=50pF or 2TTL	CL=50pF or 5TTL	10TTL	10TTL
	Symmetry	F<9.99MHz 45/55~55/45 (50% VDD) F≥10 MHz 40/60~60/40 (50% VDD)		40/60~60/40% (1.4V DC Level)	
Power Supply Voltage (VDD)		+0.5V DC ±0.5V			
Current Consumption		10mA max. (No Load VDD+5V Ta=+25°C)	30mA max. (No Load VDD+5V Ta=+25°C)	30mA max. (No Load VDD+5V Ta=+25°C)	40mA max. (No Load VDD+5V Ta=+25°C)
Stanby Function		#1 pin (Control Term) Open or "H" "L"	#5 pin (Output Term) Oscillation "L" Level	#1 pin (Control Term) Open or "H" "L"	#5 pin (Output Term) Oscillation "H" Level





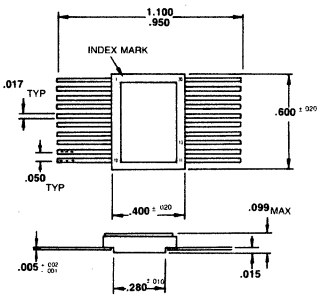
PIN	431TB 431TC	431CS 431CC 431TZ
1	NC	INH
4	GND (CASE GND)	
5	OUTPUT	
8	+5V DC	

M-tron MCCOY
ELECTRONICS COMPANY
A DIVISION OF OAK CRYSTAL INC.
100 WATTS STREET, P.O. BOX B, MT. HOLLY SPRINGS, PA 17065, TEL: (717) 486-3411, FAX: (717) 486-5920

Illustrated herein are the most popular holders, and the frequency range that they can accommodate.

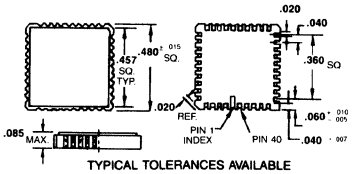
SURFACE MOUNTED CRYSTAL UNITS

LEADED PACKAGE
McCOY HOLDER #L-20



AVAILABLE FROM 10 MHz to 300 MHz
CRYSTAL CONNECTION = PINS 11 & 13
ALL OTHER PINS, NO CONNECTION

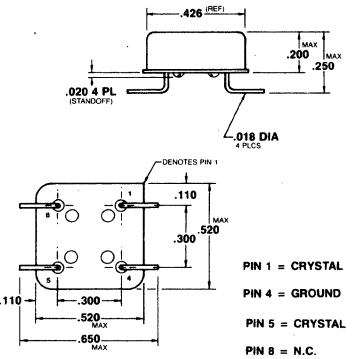
LEADLESS PACKAGE
McCOY HOLDER #L-40



TYPICAL TOLERANCES AVAILABLE
Calibration Accuracy @ RT
Choices: ± .001%
± .002% (Standard)
± .005 %
Frequency Tolerances vs Temperature
Choices ± .002% 0° to 70°C
± .005% 0° to 70°C
± .002% –40° to +90°C
± .005% –55° to +105°C (Standard)
± .01% –55° to +105°C

AVAILABLE FROM 10 MHz to 300 MHz
CRYSTAL CONNECTION - PINS 4/10 & 31/37
ALL ELSE, NO CONNECTION

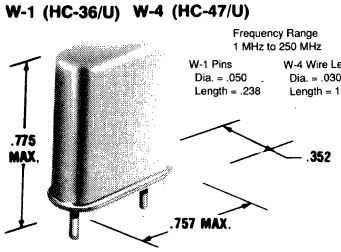
LEADED PACKAGE
McCOY HOLDER # RS-65



AVAILABLE FROM 5 MHz to 300 MHz

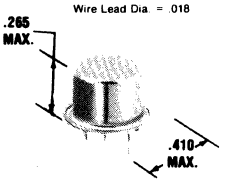
COLDWELD CRYSTALS

HOLDER SERIES
W-1 (HC-36/U) W-4 (HC-47/U)



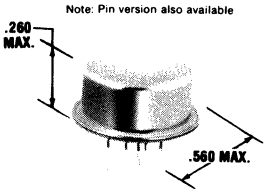
HOLDER SERIES
W-6 (HC-35/U)

Frequency Range:
10 MHz to 250 MHz
Wire Lead Dia. = .018



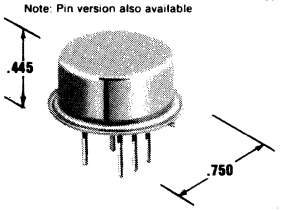
HOLDER SERIES
W-7 (HC-37/U)

Frequency Range:
3 MHz to 250 MHz
Wire Lead Dia. = .018
Note: Pin version also available



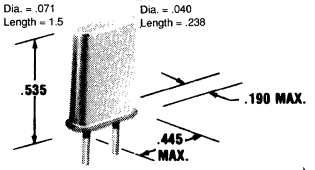
HOLDER SERIES
W-8

Frequency Range:
0.8 MHz to 250 MHz
Wire Lead Dia. = .018
Note: Pin version also available



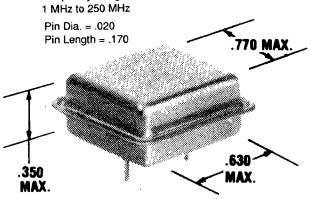
HOLDER SERIES
W-20 (HC-43/U) W-21 (HC-42/U)

Frequency Range
2.9 MHz to 250 MHz
W-20 Wire Leads
Dia. = .071
Length = 1.5
W-21 Pins
Dia. = .040
Length = .238



HOLDER SERIES
W-10 (HC-39/U)

Frequency Range
1 MHz to 250 MHz
Pin Dia. = .020
Pin Length = .170

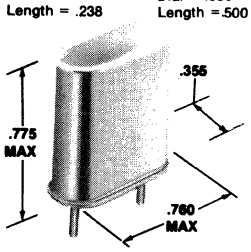


RESISTANCE WELD CRYSTALS

HOLDER SERIES
R-1 (HC-48/U) R-4 (HC-51/U)

Frequency Range
2 MHz to 250 MHz

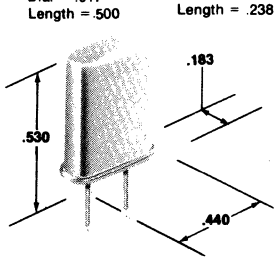
R-1 = Pins	R-4 = Wire Leads
Dia. = .050	Dia. = .030
Length = .238	Length = .500



HOLDER SERIES
R-20 (HC-49/U) R-21 (HC-50/U)

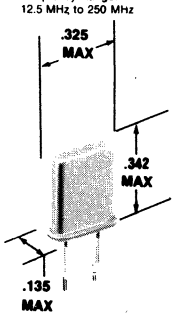
Frequency Range
2.5 MHz to 250 MHz

R-20 Wire Leads	R-21 Pins
Dia. = .017	Dia. = .040
Length = .500	Length = .238



HOLDER SERIES
R-60

Frequency Range:
12.5 MHz to 250 MHz



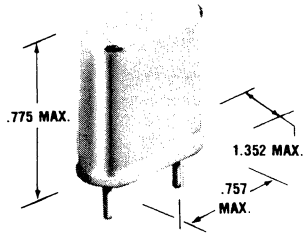
SOLDER SEAL CRYSTALS

HOLDER SERIES
M-1 (HC-6/U)
M-4 (HC-33/U)

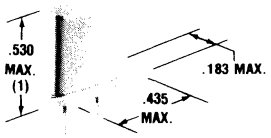
Frequency Range:
0.7 MHz to 250 MHz

M-1 Pins
Dia. = .050
Length = .248

M-4 Wire Leads
Dia. = .030
Length = 1.5



HOLDER SERIES
M-20 (HC-18/U)
M-21 (HC-25/U)



Frequency Range
2.5 MHz to 250 MHz

M-20 Wire Leads
Dia. = .017
Length = .238

M-21 Pins
Dia. = .040
Length = .238

(1) Also available with short cans
"A" Height = .460 (5 MHz to 250 MHz)
"B" Height = .425 (5 MHz to 250 MHz)
"C" Height = .360 (10 MHz to 250 MHz)
"D" Height = .312 (10 MHz to 250 MHz)
"E" Height = .250 (15 MHz to 250 MHz)
"F" Height = .400 (10 MHz to 250 MHz)

HOLDER SERIES
M-22 (HC-13/U)
M-22A/ M-22B

Frequency Range:
4 KHz to 15 KHz

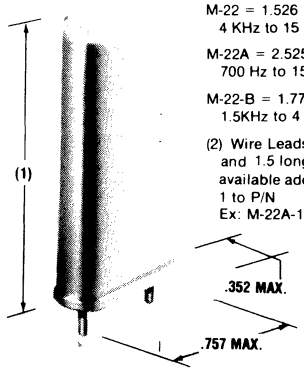
(1) Holder Height

M-22 = 1.526
4 KHz to 15 KHz

M-22A = 2.525
700 Hz to 15 KHz

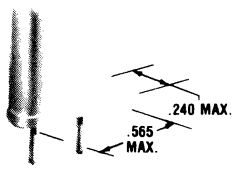
M-22-B = 1.775
1.5KHz to 4 KHz

(2) Wire Leads .030 and 1.5 long also available add dash 1 to P/N
Ex: M-22A-1



HOLDER SERIES
M-25 (HC-32/U)
M-27/ M-28

Frequency Range:
2 MHz to 250 MHz

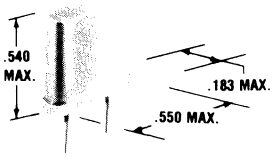


M-25 Pins
Dia. = .040
Length = .238
Holder Height = .650

M-27 Pins
Dia. = .040
Length = .238
Holder Height = .585

M-28 Wire Leads
Dia. = .017
Length = 2.0
Holder Height = .585

HOLDER SERIES
M-40/ M-41

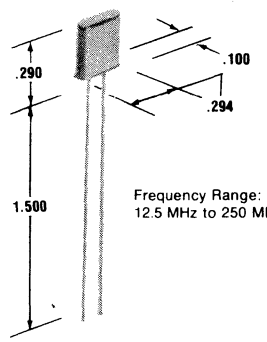


Frequency Range:
2 MHz to 250 MHz

M-40 Wire Leads
Dia. = .017
Length = 1.5

M-41 Pins
Dia. = .040
Length = .238

HOLDER SERIES
M-60 (HC-44/U)



Frequency Range:
12.5 MHz to 250 MHz

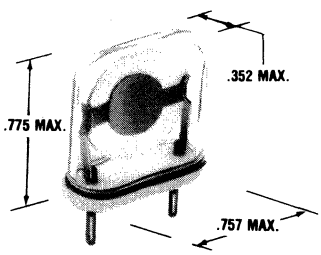
PRECISION GLASS CRYSTALS

HOLDER SERIES
G-1 (HC-27/U)
G-4

Frequency Range:
2 MHz to 100 MHz

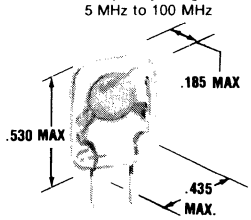
G-1 Pins
Dia. = .050
Length = .248

G-4 Wire Leads
Dia. = .030
Length = 1.5



HOLDER SERIES
G-20 (HC-26/U)
G-21 (HC-29/U)

Frequency Range:
5 MHz to 100 MHz

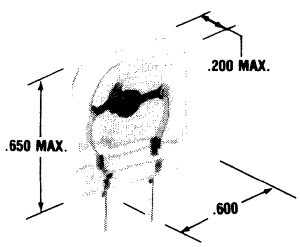


G-20 Wire Leads
Dia. = .017
Length = 1.5

G-21 Pins
Dia. = .040
Length = .238

HOLDER SERIES
G-30/ G-31

Frequency Range:
5 MHz to 100 MHz



G-30 Wire Leads
Dia. = .017
Length = 1.5

G-31 Pins
Dia. = .040
Length = .238

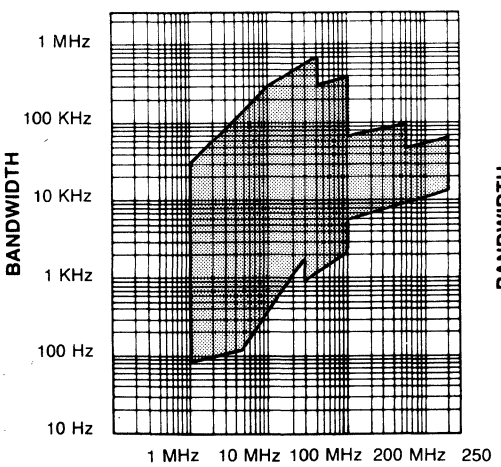
MCCOY
ELECTRONICS COMPANY
A DIVISION OF OAK CRYSTAL INC.
100 WATTS STREET, P.O. BOX B, MT. HOLLY SPRINGS, PA 17065, TEL: (717) 486-3411, FAX: (717) 486-5920

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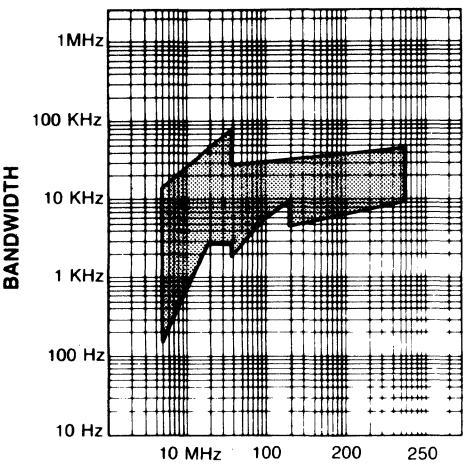
HIGH FREQUENCY CRYSTAL FILTERS

MCCoy Electronics manufactures high frequency crystal filters from 1 MHz to over 250 MHz. Both discrete crystal design and monolithic filter designs are utilized to achieve the maximum in bandwidths, selectivity, miniaturization and competitive pricing.

DISCRETE FILTER BANDWIDTH



MONOLITHIC BANDWIDTH CHART



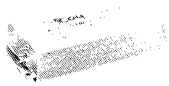
TYPICAL UNITS AVAILABLE

P/N	CENTER FREQUENCY MHz	NO. POLES	BANDWIDTH	BANDWIDTH	db I.L.	db RIPPLE	Ω IMPED.	SIZE
48B52	1.4	14	3 db ± 1.62 KHz	60 db 4.3 KHz	5	1	1K	2.975 × 1.63 × 1.18
48B30	10	6	1 db ± 15 KHz	60 db ± 58 KHz	5	0.5	500	1.87 × .5 × .475
48Q24	21.4	4	6 db 32 KHz	30 db 72 KHz	6	2	2.2K	9 × .215 × .61
48Q19	25.5	6	6 db ± 34.5 KHz	60 db ± 80 KHz	5	1	3K	2.08 × .75 × .635
48Q06	30	8	3 db ± 15 KHz	60 db 60 KHz	4	1	1.5K	.73 × .47 × .59
48B45	50	6	6 db ± 9 5 KHz	55 db ± 25 KHz	8	1	50	2.73 × .64 × 1.085
48B40	70	8	1 db ± 20 KHz	45 db ± 70 KHz	6	1	50	.985 × .719 × .475
48B76	118 to 136	8	6 db ± 12 KHZ	90 db ± 75 KHZ	1	2	50	4.98 × .985 × .985
48Q2	156	2	3 db 15 KHz	30 db 60 KHz	2	1	5K	41 dia. × .265

**ONLY A FEW UNITS ARE SHOWN,
WRITE OR CALL FOR COMPLETE CATALOG.**

SWITCHABLE BANDWIDTH FILTERS

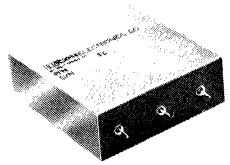
MODEL 48B12
Switchable Bandwidth



SPECIFICATIONS
Center Frequency: 70.0 MHz
Filter A: 3 db BW: ±35 KHz min.
60 db BW: ±180 KHz max.
Filter B: 6 db BW: ±19 KHz min.
60 db BW: ±90 KHz max.
Ripple: Filter A: 1.5 db max.
Filter B: 1.0 db max.
Insertion Loss: Filter A and B: 8.0 db max.
Ultimate Attenuation: 80 db min. ±200 KHz to ±20 MHz from center frequency
Source/Load Impedance: 50 Ω
Shock: 50G's, MIL-STD-202, method 202
Vibration: MIL-STD-202, method 204, test condition A
Temperature Range: –55° to +95°C
Switching Voltage:
Bias Voltage to Pin 5: 12 VDC
Filter A obtained by applying 0–1 VDC to pin 6
Filter B obtained by applying 24 VDC to pin 6
Filter will sustain no damage with .5 VRMS applied to input

SINGLE SIDEBAND FILTERS

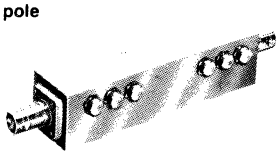
MODEL 48B33
SSB Single Sideband



Carrier Frequency: 1.750 MHz
1 db BW: Fc +295 Hz to Fc +3100 Hz min.
60 db BW: Fc –125 Hz to Fc +3975 Hz max.
Carrier Attenuation: Fc 40 db min.
Ripple: 1.0 db max.
Insertion Loss: 5.0 db max.
Ultimate Attenuation: 60 db min.
Source/Load Impedance: 500 Ω
Shock: MIL-STD-202, method 213
Vibration: MIL-STD-202, method 204A, tested condition A
Temperature Range: –40° to +78°C

HIGH FREQUENCY CRYSTAL FILTERS

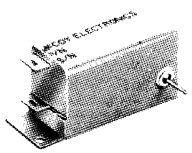
MODEL 48B76
8 pole



SPECIFICATIONS
Center Frequency: 118.0 MHz to 136 MHz
6 db BW: ±12 KHz min.
60 db BW: ±35 KHz max.
90 db BW: ±75 KHz max.
Ripple: 2.0 db max.
Insertion Loss: 1.0 db max.
Ultimate Attenuation: 90 db min.
Source/Load Impedance: 50 Ω
Shock: Standard Commercial
Vibration: Standard Commercial
Temperature Range: –40° to +70°C
External Supply Required: 10V ±10%
NOTE: Filter designed to eliminate adjacent channel interference and contains amplifier with built in power supply.

HIGH FREQUENCY CRYSTAL FILTERS

MODEL 48B10
8 pole

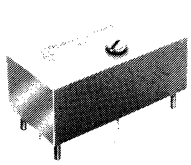


SPECIFICATIONS
Center Frequency: 30.0 MHz
3 db BW: ±31.8 KHz min.
6 db BW: ±34.5 KHz min.
60 db BW: ±57 KHz max.
Ripple: 1.0 db max. over ±25 KHz
Insertion Loss: 3.0 db max.
Ultimate Attenuation: 60 db min.
Source Impedance: 2K Ω
Load Impedance: 50 Ω
Shock: 15G's, 18 impacts
Vibration: 10–500 Hz, 10G's
Temperature Range: –55° to +105°C

CRYSTAL DISCRIMINATORS

MODEL 48D2
Crystal Discriminators

SPECIFICATIONS
Center Frequency: 498.750 KHz
Positive Slope
Peak-Peak BW: 300 Hz min.
Linear BW: ±100 Hz
Linearity: ±10%
Sensitivity: ±.5V Nominal At ±100 Hz



Driver Source Impedance: 50 Ω, 1 VRMS open circuit
Discriminator Load Impedance: 39K 1 VRMS open circuit
Drive Level: 1 VRMS open circuit
Shock: MIL-STD-202, method 213, condition J
Vibration: MIL-STD-202, method 201
Temperature Range: 0° to +70°C

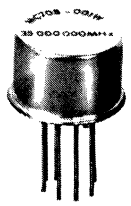
MCCOY ELECTRONICS COMPANY 100 WATTS STREET, P.O. BOX B, MT. HOLLY SPRINGS, PA 17065, TEL: (717) 486-3411, FAX: (717) 486-5920
A DIVISION OF OAK CRYSTAL INC.

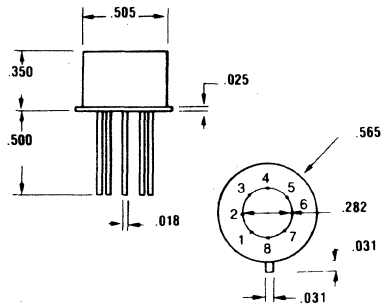
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100 WATTS STREET, P.O. BOX B, MT. HOLLY SPRINGS, PA 17065, TEL: (717) 486-3411, FAX: (717) 486-5920

CRYSTAL OSCILLATORS

MODEL MC708

Standard Oscillator
(Also available as Military P/N M55310/10)





Frequency Range: 250 KHz to 50 MHz

Stability (Options):	Temperature Range:
±50 PPM	0°C to +70°C
±50 PPM	–40°C to +85°C
±50 PPM	–55°C to +105°C

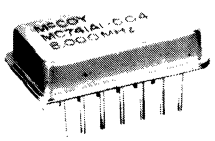
Input: +5V DC ±10%

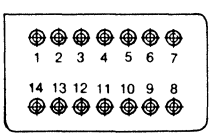
Output: TTL: Fan out 10 TTL Loads (156 KHz to 25 MHz)
TTL: Fan out 6 TTL Loads (25 MHz to 50 MHz)

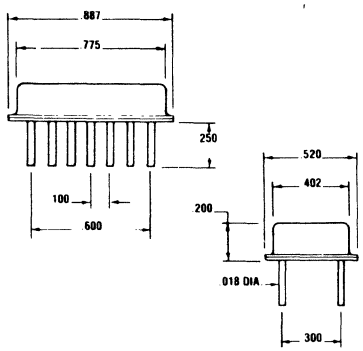
Pin Connections
1,3,& 7 N/C Internally
2 & 6 Connected Internally
4. Common
5. R.F. Output
8. Oscillator B+

MODEL MC741A1

Standard Oscillator
(Also available as Military P/N M55310/16)







Frequency Range: 250.0 KHz to 50 MHz

Stability (Options):	Temperature Range:
±50 PPM	0°C to +70°C
±50 PPM	–40°C to +85°C
±50 PPM	–55°C to +105°C
±70 PPM	–55° C to +125° C

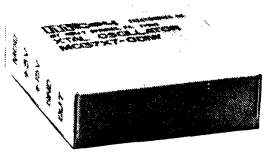
Input: +5V DC ±10%

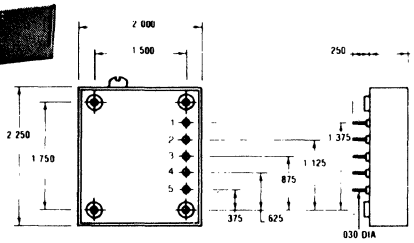
Output:
TTL: Fan out to 10 TTL Loads (250 KHz to 25 MHz)
TTL: Fan out to 6 TTL Loads (25 MHz to 50 MHz)

Pin Connections
1,2,3,4,5,6,9,10,11,12, & 13 N/C Internally
7. Common
8. R.F. Output
14. Oscillator B+

MODEL MC137X7

TCVCXO





Frequency Range: 180 KHz to 25 MHz

Stability	Temperature Range	Deviation
±1 PPM	–10°C to +70°C	±.001%
±5 PPM	–30°C to +70°C	±.0025%
±10 PPM	–40°C to +75°C	±.005%

Linearity: 5%

Output: TTL Compatible

Modulation Input Impedance: 10k Minimum

Control Voltage: ±2 Volts to ±10 Volts

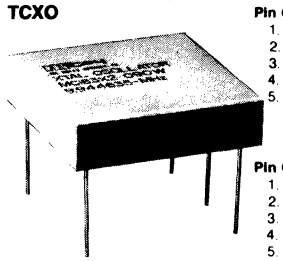
Negative Slope:

Input Voltage: +12 to +24V DC

Pin Connections
1. Modulation Input
2. Logic B+
3. Oscillator B+
4. Common and Case
5. R.F. Output

MODEL MC163X2

TCXO



Sinewave

Pin Connections
1. Oscillator B+
2. N.C.
3. R.F. Output
4. Common and Case
5. Common and Case

TTL

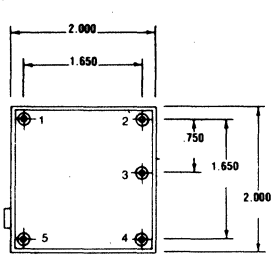
Pin Connections
1. Oscillator B+
2. Common and Case
3. R.F. Output
4. Logic B+
5. Common and Case

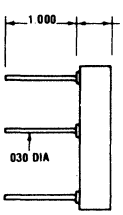
CMOS

Pin Connections
1. Oscillator B+
2. N.C.
3. R.F. Output (CMOS)
4. Common and Case
5. Common and Case

ECL

Pin Connections
1. OSC B+ or B–
2. GND
3. R.F. Output
4. Logic –5.2 VDC
5. GND





Frequency Range: 180 Hz to 150 MHz (depending upon output)

Stability Tr: ±0.5 PPM –20°C to +60°C
±1.0 PPM –40°C to +70°C
±5.0 PPM –55°C to +105°C
(Shown are typical specifications - this is a cost determining requirement and only actual needs should be specified)

Input Voltage Range: +12VDC to +24V DC ±3% and +5V DC ±5% (TTL/DTL units only)

External Trim: 5 PPM Minimum

Aging: 1 PPM/Year Maximum

Output:

Sine Wave	
Freq Range 3-150 MHz Output 1-10 MW 50 ohms Harmonics/ Sub-Harmonics –20 dB Minimum	
TTL/DTL	**CMOS**
187.5 KHz-25 MHz TTL/DTL Compatible	180 Hz-10 MHz CMOS Compatible

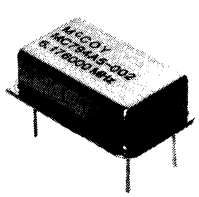
Frequency Range: 50 to 100 MHz

Input Voltage: ±12 to 24 DC ±3% and –5.2VDC ±5%

Output: ECL Compatible

CRYSTAL OSCILLATORS

MODEL MC794A5 VOLTAGE CONTROLLED CRYSTAL OSCILLATOR



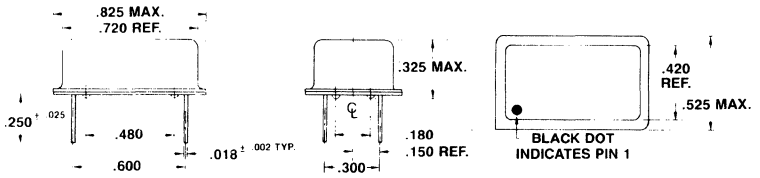


FIGURE 1

Package Size: See Figure 1

Mounting: See Figure 1

Output Frequency Range: 500 KHz to 33.0 MHz

Output Frequency: Frequency as designated at time of procurement

Frequency Stability: ± 50 ppm

Temperature Range:
Operating: – 40° to + 85° C
Storage: – 55° to + 125° C

Input Requirements:
Voltage: + 5 VDC ± 0.5 V
Current: 50 ma maximum
35 ma typical

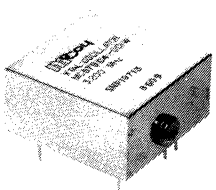
Output Specifications:
Wave Shape: TTL Compatible
Rise & Fall Times: 10 NSEC Max
Symmetry: 40/60%
Fan Out: 10 TTL Gates

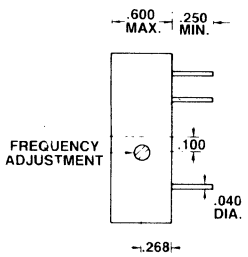
Pin Number	Function
1	= VCO
7	= GND
8	= Output
14	= VCC

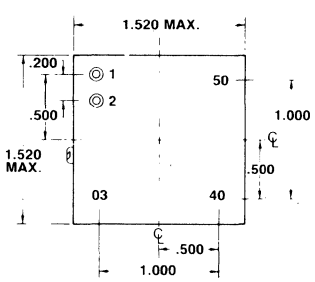
VCO Specifications:
Control Voltage: 2.5 VDC ± 0.5 VDC
Control Voltage Range: 1.0 VDC to 4.0 VDC
Control Voltage Sensitivity: 60 ppm per volt minimum, 150 ppm maximum at any point within the control voltage range.

Environmental Specifications:
Shock: 1000G's for .35 MS ½ sinewave
Vibration: 10 - 55 Hz, .06" double amplitude
55 Hz - 2 KHz, 15 G's, 12 hours duration
Leakage: 2 × 10^{-8} ATM CC/Sec. max

MODEL MC579C4-( ) STANDARD OVEN CRYSTAL OSCILLATOR







Pin Number	Function
1	= B+
2	= RF Out
3	= Case/Circuit GND
4	= Case GND
5	= Case GND

Standard oven MC579C4-( ) is 1.5 × 1.5 × 0.6 and is intended for commercial applications where stability slightly tighter than a TCXO is required. Trim effect, hysteresis and stability in temperature slew are greatly improved over TCXO's.

Frequency Range: 2.5 - 13 MHz

Stability: ± 0.4, – 55 to + 85°C

Input Voltage: + 12V ± 5%

Input current: turn-on at – 55°C 700 ma for 3 minutes
Steady state at + 25°C 100 ma

Output: TTL compatible

Aging: 1ppm/year, maximum

Trim Range: ± 3ppm, minimum

Hermetic Seal: O-ring on seal screw

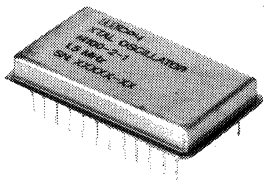
Hybrid Construction

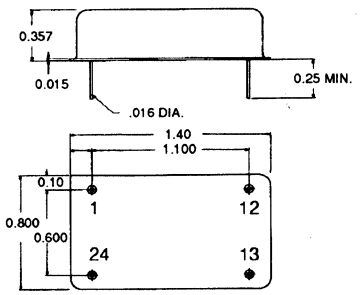
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CRYSTAL OSILLATORS

M100XX SERIES TCXO'S .2 TO 25 MHZ, TTL OR HCMOS

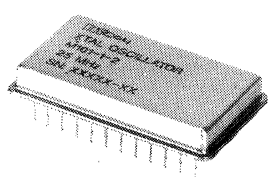


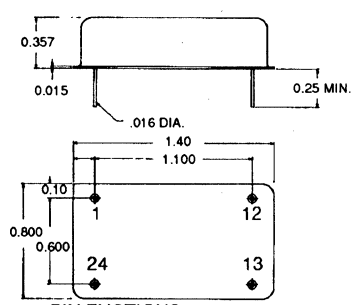


PIN FUNCTION:
1. FREQUENCY ADJUSTMENT
12. GROUND
13. RF OUTPUT
24. B+

FREQUENCY RANGE (MHZ)		.2 TO < 3	3 TO < 6	6 TO < 12	12 TO < 25
SUPPLY VOLTAGE		+5 VDC +/- 5%	+5 VDC +/- 5%	+5 VDC +/- 5%	+5 VDC +/- 5%
SUPPLY CURRENT		10 MA MAX	10 MA MAX	15 MA MAX	15 MA MAX
RISE AND FALL TIMES		25 NSEC MAX	20 NSEC MAX	20 NSEC MAX	15 NSEC MAX
AGING (PPM/YEAR)		<1 PPM/YEAR	<1 PPM/YEAR	<1.5 PPM/YEAR	<2 PPM/YEAR
TEMP. RANGE	STABILITY		M°COY MODEL		
-20 TO +70 DEGREES C	+/- 1.0 PPM	M100AD	M100BD	M100CD	M100DD
	+/- 2.0 PPM	M100AE	M100BE	M100CE	M100DE
	+/- 3.0 PPM	M100AF	M100BF	M100CF	M100DF
-40 TO +85 DEGREES C	+/- 2.0 PPM	M100AG	M100BG	M100CG	M100DG
	+/- 3.0 PPM	M100AH	M100BH	M100CH	M100DH
	+/- 5.0 PPM	M100AJ	M100BJ	M100CJ	M100DJ
-55 TO +85 DEGREES C	+/- 2.0 PPM	M100AK	M100BK	M100CK	M100DK
	+/- 3.0 PPM	M100AL	M100BL	M100CL	M100DL
	+/- 5.0 PPM	M100AM	M100BM	M100CM	M100DM

M101XX SERIES TCXO'S .2 TO 25 MHZ, TTL OR HCMOS



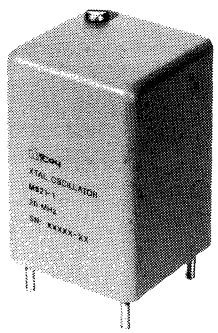


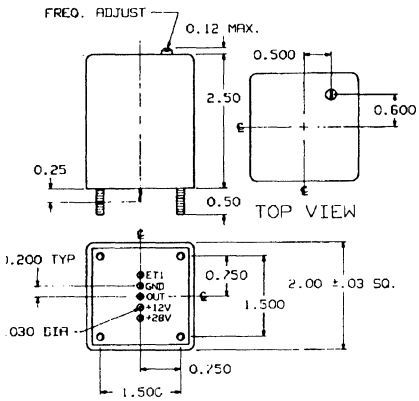
PIN FUCTIONS:
1. FREQUENCY
12. GROUND
13. RF OUTPUT
24. B+

FREQUENCY RANGE (MHZ)		.2 TO < 3	3 TO < 6	6 TO < 12	12 TO < 20
SUPPLY VOLTAGE		+12 VDC +/- 5%	+12 VDC +/- 5%	+12 VDC +/- 5%	+12 VDC +/- 5%
SUPPLY CURRENT		10 MA MAX	10 MA MAX	15 MA MAX	15 MA MAX
RISE & FALL TIMES		25 NSEC MAX	20 NSEC MAX	20 NSEC MAX	15 NSEC MAX
AGING (PPM/YEAR)		< 1 PPM/YEAR	< 1 PPM/YEAR	< 1.5 PPM/YEAR	< 2 PPM/YEAR
TEMP RANGE	STABILITY		M°COY MODEL		
-20 TO +70 DEGREES C	+/- 1.0 PPM	M101AE	M101BE	M101CE	M101DD
	+/- 2.0 PPM	M101AF	M101BF	M101CF	M101DE
	+/- 3.0 PPM	M101AG	M101BG	M101CG	M101DF
-40 TO +85 DEGREES C	+/- 1.0 PPM	M101AH	M101BH	M101CH	N.A.
	+/- 2.0 PPM	M101AJ	M101BJ	M101CJ	M101DG
	+/- 3.0 PPM	M101AK	M101BK	M101CK	M101DH
	+/- 5.0 PPM	M101AL	M101BL	M101CL	M101DJ
-55 TO +85 DEGREES C	+/- 1.0 PPM	M101AM	M101BM	N.A.	N.A.
	+/- 2.0 PPM	M101AN	M101BN	M101CM	M101DK
	+/- 3.0 PPM	M101AO	M101BO	M101CN	M101DL
	+/- 5.0 PPM	M101AP	M101BP	M101CO	M101DM

CRYSTAL OSILLATORS

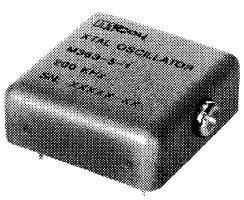
M821XX SERIES OVENIZED OSCILLATORS 7-20 MHZ, SINE OUTPUT



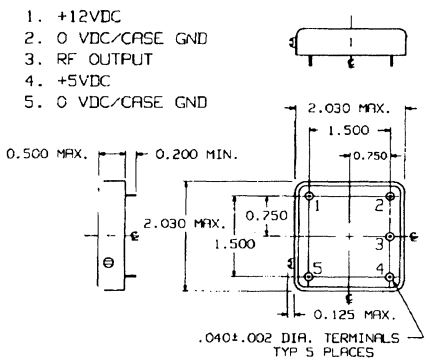


FREQUENCY RANGE	7 TO <11 MHZ		7 TO 20 MHZ	
AGING AT SHIPPING	8 X 10-10 PER DAY		2 X 10-9 PER DAY	
AGING AT 1 YEAR	2.5 X 10-7		5 X 10-7	
TEMPERATURE STABILITY		SINE WAVE OUTPUT		
0 TO +70 DEGREES C	M821AA	+/- 5 X 10-9	M821BA	+/- 5 X 10-8
-20 TO +70 DEGREES C	M821AB	+/- 2 X 10-8	M821BB	+/- 1 X 10-7
-55 TO +75 DEGREES C	M821AC	+/- 5 X 10-8	M821BC	+/- 2 X 10-7

M363XX SERIES TCXO'S 200 KHZ TO 20 MHZ



1. +12VDC
2. 0 VDC/CASE GND
3. RF OUTPUT
4. +5VDC
5. 0 VDC/CASE GND



FREQUENCY RANGE (MHZ)		.2 TO < 3	3 TO < 6	6 TO < 12	12 TO < 20
FREQUENCY ADJUST (PPM)		+/- 3.5 MIN	+/- 3.0 MIN	+/- 3.5 MIN	+/- 5.0 MIN
INPUT CURRENT (MA) @ 5 VDC		20 MA MAX	20 MA MAX	20 MA MAX	20 MA MAX
RISE & FALL TIMES (NS)		< 20	< 20	<15	< 12
AGING (PPM/YEAR)		+/- 1.0 MAX	+/- 0.75 MAX	+/- 1.0 MAX	+/- 1.25 MAX
TEMP RANGE	STABILITY (PPM)		MODEL NUMBERS		
0 TO +50 DEGREES C	+/- 0.5	M363AA	M363BA	M363CA	M363DA
	+/- 1.0	M363AB	M363BB	M363CB	M363DB
	+/- 2.0	M363AC	M363BC	M363CC	M363DC
-20 TO +70 DEGREES C	+/- 0.5	M363AD	M363BD	N.A.	N.A.
	+/- 1.0	M363AE	M363BE	M363CD	M363DD
	+/- 2.0	M363AF	M363BF	M363CE	M363DE
	+/- 5.0	M363AG	M363BG	M363CF	M363DF
-40 TO +85 DEGREES C	+/- 1.0	M363AH	M363BH	N.A.	N.A.
	+/- 2.0	M363AJ	M363BJ	M363CG	M363DG
	+/- 5.0	M363AK	M363BK	M363CH	M363DH
-55 TO +85 DEGREES C	+/- 1.0	M363AL	M363BL	N.A.	N.A.
	+/- 2.0	M363AM	M363BM	M363CJ	M363DJ
	+/- 5.0	M363AN	M363BN	M363CK	M363DK

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GUARANTEED

CRYSTAL CLOCK OSCILLATORS

CRYSTAL CLOCK OSCILLATORS

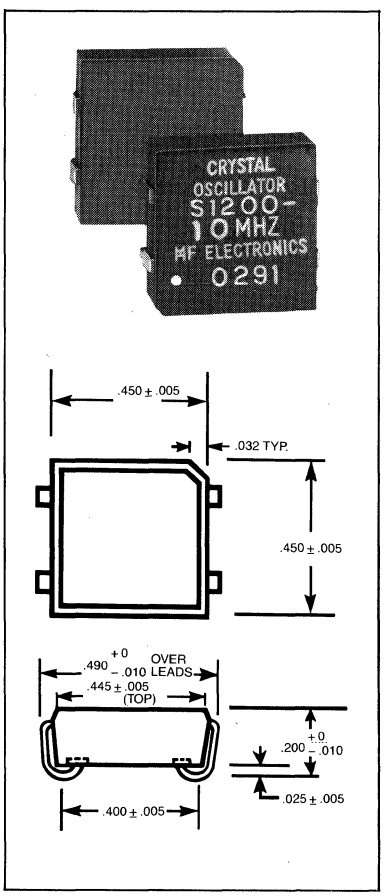
Dependable timing sources for digital devices and systems

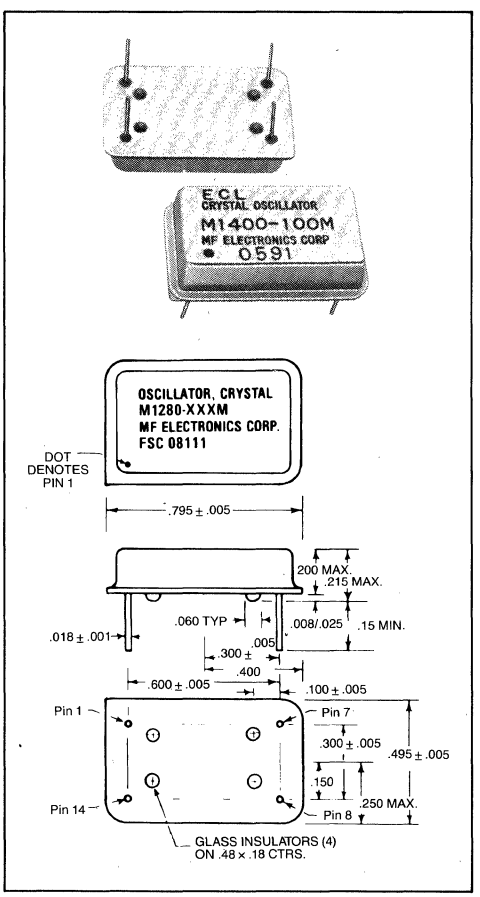
The two/three most popular packages— DIL and Surface Mount From 1 KHz to 325 MHz...

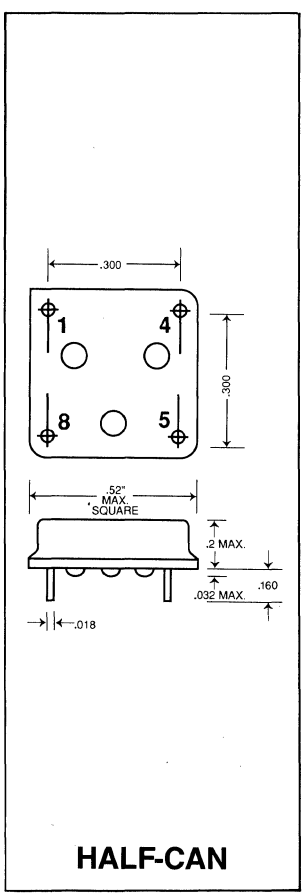
LOGIC FAMILIES OF TTL, HCMOS, ECL, LOW POWER CMOS...

- FIXED FREQUENCY
- VOLTAGE CONTROLLED AND PHASE-LOCKED
- TRI-STATE
- ENABLE/DISABLE
- HIGH DRIVE MOS
- COMPLEMENTARY
- DUAL FREQUENCY
- **TEMPERATURE CONDITIONING: All oscillators pre-aged with 10 cycles of – 55 to 125 deg C, followed by 4 hours at 125 C**

TEMPERATURE OF OPERATION:
0 to 70 deg C
STORAGE TEMPERATURE:
55 to +125 deg C
SHOCK:
1000 G's 0.35 ms, 1/2 sinewave, 3 shocks in each plane
VIBRATION:
10-2000 Hz of .06" DA or 20 G's, whichever is less
HUMIDITY:
Guaranteed to withstand 85 deg C for 1000 hours
GROSS LEAK:
Each unit checked 100% in water at 85°
FINE LEAK:
Mass spectrometer leak rate less than 2 X 10^{-8} atmos, cc/sec of helium
PINS (DIL):
Alloy 52 with 60/40 solder coat over nickel barrier
J-LEADS (SURFACE MOUNT):
Allow 42 with 60/40 solder coat over nickel barrier
DIL CASE:
Stainless Steel
SURFACE MOUNT CASE:
Plastic, for handling ease, over ceramic-metalic hermetic seal







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GUARANTEED

CRYSTAL CLOCK OSCILLATORS

TTL OSCILLATORS 1 KHz to 125 MHz

- Stability under all conditions
- +5 V ±10%, 10 TTL loads
- Symmetry 60/40 or 45/55 (special)
- Operating Temperature 0 to 70°C
- Rise and Fall Time less than 6 ns
- Jitter less than 100 ps

DIL	Surface Mount	Frequency Stability
M1200	S1200	±.01%
M1214	S1214	±.05%
M1215	S1215	±.10%
M1244	S1244	±.0025%
M1245	S1245	±.005%
*M1236	*S1236	±.01%

*Symmetry 45/55

HIGH REL MILITARY HYBRID IN FULL 14 PINS or 4 PINS— 250 KHz to 50 MHz

- Crystal specifically manufactured for oscillator with angle of cut controlled within ±1 minute
- 168 hour Class B burn-in
- M5500 and M5516 have 14 pins
- Extensive environmental testing
- M5622 and M5623 have 4 pins

Case: Stainless Steel
Marking: MF part number, date code, serial number and description. Marking will withstand MIL-STD 202, Method 215
Optional Marking: Customer part number if required

Leads: Gold Plated over nickel
Shock: MIL-STD 202 Method 213A, Test Condition 1
Vibration: MIL-STD 202, Method 204B, Test Condition B

Series	Temperature of Operation	Frequency Accuracy, All Conditions
M5622	−55 to +85°C	±.005% (±50ppm)
M5500, M5516, M5623	−55 to +125°C	±.0075% (±75ppm)

Each unit undergoes the following:

1. Stabilization bake — MIL-STD-883 Method 1008, Cond. B
2. Temperature Cycling — MIL-STD-883 Method 1010, Cond. B
3. Centrifuge — MIL-STD-883 Method 2001, Cond. A
4. Fine Leak — MIL-STD-883 Method 1014, Cond. A1
5. Gross Leak — MIL-STD-883 Method 1014, Cond. C
6. Temperature Stability — within 75 ppm from −55 to +125°C (M5500, M5516, M5623)
within 50 ppm from −55 to +85°C (M5622)
7. Electrical Test at 25°C — See Table 1

Table 1 — Electrical Tests

1. Frequency
2. Current
3. Rise Time (NL)
4. Fall Time (NL)
5. Rise Time (FL)
6. Fall Time (FL)
7. Duty Cycle (NL)
8. Duty Cycle (FL)
9. Frequency at 5.5 V
10. Frequency at 4.5 V
11. Overvoltage (6.5 volts for 30 seconds)
12. "Zero" logic level
13. "One" logic level

Test data on each unit is available for additional cost.

DUAL OUTPUT OSCILLATORS

Series	Frequency
M1260	MOS: 1 MHz to 16 MHz
M1259	MOS: 1 MHz to 8 MHz, and TTL: 2 X MOS Frequency, and
M1257	MOS: 1 MHz to 8 MHz, and TTL: 4 X MOS Frequency

Frequency and Stability:
Including calibration 25°C, operating temperature, change of input voltage, change of load, shock and vibration.

Series	Frequency and Stability
M1260	Output: (Pin 8.) 1 MHz – 16 MHz$^{+0}_{-.02\%}$ MOS
M1259	Output 1: (Pin 8.) 1 MHz – 8 MHz$^{+0}_{-.02\%}$ MOS Output 2: (Pin 1.) 2 times frequency in TTL
M1257	Output 1: (Pin 8.) 1 MHz – 8 MHz$^{+0}_{-.02\%}$ MOS Output 2: (Pin 1.) 4 times frequency in TTL

Output:
MOS:
FREQUENCY: As Specified
LOAD CAPACITANCE: 200 pf., max.
PULSE WIDTH, HIGH: (.5/fo) – 10 ns., min.
PULSE WIDTH, LOW: (.5/fo) – 10 ns., min.
RISE TIME (T_R): 10 ns., max.
FALL TIME (T_F): 10 ns., max.
ZERO LEVEL (LOW): 0.45 V, max.
ONE LEVEL (HIGH): (Vcc – 0.5V) min.

TTL:
SYMMETRY: 55/45 @ 1.4 VDC (M1259, M1260) 60/40 @ 1.4 VDC (M1257)
RISE AND FALL TIME: 10 ns. maximum from 0.5 to 2.4V
"0" LEVEL, SINKING 16 MA: +0.4V
"1" LEVEL, SOURCING 400 MICROAMP, MIN: 2.5V
LOADS: 10 TTL loads

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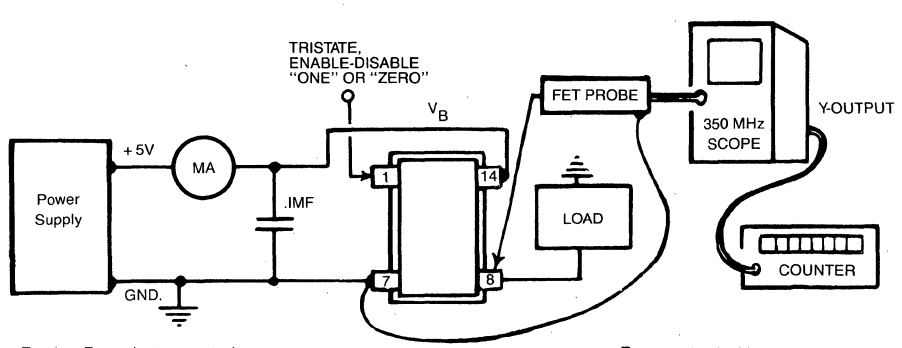
CRYSTAL CLOCK OSCILLATORS CMOS/TTL
1 KHz to 125 MHz WITH TTL/CMOS OUTPUT, ENABLE/DISABLE AND TRISTATE

HCMOS OSCILLATORS FIXED, TRISTATE, ENABLE/DISABLE — 1 KHz to 125 MHz

- **FIXED FREQUENCY—** M1280 (DIL) and S1280 (Surface Mount) are HCMOS, also capable of driving TTL.
- **ENABLE/DISABLE—** M1290 and S1290 are HCMOS, same as the M1280 and S1290 except for Enable/Disable function on Pin 1. When Pin 1 is floating or "1", the output is normal. When Pin 1 is returned to "0", the output goes to a hard "0".
- **TRISTATE—** M3290 and S3290 are HCMOS, same as the M1280 and S1290 except for the Tristate function on Pin 1. When Pin 1 is floating or "1", the output is normal. When Pin 1 is returned to "0", the output is tri-stated (high Z).

Fixed Frequency		Enable/Disable		Tristate		
DIL Series	Surface Mount Series	DIL Series	Surface Mount Series	DIL Series	Surface Mount Series	Stability
M1280	S1280	M1290	S1290	M3290	S3290	.01%
M1281	S1281	M1291	S1291	M3291	S3291	.0025%
M1282	S1282	M1292	S1292	M3292	S3292	.005%
M1283	S1283	M1293	S1293	M3293	S3293	.05%
M1284	—	M1294	S1294	M3294	S3294	.1%

ELECTRICAL SPECIFICATIONS	DIL Package	Surface Mount Package
Frequency Range	1 KHz to 125 MHz	80 KHz to 66 MHz
Input Voltage	5 V ±10% 5 V ± 5% (above 75 MHz)	Same
Input Current		
10 MHz and Below	10 ma.	Same
10.1 to 25 MHz	15 ma.	Same
25.1 to 50 MHz	30 ma.	Same
50.1 to 75 MHz	40 ma.	Same to 66 MHz
75.1 to 125 MHz	60 ma.	
Maximum TTL Loads	10 TTL	Same
Output Levels		
"0" Level, TTL or CMOS	0.4 V, max.	Same
"1" Level		
TTL	2.4 V	Same
CMOS	Vc–0.4 V	Same
Rise and Fall Times		
TTL, from 0.8 to 2.4 V	5 ns	Same
CMOS, 15 pf, 20 to 80%	4 ns	Same
	3 ns (>75 MHz)	—
30 pf, 20 to 80%	6 ns (<75 MHz)	Same



To adapt Fet probe to receptacle use Tektronix Part #103-0164-00.

TEST CIRCUIT FOR ALL UNITS

To connect output to scope use Tektronix Part #131-0258-00 (receptacle)

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CRYSTAL CLOCK OSCILLATORS CMOS/TTL

1 KHz to 125 MHz WITH TTL/CMOS OUTPUT, ENABLE/DISABLE AND TRISTATE

HCMOS OSCILLATORS FIXED, TRISTATE, ENABLE/DISABLE **1 KHz to 125 MHz**

JITTER—
The jitter of the negative transition with respect to the positive transition has a standard deviation of less than 100 picosec.

STARTING TIME—
Less than 5 ms after application of the supply voltage.

POWER SUPPLY RAMP—
Will operate properly with ramping input supply voltage.

SYMMETRY

TTL Load, 1.4 V threshold:	40/60	or better
CMOS Load, 50% fo Vc:	40/60	or better

INPUT REQUIREMENTS FOR PIN 1.:

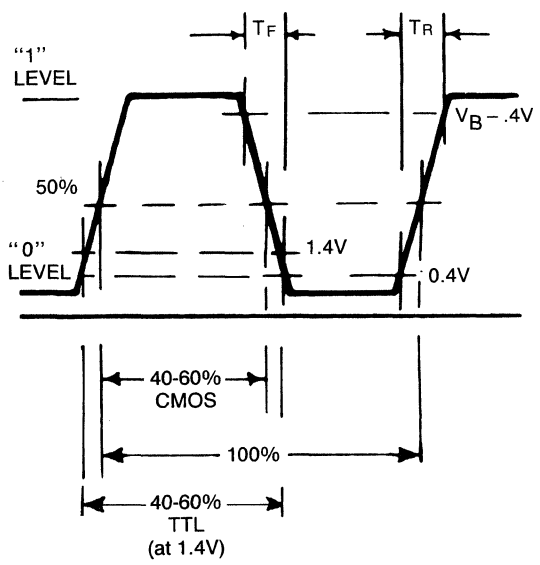
Fixed Frequency (M1280, S1280)	Not connected internally
Enable/Disable (M1290, S1290) or Tristate (M3290, S3290)	
"1" or On	Pin 1 may float or 2.4 V min., sourcing 400 microamp
"0" or (Disable or Tristate	Pin 1 requires 0.4 V, sinking 400 microamp

CONNECTIONS	M1280, S1280	M1290, S1290 Enable/Disable M3290, S3290 Tristate
PIN 1.	NOT USED	Floating or "1": Oscillator runs Ground or "0": Disable or tristate
PIN 7.	Ground and Case	
PIN 8.	Output	
PIN 14.	+ 5 VDC	

HOW TO ORDER:
For Part Number...Add frequency to the Series

For example:
Series S1200, .01% 10 MHz frequency

S1200-10M



WAVEFORMS

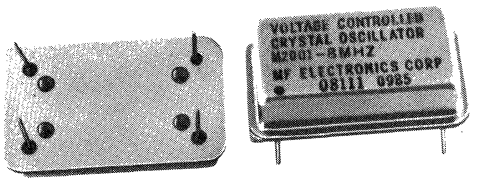
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GUARANTEED

VOLTAGE CONTROLLED CRYSTAL OSCILLATOR (VCXO)•1 MHz to 67 MHz

VOLTAGE CONTROLLED OSCILLATORS — 1 MHz to 66 MHz

Generates a TTL/HCMOS frequency output which is controlled by in input voltage. The end-point frequency/voltage parameters are defined, as is the center frequency voltage range, which is necessary for the VCXO to operate in a closed loop.



- **CAPTURE RANGE—**
  The Frequency-Capture range is equal to the Center-Frequency ± the Frequency Deviation, because every MF VCXO is ATE-tested to meet the Frequency-Deviation over the temperature range. It is not necessary to reduce the capture range by the stability.

USES
- To generate a clean signal from a phase-varying signal
- To multiply a frequency by an integer
- To detect the frequency modulation of an incoming signal

Model	Control Voltage	Frequency Deviation	Guaranteed Capture Range	Control V at Center Frequency
M2001	.3 to 10 V	* ± 175 ppm	± 175 ppm	2.5 to 5.0
M2002	.3 to 4 V	* ± 75 ppm	± 75 ppm	1.3 to 2.3
M2003	.3 to 10 V	* ± 175 to 300 ppm	± 175 ppm	2.5 to 5.0
M2004	.3 to 4 V	* ± 125 ppm	± 125 ppm	1.3 to 2.3
M2005	**1.0 to 4 V	* ± 75 to 300 ppm	± 75 ppm	1.8 to 3.0
M2006	0 to 5 V	* ± 150 ppm	± 150 ppm	
M2007	*** 0.5 to 4.5 V	* ± 125 to 250 ppm	± 125 ppm	1.8 to 2.5

*Frequency Deviation Guaranteed over all temperature range
**Designed for use with MC4044
***Designed for use with 74HC7046

Operating Temperature: 0 to 70 deg C
Supply Voltage: +5 volts
Output: TTL or CMOS

CONNECTIONS
Pin 1. Control Voltage
Pin 7. Ground
Pin 8. Output
Pin 14. +5 Volts

HOW TO ORDER:
For Part Number...
Add frequency to the Series M2001-M2004

For example:
Series M2002 + 10 MHz frequency
M2002-10M

TEST PROGRAM

All M F Electronics VCXO's are tested on the MF VCXO test program, which tests the deviations automatically for each input voltage and frequency deviation.

We are proud to offer you this program, which can be run on an XT PC, using two add-on boards, and an IEEE 488 controlled frequency counter. Please inquire about this free program.

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ECL CRYSTAL CLOCK OSCILLATORS 10 MHz TO 325 MHz

ECL OSCILLATORS

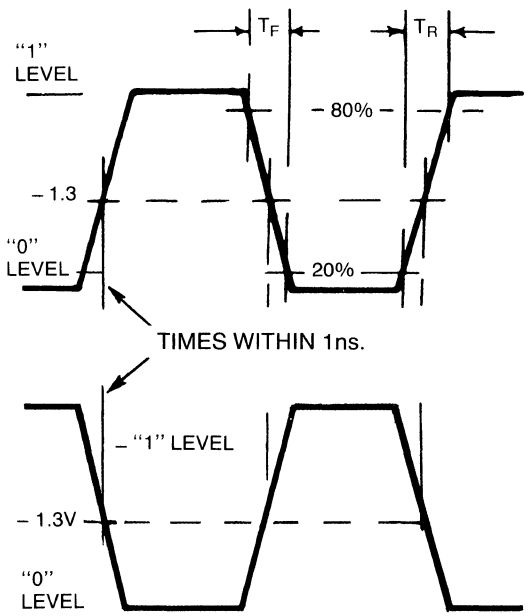
10 KHz to 250 MHz

MF ECL oscillators are available in 10K and 10KH logic, with complementary outputs, and in the three most accepted pin-outs. All are made in the standard DIL package in frequencies from 10 MHz to 325 MHz. Frequency tolerances from .1% to 25 ppm include all effects of voltage, load and ageing.

• **The Series M1400, M1500** have single outputs and the M2400, M2500 have dual-complementary outputs. They use 10K logic and have a frequency range of 10 KHz to 125 HMz.

Connections "A"			
Single Output Series	**Complementary Output Series**	**Frequency Stability**	**Range of Frequency**
M1400	M2400	± .01%	10 KHz to 325 MHz
M1410	M2410	± .02%	
M1436	M2436	± .1%	
M1444	M2444	± .0025%	
M1445	M2445	± .005%	
Connections "B"			
M1500	M2500	± .01%	10 KHz to 325 MHz
M1510	M2510	± .02%	
*M1536	*M2536	± .1%	
M1544	M1544	± .0025%	
M1545	M2545	± .005%	

*Superior symmetry 45/55



Waveforms
One waveform on series M1400-M1445
Both waveforms on series M2400-M2445
Outputs must be loaded with 50 ohms to −2 V or 270 ohms to −5.2 V.

• **The Series M1600, M1700** have single outputs and the M2600, M2700 have dual-complementary outputs. They use 10 KH logic and have a frequency range of 10 KHz to 325 MHz. These oscillators all have case tied to electrical ground.

Connections "A"		Connections "B"		Connections "C"		
Single Output Series	**Complementary Output Series**	**Single Output Series**	**Complementary Output Series**	**Single Output Series**	**Complementary Output Series**	**Frequency Stability**
M1600	M2600	M1700	M2700	M1800	M2800	± .01%
M1610	M2610	M1710	M2710	M1810	M2810	± .02%
M1614	M2614	M1714	M2714	M1814	M2814	± .05%
M1615	M2615	M1715	M2715	M1815	M2815	± .1%
M1644	M2644	M1744	M2744	M1844	M2844	± .0025%
M1645	M2645	M1745	M2745	M1845	M2845	± .005%

CONNECTIONS	"A" Connections	"B" Connections	"C" Connections
Pin 1.	Not used in Single Output or Used for Complementary Output (same termination as Pin 8.)		
Pin 7.	Electrical Ground	Electrical Ground	−5.2 V (Vee)
Pin 8.	Output (requires termination of 270 ohms to Pin 1 or 50 ohms to −2 V)	Output (requires termination of 270 ohms to Pin 7 or 50 ohms to +3 V)	Output (requires termination of 270 ohms to Pin 7 or 50 ohms to −2 V)
Pin 14.	−5 Volts	+5 Volts	Electrical Ground

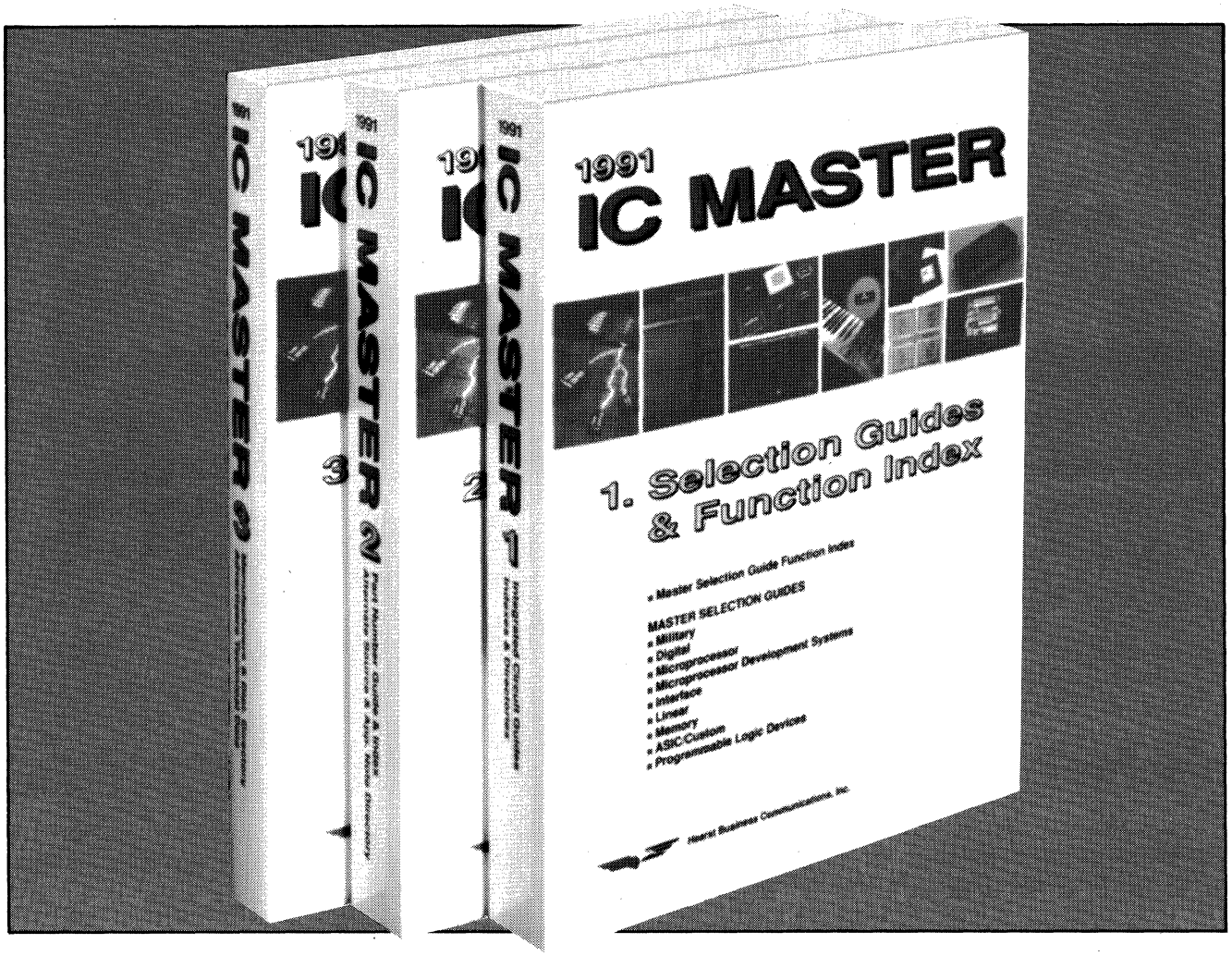
Operating Temperature: 0 to 85 deg, measured at case
Input Voltage: 4.75 to 5.25 volts

Output Levels: Standard ECL levels for 10 K or 10 KH

"NEW"—M1900 has enable/disable feature.

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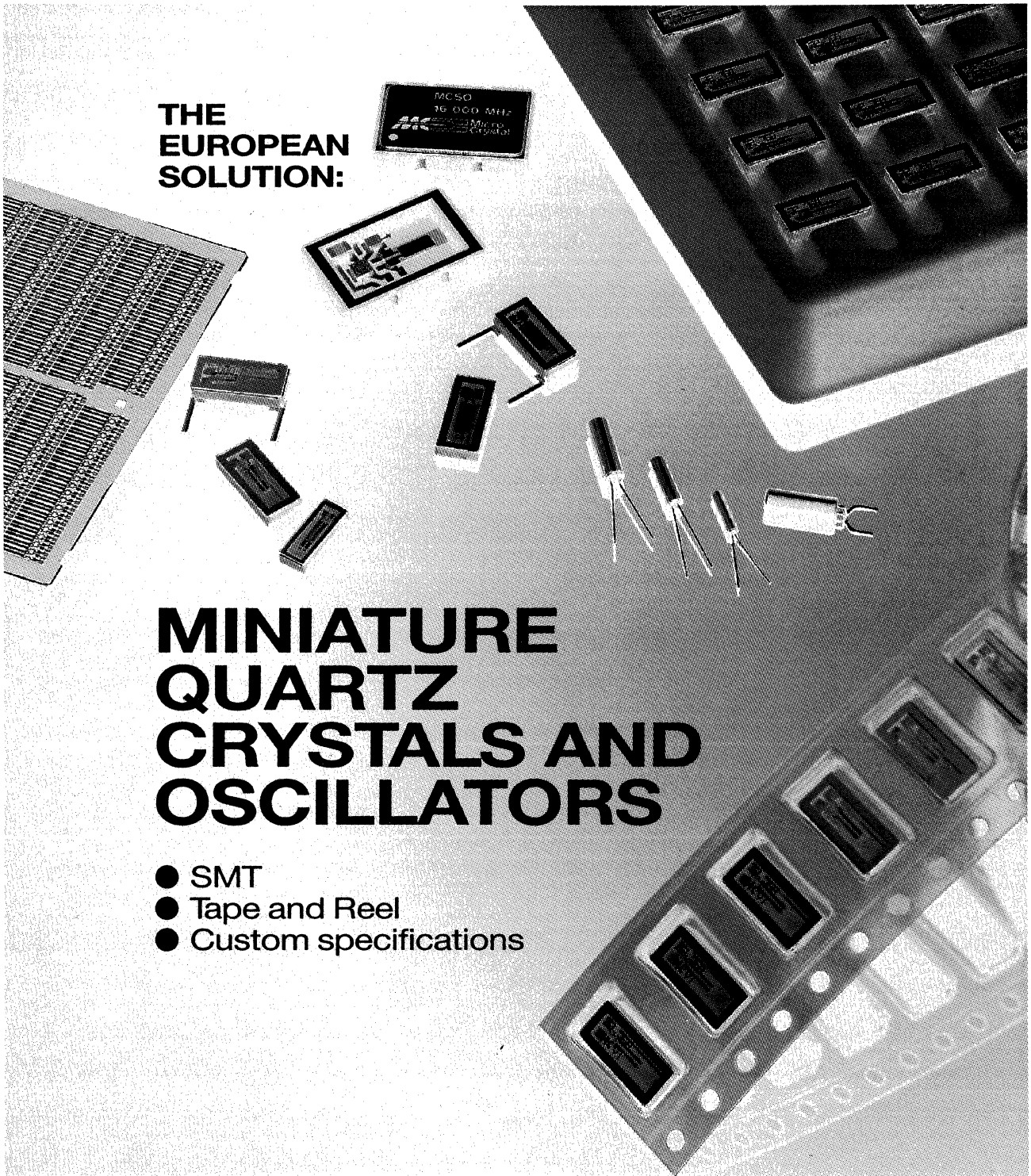
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MINIATURE QUARTZ CRYSTALS AND OSCILLATORS

- SMT
- Tape and Reel
- Custom specifications

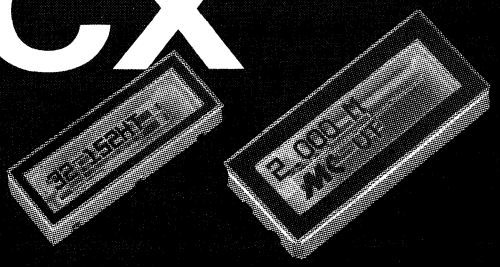
MICRO CRYSTAL
DIVISION SMH (US) INC.
702 WEST ALGONQUIN ROAD
ARLINGTON HEIGHTS, IL 60005

TEL. (708) 806 1485

A company of SMH

FAX (708) 593 5062

CX



FREQUENCY: 10 kHz – 2 MHz

FEATURES:
- Compact ceramic package
- SMD version available in Tape and Reel

DESCRIPTION
This product line uses miniature photochemically processed tuning forks in fundamental or overtone modes and length extensional resonators. Crystals are hermetically solder-sealed under vacuum after mounting in clean rooms. Outstanding features of this quartz crystal in a compact ceramic package with glass lid are tight frequency tuning by laser and high shock resistance. The standard package is available with or without leads and complies with mounting processes up to 210° C (thru-hole mounting or conductive epoxy attach). The high temperature or SMD version (260° C/20 s max) can be supplied in Tape and Reel adapted for automatic pick and place.

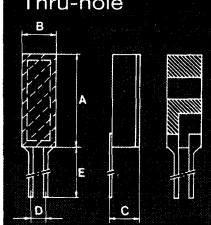
APPLICATION
These rugged and miniature crystals are designed for Pierce oscillators where low power consumption is required. They are very resistant to mechanical shocks and vibrations. Typical applications are in ***pagers, microprocessors, computer peripherals, communication systems, real time clocks, medical devices, etc.***

SPECIFICATIONS
- Tight frequency adjustment tolerances
- Electrical parameters: ask for technical data sheet
- Operating temperature ranges: industrial –40 to 85° C; military –55 to 125° C
- Shock resistance: 5000 g/0.3 ms (1/2 sine)
- Vibration resistance: 20 g/10 to 2000 Hz
- Aging (first year): +/– 5 ppm max

CX1 Dimensions: see at right side

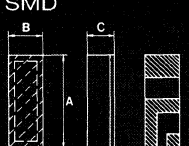
TYPICAL CX2 DIMENSIONS

Thru-hole



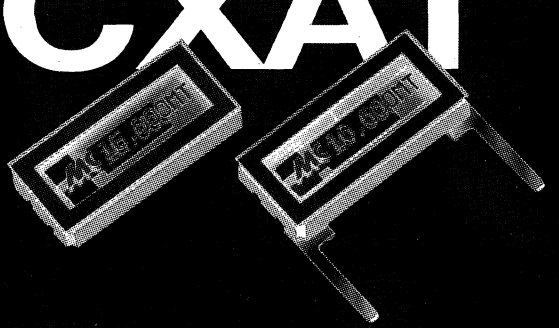
Dim.	Inches	mm
A	0.264	6.7
B	0.100	2.5
C	0.075	1.9
D	0.050	1.27
E	0.220	5.6

SMD



Dim.	Inches	mm
A	0.264	6.7
B	0.100	2.5
C	0.060	1.5

CXAT



FREQUENCY: 8 – 25 MHz

FEATURES:
- Compact ceramic package
- SMD version available in Tape and Reel
- Excellent stability with temperature

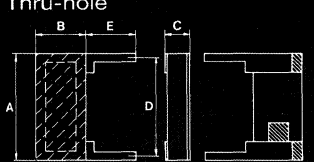
DESCRIPTION
The CXAT quartz crystal is a chemically milled AT-strip resonator vibrating in the fundamental thickness shear mode. It is hermetically solder-sealed under vacuum after mounting in clean rooms. Outstanding features of this AT-strip crystal in a compact ceramic package with glass lid are low aging and high shock resistance. The standard package is available with or without leads and complies with mounting processes up to 210° C (thru-hole mounting or conductive epoxy attach). The high temperature or SMD version (260° C/20 s max) can be supplied in Tape and Reel adapted for automatic pick and place.

APPLICATION
These miniature AT crystals are intended for applications where minimum size, improved shock and vibration resistance and excellent stability are of primary concern. Typical applications are in ***microprocessors, radio communication equipments, measuring instruments, frequency synthesizers, etc.***

SPECIFICATIONS
- Tight frequency tolerances
- Electrical parameters: ask for technical data sheet
- Operating temperature ranges: industrial –40 to 85° C; military –55 to 125° C
- Shock resistance: 5000 g/0.3 ms (1/2 sine)
- Vibration resistance: 20 g/10 to 2000 Hz
- Aging (first year): +/– 3 ppm max

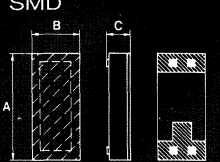
TYPICAL CX1 AND CXAT DIMENSIONS

Thru-hole



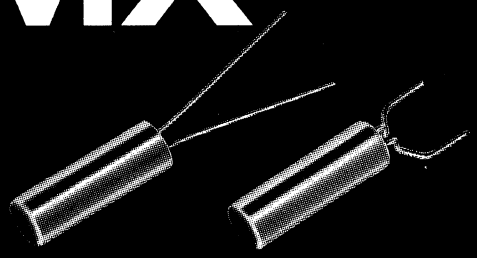
Dim.	Inches	mm
A	0.320	8.1
B	0.150	3.8
C	0.080	2.0
D	0.300	7.6
E	0.150	3.8

SMD



Dim.	Inches	mm
A	0.320	8.1
B	0.150	3.8
C	0.063	1.6

MX



FREQUENCY: 10 – 200 kHz

FEATURES:
- SMD versions in Tape and Reel
- High shock resistant
- Very price competitive

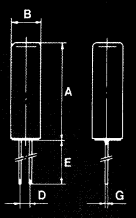
DESCRIPTION
The MX quartz crystal is a miniature chemically milled tuning fork whose performance/price ratio benefits from Micro Crystal's know how acquired in producing hundreds of millions watch tuning forks. The crystal is sealed under vacuum in a tubular ∅ 2 × 6 mm metal can. The standard version can be implemented at temperatures up to 210° C whereas the high temperature version withstands 260° C (20 s max). Two configurations are available, i.e. straight leads for thru-hole mounting or bent leads usually supplied in Tape and Reel for automatic surface mounting. The manufacturing operations are completely automated thus resulting in a very ***reliable*** and ***low priced*** product.

APPLICATION
The MX quartz crystal is intended for use in electronic timing circuits designed for low power consumption (e.g. Pierce oscillators). Due to miniature size, it has extremely high shock resistance.
A special product line has evolved for ***medical applications.***

SPECIFICATIONS
- Typical frequency adjustment: +/– 30 ppm
- Electrical parameters: ask for technical data sheet
- Operating temperature range: –40 to 85° C (other ranges upon request)
- Shock resistance: 5000 g/0.3 ms (1/2 sine)
- Vibration resistance: 20 g/10 to 2000 Hz
- Aging (first year): +/– 5 ppm max

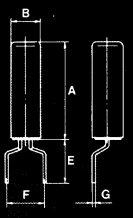
TYPICAL MX1 DIMENSIONS

Thru-hole



Dim.	Inches	mm
A	0.240	6.1
B	0.080	2.0
D	0.028	0.7
E	0.275	7.0
G	0.008	0.2

SMD



Dim.	Inches	mm
A	0.240	6.1
B	0.080	2.0
E	0.120	3.0
F	0.100	2.54
G	0.008	0.2

MCSO



CLOCK OSCILLATOR

FREQUENCY: 100 kHz – 25 MHz

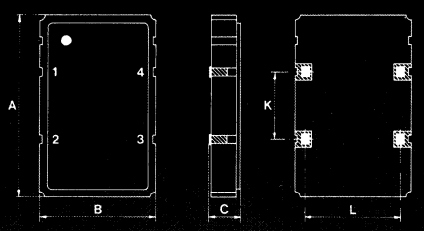
FEATURES:
- Surface mountable ceramic package
- Available in Tape and Reel or in sticks
- Excellent temperature and shock stability

DESCRIPTION
The MCSO is a CMOS and TTL compatible clock oscillator. It includes a miniature AT strip crystal and a HCMOS integrated circuit with frequency dividers. Outstanding features are tight frequency adjustment and a vacuum-sealed ceramic package. The synergic combination of material, assembly and manufacturing in clean rooms vouch for low aging and high reliability.

APPLICATION
The MCSO is designed for ***surface mount*** (260° C/20 s max) with standard pin-out configuration The ceramic package is provided with bumps and optionally with J-leads and can be supplied in Tape and Reel or in sticks. Typical applications are in ***microprocessors*** and ***computers.***

SPECIFICATIONS
- Frequency stability (overall): +/– 100 or +/– 5000 ppm
- Tighter tolerances: on request
- Operating temperature ranges: industrial –40 to 85° C; military –55 to 125° C
- Supply voltage: + 5 V DC (+/– 10 %)
- Shock resistance: 5000 g/0.3 ms (1/2 sine)
- Vibration resistance: 20 g/10 to 2000 Hz
- Aging (first year): +/– 3 ppm max

TYPICAL MCSO DIMENSIONS



Dim.	Inches	mm
A	0.555	14.1
B	0.360	9.1
C	0.095	2.4
K	0.200	5.08
L	0.285	7.25

LEAD	CONNECTION
1	N.C./OPTION: Tristate
2	GND
3	OUTPUT
4	+ Vdc

Micro Crystal was founded in 1978 and is a member of SMH, the largest Swiss group of companies manufacturing watches and microelectronics. Since its founding Micro Crystal's productions has soared to over 50 million miniature Quartz crystals per year.

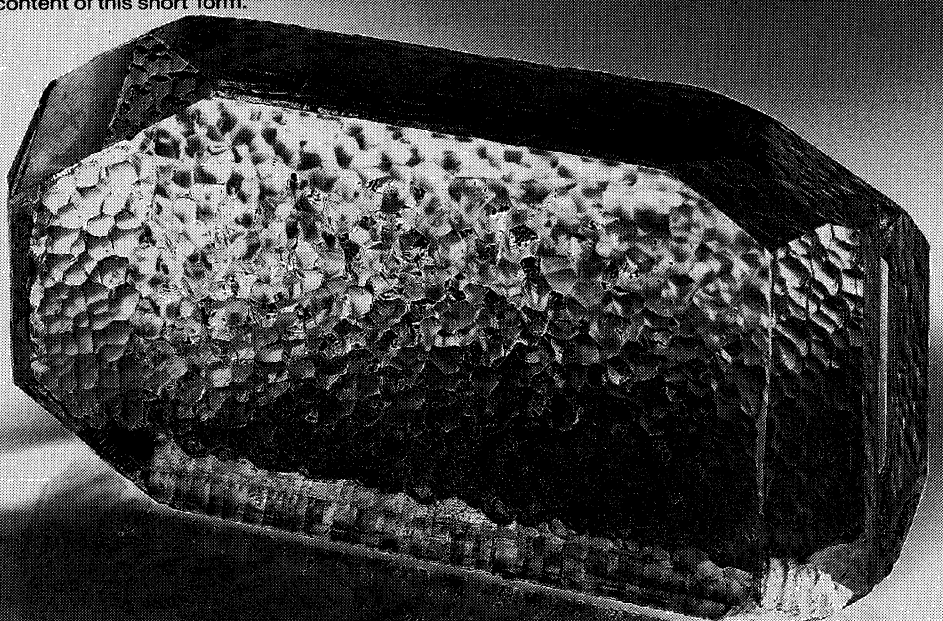
TECHNOLOGY

Micro Crystal produces chemically milled quartz resonators of different shapes and functions: tuning forks, length extensional resonators, thickness shear AT strips and vibrating crystal sensors. All crystals are etched out of accurately machined wafers using a well proven photolithographic batch process.

QUALITY ASSESSMENT

In order to meet customer specifications, Micro Crystal conforms to worldwide acknowledged quality assurance standards like ISO 9000 and to military specifications for quartz crystal units (MIL C 3098 (3) which define environmental and physical characteristics test conditions. The Quality Assurance system is smartly integrated into the manufacturing scheme as well as into design and development work such that all employees be aware of their contribution to the overall quality level.

Notes: The specifications of this short form are subject to change without notice. MC declines any responsability about the content of this short form.



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DIVISION SMH (US) INC.
702 WEST ALGONQUIN ROAD
ARLINGTON HEIGHTS, IL 60005

TEL. (708) 806 1485

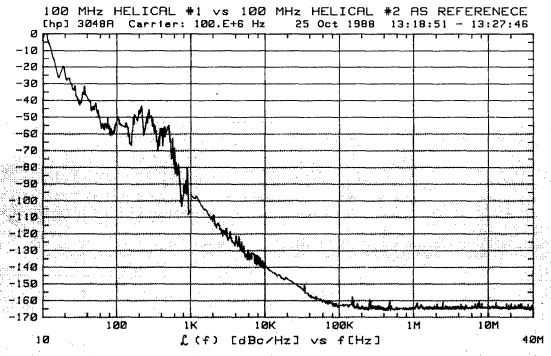
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A wide array of synthesizer configurations (from RF to 23 GHz, with standard frequency resolutions of 1 Hz, 1 KHz, 100 KHz, 125 KHz, and 1 MHz) are available, thanks to modular design and Micronics' vast selection of microwave components.

The modules are configured for either vertical or horizontal mounting. A complete four-module microwave synthesizer with 1 Hz resolution stacks in a 3½" chassis. Circuit boards employing surface mount construction are housed in cast aluminum modules with filtered interconnections to ensure mechanical strength and R.F.I. compliance. A daisy-chained ribbon cable provides complete power, programming, and BITE information.

Micronics also offers two lines of high performance oscillators. The HI "Q" Coaxial Phase Locked Oscillator series covers the frequency range of 800 MHz to 3000 MHz. These units provide excellent phase noise performance and are ideally suited for use in satellite communication systems. Micronics Dielectric Resonator Oscillator series covers the frequency range of 3 GHz to 18 GHz. These units are available as either free running or phase locked.

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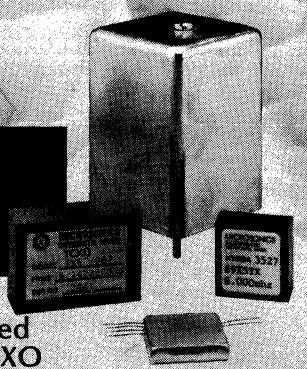
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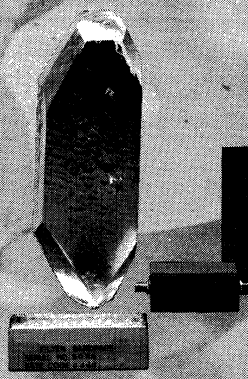
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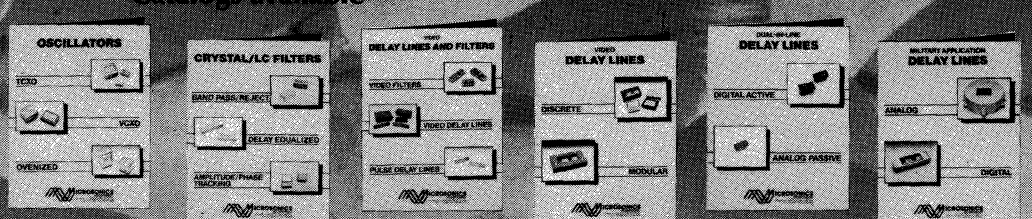
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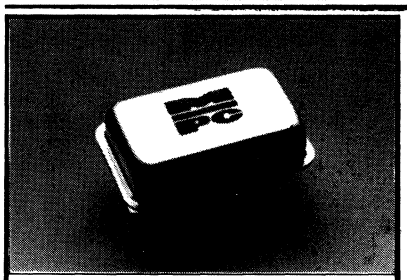
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Catalogs available

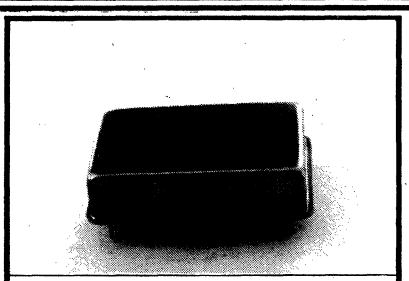


CRYSTALS
TCXO'S, VCXO'S, OCXO'S, HI-REL OSC., DIP OSC.

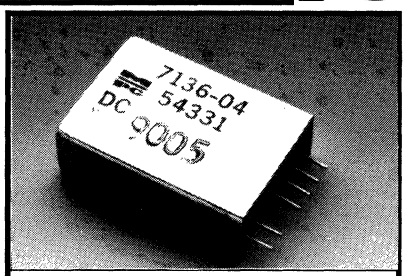
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7265 14 PIN TCXO



7298 24 PIN TCXO



7136 .8 x .4 x 1 INCH TCXO

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

*Frequency Range	Frequency Stability	Temperature Range Deg. C.	**Output Waveform	Size L×W×H in.	Input Voltage	M.P.C. Part Number
500kHZ TO 5.0 Mhz	±5 ppm	−40 to 85	CMOS	1.6×1.6×0.5	10-12 VDC	7157
1.0Mhz TO 10.0 Mhz	±2 ppm	−55 to 70	CMOS	2.0×2.0×0.82	8 VDC	7114
1.0Mhz TO 10.0 Mhz	±1 ppm	−30 to 85	CMOS	2.0×2.0×0.53	10-12 VDC	7143
1.0Mhz TO 10.0 Mhz	±0.1 ppm	0 to 50	CMOS	2.0×2.0×0.53	15 and 5 VDC	7253
10Mhz TO 50.0 Mhz	±5 ppm	−40 to 85	TTL	2.0×2.0×0.75	10-15 VDC	7204
30Mhz TO 70.0 Mhz	±0.5 ppm	0 to 50	SINEWAVE	2.0×2.0×0.75	12-15 VDC	7216

*Consult Factory for Available Standard Frequencies **Other Optional Outputs Available

HYBRID, REDUCED SIZE TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

*Frequency Range	Frequency Stability	Temperature Range Deg. C.	**Output Waveform	Size L×W×H in.	Input Voltage	M.P.C. Part Number
39kHZ TO 22.0 Mhz	±2 ppm ±1 ppm opt.	−40 to 60 −40 to 85 opt.	HCMOS	0.9×0.6×0.4 14 pin dip	12-15 VDC 5 VDC opt.	7285
5.0Mhz TO 24.0 Mhz	±1 ppm ±0.5 ppm	−40 to 85 0 to 70	HCMOS	1.4×0.8×0.35 24 pin dip	8.5-16 VDC	7298
4.0Mhz TO 20.0 Mhz	±2 ppm	−40 to 85	TTL	1.0×1.0×0.50	5 VDC	7272
6.0Mhz TO 20.0 Mhz	±3.0 ppm	−20 to 75	HCMOS	1.4×1.0×0.23	12-15 VDC	7279
25Mhz TO 75.0 Mhz	±4 ppm	−40 to 75	SINEWAVE	0.8×0.4×1.10	5.5 and 13.5 VDC	7136

*Consult Factory for Other Optional Outputs **All Above Units are Hermetically Sealed

LOWEST COST COMMERCIAL/INDUSTRIAL TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

*Frequency Range	Frequency Stability	Temperature Range Deg. C.	**Output Waveform	Size L×W×H in.	Input Voltage	M.P.C. Part Number
5.0Mhz TO 20 Mhz	±0.5 ppm	−15 to 35	TTL	1.0×0.6×0.33	5 VDC ± 5%	7400A1A1
5.0Mhz TO 20 Mhz	±1.0 ppm	0 to 50	TTL	1.0×0.6×0.33	5 VDC ± 5%	7400B2A1
5.0Mhz TO 20 Mhz	±2.0 ppm	−10 to 60	TTL	1.0×0.6×0.33	5 VDC ± 5%	7400D4A1
1.0Mhz TO 20 Mhz	±1.0 ppm	0 to 50	TTL	1.5×1.5×0.50	5 VDC ± 5%	7401B2A2
1.0Mhz TO 20 Mhz	±1.0 ppm	−10 to 60	TTL	1.5×1.5×0.50	5 VDC ± 5%	7401B4A2
1.0Mhz TO 20 Mhz	±2.0 ppm	−20 to 70	TTL	1.5×1.5×0.50	5 VDC ± 5%	7401D7A2

*Consult Factory for Available Standard Frequencies **Other Outputs Available: CMOS and Sinewave

PRECISION, OVEN CONTROLLED CRYSTAL OSCILLATORS

*Frequency Range	Frequency Stability	Temperature Range Deg. C.	**Output Waveform	Size L×W×H in.	Input Voltage	M.P.C. Part Number
1.0Mhz TO 10 Mhz	±0.1 ppm	0 to 50	TTL	2.5×2.5×2.5	15 and 28VDC	3918
5.0Mhz TO 10.0 Mhz	±5×10E−9 ±2×10E−9 opt.	0 to 50	HCMOS	2.0×2.0×1.0	5 and 15VDC	1225
5.0Mhz TO 10.0 Mhz	±2×10E−9 ±1×10E−9 opt.	0 to 50	SINEWAVE	2.0×2.0×4.0	12 -15VDC	1224

*Consult Factory for Other Available Frequencies **Other Optional Outputs Available

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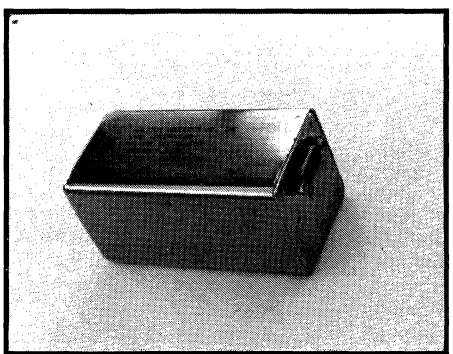
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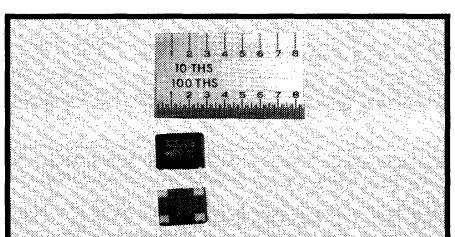
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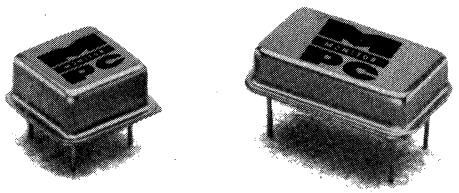
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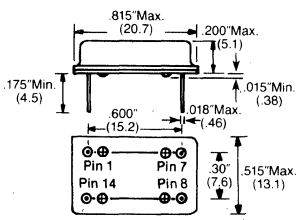
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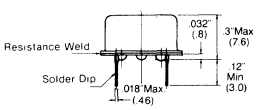
FULL SIZE OSCILLATORS

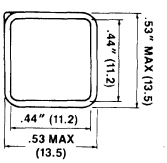


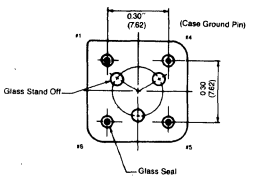
PIN CONNECTION
#1: N.C. #8: OUTPUT
#7: GND #14: + $5V_{DC}$

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Surface Mount Available,
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Glass Epoxy Base.

HALF SIZE OSCILLATORS







PIN CONNECTION
1: RESET OR N.C.
4: GND
5: OUTPUT
#8: +5VDC

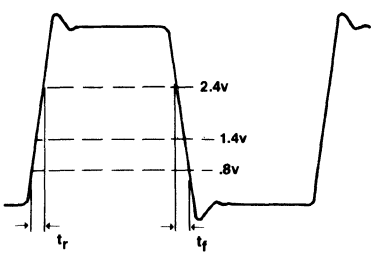
TTL/LSTTL CLOCK OSCILLATORS TO **100 MHZ**

4 PRODUCT FAMILIES

250 KHz - 100 MHz

MOST COMMONLY USED FOR MICROPROCESSOR CLOCK SIGNAL APPLICATIONS

TTL 970T
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TYPICAL OUTPUT WAVE SHAPE



CMOS/**HCMOS** LOCK OSCILLATORS TO **100 MHZ**

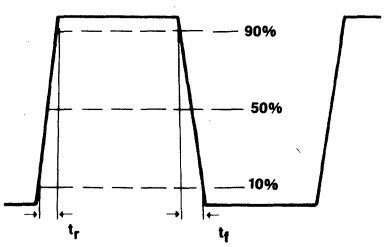
12 PRODUCT FAMILIES

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HCMOS 970H
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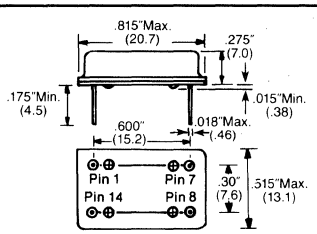


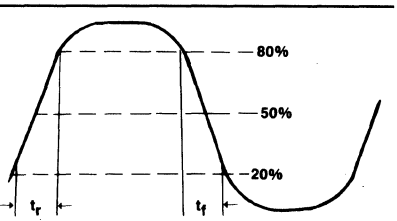
ECL CLOCK OSCILLATORS TO **200 MHZ**

3 PRODUCT FAMILIES

30 MHz - 200 MHz

MOST COMMONLY USED IN HIGH SPEED GRAPHICS APPLICATIONS





ECL 970E TYPICAL OUTPUT WAVE SHAPE

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Highest Tolerance Available: ± 25 PPM @ 25°C **AQL:** .65 Standard (MIL-STD-105)

Product Family	Frequency Range	Standard Frequency Stability	Output Symmetry	TR and TF (Max)	"0" Level (Max)	"1" Level (Min)	Input Voltage Current (Max)	Output Load
970T (TTL)	250 KHz - 100 MHz	±100 ppm (.01%)	50/50 ±10% ±5% Avail.	15nS 250 KHz - 3.5 MHz 10nS 3.5 MHz - 20 MHz 6nS 20 MHz - 80 MHz	+ 0.4V	+ 2.4V	5V ± 10% 70mA 250 KHz-3.19 MHz 30mA 3.2 MHz-24.9 MHz 50mA 25 MHz - 80 MHz	10 TTL Gates
970TX (Tight Tolerence)	9.9 MHz - 24.0 MHz	±5 ppm (.0005%)	50/50 ±10%	30nS Max	+ 0.4V	+ 2.4V	5V ± 10% 20mA Max	5 TTL Gates
975T (1/2 Size)	500 KHz - 70 MHz	±100 ppm (.01%)	50/50 ±10% ±5% Avail.	10nS Max	+ 0.4V	+ 2.4V	5V ± 10% 50mA Max	5 TTL Gates
970L (LSTTL)	4 MHz - 80 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 2.4V	5V ± 10% 30mA Max	4-25 MHz 10 LSTTL 25-50 MHz 5 LSTTL 50-80 MHz 3 TTL
970CX (Tight Tolerence CMOS)	9.9 MHz - 24.0 MHz	±5 ppm (.005%)	50/50 ±10% @ 1.4V_t	30nS Max	+ 1.0V	+ 3.2V	5V ± 10% 20mA Max	CMOS 15 pf
970H (Hi-Speed CMOS)	500 KHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	5V ± 10% 20mA Max	CMOS CL 20 pf
975H (1/2 Size)	500 KHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	5V ± 10% 15mA Max	CMOS 20pf
970HD (Dual Output HCMOS)	1.8 MHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	+5V ±10% 30mA Max	CMOS 20pf
970HHT (Tristate High Enable CMOS Input)	1.5 MHz - 100 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	50mA Max	CMOS 20pf or 10 TTL Compatible Gates to 50 MHz
970HTT (Tristate High Enable TTL Input)	1.5 MHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	50mA Max	CMOS 20pf or 10 TTL Compatible Gates to 50 MHz
970HHTX Heavy Load Tristate)	1.5 MHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	50mA Max	CMOS 50pf or 10 TTL Compatible Gates to 50 MHz
970HTTX Heavy Load Tristate)	1.5 MHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	50mA Max	CMOS 50 pf or 10 TTL Compatible Gates to 50 MHz
975HHT (Tristate High Enable CMOS Input)	1.5 MHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	5V ±10% 50mA Max	CMOS 20 pf or 10 TTL Compatible Gates to 50 MHz
975 HTT (Tristate High Enable CMOS Input)	1.5 MHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	5V ±10% 50mA Max	CMOS 20 pf or 10 TTL Compatible Gates to 50 MHz
975HTTX (Heavy Load Tristate)	1.5 MHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	5V ±10% 50mA Max	CMOS 50pf or 10 TTL Compatible Gates to 50 MHz
975 HHTX (Heavy Load Tristate)	1.5 MHz - 70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max	+ 0.5V	+ 4.5V	5V ±10% 50mA Max	CMOS 50pf or 10 TTL Compatible Gates to 50 MHz
970EAG (ECL)	30 MHz - 200 MHz	±100 ppm (.01%)	50/50 ±10%	2nS Max	+3.2V	+4.0 V	+5V ±10% 60mA Max	330 ohms
970EB 970EC (ECL)	30 MHz - 200 MHz	±100 ppm (.01%)	50/50 ±10%	2nS Max	-1.60V	-1.00V	- 5.2V ±10% 60mA Max	50 ohms

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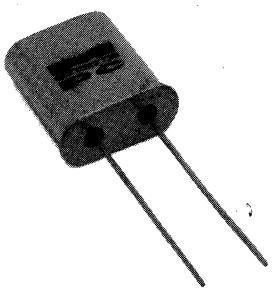
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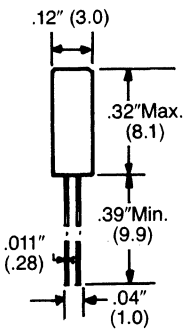
TCXO'S, VCXO'S, OCXO'S, HI-REL OSC., DIP OSC. CRYSTALS

$2 MILLION INVENTORY TO SERVE OUR CUSTOMERS

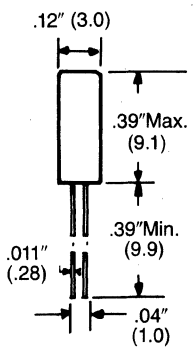
SELECTED CRYSTALS AVAILABLE FOR 28 CENTS



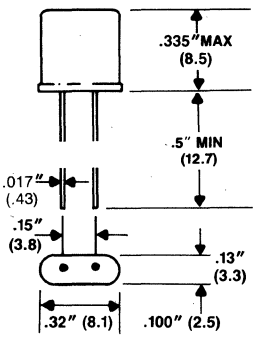
MM-38



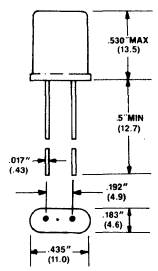
MM-39



MM-80 Dimensions in inches and (mm)

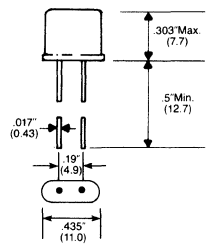


MM-18/49 *



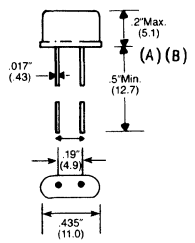
Optional 3rd Lead Available .5" (12.7) MIN
*Resistance Welded

ML-49

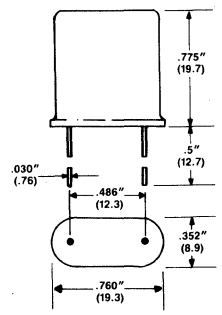


MS-49

Height Options
A = .157" (4.0)
B = .141" (3.6)



MM-33/MM-51*



Optional 3rd Lead Available .5" (12.7) MIN
*Resistance Welded

MICROPROCESSOR CRYSTAL CHARACTERISTICS

MPC Part #	Frequency Range	Stability	ESR OHMS (Max)	Drive Level (Max)	Shunt Capacitance (Max)
MM-38	23.0 KHz - 120.0 KHz	±50 ppm -10°C to 60°C	40K OHMS	100 µW	1.1pf
MM-39	3.579 MHz - 25.0 MHz	±50 ppm -10°C to 60°C	40K OHMS	100 µW	7.0 pf
MM-18/49	1.0 MHz - 24.0 MHz [2] *(Fundamental)* 24.0 - 170.0 MHz *(Overtone)*	±50 ppm[1] -20°C to 70°C	1.0 MHz 3000 OHMS 3.579 - 12.0 MHz 100 OHMS 12.0 - 70.0 MHz 40 OHMS 70.0 - 170.0 MHz 130 OHMS	1.0 mw	7.0 pf
MM-80	3.5 MHz - 30.0 MHz *(Fundamental)* 30.0 MHz - 170.0 MHz *(Overtone)*	±50 ppm -20°C to 70°C	3.5 MHz 200 OHMS 25.0 MHz 25 OHMS 130.0 - 150.0 MHz 150 OHMS	100 µW	7.0pf
MS-49	3.579 MHz - 50.0 MHz	±50 ppm -20°C to 70°C	3.5 - 3.99 MHz 150 OHMS 4.0 - 5.99 MHz 120 OHMS 6.0 - 8.99 MHz 80 OHMS 9.0 - 11.99 MHz 60 OHMS	1.0 mw	7.0pf
ML-49	3.5 MHz - 25.0 MHz *(Fundamental)*	±50 ppm -20°C to 70°C	3.5 MHz 150 OHMS 10.0 MHz 40 OHMS 25.0 MHz 60 OHMS	1.0 mw	7.0pf
	25.0 MHz - 75.0 MHz *(3rd Overtone)*	±50 ppm -20°C to 70°C	25.0 MHz 60 OHMS 40.0 - 75.0 MHz 40 OHMS		
MM-33/51	245 KHz - 4.0 MHz	±50 ppm[1] -10°C to 60°C	245 KHz - 1.0 MHz 200 OHMS 1.0 - 1.8432 MHz 800 OHMS 1.8432 - 2.0 MHz 500 OHMS 2.0 - 3.0 MHz 400 OHMS 3.0 - 4.0 MHz 100 OHMS	2.0 mw	7.0 pf

Load Capacitance: Specify [1] Below 2MHz stability tolerance is ±100 ppm [2] Frequency range over 3 MHz are all AT Cut - See MM-38 for lower frequencies

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MONITOR PRODUCTS MICROPROCESSOR CRYSTALS

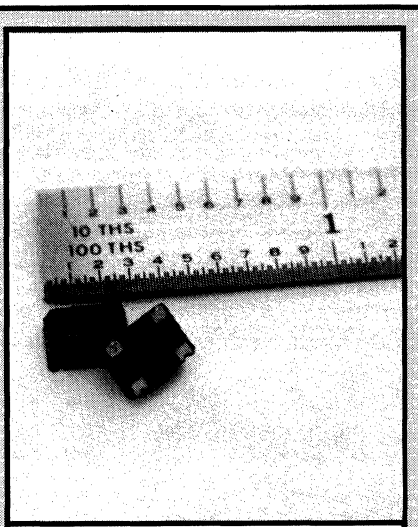
MONITOR PRODUCTS SURFACE MOUNT CRYSTALS & CLOCK OSCILLATORS

SURFACE MOUNT CLOCK OSCILLATORS

NEW SM-990 CLOCK OSCILLATOR 1.5-60 MHz

- Smallest Oscillator Available
- Ceramic/Glass Package
- Full Hermetic Seal to 2 x 10^{-8} ATM, CC/Sec. of helium
- High Reliability
- Tri-State Enable Disable
- TTL/CMOS Compatible
- Load, 50 pf TO 50 MHz, 35 pf to 60 MHz
- Storage – 55 to 125 Deg C
- Operating 0-70 Deg. C Standard
- Symmetry ± 5% (@ 50% vcc)
- 5 ns Typical Rise and Fall Time
- Input Voltage 5 vdc ± 0.5v
- Input Current 1.5-20 MHz, 20ma, 20-60 MHz, 35 ma

Options: Extended Operating Temperature Range, Tighter Frequency Tolerances, Hi-Rel Burn-In and Screening.

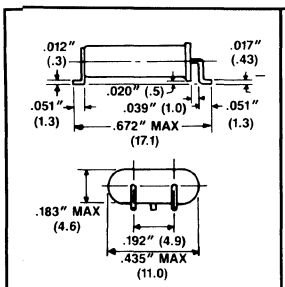


NEW SM-990 OSCILLATOR
SIZE: 0.27 x 0.19 x 0.09 INCH

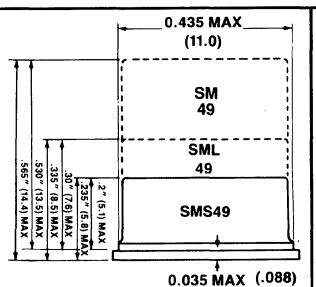
Surface Mount Oscillators available in all output formats. See 970 Series Oscillator Characteristics for specifications. Not all options available in all product families, check family datasheet or call factory.

SURFACE MOUNT CRYSTALS

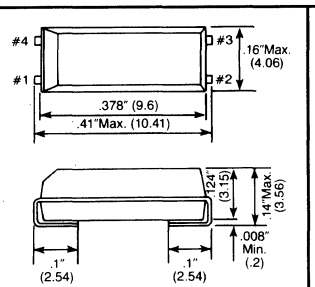
Dimensions in inches and (mm)



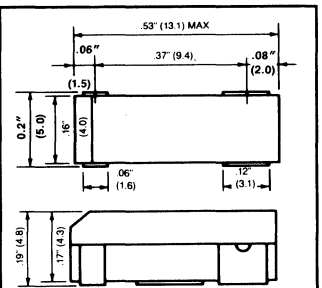
SM-49



SM-49, SML 49, SMS 49
Tape & Reel Available



SM-38
Tape & Reel Available



SM-55
Tape & Reel Available

SURFACE MOUNT CRYSTAL CHARACTERISTICS

MPC Part #	Frequency Range	Stability	ESR OHMS (Max)	Drive Level (Max)	Shunt Capacitance (Max)
SM - 49	1.0 MHz - 150.0 MHz	±50 ppm -20°C to 70°C	3.5 MHZ 200 OHMS 24.0 MHZ 20 OHMS	1.0 mw	7.0pf
SMS - 49	3.57 MHz - 20.0 MHz	±50 ppm -20°C to 70°C	6.0 MHZ 150 OHMS 6.0 - 10.0 MHZ 80 OHMS	1.0 mw	7.0 pf
SML- 49	3.57 MHz - 75.0 MHz	±50 ppm -20°C to 70°C	3.5 MHz 150 OHMS 10.0 MHz 40 OHMS 25.0 MHz 60 OHMS	1.0 mw	7.0 pf
SM - 38	32.768 KHz	±50 ppm -10°C to 60°C	40K OHMS	100 µW	.85 (TYPICAL)
SM - 55	3.5 MHz - 50.0 MHz	±100 ppm -10°C to 70°C	3.5 MHz 200 OHMS 10.0 MHz 60 OHMS 25.0 MHz 50 OHMS	100 µW	7.0 pf

Load Capacitance: Specify [1] Below 2MHz stability tolerance is ± 100 ppm [2] Frequency range over 3 MHz are all AT Cut - See MM-38 for lower frequencies

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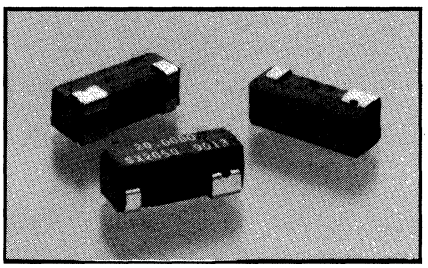
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M-tron

Your Partner for Quality, Delivery, and Service

Crystals

Our new AT strip crystals meet the growing demand for miniaturization of packaged crystals and surface mount oscillators.



The core of M-tron's business philosophy is the further development of synergistic partnerships both with existing customers and potential users of our high quality, competitively priced products worldwide. Through the ongoing communications and transactions, our component development programs are aimed directly at providing you with solutions to your future technology, product, and service needs.

	MP-1 µP	**MP-2 µP**	**UM-1**	**SX2050P**
	Fig. 3	Fig. 1		Fig. 5
Freq.	1.8432-200 MHz	1.0-200 MHz	7.0-150 MHz	4.0-24.0 MHz
Cal:	±.005%, 25° C	±.005%, 25° C	per customer spec.	±.005%, 25° C
Stab:	±.005%, 0° to +70° C	±.005%, 0° to +70° C	per customer spec.	±.01%, 0° to 70° C
C_0	7.0 pF max	7.0 pF max	7.0 pF max	5.0 pF max
C_L	18 pF std, series	18 pF std, series	18 pF std, series	18 pF std
R_1	25-800 Ohm	25-800 Ohm	50-120 Ohm	50-150 Ohm
Pkgs:	HC-18/U, HC-49/U	HC-33/U, HC-51U	per customer spec.	Surface Mount

	ATS-1 Submin.	**MMCC-1,-2**	**ATS-49 Submin.**	**MIL-C-3098 QPL**
	Fig. 4	Fig. 4	Fig. 2	Fig. 1, 3
Freq.	4.0-24.0 MHz	32.768 kHz	3.5-20.0 MHz	1.0-61.0 MHz
Cal:	±.005%, 25° C	±.002%, 25° C	±.005%, 25° C	Per Mil-Std
Stab:	±.01%, 0° to +70° C	±.003%, 0° to +50° C	±5 ppm max/year max	±Per Mil-Std
C_0	5.0 pF max	1.7 pF of max	7.0 pF max	7.0 pF max
C_L	18 pF std	12.5 pF std, series	per customer spec.	Per Mil-Spec
R_1	50-150 Ohm	35K Ohm max	40-200 Ohm	25-800 Ohm
Pkgs:	cylindrical, 3x9 mm	cyl., 3x8, 2x6 mm		HC-6/U, HC-18/U, HC-25/U, HC-33/U, HC-48/U, HC-49/U, HC-51/U, HC-50/U

Crystal Package Dimensions

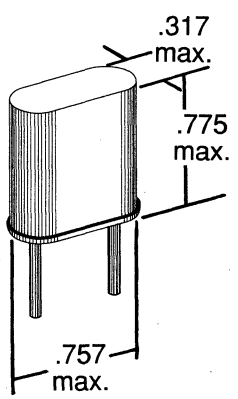


Fig. 1

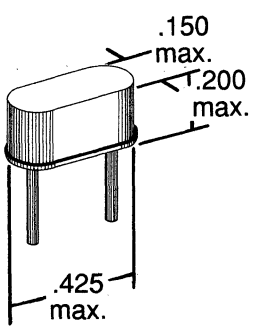


Fig. 2

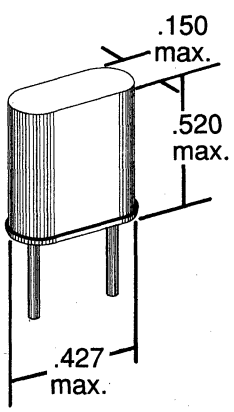


Fig. 3

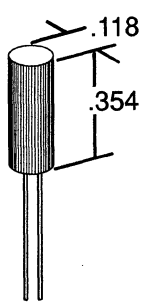


Fig. 4

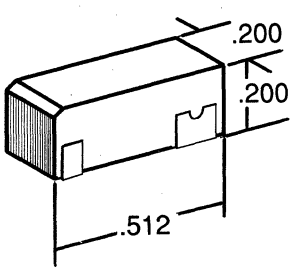
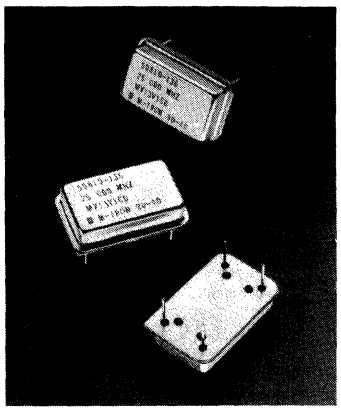


Fig. 5

Oscillators



MH series...
M-tron's MH series crystal clock oscillators provide state of the art HCMOS logic in packages HALF the size of conventional clock oscillators with TTL compatibility and enable/disable option.

ML series...
M-tron's ML series low power CMOS clock oscillator was developed originally as a stable time base generator for battery powered smart munitions. These oscillators use a 32.768 kHz tuning fork crystal as the primary timebase.

ME series...
M-tron's ME series ECL clock oscillators provide excellent rise and fall times, duty cycle, and power supply noise rejection. The ME is available from 50 to 150 MHz.

MV series...
M-tron's MV series VCXO's are HCMOS and TTL compatible, with output drive capability rated at 10 TTL gates or 50 pF HCMOS loads. Pullabilities up to ±200 ppm are available.

Communications Components

M-tron involvement in military programs has led to the development of components for local area and wide area real-time data communications. Typical of these activities is a device involved in an ongoing battlefield LAN development program which incorporates advanced DTMF techniques.

	MS HCMOS VCXO/XO	MV HCMOS VCXO	MHO+ HCMOS
	Fig. 9	Fig. 7	Fig. 7
Freq.	183 Hz-32.768 MHz	3.0-25.0 MHz	732 Hz-80.0 MHz
Stab:[1]	±100 ppm, 0° C to +70° C	±100 ppm, 0° C to +70° C	±100 ppm, 0° C to +70° C
Supply:	5.0 VDC ±10%	5.0 VDC ±5%	5.0 VDC ±10%
Pkgs:	Ceramic 6-pin DIP, SMT	Metal 14-pin DIP, SMT	Metal 14-pin DIP
Opts:	VCXO or XO, tristate	50 - 200 ppm pullability	Enable/Disable

	MHO HCMOS	MH HCMOS	ME ECL
	Fig. 7	Fig. 8	Fig. 7
Freq.	3.0-25.0 MHz	1.0-70.0 MHz	50-150 MHz
Stab.[1]	±100 ppm, 0° C to +70° C	±100 ppm, 0° C to +70° C	±100 ppm, 0° C to +70° C
Supply:	5.0 VDC ±10%	5.0 VDC ±10%	-5.2 VDC ±5%
Pkgs:	Metal 14-pin DIP, SMT	Metal 8-pin DIP, SMT	Metal 14-pin DIP, SMT
Opts:	Enable/Disable, Dual Ø	Enable/Disable	Dual Ø, reverse supply polarity

	MCO CMOS	ML CMOS	5918 CMOS
	Fig. 7	Fig. 7	Fig. 10
Freq.	732 Hz - 12.0 MHz	32.768 kHz	250 Hz - 15.0 MHz
Stab.[1]	±100 ppm, 0° C to +70° C	±100 ppm, 0° C to +70° C	±25/±50 ppm, -20° C to +70°C
Supply:	5.0 to 15.0 VDC	3.0 to 6.0 VDC	5, 8, 12, or 15 VDC
Pkgs:	Metal 14-Pin DIP, SMT	Metal 14-Pin DIP, SMT	Metal 14-pin DIP, SMT
Opts:	Dual output, Dual Ø	÷ to 2 Hz	

	MTO TTL	5916 TTL	5917 Gated TTL
	Fig. 7	Fig. 10	Fig. 10
Freq.	220 kHz-80.0 MHz	4-20 MHz	4-20 MHz
Stab.[1]	±100 ppm, 0° C to +70° C	±25/±50 ppm, -20° to +70° C	±25/±50ppm,-20°C to +70° C
Supply:	5.0 VDC ±10%	5.0 VDC ±10%	5.0 VDC ±10%
Pkgs:	Metal 14-pin DIP, SMT	Metal 14-pin DIP	Metal 14-pin DIP
Opts:	Enable/Disable, Dual Ø		Enable/Disable (std.)

	MZO NMOS
	Fig. 7
Freq.	1.75-12 MHz
Stab.[1]	+0/-200 ppm, 0° to +70° C
Supply:	5.0 VDC ±10%
Pkgs:	Metal 14-Pin DIP
Opts:	TTL output 2x NMOS freq. up to 6 MHz

Notes:
[1] Standard stability specs. Tighter specs available over extended commercial and military temperature ranges.

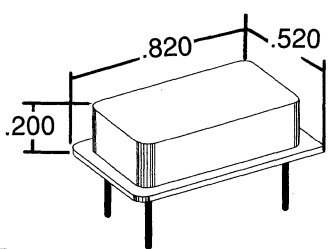


Fig. 7

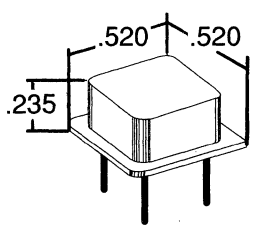


Fig. 8 (Surface Mount available)

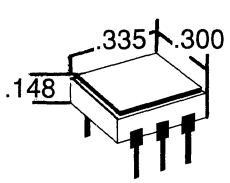


Fig. 9 (Surface Mount Available)
Also vailable with L lead, gull lead, butt lead

(All dimensions are in inches.)

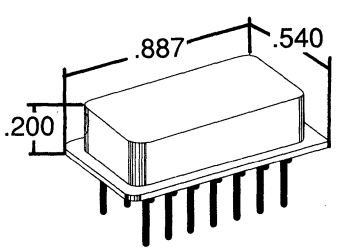


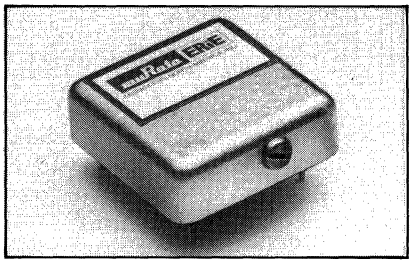
Fig. 10

M-tron Industries, Inc. P.O. Box 630, Yankton, SD 57078 (605) 665-9321 FAX(605) 665-1709

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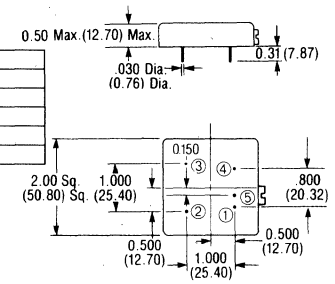
TCXO, STANDARD



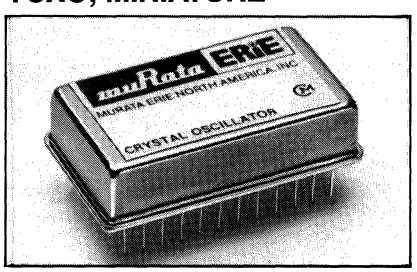
SPECIFICATIONS

MODEL	TC2140-□□
Features	High stability Very low aging
Frequency Range	6MHz to 20Mhz
Frequency Stability vs. Temperature Range	±0.25ppm 0°C to +50°C
Input Voltage & Current	D Std. @ 15mA Max. (C thru G avial.)
Output type	T Std.
Aging Rate	0.2ppm/Yr.
Frequency Adjustment	Mechanical 10 Yr. Range Minimum

PIN	FUNCTION
1	Output
2	B+
3	Ground
4	N/C
5	Ground



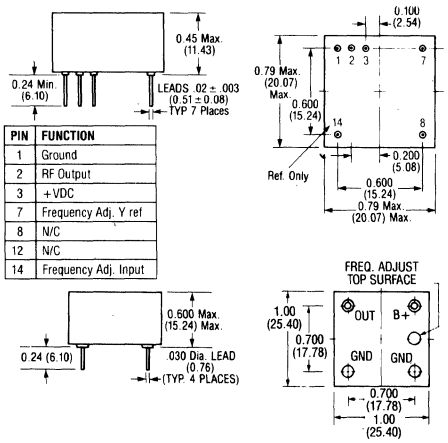
TCXO, MINIATURE



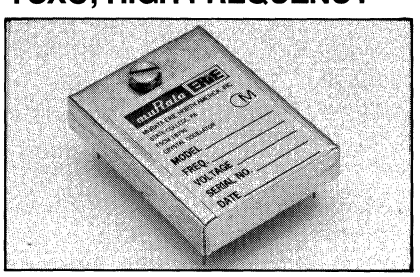
SPECIFICATIONS

MODEL	TC2100-□□	TC2110-□□
Features	Requires only 0.35 cu. In., Direct Replacement for K1516 Series	Low cost, +5VDC operation
Frequency Range	6MHz to 24MHz	5MHz to 18MHz
Frequency Stability Vs. Temperature Range	±2ppm, −40°C to +85°C	±1ppm, −20°C to +70°C
Input Voltage & Current	C Std. @ 15mA Max. (B thru F available)	A Std. @ 15mA Max.
Output Type	N Std. (Harmonics < −20dBc)	H Std.
Aging Rate	1ppm/YR.	1ppm/YR.
Frequency Adjustment	Electrical Via Ext. Pot. or control voltage; 5 Yr. Range Minimum	Mechanical 10 Yr. Range Minimum
Figure	1	2

PIN	FUNCTION
1	Ground
2	RF Output
3	+VDC
7	Frequency Adj. Y ref
8	N/C
12	N/C
14	Frequency Adj. Input



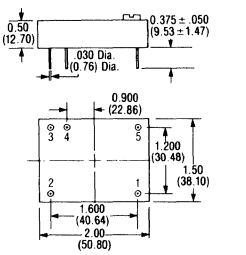
TCXO, HIGH FREQUENCY



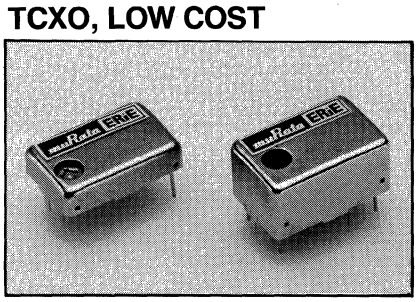
SPECIFICATIONS

MODEL	TC2170-□□	TC2180-□□
Features	Small Package Internal freq. multiplier for better stability with fundamental crystal.	Very small package for UHF TCXO
Frequency Range	24MHz to 120MHz	120MHz to 500MHz
Frequency Stability Vs. Temperature Range	±1ppm, −40°C to +70°C	±5ppm, −40°C to +70°C
Input Voltage & Current	B Std. @ 40mA Max. (B thru E available)	B Std. @ 45MA Max. (B thru E available)
Output Type	J Std. (Harmonics & Subharmonics < −30dBc)	J Std. (Harmonics & Subharmonics < −30dBc)
Aging Rate	1ppm/YR.	2ppm/YR.
Frequency Adjustment	Mechanical; 5 Yr. Range Minimum	Mechanical; 5 Yr. Range Minimum
Figure	3	3

PIN	FUNCTION
1	B+
2	Ground
3	Output
4	Ground
5	Ground



TCXO, LOW COST

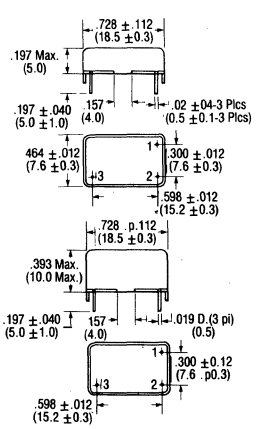


SPECIFICATIONS

MODEL	TC3024AR	TC3025AR
Features	Low Cost	Low Cost
Frequency Range	12.800 to 15.360MHz	8.00 to 26.00 MHz
Frequency Stability Vs. Temperature Range	±2.5ppm, −30°C to +70°C	±2.5ppm, −30°C to +70°C
Input Voltage & Current	5VDC, 2mA max.	5VDC, 3mA max.
Output Type	Sine 1Vp-p, 20KΩ, 10pF	Sine 1Vp.p, 20KΩ, 10pF
Aging Rate	±1ppm/YR.	±1ppm/YR.
Frequency Adjustment	Int. Trimmer	Int. Trimmer
Figure	4	5

PIN	CONNECTIONS
1	GND
2	OUT
3	+DC

PIN	CONNECTIONS
1	GND
2	OUT
3	+DC

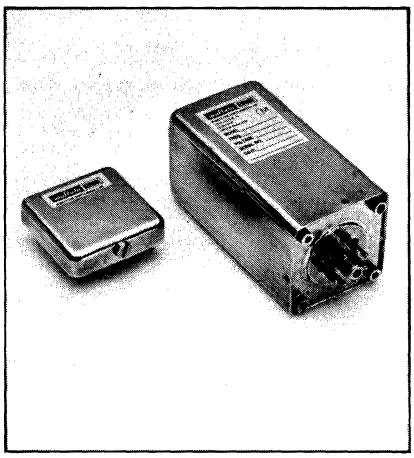


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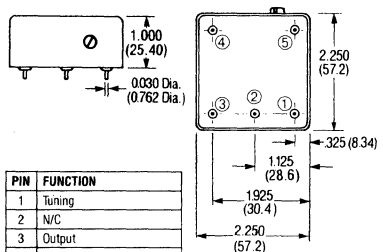
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OCXO, HIGH STABILITY



SPECIFICATIONS

MODEL	OC2500-□□	OC2520-□□	OC2530-□□	OC2540-□□
Features	Low Profile Oven	"SC" or "IT" Cut Crystal For Fast Warm-Up Low Phase Noise	VHF Frequency	Miniature Pkg. Low Power Consumption
Frequency Range	1MHz to 20MHz	5MHz to 15MHz	50MHz to 400MHz	6MHz to 20MHz
Input Voltage and Power	15VDC 1.5W @ 25°C Typ. 4W Max. @ Turn-On	F Std. 3W @ 25°C Typ. 15W Max. @ Turn-On	15VDC 3.0W @ 25°C Typ. 9W Max. @ Turn-On	10.0VDC 0.3W @ 25°C Typ. 0.6W Max. @ Turn-On
Output Type	TTL	+7 dBm into 50Ω	+3 dBm into 50Ω	TTL
Electronic Freq. Control and Freq. vs. Voltage Slope	±1.0ppm min. for 0±5v Negative	$\pm1\times10^{-7}$ for 0±5v Negative	±3ppm Mechanical	±5ppm Mechanical
Temperature Stability	$\pm1\times10^{-7}$ −20°C to +70°C	$\pm5\times10^{-9}$ −40°C to +75°C	$\pm1\times10^{-7}$ −20°C to +70°C	$\pm2\times10^{-7}$ −20°C to +50°C
Aging	2×10^{-9}/DAY	5×10^{-10}/DAY	1×10^{-8}/DAY	3×10^{-9}/DAY
Package	2.25×2.25×1.00	2.0×2.0×4.0	2.0×2.0×4.0	1.5×1.5×0.75
Figure	1	2	2	3



PIN	FUNCTION
1	Tuning
2	N/C
3	Output
4	Case & Ckt. Gnd.
5	Gnd B+

Fig. 1

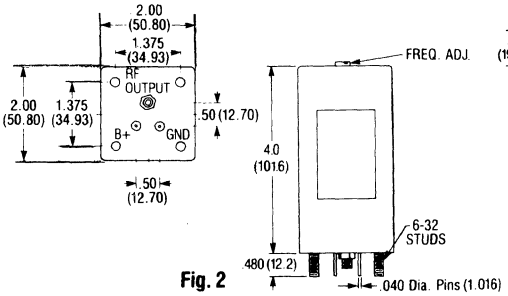
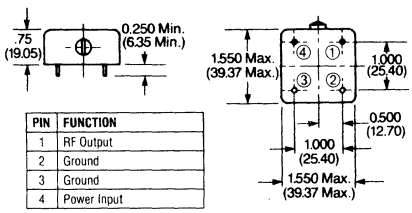


Fig. 2



PIN	FUNCTION
1	RF Output
2	Ground
3	Ground
4	Power Input

Fig. 3

DCXO, SINGLE CHIP



SPECIFICATIONS
Frequency Range: 10MHz to 25 MHz
Output: "H"
Input Voltage: A std.
Input Current: 15mA Typ.
Frequency Adjustment: To offset at least 10 Yrs. Aging
Frequency Stability: (△f/f) vs:
Temperature: See Table
Input Voltage: $\pm1\times10^{-8}$/%
Load Variation: $\pm1\times10^{-8}$/%

Time: 1ppm/Yr. Typ.
Time After Turn-On: $\pm1\times10^{-7}$ within 1 sec.
Short Term (T = 1 sec.): 1×10^{-9}
Dimensions: .79"L × .79"W × .45"H (max)

MODEL NO.	Temp Range	Max. Freq. Error
DC2210	−40°C to +85°C	$\pm1\times10^{-6}$
DC2211	−20°C to +75°C	$\pm5\times10^{-7}$
DC2212	0°C to +70°C	$\pm3\times10^{-7}$
DC2213	0°C to +50°C	$\pm2\times10^{-7}$

DCXO, HIGH STABILITY



SPECIFICATIONS
Frequency Range: 100KHz to 22MHz
Output: T Std.; C, J optional
Output Symmetry: 50/50 ± 5%
Input Voltage: A std.
Input Current: 10mA Typ.
Mechanical Frequency Adjustment: To offset at least 5 Yrs. Aging
Frequency Stability: (△f/f) vs:
Temperature: See Table
Input Voltage: $\pm1\times10^{-8}$/%
Load Variation: $\pm1\times10^{-8}$/%

Time: $\pm2\times10^{-7}$/Yr. Typ.
Time After Turn-On: $\pm1\times10^{-7}$ within 1 sec.
Short Term (T = 1 sec.): 1×10^{-10}
Dimensions: 2.0"L × 2.0"W × .5"H (max)

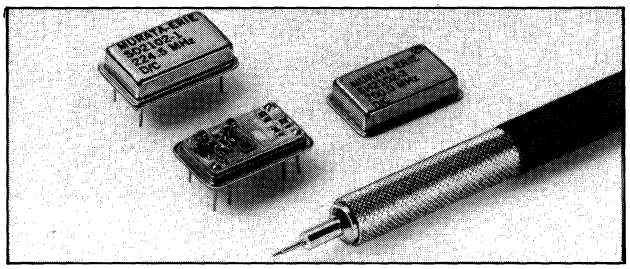
MODEL NO.	Temp Range	Max. Freq. Error
DC2200	−40°C to +85°C	$\pm2\times10^{-7}$
DC2201	−20°C to +75°C	$\pm1\times10^{-10}$
DC2202	0°C to +70°C	$\pm7\times10^{-8}$
DC2203	0°C to +50°C	$\pm5\times10^{-8}$

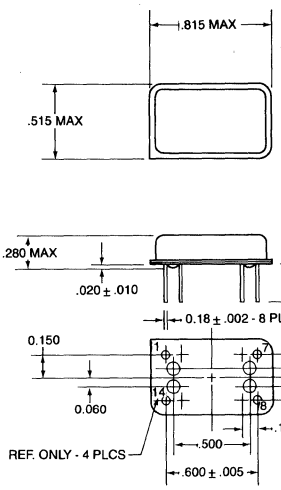
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ECL CLOCK OSCILLATOR



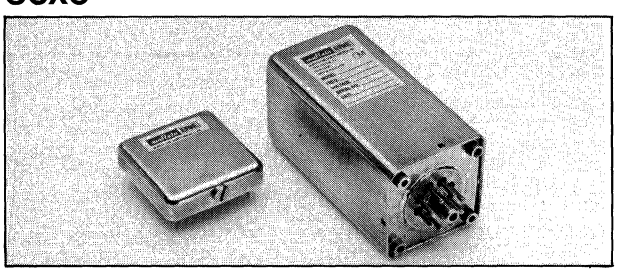


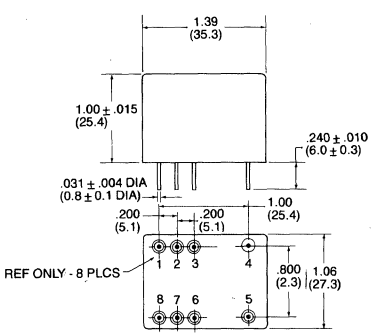
PIN	CONNECTIONS
1	Output Compliment
7	(GND) VEE
8	Output
14	+5 VCC
2, 6 9, 13	GND

SPECIFICATIONS

Features	ECL 100 Logic Compatible
Frequency Range	250.0MHz to 500MHz
Stability	±200ppm
Op. Temp. Range	0°C to +70°C
Duty Cycle	40% to 60%
Load	50 ohms
Output Level	600mV p-p min.
Input Voltage &	5.0 V, 120mA
Current Jitter	50p Sec. Max.

OCXO





PIN	CONNECTIONS
1	Output
4	GND
5	NIC
6	Freq. Adj.
8	+12V

SPECIFICATIONS

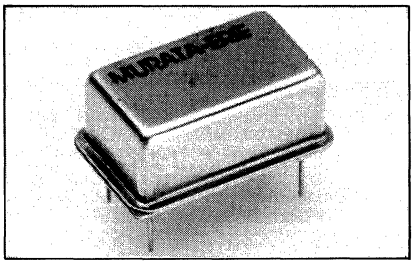
Features	TTL Compatible
Frequency	10.000 MHz
Stability	±.2ppm, 0°C to +60°C
Duty Cycle	50/50, ±10%
Input Voltage	+12 VDC, 250 mA max.
& Current	at turn-on, 90mA after warm up
Phase Noise	10 Hz, −120 dBc/Hz 100 Hz, −135 dBc/Hz 1 KHz, −145 dBc/Hz
Frequency Control	10 KHz, −150 dBc/Hz
Frequency Deviation	±4ppm min, ±7ppm max.
Control Voltage	0 to +6 V
Linearity	±15% max.
Mod. Freq.	DC to 150 Hz
Resp. Slope	Positive

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VCXO, MINIATURE HYBRID

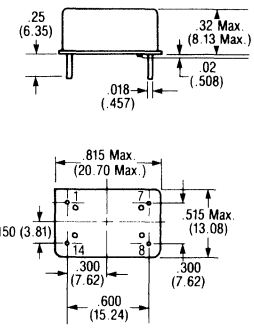


SPECIFICATIONS

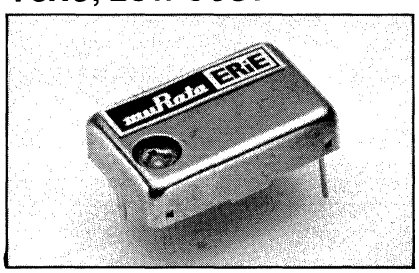
MODEL	VH2340-□□	
Features	High frequency fundamental crystal	
Frequency Range	15MHz to 60MHz	
Input Voltage & Current	H Std. @ 35mA Typ.	
Output Type	E Std.	
Control Voltage and Freq. vs. Voltage Slope	0V to −5.0V Negative	
AFC Input Impedance	10KΩ Min.	
Linearity	±20%	
Model	Deviation	Temp. Stability
	±100ppm	±25ppm
Temp. Range	0°C to 70°C	
Figure	1	

VH2340

PIN	FUNCTION
1	Voltage Control Input
7	V_{ee} (−5.2V)
8	Output
14	Case & Circuit Ground



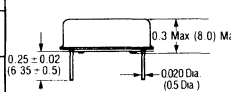
VCXO, LOW COST



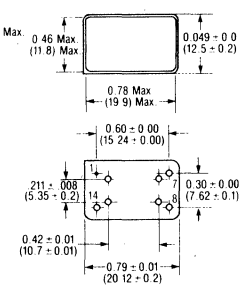
SPECIFICATIONS

MODEL	VO312□-□□			VO3130-□□	
Features	Low cost; Low profile			High frequency	
Frequency Range	Model VO3120: 8MHz to 24MHz Model VO3121: 8MHz to 36MHz			36MHz to 75MHz	
Input Voltage & Current	Model VO3120: 5VDC @ 20mA Model VO3121: 5VDC @ 30mA			5VDC @ 60mA	
Output Type	C Std.			TTL Std.	
Model	Model	Deviation	Temp Stability	Deviation	Temp. Stability
VO3100 VO3101	VO3120 VO3121	±50ppm ±200ppm	±30ppm ±30ppm	±50ppm	±50ppm
Control Voltage	2.5±2V			2.5±2V	
Aging Rate	VO3120: 4ppm/Yr. VO3121: 10ppm/Yr.			10ppm/Yr.	
Temp. Range	−10°C to 60°C			0°C to 70°C	

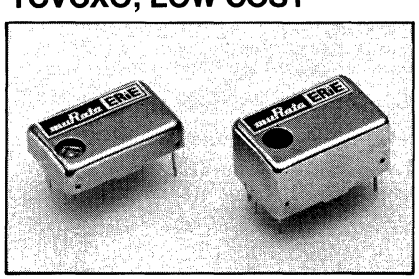
VO3120, 3121, 3130



PIN	FUNCTION
1	VC
7	V_{ee}
8	Output
14	V_{cc}



TCVCXO, LOW COST

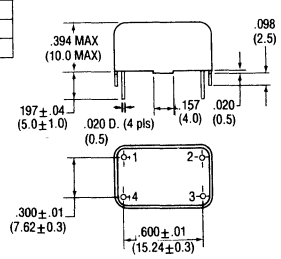


SPECIFICATIONS

MODEL	TV3023-AR
Features	Low Cost
Frequency Range	9.6 to 26MHz
Frequency Stability Vs. Temperature Range	±2.5ppm −20°C to +70°C
Input Voltage & Current	5VDC, 2mA
Output Type	Sine 1 Vp-p, 20kΩ, 10pF
Aging Rate	±1ppm/Year
Frequency Adjustment	Int Trimmer
Frequency Control	2.5V±2V±6.0 to ±12ppm

TV3023-AR

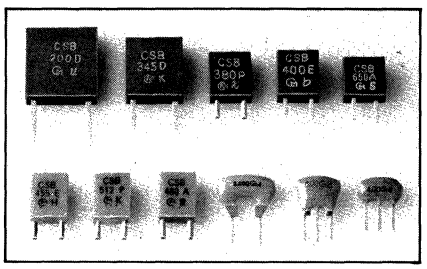
PIN	CONNECTIONS
1	VC
2	GND
3	Output
4	VCC



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piezoelectric ceramic resonators

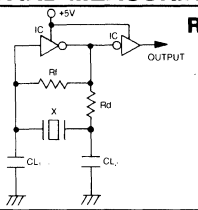
MURATA ERIE NORTH AMERICA



Murata Erie's ceramic resonators are widely used in clock oscillators for microprocessors, replacing quartz crystals at substantially reduced cost, and in many other applications.

Features of ceramic resonators include low cost, good stability, small size and rugged construction, and a wide frequency range.

STANDARD MEASURING CIRCUIT

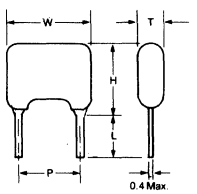


RCA CD4069

SPECIFICATIONS

TYPE	CSA TYPE	CSB TYPE	CST TYPE
Frequency Range	1.26 to 32 MHz	190 to 1250 KHz	2.0 to 25.99 MHz
Frequency Tolerance	±0.5%	±0.5%	±0.5%
Temperature Stability (-20°C to +80°C)	±0.5%	±0.3%	±0.3%
Time Stability (10 years)	±0.3%	±0.3%	±0.3%

CSA TYPE*



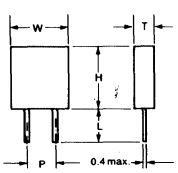
Unit: mm

Dimensions mm	MK	MG	MT	MX
	1.26 to 1.799 MHz	1.8 to 6.0 MHz	6.01 to 13.0 MHz	10.0 to 32.0 MHz
W	10.0	10.0 (12.0)**	10.0	10.0
H	10.0	7.5 (12.0)	10.0	10.0
T	5.0	5.0 (5.0)	5.0	5.0
P	5.0	5.0 (5.0)	(5.0)	5.0
L	5.0	5.0 (5.0)	5.0	5.0
Capacitance				
CL_1	30pF			
CL_2	30pF			

**Dimensions in parentheses ( ) for Freq. Range 2.0 to 2.75 MHz

CSB TYPE*

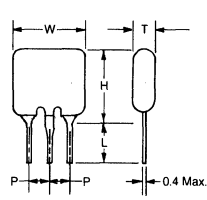
D : Offset
J : In-Line



Unit: mm

Dimensions mm	D	D	J	J	J	J
	190 to 249 KHz	250 to 374 KHz	375 to 429 KHz	430 to 519 KHz	520 to 699 KHz	700 to 1250 KHz
W	13.5	10.8	8.0	7.5	7.5	5.0
H	14.5	12.2	9.0	8.5	7.2	6.0
T	3.8	3.8	3.3	3.3	2.8	2.2
P	10.1	7.7	5.0	5.0	5.0	2.5
L	9.0	6.7	3.5	3.5	3.5	3.5
Capacitance						
CL_1	330pF	220pF	120pF	100pF	100pF	100pF
CL_2	470pF	470pF	470pF	100pF	100pF	100pF

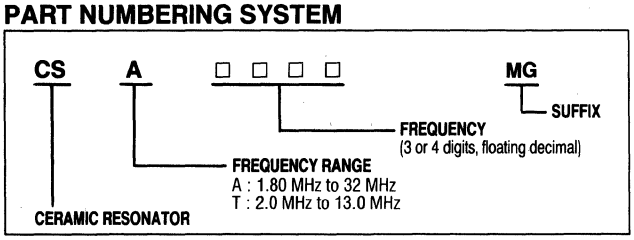
CST TYPE*

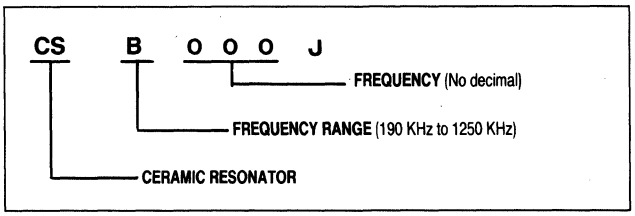


Dimensions mm	MG	MTW	MGW
	1.80 to 2.44 MHz	6.0 to 13.0 MHz	2.45 to 6.0 MHz
W	10.0	10.0	10.0
H	10.0	10.0	5.0
T	5.0	5.0	5.0
P	2.5	2.5	2.5
L	5.0	5.0	5.0
CL_1 and CL_2 (loading capacitors) built-in.			

*For additional information, please refer to Catalog #63-06

PART NUMBERING SYSTEM





MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

ceramic filters

MURATA ERIE NORTH AMERICA

Emitter Bypass Filters

Model	Center Frequency (KHz)	3dB Bandwidth (KHz)	Ripple (dB) max.	Selectivity (dB) min.	Termination Impedance (ohms) max.
BFU455K	455 ±2	8 (±2KHz)	—	8 @ -9KHz 12 @ +9KHz	30 (15)

TV Sound Filters

Model	Nominal Frequency (MHz)	3dB Bandwidth (KHz) min.	20dB Bandwidth (KHz) max.	Spurious Response (dB) min.	Insertion Loss (dB) max.	Input/Output Impedance (ohms)
SFE 4.5MBF	4.5	±60	530KHz	30dB min. (3.5-4.5MHz) 20dB min. (4.5-5.3MHz)	6	1000

Ceramic Filters For Digital Communications

Model	Nominal Center Frequency (KHz)	6dB Bandwidth (KHz) min.	Stopband Attenuation (dB) min. (f_0 ±100KHz)	Ripple (dB) max.	Selectivity (dB) min.	GDT 20μ/Sec. Bandwidth (KHz)	Insertion Loss (dB) min.	Input/Output Impedance (ohms)	Operating Temperature Range	Withstanding Voltage
SFP450D	450	±10	27	450 ±7 2	40 @ ±20KHz	—	4	1.5K	−20°C to +80°C	50V DC
SFP450F	450	±6	27	450 ±4 1.5	40 @ ±12.5KHz	—	6	2K		
SFR450D	450	±10	25	—	50 @ ±20KHz	—	5	2K		
SFR450F	450	±6	25	—	50 @ ±12.5KHz	—	4	1.5K		
SFG450D	450	±10	23	—	40 @ ±25KHz	±9	7	1.5K		
SFG450F	450	±6	23	—	40 @ ±17.5KHz	±6	9	2K		
SFH450D	450	±10	35	—	50 @ ±25KHz	±8	8	1.5K		
SFH450F	450	±6	35	—	50 @ ±17.5KHz	±5	10	2K		

Ceramic Filters For FM Radios

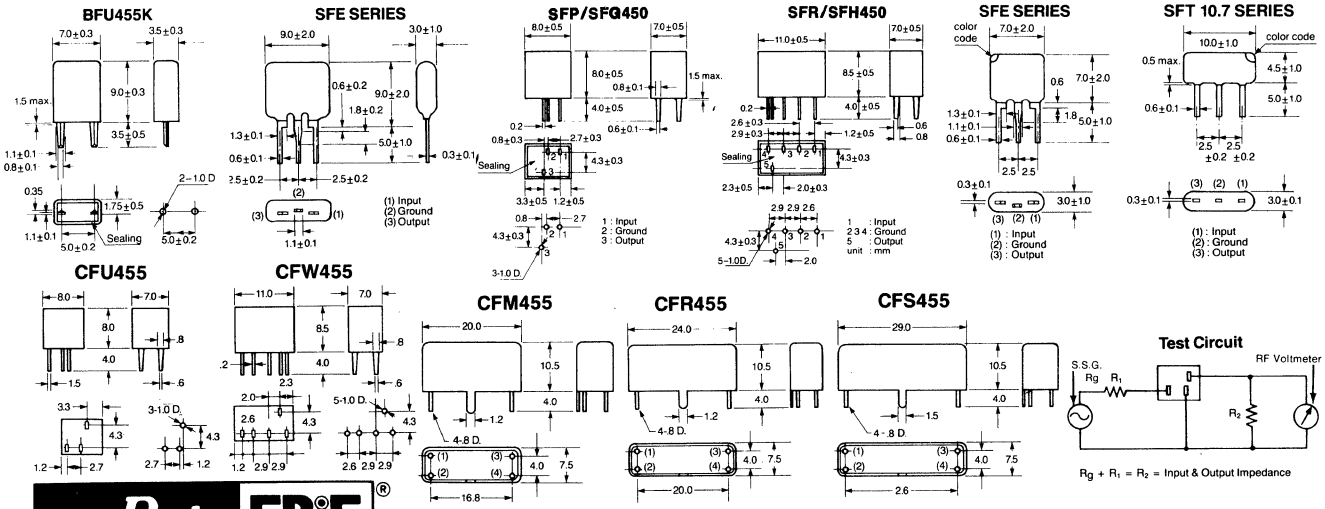
Model	Center Frequency (MHz, ±30KHz)	3dB Bandwidth (KHz) min.	20dB Bandwidth (KHz) max.	40dB Bandwidth (KHz) max.	Ripple (dB) max.	Spurious Response (8-12MHz) (dB) min.	Insertion Loss (dB) max.	Input/Output Impedance (ohms)	Operating Temperature Range	Withstanding Voltage
SFE 10.7MA5-Z	A:10.7 (Red)	280 ±50	650	—	1.0	30	6	330	−20°C to +80°C	50V DC
SFE 10.7MS2-Z	B:10.67 (Blue)	230 ±50	570	—	1.0	40	6			
SFE 10.7MS3-Z	C:10.730 (Orange)	180 ±40	520	—	1.0	40	7			
SFE 10.7MJ-Z	D:10.640 (Black)	150 ±40	380	—	1.0	38	10			
SFT 10.7MS3-Z	E:10.760 (White)	180 ±40	—	550	0.5	(9-12 MHz) 50	7.5			
SFT 10.7MA5-Z		280 ±50	—	700	0.5	(9-12 MHz) 50	6.0			

Z = Combination of all frequency groups (A thru E)

Multi-Element For High Selectivity Ladder Filters

Model	Center Frequency (KHz)	6dB Bandwidth (KHz) min.	Bandwidth (KHz) min.	Spurious Response (dB) min.	Insertion Loss (db) max.	Input/Output Impedance (ohms)	Operating Temperature Range	Withstanding Voltage
CFU455B2	455 ±2	±15	±30	27	4	1500	−20°C to +80°C	50V DC
CFU455E2	455 ±1.5	±7.5	±15	27	6	1500		
CFU455H2	455 ±1.0	±3	±9	25	6	2000		
CFW455B	455 ±2	±15	±30	35	4	1500		
CFW455E	455 ±2	±7.5	±15	35	6	1500		
CFW455H	455 ±2	±3	±9	35	6	2000		
CFM455A	455 ±2	±17.5	±30	50	3	1000		
CFM455E	455 ±2	±8	±16	45	5	1500		
CFM455H	455 ±2	±3	±7.5	45	6	2000		
CFR455A	455 ±2	±17.5	±30	60	4	1000		
CFR455E	455 ±2	±8	±16	55	6	1500		
CFR455H	455 ±2	±3	±7.5	55	7	2000		
CFS455A	455 ±2	±17.5	±30	70	4	1500		
CFS455E	455 ±2	±8	±15	70	6	1500		
CFS455H	455 ±2	±3	±7.5	70	7	2000		

ATT'N dB: CFU/40, CFW/50, CFM/60, CFR/60, CFS/70



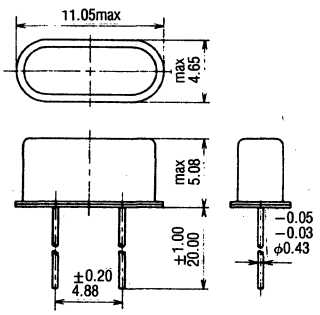
MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

NDK AMERICA, INC.
47671 WESTINGHOUSE DRIVE • FREMONT, CALIFORNIA 94539
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MICRO AT-CUT STRIP TYPE®

AT-51

(mm)



Model	AT-51
Frequency range	3.579545 ~ 23MHz (fundamental mode)
Frequency tolerance*	±20x10⁻⁶ (25±3°C)
Frequency v.s. temperature * characteristics*	±30x10⁻⁶
Operating temperature range	− 10 to 60°C
Drive level	50μW typ.
Vibration	10 ~ 55Hz; overall amplitude 15mm
Shock	Three drops onto a hard wooden baord from the height of 75 cm.

* Other specs available over extended temp. ranges

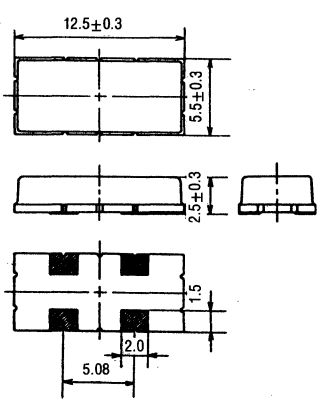
NEW

■ CP12A

The CP12A is a crystal unit for surface mount

- Compactness (height: 2.5mm)
- High-reliability ceramic package
- Superlative design making use of AT-cut based electrical characteristics
- Wide frequency range
- Continuous use at + 125°C possible in a car
- VPS or IR reflow soldering (260°C 30sec) available

(mm)

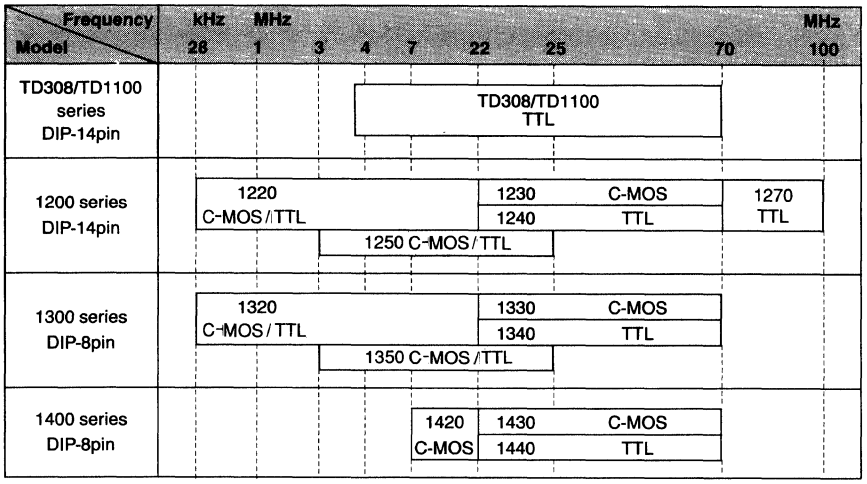


Item \ Spec	1	2	3
Model	CPI2A		
Frequency range	3.579545 ~ 23.684MHz		
Overtone order	Fundamental		
Freq. tolerance (25 ± 3°C)	± 50 × 10⁻⁶	± 100 × 10⁻⁶	± 100 × 10⁻⁶
Freq. temp. stability (25°C)	± 50 × 10⁻⁶	± 100 × 10⁻⁶	± 150 × 10⁻⁶
Operating temp. range	− 10 ~ + 70°C		− 40 ~ + 125°C
Operable temp. range	− 40 ~ + 125°C		
Series resistance	150 ~ 50Ω		200 ~ 80Ω
Drive level	100μW		
Load capacitance	12pF		
Shock resistance	Three times random drops onto a hard wooden board from the height of 75 cm.		
Soldering resistance	Soldering should be conducted at a temperature of 260°C ± 10°C and lower for 30 seconds or less.		

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CRYSTAL CLOCK OSCILLATORS

FREQUENCY RANGE VS. OUTPUT LEVEL

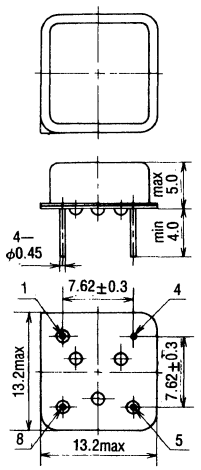


FEATURE

	TD308/TD1100 series	1200 series	1300 series	1400 series
Dimension	L21.0 x W13.0 x H5.0mm		L13.2 x W13.2 x H5.0mm	
Pin Configuration	DIP14 pin compatible		DIP8 pin compatible	
Package	Hermetically sealed metal package • Case earth (For EMI prevention) • STAND OFF			
Circuit design	Chip Tr	C-MOS IC		
Frequency Range	3.579MHz ~ 3.7MHz 3.9 MHz ~ 70MHz	28kHz ~100MHz	28kHz ~ 70MHz	7MHz ~ 70MHz
Output Level	TTL compatible	●TTL/C-MOS compatible . . . . 1230, 1250, 1320, 1350 series ●C-MOS compatible . . . . . 1230, 1330 series ●TTL compatible. . . . . 1240, 1270, 1340 series		
Shock	Natural drop 30 cm, 3 times Impact shock 1000G, 3 times		Natural drop 50 cm, 3 times Impact shock 1000G, 3 times	
Frequency Stability	±50, ±100, ±500, ±1000, ±10000 x 10^{-6}			
Stand-by Function	NONE	Standard Function		
Dual Output	NONE	Option for model 1229 and 1329		NONE

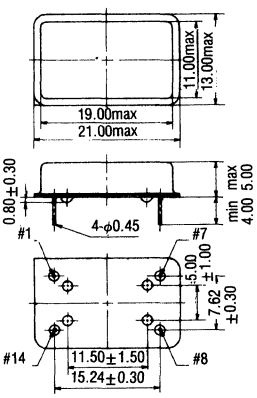
■ 1300-1400 Series

(mm)



PIN	CONNECTION
1	N.C., STANDBY or OUTPUT
4	GND(CASE)
5	OUTPUT
8	+5V DC

TD308/TD1100 1200 Series



PIN	Connection	
	TD308/TD1100 Series	1200 Series
#1	NC	NC or Stand-by or Output (Dual's)
#7	Ground to Case	Ground to Case
#8	OUT PUT	OUT PUT
#14	+5 V DC	+5 V DC

1200/1300/1400 SERIES CROSS REFERENCE

Model / Feature		1220 (1221~1229) / 1320 (1321~1329)	1230 (1230~1239) / 1330 (1330~1339)	1240 (1240~1249) / 1340 (1340~1349)	1250 (1251~1259) / 1350 (1351~1359)	1270 (1271~1272) / —	— / 1420 (1429)	— / 1430 (1431~1437)	— / 1440 (1441~1447)
Output Level		C-MOS	C-MOS	—	C-MOS	—	C-MOS	C-MOS	—
		TTL	—	TTL	TTL	TTL	—	—	TTL
Frequency Range		28kHz~22MHz	22~70MHz	22~70MHz	3~25MHz	70~100MHz	7~22MHz	22~70MHz	22~70MHz
Current	TYP	5mA	13~22mA	13~22mA	11mA	25~35mA	10~30mA	40~80mA	35~80mA
	MAX	10mA	20~40mA	20~40mA	20mA	50mA	40mA	50~85mA	45~85mA
$V_{OL}{}^{MAX}/V_{OH}{}^{MIN}$		0.5V/V_{DD}—0.5V	0.5V/V_{DD}—0.5V	0.4/2.4V or 0.5/2.4V	0.5V/V_{DD}—0.5V	0.5/2.4V	0.5V/V_{DD}—0.5V	0.5V/V_{DD}—0.5V	0.4/2.4V
Tr^{MAX}/Tf^{MAX}		10/10ns	5/5ns	5/5ns	7/7ns	5/5ns	6/6ns	6/6ns	3.5/3.5ns
Duty Cycle (°C)		40~60 for 1229 and 1329	40~60	40~60	45~55 at 1/2V_{DD} 40~60 at 1.4V	40~60	45~55	45~55	40~60
Fan out (gate)	TTL	2	5	5	5	(AS or F) 5	C_L = 150pF^{MAX}	C_L = 150pF^{MAX}	10
Stand-by Function		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dual Output	Option	1229, 1329	No	No	No	No	No	No	No

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SURFACE MOUNT TYPE

SMALL CRYSTAL CLOCK OSCILLATOR

1600 Series

FEATURES

- Small size and lightweight: height 4.7mm, volume 0.4cc, weight 1.5g
- High reliability as a result of internal sealed metal type crystal unit
- Suitable for reflow & vapour phase automatic mounting processes
- Range of frequency from 1 to 55 MHz
- Stand by function for Tristate output
- Static electricity proof as a result of tape & reel packaging

SPECIFICATIONS

Frequency Range	1 ~ 55 MHz
Frequency Stability	± 100 PPM
Operating Temp. Range	– 20 ~ 70°C

Absolute Maximum Rating
Supply Voltage (VDD) – 0.5 ~ + 7.0 VDC
Temperature Range for Storage – 55 ~ 125°C

***Directly drives the C-MOS IC**

Item	Model	1629		1631	1632	1633	1634
Frequency Range	(MHz)	1 ~ 7.9	8 ~ 25.9	26 ~ 29.9	30 ~ 33.9	34 ~ 41.9	42 ~ 55
Operating Temp. Range	(°C)	– 20 ~ 70					
Frequency Stability	(ppm)	± 100					
Supply Voltage	(V)	5 ± 10%					
Consumption Current	(mA) + 5 VDC, 25°C	5 (TYP) 10 (MAX)	15 (TYP) 20 (MAX)	18 (TYP) 25 (MAX)		20 (TYP) 30 (MAX)	25 (TYP) 35 (MAX)
VOL MAX/VOH MIN	(V)	0.5/VDD-0.5					
Tr MAX/Tf MAX	(ns)	5/5 (0.1 VDD ~ 0.9 VDD)					
Duty Cycle	(%)	45 ~ 55 (at 1/2VDD)					
Fanout	(pF)	15 (MAX 50)					
Stand-by Function	(V)	Oscillation: level H (2.2V MIN) OFF (High Impedance): level L (0.8V MAX)					

Note: The values of Consumption Current, Tr/Tf, Duty Cycle show the standard values under Cl15pF.

***Directly drives the TTL IC**

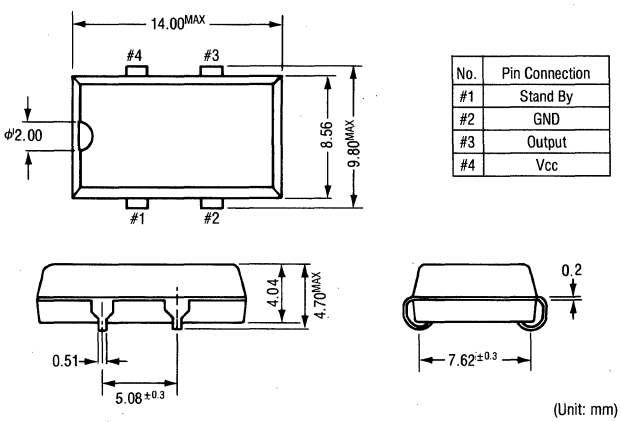
Item	Model	1629		1641	1642	1643	1644
Frequency Range	(MHz)	1 ~ 7.9	8 ~ 25.9	26 ~ 29.9	30 ~ 33.9	34 ~ 41.9	42 ~ 55
Operating Temp. Range	(°C)	– 20 ~ 70					
Frequency Stability	(ppm)	± 100					
Supply Voltage	(V)	5 ± 10%					
Consumption Current	(mA) + 5 VDC, 25°C	5 (TYP) 10 (MAX)	15 (TYP) 20 (MAX)	18 (TYP) 25 (MAX)		20 (TYP) 30 (MAX)	25 (TYP) 35 (MAX)
VOL MAX/VOH MIN	(V)	0.4/2.4					
Tr MAX/Tf MAX	(ns)	5/5 (0.4 V ~ 2.4 V)					
Duty Cycle	(%)	40 ~ 60 (at + 1.4V)					
Fanout	TTL	10					
Stand-by Function	(V)	Oscillation: level H (2.2V MIN) OFF (High Impedance): level L (0.8V MAX)					

Note: The values of Consumption Current, Tr/Tf, Duty Cycle show the standard values under Cl15pF.

Standard Frequency (MHz)

1	1.8432	16	11.9318	31	24.5760
2	2.4576	17	12.0000	32	25.0000
3	3.6864	18	12.2880	33	25.1750
4	4.0000	19	14.31818	34	28.3120
5	4.0960	20	14.7456	35	28.3220
6	4.9152	21	15.0000	36	28.6363
7	6.1440	22	15.9744	37	29.4912
8	7.3728	23	16.0000	38	32.0000
9	7.9872	24	16.2570	39	35.1900
10	8.0000	25	16.3840	40	40.0000
11	8.1920	26	18.4320	41	48.0000
12	9.6000	27	19.6608	42	50.0000
13	9.8304	28	20.0000	43	
14	10.0000	29	21.0526	44	
15	11.0592	30	24.0000	45	

Outside Dimensions



No.	Pin Connection
#1	Stand By
#2	GND
#3	Output
#4	Vcc

(Unit: mm)

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CRYSTAL OSCILLATORS

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO)

5100 Series

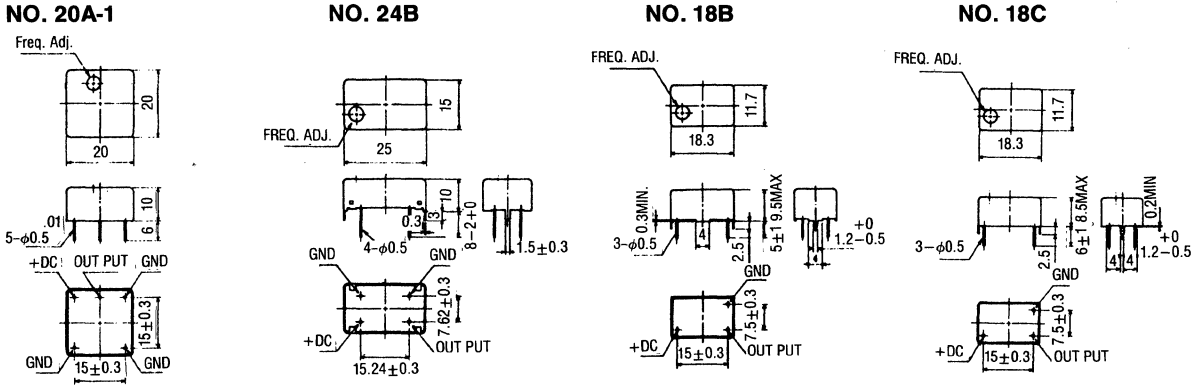
Main applications: Car telephone, mobile radio

Features: 1. Compactness and light weight in addition to the use of high-reliability metal packages
2. AFC function for the codes 5119B-ANL61 and 5118A-ANL61
3. Low power consumption

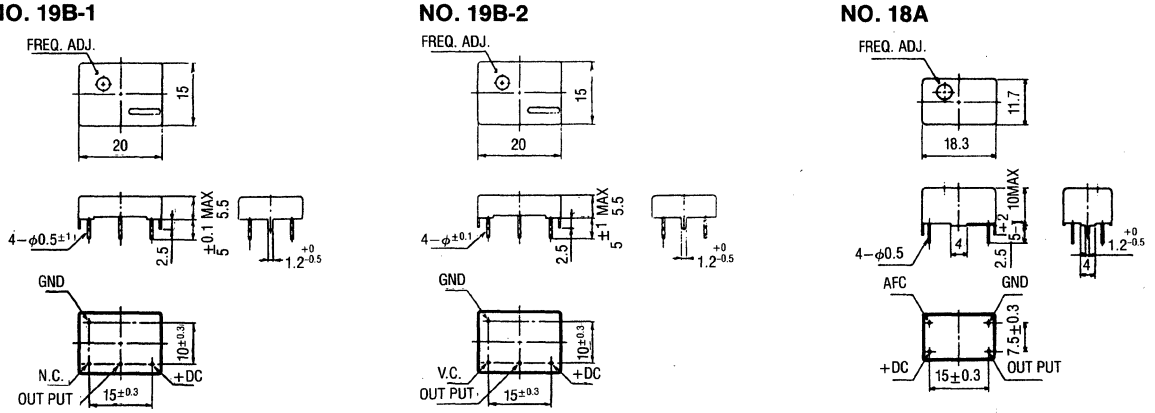
Item \ Model	5120A	5124B	5118B	5118C	5119B	5119B	5118A
Spec. Code	A	A	A	A	A	A	A
	NL60	PG60	NL60			NL61	NL61
Standard Nominal Frequency (MHz)	9.6, 10, 10.24, 12, 12.8, 13, 14.4, 15.36					9.6, 10.24, 12.8, 13, 15.36	
Available Frequency Range (MHz)	9.6 ~ 20					9.6 ~ 20	
Frequency Stability	±2.5×10⁻⁶	±3×10⁻⁶	±2.5×10⁻⁶			±2.5×10⁻⁶	
	−30 ~ 75°C	−20 ~ 60°C	−30 ~ 75°C			−30 ~ 75°C	
Supply Volt Change	±0.3×10⁻⁶/+5V±5%					±0.3×10⁻⁶/+5V±5%	
Supply Voltage	+5VDC					+5VDC	
Current Consumption	5mA MAX		1.5mA MAX			1.5mA	
Output	1 Vp-p MIN					1 Vp-p MIN	
Load	20kΩ//5pF					20kΩ//5pF	
Aging	±1.0×10⁻⁶/year					±1×10⁻⁶/year	
AFC Charact.	—					±10×10⁻⁶ min /2.5±2V	±5×10⁻⁶ min /2.5±2V
Freq. Trim Range	±3×10⁻⁶min					±3×10⁻⁶	
Case Code	20A-1	24B	18B	18C	19B-1	19B-2	18A

NO. 20A-1 **NO. 24B** **NO. 18B** **NO. 18C**

(mm)



NO. 19B-1 **NO. 19B-2** **NO. 18A**



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CRYSTAL OSCILLATORS

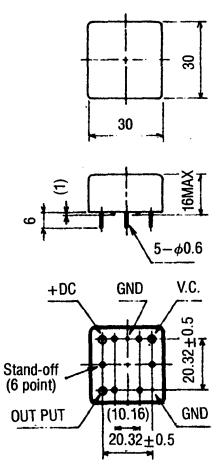
VOLTAGE CONTROLLED CRYSTAL OSCILLATORS (VCXO)

7100 Series

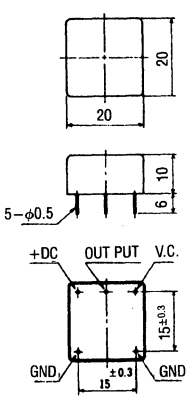
Main applications: PLL, FM Modulation, Sweep Generators etc.
Features: 1. Excellent VC characteristics
2. Wide frequency range covering high frequency

Item \ Model / Spec. Code	7130A			7120A	7135A				
	A	B	C	A	A	B	C	D	E
	SA01	VE01	VE01	VE71	RA01	RA01	RA01	RA01	RA01
Nominal Frequency Range (MHz)	8~25	25~75	75~125	14~25	10~18	18~75	75~125	125~175	175~200
Frequency Stability	±15×10⁻⁶	±30×10⁻⁶			±10×10⁻⁶				
	0~50°C	−10~60°C			0~50°C				
Supply Volt Change	±5×10⁻⁶/+12V±5%			±10×10⁻⁶/+5V±5%	±5×10⁻⁶/+12V±5%				
Supply Voltage	+12VDC			+5VDC	+12VDC				
Current Consumption	15mA MAX			20mAmax	15mA MAX				
Duty Cycle (+1.4V)	—			40~60%	—				
Output Voltage	0dBm±2dB			V_{OL}:0.4V MAX V_{OH}:2.4V MIN	0dBm±2dB				
Load	50Ω			N-TTL 2	50 Ω				
Aging	±5×10⁻⁶/year				±5×10⁻⁶/year				
VC Charact.	±200×10⁻⁶ min /+2.5V±2.5V	±100×10⁻⁶ min /+2.5V±2.5V	±40×10⁻⁶ min /+2.5V±2.5V	±200×10⁻⁶ min /+2.5V±2.5V	±30×10⁻⁶min/+2.5V±2V				
Case Code	30A-3			20A-5	35A-2				

NO. 30A-3

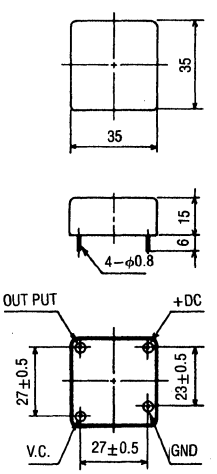


NO. 20A-5



NO. 35A-2

(mm)



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CRYSTAL FILTERS

MCF FOR MOBILE COMMUNICATION

45MHz Fundamental Mode

Model	Nominal Frequency (MHz)	Pole	Pass Band Width (dB)	Pass Band Width (kHz)	Attenuation Band Width (dB)	Attenuation Band Width (kHz)	Ripple (dB)	Insertion Loss (dB)	Terminating Impedance (Ω//pF)	Operating Temp. Range (°C)	Case Code
45S15B	45	4	3	±7.5	25	±22	1.0	3.0	800//2 Cc=6pF	−20~70	D-361-B
45S20B	45	4	3	±10	25	±25	1.0	3.0	800//2 Cc=6pF	−20~70	D-361-B
45S30A	45	2	3	±15	15	±50	0.7	2.0	1500//0	−25~70	D-361-A
45S30B	45	4	3	±15	35	±50	1.0	3.0	1500//2 Cc=6pF	−20~70	D-361-B
*45S34A	45	2	3	±17	15	±60	1.0	3.0	860//−1.7	−20~70	D-361-A

*Min. 60 dB at imaginary frequency-910 kHz is obtainable by a 2 pole filter.

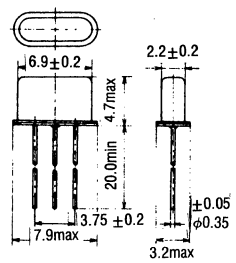
45MHz 3rd Overtone

Model	Nominal Frequency (MHz)	Pole	Pass Band Width (dB)	Pass Band Width (kHz)	Attenuation Band Width (dB)	Attenuation Band Width (kHz)	Ripple (dB)	Insertion Loss (dB)	Terminating Impedance (Ω//pF)	Operating Temp. Range (°C)	Case Code
45N7.5A	45	2	3	±3.75	15	±15	0.5	2.0	3//−0.5	−20~70	D-360-A
45N7.5B	45	4	3	±3.75	40	±15	1.0	4.0	3//−0.5	−20~70	D-360-B
45N15A	45	2	3	±7.5	15	±22	0.5	1.5	3//−1	−20~70	D-360-A
45N15B	45	4	3	±7.5	25	±22	1.0	3.0	3//−1 Cc=−1.5pF	−20~70	D-360-B
45N20A	45	2	3	±10	15	±30	0.5	1.5	3//−1	−20~70	D-360-A
45N20B	45	4	3	±10	25	±25	1.0	3.0	3//−1 Cc=−1.5pF	−20~70	D-360-B
45N30A	45	2	3	±15	15	±50	1.0	2.0	11//−1	−30~70	D-360-A
45N30B	45	4	3	±15	30	±50	1.0	3.0	8//−1.5	−30~70	D-360-B

70MHz, 90MHz 3rd Overtone

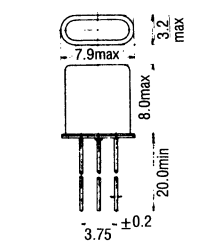
Model	Nominal Frequency (MHz)	Pole	Pass Band Width (dB)	Pass Band Width (kHz)	Attenuation Band Width (dB)	Attenuation Band Width (kHz)	Ripple (dB)	Insertion Loss (dB)	Terminating Impedance (Ω//pF)	Operating Temp. Range (°C)	Case Code
70N15A	70	2	3	±7.5	13	±25	1.0	2.0	2.5//−1	−20~70	D-360-A
70N15B	70	4	3	±7.5	30	±25	1.0	3.0	2.5//−1 Cc=−1pF	−20~70	D-360-B
70N20A	70	2	3	±10	13	±30	1.0	2.0	2.5//−1	−20~70	D-360-A
70N20B	70	4	3	±10	25	±25	1.0	3.0	2.5//−1 Cc=−1pF	−20~70	D-360-B
70N30A	70	2	3	±15	13	±50	1.0	2.0	4 //−1	−20~70	D-360-A
70N30B	70	4	3	±15	25	±50	1.0	3.0	2.5//−1 Cc=−1pF	−20~70	D-360-B
90N9B	90	4	3	±4.5	13	±12.5	—	6.0	1.5//−1	−20~70	D-360-B
90N20A	90	2	3	±10	13	±30	1.0	2.0	2.5//−1	−20~70	D-360-A
90N20B	90	4	3	±10	25	±25	1.0	3.0	2.5//−1 Cc=−1pF	−20~70	D-360-B
90N26B	90	4	3	±13	18	±25	1.0	3.0	2.5//−1 Cc=−1pF	−20~70	D-360-B

D-361-A ~ B

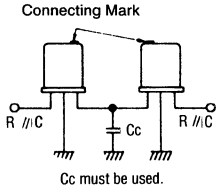


Case Code D-361-B means a pair of Case Code D-361-A.

D-360-A ~ B



Connecting Mark



Cc must be used.

D-360-B means a pair of Case Code D-360-A.

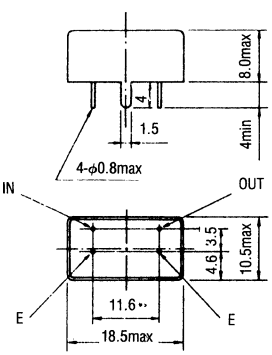
MINIATURE MCF FOR MOBILE TELEPHONE SYSTEM

This type of compact size with a maximum height of only 8 mm as compared to conventional crystal filters for car telephones. Being a built-in transformer type, it is also possible to match the input/output circuits with various impedance values.

Features
1. Compact and light
2. Temperature characteristics are stable
3. Can be manufactured with your desired terminal impedance value
4. No adjustments required when using since it is completely preadjusted
5. Can be manufactured in a wide range of frequencies

Nominal Frequency	70 MHz ~ 90 MHz	90 MHz
3 dB Pass Band Width	±15 kHz min	±4.5 kHz min
13 dB Attenuation Band Width	—	±12.5 kHz max
25 dB Attenuation Band Width	±60 kHz max	—
Guaranteed Attenuation	Min. 15 dB at +(60~150) kHz Min. 30 dB at −(60~150) kHz Min. 70 dB at −910 kHz	Min. 30 dB at ±(100~500) kHz Min. 70 dB at ±(500~1000) kHz
Spurious Response	10 dB min	—
Group Delay Variation	Max. 14 μs at ±10 kHz	Max. 8 μs at ±4 kHz
Ripple	1.5 dB max	Non-ripple
Insertion Loss	60 dB max	
Terminating Impedance	Designed impedance within 50Ω~1kΩ	
Operating Temp. Range	−20~70°C	
Case Code	D-169	

D-169



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CRYSTAL FILTERS

45 ~ 95MHz MINIATURE MCF FOR MOBILE RADIO

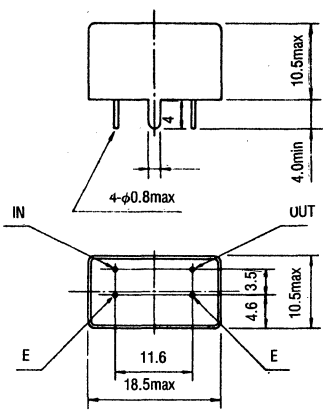
This type is one third the size (volume ratio) compared to the conventional MCF. The input/output circuits can also be matched with various impedance values because of its built-in transformer.

Features
1. Compact and light
2. Temperature characteristics are stable
3. Can be manufactured with your desired terminal impedance value
4. Adjustments not required when using since it has been completely preadjusted
5. Can be manufactured in a wide range of frequencies

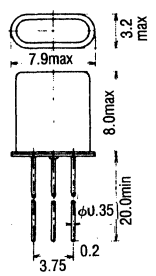
Nominal Frequency	Specified value within 45 ~ 95 MHz range	
Pass Width	N (narrow band)	W (wide band)
3 dB Pass Width	± 3.75 kHz	± 7.5 kHz

Attenuation Band Width	Max. ± 12.5kHz at 25dB	Max. ± 25kHz at 30 dB
Ripple	2 dB	
Minimum Loss	6 dB	
Guaranteed Attenuation	Min. 40 dB at ± 20 ~ ± 350 kHz	Nominal frequency of lower than 60 Mhz; Min. 35 dB at ± 100 ~ ± 350 kHz
		Nominal frequency of higher than 60 MHz; Min. 35 dB at ± 30 ~ ± 350 kHz
	*Min. 70 dB at ± 910 kHz	
Operating Temp. Range	− 40 ~ 80°C	
Terminating Impedance	Designed impedance within 50Ω ~ 1kΩ	
Case Code	D-168	

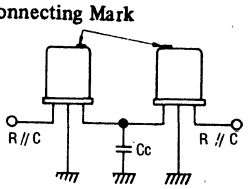
D-168 (mm)



D-360-A ~ B



Connecting Mark



Cc must be used

D-360-B means a pair of Case Code D-360-A.

MCF FOR CORDLESS PHONE

Features
1. The image frequency (fo-910 kHz) can be attenuated over 60 dB with one element.
2. Compact and light
3. Outstanding temperature characteristics

Model	21N12A	21N12B	58N12AA	58N15BB
Nominal Frequency	21.7 MHz	21.7 MHz	58.1125 MHz	58.1125 MHz
3 dB Pass Band Width	± 6 kHz min	± 6 kHz min	± 6 kHz min	± 7.5 kHz min
Attenuation Band Width	15dB ± 20 kHz max	40 dB ± 20 kHz max	15 dB ± 25 kHz max	35 dB ± 25 kHz max
Ripple	1.0 dB max	1.5 dB max	2.0 dB max	2.0 dB max
Insertion Loss	2.0 dB max	3.0 dB max	3.0 dB max	4.0 dB max
Guaranteed Attenuation	Min. 45 dB at + (910 ± 10) kHz Min. 60 dB at − (910 ± 10) kHz Spurious: 12 dB min	Min. 80 dB at + (910 ± 10) kHz Spurious: 40 dB min	Min. 45 dB at + (910 ± 10) kHz Min. 60 dB at − (910 ± 10) kHz Spurious: 12 dB min	Min. 80 dB at ± (910 ± 10) kHz Spurious: 30 dB min
Terminating Impedance	1200Ω/2.5pF	1200Ω/2.5pF	3kΩ/ − 1pF	3kΩ/ − 1pF
Operating Temp. Range	− 20°C ~ + 60°C	− 20°C ~ + 60°C	− 20°C ~ + 60°C	− 20°C ~ + 60°C
Case Code	D-360-A	D-360-B	D-360-A	D-360-B

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SAW DEVICES

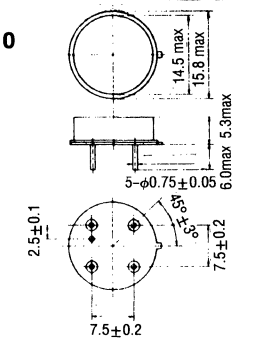
FOR TV BROADCASTING (SATELLITE BROADCASTING) RECEIVING SYSTEM

These SAW products feature good phase linearity over a broad bandwidth and serve as interface filters for satellite broadcasting receivers. They are ideal for achieving higher performance, higher integration and mass production of such receivers.

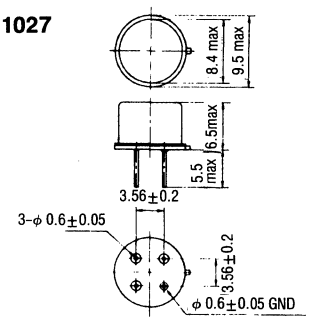
Features
- Broad bandwidth
- Good phase linearity
- Compact and light-weight design
- No adjustments required
- High reliability

Characteristics / Model	Nominal Frequency (MHz)	Pass Bandwidth (dB)	Pass Bandwidth (MHz)	Attenuation Bandwidth (dB)	Attenuation Bandwidth (MHz)	Guaranteed Attenuation Bandwidth (dB)	Guaranteed Attenuation Bandwidth (MHz)	Ripple (dB)	Insertion Loss (dB)	Delay Time (ns)	Terminating Impedance (Ω)	Operating Temp Range (°C)	Case Code
70FC8	70	3	±13.0	30	±17.5	35	±20~±50	1.0	30	50	50	0~50	1010
70FC8A	70	1	±12.0	30	±22	30	±22~±50	1.5	28	50	75	0~50	1010
70FC9	70	3	±13.5	30	±22	30	±22~±50	1.0	28	50	75	−10~60	1010
134FB0	134	3	±13.5	35	±25	35	±25~±100	1.0	25	15	50	−10~50	1010
380F71	380	3	±13.5	35	±25	35	±25~±100	1.0	25	10	50	−10~50	1027

1010



1027



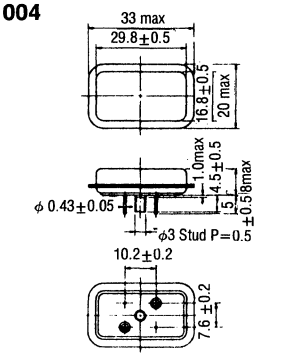
FOR MOBILE MICRO WAVE RELAY TRANSMITTER (TV BROADCASTING)

These SAW products which have flat amplitudes and group delay characteristics, are finding application as interface filters for mobile microwave repeaters while contributing to reducing their size and weight:

Feature
- Reduced ripples in amplitude characteristic
- Reduced group delay deviation
- Compact and light-weight design
- No adjustments required, increased reliability and improved reproducibility.

Characteristics / Model	Nominal Frequency (MHz)	Pass Bandwidth (dB)	Pass Bandwidth (MHz)	Attenuation Bandwidth (dB)	Attenuation Bandwidth (MHz)	Guaranteed Attenuation Bandwidth (dB)	Guaranteed Attenuation Bandwidth (MHz)	Ripple (dB)	Insertion Loss (dB)	Delay Time (ns)	Terminating Impedance (Ω)	Operating Temp Range (°C)	Case Code
130FA4	130	3	± 9.2	30	±15.5	30	±15.5~±30	0.5	26	15	50	−10~50	1004
130FA5	130	3	±10.0	35	±16.0	40	±18.0~±130	0.5	26	15	50	−10~50	1004
130FA5A	130	3	± 9.5	30	±16.0	35	±16.0~±50	0.5	26	15	50	0~50	1010

1004



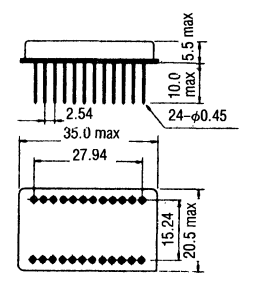
FOR TV RELAY BROADCASTING EQUIPMENT ADJACENT CHANNEL ELIMINATION

These SAW products serve as filters for removing adjacent channels of TV relay broadcasting systems.

For Broadcasting System

Characteristics / Model	Nominal Frequency (MHz)	Pass Bandwidth (dB)	Pass Bandwidth (MHz)	Attenuation Bandwidth (dB)	Attenuation Bandwidth (MHz)	Guaranteed Attenuation Bandwidth (dB)	Guaranteed Attenuation Bandwidth (MHz)	Ripple (dB)	Insertion Loss (dB)	Delay Time (ns)	Terminating Impedance (Ω)	Operating Temp Range (°C)	Case Code
19FB7F	19.75	1	Width 5.5	30	±7.55	30	—	0.8	30	70	50	−10~50	1014
19FB8	19.25	1	Width 4.7	40	±6.0	40	—	1.0	33	250	50	−10~50	1020
19FB8B	19.25	1	Width 4.75	40	±6.0	40	—	2.0	35	200	50	0~50	1020
22F13	22.25	3	±1.5	35	±0.55	35	±0.55~±5.0	1.0	25	500	50	−10~50	1005

1014



For Multi-Communication

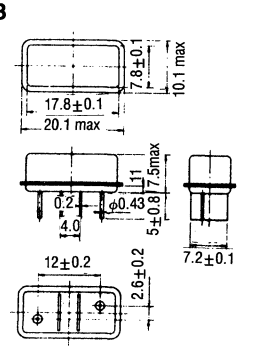
Characteristics / Model	Nominal Frequency (MHz)	Pass Bandwidth (dB)	Pass Bandwidth (MHz)	Attenuation Bandwidth (dB)	Attenuation Bandwidth (MHz)	Guaranteed Attenuation Bandwidth (dB)	Guaranteed Attenuation Bandwidth (MHz)	Ripple (dB)	Insertion Loss (dB)	Delay Time (ns)	Terminating Impedance (Ω)	Operating Temp Range (°C)	Case Code
70FA0	70	3	±3.5	40	±8.58	40	±8.58~±10	0.5	25	25	75	−10~50	1004
70FA1	70	3	±3.75	40	±10.4	40	±10.0~±30	0.5	25	50	50	−10~50	1018

FOR OPTICAL COMMUNICATION TIMING SELECTION

These SAW products, which feature high Q values (fo/△f) and high stability in narrow-band ranges, serve as filters for timing extraction in optical communication.

Characteristics / Model	Nominal Frequency (MHz)	fo/△f	Guaranteed Attenuation Bandwidth (dB)	Guaranteed Attenuation Bandwidth (MHz)	Ripple (dB)	Insertion Loss (dB)	Phase Shift (°)	Terminating Impedance (Ω)	Operating Temp Range (°C)	Case Code
97F01	97.728	450	40	±6.1~±40	1	13	10	50	−10~+60	1004
97F02	97.728	500	35	±1.2~±15	1	15	15	50	0~+50	1004
97F04	97.728	200	40	±1.1~±4.9	2	14	12	50	−10~+50	1004
196F02	196.608	600	30	±1.5~±10	2	15	26	50	0~60	1004
198F01	198.989	500	20	±10~±40	2	15	6 (2kHz)	50	0~60	1004
300F02	300.00	500	24	±30~±100	1	15	13	50	0~50	1003

1003



MINIGLOSSARIES FORMULAS • CHARTS PRODUCT SELECTION GUIDES FORMS CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
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SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
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Switches, Product Selection Guide **B**•1639
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Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
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Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

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"Over 37 Years of Service to the Electronics Industry"

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NEL SERIES**	LOGIC TYPE	FREQUENCY RANGE
HS-100*/300/350*/400/500	TTL/CMOS/STTL	244HZ-88.0MHz
HS-380*/2890*	Z80 Compatible	500.0kHz-20.0MHz
HS-426	Real Time Clock	32.768kHz
HS-600/2600	ECL Compatible	30.0MHz-220.0MHz
HS-1200*	TTL 3-State Enable/Disable	500.0kHz-36.0MHz
HS-1210*	TTL 3-State Enable/Disable	500.0kHz-63.0 MHz
HS-1370*	CMOS 3-State Enable/Disable	500.0kHz-36.0MHz
HS-1380*	CMOS 3-State Enable/Disable	500.0kHz-63.0 MHz
HS-2150/2250/2400	Dual Output TTL/CMOS	62.5kHz-36.0MHz
HF-5700 Programmable Clock Generator:	Controls Peak-Peak phase jitter to less than 1 nanosecond under worst case conditions in Computer Graphic, Disk Drive and Fiber Optic Applications, and LAN requirements.	781.25 kHz-200.0 MHz

* Metal half-pack available (HA/SA Series). Some series may be limited by frequency.
**Contact factory for proper series number for specific frequency and application.

NEL NOMENCLATURE DEFINITION

HS-XXX Standard 4 pin, 14 pin DIP compatible, thru hole full metal package
SM-XXX Standard 4 pin, 14 pin DIP compatible, surface mount full metal package
HA-XXX 4 pin, 8 pin DIP compatible, thru hole metal half-pack
SA-XXX 4 pin, 8 pin DIP compatible, surface mount metal half-pack

NEW PRODUCT

HG-1390 Enable/Disable Clock Oscillator:	100 MHz-180 MHz This device is intended to drive a CMOS input to TTL compatible logic levels (74ACT Type).
HS-109/HS-1219 TTL or CMOS 3-State:	40 MHz to 67.0 MHz This device is intended for use with the Motorola 68040 microprocessor. Unit features ±2.5% symmetry.
ECL Surface Mount Clock Oscillator:	100 MHz-200 MHz This device offers .200"x.400" footprint with lead frame embedded in glass base, sealed to a metal cover.
HS-1500/1510, HS-1400/1410 Enable/ Disable 3-State Compatible Oscillators:	63.0MHz to 200.0 MHz This series of quartz crystal clock oscillators provide enable/disable 3-state TTL/CMOS compatible signals for bus connected systems.
High Frequency ECL Oscillators:	220 MHz-500 MHz ECLIPS compatible.

QUARTZ CRYSTALS

NEL Frequency Controls, Inc. is a full spectrum manufacturer of Quartz Crystals, covering the frequency range of 1kHz to 200MHz. Products range from a complete line of Microprocessor Grade Crystals, to the very complex sophisticated parameter controlled units for filter, instrumentation, and telecommunication applications. All the popular methods of sealing, including resistance weld, cold weld, solder seal, and glass, are available.

Request Catalog 9001 for Details on All Products

ALL PRODUCTS ARE AVAILABLE THROUGH LOCAL DISTRIBUTORS. CONTACT FACTORY FOR DISTRIBUTOR NEAREST YOU.

OSCILLATEK CRYSTAL OSCILLATORS

OCXO'S
TCVCXO'S
TCXO'S
CLOCK OSCILLATORS

Since 1979, Oscillatek has been a steadily growing supplier of precision crystal oscillators. Oscillatek has always been guided by three principles:

1. Excellence in Customer Service
2. Engineering Leadership
3. Quality Products

We will always be guided by these three principles. Thus, despite enormous growth, numerous exciting new products, and greatly expanded facilities, we will always be a company with a very simple message. Whatever your oscillator requirement, come to Oscillatek for its fulfillment. You will find a friendly, courteous company ready to give priority to your needs. Your oscillators will be designed and manufactured by intelligent experts in this very specialized technology, with careful attention to quality from the very first contact until the final oscillator is shipped. You will find it very easy to talk to us, even when discussing the most difficult requirements. After all, that's our business.

OUR PRODUCTS

OCXO'S

Ovenized crystal oscillators offer very good stability versus temperature, especially in applications where space and power are not at a premium. Our expertise here is in thermal and mechanical design.

TCVCXO'S

Voltage-tuned TCXO's for low-distortion linear and phase-locked loop applications are another Oscillatek strength.

TCXO'S

Our temperature compensated crystal oscillators are used in applications where reliability, size, weight and power requirements are difficult to meet with ovenized oscillators. Our computer-aided compensation network synthesis technique allows us to use a minimum number of components most effectively to reduce compensation error to the minimum possible.

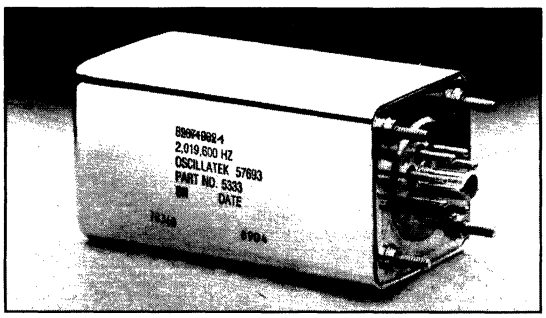
CLOCK OSCILLATORS

Our crystal-controlled thick film hybrid clock oscillators offer high reliability in small packages. We offer many standard packages including DIP, TO-5, TO-8, Flatpack and LCC. One of our specialties is very high frequency clock oscillators. All hybrid oscillators are manufactured in our new, controlled-environment clean room.

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OVEN CONTROLLED CRYSTAL OSCILLATORS

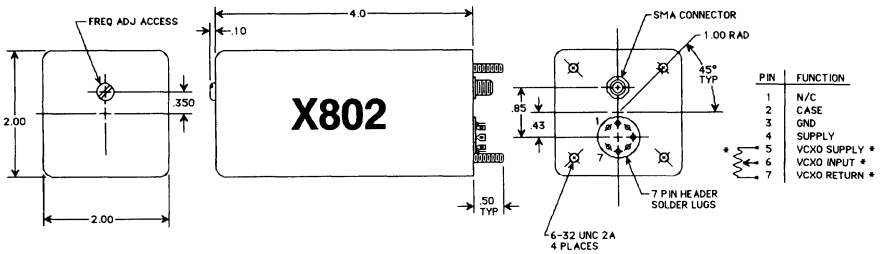
MODEL 800 SERIES OCXO



In the 800 Series of Oven Controlled Crystal Oscillators, Oscillatek offers a wide range of performance and mechanical options. The following options are offered as suggestions of possible starting points for your unique requirements for precision Ovenized Quartz Crystal Oscillators.

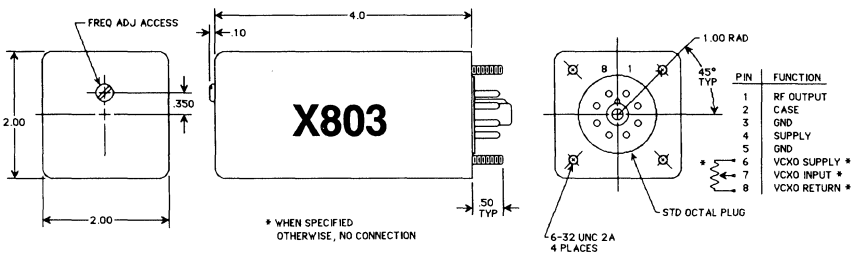
Output Options (Standard):
TTL, CMOS, HCMOS, or SINE:
+7dBm, 50 Ω
Harmonics: -20dBc

Supply (Standard:)
Voltage: 24VDC ± 5%
Stability: 1 x 10^{-9}/percent



Power:
Turn-on: 8 W maximum
Stabilized @ +25°C; 3 W maximum

Frequency Adjust:
Mechanical: For 10 years aging
Electrical (with option "E"):
3 x 10^{-7} minimum for 0 to +5V or external 20K potentiometer



Phase Noise (Sine, 10MHz):

Offset	SSB Level
100 Hz	-130dBc/Hz
1 KHz	-140dBc/Hz
10 KHz	-145dBc/Hz
50 KHz	-150dBc/Hz

Supply Options:
Any specified voltage in the range of 12VDC to 28VDC.
Multiple supplies for oven, RF and Logic.

Output Options (Additional):
Sine Output: Levels from -20dBm to +13dBm
ECL: Available with addition of -5.2V supply

ORDERING METHOD

OUTPUT LOGIC	MODEL NUMBER	AGING PER DAY	TEMP. RANGE	FREQUENCY STABILITY OPTION		VOLTAGE CONTROL	FREQUENCY	SUPPLY VOLTAGE
T = TTL	X802	1 = 1 x 10^{-8}	A = 0°C to +50°C	39 = ± 3 x 10^{-9},	28 = ± 2 x 10^{-8} 18 = ± 1 x 10^{-8}	E IF VOLTAGE CONTROL OPTION IS DESIRED	TTL = .01Hz to 30MHz	SPECIFIED SUPPLY VOLTAGE: 12VDC TO 28VDC
S = SINE	X803	2 = 5 x 10^{-9}	B = 0°C to +70°C	59 = ± 5 x 10^{-9},	58 = ± 5 x 10^{-8} 18 = ± 1 x 10^{-8}		SINE = 100KHz to 30MHz	
C = CMOS		3 = 3 x 10^{-9}	C = -20°C to +70°C	18 = ± 1 x 10^{-8},	58 = ± 5 x 10^{-8} 28 = ± 2 x 10^{-8}		CMOS = .01Hz to 15MHz	
HC = HCMOS		4 = 1 x 10^{-9}	D = -40°C to +70°C	28 = ± 2 x 10^{-8},	17 = ± 1 x 10^{-7} 58 = ± 5 x 10^{-8}		HCMOS = .01Hz to 30MHz	
			E = -55°C to +70°C	58 = ± 5 x 10^{-8},	27 = ± 2 x 10^{-7} 17 = ± 1 x 10^{-7}			

EXAMPLE	S	X802	2	B	18		–	10 MHz	,	24V

NOTE: SX8022B18-10MHz,24V is a catalog number which defines an ovenized crystal oscillator in the X802 package with a 10MHz Sine output, aging of 5 x 10^{-9}/day, stability of ± 1 x 10^{-8} over the temperature range of 0°C to +70°C, operating on a +24VDC supply.

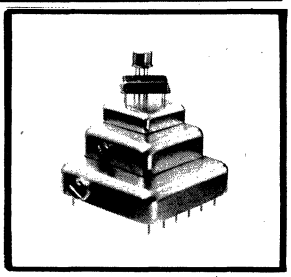
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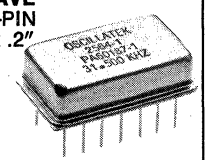
PHONE: (913) 829-1777
FAX: (913) 829-3505

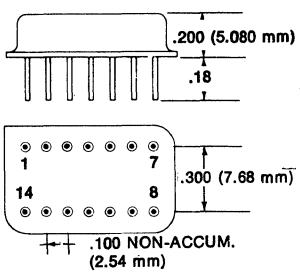


- Crystal controlled thick film hybrid oscillators (XO's)
- Baud rate generators and microprocessor drivers
- QPL'd to MIL-0-55310/09/14/16
- Temperature compensated crystal oscillators (TCXO's)
- Custom designed oscillators to meet your specifications
- Standard frequencies are available from stock

DIP

TTL, CMOS, ECL & SINEWAVE
4-PIN, 14-PIN
.8" x .5" x .2"

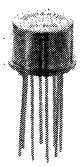


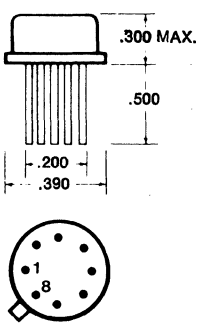


Pin	Connection	
	TTL, CMOS, SINE	ECL
7	Gnd	-5.2V
8	Out	Out
14	Vcc	Gnd
Rest	NC/ITP	

TO5

TTL, CMOS
TO5:
Dia = .39" Max
H = .30" Max.
Pins = .50" Min.

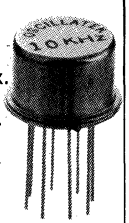


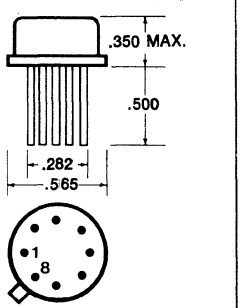


Pin	Conn.
4	Gnd
5	Out
8	Vcc
Rest	NC/ITP

TO8

TTL, CMOS
TO8:
Dia = .565" Max.
H = .350" Max.
Pins = .50" Min.

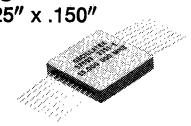


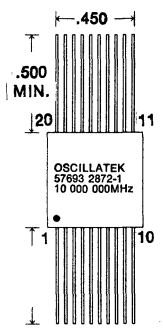


Pin	Conn.
4	Gnd
5	Out
8	Vcc
Rest	NC/ITP

FLAT PACKAGE

TTL, CMOS
.625" x .625" x .150"
20 Pins





Pin	Conn.
4	Gnd
5	Out
8	Vcc
Rest	NC/ITP

LCC

TTL, CMOS
.480" x .480" x .110"
40 Leads Surface Mount

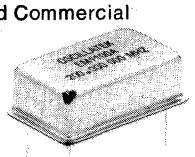


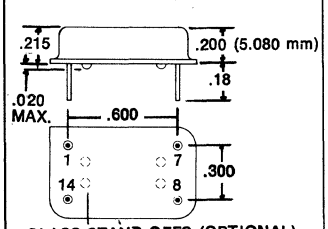


480	Conn.
4, 10	Vcc
31, 37	Gnd
39	Out
Rest	NC/ITP

M1100 Series

TTL, ECL, CMOS
.8" x .5" x .2"
Standard Commercial Series



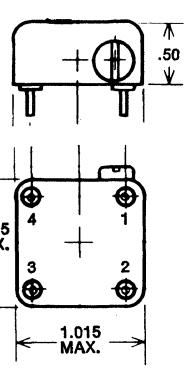


GLASS STAND OFFS (OPTIONAL)

Pin	Connection	
	TTL, CMOS, SINE	ECL
1	N/C	N/C
7	Gnd	-5.2V
8	Out	Out
14	Vcc	Gnd

X101

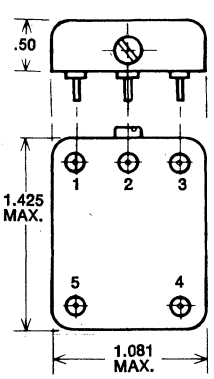
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Connection	
	CMOS, TTL, SINE	ECL
1	Gnd, case	Vee
2*	Gnd	N/C
3	Supply	Vcc
4	Output	Output

X114

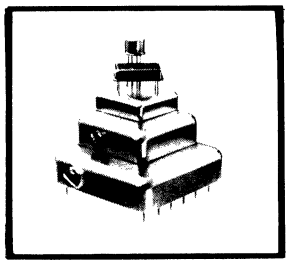
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



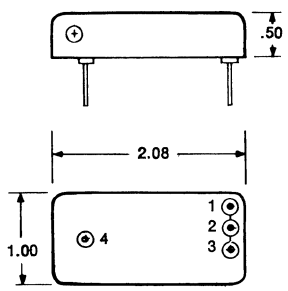
Pin	Connection	
	CMOS, TTL, SINE	ECL
1 †	N/C	N/C
2 †	N/C	N/C
3	Supply	Vcc
4	Output	Output
5	Case, ground	Vee

* Pin 2 serves as VCO input or connection for an external potentiometer where external frequency adjust is required.
† Pins 1 and 2 serve as VCO inputs or connections for an external potentiometer where external frequency adjust is required.

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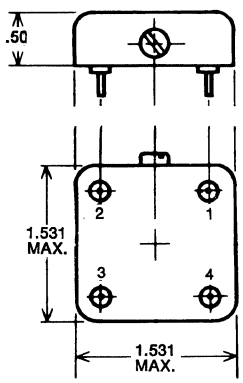


X121
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



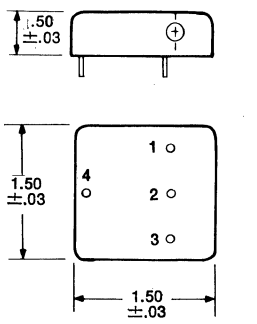
Pin	Connection CMOS, TTL, SINE	ECL
1	Output	Output
2	Supply	Vcc
3	Gnd	Vee
4	Gnd	Case

X151
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



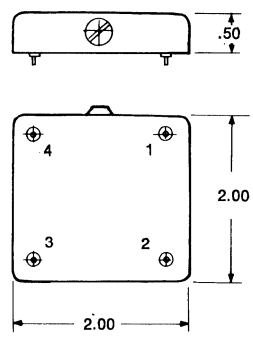
Pin	Connection CMOS, TTL, SINE	ECL
1	Gnd, case	Vee
2	Supply	Vcc
3	Output	Output
4‡	Gnd	N/C

X154
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



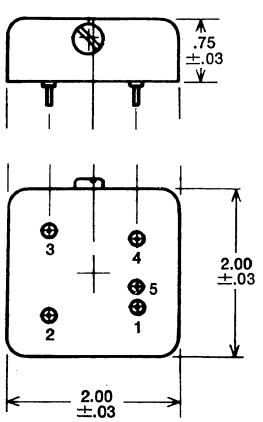
Pin	Connection CMOS, TTL, SINE	ECL
1	Gnd, case	Vee
2	Case	Case
3	Supply	Vcc
4	Output	Output

X201
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



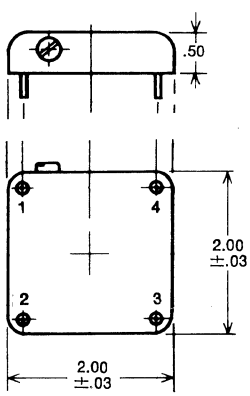
Pin	Connection CMOS, TTL, SINE	ECL
1	Supply	Vcc
2	Gnd, case	Vee
3	N/C	N/C
4	Output	Output

X202
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



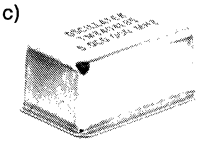
Pin	Connection CMOS, TTL, SINE	ECL
1	Output	Output
2	Supply	Vcc
*3	Gnd	Vee
4	Case	Case
*5	RF return	RF ret.

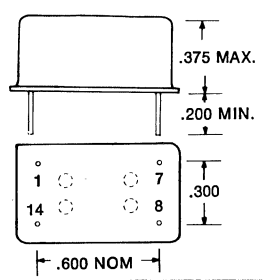
X205
TTL, ECL, CMOS & SINEWAVE Outputs
Weight = <2 oz.
Mounting = P.C.B. Type
Seal = Solder



Pin	Connection CMOS, TTL, SINE	ECL
1	Gnd, case	Case
2	Supply	Vcc
3	Output	Output
4*	Gnd, Case	Vee

DIP-TCXO
TTL, ECL, CMOS & SINEWAVE Outputs
Size = .8″ x .5″ x .375″, 4 Pin DIP
Weight = <1.5 oz.
Mounting = P.C.B. Type
Seal = Resistance weld (hermetic)

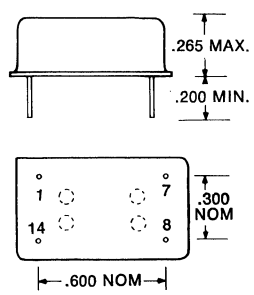




Pin	Connection TTL, CMOS, SINE	ECL
7	Gnd/case gnd	-5.2V
8	Out	Out
14	Vcc	Gnd
1	Freq. Adj/Mod (Opt.)	

DIP-VCXO
TTL Output
Size = .8″ x .5″ x .265″ 4 Pin DIP
Weight = <1.5 oz.
Mounting = P.C.B. Type
Seal = Resistance weld (hermetic)





Pin	Connection
7	Gnd
8	Out
14	Vcc
1	V cont.

• Internally connected

‡ With electronic frequency adjust option, frequency control voltage is applied from Pin 4 to Pin 1.

QPL'D CLOCK OSCILLATORS

M55310/09/14/16

- **MIL-O-55310/9** (TO5 Equivalent Package)
  - **OUTPUT:** TTL Square wave.
  - **FREQUENCY RANGE:** 400 KHz to 30 MHz
  - **SCREENING CLASS:** B

  NOTE: For QPL part number selection see the latest slash sheet issued by DESC on M55310/9.

- **MIL-O-55310/14** (DIP Package)
  - **OUTPUT:** TTL Square wave.
  - **FREQUENCY RANGE:** .1 Hz to 25 MHz
  - **SCREENING CLASS:** B

  NOTE: For QPL part number selection see the latest slash sheet issued by DESC on M55310/14.

- **MIL-O-55310/16** (DIP Package)
  - **OUTPUT:** TTL Square wave.
  - **FREQUENCY RANGE:** 0.1 Hz to 60 MHz
  - **SCREENING CLASS:** B

  NOTE: For QPL part number selection see the latest slash sheet issued by DESC on M55310/16.

NOTE: Consult Factory for current qualification status on different MIL-0-55310 slash sheets.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SÅS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

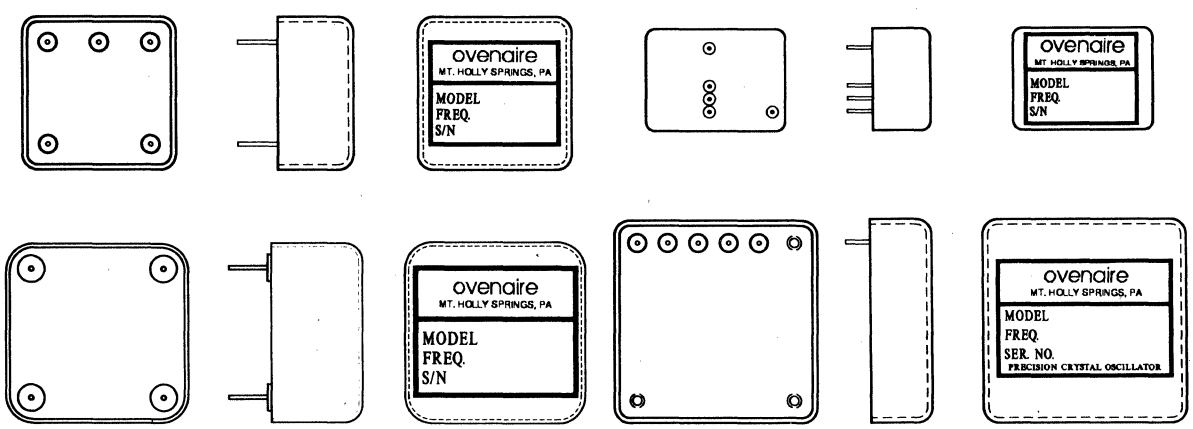
ovenaire customized oscillators

TCXO

Model SERIES	fo Range MHZ	Aging PPM/YR	Voltage SUPPLY	Output TYPE	Size (MM) L,W,H	Temperature Range	Stability fo VS temp	Vco input Vdc	Manual trim
OSC 91-1	0.1 to 5	0.5	12	5VCMOS	51, 51, 16	0 to +60C	+/- 0.5PPM	N/A	+/- 4PPM
OSC 91-2	5 to 20	1	5	HCMOS	39, 39, 16	0 to +60C	+/- 1PPM	N/A	+/- 6PPM
OSC 91-3	20 to 40	1	12	SINE	39, 39, 16	-20 to +70	+/- 1PPM	N/A	+/- 5PPM
OSC 91-6	10 to 40	0.5 to 1	12	SINE	51, 51, 19	- 35 to +70	+/- 1PPM	N/A	+/- 6PPM
OSC 91-7	40 to 120	1 to 3	12	SINE	64, 51, 19	0 to +60C	+/- 1PPM	N/A	+/- 8PPM
OSC 91-8	5 to 50	1	15	SINE	51, 51, 19	-40 to +80C	+/- 1PPM	N/A	+/- 5PPM

TCVCXO

Model SERIES	fo Range MHZ	Aging PPM/YR	Voltage SUPPLY	Output TYPE	Size (MM) L,W,H	Temperature Range	Stability fo VS temp	Vco input Vdc	Manual trim
OSC 91-4	10 to 20	1	5	SINE	34, 24, 14	0 to +60C	+/- 1PPM	1 to 5	N/A
OSC 91-5	10 to 40	0.5 to 1	12	5VCMOS	51, 51, 16	-30 to 80C	+/- 1PPM	0 to 5	N/A
OSC 91-9	10 to 40	1	12	SINE	51, 51, 19	-10 to +70C	+/- 1PPM	0 to 5	+/- 5PPM



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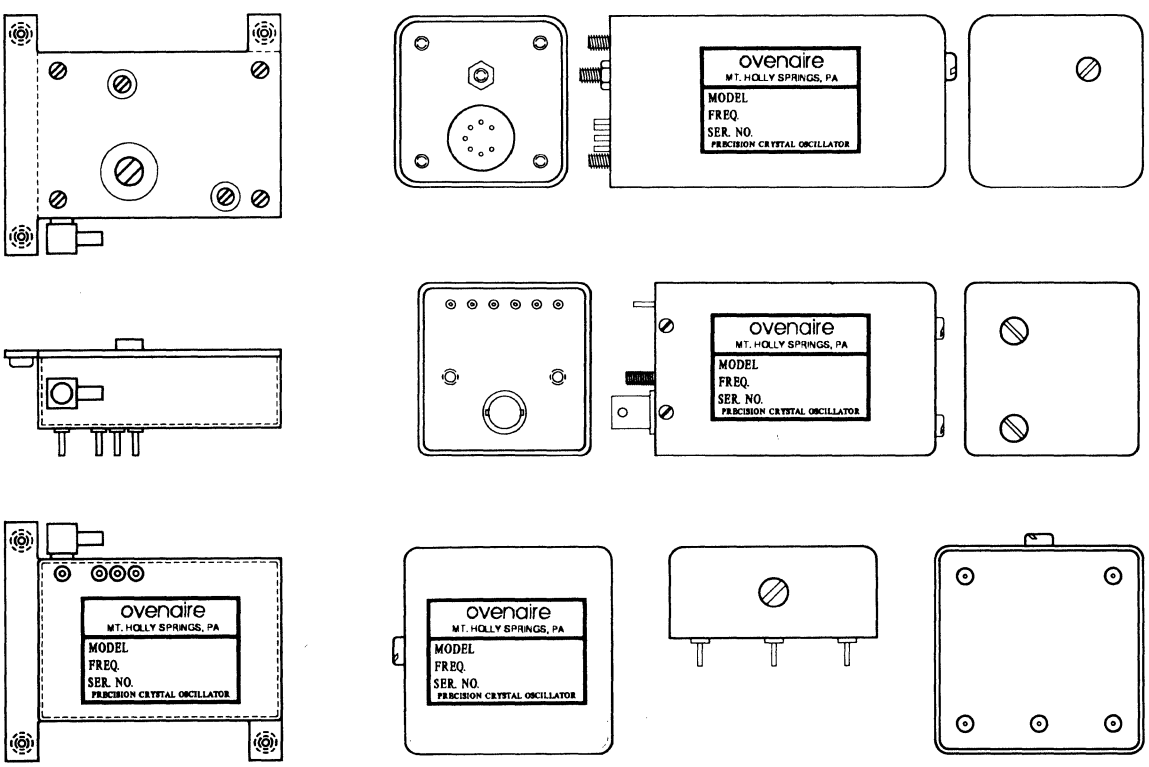
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100 Watts Street, P.O. Box B, Mt. Holly Springs, PA 17065, TEL (717) 486-3411, FAX (717) 486-5920

ovenaire customized oscillators

OCXO, OCVCXO

Model SERIES	fo Range MHZ	Aging PPM/YR	Voltage SUPPLY	Power WATTS	Size (MM) L,W,H	Temperature Range	Stability fo VS Temp
OSC 92-1	1 to 5	0.5	12	8 MAX	101, 51, 51	-20 to 70	+/-1E-8
OSC 92-2	1, 5, 10	0.1	12	8 MAX	98, 51, 51	0 to 70	+/-3E-9
OSC 92-3	5 to 30	1.0	12	9 MAX	58, 58, 26	-20 to 70	+/-1E-7
OSC 92-4	10 to 20	0.5	20	6.5 MAX	78, 50, 41	-20 to 65	+/-5E-8
OSC 92-5	10	0.1	15	7 MAX	76, 25, 41	0 to 65	+/-5E-8
OSC 92-6	10	0.1	15	7.5 MAX	68, 46, 22	-10 to 60	+/-1E-8
OSC 92-7	10	0.5	5	3 MAX	51, 26, 51	0 to 65	+/-3E-8
OSC 92-8	20 to 120	1 to 3	12, 24	6 MAX	48, 37, 91	-20 to 60	+/-5E-8
OSC 92-9	20 to 120	1.0	24	9 MAX	51, 51, 101	-20 to 60	+/-1E-8



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ovenaire mini - control ovens

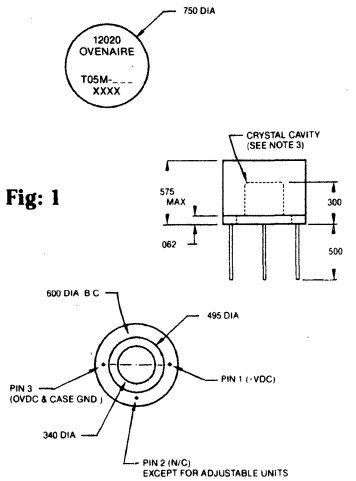
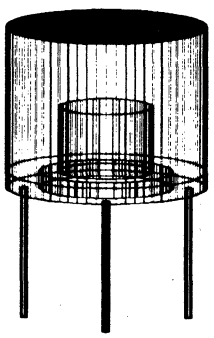


Fig: 1



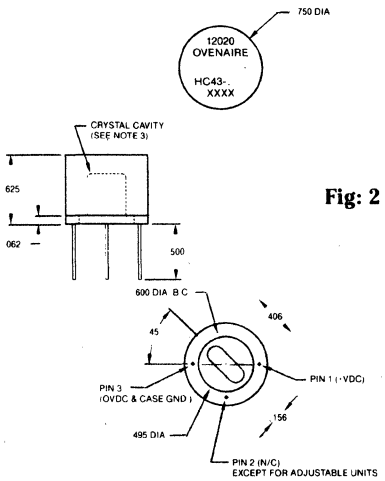


Fig: 2

A miniature component oven is a small electronic device that will reduce the variation in temperature for a given component or circuit by a factor of 10 to 100. In general, if no care has been taken to reduce thermal leakage from the oven and the device to be heated, the reduction factor will run about 10. It is necessary to take special care to insure that thermal loss will be kept to a minimum in order to approach the 100 to 1 reduction. It is important to look at the basic operation of the oven and sources of thermal leakage to get a feel for how this can be done.

With the increasing demand for more accuracy in electronic equipment, it is often found that the performance of a component or circuit over a given temperature range is not adequate. This is especially true if the equipment is to be used over a wide range of temperatures. In many cases it is possible to improve the performance considerably by the use of a miniature component oven. The incorporation of an oven in a given piece of equipment or on a printed circuit board is not simply a matter of applying the oven to the board and assuming that the problem has been solved. There are certain factors which must be taken into consideration prior to using these devices if they are to serve their intended purpose.

MINIATURE CONTROL OVENS
TO5, HC-18/U, HC-25/U, HC-35/U, HC-42/U, HC-43/U & HC-49/U TYPE CRYSTAL

SPECIFICATIONS

- OPERATING VOLTAGE: 10 to 28 V.D.C.
- MAX. CURRENT AT TURN ON: 496 MA. MAX.
- SET POINT: 50 DEG. C. TO 85 DEG. C.
- SLOPE: +/-3 DEG. C. OVER THE AMBIENT TEMPERATURE RANGE.
- AMBIENT RANGE: FROM -30 to 10 DEG. C. BELOW THE SET POINT TEMPERATURE.
- POWER: 5.95 WATTS MAX.
- WARM UP: 4 MINUTES MAXIMUM.
- QUIESCENT POWER AT 25 DEG. C: 1.3 WATT(TYPICAL).
- QUIESCENT POWER AT -30 DEG. C. =2.2 WATT(TYPICAL)
- QUIESCENT POWER AT SET POINT -10 DEG. C. BELOW SET TEMP. =.30 WATTS (TYP.)

MECHANICAL

- DIMENSIONS AND CONFIGURATION: SEE FIGURE 1 AND 2.
- TERMINAL STRENGTH: LEADS WILL WITHSTAND A 2 LB PULL.
- WEIGHT (EXCLUDING COMPONENT): 5 GRAMS MAXIMUM

SOLDERABILITY

- RESISTANCE TO SOLDERING: WILL WITHSTAND IMMERSION OF LEADS INTO SOLDER AT 350 C FOR 3.5 SECONDS.
- 95% SOLDER COATING: 5 TO 10 SECONDS IMMERSION OF LEADS IN 260 DEG. SOLDER.

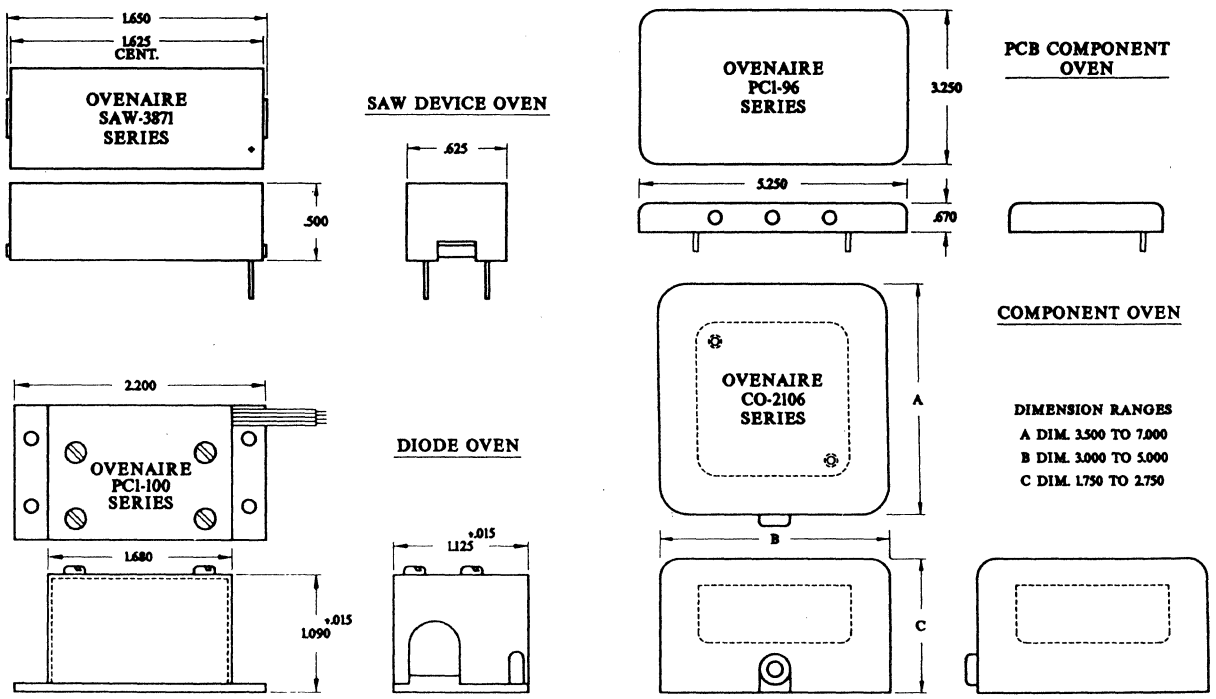
ENVIRONMENTAL

- NON-OPERATING TEMP.: MINUS 64 TO PLUS 125C
- ALTITUDE: OPERATING - FROM SEA LEVEL TO 10,000 FEET, NON-OPERATING SEA LEVEL TO 50,000 FEET
- HUMIDITY: 95% RH. FOR A PERIOD OF 1000 HRS.
- VIBRATION: 10 TO 55 CPS WITH DOUBLE AMPLITUDE OF .06 INCH ALONG EACH OF 3 MUTUALLY PERPENDICULAR AXES.
- SHOCK: 18 IMPACT SHOCKS OF 20G's (3 SHOCKS IN OPPOSITE DIRECTIONS ALONG EACH OF 3 MUTUALLY PERPENDICULAR AXES); EACH SHOCK TO BE 11 MILLISECONDS PLUS OR MINUS 1 MILLISECOND.

"CUSTOMIZED OVENS ARE OUR SPECIALTY"

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A DIVISION OF OAK CRYSTAL INC.
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ovenaire customized ovens



The component oven consists of three basic parts, a heater, a temperature sensor, and a control circuit. The heating element is usually some form of resistance device which is used to convert electricity to heat. The temperature sensor is usually a temperature variable resistor such as a thermistor. The control device in its simplest form is a thermostat. A thermostat serves as both the temperature sensor and controller. It has a set of contacts which opens the circuit when a certain temperature is reached. In more complex ovens the controller is an electronic circuit which reads the temperature sensor and when the selected temperature is reached, the circuit reduces the current to the heater. This circuit is referred to as a proportional controller because during normal operation, the controller continuously changes the oven current in response to changing amounts of heat loss in order to keep temperature constant.

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EEM COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
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Q (meter) quality-factor meter

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VRM voice recognition module
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VSWR voltage standing wave ratio

W
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Y
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Z
ZIF zero insertion force

Pletronics

ple

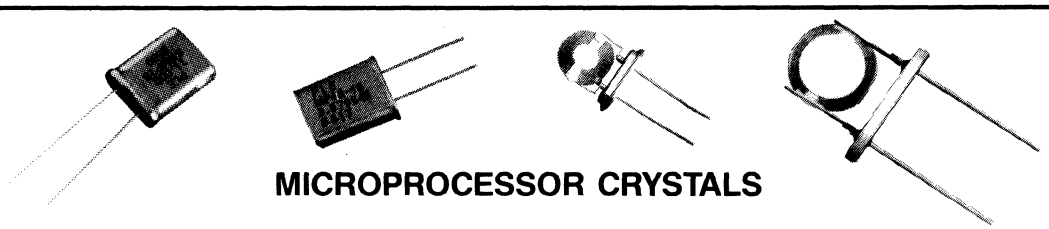
MICROPROCESSOR CRYSTALS & CLOCK OSCILLATORS

PLETRONICS *presents . . .*

. . . a full line of quartz crystals and clock oscillators available from the following categories:

- Standard Microprocessor Crystals
- Low Profile Crystals
- Miniature (UM-1) Crystals
- Tuning Fork Watch Crystals
- TTL Oscillators
- CMOS Oscillators
- HCMOS Oscillators
- Tri-State (Enable/Disable) Oscillators
- Dual Output Oscillators
- 4-Pin Mini-DIP Oscillators
- Surface Mount Oscillators

If the product you need is not listed here among our standard crystals and oscillators, our engineering staff will be happy to custom design a product to fit your exact specifications.



MICROPROCESSOR CRYSTALS

Crystals in HC-18* or HC-49 Package MP18/MP49 Series

The following standard microprocessor crystals are available immediately from stock:

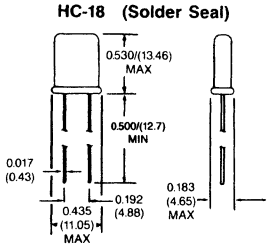
Part Number	Frequency (MHz)	Part Number	Frequency (MHz)
MP49-13**	1.843200	SRMP49	9.830400
MP49-32	2.457600	SRMP49	10.000000
MP49-18	3.276800	SRMP49	11.000000
MP49-18	3.579545	MP49-20	11.059200
MP49-30	3.600000	SRMP49	11.059200
MP49-20	3.686400	SRMP49	12.000000
MP49-20	4.000000	SRMP49	13.516800
SRMP49***	4.000000	SRMP49	14.318180
MP49-22	4.032000	SRMP49	14.745600
MP49-12	4.194304	SRMP49	15.000000
MP49-20	4.433619	SRMP49	16.000000
SRMP49	4.915200	SRMP49	18.000000
SRMP49	5.000000	SRMP49	18.432000
SRMP49	5.068800	MP49-20	18.869600
MP49-20	5.185000	SRMP49	19.660800
SRMP49	6.000000	SRMP49	20.000000
MP49-30	6.144000	SRMP49	22.118400
MP49-20	6.400000	SRMP49	24.000000
MP49-20	6.553600	SRMP49	25.000000
SRMP49	7.372800	SRMP49	36.000000
SRMP49	8.000000	SRMP49	48.000000

*For crystals in HC-18 package, MP49 becomes MP18 in Part No.
**Dashed numbers (e.g. -32) indicate load capacitance in pico Farads (e.g. 32pF)
***Model numbers without dashed numbers indicate series resonance.

SPECIFICATIONS:

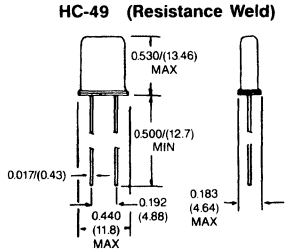
1. Calibration Tolerance: ±0.005% (50 ppm) at 25°C.
2. Overall Frequency Stability: ±0.01% (100ppm), 0-70°C.
3. Equivalent Series Resistance:
   1.000-2.4576 MHz . . . 250-750 ohms
   3.579545-7.3728 MHz . . . 75-150 ohms
   8.00-48.00 MHz . . . 25-40 ohms, max
4. Sealing Method: Solder Seal (HC-18)
   Resistance Weld (HC-49)

HC-18 (Solder Seal)



Inches/(Millimeters)

HC-49 (Resistance Weld)



Specifications subject to change without notice.

Pletronics, Inc., 19015 36th Ave. West, Suite H, Lynnwood, WA 98036 (206)776-1880 FAX: (206)776-2760

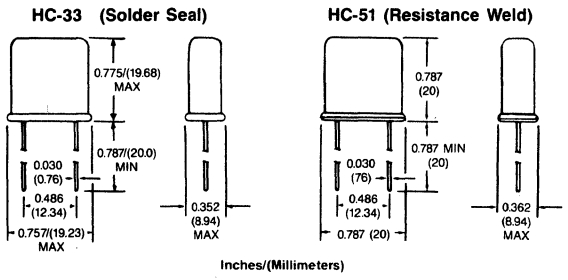
Crystals in HC-33 or HC-51* Package
MP33/MP51 Series

The following standard microprocessor crystals are available immediately from stock:

Part Number	Frequency (MHz)	Part Number	Frequency (MHz)
MP33-13**	1.000000	MP33-20	2.097152
MP33-13	1.843200	MP33-32	2.457600
MP33-20	2.000000	MP33-18	3.579545

*For crystals in HC-51 packages, MP33 becomes MP51 in Part No.
**Dashed numbers (e.g. -13) indicate load capacitance in picoFarads (e.g. 13pF)

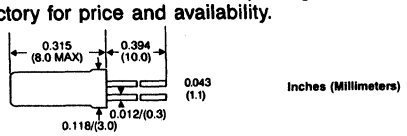
SPECIFICATIONS:
1. Calibration Tolerance: ±0.005% (50 ppm) at 25°C.
2. Overall Frequency Stability: ±0.01% (100ppm), 0-70°C.
3. Equivalent Series Resistance:
   1.000-2.4576 MHz . . . 250-750 ohms
   3.57945-7.3728 MHz . . . 75-150 ohms
   8.00-48.00 MHz . . . 25-40 ohms, max
4. Sealing Method: Solder Seal (HC-33)
   Resistance Weld (HC-51)



Tuning Fork Watch Crystals

Industry standard, 32.768kHz tuning fork watch crystals are also available from stock in 3X8mm packages.

Specifications:
Size* ..... 3.0mm x 8.0mm (+/−0.2mm)
Calibration Tolerance ..... ±0.002% at 25°C
Operating Temperature ..... −10°C to +60°C
Temperature Turnover Point ..... 23°C +/−5°C
Series resistance ..... 25K ohms typical
Quality Factor ..... 80,000 typical
Drive Level ..... 1 microwatt max
Aging ..... 1st year @ 25°C 1 ppm typical
*1.5mm x 8.0mm and 2.0mm x 8.0mm package also available, contact factory for price and availability.



Custom Designed Crystals

PLETRONICS will design and manufacture quartz crystals to customer specifications within the following limits:
—Frequency Range: 1.00 to 200.00 MHz.
—Overall Frequency Stability:
±0.001% (10ppm) to ±0.01% (100ppm)



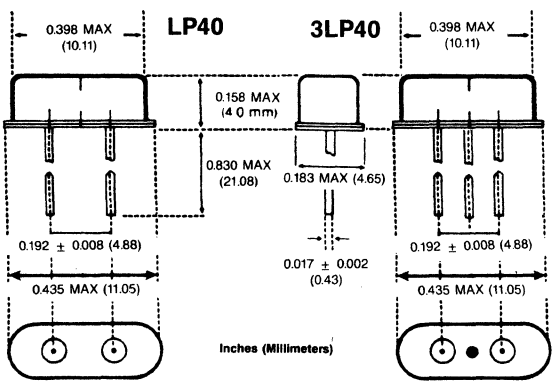
Low Profile Crystals
LP40 Series

AT-Strip crystals are housed in low-profile packages (Height: 4.0mm).* They may be substituted for HC-18 or HC-49 crystals when height is a constraining factor. The following standard frequencies (in MHz) and load capacitances (where shown) are available from stock. If capacitance is not shown, calibration is series resonance.

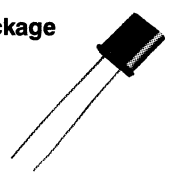
3.579545(18pF)	5.068800	12.000000
3.686400(20pF)	6.000000	14.318180
4.000000(20pF)	6.144000(30pF)	15.000000
4.194304(12pF)	8.000000	16.000000
4.915200	10.000000	18.000000
5.000000(20pF)	11.059200	20.000000
		24.000000

*Also available in 3.5mm package (LP49 Series)

1. Calibration Tolerance: ±0.005% (50ppm) at 25°C.
2. Overall Frequency Stability: ±0.01% (100ppm), 0-70°C.
3. Crystals housed in 3-lead package (3LP40) also available.

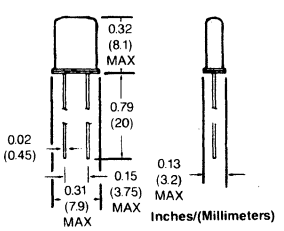


Miniature Crystals in UM-1 Package
UM1 Series



Miniature crystals housed in UM-1 packages are available as follows:
—Frequency Range:
8.00 to 120.00 MHz.
—Overall Frequency Stability:
±0.001% (10ppm) to
±0.01% (100ppm)

UM-1 (Resistance Weld)

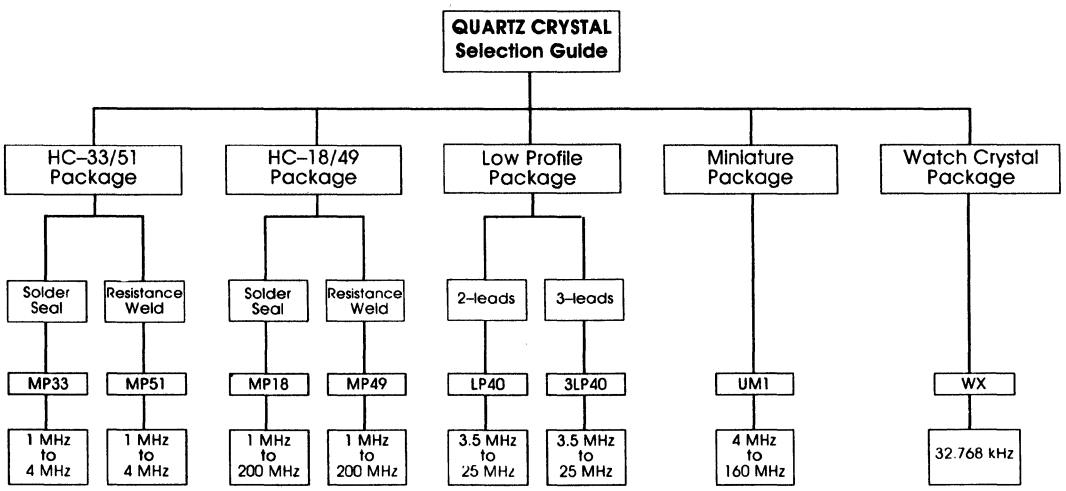


Specifications subject to change without notice.

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CRYSTAL SELECTION GUIDE

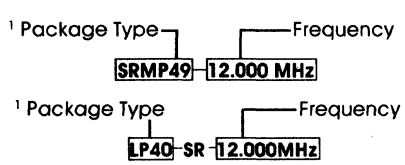
The PLETRONICS Quartz Crystal Selection Guide has been prepared to assist you in selecting the crystal you need. As long as you know what frequency you want, and you know what package you would like, you can easily find the desired part number. If you can't find a basic part number in this guide to meet your needs, call for help. We will gladly help you prepare the appropriate special part number and, of course, the custom crystal to fit your unique application. And we'll do it faster than you would have believed possible.



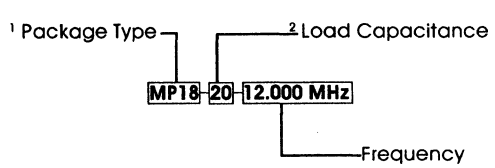
CRYSTAL PART NUMBERING GUIDE

The PLETRONICS Crystal Part Number is composed of three major elements: (1) the crystal package type, (2) the frequency of operation, and (3) the calibration method. If the crystal has been calibrated at series resonance, the package number will be preceded or followed by "SR". If the crystal has been calibrated at parallel resonance, the package number will be followed by the load capacitance value in picofarads.

- When calibration is at **series resonance**:



- When calibration is at **parallel resonance**:



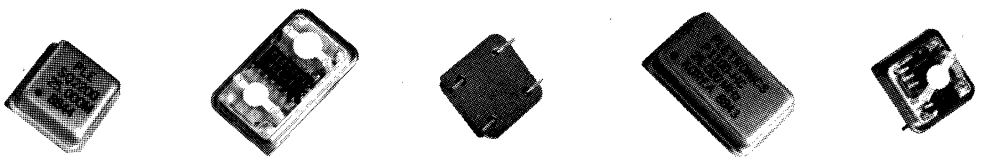
[1]Package Type: See Selection Guide above
[2]Load Capacitance: Specified by customer in picofarads (pF)

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New!

Pletronics now offers clock oscillators with frequencies up to 120 MHz!

- **Standard Frequencies include: 60, 64, 66, 66⅔, 80, and 100MHz**
- **HCMOS and TTL compatible**
- **DIP-14 and MINI-DIP Metal Packages**
- **Surface Mount Plastic Package**



CLOCK OSCILLATORS

P1100-HC Series Clock Oscillators

These clock oscillators are both TTL and CMOS compatible. They can drive up to ten standard TTL loads, and they are completely compatible with high-speed CMOS.

The following standard frequencies (in MHz) are available from stock:

1.000000	6.144000	18.432000	40.000000
1.843200	7.372800	19.660800	44.900000
2.000000	8.000000	20.000000	48.000000
2.457600	9.600000	24.000000	50.000000
3.579545	10.000000	25.000000	50.350000
3.686400	11.059200	25.175000	60.000000
4.000000	12.000000	28.322000	64.000000
4.915200	14.318180	30.000000	66.000000
5.000000	15.000000	32.000000	66.667000
5.068800	16.000000	33.333000	80.000000
6.000000	16.257000	36.000000	100.000000

P1100-3S Clock Oscillators (Tri-State — Enable/Disable Clock Oscillators)

These "True" tri-state clock oscillators are fully HCMOS and TTL compatible. When the input at pin 1 is in "Enable State," the output at pin 8 is also in "Enable State" (normal). When the input at pin 1 is in "Disable State," the output at pin 8 is also in "Disable State" (high impedance). The input is normally disabled by grounding pin 1. Thus, with pin 8 in the high impedance condition, the unit is ready to receive test signals or to connect to alternative circuits.

—Enable/Disable input requirements at pin 1:
Vih 0.6 Vcc minimum Vil 0.4V maximum
Iih 10μA maximum Iil -150μA maximum

DF1100 Series Clock Oscillators

These clock oscillators contain two independently operating crystals in one package: One independent output from Pin 1, the other independent output from Pin 8.
—Frequency Range: Pin 1: 4 MHz to 60 MHz.
Pin 8: 4 MHz to 60 MHz.

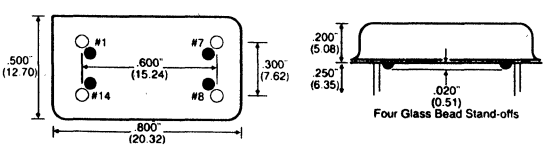
—Both outputs are TTL and HCMOS compatible.

P1100-SC Series Clock Oscillators

These clock oscillators compatible with 4000 Series CMOS are designed for applications requiring high voltage and low current consumption. Available frequency ranges depend on the input voltage specified as follows:
—When Vcc = 12 to 15V, 250 Hz to 15.00 MHz.
—When Vcc = 9 to 12V, 250 Hz to 12.00 MHz.
—When Vcc = 6 to 9V, 250 Hz to 8.00 MHz.

—See Specification Table

P1100/DF1100 SERIES



PIN	HC, 3S, SC	DF
1	N/C or Enable/Disable Input	Output 1
7	Circuit/Case Ground	Case Ground
8	Output	Output 2
14	Input (Vcc/Vdd)	Input (Vcc)

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SM1100 SERIES

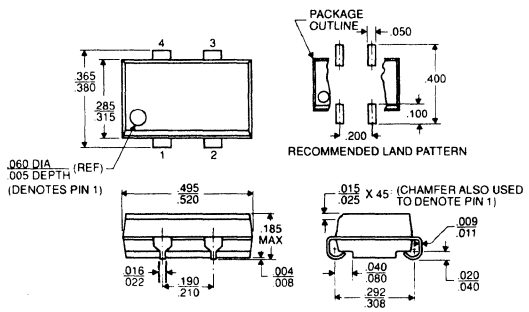
Surface Mount Clock Oscillators

These new plastic-molded, surface mountable clock oscillators are available in two different footprints: J-lead, compatible with the Electronic Industry Association standard surface mount land pattern. And Gull-wing, compatible with the industry standard SO-L-20 land pattern.

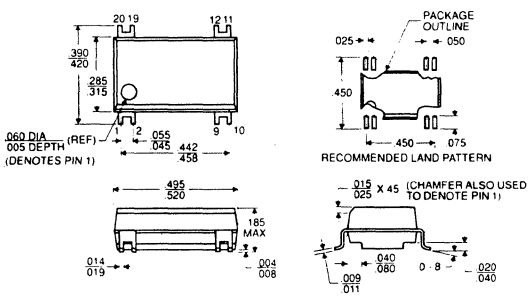
- Frequencies from 1.56MHz to 120 MHz.
- HCMOS, ACMOS, and 10-TTL compatible
- Proprietary structure of the internal crystal makes the oscillator extremely rugged
- Tri-State output standard in all units
- Increased rise and fall times for frequencies below 43 MHz to minimize EMI emission and waveform distortion often found in high-performance integrated circuits
- ESD-protected Input/Output

—See specification table

PHYSICAL DIMENSIONS (inches):



SM1100J



SM1100G

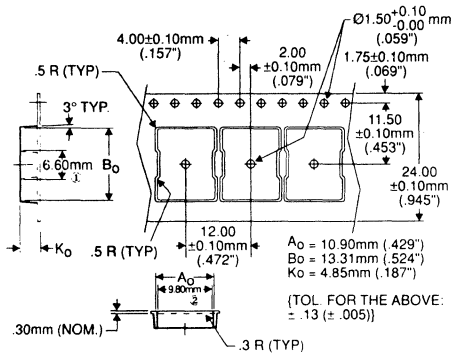
PIN CONNECTIONS		
Pin		Connection
SM1100J	SM1100G	
1	1, 2	Enable/Disable Input
2	9,10	Ground
3	11,12	Output
4	19, 20	Vin (Vcc)

The following standard frequencies (in MHz) are available in the Model SM1100J.

1.843200	16.257000	32.000000	64.000000
4.000000	20.000000	33.333000	66.000000
11.059200	24.000000	40.000000	66.667000
14.318180	25.175000	50.000000	80.000000
16.000000	28.322000	60.000000	100.000000

SHIPPING SPECIFICATIONS:

SHIPPING TAPE (Embossed Carrier Tape):



SHIPPING REEL:

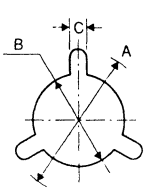
Size: 330mm (13") diameter

Center Hole:

A: 21mm (.83")

B: 13mm (.51")

C: 2mm (.08")



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SQ2200 Series Clock Oscillators

These Clock Oscillators are fully HCMOS and TTL compatible, and they are housed in 4-pin, Mini-DIP packages. This package size is one half the size of regular clock oscillator packages. (See Drawings.)

The following standard frequencies (in MHz) are available from stock:

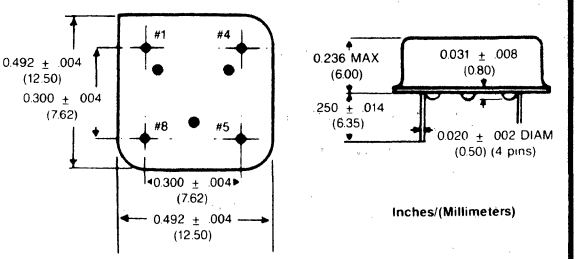
1.843200	16.000000	28.322000	60.000000
3.686400	16.257000	30.000000	64.000000
4.000000	18.432000	32.000000	66.000000
8.000000	20.000000	36.000000	66.667000
10.000000	24.000000	40.000000	80.000000
12.000000	25.000000	48.000000	100.000000
14.318180	25.175000	50.000000	

SQ3300 Series Clock Oscillators

These units are Tri-State clock oscillators housed in Mini-DIP packages. The mechanical dimensions are the same as SQ2200. The electrical specifications are the same as P1100-3S.

—See Specification Table,

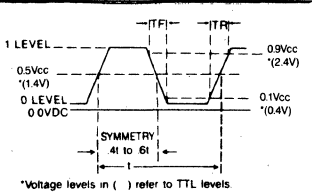
SQ SERIES



PIN	SQ2200/SQ3300
1	N/C or Enable/Disable
4	Circuit/Case Ground
5	Output
8	Input (Vcc)

CLOCK OSCILLATOR SPECIFICATION TABLE

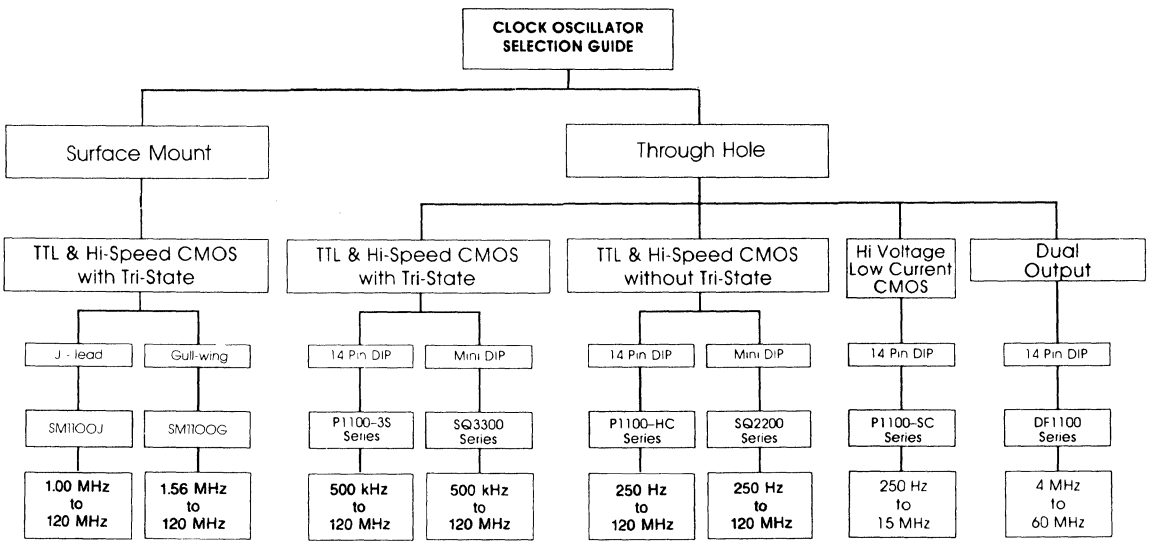
	SM1100	P1100-HC	P1100-3S	SQ2200	SQ3300	DF1100	P1100-SC
Frequency Range	1.00 MHz to 120 MHz	250 Hz to 120 MHz	500 kHz to 120 MHz	250 Hz to 120 MHz	500 kHz to 120 MHz	4 MHz to 60 MHz Both Outputs	See text under P1100-SC Series
Operating Temp Range	0° to 70°C (–40° to 85°C avaialble)						
Overall Freq Stability	±0.01% (100ppm) from 0°C to 70°C — Standard (–40° to 85°C available) 25ppm to 1000ppm also available. See selection guide for corresponding part numbers.						
Input Voltage	5VDC ±10%						6V to 15V Customer Specified
Test Load	50pF when used as HC device 10-TTL + 20pF when used as TTL device						20pF
Output Symmetry	60/40 to 40/60 (55/45 to 45/55 typical)						
Rise & Fall Times	3nS±1nS typ. (43MHz) 1.5nS±1nS typ. (43MHz)	6nS maximum with 10-TTL Load					Vcc=6V -100nS max. Vcc=15V -30nS max.
Logic Level "1"	0.9xVcc minimum when used as HCMOS device 2.4V minimum when used as TTL device						0.9 x Vcc minimum
Logic Level "0"	0.1xVcc maximum when used as HCMOS device 0.4V maximum when used as TTL device						0.1 x Vcc maximum



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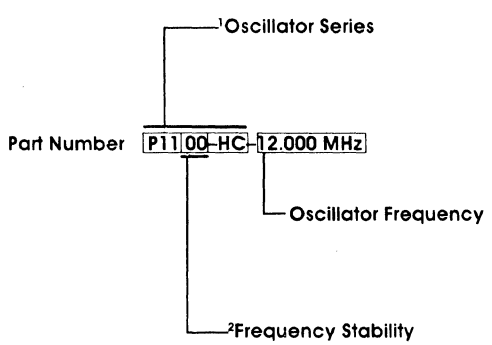
OSCILLATOR SELECTION GUIDE

The PLETRONICS Clock OSCILLATOR Selection Guide has been prepared to assist you in selecting the oscillator you need. As long as you know the parameters you want, the package you want, and the frequency you want, you can easily find the desired part number. If you can't find a basic part number in this guide to meet your needs, call for help. We will gladly help you prepare the appropriate special part number and, of course, the custom oscillator to fit your unique application.



OSCILLATOR PART NUMBERING GUIDE

The PLETRONICS Clock Oscillator Part Number is composed of three major elements: (1) the basic series part number, (2) the frequency of operation, and (3) the overall frequency stability. This allows you to place an order directly by part number.



Frequency Stability

45:	50PPM (0.005%)
00:	100PPM (0.010%)
14:	500PPM (0.050%)
15:	1000PPM (0.100%)

[1]See Selection Guide Above
[2]See Frequency Stability Table on Right.

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Q-Tech Corporation
10150 W. Jefferson Blvd., Culver City, CA 90232, USA
(213) 836-7900 • Telex: 69-6140 • FAX (213) 836-2157

Quality Hybrid Crystal Clock Oscillators

LOGIC FAMILIES: TTL, CMOS, HCMOS, ACMOS & ECL

TTL

Standard TTL outputs can drive up to 10 TTL loads. Some Q-Tech clocks use low power Schottky (LS) dividers and gates to reduce internal power consumption. These units drive 2 TTL loads or 4 LS loads over the full military temperature range.

SPECIFICATION	FREQUENCY RANGE	SYMBOL	MIN	TYP	MAX	UNIT
Operating Voltage	All	V_{CC}	4.5	5.0	5.5 *7.0	Volt (V)
Supply Current	50 MHz-100 MHz	I_{CC}		40		milliAmpere (mA)
	27 MHz to 50 MHz			25		
	6.5 MHz to 27 MHz			12		
	.01Hz to 6.5 MHz			20		
Output Voltage -High	All	V_{OH}	2.4	3.8		Volt (V)
Output Voltage -Low	All	V_{OL}		0.3	0.4	
Rise/Fall Times (measured btw .8V & 2.0V)	5 MHz to 80 MHz	t_r/t_f		3	5	nanosecond (ns)
	Less than 5 MHz			8	10	
Start-Up Time	27.5 MHz to 100 MHz	t_s		10		millisecond (ms)
	16 MHz to 27.5 MHz			2		
	10 MHz to 16 MHz			5		
	Less than 10 MHz			15		
**Duty Cycle or Symmetry	27 MHz to 80 MHz	N/A	40	50	60	percent %
	6.5 MHz to 27 MHz		40	50	60	
	With divider(s)		45	50	55	
	Less than 5 MHz		45	50	55	
Load	27 MHz to 65 MHz	N/A			6	TTL loads
	Less than 27 MHz				10	TTL loads
Stability vs. Supply Voltage	All	N/A		$\pm 1x10^{-6}$	$\pm 2x10^{-6}$	$\Delta F/\Delta V$ for $\Delta V = \pm 10\%$
Stability vs. Load	All	N/A			$\pm 1x10^{-6}$	$\Delta F/\Delta$ Load for Δ Load $= \pm 20\%$
Aging & Stability	All	N/A		± 5	± 10	PPM/Year
Screening	Full MIL Temperature Range: −55°C to +125°C with special option to +200°C if required					
Package	**Available in all Q-Tech packages**					

* Absolute maximum operating voltage. ** For tighter tolerance, or special waveform, consult the factory.

CMOS, HCMOS, ACMOS & "Z" DRIVERS

Q-Tech **"C"** type clock oscillators are compatible with the **high voltage, 4000 series CMOS** logic family. Frequencies from .01 Hz to 15 MHz and voltages from 5 volts to 15 volts are available.
The **"HC/AC"** clock oscillators match the **High Speed CMOS** logic family. Q-Tech HC/AC clocks produce rail-to-rail CMOS logic levels at frequencies to over 100 MHz. These units can drive one TTL load or high capacitance CMOS and NMOS loads.
Options available in the HC/AC line include provisions for **special symmetry** option, a **low current** option for battery operation when the output frequency is below to 100 KHz, and optional 10 TTL drive capability. Although normally run at 5.0 volts like TTL, HC clocks can operate down to 2.5 volts, with some restrictions on maximum frequency.
The **"Z"** type clock oscillators have **more power to drive very high capacitance loads.** Use "Z" designation in part number: e.g. QT6Z9M—12 MHz. This unit can drive 150 pF load with a typical 6 nanoseconds (ns) rise & fall times (t_r, t_f).
Extra outputs, gates, special digital functions and automatic testing provisions can often be included at low cost.

SPECIFICATION	STD CMOS	HC/AC
Frequency Range	.01 Hz to 15 MHz (Max. frequency depends on voltage)	.01 Hz to 100 MHz
Supply Voltage	*5 to 15 volts	*2.5 to 5.0 Volts
Supply Current	2-4 mA typical at 5 V and 6 MHz	6 mA typical @ 10 MHz
Load	10 CMOS/MOS loads typical (depends on frequency)	±2 mA drive typical. Can drive 1 TTL load, excellent for high capacitance loads ***
Rise/Fall Times (t_r and t_f)	<100 ns @ 5 V (depends on load)	6 ns typical @ 6 MHz. 10 ns max.
Logic Level "1"	V_{CC} −0.1 V min.	V_{CC} −0.1 min.
Logic Level "0"	0.0 +0.1 V max.	0.0 +0.1 V max.
Aging & Stability	Same as TTL	Same as TTL
Symmetry	60/40 4 MHz to 15 MHz 50/50 below 4 MHz	60/40 STD **50/50 available up to 25 MHz.
Screening	Full MIL Temperature Range −55°C to +125°C	
Package	**Available in all Q-Tech packages**	

Notes: *Special supply voltage. Ultra low current for battery operation available.
**Special tightened symmetry or arbitrary specified symmetry available.
***Higher drive capabilities available.

ECL

The ECL logic family is characterized by **very high speed** (clocks available to 200 MHz.) Q-Tech ECL clocks use 10K, 10KH, 100K and ECLinPS for compatibility with most ECL systems.
ECL components typically use a negative **Vcc of – 5.2 Volts D.C.,** referenced to ground pin. for example, the Q-Tech QT48 package, built as an ECL clock, would use – 5.2 Volts on pin 7 ("Vcc") and ground on pin 14. Other pin configurations are also available.
2 new ECL options are available (QT6E1 and QT41E1 series) with quick delivery on standard frequencies. For more information, request bulletin **ECL.**

Available Features:

1. Full Military Temperature range
2. Internal bias (Vbb) available on a pin
3. Low cost commercial version (request bulletin ECL)
4. A.C. coupled output for r.f. applications
5. Custom clocks with gates, complementary outputs, etc.
6. Positive Vcc.
7. Custom load requirements.

SPECIFICATION	ECL
**Frequency Range	1 MHz to 200 MHz
Supply Voltage	– 5.2 V std for 10K and 10 KH output
	– 4.5 V std for 100K output
Supply Current	30 mA typical
Load	Std ECL
Rise/Fall Times (t_r and T_f)	Std 10K, 100K, and 10 KH
Levels	STD 10K, 100K and 10 KH
Aging & Stability	Same as TTL
Symmetry	60/40 (max), 55/45 (typical)
Screening	Full MIL Temperature range: −55° to +125°C
Package	**Available in all Q-Tech standard packages except QT1, QT3 and QT14**

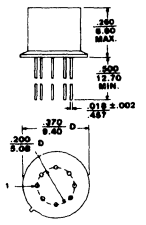
** For higher frequency, refer to UHF and VHF sources in our catalog.

Q-Tech Corporation
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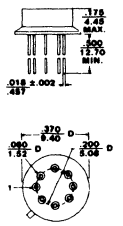
QPL to Full Mil-O-55310/08 Thru /20

QUALITY HYBRID CRYSTAL CLOCK OSCILLATORS DRAWING OUTLINES

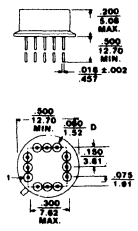
QT1



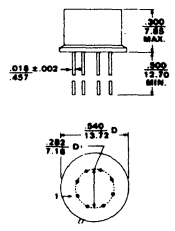
QT14



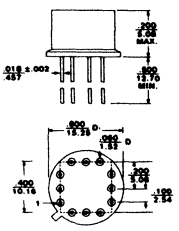
QT2



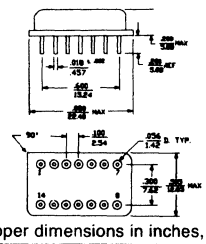
QT3



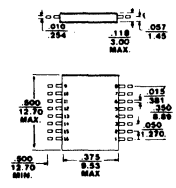
QT8



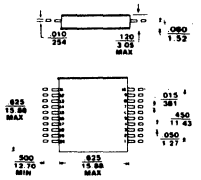
QT4, 6, 10, 12



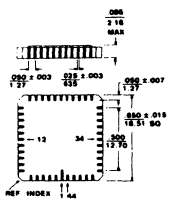
QT22



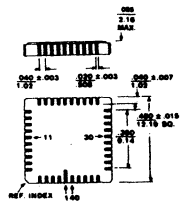
QT24



QT62



QT66



Upper dimensions in inches, lower dimensions in millimeters.

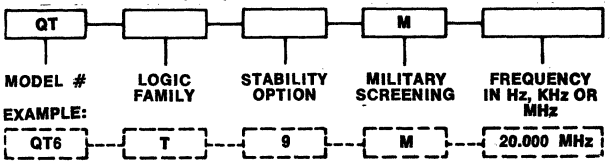
					LOGIC FAMILY	TTL	CMOS		HCMOS/ACMOS	ECL
					INPUT VOLTAGE	5.0V	5.0V - 10.0V	10.0V - 15.0V	5.0V	−5.2V
MODEL #	PCKG.	PIN CONNECTIONS VCC/ VDD	GND/ CASE	OUT	EQUIVALENT MIL-O-P/N M 55310/XX	FREQUENCY RANGE				
QT1	TO 5	8	4/4	5	/09 = TTL & /12 = CMOS	400 Hz - 60 MHz	1.5 KHz - 8.5 MHz	1.5 KHz - 15 MHz	400 Hz - 60 MHz	N/A
QT14	TO 5	8	4/4	5	N/A					
QT2	TO 8	12	6/6	5	N/A	1 Hz - 80 MHz	1 Hz - 8.5 MHz	1 Hz - 15 MHz	.01 Hz - 80 MHz	1 MHz - 200 MHz
QT3	TO 8	8	4/4	5	/10 = TTL & /13 = CMOS	1.5 KHz - 30 MHz			.01 Hz - 30 MHz	N/A
QT4	DIP	4	7/7	5	/14 = TTL	0.1 Hz ↓ 100 MHz	0.01 Hz ↓ 8.5 MHz	0.01 Hz ↓ 15 MHz	.03 Hz ↓ 100 MHz	1 MHz ↓ 200 MHz
QT6	DIP	14	7/7	8	/16 & /17 = TTL & /18 = CMOS					
QT10	DIP	14	8/2	1	/08 = TTL & /11 & /15 = CMOS					
QT12	DIP	14	7/7	4	N/A					
QT22	FP	8	9/9	10	N/A	1.5 KHz - 100 MHz	1 Hz ↓ 8.5 MHz	1 Hz ↓ 15 MHz		
QT24	FP	13	10/10	11	/21 = TTL	1 Hz - 100 MHz				
QT62	LCC	6, 12	34, 40	42	/20 = TTL	1.5 KHz - 100 MHz				
QT66	LCC	4, 10	31,37	39	/19 = TTL					

FREQUENCY STABILITY VS TEMPERATURE**

OPTION CODE	±%	±PPM	TEMPERATURE
1	.01	100	0°C — +70°C
4	.005	50	
2	.005	50	0°C — +50°C
*3	.0005	5	
5	.0025	25	−20°C — +70°C
6	.005	50	−55°C — +105°C
9	.005	50	−55°C — +125°C
10	.01	100	
8	TO CUSTOMER SPECIAL REQUIREMENTS		

* Requires external tuning capacitor.
** All units operate from −55°C to +125°C. Tolerance unspecified outside of temperature limits.

HOW TO ORDER (213) 836-7900



NORMALLY WRITTEN: QT6T9M-20.000 MHz

There are three ways to order a Q-Tech Clock Oscillator:

1. By ordering a Q-Tech standard part number such as: **QT6 T 9 M-20 MHz.**
2. By ordering a MIL-O-55310 part number such as **M55310/16-B31 A-20 MHz.**
3. By ordering a special custom requirement unit (whether the product is governed by a customer source control document or is a Q-Tech special design), a special part number **MCM XXXX** will be assigned to the product designating **Microelectronic Custom (Oscillator) Module,** which will also assure you of **confidentiality** regarding the **proprietary nature** of your design.

SPECIAL OPTIONS AVAILABLE

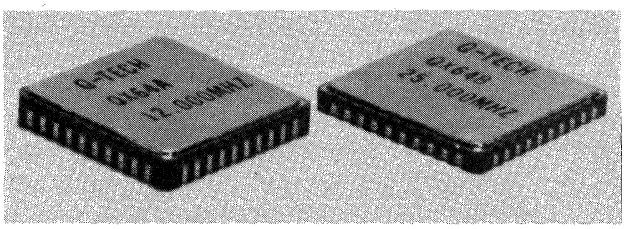
- Gated Outputs
- Multiple Frequency Outputs
- Tri-State Outputs
- Fine Frequency Adjustment
- Precise Programmed Outputs
- Reliable Start-Up Time
- Sinewave Output
- Special Symmetry
- Logic: TTL, CMOS, HCMOS, ACMOS, ECL and 'Z' Drivers
- 200°C Operation
- Very Low Consumption
- Special Package Configurations
- Special Pin Configurations

Q-Tech Corporation
10150 W. Jefferson Blvd., Culver City, CA 90232, USA
(213) 836-7900 • Telex: 69-6140 • FAX (213) 836-2157

Other Q-Tech Products

SURFACE MOUNT CRYSTALS

Q-Tech is introducing its new line of Surface Mount Crystals: the ***QX64A*** (85 mils thick) and ***QX64B*** (65 mils thick) ***series*** with a frequency range of 5 MHz to 125 MHz. These surface mount crystals can withstand full military environmental testings. They are hermetically sealed in a 40 pad LCC with any pin configuration at no extra charge. They are also available in swept quartz for ***radiation hardened applications.*** For more details please request bulletin ***SMX.***



Surface Mount Crystals

ULTRA-SMALL HF AND VHF SOURCES

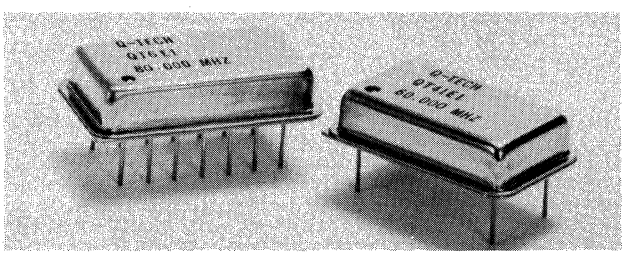
Q-Tech's crystal controlled oscillator model ***QT-815*** is available in the frequency range from 4 MHz to 500 MHz. With a package size of just 1.66 in. x .875 in. x .275 in., the ***QT-815*** is one half the size of competing units with no compromise in specifications. Features include: Low noise, crystal stability, + 7 dBm output, low DC current. Other packages and options available. For full details please request bulletin ***QT-800.*** Also, see page four of this ad.

VCXO'S

Q-TECH ***Voltage Controlled Crystal Oscillators*** can be ***"frequency shifted"*** or ***"controlled"*** with an external voltage source. Q-Tech VCXO's, often used for frequency synthesis, clock recovery and other phase lock loop applications, are available in DIP packages as well as custom packages. Typical deviation (pulling) is +/– 100 ppm for a control voltage range of 0 to 5 volts. VCXO's requiring a wider pull range, improved linearity, ECL or sinewave output are also available. Integrating the VCXO, the loop filter and the phase detector into one small package can reduce cost, space and system noise. Q-Tech Voltage Controlled Oscillators (VCOs) are also available.
For more details, please request the VCXO bulletin.

ECL CLOCK OSCILLATORS

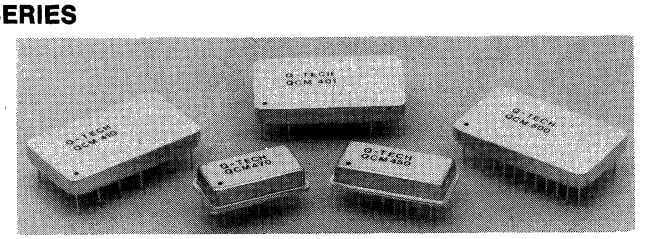
In addition to its complete line of ECL Clock Oscillators, Q-Tech now offers another version of unscreened and fast delivery ECL in 2 standard DIPS: ***QT6E1*** (14 pin DIP) and the ***QT41E1*** (4 pin DIP) ***series.*** These units operate at – 5.2 Volts with a frequency range of 1 MHz to 200 MHz. For more details please request bulletin ***ECL.***



ECL Clock Oscillators

MICROPROCESSOR CLOCK DRIVERS — THE QCM SERIES

Q-Tech has developed ***clock generators/drivers*** with quartz crystal stability for all commonly used microprocessors. Versions are available with TTL, CMOS and/or NMOS output levels (as required). ***The QCM series clock drivers*** are available in both commercial and full MIL-spec designs. Q-Tech can provide drivers for almost all available microprocessors. For full details please request bulletin ***MCD.***

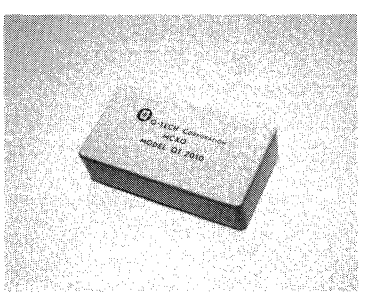


The QCM Series

M C X O
Microprocessor Compensated Crystal Oscillator

A new approach to low power high stability design, Q-TECH's MCXO breaks the 30 year, 1 ppm frequency stability barrier for compensated crystal oscillators.

- ± 3 x 10^{-8} stability from –55°C to +85°C **(without an oven!)**
- 60 milliwatts maximum power input
- 10 second initialization
- Designed-in spectral purity; 10 MHz output
- Package Dimensions: 3" x 2" x 1"
- Custom packages available



Q-Tech Corporation
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(213) 836-7900 • Telex: 69-6140 • FAX (213) 836-2157

Crystal Controlled Sinewave Sources

QT-815

This tiny unit (less than 0.4 cu. in.) is the smallest member of Q-Tech's line of HF/VHF sources. Other models and options are available, see below.



QT-815
1.66 in. x .875 in. x .27 in.
4 TO 500 MHz
ULTRA-SMALL SOURCE

Features

FREQUENCY	**4 MHZ to 500 MHZ**	
OUTPUT		
Level	+7 dBm STANDARD (>0.7 Vrms/50 ohms)	
Harmonics	−20 dBc (dB below carrier)	
Subharmonics/	−40 dBc	
Spurious	(−70 dBc for specific bands around carrier)	
Phase Noise	Offset From Carrier	Phase Noise
	100 Hz	−115 dBc/Hz
(Typical	1 kHz	−135 dBc/Hz
at	10 kHz	−150 dBc/Hz
100 MHz)	50 kHz	−155 dBc/Hz
STABILITY		
25°C	±10 PPM	
Temperature	−20°C to +70°C ±25 PPM	
Aging	5 PPM 1st year, 3 PPM/year, thereafter	
SUPPLY		
Voltage	12 or 15 Vdc, ±10% (any supply in 12-24 volt range, optional)	
Current	<20 mA	
MECHANICAL		
Size	0.875 in. x 1.66 in. x 0.275 in.	
Mounting	PCB Mount	

Other Models, Options:

QT-825: Package size 1.5 in. x 1.5 in. x .5 in.
QT-875: +30 dBm output (1 Watt) Package is 2 in. x 3 in. x .5 in.
Temperature/ Stability +50 ppm from −55 degrees C. to +125 degrees C
Connections: PC board mount: BNC, SMA optional output connectors

REEVES-HOFFMAN

DIVISION DYNAMICS CORPORATION OF AMERICA

QUARTZ CRYSTALS

CRYSTAL PRODUCT LINE CAPABILITY SUMMARY

The following is a brief overview of the packaged crystals and crystal blanks manufactured by Reeves-Hoffman Division. We have 50 years of crystal design and manufacturing experience and we welcome the opportunity to quote your requirements. Please contact us with your specifications for a prompt quotation.

LOW FREQUENCY CRYSTALS (1 KHz to 1 MHz)

FREQUENCY RANGE	HOLDER	TEMP. RANGE	STABILITY	RESISTANCE
1 KHz to 15 KHz	A	−40 °C to +95 °C	200 ppm	1250 ohms
15 KHz to 100 KHz	A	−40 °C to +95 °C	100 ppm	50K to 90K ohms
100 KHz to 200 KHz	A	−40 °C to +95 °C	150 ppm	5000 ohms
200 KHz to 450 KHz	B	−40 °C to +95 °C	100 ppm	2K to 5K ohms
450 KHz to 1 MHz	C	−40 °C to +95 °C	75 ppm	1K to 2K ohms

HIGH FREQUENCY CRYSTALS (1 MHz to 200 MHz)*

FREQUENCY RANGE	HOLDER	MODE	TEMP. RANGE	STABILITY	RESISTANCE
1 MHz to 3 MHz	B	Fund.	−55 °C to +105 °C	50 ppm	50 to 500 ohms
3 MHz to 60 MHz	C	Fund.	−55 °C to +105 °C	50 ppm	15 to 50 ohms
10 MHz to 60 MHz	D	Fund.	−55 °C to +105 °C	50 ppm	15 to 50 ohms
10 MHz to 29 MHz	B	3rd	−55 °C to +105 °C	50 ppm	35 ohms max.
30 MHz to 70 MHz	E	3rd	−55 °C to +105 °C	50 ppm	35 ohms max.
50 MHz to 125 MHz	E	5th	−55 °C to +105 °C	50 ppm	50 ohms max.
100 MHz to 200 MHz	E	7th	−55 °C to +105 °C	50 ppm	125 ohms max.

*NOTE: Numerous temperature range/stability options are available (for example, 4 to 200 MHz, 0° TO 50°C, +/−10 ppm). Please contact factory for details.

DEFINITION OF HOLDER TYPES

A	B	C	D	E
HC-13	HC-6 HC-47	HC-18 HC-43	HC-45	HC-18 HC-43 HC-50
HC-34	HC-33 HC-48	HC-25 HC-49		HC-25 HC-45
	HC-36 HC-51	HC-42 HC-50		HC-42 HC-49

QPL TYPES PER MIL-C-3098:

CR-5A/U	CR-8A/U	CR-19A/U	CR-64/U	CR-79/U	CR-97/U	CR-140/U
CR-6A/U	CR-18A/U	CR-58A/U	CR-78A/U	CR-89/U	CR-119/U	CR-157/U

ETHERNET CRYSTALS

Reeves-Hoffman Division offers a low cost 20 MHz crystal for Ethernet applications. The part number for this device is 04-20423-312.

CRYSTAL BLANKS

- Finished Blank Frequency Range: 8 to 200 MHz
  Fundamental Range: 8 to 60 MHz
  3rd, 5th, 7th, 9th Overtone: 8 to 200 MHz
- Square or round unfinished blanks also available.

For further information or catalog, contact your Reeves-Hoffman representative or
Reeves-Hoffman, Division Dynamics Corporation of America • 400 W. North Street, Carlisle, PA 17013 USA • Phone 717-243-5929 • FAX 717-243-0079

REEVES-HOFFMAN

DIVISION DYNAMICS CORPORATION OF AMERICA

OSCILLATORS

HYBRID CLOCK OSCILLATORS

Reeves-Hoffman Division produces a wide variety of hybrid clocks for computer, test equipment, medical imaging, communication, and various military applications. Our hybrid clocks use crystals and packages that are manufactured in our Carlisle, Pa. facility. High volume orders are produced using automated assembly and test equipment.

FREQUENCY RANGE	PART NUMBER	TEMPERATURE RANGE	STABILITY	OUTPUT	LOAD	INPUT VOLTAGE	INPUT CURRENT	NOTES
16 KHz to 115 MHz	2181	0° to +85°C	±25 ppm	TTL	510 ohms	+5 VDC ±5%	15 to 75 mA	Standard TTL clock
7 MHz to 60 MHz	2031	0° to +60°C	±3 ppm	TTL	3 TTL loads	+5 VDC ±5%	15 to 25 mA	High stability 5 pin
8 MHz to 12 MHz	2290	0° to +55°C	±3 ppm	TTL	15pf + 50K	+5 VDC ±5%	3 to 4 mA	High stability 4 pin
4 MHz to 200 MHz	2144	0° to +85°C	±50 ppm	ECL	50 ohms to −2V	−5.2 VDC ±5%	30 to 70 mA	Standard 10 KH ECL clock
4 MHz to 120 MHz	2247	−20° to +70°C	±50 ppm	ECL	50 ohms to −2V	−5.2 VDC ±5%	20 to 30 mA	Complementary output
4 MHz to 132 MHz	2248	0° to +85°C	±50 ppm	ECL	50 ohms to −2V	−5.2 VDC ±5%	15 to 70 mA	Low-level enable
4 MHz to 100 MHz	3108	0° to +85°C	±50 ppm	ECL	50 ohms to −2V	−5.2 VDC ±5%	15 to 70 mA	Complementary O/P and enable
7 MHz to 12 MHz	2038	0° to +70°C	±20 ppm	CMOS	15 pf	+5 VDC ±5%	15 to 70 mA	Standard CMOS clock
40 MHz to 50 MHz	3147	−40° to +85°C	±11 ppm	HCMOS	15 pf	+5 VDC ±5%	15 to 45 mA	Standard HCMOS clock

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Reeves-Hoffman Division produces TCXO's for position location, navigation, communications, and test equipment applications. Surface mount construction and internal crystal capabilities allow us to produce high stability, low cost TCXO's.

FREQUENCY RANGE	PART NUMBER	TEMPERATURE RANGE	STABILITY	OUTPUT	INPUT VOLTAGE	INPUT CURRENT	AGING	NOTES
3 MHz to 16 MHz	2155	0° to +55°C	±1 ppm	TTL	+5 VDC ±5%	10 to 15 mA	3 ppm/yr	Standard TTL TCXO
1 MHz to 16 MHz	3149	−40° to +85°C	±5 ppm	TTL	+5 VDC ±5%	5 to 15 mA	1 ppm/yr	Extended temperature range
4 MHz to 50 MHz	1994	−20° to +70°C	±4 ppm	ECL	−5.2 VDC ±5%	30 to 80 mA	1 ppm/yr	Standard ECL TCXO
4 MHz to 16 MHz	2158	+15° to +65°C	±0.5 ppm	SINE	+5 VDC ±5%	5 to 10 mA	1 ppm/yr	1.8″ x 1.2″ x 0.65″
20 MHz to 200 MHz	2173	−20° to +55°C	±2 ppm	SINE	+15 VDC ±5%	80 to 100 mA	1 ppm/yr	2.0″ x 2.0″ x 0.50″

INTERNAL CAPABILITIES

Reeves-Hoffman Division is highly vertically integrated and has internal capabilities for the following processes/operations:

- Thickfilm hybrid print, fire, and trim
- Pick-and-place hybrid assembly
- Automated wire bonding
- Computer-controlled oscillator testing
- Radiographic inspection
- Environmental test
- Computer-controlled crystal testing
- High-reliability crystal processing
- CAD/CAM
- CAE RF design
- NC milling
- Screen room for noise measurement
- Complete glass sealing and brazing
- Plating (electroless/electrolytic nickel and gold)
- Tin/lead solder dipping
- X-ray fluorescence plating thickness measurement
- Quartz crystal chemical etching
- Helium leak detection
- Resistance-, cold-weld, and eutectic sealing

For further information or catalog, contact your Reeves-Hoffman representative or
Reeves-Hoffman, Division Dynamics Corporation of America • 400 W. North Street, Carlisle, PA 17013 USA • Phone 717-243-5929 • FAX 717-243-0079

REEVES-HOFFMAN
DIVISION DYNAMICS CORPORATION OF AMERICA

OSCILLATORS

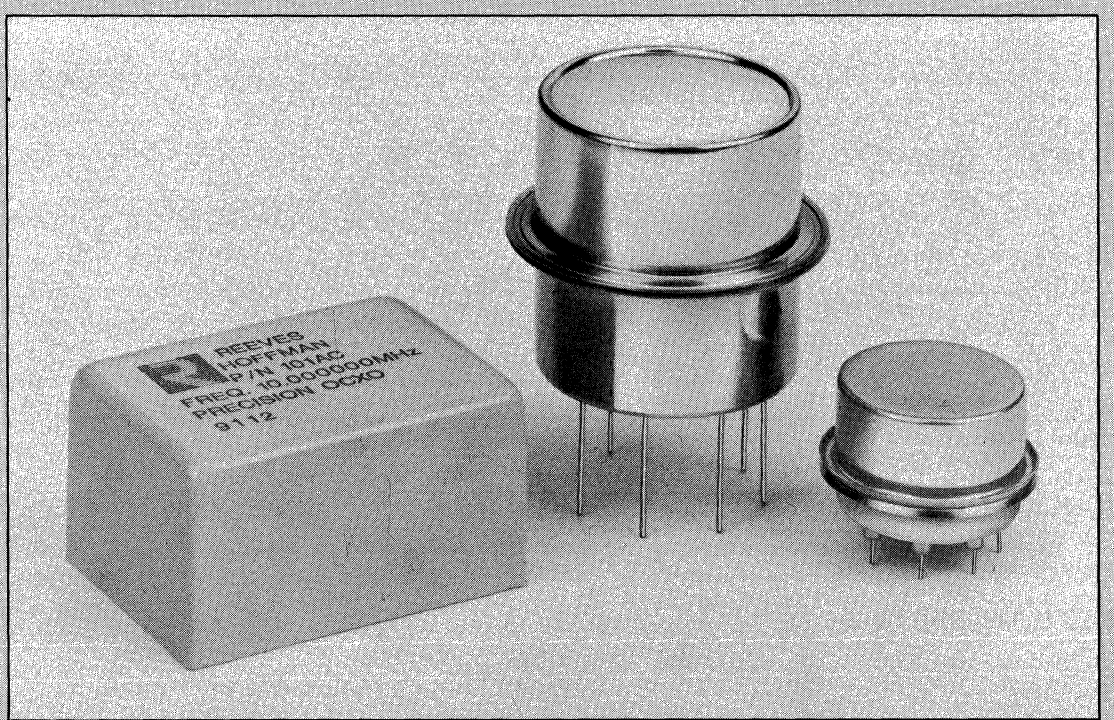
HYBRID VOLTAGE CONTROLLED CRYSTAL OSCILLATORS

Reeves-Hoffman Division produces hybrid VCXO's for communications and telecommunications applications. Our internal crystal design and processing capabilities allow us to produce high frequency fundamental crystals that are used in our VCXO's.

FREQUENCY RANGE	PART NUMBER	TEMPERATURE RANGE	STABILITY	OUTPUT	INPUT VOLTAGE	INPUT CURRENT	DEVIATION	CONTROL VOLTAGE	NOTES
7 MHz to 30 MHz	2170	0° to +70°C	±10 ppm	TTL	+5 VDC ±5%	15 to 25 mA	±110 ppm	+1 to +4 VDC	Standard VCXO
35 MHz to 62 MHz	3109	0° to +70°C	±10 ppm	TTL	+5 VDC ±5%	70 to 100 mA	±200 ppm	0 to +5 VDC	High Frequency VCXO
40 MHz to 50 MHz	3141	0° to +70°C	±25 ppm	ECL	−5.2 VDC ±5%	40 to 65 mA	±100 ppm	0 to −5 VDC	Standard ECL VCXO

Reeves-Hoffman Division announces
the availability of our newest product line,

PRECISION OVENIZED OSCILLATORS!



Utilizing "State of the Art" technology, Reeves-Hoffman offers a wide range of ovenized oscillators. Surface mount construction and internal crystal capabilities allow us to produce high performance, low cost OCXO's.

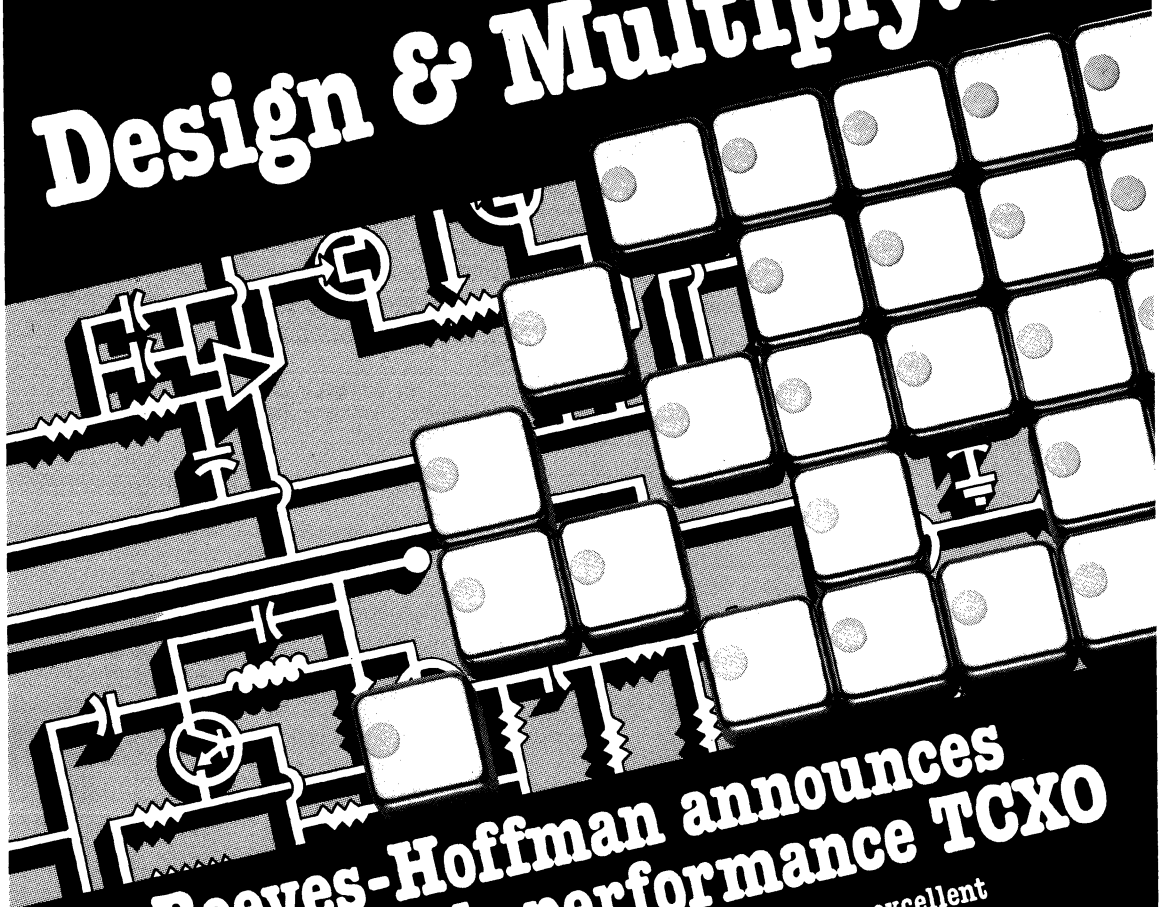
FEATURES:

- 5 MHz to 150 MHz
- Small size (to 1.6 cubic inches)
- Innovative thermo-mechanical design
- Precision resonators and surface mount construction
- Aging to 3×10^{-10}/day
- Ambient stabilities to 5×10^{-11}/degree Celsius

Contact a Reeves-Hoffman sales representative with your requirements.

For further information or catalog, contact your Reeves-Hoffman representative or
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Design & Multiply...

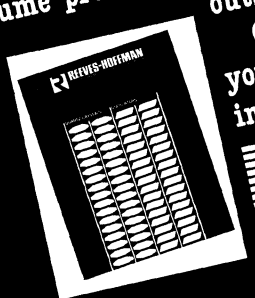


...Reeves-Hoffman announces low-cost high-performance TCXO

The 3149 series TCXO, available from 3.20 to 16 MHz, is an excellent TCXO for test equipment, LORAN, GPS, and broadcast video applications. Standard temperature stability is ± 1 ppm over 0 to +55C, although a range of stability options are available. The 3149 is TTL/HCMOS compatible and is housed in a 1.2″ × 1.2″ × 0.68″ package.

In-house crystal, hybrid, and package expertise allow Reeves-Hoffman to offer superior delivery, unprecedented pricing, and volume production. In addition, an innovative internal design means outstanding long-term reliability.

Call or write for FREE CATALOG or contact your Reeves-Hoffman representative for further information.



REEVES-HOFFMAN
DIVISION DYNAMICS CORPORATION OF AMERICA

400 West North Street, Carlisle, PA 17013-2248 USA
Phone 717-243-5929/ FAX 717-243-0079

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MADE IN USA

RXD
P.O. Box 1494 • 806 Custer Avenue • Norfolk, NE 68701
WATS 1-800-228-8108 • Phone 402-379-0112 • Fax 402-379-3074

RXD MICROPROCESSOR CRYSTAL

PART NUMBERING SYSTEM

MODEL
MP49
MP494
MP35
UM1
SMD
AT39
AT310
WC26
WC38
SMWC36
SM36
SM48

ID *	LOAD CAPACITANCE
Y	10pF
U	12pF
*	18Pf
T	32pF
S	Series
*	Standard Load Capacitance is not designated on crystal.
Z	20pF
Q	30pF

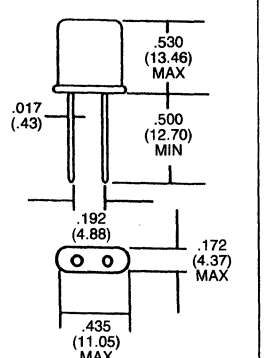
ID #	OPTIONS
V	Vinyl Sleeve
I	Spacer
G	3rd Lead (Ground)
B	Bent Lead
L	Leadless Surface Mount (Low Profile)
R	Tape & Reel
X	Non Standard Temperature Range Frequency Stability, Frequency Tolerance, Load Capacitance.

ID #	MODE
*	Fundamental
3	3rd O.T.
5	5th O.T.
7	7th O.T.
*	Fundamental is not designated on crystal.

SAMPLE:

MP49—U—G—3 where every option is selected. MP49—G where load capacitance & mode are standard options.

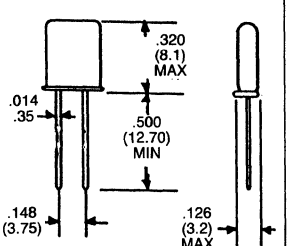
HC-49/U



FREQ.	MX OHMS
1.000	3000
1.8432	600
2.000	450
2.4576	250
3.2768	150
3.579 - 3.6864	120
4.00 - 4.194304	100
4.9152	75
5.000 - 5.9904	50
6.000 - 8.000	40
9.8304	35
10.000 - 12.000	30
13.5168 - 16.000	25
18.000 - 25.000	20

SPECIFICATIONS: 1.8-25.0
Calibration Tolerance: ±25ppm at 25°C
Stability Tolerance: ±35ppm −20 to +75°C
Shunt Capacitance: 7pf

UM1

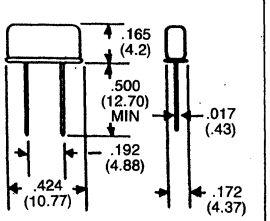


FREQ.	MX OHMS	MODE
3.5 - 3.99	300	F
4.0 - 4.49	250	F
4.5 - 4.99	200	F
5.0 - 5.99	180	F
6.0 - 6.99	150	F
7.0 - 7.99	120	F
8.0 - 8.99	100	F
9.0 - 9.99	70	F
10.0 - 12.99	50	F
13.0 - 30.0	40	F
31.0 - 39.99	60	3
40.0 - 60.0	50	3
61.0 - 90.00	50	3
50.0 - 70.0	130	5
70.0 - 150.0	120	5
70 - 180.0	180	7

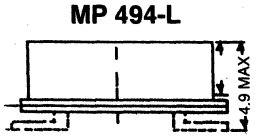
SPECIFICATIONS
Calibration Tolerance: ±20ppm at 25°C
Stability Tolerance: ±50ppm −10 to +60°C
Shunt Capacitance: 7pf

LOW PROFILE

MP 494



MP 494-L

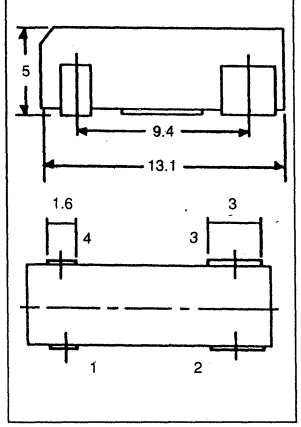


FREQ.	MX OHMS
3.2768 - 3.500	200
3.57954 - 3.999	170
4.00 - 5.999	150
6.00 - 6.999	120
7.00 - 9.999	90
10.00 - 15.999	70
16.00 - 19.999	50
20.000 - 23.999	40
24.00 - 33.000	45

SPECIFICATIONS:
Calibration Tolerance: ±30ppm at 25°C
Stability Tolerance: ±50ppm at −10 to +60°C
Shunt Capacitance: 7pf

SURFACE MOUNT

SMD



FREQ.	MX OHMS
3.50 - 3.999	200
4.00 - 4.999	150
5.00 - 5.999	120
6.00 - 6.999	100
7.00 - 8.999	80
9.00 - 12.999	60
13.00 - 25.00	50

SPECIFICATIONS:
Calibration Tolerance: ±50ppm at 25°C
Stability Tolerance: ±100ppm at −10 to +70°C
Shunt Capacitance: 7pf

RXD P.O. Box 1494 • 806 Custer Avenue • Norfolk, NE 68701
WATS 1-800-228-8108 • Phone 402-379-0112 • Fax 402-379-3074

RXD CLOCK OSCILLATOR

PART NUMBERING SYSTEM

OSCILLATOR MODEL	ID CD.
TTL	T
SMTTL CMOS COMPATIBLE	SMT
HIGH FREQUENCY	HF
HCMOS	HSC
HALF SIZE	H
DUAL OUTPUT	D
TRISTATE ENABLE/DISABLE	R
ECL	1E-4E
OVEN CONTROLLED CLOCK OSCILLATOR	OCX
TEMPERATURE CONTROLLED OSCILLATOR	TCX
VOLTAGE CONTROLLED CLOCK OSCILLATOR	VCX
MONOLITHIC FILTER	MF

STABILITY REQUIREMENT	ID CD.
±0.0025% (25 ppm)	0
±0.005% (50 ppm)	1
±0.01% (100 ppm)	2
±0.05% (500 ppm)	3
±0.1% (1000 ppm)	4
Other	7

OPERATING TEMPERATURE RANGE	ID CD.
0°C to +70°C	Std. No. Code
−40°C to +85°C	A
Other	B

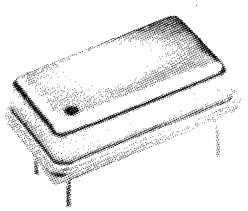
SYMMETRY	ID CD.
60/40	Std. No. Code
55/45	5
Other	6

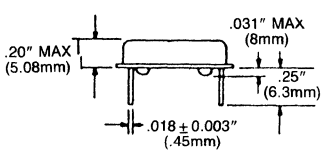
SURFACE MOUNT	ID CD.
Molded	J

EXAMPLE:

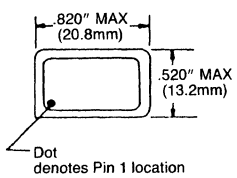
High Speed CMOS 40.00
±100 ppm
RXD
40.000 MHZ
Part # is: HSC-2

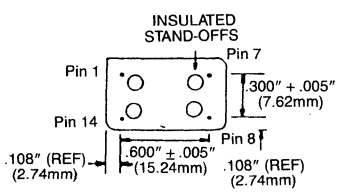
RXD T-2





14 PIN DIP



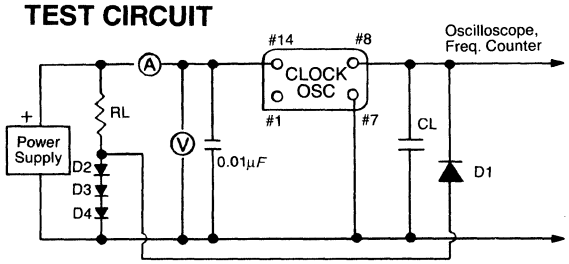


PIN 1—N.C.
PIN 7—CASE GND
PIN 8—OUTPUT
PIN 14— + VDD

SPECIFICATIONS

Frequency Range:		250KHz to 75 MHz
Frequency Stability:		(STD) ± 100 ppm
Operating Temperature Range:		0 - 70°C
Storage Temperature Range:		−55 to +125°C
Supply Voltage:		5.0V DC ± 10%
Supply Current (at 25°C)		0.250 to 3.999 MHz 50mA Max.
		4.000 to 23.999 MHz 40mA Max.
		24.000 to 75.000 MHz 70mA Max.
Output: Load		1-10 TTL Gates
Symmetry		60/40 at 1.4V DC
Voltage "0" Level		0.250 - 23.999 MHz to 0.4V Max.
Voltage "0" Level		24.000 to 75.000 MHz to 0.5V Max.
Voltage "1" Level		+24V min.
Rise/Fall Time:		0.25 - 3.999 15ns
		4.000 - 23.999 10ns
		24.000 - 75.000 6ns

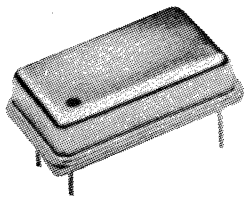
TEST CIRCUIT



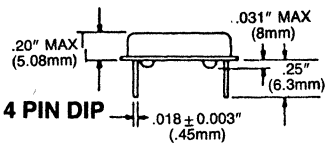
CL is includes probe & test jig

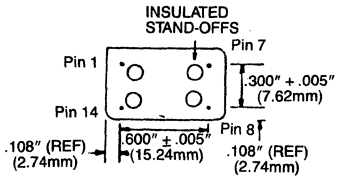
D1-D4 SWITCHING DIODE
CL 15pF
RL 400Ω 250 kHz-25.0 MHz
280Ω 25.1 MHz-75.0 MHz

RXD
P.O. Box 1494 • 806 Custer Avenue • Norfolk, NE 68701
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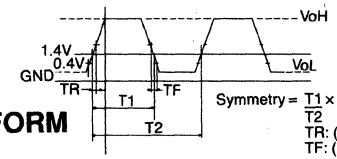
HSC-2 HIGH SPEED CMOS CLOCK



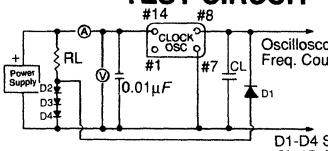


Frequency:	500 KHz to 70 MHz
Frequency Stability:	(STD) ± 100 ppm
Operating Temp. Range:	0°C to + 70°C
Storage Temp. Range:	– 55°C to + 125°C
Input Voltage	+ 5.0V DC ± 10%
Supply Current:	500 KHz to 19.999 MHz 20mA
	20,000 MHz to 34.999 MHz 30mA
	35,000 MHz to 70.000 MHz 40mA
Rise/Fall Time:	500 kHz to 23.999 MHz 10ns
	24.000 MHz to 70.000 MHz 6ns
Output Voltage "0" Level	+ 0.5V (10% VDD) max
"1" Level	+ 4.5V (90% VDD) max
Load:	CL = 15 pf (Typical)
Symmetry:	40/60% at ½ VDD

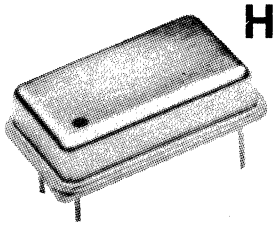
WAVEFORM

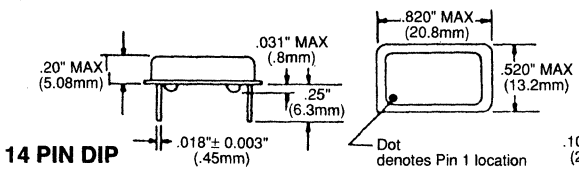


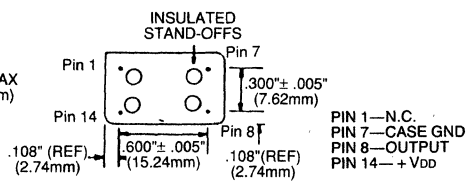
TEST CIRCUIT



HF-T2/HF-HSC-2

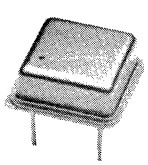


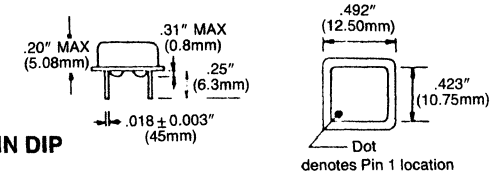


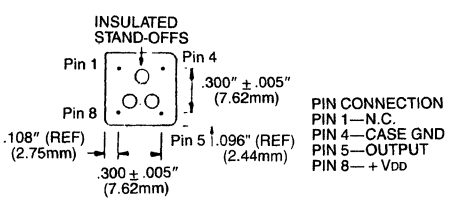


	HF-T-2	HF-HSC-2
Frequency Range:	**70.0 to 100.00 MHz**	
Frequency Stability:	± 100 ppm	
Operating Temp. Range:	0°C to 70°C	
Storage Temp. Range:	– 55°C to + 125°C	
Input Voltage:	5.0V ± 0.5V	
Input Current:	40mA max.	60mA max.
Output Load:	2 TTL max	CL = 15 pf max.
"0" Level	0.5V max	0.5V max.
"1" Level	2.4V min	0.5V min. VCC
Symmetry:	40/60% + 1.4V	40/60% ½ VCC
Rise/Fall Time:	5ns	5ns 0.5Vcc-0.5Vdc
Load	TTL	HCMOS

H-T-2, H-HSC-2, H-HF-T-2, H-HF-HSC-2







	H-T-2	H-HSC-2	H-HF-T-2	H-HF-HSC-2
Frequency Range:	250KHz-75.0MHz	500KHz-70 MHz	70-100MHz	70-100MHz
Frequency Stability:	± 100 ppm			
Operating Temp. Range:	0-70°C			
Storage Temp. Range:	– 55°C to + 125°C			
Input Voltage:	5.0V ± 0.5V			
Input Current:	30mA to 70mA	20mA to 40mA	40mA max	60mA max
Output Load:	1-10 TTL	CL = 15 pf max.	2TTL	CL = 15 pf max
"0" Level	+ 0.4 to + 0.5V	+ 0.5V max	0.5V max	0.5V max
"1" Level	+ 2.4V	+ 4.5V (90% VDD) min.	2.4V min.	0.5V min VCC
Symmetry:	40/60 at 1.4V	40/60 at ½ VDD	40/60 at 1.4V	40/60 at ½ VCC
Rise/Fall Time:	6ns to 15ns	6ns to 10ns	5ns	5ns 0.5VCC-0.5V DC
Load	1-10 TTL Gates	CL = 15 pf Typical	TTL	HCMOS

Nymph Products by SaRonix

Quartz Crystals

SaRonix offers a broad line of crystal products with the best combination of price, quality, delivery and service available. We carry a large stock of commonly used crystals, and feature rapid turnaround time on special units and large production runs.

In addition to the industry standard holders, many special configurations and a wide range of miniature units are available. We provide back-up stock for all scheduled orders.

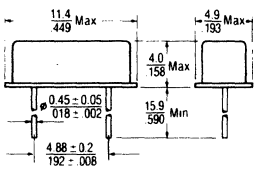
Send your drawings and specifications, or call our Customer Service Department for ordering assistance and availability.
(800) 227-8974
FAX (415) 856-4732
TLX 348465 SARONIX PLA

Standard Microprocessor Crystals

The following selection chart lists NYMPH AT-cut quartz crystals available from stock for most common microprocessor applications.

Freq. MHz	NYMPH Part No.	Freq. MHz	NYMPH Part No.	Freq. MHz	NYMPH Part No.	Freq. MHz	NYMPH Part No.	Freq. MHz	NYMPH Part No.
HC-33/U		**HC-49/U**		**HC-49/U**		**HC-49/U**		**HC-49/U**	
1.000000	NYP010-13	3.330000	NMP033A	7.159090	NYP071-20	16.000000	NYP160-20	30.000000	NMP300
1.000000	NMP010	3.579545	NYP035A-18	7.372800	NYP073-20	16.000000	NMP160	32.000000	NMP320
1.843200	NYP018-13	3.579545	NMP035A	7.372800	NMP073	16.257000	NYP162-20	36.000000	NMP360
1.843200	NMP018	3.600000	NYP036-30	8.000000	NYP080-18	16.384000	NYP163-20	40.000000	NMP400
2.000000	NYP020-20	3.686400	NYP037-20	8.000000	NMP080	16.384000	NMP163	48.000000	NMP480
2.000000	NMP020	3.686400	NMP037	8.192000	NYP081-20	17.360000	NMP173	**HC-45/U** (res. weld)	
2.097152	NYP021-20	3.932160	NYP039-12	9.216000	NMP092	18.000000	NMP180		
2.457600	NYP024-32	3.932160	NMP039	9.830400	NYP098-20	18.432000	NYP184-20	6.000000	44N060
2.457600	NMP024	4.000000	NYP040-20	9.830400	NMP098	18.432000	NMP184	8.000000	44N080
3.579545	NYP035-18	4.000000	NMP040	10.000000	NYP100-20	19.354000	NYP193-20	10.000000	44N100
HC-49/U		4.096000	NYP0409-20	10.000000	NMP100	19.354000	NMP193	12.000000	44N120
1.000000	NMP010A	4.194304	NYP041-12	10.738635	NYP107-32	19.660800	NYP196-20	12.500000	44N125
1.843200	NYP018A-13	4.433619	NYP044-20	11.000000	NMP110	19.660800	NMP196	14.318180	44N143
1.843200	NMP018A	4.915200	NMP049	11.059200	NYP111-20	20.000000	NYP200-20	14.400000	44N144
2.000000	NYP020A-20	5.000000	NYP050-20	11.059200	NMP111	20.000000	NMP200	15.000000	44N150
2.000000	NMP020A	5.068800	NMP051	12.000000	NYP120-20	22.118400	NMP221	16.000000	44N160
2.097152	NYP021A-20	5.185000	NYP052-20	12.000000	NMP120	23.400000	NMP234	18.000000	44N180
2.457600	NYP024A-20	5.714300	NMP057	12.288000	NYP122-20	24.000000	NYP240-20	18.432000	44N184
2.457600	NMP024A	5.990400	NMP059	12.288000	NMP122	24.000000	NMP240	19.354000	44N193
3.000000	NYP030A-30	6.000000	NMP060	13.516800	NMP135	24.576000	NYP245-18	19.660800	44N196
3.000000	NMP030A	6.144000	NYP061-30	14.318180	NYP143-32	25.000000	NMP250	20.000000	44N200
3.276800	NYP032A-15	6.400000	NYP064-20	14.318180	NMP143	27.000000	NMP270	22.118400	44N221
3.276800	NMP032A	6.553600	NMP065	14.745600	NMP147	28.636360	NYP286-32	24.000000	44N240
		7.000000	NMP070	15.000000	NMP150	30.000000	NYP300-20	25.000000	44N250

49S Series (3.5000 MHz to 24.0000 MHz) Other Selected Frequencies Available



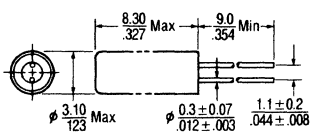
Designed to replace the standard HC-49/U and HC-43/U holder in applications where board height is a problem. This miniature AT-cut strip resonator crystal is housed in a 4 mm high package.

Electrical Specifications:
Freq. Calib. Tol. at 25°C ..... ±30 ppm
Freq. Stability Tolerance ..... ±50 ppm –20 to +70°C
Effective Series Resistance-R_s. ..... 50 to 200 Ohms (frequency dependent)
Drive Level-P_d. ..... 500 µW max.
Shunt Capacitance-C_0. ..... 7 pF max.

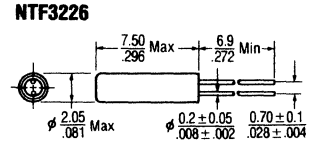
Miniature Quartz Crystals

NTF Series (32.768 kHz)

NTF3238



NTF3226



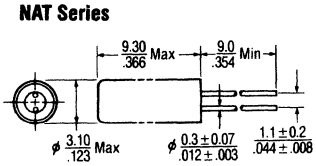
Designed for use in parallel resonant Pierce oscillators. Highly stable, low cost fundamental mode tuning fork type crystals for low power applications.

Electrical Specifications:
Frequency Tolerance at 25°C ..... ±20 ppm (0.002%)
Turnover Temperature-T_o. ..... 25°C ± 5°C
Temp. Characteristics-K ..... –0.038 ppm/°C², typ.
Quality Factor-Q ..... 80,000, typ.
Load Capacitance-C_L. ..... 9.5 to 15 pF, typ.
Series Resistance-R_s. ..... 30 k Ohms, typ.
Motional Capacitance-C_1. ..... 0.003 pF, typ.
Shunt Capacitance-C_0. ..... 1.5 pF, typ.
Drive Level-P_d. ..... 10 µW max.
Temperature Range:
Storage ..... –55 to +125°C
Operating (Commercial) ..... –10 to +60°C
Aging First Year ..... 10 ppm max.
Shock Resistance ..... 1000g, 1 ms, ½ sine wave
Vibration Resistance ..... 10g, 10 Hz to 2 kHz random

Note: Other selected frequencies are available.

NAT Series (3.500 MHz to 20.0000 MHz)

NAT Series



Scale: None (Dimensions in mm / inches)

An AT-cut strip resonator crystal housed in a miniature 3.1 × 9.3 mm tubular package. It has the same temperature characteristics as traditional AT-cut crystals but requires only 20% of physical PC board space compared to the standard HC-49/U holders.

Electrical Specifications:
Freq. Calib. Tol. at +25°C ..... ±30 ppm
Temp. Stability Tolerance ..... ±50 ppm –20 to +70°C
Load Capacitance-C_L. ..... 20 pF to 32 pF
Effective Series Resistance-R_s. ..... 120-15 Ohms (frequency dependent)
Drive Level-P_d. ..... 500 µW max.
Shunt Capacitance-C_0. ..... 7 pF max.

SaRonix reserves the right to change all data without notice.

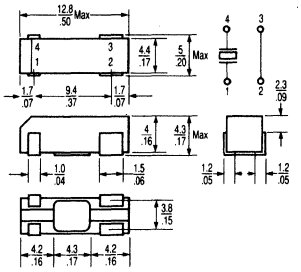
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NYMPH®

Nymph Products by SaRonix

Quartz Crystals/Surface Mountable Crystals

These AT-cut strip crystals are sealed in tubular metal holders to ensure hermeticity and minimum aging, and encapsulated in a thermoplastic housing to allow surface mounting. They are available in bulk or on 24 mm tape and reel.



NCS Series (3.5000 MHz to 24.0000 MHz)

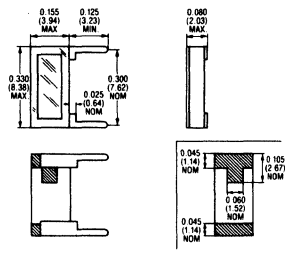
Freq. Calib. Tol. at 25°C ..... 0.005% (tighter tolerances available)
Freq. Stability Tolerance ..... ±0.005% from –20 to +70°C (tighter tolerances available)
Oper. Temp. Range ..... –20 to +70°C
Load Capacitance ..... 16 pF to 32 pF or Series
Effective Series Resistance ..... 50 to 250 Ohms (frequency dependent)
Drive Level ..... 0.5 mW maximum
Shunt Capacitance ..... 7 pF max.

Standard Frequencies: The following selection charts lists the NCS Series crystals available from stock. Special frequencies are available upon request.

Frequency MHz	Nymph Part Number	Circuit Calibration Condition	Maximum ESR (Ohms)	Frequency MHz	Nymph Part Number	Circuit Calibration Condition	Maximum ESR (Ohms)
3.579545	NCS035-18	18 pF	250	10.000000	NCS100	Series	60
3.686400	NCS037-20	20 pF	250	12.000000	NCS120	Series	60
4.000000	NCS040-20	20 pF	150	14.318180	NCS143	Series	50
4.000000	NCS040	Series	150	16.000000	NCS160	Series	50
4.915200	NCS049	Series	150	18.432000	NCS184	Series	50
5.068800	NCS051	Series	150	19.660800	NCS196	Series	50
6.000000	NCS060	Series	100	20.000000	NCS200	Series	50
7.372800	NCS073	Series	80	22.118400	NCS221	Series	50
8.000000	NCS080	Series	80	24.000000	NCS240	Series	50

These photolithographically produced crystals are hermetically sealed in a miniature ceramic package. They are available with leads for through-hole mounting or leadless on 12 mm and 16 mm tape and real for surface mounting.

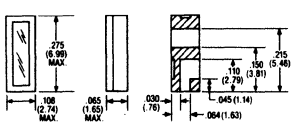
Packages CX-1



-03 Side Leads -01 No Leads

Packages CX-2

Dimensions and case styles — CX-2



-01 No Leads

Standard marking is frequency plus V (Pierce) or H (Series).

CX Series (10 kHz to 2.0000 MHz) Equivalent to Stated CX Series

- High Performance
- Superior Quality Factor
- Rugged and Shock Resistant
- Low Power Consumption
- Excellent Stability
- Extremely Low Aging
- Small IC Compatible Dimensions
- Precision Tuned by Laser

Temperature Range:
Storage ..... –55 to +125°C
Operating (Industrial) ..... –40 to +80°C
Operating (Military) ..... –55 to +125°C
Parabolic Temp. Coef ..... typ. –0.038 ppm/°C²
Aging First Year ..... 10 ppm max.
Shock Resistance ..... 1000g, 1 ms, ½ sine wave
Vibration Resistance ..... 10g rms, 10 Hz to 2 kHz random
Drive Level ..... ≤1 µW (10-499 kHz) 10 µW (500-2000 kHz)
Typical Shunt Capacitance:
CX-1V or 2V ..... 10-499 kHz, 1.4 pF
CX-1V or 2V ..... 500-2000 kHz, 0.85 pF
CX-1H or 2H ..... 10-600 kHz, 1.4 pF

Standard Frequencies (kHz)

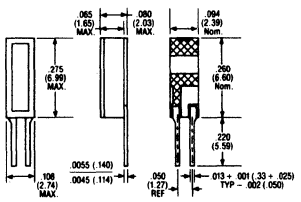
10.000*	32.768	77.500	768.000
12.800*	38.400	100.000	1000.000
16.000	40.000	153.600	1008.000
16.384	40.960	180.000	1228.800
20.480	50.000	240.000	1500.000
30.720	53.103	307.200	1843.200
31.500	60.000	455.000	2000.000
32.000	76.800	500.000	*CX-1 only.*

Standard Calibration Tolerances

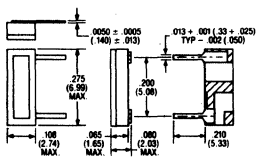
Frequency kHz	Calibration Tolerances at 25°C A	B	C
10-74.9	±0.003%	±0.01%	±0.10%
75-169	±0.005%	±0.01%	±0.10%
170-249	±0.010%	±0.02%	±0.20%
250-499	±0.020%	±0.05%	±0.50%
500-2000	±0.050%	±0.10%	±1.00%

Special frequencies and tolerances available upon request.

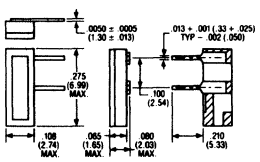
SaRonix reserves the right to change all data without notice.



-02 End Leads



-03 Side Leads



-04 Side Leads

The AT-strip crystal resonator, housed in the popular CX-1 package for surface mount applications, may be used where board space is sparse, and where automatic assembly is required.

CX Series, AT-cut (8.0000 MHz to 25.0000 MHz)

Temperature Range:
Storage ..... –55 to +125°C
Operating ..... 0 to 70°C
–40 to +125°C
–55 to +125°C
Calib. Tolerance ..... ±50 to 10,000 ppm
Stability Tolerance ..... ±50 to 100 ppm, temp. dependent
ESR ..... 50 to 100 Ω max., (frequency dependent)
Available Series or Parallel Resonant:
Drive Level ..... 500 µW, max.
Shock Resistance ..... 5,000g, 0.3 ms, ½ sine
Vibration Resistance ..... 20g, 10-2,000 Hz

Please consult factory for application-specific modifications.

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Nymph Products by SaRonix

Crystal Clock Oscillators

The SaRonix NYMPH crystal clock oscillator family includes a wide variety of state-of-the-art thick film hybrid devices for generating TTL, CMOS, HCMOS, ECL, Tri-State, Dual Independent Output, Baud Rates, and special output characteristics.

S1100 Series (TTL)

Equivalent to Motorola K1100 Series, including K1114, K1144, K1145, K1158 & K1162

Frequency Range	250 kHz to 110 MHz	TTL Output:	
Frequency Stability	±0.0025 to ±0.05% (over all conditions)	Symmetry	50% ± 10% @ 1.4VDC Level (S1162 50% ±5%)
Temperature Range:		Rise & Fall Times	8 ns max., 250 kHz to 25 MHz 6ns max., 25 MHz to 70 MHz 3ns max. over 70 MHz
Operating	0 to +70°C (S1158 −40 to +85°C)	"0" Level	+0.4 Volts
Storage	−55 to +125°C	"1" Level	+2.4 Volts
Input Voltage	+5VDC ±0.5V	Output Load	1 to 5 TTL gates
Input Current	30 mA to 40 mA max. @ 25°C (frequency dependent)		

NCT Series (TTL)/NTT Series (Tri-State TTL)*

Frequency Range	250 kHz to 110 MHz	TTL Output:	
Frequency Stability	±0.0025% to ±0.05% (over all conditions)	Symmetry	50% ±10% @ 1.4VDC Level
Temperature Range:		Rise & Fall Times	8 ns max. for 250 kHz to 25 MHz 6 ns max. for 25 MHz to 70 MHz 3 ns max. for over 70 MHz
Operating	0 to +70°C	"0" Level	+0.4 Volts
Storage	−55 to +125°C	"1" Level	+2.4 Volts
Input Voltage	+5VDC ±10%	Output Load	1 to 10 TTL gates
Input Current	30 mA to 90 mA max. @ 25°C (frequency dependent)		

***Tri-State Control Pin 1: Logic "1" or no connection = RF out; Logic "0" or ground = High Impedance.**
†Note: NCT Series available in standard and low profile packages.

NCC Series (CMOS)

Frequency Range	250 kHz to 24 MHz	Input Current:	2 to 8.5 mA typical (frequency dependent)
Frequency Stability	±0.0025% to ±0.05% (over all conditions)	CMOS Output:	
Temperature Range:		Symmetry	50% ±10% @ 50% V_{DD}
Operating	0 to +70°C	Rise & Fall Times (1 TTL)	20% V_{DD} to 80% V_{DD} = 12 ns max. 0.5V to 2.5V = 8 ns max.
Storage	−55 to +125°C	"0" Level	V_{SS} +0.5 Volt max.
Input Voltage:		"1" Level	V_{DD} −0.5 Volt min.
Rated	+5VDC ±10%	**Note: Enable/Disable Function available.**	
Operating	+3VDC min. to +7VDC max.		

32.768 kHz (Real Time Low Power CMOS)

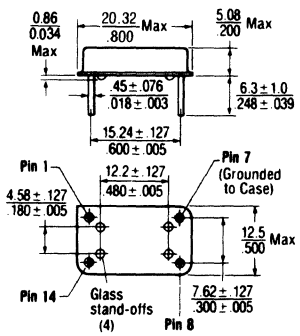
Part Number	NCC020C-32.7680	Input Voltage:	
Frequency	32.7680 kHz	Rated	+5VDC ±10%
Frequency Tolerance	±0.001% or 0.0025% (initial accuracy @ +25°C)	Operating	+3VDC min. +10VDC max.
		Input Current	40 µA typical, 80 µA max.
Operating Stability	±0.0025% 0 to +50°C ±0.005% −20 to +70°C	CMOS Output:	
		Symmetry	50% ±10% @ 50% V_{DD}
Temperature Range:		Rise & Fall Times	40 ns typical, 60 ns max.
Operating	0 to +70°C	"0" Level	V_{SS} +0.5V max.
Storage	−30 to +85°C	"1" Level	V_{DD} −0.5V min.
		Output Load	200 kΩ at 15 pF

A crystal controlled CMOS oscillator suitable for extremely low power applications including portable devices, handheld instruments, and other battery powered equipment.

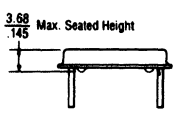
NCL Series (Low Power CMOS)

Frequency Range	10 kHz to 2.0000 MHz	Input Current	40 µA typical (rated at +5VDC, 40.0000 kHz)
Frequency Tolerance	0.0010% to 1.000% (initial accuracy @ +25°C)	CMOS Output:	
Temperature Range:		Symmetry	50% ±10% @ 50% V_{DD}
Operating	−20 to +70°C	Rise & Fall Times	40 ns typical, 60 ns max.
Storage	−30 to +85°C	"0" Level	V_{SS} +0.5V max.
Input Voltage:		"1" Level	V_{DD} −0.5V min.
Rated	+5VDC ±10%	Output Level	200 k Ohms at 15 pF
Operating	+3VDC min., +10VDC max.		

Standard Package



†Low Profile Package



Available with or without glass bead standoffs. Low profile package available in NCT Series (TTL) and NCH Series only.

Scale None (Dimensions in mm / inches)

SaRonix reserves the right to change all data without notice.

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Nymph Products by SaRonix

Crystal Clock Oscillators

A crystal controlled, low current hybrid oscillator circuit providing precise rise and fall times to drive high speed CMOS and NMOS microprocessors. Compatible with both CMOS and TTL; physically and functionally interchangeable with RASCO.* (HCMOS only.)

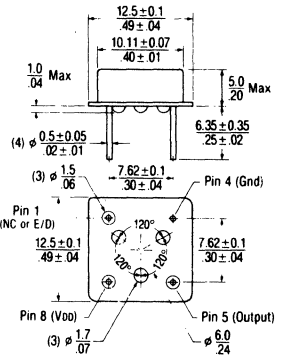
***RASCO is a trademark of MOTOROLA.**

NCH/NTH Series (HCMOS) Equivalent to Motorola's RASCO* Series

Frequency Range	500 kHz to 50 MHz
Frequency Stability	±0.0025 to ±0.05% (over all conditions)
Temperature Range:	
Operating	0 to +70°C
Storage	−55 to +125°C
Input Voltage:	
Rated	+5VDC ±10%
Operating	+4VDC min. to +7VDC max.

Note: Tri-State Function available.
Enable/Disable Function available.
†Note: HCMOS available in low profile package as well.

Input Current (C_L = 15 pF)	
500 kHz-24 MHz	15 mA max. @ 25°C, 10 mA typ. 20 mA max. over oper. temp. range
Over 24 MHz	30 mA max. @ 25°C, 20 mA typ. 35 mA max. over oper. temp. range
HCMOS Output:	
Symmetry	50% ±5% @ 50% V_{DD}
Rise & Fall Times (10 TTL Loads)	20% to 80% V_{DD} = 3 ns max. 0.5V to 2.5V = 4 ns max.
"0" Level	V_{SS} +0.5 Volt max.
"1" Level	V_{DD} −0.5 Volt min.



NCC/NCH Series (CMOS/HCMOS) Half Size Package

Frequency Range:	
CMOS	250 kHz to 24.0000 MHz
HCMOS	1.8432 MHz to 80.0000 MHz
Frequency Stability	±0.0025% to ±0.05% (over all conditions)
Temperature Range:	
Operating	0 to +70°C
Storage	−55 to +125°C
Input Voltage	+5VDC ±10%
Input Current:	
CMOS	2 to 8.5 mA typical (frequency dependent)
HCMOS	10 mA typical to 24 MHz 20 mA typical over 24 MHz 30 mA typical over 40 MHz

Symmetry:	
CMOS	50% ±10% max.
HCMOS	50% ±5% max.
Rise & Fall Times:	
CMOS (1 TTL)	20% to 80% V_{DD} = 12 ns max. 0.5V to 2.5V = 8 ns max.
HCMOS (10 TTL)	20% to 80% V_{DD} = 3 ns max. 0.5V to 2.5V = 4 ns max.
"0" Level	V_{SS} + 0.5 Volt max.
"1" Level	V_{DD} − 0.5 Volt min.

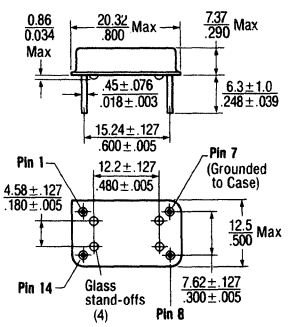
Note: Enable/Disable Function available.
† Note: HCMOS available in low profile package as well.

A voltage controlled crystal oscillator designed primarily for use in phase locked loops and other telecommunication applications. Output is HCMOS/TTL compatible. Device is packaged in standard 14-pin dip compatible resistance welded package. Pin 7 is grounded to reduce RFI. Physically and functionally compatible with Motorola K1523AA VCXO.

S1523AA VCXO (HCMOS/TTL) Equivalent to Motorola K1523AA VCXO

Frequency Range	1.5 MHz to 120.0000 MHz
Frequency Stability	±0.0025% (over all conditions)
Temperature Range:	
Operating	0 to +70°C (extended temp. avail.)
Storage	−55 to +125°C
Input Voltage	5V ±10%
Input Current	5 mA to 50 mA
Rise & Fall Times	4V to 2.4V, T_r & T_f = 8ns max. each
Symmetry	40/60; 45/55 available
Modulation Characteristics:	
Deviation Sensitivity	±50 ppm/V min; up to 220 ppm/V, available
Control Voltage	0.5 VDC to 4.5 VDC; 2.5 VDC, nominal
Monotonic Linearity	<20%, typical; down to 1%, available

(Available options include: ECL output; Tri-state feature; sine wave output. Consult factory.)



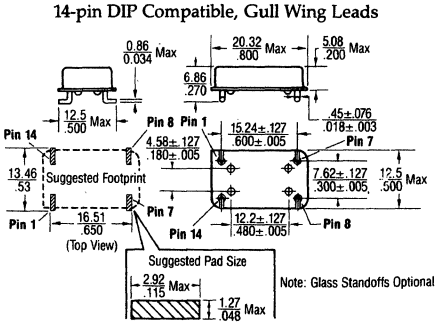
Pin 1: NC or E/D **Pin 7:** GND (Vss)
Pin 8: Output **Pin 14:** +5 VDC (VDD)

For shorter seated height contact factory

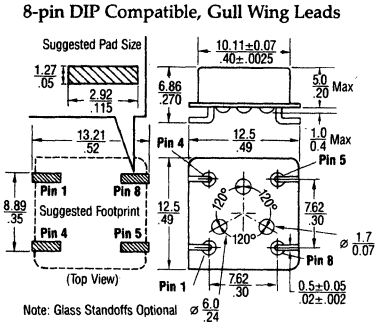
Scale: None (Dimensions in mm / inches)

SURFACE MOUNT OPTIONS For Metal-Packaged Oscillators

14-pin DIP Compatible, Gull Wing Leads



8-pin DIP Compatible, Gull Wing Leads



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Nymph Products by SaRonix

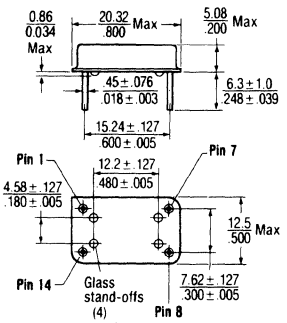
Crystal Clock Oscillators

A crystal controlled hybrid oscillator circuit providing precise rise and fall times to drive ECL devices. Unit is packaged in a 14-pin DIP compatible, resistance welded, all metal case. Options include Internal Termination, Open Emitter Output, Complementary Output, and Positive Logic.

NCK/NCE Series (ECL)

Frequency Range:	
10 k Family	5.0 MHz to 140 MHz
10 kH Family	50 MHz to 200 MHz
Frequency Stability	±0.0025% to ±0.05% (over all conditions)
Temperature Range:	
Operating	0 to +70°C
Storage	−55 to +125°C
Input Voltage	5.2V ±5%
Input Current	40 mA typical
Rise & Fall Times:	
10 k Family	1.5 ns typical
10 kH Family	1.0 ns typical
Symmetry	50% ±10% at V_{BB}

The S1149 Series of ECL "clocks" offers a wide variety of output conditions and pin outs. This series is a direct equivalent to the Motorola K1149 family of ECL devices.



S1149 Series (ECL) Equivalent to Motorola K1149 Series

Frequency Range:	
10 k Family	5.0 MHz to 140 MHz
10 kH Family	50 MHz to 160 MHz
Frequency Stability	±0.0025% to ±1.00% (over all conditions)
Temperature Range:	
Operating	0 to +70°C
Storage	−55 to +125°C
Input Voltage	5.2V ±5%
Input Current	40 mA typical
Rise & Fall Times:	
10 k Family	1.5 ns typical
10 kH Family	1.0 ns typical
Symmetry	50% ±10% at V_{BB}

Part Numbering and Pin Assignment Guide

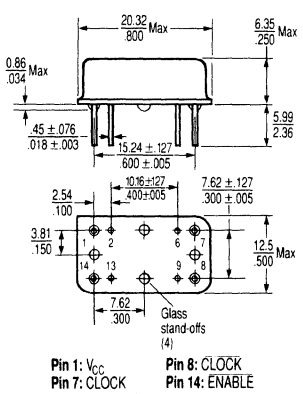
	S1149AA	S1149AB	S1149AC	S1149AM	S1149BA	S1149BC	S1149BM
Pin 1	GND	GND	N.C.	N.C.	ECL comp out	ECL comp out	ECL comp out
Pin 7	V_{EE}	V_{CC}	V_{EE}	GND	GND	V_{EE}	GND
Pin 8	ECL out	ECL out	ECL out	ECL out	ECL out	ECL out	ECL out
Pin 14	V_{CC}	V_{EE}	GND	V_{EE}	V_{CC}	GND	V_{EE}

A crystal controlled monolithic IC utilizing state-of-the-art gallium arsenide technology to synthesize high frequency ECL-compatible (100 K and 100 E) outputs. AT-cut crystal performance and comprehensive, imbedded circuit design provides a superior alternative to conventional SAW technology. Ideal for high resolution graphics imaging applications.

GaAs PLL Clock Generator (ECL)

Frequency Range	50.0 MHz to 640 MHz
Frequency Stability	.0025% to .1000%
Temperature Range:	
Operating	0 to +85°C
Storage	−40 to +125°C
Input Voltage	+4.275V to +5.425V
Input Current	60 mA, typ.; 80 mA, max.
Rise & Fall Times	350 ps, typ.; 500 ps max.
Symmetry	50% ± 5% Complementary
Output Skew	150 ps, max.
Jitter	40 ps, max.
True Tri-state Capability	ECL-compatible control, active low

Please consult factory for application-specific modifications.



Pin 1: V_{CC} Pin 8: CLOCK
Pin 7: CLOCK Pin 14: ENABLE
Pin 2, 6, 9, 13: GND

NPC/NPH Series (Dual Independent Output) Consult Factory

TCXO Consult Factory for Special Requirements

NCH Series (HCMOS) SMD Equivalent to Motorola MSO Series

Frequency Range	100 kHz to 35 MHz
Frequency Stability	±0.005% to ±0.050.% (over all conditions)
Temperature Range:	
Operating (Industrial)	0 to +70°C
Operating (Military)	−40 to +85°C
Storage	−55 to +125°C
Input Voltage	+5 VDC ± 10%
Input Current	8 mA at 1 MHz (typical when C_L = 15 pF) ... 20 mA at 30 MHz
Rise & Fall Times	20% to 80% V_{CC}: (when C_L = 15 pF) ... T_r = 8ns max., T_f = 7ns max. 0.5 to 2.5V: T_r & T_f = 6ns max., each
Start Up Time	≤5ns typical

Note: Enable/Disable function available.

Consult factory for mechanical drawing and full data sheet.

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eem SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States (ANSI) American National Standards Institute

United States (NEMA) National Electrical Manufacturers Association

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

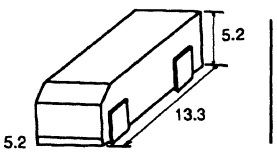
Yugoslavia Federal Institute of Standardization

SII
Seiko Instruments

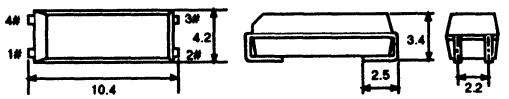
SURFACE MOUNT

SURFACE MOUNT CRYSTALS

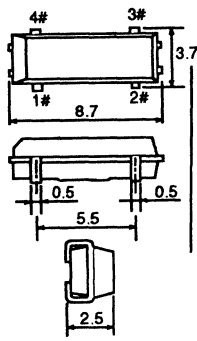
Seiko Instruments supplies a full range of surface mount crystals to meet your design needs. Our surface mount line covers frequencies from 32KHz to 40MHz. Offering one of the most extensive SM crystal lines in the industry.



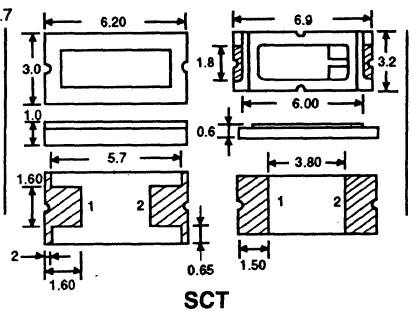
SPA1
3.57-35 MHz
13.3 x 5.2 x 5.2 — Plastic



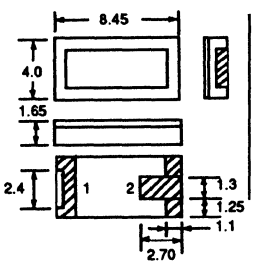
SPT1
32.768-200 KHz
10.4 x 4.2 x 3.4 — Plastic



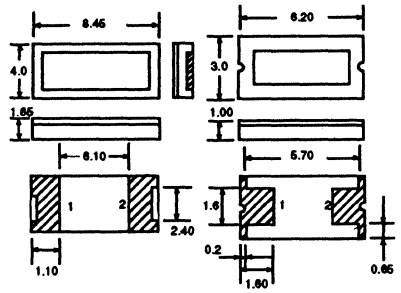
SPT2
32.768-200 KHz
8.7 x 3.7 x 2.5 — Plastic



SCT
32.768-200 KHz
6.9 x 3.0 x 1.0 — Ceramic
6.9 x 3.2 x 0.60 — Ceramic



SCL1
1.0-1.536 MHz
8.5 x 4.0 x 1.65 — Ceramic



SCK
1.536-4.194 MHz
8.5 x 4.0 x 1.65 — Ceramic
6.2 x 3.0 x 1.0 — Ceramic

TIGHT TOLERANCE/WIDE TEMPERATURE

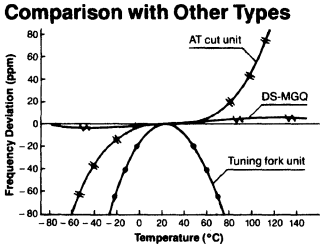
DS-MGQ SERIES

Standard Specifications

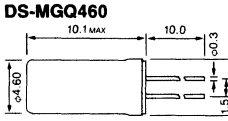
- ☐ *Frequency Range:* 1.0MHz to 3.0MHz
- ☐ *Frequency Temperature Stability:* Down to ±2.5ppm
- ☐ *Operating Temperature:* −30°C to +70°C
- ☐ *Series Resistance:* 35Ω to 120Ω Typical*
- ☐ *Aging:* ±1ppm (1st year)
- ☐ Extremely Shock Resistant

*Frequency Dependent

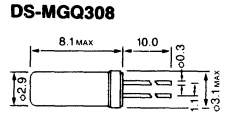
Comparison with Other Types



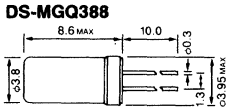
DS-MGQ460



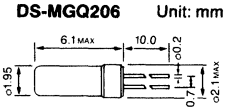
DS-MGQ308



DS-MGQ388



DS-MGQ206 Unit: mm



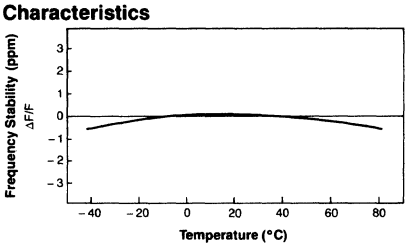
MGX0 SERIES OSCILLATORS

- ☐ 14 Pin DIP Compatible
- ☐ TCX0 Specs/Low Power
- ☐ Extremely Shock Resistant

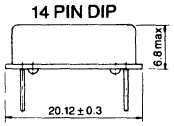
The DS-MGX0 series oscillators use miniature GT cut crystal units (DS-MGQ) developed by SEIKO INSTRUMENTS. Their excellent frequency temperature characteristics (down to +2.5ppm over temperature) make the DS-MGX0 ideal for applications, such as cellular telephones to facsimile machines and computer designs.

The DS-MGX0 incorporates precision electrical adjustable capacitance (PEAC) elements verses the use of trimmer capacitors. PEACs are floating gate semiconductor elements that can vary internal capacitance by applying voltage to pin #1 (#3 for SM model). When not adjusting frequency, voltage can be removed and the PEAC maintains the capacitance setting. The PEAC coupled with the excellent temperature characteristics of the DS-MGQ enable +2.5ppm temperature stability over a wide temperature range.

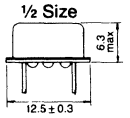
Characteristics



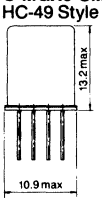
DS-MGX0-68
14 PIN DIP



DS-MGXO-DM
½ Size



DS-MGX0-SM
HC-49 Style



Standard Specifications Unit: mm

Items	A	B	C	D	E
Oscillation Frequency	0.5 Hz ~ 3 MHz				
Frequency Stability (at room temperature)	±2 ppm	± 3ppm	± 5 ppm	±10 ppm	± 20 ppm
Frequency Temperature Stability (−20°C ~ +70°C)	±5 ppm	±10 ppm	±25 ppm	±50 ppm	±100 ppm
Aging (first year)	±2 ppm/First Year				
Power Supply Voltage	DC 5.0V ± 0.5V				
Current Consumption	Max. 200μA (3mA in MHz range)				
Output Current	0.2mA (3mA in MHz range)				
Output Waveform	Square wave duty ratio 50% ± 10%				
Rise and Fall Time	Max. 100ns				
Operating Temperature Range	−20°C ~ +70°C				

Seiko Instruments USA, Inc. Electronic Components Division, 2990 W. Lomita Blvd., Torrance, CA 90505 (213) 517-7770 FAX: (213) 517-7792
SII is registered with the U.S. Patent and Trademark Office.

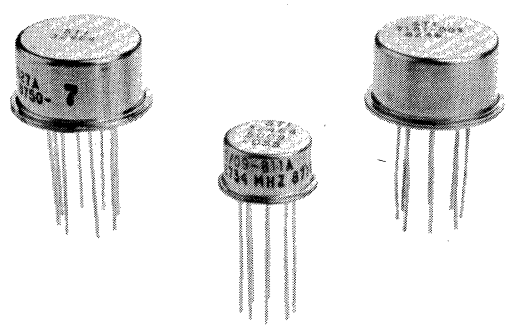
Spectrum Technology inc
a DATUM company

749 Ward Dr. • Santa Barbara, CA 93111
P.O. Box 948 • Goleta, CA 93116
TEL: (805) 964-7791 • FAX: (805) 683-3481 • TWX: 910-334-1163

HYBRID CRYSTAL OSCILLATORS

SUBMINIATURE HYBRID CRYSTAL OSCILLATORS

SERIES 7181/7180/7150 TTL / 4181/4180/4150 CMOS



FEATURES:

- High Reliability
- TO-5 and TO-8 package styles
- Low Profile, (7150/4150, 7180/4180)
- Any frequency, 3.5 Hz to 65 MHz

OPTIONS:

- Screening per MIL-STD-883 Class B when specified (Class S also available).
- QPL Units
  TTL: M55310/09, /10
  (Spectrum Series 5009, 5010)
  CMOS: M55310/12
  (Spectrum Series 5012)

DESCRIPTION AND APPLICATIONS:

Series 7181/7180/7150/4181/4180/4150 are produced with thick film hybrid circuits and integrally mounted crystals in a resistance weld, hermetically sealed package. This proven design provides a mechanically rugged package for high reliability, low aging applications in military, aerospace and Hi-Rel commercial systems. Screening to the requirements of MIL-STD-883 or MIL-O-55310 is available.
Prices range from approximately $35.00 to $200.00 depending on frequency, specified temperature range, and quantity.

SPECIFICATIONS:

TTL:	Supply Voltage:	+5 Vdc @ 10 to 50 mA depending on frequency.
OUPUT:	Frequency:	TO-8 - 28 Hz to 65 MHz TO-5 - 70 kHz to 65 MHz
	Logic 0/1:	+0.5 V max./+2.5 V min., 10 TTL Loads
CMOS:	Supply Voltage:	+10 to +15 Vdc @ 2 to 15 mA Depending on frequency and supply voltage which must be specified. (+5 Vdc available on certain designs)
OUTPUT:	Frequency:	TO-8 - 3.5 Hz to 20 MHz TO-5 - 500 Hz to 20 MHz
	Logic 0/1:	0.1 VDD max./0.9-VDD min.

PIN CONNECTIONS:	7150/7181 4150/4181	7180 4180
FUNCTION	**PIN**	**PIN**
Common (case)	4	6
Output	5	5
Supply	8	12

Note: Where other pins are present they may be internally connected and are not to be used as external tie points.

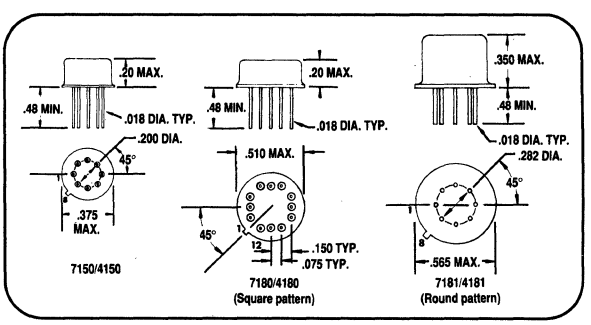
ACCURACY AND STABILITY OPTIONS:

Any of the following standard temperature ranges and accuracy/stability "Mix & Match" combinations are available.

TEMP RANGES:	STANDARD STABILITIES
0 to +70°C	±0.1% (1000 ppm)
-40 to +85°C	±0.05% (500 ppm)
-55 to +105°C	±0.01% (100 ppm)
-55 to +125°C	±0.005% (50 ppm)

Other stabilities and temperature ranges are available for special applications.

SPECIAL MODEL NUMBER DESIGNATION:
For specific applications a three digit dash number (suffix) is added to the Series number to provide a complete model number designation. This is assigned for convenience in ordering and is maintained as a unique cross reference designation to a specific customer part or specification number.



Specifications subject to change without notice.

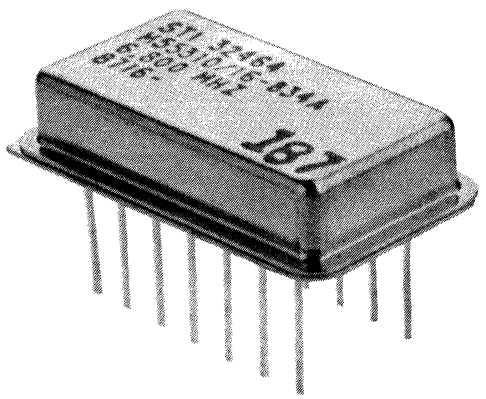
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CRYSTAL OSCILLATOR IC LOGIC CLOCKS

HYBRID DIP LOW PROFILE

SERIES: 7116 TTL / 4116 CMOS



FEATURES:

- High Reliability
- Low profile
- DIP Mounting
- Any frequency, 0.015Hz to 65 MHz

OPTIONS:

- Screening per MIL-STD-883 Class B when specified (Class S also available).
- 4-pin DIP (Series 7114 & 4114)
- 7-pin DIP (Series 7117 & 4117)
- QPL Units
  TTL: M55310/08, /14, /16, /17 (Spectrum series 5008, 5014, 5016, 5017)
  CMOS: M55310/11, /15, /18 (Spectrum series 5011, 5015, 5018)

DESCRIPTION AND APPLICATIONS:

Series 7116/4116 oscillators are produced with thick film hybrid circuits and integrally mounted crystals in a resistance weld, hermetically sealed package. This proven design provides a mechanically rugged package for high reliability, low aging applications in military, aerospace, and Hi-Rel commercial systems. Screening to the requirements of MIL-STD-883 or MIL-O-55310 is available.
Prices range from approximately $30.00 to $200.00 depending on frequency, specified temperature range, and quantity.

SPECIFICATIONS:

TTL:	Supply Voltage:	+5 Vdc @ 10 to 50 mA depending on frequency.
OUPUT:	Frequency:	1 Hz to 65 MHz
	Logic 0/1:	+0.5 V max./+2.5 V min., 10 TTL Loads
CMOS:	Supply Voltage:	+5 to +15 Vdc @ 2 to 15 mA Depending on frequency and supply voltage which must be specified.
OUTPUT:	Frequency:	0.015 Hz to 15 MHz
	Logic 0/1:	0.1 VDD max./0.9-VDD min.

PIN CONNECTIONS:

FUNCTION	7116/4116 7114/4114 PIN	7117/4117 PIN
Common (case)	7	7
Output	8	4
Supply	14	14

Note: Where other pins are present they may be internally connected and are not to be used as external tie points.

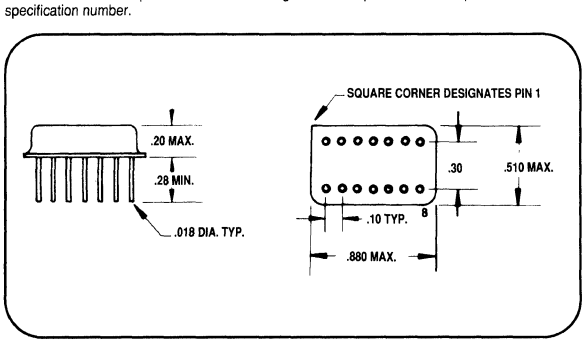
ACCURACY AND STABILITY OPTIONS:

Any of the following standard temperature ranges and accuracy/stability "Mix & Match" combinations are available.

TEMP RANGES:	STANDARD STABILITIES
0 to +70°C	±0.1% (1000 ppm)
-40 to +85°C	±0.05% (500 ppm)
-55 to +105°C	±0.01% (100 ppm)
-55 to +125°C	±0.005% (50 ppm)

Other stabilities and temperature ranges are available for special applications.

SPECIAL MODEL NUMBER DESIGNATION:
For specific applications a three digit dash number (suffix) is added to the Series number to provide a complete model number designation. This is assigned for convenience in ordering and is maintained as a unique cross reference designation to a specific customer part or specification number.



Specifications subject to change without notice.

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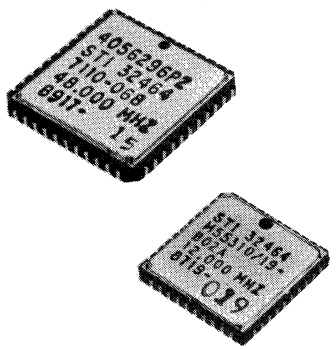
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HYBRID CRYSTAL OSCILLATOR

SUBMINIATURE HYBRID CRYSTAL OSCILLATORS

LEADLESS CHIP CARRIER (LCC)

SERIES: 7110 TTL/ 4110 CMOS
7119 TTL/ 4119 CMOS
*7120 TTL/ 4120 CMOS



FEATURES:

- High Reliability
- MInimum Size
- Surface Mountable
- Hermetically Sealed
- Any Frequency 600 Hz to 65 MHz

OPTIONS:

- Screening per MIL-0-55310 Class B or MIL-STD-883 Class B when specified (Class S also available).
- Alternative Configurations
- Package Heights as low as 0.089"
- QPL Units
  TTL: M55310/19
  (Spectrum Series 5019)
  (40 pin LCC 0.085" max. ht.)

DESCRIPTION AND APPLICATIONS:

Series 7119/4119 are produced with thick film hybrid circuits and integrally mounted crystals in hermetically sealed packages. This proven design provides a mechanically rugged package for high reliability, low aging applications in military, aerospace, and Hi-Rel commercial systems. Screening to the requirements of either MIL-STD-883 or MIL-O-55310 is available.

Prices range from approximately $40.00 to $200.00 depending on frequency, specified temperature range, and quantity.

SPECIFICATIONS:

TTL:	Supply Voltage:	+5 Vdc @ 10 to 50 mA depending on frequency.
OUPUT:	Frequency:	48 Terminal - 39 kHz to 65 MHz * 44 Terminal - 39 kHz to 65 MHz 40 Terminal - 500 kHz to 65 MHz
	Logic 0/1:	+0.5 V max./+2.4 V min. 10 TTL Loads
CMOS:	Supply Voltage:	+5 to +15 Vdc @ 2 to 15 mA Depending on frequency and supply voltage which must be specified.
OUTPUT:	Frequency:	48 Terminal - 600 Hz to 15 MHz *44 Terminal - 600 Hz to 15 MHz 40 Terminal - 80 kHz to 15 MHz
	Logic 0/1:	0.1 VDD max./0.9 VDD min.

PIN CONNECTIONS:

	7110/4110 48 Terminal	*7120/4120 44 Terminal	7119/4119 40 Terminal
FUNCTION	**PIN**	**PIN**	**PIN**
Common	44	34,40	31,37
Output	47	42	39
Supply	5	6,12	4,10

Note: Other pins may be internally connected and are not to be used as external tie points.

*44 pin 7120 TTL/ 4120 CMOS not shown

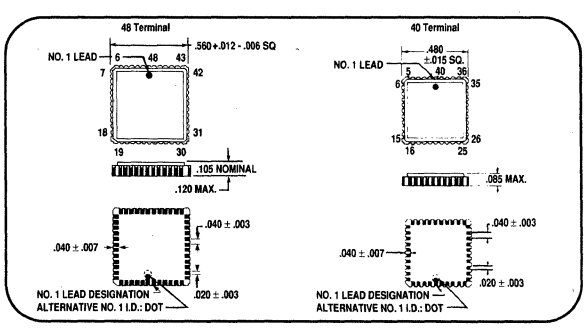
ACCURACY AND STABILITY OPTIONS:

Any of the following standard temperature ranges and accuracy/stability "Mix & Match" combinations are available.

TEMP RANGES:	STANDARD STABILITIES
0 to +70°C	±0.1% (1000 ppm)
-40 to +85°C	±0.05% (500 ppm)
-55 to +105°C	±0.01% (100 ppm)
-55 to +125°C	±0.005% (50 ppm)

Other stabilities and temperature ranges are available for special applications.

SPECIAL MODEL NUMBER DESIGNATION:
For specific applications a three digit dash number (suffix) is added to the Series number to provide a complete model number designation. This is assigned for convenience in ordering and is maintained as a unique cross reference designation to a specific customer part or specification number.



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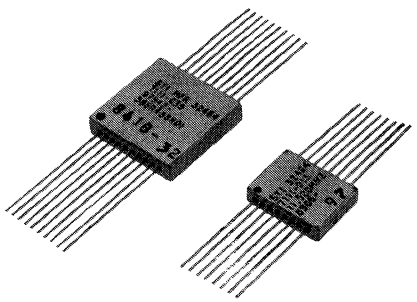
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SUBMINIATURE HYBRID CRYSTAL OSCILLATORS

FLAT PACK

SERIES: 7111 TTL/ 4111 CMOS
7121 TTL/ 4121 CMOS



FEATURES:

- High Reliability
- Minimum Size
- Surface Mountable
- Hermetically Sealed
- Any Frequency 3.5 Hz to 65 MHz

OPTIONS:

- Screening per MIL-STD-883 Class B or MIL-0-55310 Class B when specified (Class S also available).
- Alternative Package Heights
- Alternative Configurations
- Package Heights as low as 0.100"

DESCRIPTION AND APPLICATIONS:

Series 7111/4111are produced with thick film hybrid circuits and integrally mounted crystals in hermetically sealed packages. This proven design provides a mechanically rugged package for high reliability, low aging applications in military, aerospace, and Hi-Rel commercial systems. Screening to the requirements of either MIL-STD-883 OR MIL-O-55310 is available.
Prices range from approximately $45.00 to $200.00 depending on frequency, specified temperature range, and quantity.

SPECIFICATIONS:

TTL:	Supply Voltage:	+5 Vdc @ 10 to 50 mA depending on frequency.
OUPUT:	Frequency:	20 Lead - 28 Hz to 65 MHz 16 Lead - 39 kHz to 65 MHz
	Logic 0/1:	+0.5 V max./+2.4 V min. 10 TTL Loads
CMOS:	Supply Voltage:	+5 to +15 Vdc @ 2 to 15 mA Depending on frequency and supply voltage which must be specified.
OUTPUT:	Frequency:	20 Lead - 3.5 Hz to 15 MHz 16 Lead - 62 kHz to 15 MHz
	Logic 0/1:	0.1 VDD max. / 0.9 VDD min.

PIN CONNECTIONS:

	7111/4111 16 LEAD		7121/4121 20 LEAD
FUNCTION	**STD PIN**	**OPTIONAL PIN**	**STD PIN**
Common (case)	9	8	10
Output	10	9	11
Supply	8	16	13, 20

Note: Other pins may be internally connected and are not to be used as external tie points..

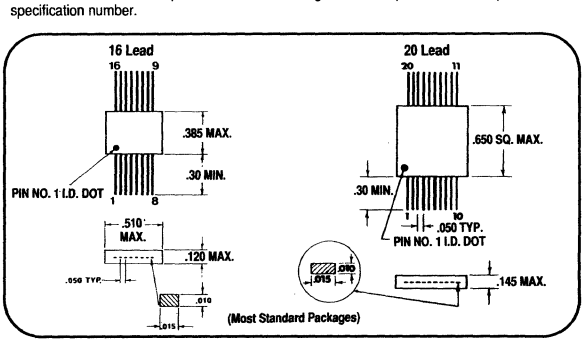
ACCURACY AND STABILITY OPTIONS:

Any of the following standard temperature ranges and accuracy/stability "Mix & Match" combinations are available.

TEMP RANGES:	STANDARD STABILITIES
0 to +70°C	±0.1% (1000 ppm)
-40 to +85°C	±0.05% (500 ppm)
-55 to +105°C	±0.01% (100 ppm)
-55 to +125°C	±0.005% (50 ppm)

Other stabilities and temperature ranges are available for special applications.

SPECIAL MODEL NUMBER DESIGNATION:
For specific applications a three digit dash number (suffix) is added to the Series number to provide a complete model number designation. This is assigned for convenience in ordering and is maintained as a unique cross reference designation to a specific customer part or specification number.



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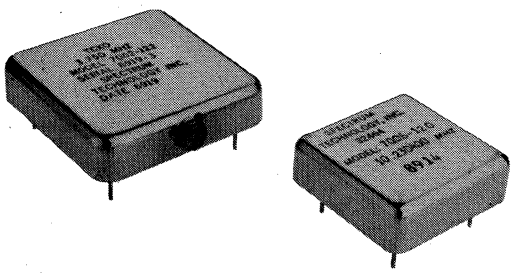
749 Ward Dr. • Santa Barbara, CA 93111
P.O. Box 948 • Goleta, CA 93116
TEL: (805) 964-7791 • FAX: (805) 683-3481 • TWX: 910-334-1163

TCXOs & TCVCXOs

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

(STABLE FREQUENCY & CLOCK SOURCE)

SERIES 7000/7001/7002/7006/7010



FEATURES:

- Output TTL or CMOS logic, Sine wave, ECL, or special
- Low power consumption
- Any frequency, 1 Hz to 125 MHz depending on stability and temperature range
- Stability to 3 x 10^{-7} over temperature range
- Trim adjustment for ten years aging
- VCO input available
- Printed Circuit Board mounting
- QPL Units available M55310/04, /05, /06, and /07 (Spectrum Series 5004, 5005, 5006, and 5007)

DESCRIPTION AND APPLICATIONS:

Series 7000, 7001, 7002 and 7006 temperature compensated crystal oscillators are designed for applications requiring low power and short warm-up time. The units are designed to be terminal mounted on PC cards. Optimum temperature results and low aging are achieved with use of coldweld enclosed crystals and thermistor/varactor computer optimized compensation.

Prices range from approximately $50.00 to $350.00 depending on frequency, specified temperature range, and quantity.

SPECIFICATIONS:

INPUT:

Voltage: Any specified voltage between 5 to 20 Vdc, 10% regulation.
Current: 5 mA to 30 mA Typical

OUTPUT:

Frequency Range: 1 Hz to 125 MHz

STANDARD: Square wave

TTL:	Logic 0: 0.5 V max.	CMOS:	0.1 VDD max.
	Logic 1: 2.5 V min.		0.9 VDD min.

OPTIONAL:

Sine wave, ECL or Special

STANDARD PIN CONNECTIONS:

1. Supply	3. No Connection
2. Common/Case	4. Output

PACKAGE HEIGHT:	2"x2"			1.5"x1.5"	
Series	7000	7001	7002	7006	7010
	0.63"	0.75"	0.50"	0.50"	0.30"

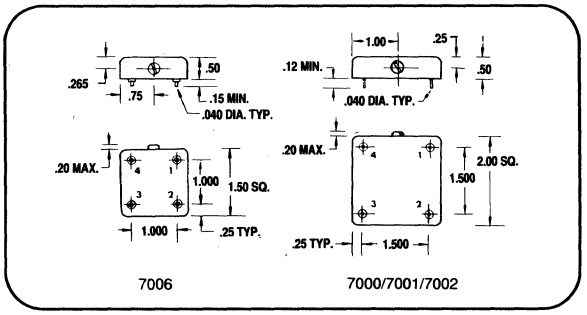
SPECIAL MODEL NUMBER DESIGNATION:
For specific applications a three digit dash number (suffix) is added to the Series number to provide a complete model number designation. This is assigned for convenience in ordering and is maintained as a unique cross reference designation to a specific customer part or specification number.

ACCURACY AND STABILITY OPTIONS:

Standard temperature ranges and accuracy/stability specifications are:

TEMP RANGE:	ACCURACY/STABILITY:
+15 to +35°C	
0 to +55°C	± 0.3 ppm
-20 to +65°C	± 1.0 ppm
-40 to +70°C	± 2.0 ppm
-40 to +85°C	± 5.0 ppm
-55 to +85°C	
-55 to +105°C	

Not all stabilities are available over the broader temperature ranges or at frequencies greater than 20 MHz.



7006 7000/7001/7002

Specifications subject to change without notice.

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QPL to MIL-O-55310

Temperature Controlled Crystal Oscillators[1]

Spectrum Part No.	M55310/XX	PackageType	Frequency Range[2]	Stability Option[3]	Output Type	PIN NUMBERS			
						OUT	Case	B-	B+
5004	/04	1.5x1.5x0.5"h	750kHz-10MHz	(5)	CMOS	1	4	3	2
5005	/05	2x2x0.7"h	1MHz-10MHz	(5)	TTL	1	4	3	2
5006	/06	1.55x1.015x0.7"h	15.7kHz-10MHz	(6)	TTL	1	4	3	2
5007	/07	2x2x0.7"h	10MHz-90MHz	(7)	SINE	3	4	5	1

Hybrid Logic Clock Oscillators[1]

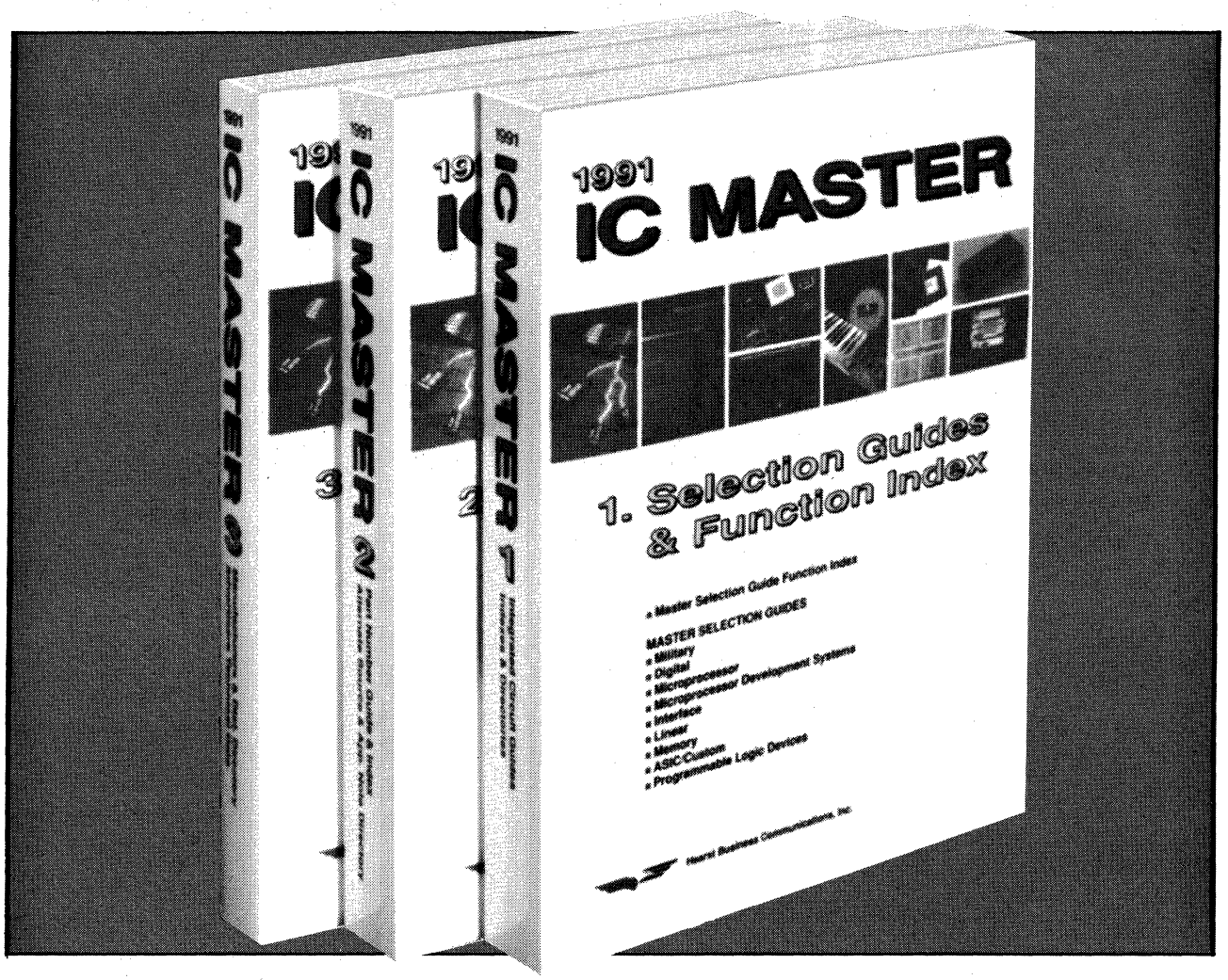
Spectrum Part No.	M55310/XX	PackageType	Frequency Range[2]	Stability Option[3]	Output Type	PIN NUMBERS			
						OUT	Case	B-	B+
5008	/08	14-pin DIP, 0.2"h	50Hz-50MHz	(3)	TTL	1	2	8	14
5009	/09	TO-5	400kHz-60MHz	(3)	TTL	5	4	4	8
5010	/10	TO-8	1kHz-60MHz	(3)	TTL	5	4	4	8
5011	/11	14-pin DIP, 0.4"h	50kHz-10MHz	(3)	CMOS	1	2	8	14
5012	/12	TO-5	50kHz-10MHz	(4)	CMOS	5	4	4	8
5014	/14	14-pin DIP, 0.2"h	0.1Hz-25MHz	(3)	TTL	5	7	7	4
5015	/15	14-pin DIP, 0.2"h	0.01Hz-10MHz	(3)	CMOS	1	2	8	14
5016	/16	14-pin DIP, 0.2"h	0.1Hz-60MHz	(1)	TTL	8	7	7	14
5017	/17	14-pin DIP, 0.2"h	250kHz-50MHz	(1)	TTL	8	7	7	14
5018	/18	14-pin DIP, 0.2"h	0.01Hz-15MHz	(1)	CMOS	8	7	7	14
5019	/19	40-pin LCC, 0.085"h	1.0MHz-60MHz	(2)	TTL	39	-	31/37	4/10
5020	Note [4]	44-pin LCC, 0.085"h	40kHz-70MHz	(1)	TTL	42	-	34/40	6/12
5021	Note [4]	20-pin Flatback, 0.12"h	1.0MHz-60MHz	(1)	TTL	11	10	10	13/20

[1] Screening to Class B or S
[2] Common frequencies normally in stock
[3] See Stability Options below
[4] Pending certification

Option Number	Stability	Temperature Range	
(1)	±50 or 100 ppm	A	-55 to + 125°C
	±40 or 80 ppm	B	-55 to + 105°C
	±25 or 50 ppm	C	-20 to + 70°C
(2)	±100 or 200 ppm	A	-55 to + 125°C
	±75 or 150 ppm	B	-55 to + 105°C
	±50 or 100 ppm	C	-20 to + 70°C
(3)	±50 ppm	A	-55 to + 125°C
	±40 ppm	B	-55 to + 105°C
	±25 ppm	C	-20 to + 70°C
(4)	±100 ppm	A	-55 to + 125°C
	±70 ppm	B	-55 to + 105°C
	±55 ppm	C	-20 to + 70°C

(5)	±0.5ppm or 10ppm depending on supply voltage and temp. range
(6)	±50ppm from -65 to +85°C
(7)	± 1 to ±10ppm depending on termperature range

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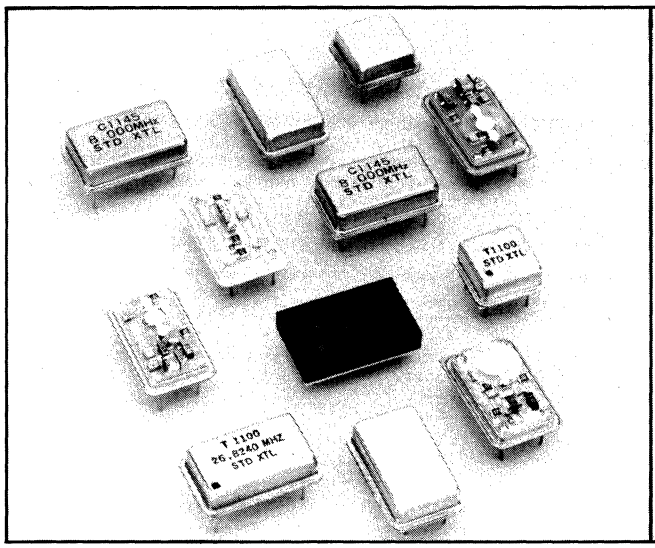
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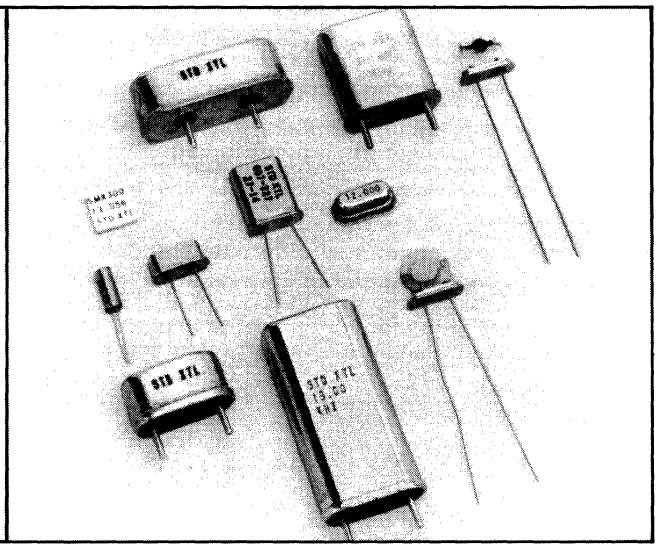
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Miniature Quartz Crystals–Leaded and Surface Mount (10kHz–40MHz)

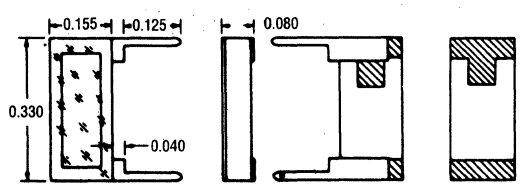
Crystal Selection Guide

MODEL	PACKAGE	TERMINATIONS	MAXIMUM TEMP °C (10 sec.)	FREQUENCY/ STABILITY	CRYSTAL CALIBRATION TOLERANCE AT 25°C	OPERATING & STORAGE TEMP
CX miniature quartz crystal in a rectangular hermetically sealed ceramic package **H** designates series operation **V** intended for a Pierce oscillator	**-1** Statek miniature ceramic package	Standard leads **-01** (no lead)–gold **-SM1** **-SM2** **-SM3**	210 210 260 260 260	10 kHz to 2 Mhz —0.035 ppm/°C² 8 MHz to 32 MHz ± 100 ppm	10-74.9 kHz **A** ± 0.003% **B** ± 0.01% **C** ± 0.1% 75-169 kHz **A** ± 0.005% **B** ± 0.01% **C** ± 0.1% 170-249 kHz **A** ± 0.01% **B** ± 0.02% **C** ± 0.2% 250-600 kHz **A** ± 0.02% **B** ± 0.05% **C** ± 0.5% *(CX-1 only)* 530-2 MHz **A** ± .05% **B** ± 0.1% **C** ± 1.0% 8 MHz-32 MHz **A** ± 0.01% **B** ± 0.1% **C** ± 1.0% *(CX-2 & CX-3 only)* 800-1350 kHz **A** ± 0.05% **B** ± 0.1% **C** ± 1.0%	**I:** Industrial Range –40°C to +85°C **M:** Military Range –55°C to +125°C *CX-4 only:* –20°C to +80°C
	-2 smaller package with multiple lead-out options	**-02** (end leads) **-03** (side corner leads) **-04** (side center leads)	210 210 210	18 kHz to 600 kHz and 800 kHz to 1.35 MHz –0.035 ppm/°C²		
	-3 NEW surface mount low-profile package	**-SM1** **-SM2** **-SM3**	260 260 260			
	-4 NEWEST and **SMALLEST** surface mount package	Gold plated (epoxy mount only)	210	32.768 kHz –0.035 ppm/°C² 30-100 kHz available		
SX miniature quartz crystals within a TO-5 can **H** designates series operation **V** intended for a Pierce oscillator	**-1** rugged three-pin hermetically sealed TO-5 package	3 leads (solderable)		10 kHz to 2 MHz –0.035 ppm/°C² 8 MHz to 32 MHz ± 100 ppm	10-24.9 kHz **A** ± 0.01% **B** ± 0.03% 25-49.9 kHz **A** ± 0.01% **B** ± 0.03% 50-149.9 kHz **A** ± 0.02% **B** ± 0.05% 150-600 kHz **A** ± 0.02% **B** ± 0.05% 800 kHz-2 MHz **A** ± 0.05% **B** ± 0.1% 8 MHz-32 MHz **A** ± 0.010% **B** ± 0.1% **C** ± 1.0%	
TS laser trimmed quartz crystal for temperature sensing applications Stable high accuracy internal sensor	Same as CX-2	Same as CX-2		Linear Coefficient 34.5 to 10^{-6} °C^{-1} Typical	Thermal Parameters 262.144 kHz	—55°C to +125°C

Crystal Packaging Details

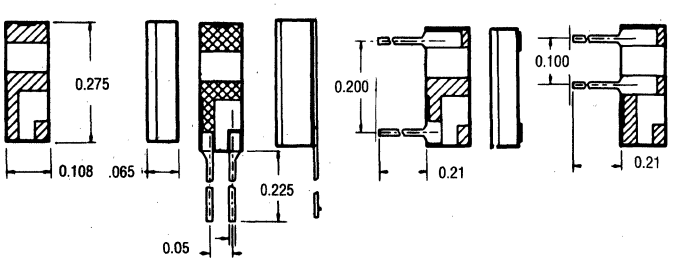
CX-1

SIDE LEAD **—01 NO LEAD**

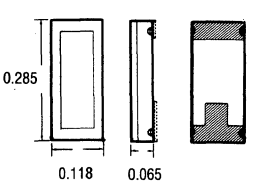


CX-2

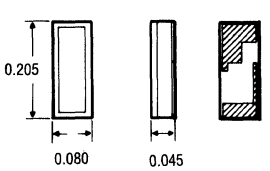
—01 NO LEAD **—02 END LEAD** **—03 SIDE LEAD** **—04 SIDE LEAD**



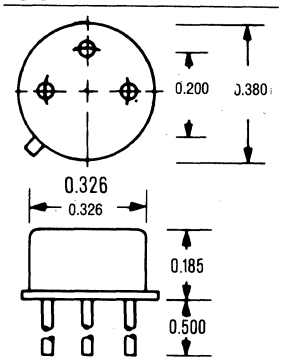
CX-3



CX-4



TO-5



Surface Mount Termination Guide

Designation	Termination	Recommended Application
SM1	Gold Plated	Vapor Phase or Infrared Solder Reflow, or Conductive Epoxy
SM2	Ni Sn Plated	Vapor Phase or Infrared Solder Reflow, or Wave Solder
SM3	Ni Sn Plated Solder Dipped	Wave Solder

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Miniature Quartz Crystal Oscillators (0.001Hz–40MHz)

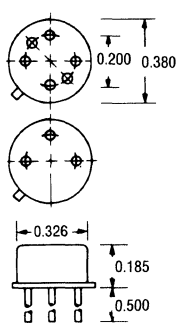
Oscillator Selection Guide —Frequency stability determined by Crystal Selection Guide

MODEL	PACKAGE	DESCRIPTION	FEATURES	FREQUENCY	CALIBRATION TOLERANCE (25°C)
SQXO-2 **SQXO-2 SM**	TO-5 24-pad LCC	Hybrid series resonant crystal oscillator	TTL/CMOS compatible 5 volts	10 kHz to 2 MHz and 10 MHz to 32 MHz	**A** ±0.01% **B** ±0.03%
LXO	4-pin DIP	High stability, low-power crystal oscillator, hermetically sealed	Laser trimmed after crystal sealing Current consumption: <100μA Aging: 1 ppm/yr typ, 3 ppm/yr max	10 kHz to 32 MHz Calibration tolerance at 5 volts	32.768 kHz **A** ±0.001% **B** ±0.0025% All other std. freqs. **A** ±0.01% **B** ± .03%
LQXO-1,2 **LQXO-1F,2F** **LQXO-4**	3-lead TO-5 14-pin flat pack	Hybrid parallel resonant crystal oscillator	**–1** 5 vdc **–2** 12 vdc Current consumption: ±500 μA	10 kHz to 2 MHz (Stock Frequencies: 16.0, 16.384, and 32,768 kHz)	10 KHz to 50 kHz **A** ±0.01% **B** ±0.03% 50 kHz to 2 MHz **A** ±0.02% **B** ±0.05%
DQXO-1,2,3 **DQXO-1F,2F** **DQXO-3 SM**	**–1** 6-pin TO-5 **–2** 6-pin TO-5 **–3** 3-pin TO-5 14-lead flat pack 24-pad LCC	Hybrid timer comprising oscillator and frequency divider chips	**–1** 5 vdc **–2** 12 vdc **–3** 5 or 12 vdc as req'd	Fundamental and divided output **–1** 0.0006 Hz - 1 Hz **–2** 0.0006 Hz - 1 Hz single output **–3** 1 Hz - 10kHz	**A** ±0.01% **B** ±0.03% Stability ±0.02%, -40°C to +85°C *DQXO-3 SM only:* –55°C to +125°C
PXO	16-pin DIP	Frequency-selectable dual-output crystal oscillator	57 frequencies Current consumption: .7 mA typ at 5 volts Aging: 10 ppm max first year	0.002 Hz to 2 MHz Stability ±0.015% –10°C to +70°C	32.768 kHz **A** ±0.001% 600 kHz to 2 MHz **A** ±0.01%
Real Time Clock	16-lead DIP	Combination real-time clock and crystal oscillator	Current consumption <30μA Supply voltage: 5 vdc	Crystal frequency: 32.768 kHz	**A** ±0.005%

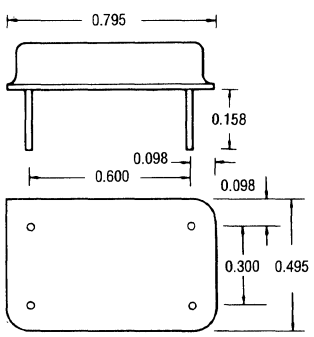
Oscillator Packaging Details

Note: Dimensions are in inches

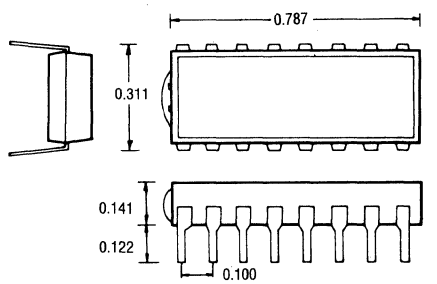
TO-5



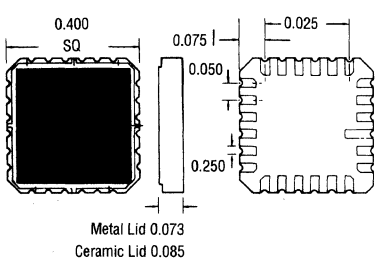
4 pin DIP



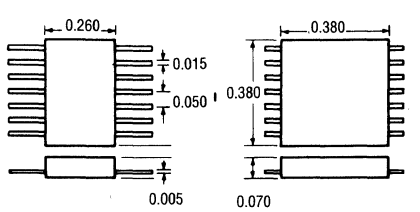
Real time Clock 16 pin DIP



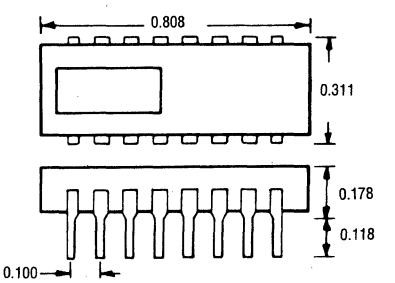
24-pad LCC



14 lead flat pack



PXO 16 Pin DIP



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Product	Item	Application
Cultured Quartz	Raw, Pre-dimensioned	Electrical, Optical
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Crystal Unit	Hermetically sealed, SMD	Communication, Microprocessor, Instrumentation
Crystal Filter	Monolithic, Linear phase	Communication, Instrumentation
Crystal Oscillator	Clock, PXO, TCXO, VCXO, TCVCXO, OCXO, Digital TCXO	Communication, Clock, Instrumentation
Saw Device	Resonator, Filter	Communication, VCR, CATV, Security system
Optical Component	Wave length plate, Isolator Low pass filter	Optical disk, AV, OA, Communication, Measurement equipment

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SMD QUARTZ PRODUCTS

Clock Oscillator & Crystal Unit

Surface Mountable Clock Oscillator

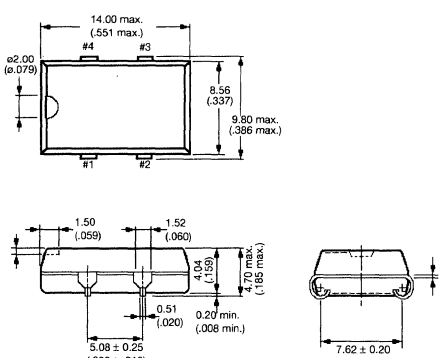
MODEL	TCO-711JT	TCO-711JTC
Output	TTL Logic	CMOS Logic
Frequency range	1.5 to 70MHz	1.5 to 70MHz
Frequency stability	±100ppm	
Operating temperature	0° to +70°C	
Input voltage	±5.0VDC ±10%	
Input current	10mA max. (1.5 to 10MHz) 15mA max. (10 to 26MHz) 35mA max. (26 to 50MHz) 50mA max. (50 to 70MHz)	CL = 15pF 8mA max. (1.5 to 10MHz) 15mA max. (10 to 26MHz) 35mA max. (26 to 50MHz) 50mA max. (50 to 70MHz)
Rise/Fall time	5ns max. (1.5 to 70MHz)	6ns max. (CL = 15pF) 12ns max. (CL = 50pF)
Fan out	1 to 10 gates, 1.6mA/gate	$\|I_{OH}\| = I_{OL}$ = 4mA min.
Remarks	R Reflow — 260°C for 20 seconds max. Tri State — Pin #1H (open) = Fo output, pin #1L (Gnd) = High Z	

Surface Mountable Crystal Unit

MODEL	HC-49/USMD-B	TQC-6G SERIES
Frequency range	3.5 to 32MHz	3.5 to 32MHz
Frequency tolerance	±50ppm (at +25°C)	N/A
Frequency stability	±100ppm (0° to +70°C, inclusive of frequency tolerance at +25°C)	±200ppm (0° to +70°C, inclusive of frequency tolerance at +25°C)
Load capacitance	16.0 ±0.2pF, 10.0 ±0.2pF (32MHz)	
Remarks	Shunt capacitance 5pF max., Drive level 0.5 ±0.1mW	

OUTLINE DRAWINGS

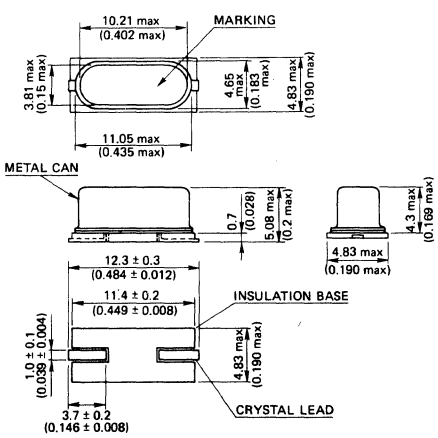
TCO-711J Series



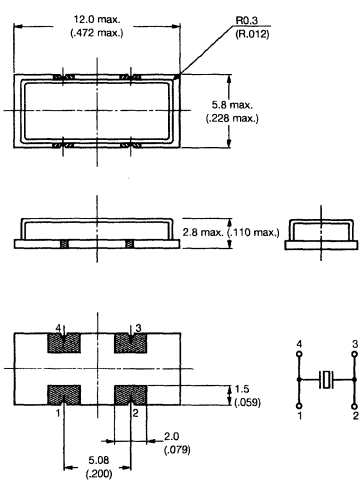
Lead	Connection
#1	*N.C. or Control
#2	GND
#3	OUTPUT
#4	+ VDC

*DO NOT use as a tie-point on N.C. models

HC-49/USMD-B



TQC-6G Series



Size: mm (inch)

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TOYOCOM

CRYSTAL OSCILLATOR

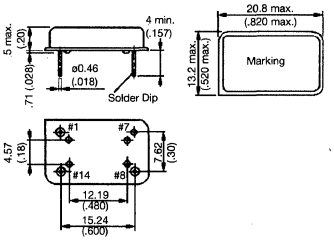
TTL Clock Oscillator
TCO-700 Series

TTL

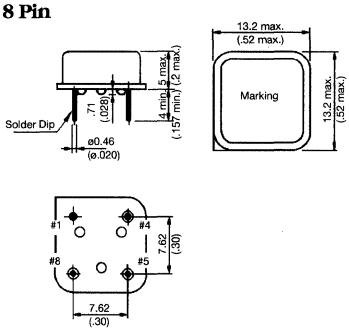
MODEL	TCO-711A	TCO-711S4	TCO-711TH	TCO-711STH
Output level	TTL Logic		Tri-state, TTL Logic	
Package	14 pin	8 pin	14 pin	8 pin
Frequency range	0.15 to 100MHz	1.25 to 70MHz	1.25 to 70MHz	1.25 to 70MHz
Frequency stability	± 100ppm (see note 1 for other standards)			
Symmetry	40 to 60%			
Input current/ Frequency	~10MHz 10mA	~26MHz 15mA	~50MHz 35mA	~70MHz 50mA
Rise/Fall time	1.25MHz to 70MHz, 5ns max.			
Fan out	1 to 10 gates (0.15 to 60MHz) 1 to 5 gate (60 to 100MHz)	1 to 10 gates 1.6mA/gate	1 to 10 gates 1.6mA/gate	1 to 10 gates 1.6mA/gate
Remarks	—	—	Tri-state	
			#1 L (GND) H (Open)	#8 Z (High Impedance) F_O

OUTLINE DRAWINGS

14 Pin



8 Pin



Pin Connection

Pin	TCO-711A	TCO-711TH
1	N.C.	Control
7	Case GND	Case GND
8	Output	Output
14	5.0 VDC	5.0 VDC

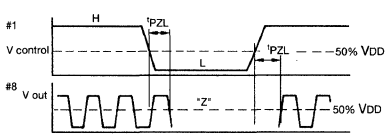
Pin Connection

Pin	TCO-711S4	TCO-711STH
1	N.C.	Control
4	Case GND	Case GND
5	Output	Output
8	5.0 VDC	5.0 VDC

Standard Specifications

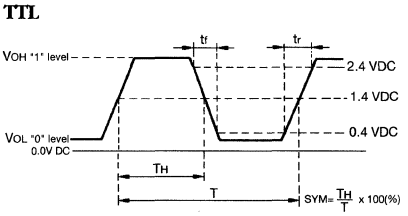
Frequency stability	see table 1
Operating temperature	0° to 70°C
Storage temperature	–25° to +85°C
Input voltage	+5V ± 10%
Symmetry	40 to 60% at 1.4V

DISABLE/ENABLE



WAVE FORM

TTL



Note 1

Model	Frequency Stability*	
TCO-711	± 0.01%	(± 100 ppm)
TCO-744	± 0.0025%	(± 25 ppm)
TCO-745	± 0.005%	(± 50 ppm)

*Inclusive of calibration tolerance @25°C operating temperature, input voltage change, load change, aging, shock and vibration.

Size: mm (inch)

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

TOYOCOM

CRYSTAL OSCILLATOR

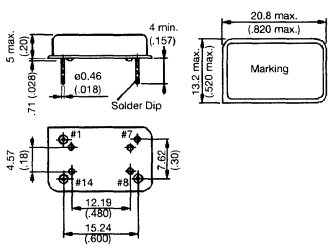
CMOS Clock Oscillator
TCO-700 Series

CMOS

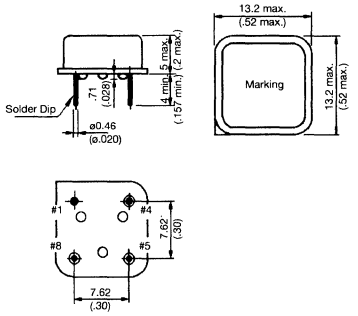
MODEL	TCO-711HC	TCO-711SHC	TCO-711THC	TCO-711STHC
Output level	CMOS logic		Tri-state, CMOS logic	
Package	14 pin	8 pin	14 pin	8 pin
Frequency range	1.25 to 50MHz	1.25 to 50MHz	1.25 to 50MHz	1.25 to 50MHz
Frequency stability	±100ppm (see note 1 for other standards)			
Input current/ Frequency	~10MHz 8mA	~26MHz 15mA	~50MHz 35mA	~70MHz 50mA
Rise/Fall time	10ns	8ns	7ns	5ns
Fan out	$\|I_{OH}\| = I_{OL}$ = 4mA min.			
Remarks	—	—	Tri-state	
			#1 L (GND) H (Open)	#8 Z (High Impedance) F_O

OUTLINE DRAWINGS

14 Pin



8 Pin



Pin Connection

Pin	TCO-711HC	TCO-711THC
1	N.C.	Control
7	Case GND	Case GND
8	Output	Output
14	5.0 VDC	5.0 VDC

Pin Connection

Pin	TCO-711SHC	TCO-711STHC
1	N.C.	Control
4	Case GND	Case GND
5	Output	Output
8	5.0 VDC	5.0 VDC

Standard Specifications

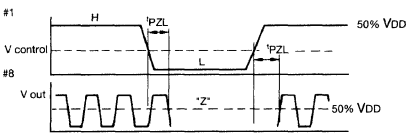
Frequency stability	see table 1
Operating temperature	0° to 70°C
Storage temperature	-25° to +85°C
Input voltage	+5V ± 10%
Symmetry	40 to 60% at 50% VDD

Note 1

Model	Frequency Stability*	
TCO-711	± 0.01%	(± 100 ppm)
TCO-744	± 0.0025%	(± 25 ppm)
TCO-745	± 0.005%	(± 50 ppm)

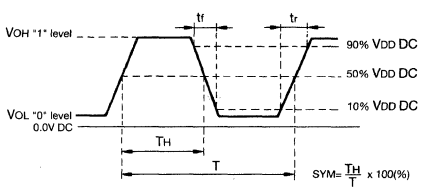
*Inclusive of calibration tolerance @25°C operating temperature, input voltage change, load change, aging, shock and vibration.

DISABLE/ENABLE



WAVE FORM

CMOS



Size: mm (inch)

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TOYOCOM

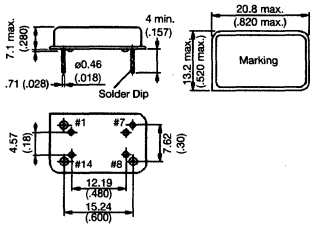
CRYSTAL OSCILLATOR

ECL, Tight Stability Clock Oscillator
TCO-700 Series

ECL & Tight Stability

OUTLINE DRAWING

14 Pin



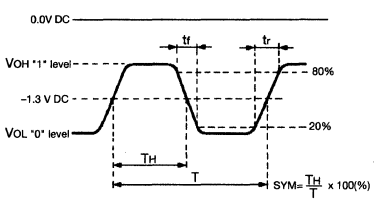
Pin Connection

Pin	TCO-711E4	TCO-711G4	TCO-706AB TCO-706AC
1	N.C.	Case GND	N.C.
7	Case GND	V_{EE}	Case GND
8	Output	Output	Output
14	-5.2 VDC	V_{CC}	5.0 VDC

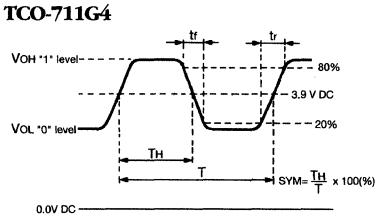
MODEL	TCO-711F4	TCO-711G4	TCO-706AB	TCO-706AC
Output level	10K ECL		CMOS logic	
Package	14 pin (HT. 10 to 90MHz, 5.0mm max; 90 to 125MHz 7.11 mm max.)		14 pin	
Frequency range	40 to 125MHz		1.25 to 25MHz	
Frequency stability	± 100ppm		± 5ppm over Temperature ± 1ppm vs. Input Voltage ± 2ppm/year vs. Aging	
Input voltage	-5.46 to -4.94VDC	+4.94 to +5.46VDC	5.0V ± 5%	
Remarks	High level -0.960 to -0.810V Low level -1.850 to -1.650V	High level +4.24 to +4.39VDC Low level +3.35 to +3.55VDC	Frequency adjustment by internal trimmer ± 3ppm min.	Frequency tolerance (at +25°C) ± 2ppm

OUTPUT WAVEFORM

TCO-711F4

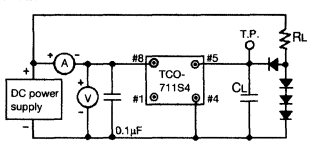


TCO-711G4

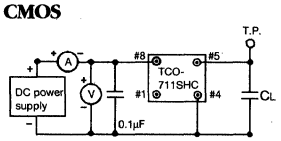


TEST CIRCUIT DIAGRAM

TTL



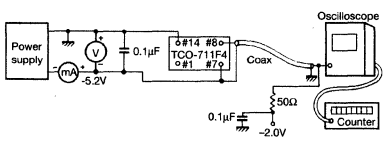
CMOS



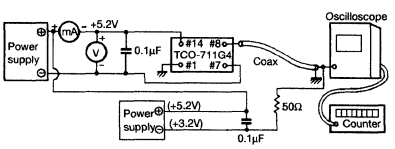
Standard Specifications

Frequency stability	see table 1
Operating temperature	0° to 70°C
Storage temperature	-25° to +85°C
Input voltage	+5V ± 10%
Symmetry	40 to 60% at 1.4V or 50% VDD

TCO-711F4



TCO-711G4



Size: mm (inch)

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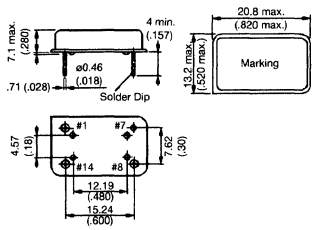
TOYOCOM VOLTAGE CONTROLLED CRYSTAL OSCILLATOR

VCXO
TCO-700 Series

VCXO

OUTLINE DRAWINGS

14 Pin



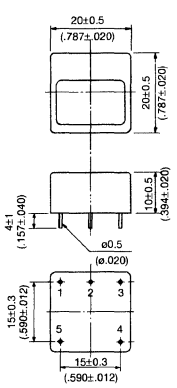
Note: Height of TCO -730C1 is 0.335 inches.

MODEL	TCO-745VC	TCO-745V	TCO-711VC	TCO-711V
Output level	CMOS logic	TTL logic	CMOS logic	TTL logic
Package	14 pin		14 pin	
Frequency range	1.25 to 25MHz		1.25 to 33MHz	
Frequency stability	± 50ppm including calibration temp. voltage at 2.5VDC		± 100ppm including calibration temp. voltage at 2.5VDC	
Frequency deviations vs. control voltage	± 150ppm at 2.5VDC ± 2.5V		± 200ppm at 2.5VDC ± 2.5VDC	
Control voltage	0 to 5.0VDC		0 to 5.0VDC	
Fan out	IOH - IOL = 2mA	1 to 10 gate	IOH - IOL = 2mA	1 to 10 gate

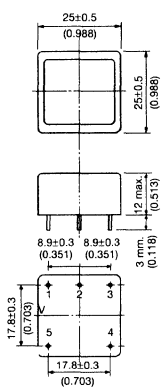
VCXO

MODEL	TCO-730C1	TCO-208C	TCO-215K1
Output level	TTL compatible	TTL compatible	Sine wave,+OdBm min into 5ohm
Package	14 pin with height of 0.335 inch	see outline drawing	see outline drawing
Frequency range	12 to 20MHz	1 to 25MHz	20 to 100MHz
Frequency stability	± 30ppm/-20~70℃ ± 1ppm/+5V ± 5% ± 3ppm/yr.	± 30ppm/0~55℃ ± 5ppm/+5V ± 5% ± 3ppm/yr.	± 10ppm max/Vcont +2.5V@25℃ ± 30ppm/0 ~ 65℃ ± 5ppm/yr.
Supply current	16mA max.	25mA	20mA
Control voltage	+2.5 ± 2V ± 50ppm min.	+2.5 ± 2.5V ± 200ppm min.	+2.5 ± 2.5V ± 100ppm min.
Fan out	1 to 2 gate	1 to 2 gate	—

TCO-208C



TCO-215K1

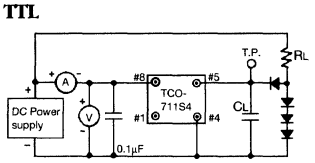


Pin Connection

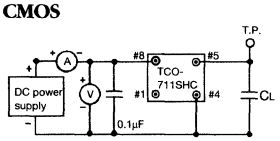
Pin	TCO-745VC, V 711VC, V	TCO-730C1	Pin	TCO-208C, 215K1
1	Control	Control	1	$+V_{cc}$
7	Case GND	Case GND	2	Output
8	Output	Output	3	GND
14	5.0VDC	5.0VDC	4	Control
			5	GND

TEST CIRCUIT DIAGRAM

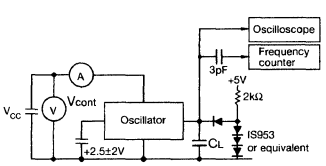
TTL



CMOS



TCO-730C1, -208C, -215K1



CL: Total fixture and probe capacitance = 15pF max.

Size: mm (inch)

Standard Specifications

Frequency stability	see table 1
Operating temperature	0° to 70℃
Storage temperature	-25° to +85℃
Input voltage	+5V ± 10%
Symmetry	40 to 60% at 1.4V or 50% VDD

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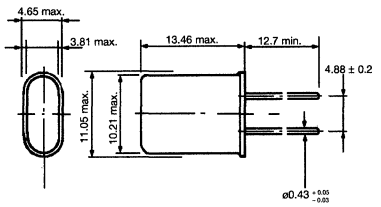
TOYOCOM

CRYSTAL UNITS

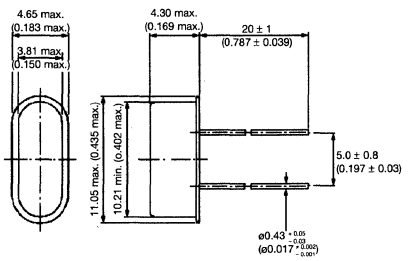
Microprocessor and Miniature Package Units

OUTLINE DRAWINGS

HC-49/U-10



HC-49/U-70

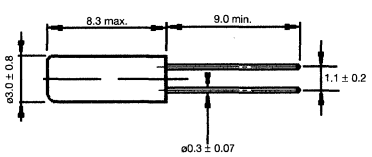


TYPE	STANDARD	TOC-100A-7C	LOW PROFILE
Frequency range	1.8432 to 60MHz	32.768KHz	3.0 to 60MHz
Frequency tolerance	± 50ppm (at + 25℃)	± 20ppm (at + 25℃)	± 50ppm (at + 25℃)
Load capacitance	12, 16, 32pF	12 ± 0.2pF	16 ± 0.2pF
Resonant resistance	25~650Ω max.	30KΩ max.	50~180Ω max.
Operating temperature	0° to +70℃		
Shunt capacity	7pF max.	1.6 ± 0.4pF	5pF max.
Package (Resistance weld)	HC-49/U-10	RV-38	HC-49/U-70

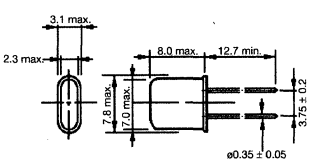
For Professional Use

TYPE	UM-1 UM-4 UM-5	UM-1 WITH METAL JACKET	UM-4S WITH METAL JACKET
Frequency range	30 to 175MHz	10 to 200MHz	12 to 200MHz
Frequency tolerance (at +25℃)	± 5, ± 10, ± 15ppm	± 10, ± 15, ± 20, ± 30ppm	± 10, ± 15, ± 20, ± 30ppm
Frequency stability	as tight to ± 3ppm (-10° to +50℃). ± 7.5ppm (-20° to +70℃)	as tight to ± 3ppm (-10° to +60℃). ± 15ppm (-30° to +80℃)	as tight to ± 4ppm (0° to +55℃). ± 20ppm (-30° to +85℃)
Aging/year	± 1ppm, ± 2ppm, ± 4ppm		
Load capacitance	Series, 20pF, 30pF		
Drive level	2μ W	0.5, 1, 2m W	0.5, 1, 2m W
Application	Pager	Surface mount technology	

RV-38

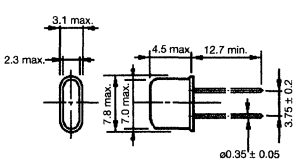


UM-1

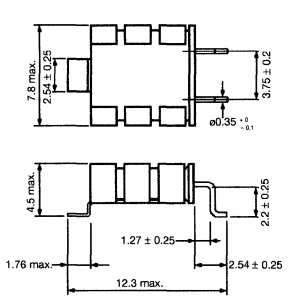


mm	inch
0.05	.002
0.2	.008
0.35	.014
2.3	.091
3.1	.122
3.75	.148
4.5	.177
5.8	.228
7.0	.276
7.8	.307
12.7	.500

UM-4

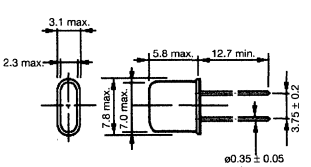


UM-1 SMD with Metal Jacket

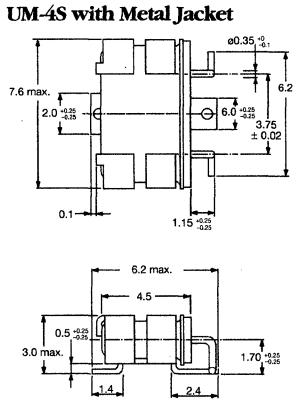


mm	inch
0.1	.004
0.2	.008
0.25	.01
0.35	.014
1.27	.05
1.76	.069
2.2	.081
2.54	.100
3.75	.148
4.5	.177
7.8	.307
12.3	.484

UM-5



UM-4S with Metal Jacket



Size: mm (inch)

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

TOYOCOM NEW CRYSTAL OSCILLATORS

Digitally Compensated TCXO
SMD TCXO

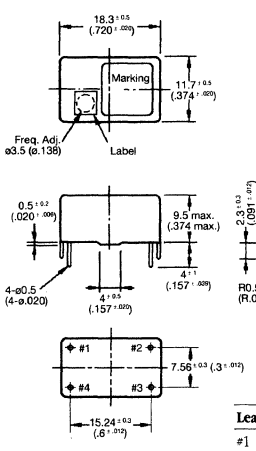
Toyocom's Digitally Compensated TCXO delivers unexcelled value in crystal oscillators. Features such as compact design and excellent frequency stability over a wide temperature range allow use as a reference oscillator for fixed or portable equipment. In addition, Toyocom now has a very small (ICC) surface mount type TCXO available.

TCXO & SMD

MODEL	DTCXO TCO-109A	SURFACE MOUNTABLE TYPE TCO-935A
Output frequency	12.8MHz, 15.36MHz, 14.4MHz	12.8MHz, 15.36MHz, 14.4MHz, 16.8MHz
Supply voltage	DC + 5V ± 10%	DC + 5V ± 5%
Current drain	5mA max.	2mA max.
Output level	1V p-p min./clipped sinewave (DC-cut)	1V p-p min./clipped sinewave (DC-cut)
Load	20KΩ/5pF ± 10%	20KΩ/5pF ± 10%
Frequency stability		
vs. Temperature	± 1.0ppm/-30° to +80°C	± 2.5ppm/-30° to +75°C
vs. Supply voltage	± 0.2ppm/DC +5V ± 10%	± 0.3ppm/DC +5V ± 5%
vs. Load	± 0.2ppm/20KΩ/5pF ± 10%	± 0.3ppm/20KΩ/5pF ± 10%
Aging	± 1.0ppm/year	± 1.0ppm/year
Frequency adjustment	± 3.0ppm min. by internal trimmer	± 3.0ppm min. by internal trimmer

OUTLINE DRAWINGS

TCO-109A

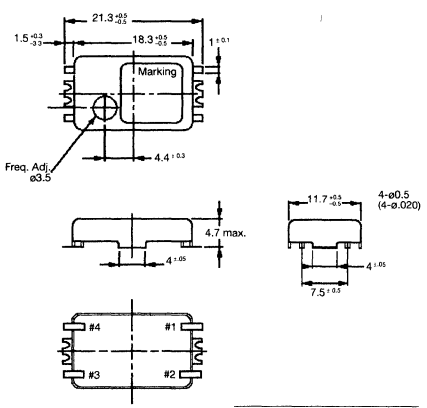


Lead	Connection
#1	N.C.
#2	Common & Case
#3	Output
#4	+ Vcc

(Material)
Case: Silver-Nickel
Pin: Silver-Nickell

Size: mm (inch)

TCO-935A



Lead	Connection
#1	Common & Case
#2	Output
#3	+ Vcc
#4	N.C. Control Voltage

(Material)
Case: Silver-Nickel
Pin: Solder Coated PBR-1/2H

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TOYOCOM

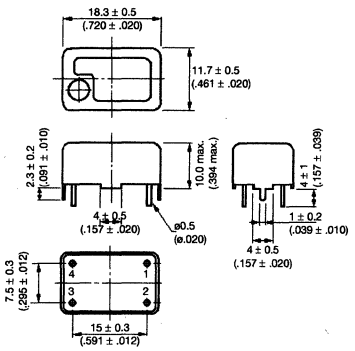
CRYSTAL OSCILLATOR

TCXO & OCXO

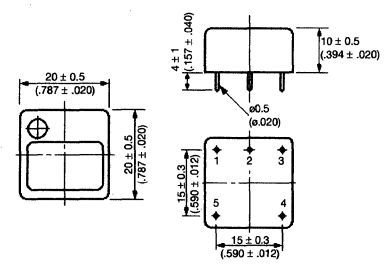
TCXO

OUTLINE DRAWINGS

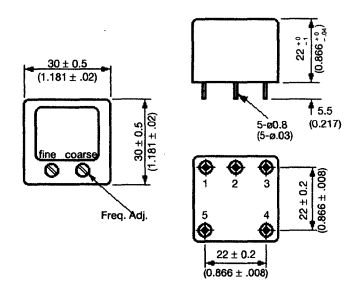
TCO-909Z, TCO-919A



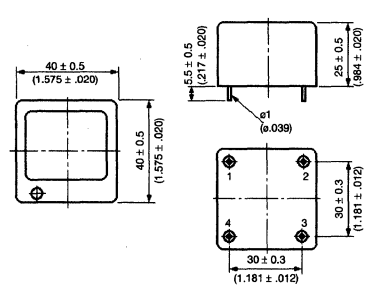
TCO-519L



TCO-635A, A1



TCO-627B

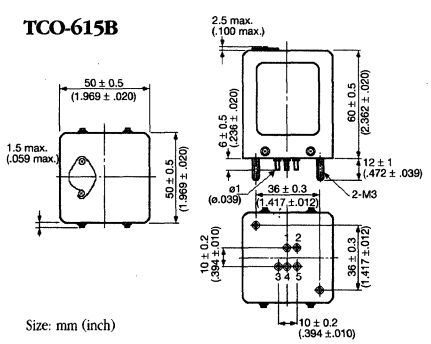


MODEL	TCO-909Z	TCO-919A	TCO-519L
Standard frequency	12.8MHz, 15.36MHz	12.8MHz	12.8MHz, 15.36MHz
Available frequency	10 to 24MHz	12 to 17MHz	10 to 24MHz
Frequency stability vs. Temperature vs. Supply voltage Aging	 ±2.5ppm/-30° to +75°C ±0.3ppm/+5V ±5% ±1ppm/year	 ±2.5ppm/-30° to +75°C ±0.3ppm/+5V ±5% ±1ppm/year	 ±1ppm/-20° to +70°C ±0.2ppm/+5V ±5% ±1ppm/year
Supply voltage	+5V ±5%	+5V ±5%	+5V ±5%
Supply current	2mA max.	2mA max.	2mA max.
Output	1V p-p min. Clipped Sinewave (DC-Cut)	1V p-p min. Clipped Sinewave (DC-Cut)	1V p-p min. Clipped Sinewave (DC-Cut)
Operating temperature	–40° to +85°C	–35° to +80°C	–30° to +80°C
Frequency adjustment	±3ppm min. by internal trimmer	±3ppm min. by internal trimmer	±3ppm min. by internal trimmer
Audio modulation	—	Deviation: ±8ppm min. Distortion: 3% max. Input voltage: 2V p-p Modulation range: 1Hz to 3KHz Response slope: Negative	—

OCXO

MODEL	TCO-635A	TCO-635A1	TCO-627B	TCO-615B
Standard frequency	10MHz	10MHz	5MHz, 6.4MHz or 10MHz	5MHz
Available frequency	—	5 to 25MHz	4 to 10MHz	—
Frequency stability vs. Temperature vs. Supply voltage Aging per day Aging per year Warm up	 ±1 x 10^{-7}/-20° to +70°C ±3 x 10^{-8}/+12V ±10% ±2 x 10^{-8} ±2 x 10^{-7} ±5 x 10^{-8} (5 minutes at 25°C)		 ±5 x 10^{-8}/-10° to +60°C ±3 x 10^{-8}/+12V ±10% ±2 x 10^{-8} ±1 x 10^{-7} ±5 x 10^{-8} (10 minutes)	 ±5 x 10^{-9}/-10° to +60°C ±1 x 10^{-9}/+12V ±5% ±5 x 10^{-10} ±2 x 10^{-8} ±5 x 10^{-8} (30 minutes)
Supply voltage	+12V ±10%			
Supply current Warm up Steady at +25°C	 150mA max. 70mA max.		 330mA max. 120mA max.	 500mA max. 300mA max.
Output	Sinewave +8 ± 2dBm/50Ω	TTL compatible, Fanout 2		
Frequency adjustment	±1 x 10^{-6} min.		±5 x 10^{-7} min.	±1 x 10^{-7} min.

TCO-615B



Size: mm (inch)

Pin Connection

Pin	TCO-909Z	TCO-919A	TCO-519L	TCO-535A,A1	TCO-627B	TCO-615B
1	Common & Case		+$\overline{V}_{CC}$	NC	NC	Output
2	Output		Output	NC	Output	+V_{CC}
3	+$\overline{V}_{CC}$		Common & Case	Common & Case	+$\overline{V}_{CC}$	NC
4	—	Control	Common & Case	Output	Common & Case	NC
5	—	—	Common & Case	+$\overline{V}_{CC}$	—	Common & Case

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Toyocom HCM Filter (Monolithic Crystal Filter) features compact design, high reliability and excellent intermodulation characteristics for use in a wide range of applications. Nominal frequency ranges from 10 to over 100MHz with 2 to 8 poles.

TOYOCOM

CRYSTAL FILTER

HCM Filter, Miniature Package & VHF Series

Miniature Package

Type	Center frequency (MHz)	No. of pole	Passband (dB)	Passband (kHz)	Stopband (dB)	Stopband (kHz)	Max. ripple (dB)	Max. loss (dB)	Guaranteed attenuation (dB)	Guaranteed attenuation (kHz)	Terminating impedance Zt (Ω/pF)	Case
21J1D3	21.4	2	3	±10	13	±30	1.0	1.5			1.8k/1.0	UM-5
21J1B3	21.4	2	3	±7.5	15	±25	1.0	1.5	35 60	+350 to +1000 −300 to −1000	1.5k/2.5	UM-5
21M1B3	21.7	2	3	±7.5	15	±25	1.0	1.5			1.5k/2.5	UM-5
TQF-602A	26 to 50	2	3	±10	10	±30	1.0	2.0	35 60	+910 −910	1.5k/2.5 ± 2	UM-5

Operating temperature range: −30° to +80°C

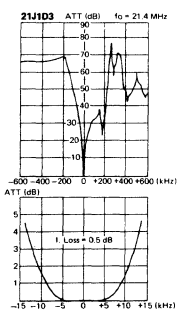
VHF 45MHz Fundamental Series

Type	No. of pole	Passband (dB)	Passband (kHz)	Stopband (dB)	Stopband (kHz)	Max. ripple (dB)	Max. loss (dB)	Guaranteed attenuation (dB)	Guaranteed attenuation (kHz)	Terminating impedance Zt (Ω//pF)	Coupling impedance Zc (pF)	Case
45E1FF	2	3	±3.75	10	±12.5	1.0	2.0	65	−910	200//4	—	UM-1
45E2FF	4	3	±3.75	30	±12.5	1.0	4.0	90	±910	350//6.5	18	(UM-1) x 2
45E3FF	6	3	±3.75	50	±12.5	2.0	6.0	80	±910	350//5	—	H-1
45E4FF	8	3	±3.75	70	±12.5	2.0	7.0	80	±910	350//5	—	H-1
45E1BF	2	3	±7.5	15	±25	1.0	2.0	65	−910	650//3	—	UM-1
45E2BF	4	3	±7.5	30	±25	1.0	3.0	90	±910	650//3	9	(UM-1) x 2
45E3BF	6	3	±7.5	60	±25	2.0	5.0	80	±910	650//1.5	—	H-1
45E4BF	8	3	±7.5	80	±25	2.0	6.0	80	±910	650//1.5	—	H-1
45E1AF	2	3	±15	10	±50	1.0	2.0	65	−910	1100//-0.9	—	UM-1
45E2AF	4	3	±15	30	±50	1.0	3.0	80	±910	1200//0.7	3.5	(UM-1) x 2

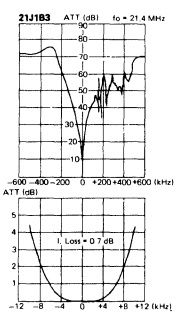
Operating temperature range: −30° to +80°C

ELECTRICAL DATA

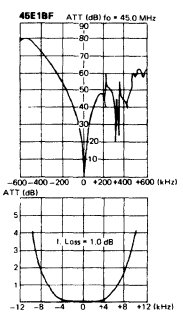
21J1D3



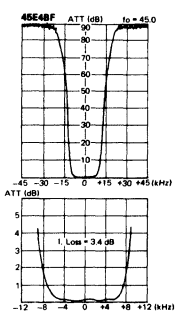
21J1B3



45E1BF

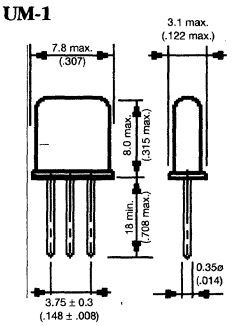


45E4BF



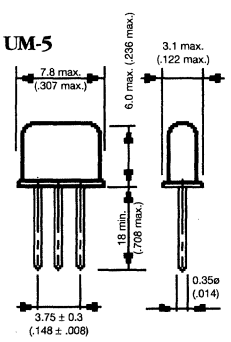
OUTLINE DRAWINGS

UM-1

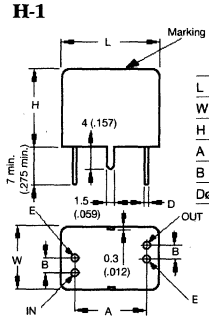


Size: mm (inch)

UM-5

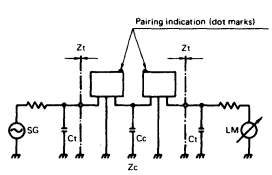


H-1



	(mm)	(in)
L	11.0	.433
W	8.5	.335
H	11.5	.452
A	7.4	.291
B	2.0	.078
Dø	0.35	.012

4-Pole



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TOYOCOM

SAW DEVICE

Filter & Resonator

Surface Acoustic Wave Filter

MODEL	TQS-618A	TQS-417A	TQS-705G
Nominal frequency	80 to 95MHz	135 to 175MHz	850 to 950MHz
Passband at 3dB	fo ± 15KHz min.	fo ± 4MHz min.	fo ± 5MHz min.
Loss	3dB max.	5dB max. including ripple	4.5dB max. including ripple
Ripple in band	1.5dB max.	—	—
Stopband	70dB min. at fo -910KHz	50dB min. at fo -42.8MHz	45dB min. at fo -42.8MHz
Attenuation	60dB min.	40dB min.	45dB min.
Termination	830Ω / -3pF	500Ω / -7pF	150Ω / -1pF
Operating temperature	-30° to +70°C	-10° to +50°C	-20° to +70°C
Package	SS-18093A	F-11 or SS-972A	F-11 or SS-541†

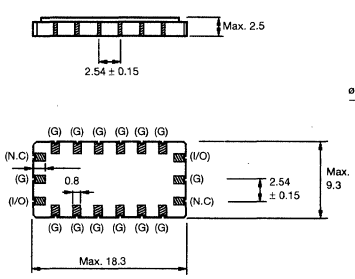
Surface Acoustic Wave Resonator

MODEL	TQS-301□-5R	TQS-302□-5R	TQS-303□-5R	TQS-304□-5R	TQS-305□-5R	TQS-306□-5R	TQS-307□-5R	TQS-308□-5R	TQS-309□-5R	TQS-310□-5R
Frequency (MHz)	303.875	310	471.25	591.25	567	668	674	680	704	710
Freq. tolerance at 25°C(kHz)	± 250	± 250	± 150	± 200	± 200	± 200	± 200	± 200	± 200	± 200
Insertion loss (dB)	18	18	12	12	12	12	12	12	12	12
Input, Output capacitance (pF)	1.4 ± 0.5	1.4 ± 0.5	2.3 ± 0.6	2.0 ± 0.6	2.0 ± 0.6	1.9 ± 0.6	1.9 ± 0.6	1.9 ± 0.6	1.9 ± 0.6	1.9 ± 0.6
Insertion phase shift	180° or 0° at F_C									
Turnover temp.	45° ± 30°C									
Operating temp. range	0° to +60°C									
Storage temp. range	-40° to +85°C									
Package	TO-39/2P3L									

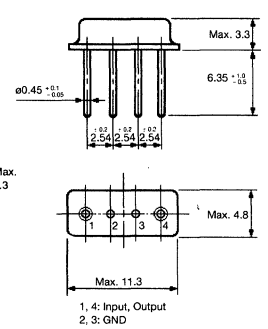
*Note: Please specify insertion phase shift with following Type Number (180°C to TQS-3XXA-5R, 0° to TQS-3XXB-5R)
*Note 2: Other frequencies and specifications of our SAW Resonator TQS-300 Series ranging from 200 to 1000 MHz are available upon request.

OUTLINE DRAWINGS †: Consult TOYOCOM to obtain detailed Outline Drawing for Package SS-541.

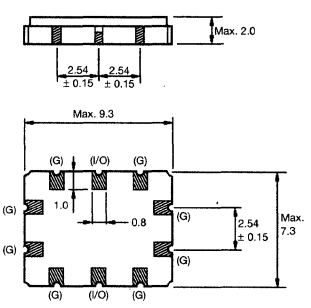
SS-18093A



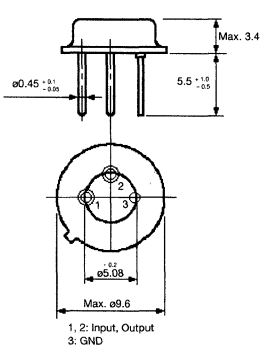
F-11



SS-972A



TO-39/2P3L



Size: mm (inch)

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Clock Oscillators

TTL

	DIP, FLATPACK & SURFACE MOUNT		LCC
			
Series	**CO-401:** 4 Pin DIP **CO-402:** 14 Pin DIP **CO-406:** Surface Mount **CO-407:** Flatpack	**CO-238**	**CO-408**
Frequency	16 kHz-100 MHz	16 kHz-70 MHz	1 MHz-60 MHz
Output	Drives 10 TTL loads (above 50 MHz, CO-238 drives 2 Schottky loads).		
Supply	5 Vdc ±5% at 30-90 mA depending upon frequency.		
Accuracy (at 25°C)	**CO-40** ☐ **A:** ±50 ppm **CO-40** ☐ **C:** ±25 ppm **CO-40** ☐ **D:** ±15 ppm **CO-40** ☐ **B:** ±10 ppm ***CO-40** ☐ **E:** ±1 ppm ☐ for 4 pin DIP [2] for 14 pin DIP [6] for surface mount [7] for flatpack *Set to ±1 ppm via external capacitor (≤20 MHz only)	**CO-238A:** ±50 ppm **CO-238C:** ±25 ppm **CO-238D:** ±15 ppm **CO-238B:** ±10 ppm **CO-238T:** ±1 ppm **Tuning adjust settable to ±1 ppm; available 16 kHz-30 MHz	**CO-408A:** ±50 ppm **CO-408C:** ±25 ppm
Temperature Stability	**STANDARD:** 0°C to +70°C: ±25 ppm Option 1: −55°C to +85°C: ±50 ppm Option 2: −55°C to +125°C: ±50 ppm Option 3: 0°C to +50°C: ±3 ppm (only in CO-238) Option 5: 0°C to +50°C: ±5 ppm Option 6: 0°C to +50°C: ±10 ppm Option 7: −55°C to +125°C: ±100 ppm ***Option 9: −55°C to +200°C: ±300 ppm (only in CO-401/2/6/7 in 4-20 MHz range) ***Specified stability includes initial accuracy: do not specify A, B, C, D or E		
Aging Rate (typical after 30 days)	3 ppm first year 2 ppm/year thereafter	5 ppm first year 3 ppm/year thereafter Opt "Y": 1 ppm/year	3 ppm first year 2 ppm/year thereafter
Size	†CO-401: 0.5" x 0.8" x 0.2" CO-402: 0.5" x 0.8" x 0.2" CO-406: 0.5" x 0.8" x 0.25" ††CO-407: 0.6" x 0.8" x 0.17" †CO-401 Series available with insulated standoffs; height increases to 0.23" ††0.12" opt. to 20 MHz	0.5" x 0.8" x 0.35"	0.48" x 0.48" x 0.085"
Case	Resistance welded metal case	Epoxy Case	Sealed ceramic leadless chip carrier

CO-402 QPL to MIL-O-55310 16

CMOS/HCMOS

	CMOS (5V)	CMOS (8-15V)	HCMOS (5V)	HCMOS LCC
				
Series	**CO-421:** 4 Pin DIP **CO-422:** 14 Pin DIP **CO-426:** Surface Mount **CO-427:** Flatpack	**CO-411:** 4 Pin DIP **CO-412:** 14 Pin DIP **CO-416:** Surface Mount **CO-417:** Flatpack	**CO-441:** 4 Pin DIP **CO-442:** 14 Pin DIP **CO-446:** Surface Mount **CO-447:** Flatpack	**CO-448**
Frequency	1 Hz-8 MHz	1 Hz-15 MHz	1 Hz-125 MHz	12.5 MHz-50 MHz
Output	Standard CMOS	Standard CMOS	HCMOS/ACMOS	HCMOS
Supply	5 Vdc ±5%	8-15 Vdc	5 Vdc ±5% (3 Vdc opt. to 20 MHz)	5 Vdc ±5%
Accuracy (at 25°C)	**CO-42** [ ] **A:** ±50 ppm **CO-42** [ ] **C:** ±25 ppm **CO-42** [ ] **D:** ±15 ppm **CO-42** [ ] **B:** ±10 ppm ***CO-42** [ ] **E:** ±1 ppm	**CO-41** [ ] **A:** ±50 ppm **CO-41** [ ] **C:** ±25 ppm **CO-41** [ ] **D:** ±15 ppm **CO-41** [ ] **B:** ±10 ppm ***CO-41** [ ] **E:** ±1 ppm	**CO-44** [ ] **A:** ±50 ppm **CO-44** [ ] **C:** ±25 ppm **CO-44** [ ] **D:** ±15 ppm **CO-44** [ ] **B:** ±10 ppm ***CO-44** [ ] **E:** ±1 ppm	**CO-448A:** ±50 ppm **CO-448C:** ±25 ppm
	[1] for 4 pin DIP [2] for 14 pin DIP [6] for surface mount [7] for flatpack *Settable to ±1 ppm via external capacitor (≤20 MHz only)			
Temperature Stability	**STANDARD:** 0°C to +70°C: ±25 ppm Option 1: −55°C to +85°C: ±50 ppm Option 2: −55°C to +125°C: ±50 ppm Option 5: 0°C to +50°C: ±5 ppm Option 6: 0°C to +50°C: ±10 ppm Option 7: −55°C to +125°C: ±100 ppm *Option 9: −55°C to +200°C: ±300 ppm (only to 20 MHz; N/A in CO-448) *Specified stability includes initial accuracy; do not specify A, B, C, D or E			
Aging Rate (Typical after 30 days)	3 ppm first year 2 ppm/year thereafter			
Size	†CO-411/421/441: 0.5" x 0.8" x 0.2" CO-412/422/442: 0.5" x 0.8" x 0.2" CO-416/426/446: 0.5" x 0.8" x 0.25" ††CO-417/427/447: 0.6" x 0.8" x 0.17" †4 Pin DIP Series available with insulated standoffs; height increases to 0.23" ††0.12" height optional to 20 MHz			0.48" x 0.48" x 0.085"
Case	Resistance Welded Metal Case			Sealed ceramic leadless chip carrier

CO-412 and CO-422 QPL to MIL-O-55310 18

How to Specify Clock Models

CO-400 Series Hybrid Models

CO-4 ☐☐☐ – ☐☐ at ☐

- TTL/5V = 0
- CMOS/8-15V = 1
- CMOS/5V = 2
- ECL/−5.2V = 3
- HCMOS/5V = 4
- 100K ECL/−4.5V = 5
- Sine/15V = 8

- 4 pin DIP = 1
- 14 pin DIP = 2
- 16 pin double DIP = 4
- Surface mount = 6
- Flatpack = 7
- LCC = 8

Initial accuracy at 25°C (A, B, C, D, or E; leave blank with 9 option)

Temperature stability (0 for standard, or option 1, 2, 5, 6, 7 or 9)

Screen test option
X = Standard testing
B = Class B of MIL-O-55310
S = Class S of MIL-O-55310

Frequency

All Other Clock Models**

CO- ☐ – ☐☐☐☐ at ☐

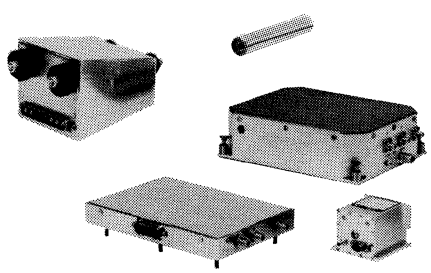
- Basic Model
- *Accuracy/tuning (A, B, C, D or T)
- *Stability option (1, 2, 3, 5, 6 or 7)
- Frequency
- *F for CO-233 KEQ with 5.2V input
- *C for solder sealed case
- *Y for improved aging

*leave blank if not applicable to your requirement

**This does not apply to Clock TCXOs

CUSTOM PRODUCTS

Vectron offers the broadest available line of standard product crystal oscillators. With these products as a base, Vectron has produced special crystal oscillators in virtually every conceivable package, some of which are pictured below. Further, Vectron has engineered and produced a variety of crystal oscillator based sub-systems; photos of some of these are also shown below. We welcome the opportunity to design and construct custom crystal oscillator related products for your specific needs.

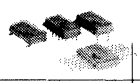
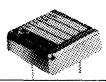
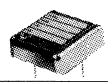


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The Crystal Oscillator Company

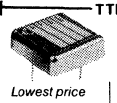
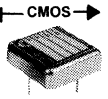
VECTRON LABORATORIES, INC.
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Clock Oscillators

ECL

	STANDARD ECL		100K ECL, ECLiPS	
				
Series	**CO-431:** 4 Pin DIP **CO-432:** 14 Pin DIP **CO-434:** 16 Pin Double DIP **CO-436:** Surface Mount **CO-437:** Flatpack	**CO-233ME** **CO-233MEH**	**CO-451:** 4 Pin DIP **CO-452:** 14 Pin DIP **CO-454:** 16 Pin Double DIP **CO-456:** Surface Mount **CO-457:** Flatpack	CO-233KEQ
Frequency	CO-434: 200.1 MHz to 300 MHz Other models: 5.0 MHz to 200 MHz		CO-454: 200.1 MHz to 500 MHz CO-233KEQ: 150.0 MHz to 700 MHz Other models: 5.0 MHz to 200 MHz	
Output	Output taken directly from 10K, 10KH or MECL III gate, depending on frequency Complementary outputs optional (Standard in CO-434)		≤ 400 MHz: 100K ECL >400 MHz: ECLiPS Complementary outputs standard in CO-454, optional in CO-452 and CO-457	· 350 MHz: from 100K gate ·350 MHz: from ECLiPS gate complementary outputs
Supply	5.2V · 5% · 40 mA from 5 to 110 MHz · 60 mA above 110 MHz		Standard: 4.5V · 5% at · 60 mA Option **F**: 5.2V · 5% at · 70 mA	
Accuracy (at 25°C)	**CO-43** · **A:** · 50 ppm **CO-43** · **C:** · 25 ppm **CO-43** · **D:** · 15 ppm **CO-43** · **B:** · 10 ppm · 4 pin DIP 2 14 pin DIP 4 double DIP 6 surface mount 7 flatpack	5-149.9 MHz models: **CO-233ME:** · 10 ppm ***CO-233MET:** · 1 ppm *Tuning adjust settable to · 1 ppm 150-200 MHz models: **CO-233MEHA:** · 50 ppm **CO-233MEHB:** · 10 ppm	**CO-45** **A:** · 50 ppm **CO-45** **C:** · 25 ppm **CO-45** **D:** · 15 ppm **CO-45** **B:** · 10 ppm 4 pin DIP 2 14 pin DIP 4 double DIP 6 surface mount 7 flatpack	**CO-233KEQ:** · 10 ppm ***CO-233KEQT:** · 1 ppm *Tuning adjust settable to · 1 ppm with · 5 ppm nominal range
Temperature Stability	**STANDARD:** 0°C to · 70°C · 25 ppm Option **1:** 55°C to · 85°C · 50 ppm (See * note regarding temperature restrictions) Option **2:** 55°C to · 125°C · 50 ppm (See * note regarding temperature restrictions) Option **3:** 0°C to · 50°C · 3 ppm (Only available in Model CO-233ME and CO-233KEQ) Option **5:** 0°C to · 50°C · 5 ppm Option **6:** 0°C to · 50°C · 10 ppm Option **7:** 55°C to · 125°C · 100 ppm (See * note regarding temperature restrictions) * 1, 2, 7 restricted to -30/ · 85°C above 200 MHz in CO-431/2/4/6/7 and above 110 MHz in CO-233ME 1, 2, 7 restricted to 0/ · 85°C in 100K and ECLiPS models These restrictions are due to specified limits by the I.C. manufacturer			
Aging Rate (typical after 30 days)	3 ppm first year 2 ppm/year thereafter	5 ppm first year 3 ppm/year thereafter Opt "Y": 1 ppm/year	3 ppm first year 2 ppm/year thereafter	5 ppm first year 3 ppm/year thereafter Opt "Y": 1 ppm/year
Size	**#CO-431:** 0.5" x 0.8" x 0.2" **CO-432:** 0.5" x 0.8" x 0.2" **CO-434:** 0.8" x 1.0" x 0.2" **CO-436:** 0.5" x 0.8" x 0.25" **CO-437:** 0.6" x 0.8" x 0.17"	1.5" x 1.5" x 0.625" **CO-233ME:** 4 pin base **CO-233MEH:** 5 pin base	**#CO-451:** 0.5" x 0.8" x 0.2" **CO-452:** 0.5" x 0.8" x 0.2" **CO-454:** 0.8" x 1.0" x 0.2" **CO-456:** 0.5" x 0.8" x 0.25" **CO-457:** 0.6" x 0.8" x 0.17"	1.5" x 1.5" x 0.5"
Case	resistance welded metal case #CO-431 available with insulated standoffs; increases height to 0.23"	metal case "C" option: meets gross leak test	resistance welded metal case #CO-451 available with insulated standoffs; increases height to 0.23"	metal case "C" option: meets gross leak test

Clock TCXOs

	TTL		CMOS
			
	Lowest price	*Smallest size; DIP pin configuration*	
Frequency	12 kHz-20 MHz	32 kHz-20 MHz	300 Hz-15 MHz
Temperature Stability			
(Temp. Range **A**) +15°C to +35°C	**CO-231A57:** · 5 x 10⁻⁷	**CO-532A57:** · 5 x 10⁻⁷	**CO-236A57:** · 5 x 10⁻⁷
(Temp. Range **B**) 0°C to +50°C	**CO-231B16:** · 1 x 10⁻⁶	**CO-532B16:** · 1 x 10⁻⁶	**CO-236B16:** · 1 x 10⁻⁶
(Temp. Range **C**) 0°C to +70°C	**CO-231C36:** · 3 x 10⁻⁶	**CO-632C36:** · 3 x 10⁻⁶	**CO-236C36:** · 3 x 10⁻⁶
(Temp. Range **D**) -20°C to +70°C	**CO-231D56:** · 5 x 10⁻⁶	**CO-532D56:** · 5 x 10⁻⁶	**CO-236D56:** · 5 x 10⁻⁶
(Temp. Range **E**) -40°C to +75°C	**CO-231E15:** · 1 x 10⁻⁵	**CO-532E15:** · 1 x 10⁻⁵	**CO-236E15:** · 1 x 10⁻⁵
(Temp. Range **F**) -55°C to +85°C	**CO-231F25:** · 2 x 10⁻⁵	**CO-532F25:** · 2 x 10⁻⁵	**CO-236F25:** · 2 x 10⁻⁵
Aging Rate	1 x 10⁻⁶ per year		
Output	TTL compatible (drives 10 TTL loads)		CMOS compatible
Supply	· 5 Vdc · 5%		· 12 Vdc · 5% (9-15 Vdc optional)
Current	4-20 MHz: · 30 mA 4 MHz: 40-80 mA	8-20 MHz: · 30 mA · 8 MHz: 40-80 mA	3-10 mA depending upon frequency
Frequency Adjustment	settable to 1 x 10⁻⁶		
Size	1/2" x 1/2" x 1/2" (38 x 38 x 13 mm) pcb mount housed in metal can with epoxy base	1" x 1" x 0.38" (26 x 26 x 10 mm) DIP compatible pin configuration metal can with metalized base	1½" x 1½" x ½" (38 x 38 x 13 mm) pcb mount housed in metal can with epoxy base

Sinewave Oscillators

50 HZ-1.3 GHz
(Beyond 2 GHz by mid 1991)

	50 Hz to 4 MHz	4 MHz to 500 MHz			500.1 MHz to 1.3 GHz	
Series	*Low Frequency* **CO-281**	*Basic Line* **CO-233 (H, F, FW)**	*Reduced Size Line* **CO-285W**	*Miniature Hybrid* **CO-484**	*Basic Line* **CO-283W**	*Reduced Size Line* **CO-286W**
Frequency	50 Hz to 4 MHz	4 MHz to 500 MHz	4 MHz to 500 MHz	4 MHz to 500 MHz	500.1 MHz to 1.2 GHz	500.1 MHz to 1.3 GHz
Output	Std: · 1 Vrms/1 kΩ Opt: · 0 dBm/50Ω to +20 dBm/50Ω	Standard · 0.5 Vrms/50Ω (+7 dBm) Option **R** 1 Vrms/50Ω (+13 dBm) Not available above 200 MHz in CO-484 High level option 1 watt (+30 dBm) available in 2" x 3" x ¾" package			Standard · 0.5 Vrms/50Ω (+7 dBm) Option **R** 1 Vrms/50Ω (+13 dBm) High level option · 20 dBm/50Ω	
Supply	+15 Vdc · 5%	· 15 Vdc · 5% (Any supply in 12-24 Vdc range optional, supply less than 15 Vdc subject to reduced output level)			· 15 Vdc · 5%	
Accuracy (at 25°C)	Standard · 10 ppm *Option "T" · 1 ppm *Tuning adjustment settable to · 1 ppm	Standard · 10 ppm *Option "T" · 1 ppm *Tuning adjustment settable to · 1 ppm	Standard · 10 ppm *Option "T" · 1 ppm *Tuning adjustment settable to · 1 ppm	**CO-484A:** · 50 ppm **CO-484C:** · 25 ppm **CO-484D:** · 15 ppm **CO-484B:** · 10 ppm	Standard · 10 ppm *Option "T" · 1 ppm *Tuning adjust settable to · 1 ppm	
Temperature Stability	**Standard:** 0°C to · 70°C · 25 ppm Option **1:** 55°C to · 85°C · 50 ppm Option **2:** 55°C to · 125°C · 50 ppm (not available above 800 MHz) Option **3:** 0°C to · 50°C · 3 ppm (not available in CO-484) Option **4:** 0°C to · 50°C · 1 ppm (only in CO-281) Option **5:** 0°C to · 50°C · 5 ppm Option **6:** 0°C to · 50°C · 10 ppm For higher stability, see sections describing Vectron TCXOs and oven-controlled types					
Aging Rate (after 30 days)	Standard: 5 ppm first year, 3 ppm per year thereafter Option **Y**: 2 ppm first year, 1 ppm per year thereafter			3 ppm first year 2 ppm per year thereafter	Standard: 5 ppm first year, 3 ppm per year thereafter Option **Y**: 2 ppm first year, 1 ppm per year thereafter	
Phase Noise (typical 4-100 MHz)	Offset from Carrier: 100 Hz, 1 kHz, 10 kHz, 50 kHz Standard: 100 dBc/Hz, 125 dBc/Hz, 140 dBc/Hz, 145 dBc/Hz *Option L1: 115 dBc/Hz, 140 dBc/Hz, 150 dBc/Hz, 155 dBc/Hz **Option L2: 120 dBc/Hz, 145 dBc/Hz, 160 dBc/Hz, 160 dBc/Hz Noise degrades by 6 dB per octave above 100 MHz *L1 Option is not available in CO-281 or CO-484 **L2 Option is available only in CO-233FW and is limited to 200 MHz above 100 MHz; output of CO-233FWL2 is restricted to · 7 dBm					
Size	2" x 2" x ¾" 2" x 2" x ½" optional	**CO-233, CO-233H:** 1½" x 1½" x ⅝" **CO-233F, CO-233FW:** 2" x 2" x ¾"	1" x 1.6" x 0.5"	0.8" x 1.0" x 0.20"	2" x 3" x ¾"	1" x 2" x 0.6"
Configuration	pins for pcb mount Option "W": SMA connector Option "U": SMC connector Option "X": BNC connector	**CO-233:** (4-149 MHz) pcb mount **CO-233H:** (150-300 MHz) pcb mount **CO-233FW:** (4-500 MHz) SMA connector, terminals and studs on base **CO-233F:** (4-500 MHz) pcb mount	terminals on base SMA on side Option "P": pcb mount without SMA connector	16 pin double DIP resistance welded Hermetic seal per MIL-STD-883, Method 1014, 10⁻⁸ atm cc/second	SMA connector and terminals on side surface, mounting studs on base Option "U": SMC in place of SMA Option "X": BNC in place of SMA	terminals on base SMA on side



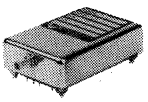
VECTRON
The Crystal Oscillator Company

VECTRON LABORATORIES, INC.
166 Glover Avenue, Norwalk, Connecticut 06850
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TCXOs Temperature Compensated Crystal Oscillators

Basic TCXOs





	50 Hz to 20 MHz		20.1 MHz to 140 MHz	140 MHz to 420 MHz	420 MHz to 630 MHz	630 MHz to 1 GHz
	CO-251 SERIES Moderate Stability	**CO-252 SERIES** High Stability	**CO-254 SERIES**	**CO-255 SERIES**	**CO-256 SERIES**	**CO-856 SERIES**
Temperature Stability (Temp. Range **A**) +15°C to +35°C	**CO-251A57:** ±5 x 10^{-7} **CO-251A27:** ±2 x 10^{-7}	**CO-252A17:** ±1 x 10^{-7} **CO-252A58:** ±5 x 10^{-8}	**CO-254A57:** ±5 x 10^{-7} **CO-254A17:** ±1 x 10^{-7}	**CO-255A57:** ±5 x 10^{-7} **CO-255A17:** ±1 x 10^{-7}	**CO-256A57:** ±5 x 10^{-7} **CO-256A17:** ±1 x 10^{-7}	**CO-856A57:** ±5 x 10^{-7} **CO-856A17:** ±1 x 10^{-7}
(Temp. Range **B**) 0°C to +50°C	**CO-251B16:** ±1 x 10^{-6}	**CO-252B57:** ±5 x 10^{-7} **CO-252B27:** ±2 x 10^{-7} **CO-252B17:** ±1 x 10^{-7}	**CO-254B16:** ±1 x 10^{-6} **CO-254B57:** ±5 x 10^{-7} **CO-254B27:** ±2 x 10^{-7}	**CO-255B16:** ±1 x 10^{-6} **CO-255B57:** ±5 x 10^{-7} **CO-255B27:** ±2 x 10^{-7}	**CO-256B16:** ±1 x 10^{-6} **CO-256B57:** ±5 x 10^{-7} **CO-256B27:** ±2 x 10^{-7}	**CO-856B16:** ±1 x 10^{-6} **CO-856B57:** ±5 x 10^{-7}
(Temp. Range **C**) 0°C to +70°C	**CO-251C36:** ±3 x 10^{-6}	**CO-252C16:** ±1 x 10^{-6} **CO-252C57:** ±5 x 10^{-7} **CO-252C37:** ±3 x 10^{-7}	**CO-254C36:** ±3 x 10^{-6} **CO-254C16:** ±1 x 10^{-6} **CO-254C37:** ±3 x 10^{-7}	**CO-255C36:** ±3 x 10^{-6} **CO-255C16:** ±1 x 10^{-6} **CO-255C37:** ±3 x 10^{-7}	**CO-256C36:** ±3 x 10^{-6} **CO-256C16:** ±1 x 10^{-6} **CO-256C37:** ±3 x 10^{-7}	**CO-856C36:** ±3 x 10^{-6} **CO-856C16:** ±1 x 10^{-6}
(Temp. Range **D**) −20°C to +70°C	**CO-251D56:** ±5 x 10^{-6}	**CO-252D16:** ±1 x 10^{-6} **CO-252D57:** ±5 x 10^{-7}	**CO-254D56:** ±5 x 10^{-6} **CO-254D16:** ±1 x 10^{-6} **CO-254D57:** ±5 x 10^{-7}	**CO-255D56:** ±5 x 10^{-6} **CO-255D16:** ±1 x 10^{-6} **CO-255D57:** ±5 x 10^{-7}	**CO-256D56:** ±5 x 10^{-6} **CO-256D16:** ±1 x 10^{-6} **CO-256D57:** ±5 x 10^{-7}	**CO-856D56:** ±5 x 10^{-6} **CO-856D16:** ±1 x 10^{-6}
(Temp. Range **E**) −40°C to +75°C	**CO-251E15:** ±1 x 10^{-5}	**CO-252E56:** ±5 x 10^{-6} **CO-252E26:** ±2 x 10^{-6} **CO-252E16:** ±1 x 10^{-6}	**CO-254E56:** ±5 x 10^{-6} **CO-254E26:** ±2 x 10^{-6} **CO-254E16:** ±1 x 10^{-6}	**CO-255E56:** ±5 x 10^{-6} **CO-255E26:** ±2 x 10^{-6} **CO-255E16:** ±1 x 10^{-6}	**CO-256E56:** ±5 x 10^{-6} **CO-256E26:** ±2 x 10^{-6} **CO-256E16:** ±1 x 10^{-6}	**CO-856E56:** ±5 x 10^{-6} **CO-856E26:** ±2 x 10^{-6}
(Temp. Range **F**) −55°C to +85°C	**CO-251F25:** ±2 x 10^{-5}	**CO-252F56:** ±5 x 10^{-6} **CO-252F26:** ±2 x 10^{-6} **CO-252F16:** ±1 x 10^{-6}	**CO-254F56:** ±5 x 10^{-6} **CO-254F26:** ±2 x 10^{-6} **CO-254F16:** ±1 x 10^{-6}	**CO-255F56:** ±5 x 10^{-6} **CO-255F26:** ±2 x 10^{-6} **CO-255F16:** ±1 x 10^{-6}	**CO-256F56:** ±5 x 10^{-6} **CO-256F26:** ±2 x 10^{-6} **CO-256F16:** ±1 x 10^{-6}	**CO-856F56:** ±5 x 10^{-6}
(Temp. Range **G**) −55°C to +105°C		**CO-252G56:** ±5 x 10^{-6}	**CO-254G56:** ±5 x 10^{-6}	**CO-255G56:** ±5 x 10^{-6}	**CO-256G56:** ±5 x 10^{-6}	
(Temp. Range **H**) −55°C to +125°C		**CO-252H15:** ±1 x 10^{-5}	**CO-254H15:** ±1 x 10^{-5}	**CO-255H15:** ±1 x 10^{-5}	**CO-256H15:** ±1 x 10^{-5}	
Output Level & Frequency	TTL: 50 Hz -20 MHz CMOS: 50 Hz -15 MHz Sine: 1 MHz-20 MHz HCMOS: 40 kHz-20 MHz (CO-252)		Sine: 20 MHz-140 MHz TTL: 20 MHz-100 MHz ECL: 20 MHz-140 MHz HCMOS: 20 MHz- 50 MHz	Sine: 140 MHz-420 MHz ECL: 140 MHz-280 MHz	Sine: 420 MHz-630 MHz	Sine: 630 MHz-1 GHz
Supply	Any supply voltage in 5-24 Vdc range; current as low as 3 mA for some models			Any supply voltage in 12-24 Vdc range		
Frequency Adjustment	Screwdriver adjustment, settable to 1 x 10^{-7}. Electronic tuning (TC/VCXO) capability optional.					
Aging Rate	5 x 10^{-7} to 1 x 10^{-6} per year		1 x 10^{-6}/year	1 x 10^{-6}/year		
Size	2" x 2" x ¾" (51 x 51 x 19 mm) ½" height and smaller size available			2" x 3" x ¾" (51 x 76 x 19 mm)	2" x 4" x ¾" (51 x 102 x 19 mm)	1.75" x 3.75" x 0.75" (45 x 95 x 19 mm)

Size Reduced TCXOs

	Hybrid Design		Other small TCXOs	
	CO-258 *Lowest profile 0.32" (8.2 mm) height*	**CO-259** *0.4" (10.2 mm) height with mechanical tuning*	**CO-257** *Least expensive type among Vectron's size reduced Series*	**CO-253** *24 pin DIP resistance welded package*
Output level & Frequency	TTL: 20 kHz to 70 MHz HCMOS 40 kHz to 50 MHz CMOS: 400 Hz to 15 MHz ECL: 5 Mhz to 70 MHz		*TTL/HCMOS: 1 MHz to 50 MHz +7 dBm sine: 5 MHz to 140 MHz *Drives 3 TTL loads, 10 LSTTL loads or HCMOS (output from HCMOS gate).	*TTL/HCMOS: 315 kHz to 50 MHz sine: 5 MHz to 140 MHz
Temperature Stability (Temp. Range **A**) +15°C to +35°C	**CO-258A37:** ±3 x 10^{-7} **CO-258A17:** ±1 x 10^{-7}	**CO-259A37:** ±3 x 10^{-7} **CO-259A17:** ±1 x 10^{-7}	**CO-257A37:** ±3 x 10^{-7} **CO-257A17:** ±1 x 10^{-7}	**CO-253A37:** ±3 x 10^{-7} **CO-253A17:** ±1 x 10^{-7}
(Temp. Range **B**) 0°C to +50°C	**CO-258B57:** ±5 x 10^{-7} **CO-258B27:** ±2 x 10^{-7}	**CO-259B57:** ±5 x 10^{-7} **CO-259B27:** ±2 x 10^{-7}	**CO-257B57:** ±5 x 10^{-7} **CO-257B27:** ±2 x 10^{-7}	**CO-253B57:** ±5 x 10^{-7} **CO-253B27:** ±2 x 10^{-7}
(Temp. Range **C**) 0°C to +70°C	**CO-258C57:** ±5 x 10^{-7} **CO-258C37:** ±3 x 10^{-7}	**CO-259C57:** ±5 x 10^{-7} **CO-259C37:** ±3 x 10^{-7}	**CO-257C57:** ±5 x 10^{-7} **CO-257C37:** ±3 x 10^{-7}	**CO-253C57:** ±5 x 10^{-7} **CO-253C37:** ±3 x 10^{-7}
(Temp. Range **D**) −20°C to +70°C	**CO-258D36:** ±3 x 10^{-6} **CO-258D16:** ±1 x 10^{-6} ***CO-258D57:** ±5 x 10^{-7}	**CO-259D36:** ±3 x 10^{-6} **CO-259D16:** ±1 x 10^{-6} ***CO-259D57:** ±5 x 10^{-7}	**CO-257D36:** ±3 x 10^{-6} **CO-257D16:** ±1 x 10^{-6} ***CO-257D57:** ±5 x 10^{-7}	**CO-253D36:** ±3 x 10^{-6} **CO-253D16:** ±1 x 10^{-6} ***CO-253D57:** ±5 x 10^{-7}
(Temp. Range **E**) −40°C to +75°C	**CO-258E56:** ±5 x 10^{-6} **CO-258E26:** ±2 x 10^{-6} **CO-258E16:** ±1 x 10^{-6}	**CO-259E56:** ±5 x 10^{-6} **CO-259E26:** ±2 x 10^{-6} **CO-259E16:** ±1 x 10^{-6}	**CO-257E56:** ±5 x 10^{-6} **CO-257E26:** ±2 x 10^{-6} **CO-257E16:** ±1 x 10^{-6}	**CO-253E56:** ±5 x 10^{-6} **CO-253E26:** ±2 x 10^{-6} **CO-253E16:** ±1 x 10^{-6}
(Temp. Range **F**) −55°C to +85°C	**CO-258F56:** ±5 x 10^{-6} **CO-258F26:** ±2 x 10^{-6} ***CO-258F16:** ±1 x 10^{-6}	**CO-259F56:** ±5 x 10^{-6} **CO-259F26:** ±2 x 10^{-6} ***CO-259F16:** ±1 x 10^{-6}	**CO-257F56:** ±5 x 10^{-6} **CO-257F26:** ±2 x 10^{-6} ***CO-257F16:** ±1 x 10^{-6}	**CO-253F56:** ±5 x 10^{-6} **CO-253F26:** ±2 x 10^{-6} ***CO-253F16:** ±1 x 10^{-6}
(Temp. Range **G**) −55°C to +105°C	**CO-258G56:** ±5 x 10^{-6} ***CO-258G36:** ±3 x 10^{-6}	**CO-259G56:** ±5 x 10^{-6} ***CO-259G36:** ±3 x 10^{-6}	**CO-257G56:** ±5 x 10^{-6} ***CO-257G36:** ±3 x 10^{-6}	**CO-253G56:** ±5 x 10^{-6} ***CO-253G36:** ±3 x 10^{-6}
(Temp. Range **H**) −55°C to +125°C	**CO-258H15:** ±1 x 10^{-5} *Asterisked models not available above 12 MHz	**CO-259H15:** ±1 x 10^{-5}	**CO-257H15:** ±1 x 10^{-5} *Asterisked model not available above 12 MHz	
Aging Rate	1 x 10^{-6} per year	1 x 10^{-6} per year	1 x 10^{-6} per year	1 x 10^{-6} per year
Supply Voltage	TTL & HCMOS: 10-15V and 5V (single 5V optional in CO-259) CMOS: 10-15V; ECL: 10-15V and −5.2V		5V for TTL/HCMOS 12-15V for sine	10-24V and 5V single 5V supply optional
Frequency Adjustment	Voltage control	Mechanical (VCXO opt.)	Mechanical (VCXO opt.)	external potentiometer
Size	1.5" x 1.5" x 0.32" (38 x 38 x 8.2 mm)	1.5" x 2.0" x 0.4" (38 x 51 x 10.2 mm)	1.5" x 1.5" x 0.5" (38 x 38 x 12.7 mm)	0.8" x 1.4" x 0.39" (21 x 36 x 9.9 mm)

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VCXOs Voltage Controlled Crystal Oscillators

for Phase Locking Applications



	TTL			CMOS	HCMOS	ECL		SINEWAVE			
Configuration	PC board mount	low profile hybrid DIP		PC board mount	low profile hybrid DIP	low profile hybrid DIP Std. ECL	100K ECL	PC board mount		rf output connector	low profile hybrid DIP
Series	(a) **CO-231V** (b) **CO-231VH**	**CO-401V** **CO-402V**	**CO-404V**	**CO-236V**	**CO-444V**	**CO-434V**	**CO-454V**	(a) **CO-233V** (b) **CO-233VH**	**CO-233VF**	(a) **CO-233VFW** (b) **CO-286VW**	**CO-484V**
Center Frequency	(a) 32 kHz-25 MHz (b) 25.1-70 MHz	32 kHz-25 MHz	25.1-70 MHz	300 Hz-10 MHz	1 kHz-70 MHz	8-200 MHz	8-200 MHz	(a) 8-149.9 MHz (b) 150-200 MHz	8-400 MHz	(a) 8-400 MHz (b) 400.1-750 MHz	8-200 MHz
Supply Voltage	+ 5 Vdc			+ 12 Vdc	+ 5 Vdc	5.2 Vdc	4.5/ 5.2 Vdc	+ 15 Vdc (+ 12 Vdc to + 24 Vdc optional)			

Deviation/ Stability Alternatives

Code	Temperature Range	Temperature Stability	Minimum Deviation
0	0/ + 50°C	± 10 ppm	± 30 ppm
A	0/ + 50°C	± 20 ppm	± 50 ppm
B	0/ + 50°C	± 35 ppm	± 100 ppm
C*	0/ + 50°C	± 35 ppm	± 200 ppm
D	0/ + 70°C	± 20 ppm	± 40 ppm
E	0/ + 70°C	± 40 ppm	± 100 ppm
F*	0/ + 70°C	± 40 ppm	± 200 ppm

Code	**Temperature Range	Temperature Stability	Minimum Deviation
G	20/ + 70°C	± 30 ppm	± 60 ppm
H	20/ + 70°C	± 40 ppm	± 100 ppm
I*	20/ + 70°C	± 40 ppm	± 200 ppm
J	40/ + 85°C	± 40 ppm	± 60 ppm
K	40/ + 85°C	± 50 ppm	± 100 ppm
L*	40/ + 85°C	± 50 ppm	± 200 ppm
M	55/ + 85°C	± 50 ppm	± 100 ppm
N*	55/ + 85°C	± 50 ppm	± 200 ppm

**Lower temperature limit is restricted to 30°C in CO-434V and 0°C in CO-454V

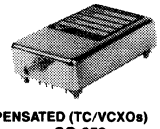
*The following notes apply to options C, F, I, L and N (± 200 ppm deviation)
- They are only available at frequencies up to 25 MHz
- Linearity of ± 10% is standard
- Models CO-231V and CO-236V, which are normally packaged in a 1.5" x 1.5" x 0.5" metal can with epoxy base, require a metal base which increases height to ⅝"; pin diameter is then .030".

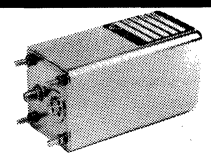
Control Voltage	0 to 5V; positive transfer function (lowest frequency at 0V)			0 to 5V; positive transfer function (lowest frequency at 0V)		0 to 5V (lowest frequency at 0V) ± 3V to ± 10V optional for CO-233MEV		0 to + 6V positive transfer function (lowest frequency at 0V) ± 3V to ± 10V optional			
						*(With bipolar control voltage option, transfer function is negative, linearity is ± 10%, and an additional + 12V to + 24V supply is required for ECL models)					
Linearity	± 20% (± 10% optional); ± 10% is standard with bipolar control voltage and with deviation/stability options C, F, I, L and N at frequencies up to 25 MHz										
Mechanical Tuning Option	"T"	N/A	N/A	"T"	N/A	N/A		"T"	"T"	"T"	N/A
	"T" indicates that a mechanical tuning option is available; add "T" to model number					"T" indicates that a mechanical tuning option is available; add "T" to model number					
Size	(a) CO-231V 1½" x 1½" x ½" (b) CO-231VH 1⅜" x 1⅜" x ½"	0.5" x 0.8" x 0.2" CO-401V: 4 pin CO-402V: 14 pin	0.8" x 0.8" x 0.2" 14 pin double DIP	1½" x 1½" x ½"	0.8" x 0.8" x 0.2" 14 pin double DIP	0.8" x 0.98" x 0.2" 16 pin double DIP		1½" x 1½" x ⅝" CO-233V & VH differ in pin configuration	2" x 2" x ¾"	(a) 2" x 2" x ¾" (b) 1" x 2" x 0.6"	0.8" x 0.98" x 0.2" 16 pin double DIP

Wide Deviation Linear VCXOs

(see last page for non-crystal VCOs)







	BASIC VCXOs		TEMPERATURE COMPENSATED (TC/VCXOs)		OVEN CONTROLLED (OC/VCXOs)	
Series	**CO-271**	**CO-275**	**CO-351**	**CO-352**	**CO-272**	**CO-276**
Center Frequency	to 23 MHz	23.1-500 MHz	to 20 MHz	20.1-500 MHz	to 23 MHz	23.1-500 MHz
Deviation	± .001% to ± .25%. Model Codes for ± .01%, ± .03%, and ± .1% are shown in the stability section below (for deviation exceeding ± 0.25% consider a Vectron non-crystal VCO or custom VCXO).					
Control Voltage	± 5 volts (higher or lower sensitivity, or unipolar control, available); Negative transfer function					
Linearity	"N": ± 5% (smooth monotonic "A": ± 3% characteristic with "B": ± 1% no discontinuities)					

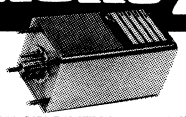
Temperature Stability	± .01% deviation (G)		± .03% deviation (H)		± .1% deviation (L)		± .01% deviation (G)		± .03% deviation (H)		± .1% deviation (L)		± .01% deviation (G)		± .03% deviation (H)		± .1% deviation (L)	
	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability
(Temperature Range B) 0°C to + 50°C	**GB35** **GB15**	± .003% ± .001%	**HB55** **HB25**	± .005% ± .002%	**LB14** **LB35**	± .01% ± .003%	**GB36** **GB57**	± .0003% ± .00005%	**HB15** **HB56**	± .001% ± .0005%	**LB25** **LB15**	± .002% ± .001%	**GB37**	± .00003%	**HB16**	± .0001%	**LB36**	± .0003%
(Temperature Range D) – 20°C to + 70°C	**GD55** **GD35**	± .005% ± .003%	**HD14** **HD55**	± .01% ± .005%	**LD24** **LD14**	± .02% ± .01%	**GD56** **GD16**	± .0005% ± .0001%	**HD15** **HD56**	± .001% ± .0005%	**LD55** **LD25**	± .005% ± .002%	**GD57**	± .00005%	**HD26**	± .0002%	**LD56**	± .0005%
(Temperature Range F) – 55°C to + 85°C	**GF55**	± .005%	**HF14**	± .01%	**LF34**	± .03%	**GF25** **GF56**	± .002% ± .0005%	**HF55** **HF25**	± .005% ± .002%	**LF14** **LF55**	± .01% ± .005%						

Output Level	Sinewave is standard (3.5-500 MHz); TTL optional (3.5-100 MHz), ECL optional (20-200 MHz); lower frequency sine/TTL, and CMOS/HCMOS available on special order.					
Supply Voltage	15 Vdc ± 5% standard; 12-28 Vdc optional. + 5 Vdc required for TTL; – 5.2 Vdc required for ECL				24 Vdc standard; 12-28 Vdc optional. + 5 Vdc required for TTL; – 5.2 Vdc required for ECL	
Frequency Adjust.	Screwdriver adjustment permits setting center frequency; range is approximately 10% of deviation, but no less than ± .001%					
Size	2" x 2" x ¾" (51 x 51 x 19 mm) 2" x 2¼" x ¾" for SW option	2" x 3" x ¾" (51 x 77 x 19 mm) (reduced size available)	2" x 2" x ¾" (51 x 51 x 19 mm) 2" x 2¼" x ¾" for SW option	2" x 3" x ¾" (51 x 77 x 19 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2" x 2" x 4" (51 x 51 x 102 mm)
Configuration Options	pins for pc board mounting (rf output connector option recommended above 200 MHz) "W": SMA, pins, and mounting studs on base "SW": SMA on side, pins on base (studs optional on CO-271SW, Std on CO-275SW) (SMC connector available)		pins for pcb mount "W": SMA, pins and mounting studs on base "SW": SMA on side, pins on base (studs optional) (SMC connector available)	pins for pcb mount and studs (rf output connector option recommended above 200 MHz) "SW": SMA on side, pins and studs on base (SMC connector available)	octal plug-in, studs "W": SMA, solder header, studs "U": SMC, solder header, studs "X": BNC, solder header, studs	SMC, solder header, studs "W": SMA, solder header, studs "X": BNC, solder header, studs

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High Frequency OCXOs
Oven Controlled Crystal Oscillators

Basic OCXOs





* Low Phase Noise Options

	HIGH STABILITY (to 5 x 10^{-10}/day)			ULTRA-STABLE (to 1 x 10^{-10}/day)	
	Most economical CO-211 SERIES	**Higher stability and output CO-200 SERIES**	**Superior temperature stability CO-244 SERIES**	**Best aging: single oven CO-206 SERIES**	**Best aging: double oven CO-246 SERIES**
Frequency	1, 2, 4, 5 or 10 MHz standard (broad range of frequencies available)			5 MHz standard (other frequencies available to 100 MHz)	
Temperature Stability (Temp. Range A) +15/+35°C	CO-21 ☐ **A38:** ±3 x 10^{-8} CO-21 ☐ **A59:** ±5 x 10^{-9}	CO-20 ☐ **A39:** ±3 x 10^{-9} CO-20 ☐ **A19:** ±1 x 10^{-9}	CO-24 ☐ **A510:** ±5 x 10^{-10}	CO-20 ☐ **A39-V:** ±3 x 10^{-9} CO-20 ☐ **A510-V:** ±5 x 10^{-10}	CO-24 ☐ **A210-V:** ±2 x 10^{-10}
(Temp. Range B) 0/+50°C	CO-21 ☐ **B58:** ±5 x 10^{-8} CO-21 ☐ **B18:** ±1 x 10^{-8}	CO-20 ☐ **B59:** ±5 x 10^{-9} CO-20 ☐ **B39:** ±3 x 10^{-9}	CO-24 ☐ **B19:** ±1 x 10^{-9}	CO-20 ☐ **B59-V:** ±5 x 10^{-9} CO-20 ☐ **B19-V:** ±1 x 10^{-9}	CO-24 ☐ **B510-V:** ±5 x 10^{-10}
(Temp. Range D) −20/+70°C	CO-21 ☐ **D17:** ±1 x 10^{-7} CO-21 ☐ **D38:** ±3 x 10^{-8}	CO-20 ☐ **D18:** ±1 x 10^{-8} CO-20 ☐ **D59:** ±5 x 10^{-9}	CO-24 ☐ **D39:** ±3 x 10^{-9}	CO-20 ☐ **D18-V:** ±1 x 10^{-8} CO-20 ☐ **D39-V:** ±3 x 10^{-9}	CO-24 ☐ **D19-V:** ±1 x 10^{-9} (−20/+60°C)
(Temp. Range G) −55/+75°C	CO-21 ☐ **G27:** ±2 x 10^{-7} CO-21 ☐ **G58:** ±5 x 10^{-8}	CO-20 ☐ **G38:** ±3 x 10^{-8}	CO-24 ☐ **G18:** ±1 x 10^{-8}	CO-20 ☐ **G38-V:** ±3 x 10^{-8} CO-20 ☐ **G18-V:** ±1 x 10^{-8}	
Aging	**4:** 1 x 10^{-8}/day **5:** 5 x 10^{-9}/day **6:** 3 x 10^{-9}/day **7:** 1 x 10^{-9}/day ***8S:** 5 x 10^{-10}/day	**1:** 1 x 10^{-8}/day **2:** 5 x 10^{-9}/day **3:** 3 x 10^{-9}/day **4:** 1 x 10^{-9}/day ***5S:** 5 x 10^{-10}/day	**4:** 1 x 10^{-9}/day ***5S:** 5 x 10^{-10}/day	**6:** 3 x 10^{-10}/day 4 x 10^{-8}/year ***7:** 1 x 10^{-10}/day 2 x 10^{-8}/year	**6:** 3 x 10^{-10}/day 4 x 10^{-8}/year ***7:** 1 x 10^{-10}/day 2 x 10^{-8}/year
	*8S and 5S types use SC cut crystals for 5 x 10^{-10}/day, 1 x 10^{-7}/year aging with further improved aging available.			*1 x 10^{-10}/day models available only at 1, 5 and 10 MHz	
Output Level	Standard: >1 Vrms into 500Ω Optional: 0 or +7 dBm/50Ω, TTL or HCMOS	Standard: >1 Vrms into 50Ω Optional: TTL, HCMOS, or ECL	Standard: >1 Vrms into 500Ω Optional: 0, 7 or +13 dBm/50Ω, TTL, HCMOS or ECL	Standard: >1 Vrms into 50Ω Optional: TTL or HCMOS	
Supply Voltage	24 Vdc standard (Operation from any voltage in 5-28 Vdc range optional)			24 Vdc standard (Operation from any voltage in 15-28 Vdc range optional)	
Input Power	<6 watts at turn-on (−20/+70°C); <3 watts stabilized (25°C) reduced power drain available			<6 watts at turn-on (−20/+70°C) <3 watts stabilized (25°C)	<11 watts at turn-on (0/+70°C) <5 watts stabilized (25°C)
Frequency Adjustment	Screwdriver adjustment settable to 1 x 10^{-8} nominal. Electronic tuning (VCXO) option "**V**"			Screwdriver adjustment and electronic tuning	
Size	2" x 2" x 3" (51 x 51 x 76 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	2¼" x 2¼" x 4¼" (57x 57 x 110 mm)	3" x 3" x 5½" (76 x 76 x 140 mm)
Base	Octal plug, solder header or rf connector with solder header			Same options as CO-244	Solder header and BNC

* **Phase noise (typical)** with sine output in 4-12 MHz range for "High Stability" Series and in 4-6 MHz range for "Ultra-Stable" Series

Offset from Carrier	Standard	Low Noise Option L1	*Ultra Low Noise Option L2
100 Hz	−130 dBc/Hz	−135 dBc/Hz	−150 dBc/Hz
1 kHz	−140 dBc/Hz	−145 dBc/Hz	−163 dBc/Hz
10 kHz	−143 dBc/Hz	−148 dBc/Hz	−165 dBc/Hz
50 kHz	−145 dBc/Hz	−150 dBc/Hz	−168 dBc/Hz

*Output level with L2 option is +10 dBm minimum for all models; SMA output connector is standard.

Offset from Carrier	Standard	*Ultra-Low Noise Option L2
10 Hz	−115 dBc/Hz	−135 dBc/Hz
100 Hz	−135 dBc/Hz	−155 dBc/Hz
1 kHz	−145 dBc/Hz	−165 dBc/Hz
10 kHz	−148 dBc/Hz	−168 dBc/Hz
50 kHz	−150 dBc/Hz	−168 dBc/Hz

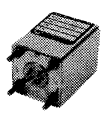
*L2 option restricted to +10 dBm output

Size Reduced OCXOs

Low Profile PC Board Mount OCXOs



Premium Performance Miniature OCXOs



* Low Phase Noise Options

	CO-711 SERIES (AT Cut Crystal)	CO-718S SERIES (SC/IT Cut Crystal)	CO-700 SERIES (AT Cut Crystal)	CO-705S SERIES (SC/IT Cut Crystal)
Frequency	5 MHz and 10 MHz standard (broad range of frequencies available)			
Temperature Stability (Temp. Range A) +15°C to +35°C	CO-71 ☐ **A28:** ±2 x 10^{-8} CO-71 ☐ **A59:** ±5 x 10^{-9}	CO-718SA28: ±2 x 10^{-8} CO-718SA59: ±5 x 10^{-9}	CO-70 ☐ **A59:** ±5 x 10^{-9} CO-70 ☐ **A19:** ±1 x 10^{-9}	CO-705SA39: ±3 x 10^{-9} CO-705SA510: ±5 x 10^{-10}
(Temp. Range B) 0°C to +50°C	CO-71 ☐ **B58:** ±5 x 10^{-8} CO-71 ☐ **B18:** ±1 x 10^{-8}	CO-718SB58: ±5 x 10^{-8} CO-718SB18: ±1 x 10^{-8}	CO-70 ☐ **B18:** ±1 x 10^{-8} CO-70 ☐ **B29:** ±2 x 10^{-9}	CO-705SB59: ±5 x 10^{-9} CO-705SB19: ±1 x 10^{-9}
(Temp. Range D) −20°C to +70°C	CO-71 ☐ **D17:** ±1 x 10^{-7} CO-71 ☐ **D38:** ±3 x 10^{-8}	CO-718SD17: ±1 x 10^{-7} CO-718SD38: ±3 x 10^{-8}	CO-70 ☐ **D38:** ±3 x 10^{-8} CO-70 ☐ **D59:** ±5 x 10^{-9}	CO-705SD18: ±1 x 10^{-8} CO-705SD39: ±3 x 10^{-9}
(Temp. Range G) −55°C to +75°C	*CO-71 ☐ **G27:** ±2 x 10^{-7} *CO-71 ☐ **G58:** ±5 x 10^{-8}	CO-718SG27: ±2 x 10^{-7} CO-718SG58: ±5 x 10^{-8}	CO-70 ☐ **G58:** ±5 x 10^{-8} CO-70 ☐ **G18:** ±1 x 10^{-8}	CO-705SG28: ±2 x 10^{-8} CO-705SG59: ±5 x 10^{-9}
(Temp. Range F) −55°C to +85°C	*not available with L2 option	*CO-718SF27: ±2 x 10^{-7} *CO-718SF58: ±5 x 10^{-8}		CO-705SF38: ±3 x 10^{-8} CO-705SF18: ±1 x 10^{-8}
Aging	**4:** 1 x 10^{-8}/day (2 x 10^{-6}/year) **5:** 5 x 10^{-9}/day (1.5 x 10^{-6}/year) **6:** 3 x 10^{-9}/day (1 x 10^{-6}/year) **7:** 1 x 10^{-9}/day (3 x 10^{-7}/year)	5 x 10^{-10}/day (1 x 10^{-7}/year) (5 x 10^{-8}/year optional at some frequencies)	**1:** 1 x 10^{-8}/day (2 x 10^{-6}/year) **2:** 5 x 10^{-9}/day (1.5 x 10^{-6}/year) **3:** 3 x 10^{-9}/day (1 x 10^{-6}/year) **4:** 1 x 10^{-9}/day (3 x 10^{-7}/year)	5 x 10^{-10}/day (1 x 10^{-7}/year) (5 x 10^{-8}/year optional at some frequencies)
Restabilization (frequency relative to that 2 hours after turn-on)	1 x 10^{-7}: 8 minutes 3 x 10^{-8}: 12 minutes 1 x 10^{-8}: 30 minutes	Standard / 6W Turn-on 1 x 10^{-7}: 7 minutes / 4 minutes 3 x 10^{-8}: 10 minutes / 7 minutes 1 x 10^{-8}: 15 minutes / 10 minutes	1 x 10^{-7}: 10 minutes 3 x 10^{-8}: 15 minutes 1 x 10^{-8}: 30 minutes	Standard / 15W Turn-on 1 x 10^{-7}: 9 minutes / 3 minutes 3 x 10^{-8}: 12 minutes / 4 minutes 1 x 10^{-8}: 15 minutes / 5 minutes
Output Level	>0.5 Vrms/50Ω (+7 dBm); >1 Vrms/50Ω (+13 dBm) with L2 option HCMOS/TTL optional		>1 Vrms/50Ω (+13 dBm) HCMOS/TTL optional	
Supply Voltage	+15 Vdc standard (12-24 Vdc optional); +5 Vdc also for logic output.			
Input Power	<3 Watts at turn-on; <1.5 Watts stabilized at 25°C		<5 Watts at turn-on; <2 Watts stabilized at 25°C	
Frequency Adjustment	Screwdriver adjustment settable to 1 x 10^{-8}. Option "**V**": Voltage tuning			
Size	2" x 2" x 1", pins for pc board mounting		1.5" x 1.5" x 2", solder header and studs; SMA output optional	

* **Phase Noise** (with sinewave output)

Offset	Standard	Option L2
10 Hz	−105 dBc/Hz	−120 dBc/Hz
100 Hz	−135 dBc/Hz	−145 dBc/Hz
1 kHz	−145 dBc/Hz	−160 dBc/Hz
10 kHz	−150 dBc/Hz	−165 dBc/Hz
50 kHz	−150 dBc/Hz	−168 dBc/Hz

Offset	Standard	Option L2
10 Hz	−120 dBc/Hz	−130 dBc/Hz
100 Hz	−140 dBc/Hz	−150 dBc/Hz
1 kHz	−145 dBc/Hz	−160 dBc/Hz
10 kHz	−150 dBc/Hz	−165 dBc/Hz
50 kHz	−150 dBc/Hz	−168 dBc/Hz

Offset	Standard	Option L2
10 Hz	105 dBc/Hz	−120 dBc/Hz
100 Hz	−135 dBc/Hz	−145 dBc/Hz
1 kHz	−145 dBc/Hz	−160 dBc/Hz
10 kHz	−150 dBc/Hz	−165 dBc/Hz
50 kHz	−150 dBc/Hz	−168 dBc/Hz

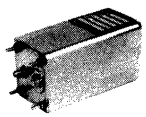
Offset	Standard	Option L2
10 Hz	120 dBc/Hz	130 dBc/Hz
100 Hz	140 dBc/Hz	150 dBc/Hz
1 kHz	145 dBc/Hz	160 dBc/Hz
10 kHz	150 dBc/Hz	165 dBc/Hz
50 kHz	150 dBc/Hz	168 dBc/Hz

VECTRON
The Crystal Oscillator Company
VECTRON LABORATORIES, INC.
166 Glover Avenue, Norwalk, Connecticut 06850
Tel.: 203/853-4433 TWX: 710/468-3796 FAX: 203/849-1423

VHF OCXOs Oven Controlled Crystal Oscillators (25-400 MHz)

*Low Phase Noise

Ask about our new CO-724 Series OCXO measuring only 2"x2"x1" for either pcb mounting or with SMA connector (25-140 MHz).



	Most Economical CO-228/CO-229 SERIES	Higher Output Level and Higher Frequency CO-223/CO-224 SERIES	Superior Aging and Stability CO-220/CO-225 SERIES	
Frequency	25 MHz to 200 MHz	25 MHz to 400 MHz	25 MHz to 200 MHz	
Temperature Stability (Temp. Range **A**): +15°C to +35°C	CO-22 ☐ **A38:** ±3 x 10^{-8} CO-22 ☐ **A59:** ±5 x 10^{-9}	CO-22 ☐ **A38:** ±3 x 10^{-8} CO-22 ☐ **A59:** ±5 x 10^{-9}	CO-22 ☐ **A16:** ±1 x 10^{-8} CO-22 ☐ **A19:** ±1 x 10^{-9}	CO-225S **A18:** ±1 x 10^{-8} CO-225S **A19:** ±1 x 10^{-9}
(Temp. Range **B**): 0°C to +50°C	CO-22 ☐ **B58:** ±5 x 10^{-8} CO-22 ☐ **B18:** ±1 x 10^{-8}	CO-22 ☐ **B58:** ±5 x 10^{-8} CO-22 ☐ **B18:** ±1 x 10^{-8}	CO-22 ☐ **B58:** ±5 x 10^{-8} CO-22 ☐ **B18:** ±1 x 10^{-8} CO-22 ☐ **B29:** ±2 x 10^{-9}	CO-225S **B58:** ±5 x 10^{-8} CO-225S **B18:** ±1 x 10^{-8} CO-225S **B29:** ±2 x 10^{-9}
(Temp. Range **D**): −20°C to +70°C	CO-22 ☐ **D17:** ±1 x 10^{-7} CO-22 ☐ **D38:** ±3 x 10^{-8}	CO-22 ☐ **D17:** ±1 x 10^{-7} CO-22 ☐ **D38:** ±3 x 10^{-8}	CO-22 ☐ **D38:** ±3 x 10^{-8} CO-22 ☐ **D18:** ±1 x 10^{-8} CO-22 ☐ **D59:** ±5 x 10^{-9}	CO-225S **D38:** ±3 x 10^{-8} CO-225S **D18:** ±1 x 10^{-8} CO-225S **D59:** ±5 x 10^{-9}
(Temp. Range **G**): −55°C to +75°C	CO-22 ☐ **G27:** ±2 x 10^{-7} CO-22 ☐ **G58:** ±5 x 10^{-8}	CO-22 ☐ **G27:** ±2 x 10^{-7} CO-22 ☐ **G58:** ±5 x 10^{-8}	CO-22 ☐ **G17:** ±1 x 10^{-7} CO-22 ☐ **G38:** ±3 x 10^{-8}	CO-225S **G17:** ±1 x 10^{-7} CO-225S **G38:** ±3 x 10^{-8}
(Temp. Range **F**): −55°C to +85°C	▲	▲	▲	CO-225S **F58:** ±5 x 10^{-8}
Aging	[3] 3 x 10^{-8}/day, 5 x 10^{-6}/year [4] 1 x 10^{-8}/day, 2 x 10^{-6}/year	[3] 3 x 10^{-8}/day, 5 x 10^{-6}/year [4] 1 x 10^{-8}/day, 2 x 10^{-6}/year	[3] 3 x 10^{-9}/day, 1 x 10^{-6}/year [5] 1 x 10^{-9}/day, 3 x 10^{-7}/year	5 x 10^{-10}/day, 1 x 10^{-7}/year
Output Level	Standard: >0.5 Vrms into 50Ω (+7 dBm) Optional: TTL to 100 MHz	Standard: >1 Vrms into 50Ω (+13 dBm) Optional: ECL (to 200 MHz)	Standard: >0.5 Vrms into 50Ω (+7 dBm) Optional: +13 dBm ("**R**"), TTL, ECL	
Supply Voltage	24 Vdc standard. Operation from any specified voltage in 12-28 Vdc range optional.			
Input Power	<6 watts at turn-on (−20/+70°C); <3 watts stabilized (25°C)			
Frequency Adjustment	Screwdriver adjust, settable to <1 x 10^{-8} nominal. Electronic tuning (VCXO) option "**V**".			
Size	2" x 2" x 3" (51 x 51 x 77 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	
Base	SMC output, solder header and 4 studs; SMA or BNC optional			

*** Phase noise** typical, with sine output in 75-125 MHz range

Offset from Carrier	Standard	Ultra-low noise option not available
100 Hz	−120 dBc/Hz	
1 kHz	−135 dBc/Hz	
10 kHz	−140 dBc/Hz	
50 kHz	−145 dBc/Hz	

Offset from Carrier	Standard	*Ultra Low Noise Option **L2**
100 Hz	−120 dBc/Hz	−130 dBc/Hz
1 kHz	−135 dBc/Hz	−145 dBc/Hz
10 kHz	−140 dBc/Hz	−150 dBc/Hz
50 kHz	−145 dBc/Hz	−155 dBc/Hz

*L2 option is restricted to +10 dBm (+7 dBm above 300 MHz)

Offset from Carrier	Standard	*Ultra Low Noise Option **L2**
100 Hz	−105 dBc/Hz	−120 dBc/Hz
1 kHz	−115 dBc/Hz	−130 dBc/Hz
10 kHz	−120 dBc/Hz	−135 dBc/Hz
50 kHz	−125 dBc/Hz	−140 dBc/Hz

*L2 option is available to 125 MHz; contact factory for further improvement.

Replacement for for Hewlett Packard Model 10811B



Vectron type CO-811B offers mechanical and electrical-interface interchangeability with discontinued HP10811B

Aging	5 x 10^{-10}/day 1 x 10^{-7}/year
0/+71°C **−55/+71°C**	2.5 x 10^{-9} p-p 4.5 x 10^{-9} p-p
Noise	100 Hz: −145 dBc/Hz 10 kHz: −168 dBc/Hz
Crystal	SC-cut for fast stabilization

Note: if mechanical interchangeability with HP10811B is not required, we suggest that you select a model from page 6.

VCOs Non-Crystal Oscillators





Series	VC-381	VC-371	VC-373
Center Frequency	10 Hz to 500 kHz	500 kHz to 500 MHz	1 MHz to 90 MHz
Deviation	±10%; wider and narrower deviation optional to a full octave (limited to 300 MHz in VC-371 and 75 MHz in VC-373)		
Control Voltage	±5V (higher and lower sensitivity optional)		0 to +5V (±5V optional)
Linearity	±1%	±10% standard (±3% and ±1% optional with limited deviation)	±10%
Transfer Function	Positive	Negative	Positive for 0 to 5V Negative for ±5V
Accuracy (25°C)	±0.5% (tuning adjust optional, settable to ±0.1%)		N/A
Temperature Stability	**Standard:** 0/+50°C: ±1.5% Option **1**: −20/+70°C: ± 3% Option **2**: −55/+85°C: ± 6%	**Standard:** 0/+50°C: ±1% Option **1**: −20/+70°C: ±2% Option **2**: −55/+85°C: ±4% *Option **3**: 0/+50°C: ±0.3% *Option **4**: −20/+70°C: ±0.5% *Only for deviation ≤ ±10% Improved stability with oven	**Std:** 0/+50°C: ±2% ±1% Opt **1**: −20/+70°C: ±3% ±2% Opt **2**: −55/+85°C: ±5% ±4% Opt **3**: −55/+125°C: ±6% ±5% *unipolar control voltage **bipolar control voltage
Output Level	>1 Vrms into 1kΩ (TTL and CMOS optional)	>0.5 Vrms into 50Ω (TTL, CMOS, ECL optional)	TTL (HCMOS optional to 40 MHz)
Supply Voltage	15 Vdc ±5% (12-28 Vdc optional) +5 Vdc required for TTL, −5.2 Vdc required for ECL		5 Vdc ±5%
Size	2" x 2" x ¾" (51 x 51 x 19 mm) reduced height optional		0.5" x 0.8" x 0.2"
Configuration	Pins on base for pc board mounting Option "**W**": SMA, pins and mounting studs on base Option "**SW**": SMA on side, pins on base (size is 2" x 2¼" x ¾")		14 pin DIP

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SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States (ANSI) American National Standards Institute

United States (NEMA) National Electrical Manufacturers Association

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

XSIS

The QPL Source for Hybrid Oscillators M55310/8, 11, 14, 15, 16, 17, 18, 19

XSIS has earned the reputation among OEM's as the industry's most reliable supplier of advanced-design microcircuit crystal oscillators. Superior designs and consistent high-quality workmanship make the XSIS oscillators virtually failure-free. Overall quality and the industry's best on-time quoted delivery make XSIS the supplier of choice for hi-rel hybrid oscillators.

TTL — CMOS — HCMOS — ECL — GATED — SCHOTTKY — MULTI- FREQUENCY OUTPUTS

All oscillators manufactured by XSIS are tested for all electrical parameters over the operating temperature range. 100% screening tests include fine and gross leak, constant acceleration, automatic temperature cycling and electrical tests plus 160-hour power-on burn in. When required, other testing may include PIND test, destructive and non-destructive bond pull test and die shear test. These tests are also performed in-house on a continuous sampling basis to insure consistent quality.

Environmental tests performed in-house include shock and vibration, salt spray, moisture resistance and 8-hour steam aging.

Temperature, humidity, airborne particulate levels and electrostatic discharge (ESD) conditions are monitored and controlled in our expanded engineering, production assembly and test areas.

XSIS Electronics, Inc. is an OEM certified supplier and our only product is the superior hybrid crystal oscillator. As a QPL source, all XSIS microcircuit oscillators are manufactured to the electrical and mechanical parameters of MIL-O-55310, workmanship standards are in accordance with MIL-H-38534, the product assurance program plan is in accordance with MIL-STD-790E, and the quality system is as required by MIL-I-45208B.

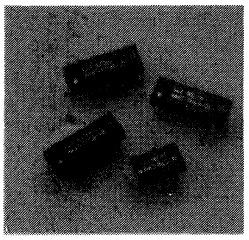
- Calibration accuracy: ± .0015% @ +25°C.
- Frequency stability-vs-temperature: ±.005% over -55°C to +125°C
- Frequency aging @ +25°C: ±.0005% per year
- Lowered input current
- Unique, rugged design for high shock and vibration environs
- Resistance-welded, hermetically-sealed .480" square LCC and 14-pin DIP packages for utmost long-term reliability

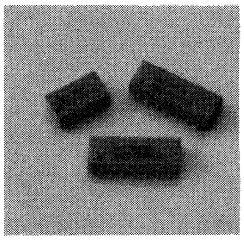
XSIS **is** excellence in hybrid oscillators

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12620 W. 63rd St.
Shawnee, KS 66216 USA
(913) 631-0448
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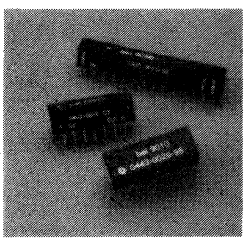
DELAY LINES





bel...Defining a degree of excellence

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Transfer Molded Delay Lines
DIP & SIP Packages
Surface Mount Delay Lines with tape & reeling
Active & Passive Delay Lines
Module Delay Lines
Fast Logic Delay Lines
CMOS Delay Lines
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When you need delay lines, miniature or micro fuses, magnetic products, or custom thick film hybrids...come to bel, the company who has been supplying the world with electronic components since 1949.

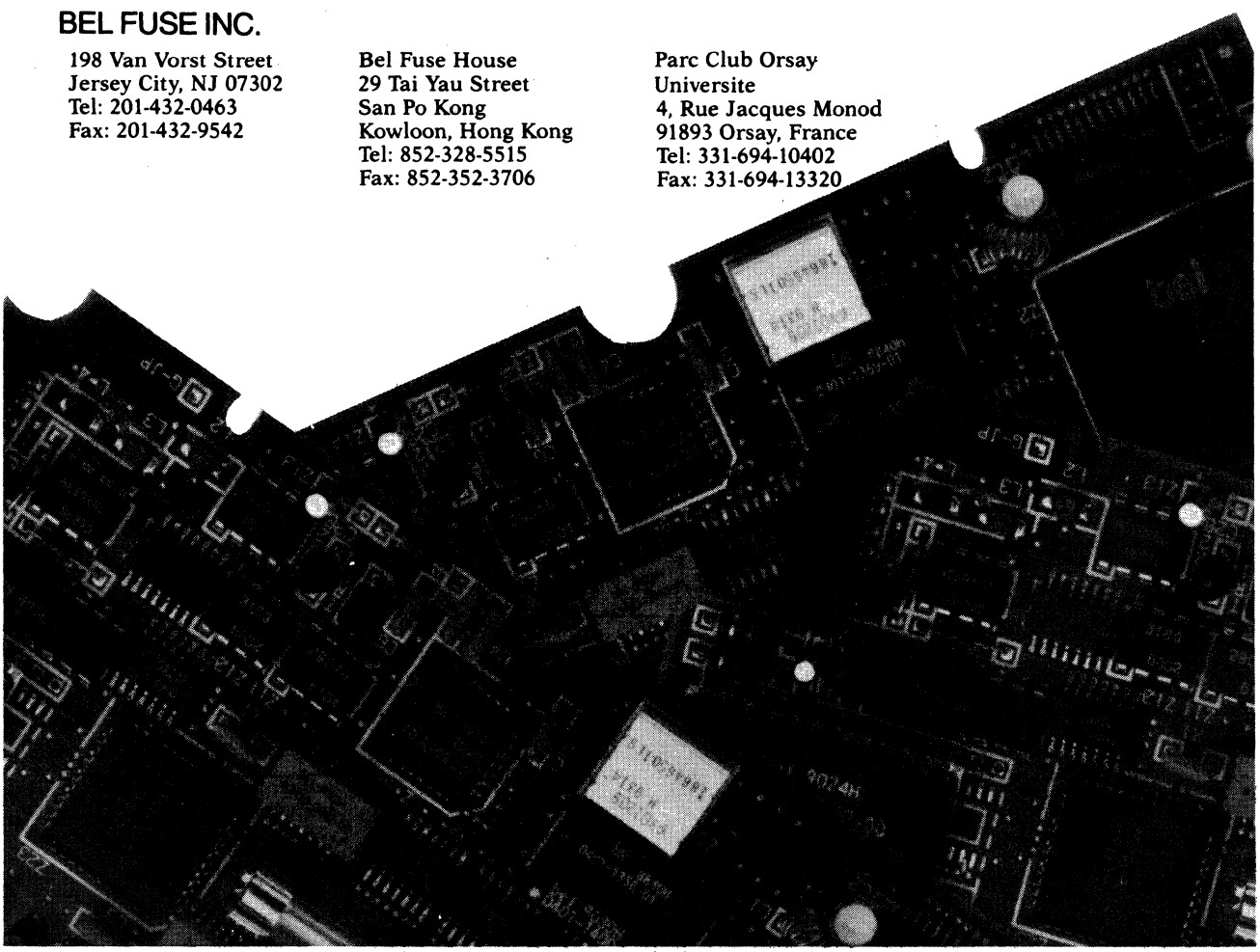
bel

BEL FUSE INC.

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Fax: 201-432-9542

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Tel: 852-328-5515
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91893 Orsay, France
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DELAY LINES

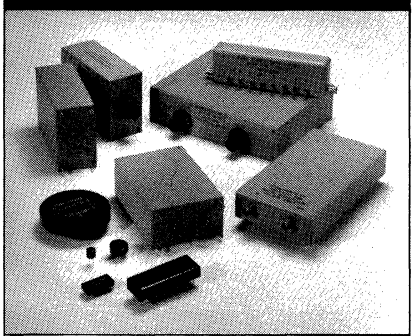
Manufacturer	Starting EEM Page No.	Passive				Digital				
		Distributed Constant		Lumped Constant						
		Fixed	Variable	Fixed	Variable	Tapped	Program-mable	Video	Glass & Quartz	Other Types
Allen Avionics Inc.	A•1494	√§*	√§*	√§*	√§*	√§*	√§*	√§*		
Automatic Coil Corp.	A•1495	√§		√§*		√§*	√§*	√§*		
Bel Fuse Inc.	A•1499	√	√	√	√	√§	√§			
Dallas Semiconductor	A•1529					√§	√§			DIPS; delay lines with logic
Data Delay Devices	A•1532	√§*	√§*	√§*	√§*	√§*	√§*	√§*		
Elmec Tech. of America	A•1549	√§*	√*	√§*	√§*		√			
ESC Electronics Corp.	A•1558			√§*		√§*	√§*	√§*		
JBM Electronics Inc.	A•1572			√§*		√§*	√			
Kappa Technologies	A•1578	√*	√*	√§*	√*	√§*	√§*	√*		
PCA Electronics	A•1589			√§		√§	√§			
RCD Components	A•1595	√ç*		√§*		√§*	√§*			
TDK Corp. of America	A•1597			√§						Active, lump constant fixed
Technitrol Inc.	A•1598	√§*		√§*		√§*	√§*			
Valor Electronics	A•1606	√§		√§		√§	√			Silicon delay lines

* Mil Specs § Surface Mount

ALLEN AVIONICS, INC.

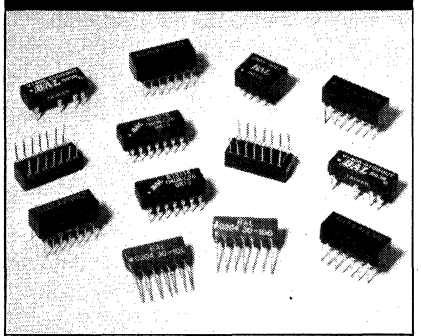
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Video Delay Lines • General Purpose Delay Lines
Video Filters • LC Filters from 20Hz to 3GHz
Video Hum Eliminators & Isolation Transformers
Digital Delay Lines and Video Instrumentation.

GENERAL PURPOSE DELAY LINES



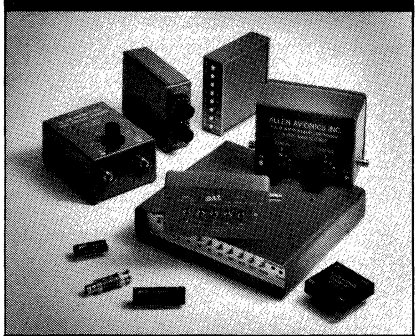
- Audio
- RF
- Lumped & Distributed
- Spiradel
- Fixed
- Variable
- Tapped
- Dual-In-Line
- Programmable
- Miniature & TO5 Package
- Radio Paging
- High Frequency
- Custom Designs
- Military
- Surface Mount

DIGITAL DELAY LINES



- TTL
- DTL
- ECL
- Fixed
- Variable
- Programmable
- Ultra-High-Speed
- Surface Mount
- Delay Trimmers

VIDEO DELAY LINES



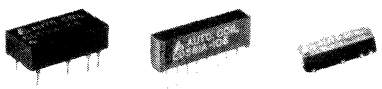
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Phone: (305) 696-6660 • Fax: (305) 696-0626

TTL Digital Delay Module, 5 TAP



- TTL input and outputs
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10 TTL loads/tap, 20 TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to +125°C

Electrical Characteristics:

VIH (High level input voltage) ..2.0 to 5.0V
IIH (High level input current) ..50 μA Max.
VIL (Low level input voltage) ....0.8V Max.
IIL (Low level input current) . −2 ma Max.
VOH (High level output voltage) ..2.5V Min.
VOL (Low level output voltage) ..0.5V Max.
VCC (Supply voltage) .....5.0V ±0.25 VDC
ICC (Supply current) ..... 75 ma Max.

Specifications subject to change without notice.

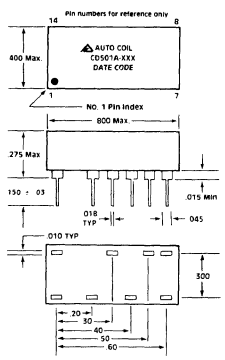
Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

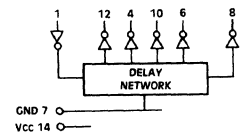
Input Conditions:
1) Pulse amplitude 3.20V
2) Input rise time 3.0 NS (10 to 90%)
3) Pulse width 2 x total delay
4) Duty cycle < 25%

Input and test conditions are not limiting parameters.

CD501 SERIES, 14 PIN DIP

COMMERCIAL VERSION





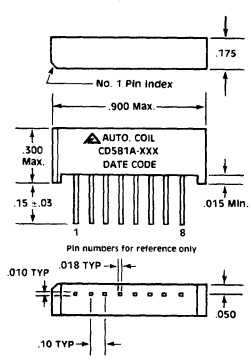
Mechanical Specifications:
Case: Epoxy filled D.A.P.
Leads: Alloy 42 or equiv. solder coated
Marking: White epoxy ink
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Failing edge delay specifications
Non tapped modules
Military versions
LS and ALS versions
Auto insertable modules

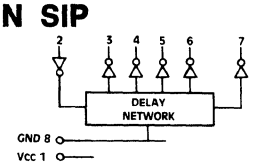
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD501A-101	5	10	15	20	25
CD501A-102	6	12	18	24	30
CD501A-103	7	14	21	28	35
CD501A-104	8	16	24	32	40
CD501A-105	9	18	27	36	45
CD501A-106	10	20	30	40	50
CD501A-107	15	30	45	60	75
CD501A-108	20	40	60	80	100
CD501A-109	25	50	75	100	125
CD501A-110	30	60	90	120	150
CD501A-111	40	80	120	160	200
CD501A-112	50	100	150	200	250
CD501A-113	60	120	180	240	300
CD501A-114	70	140	210	280	350
CD501A-115	80	160	240	320	400
CD501A-116	90	180	270	360	450
CD501A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD581 SERIES, 8 PIN SIP

ULTRA THIN SPACE SAVER





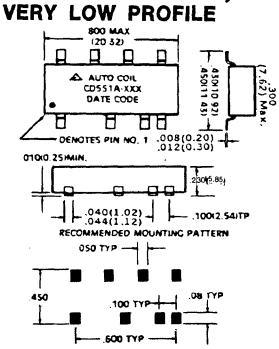
Mechanical Specifications:
Case: Epoxy filled D.A.P.
Leads: Phosphor bronze or equiv. solder coated
Marking: White epoxy ink
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications
Non tapped modules

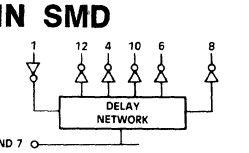
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
CD581A-101	5	10	15	20	25
CD581A-102	6	12	18	24	30
CD581A-103	7	14	21	28	35
CD581A-104	8	16	24	32	40
CD581A-105	9	18	27	36	45
CD581A-106	10	20	30	40	50
CD581A-107	15	30	45	60	75
CD581A-108	20	40	60	80	100
CD581A-109	25	50	75	100	125
CD581A-110	30	60	90	120	150
CD581A-111	40	80	120	160	200
CD581A-112	50	100	150	200	250
CD581A-113	60	120	180	240	300
CD581A-114	70	140	210	280	350
CD581A-115	80	160	240	320	400
CD581A-116	90	180	270	360	450
CD581A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD551 SERIES, 14 PIN SMD

VERY LOW PROFILE





Mechanical Specifications:
Case: Transfer molded epoxy
Leads: Phosphor bronze or equiv. solder coated
Marking: White epoxy ink
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications
Non tapped modules

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD551A-101	5	10	15	20	25
CD551A-102	6	12	18	24	30
CD551A-103	7	14	21	28	35
CD551A-104	8	16	24	32	40
CD551A-105	9	18	27	36	45
CD551A-106	10	20	30	40	50
CD551A-107	15	30	45	60	75
CD551A-108	20	40	60	80	100
CD551A-109	25	50	75	100	125
CD551A-110	30	60	90	120	150
CD551A-111	40	80	120	160	200
CD551A-112	50	100	150	200	250
CD551A-113	60	120	180	240	300
CD551A-114	70	140	210	280	350
CD551A-115	80	160	240	320	400
CD551A-116	90	180	270	360	450
CD551A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

COMPLETE TECHNICAL SPECIFICATIONS SHOWN IN CATALOG AC-37, AVAILABLE FREE UPON REQUEST.

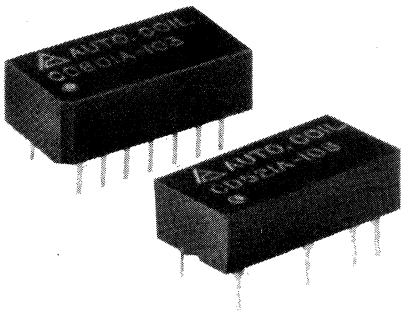
Automatic Coil Corp.
Subsidiary of Designatronics, Inc.
Dept. E 3545 N.W. 71st Street, Miami FL 33147
Phone: (305) 696-6660 • Fax: (305) 696-0626

TTL Digital Delay Module

- TTL input and outputs
- Usable for pulse widths to 20% of total delay
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10 TTL loads/tap, 20 TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to +125°C

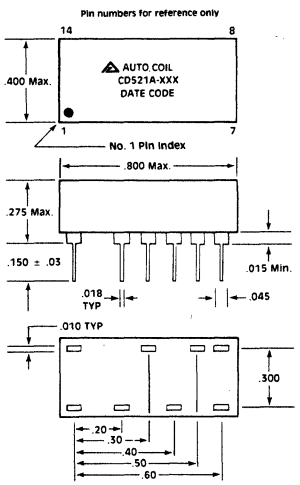
Electrical Characteristics:

VIH (High level input voltage) ..2.0 to 5.0V
IIH (High level input current) ..50 μA Max.
VIL (Low level input voltage) ....0.8V Max.
IIL (Low level input current) . −2 ma Max.
VOH (High level output voltage) ..2.5V Min.
VOL (Low level output voltage) ..0.5V Max.
VCC (Supply voltage) .....5.0V ±0.25 VDC
Specifications subject to change without notice.



CD521 SERIES 14 PIN, 5 TAP

CONTROLLED LEADING AND FALLING EDGES



Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading and falling edges

Input Conditions:

1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width 2 x total delay delay
4) Duty cycle: < 25%

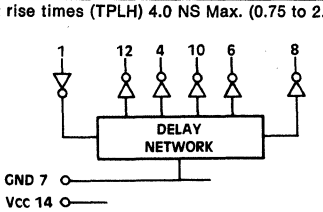
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Non tapped modules
Input and test conditions are not limiting parameters.

ICC (Supply Current) ..... 75 ma Max.

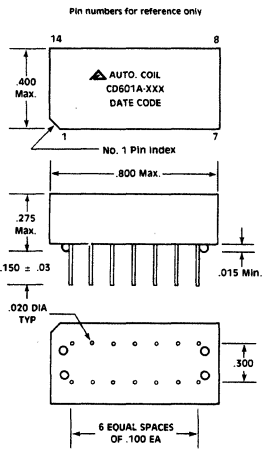
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater

Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD521A-101	5	10	15	20	25
CD521A-102	6	12	18	24	30
CD521A-103	7	14	21	28	35
CD521A-104	8	16	24	32	40
CD521A-105	9	18	27	36	45
CD521A-106	10	20	30	40	50
CD521A-107	15	30	45	60	75
CD521A-108	20	40	60	80	100
CD521A-109	25	50	75	100	125
CD521A-110	30	60	90	120	150
CD521A-111	40	80	120	160	200
CD521A-112	50	100	150	200	250
CD521A-113	60	120	180	240	300
CD521A-114	70	140	210	280	350
CD521A-115	80	160	240	320	400
CD521A-116	90	180	270	360	450
CD521A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)



CD601 SERIES 14 PIN, 10 TAP



Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:

1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 2 x total delay
4) Duty cycle: < 25%

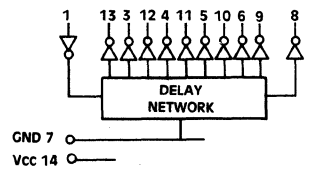
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications
Input and test conditions are not limiting parameters.

ICC (Supply Current) .....150 ma Max.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater

Automatic Coil Part Number	Total Delay	Tap Delay
CD601A-101	50	5.0
CD601A-102	75	7.5
CD601A-103	100	10.0
CD601A-104	150	15.0
CD601A-105	200	20.0
CD601A-106	250	25.0
CD601A-107	300	30.0
CD601A-108	350	35.0
CD601A-109	400	40.0
CD601A-110	450	45.0
CD601A-111	500	50.0
CD601A-112	600	60.0
CD601A-113	700	70.0
CD601A-114	800	80.0
CD601A-115	900	90.0
CD601A-116	1000	100.0

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)



Ask about our military version.

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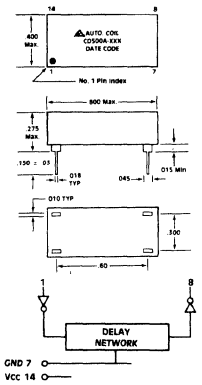
TTL Digital Delay Module

CD500/502 Series 14 PIN, SINGLE & MULTI DELAY MODULE



CD500A SERIES

Pin numbers for reference only



Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delay measured @ 1.5V level
5) Delay and tolerance for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:
1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 2 x total delay
4) Duty cycle: < 25%

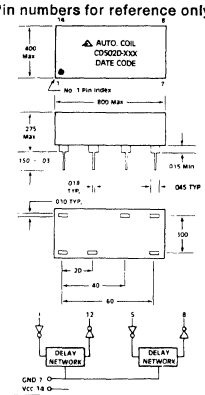
Input and test conditions are not limiting parameters.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater			
Automatic Coil Part Number	PIN 1 to 8	Automatic Coil Part Number	PIN 1 to 8
CD500A-101	6	CD500A-118	60
CD500A-102	8	CD500A-119	70
CD500A-103	10	CD500A-120	80
CD500A-104	12	CD500A-121	90
CD500A-105	14	CD500A-122	100
CD500A-106	16	CD500A-123	110
CD500A-107	18	CD500A-124	120
CD500A-108	20	CD500A-125	130
CD500A-109	22	CD500A-126	140
CD500A-110	24	CD500A-127	150
CD500A-111	26	CD500A-128	200
CD500A-112	28	CD500A-129	250
CD500A-113	30	CD500A-130	300
CD500A-114	35	CD500A-131	350
CD500A-115	40	CD500A-132	400
CD500A-116	45	CD500A-133	450
CD500A-117	50	CD500A-134	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD502D SERIES

Pin numbers for reference only



Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:
1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 3 x total delay
4) Duty cycle: < 25%

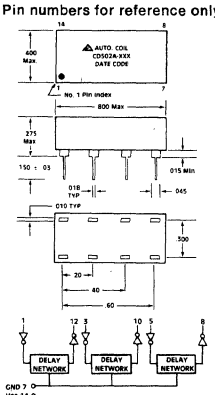
Input and test conditions are not limiting parameters.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater		
Automatic Coil Part Number	PIN 1 to 12	PIN 5 to 8
CD502D-151	5	5
CD502D-152	10	10
CD502D-153	20	20
CD502D-154	30	30
CD502D-155	40	40
CD502D-156	50	50
CD502D-157	60	60
CD502D-158	70	70
CD502D-159	80	80
CD502D-160	90	90
CD502D-161	100	100
CD502D-171	5	20
CD502D-172	10	20
CD502D-173	10	30
CD502D-174	20	50
CD502D-175	50	100

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD502A SERIES

Pin numbers for reference only



Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:
1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 3 x total delay
4) Duty cycle: < 25%

Input and test conditions are not limiting parameters.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater			
Automatic Coil Part Number	PIN 1 to 12	PIN 3 to 10	PIN 5 to 8
CD502A-101	5	5	5
CD502A-102	10	10	10
CD502A-103	20	20	20
CD502A-104	30	30	30
CD502A-105	40	40	40
CD502A-106	50	50	50
CD502A-107	60	60	60
CD502A-108	70	70	70
CD502A-109	80	80	80
CD502A-110	90	90	90
CD502A-111	100	100	100
CD502A-121	5	10	20
CD502A-122	10	20	20
CD502A-123	10	10	30
CD502A-124	20	30	50
CD502A-125	50	50	100

Output rise time (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

- TTL input and outputs
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10 TTL loads/tap, 20 TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to +125°C

Electrical Characteristics:

VIH (High level input voltage) ..2.0 to 5.0V
IIH (High level input current) ..50 μA Max.
VIL (Low level input voltage) ....0.8V Max.
IIL (Low level input current) . −2 ma Max.
VOH (High level output voltage) ..2.5V Min.
VOL (Low level output voltage) ..0.5V Max.
VCC (Supply voltage) .....5.0V ±0.25 VDC

Specifications subject to change without notice.

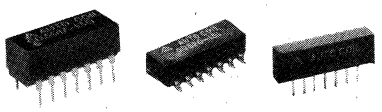
Also Available:

Intermediate delays
Lower profiles
Tighter delay tolerances
Falling edge delay specifications tapped modules
Military versions, LS, AS and ALS modules

COMPLETE TECHNICAL SPECIFICATIONS SHOWN IN CATALOG AC-37, AVAILABLE FREE UPON REQUEST.

Passive Delay Line

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- Standard packages
- Compatible with various logic systems including TTL and video
- Precise and stable delays
- Reliable hybrid construction
- Designed to meet MIL-D-23859
- Operating temperature −55° to +125°C

Electrical Characteristics:

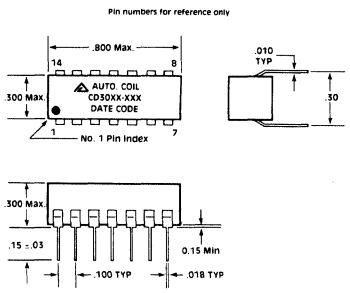
Total delay tolerances: ±2 NS or 5%, whichever is greater
Tap interval tolerances:
Below 5.0 NS: ±0.5 NS or ±20%, whichever is greater
5 NS and above: ±1.0 NS or ±10%, whichever is greater
Impedance tolerance: ±10%
Temperature coefficient: 100 PPM/°C
Dielectric strength: 100 VDC @ 50 ma 5 Sec. Min.
Insulation resistance: 1000MΩ Min.
Attenuation: 10% Max.
Specifications subject to change without notice.

Test Conditions:

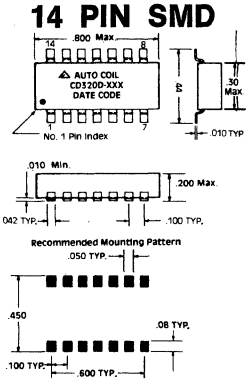
1) All measurements are made @ 25°C
2) Delays are measured @ 50% points
3) Rise times are measured from 10% to 90% points
4) Pulse width 3 x total delay

Input and test conditions are not limiting parameters.

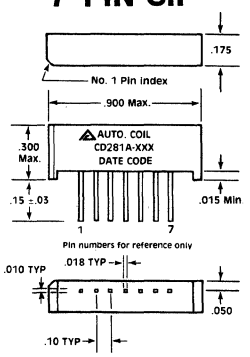
CD300 SERIES 14 PIN DIP



CD320 SERIES 14 PIN SMD

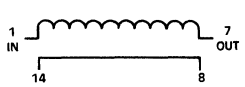


CD281 SERIES 7 PIN SIP

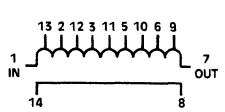


Total Delay (nsec)	Tap Interval (nsec)	Rise Time (nsec)	Automatic Coil Part Number				
			50Ω	100Ω	200Ω	350Ω	500Ω
5	.5	2.5	CDXXXX-101	CDXXXX-121	CDXXXX-141	CDXXXX-201	CDXXXX-221
10	1.0	3.5	CDXXXX-102	CDXXXX-122	CDXXXX-142	CDXXXX-202	CDXXXX-222
15	1.5	4.5	CDXXXX-103	CDXXXX-123	CDXXXX-143	CDXXXX-203	CDXXXX-223
20	2.0	5.5	CDXXXX-104	CDXXXX-124	CDXXXX-144	CDXXXX-204	CDXXXX-224
25	2.5	6.0	CDXXXX-105	CDXXXX-125	CDXXXX-145	CDXXXX-205	CDXXXX-225
30	3.0	6.5	CDXXXX-106	CDXXXX-126	CDXXXX-146	CDXXXX-206	CDXXXX-226
35	3.5	7.0	CDXXXX-107	CDXXXX-127	CDXXXX-147	CDXXXX-207	CDXXXX-227
40	4.0	8.0	CDXXXX-108	CDXXXX-128	CDXXXX-148	CDXXXX-208	CDXXXX-228
45	4.5	9.0	CDXXXX-109	CDXXXX-129	CDXXXX-149	CDXXXX-209	CDXXXX-229
50	5.0	10.0	CDXXXX-110	CDXXXX-130	CDXXXX-150	CDXXXX-210	CDXXXX-230
60	6.0	12.0	CDXXXX-111	CDXXXX-131	CDXXXX-151	CDXXXX-211	CDXXXX-231
70	7.0	14.0	CDXXXX-112	CDXXXX-132	CDXXXX-152	CDXXXX-212	CDXXXX-232
80	8.0	16.0	CDXXXX-113	CDXXXX-133	CDXXXX-153	CDXXXX-213	CDXXXX-233
90	9.0	18.0	CDXXXX-114	CDXXXX-134	CDXXXX-154	CDXXXX-214	CDXXXX-234
100	10.0	20.0	CDXXXX-115	CDXXXX-135	CDXXXX-155	CDXXXX-215	CDXXXX-235
125	12.5	25.0	CDXXXX-116	CDXXXX-136	CDXXXX-156	CDXXXX-216	CDXXXX-236
150	15.0	30.0	CDXXXX-117	CDXXXX-137	CDXXXX-157	CDXXXX-217	CDXXXX-237
200	20.0	40.0	CDXXXX-118	CDXXXX-138	CDXXXX-158	CDXXXX-218	CDXXXX-238
250	25.0	50.0	CDXXXX-119	CDXXXX-139	CDXXXX-159	CDXXXX-219	CDXXXX-239
300	30.0	60.0	CDXXXX-120	CDXXXX-140	CDXXXX-160	CDXXXX-220	CDXXXX-240

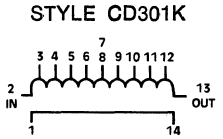
STYLE CD300D



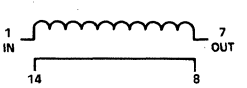
STYLE CD301A



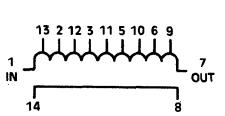
STYLE CD301K



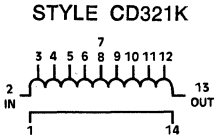
STYLE CD320D



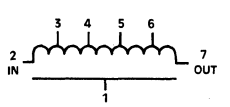
STYLE CD321A



STYLE CD321K



STYLE CD281A



Tap delay 2 x listed interval.

Also Available:
Intermediate delays
Special taps
Electrical parameters other than listed
Independent delay increments
Internal terminations
Tighter tolerances
Auto insertable versions

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defining a degree of excellence

DELAY LINES

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A447-XXXX-10 14 pin DIP, 10 tap 10
A447-XXXX-06 14 pin DIP, fixed delay 11
A447-XXXX-A1 14 pin DIP, 5 tap, controlled leading and trailing edge 12
A447-XXXX-08 14 pin DIP, fixed delay, low power module 13
A447-XXXX-09 14 pin DIP, 5 tap, low power module 13
A447-XXXX-A3 14 pin DIP, Triple output module 14
0462-XXXX-02 8 pin single in line, 5 tap 15
A463-XXXX-02 8 pin DIP, 5 tap 16

SMD TTL DIGITAL DELAY LINES
S423 Series, 5 tap 17
S422 Series, 10 tap 18

PASSIVE DELAY LINES
A446 and 0446 Series 14 pin DIP, 10 tap 19
0401 Series, 8 pin single in line, fixed delay 20
0438 Series, 14 pin single in line, 10 tap 21
0402 Series, 3 pin single in line, fixed delay 22
0432 Picoline 3 pin single in line, fixed picosecond delay 22

TTL PROGRAMMABLE DELAY MODULES
0449-XXXX-03 16 pin DIP, 3 bit 23
0449-XXXX-04 32 pin DIP, 4 bit 24
0449-XXXX-06 46 pin DIP, 6 bit 25

TTL OSCILLATORS AND PULSE GENERATORS
A456-XXXX-01 14 pin DIP, pulse width generator 26
A457-XXXX-01 14 pin DIP, square wave generator 27
0458-XXXX-01 16 pin DIP, digital delay generator 28

CMOS DIGITAL DELAY LINES
0450-XXXX-02 14 pin DIP, 5 tap 29

ECL 10K DIGITAL DELAY LINES
0443-XXXX-02 16 pin DIP, 5 tap 30
0443-XXXX-10 32 pin DIP, 10 tap 3
0464-XXXX-01 16 pin DIP, dual output module 3

ECL 10K PROGRAMMABLE DELAY MODULES
0451-XXXX-03 16 pin, 3 bit 3

ECL 10K PULSE GENERATORS
0452-XXXX-01 16 pin DIP, pulse generator 3

ECL 10KH DELAY LINES AND PULSE GENERATORS
0459-XXXX-02 16 pin DIP, 5 tap 3
0453-XXXX-03 16 pin DIP, 3 bit programmable 3
0453-XXXX-04 32 pin DIP, 4 bit programmable 3
0454-XXXX-01 16 pin DIP, pulse generator 3

ECL 100K DIGITAL DELAY LINES
0461-XXXX-01 24 pin DIP, 8 tap 3

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DIGITAL DELAY LINE SERIES A447 5 TAP

AVAILABLE IN FAST LOGIC
REQUEST A427 SERIES

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

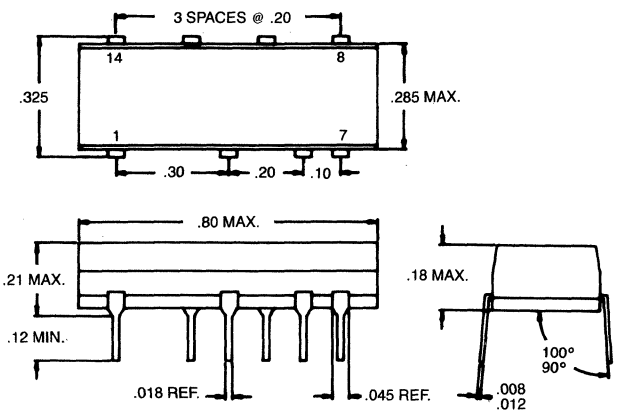
ELECTRICAL CHARACTERISTICS

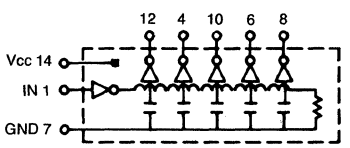
Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
−2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request





Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
A447-0025-02	25NS	5NS	4NS
A447-0030-02	30NS	6NS	4NS
A447-0040-02	40NS	8NS	4NS
A447-0050-02	50NS	10NS	4NS
A447-0060-02	60NS	12NS	4NS
A447-0070-02	70NS	14NS	4NS
A447-0080-02	80NS	16NS	4NS
A447-0090-02	90NS	18NS	4NS
A447-0100-02	100NS	20NS	4NS
A447-0125-02	125NS	25NS	4NS
A447-0150-02	150NS	30NS	4NS
A447-0200-02	200NS	40NS	4NS
A447-0250-02	250NS	50NS	4NS
A447-0300-02	300NS	60NS	4NS
A447-0400-02	400NS	80NS	4NS
A447-0450-02	450NS	90NS	4NS
A447-0500-02	500NS	100NS	5NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES A447 10 TAP

AVAILABLE IN FAST LOGIC REQUEST A427 SERIES

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	120.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

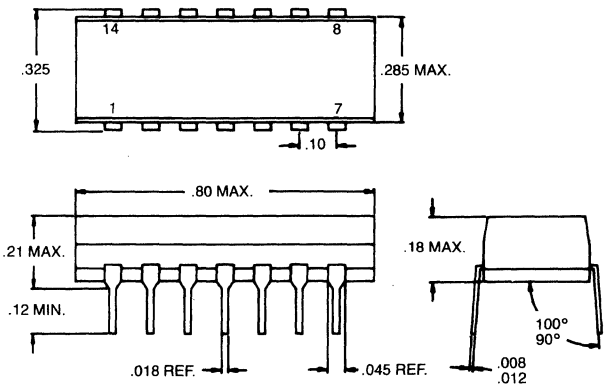
ELECTRICAL CHARACTERISTICS

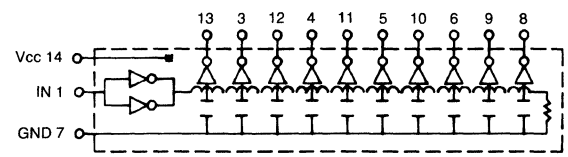
Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Logic 1 Input Current
100 Microamp max.
Logic 0 Input Current
– 4 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request





Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
A447-0050-10	50NS	5NS	4NS
A447-0100-10	100NS	10NS	4NS
A447-0150-10	150NS	15NS	4NS
A447-0200-10	200NS	20NS	4NS
A447-0250-10	250NS	25NS	4NS
A447-0300-10	300NS	30NS	4NS
A447-0350-10	350NS	35NS	4NS
A447-0400-10	400NS	40NS	4NS
A447-0500-10	500NS	50NS	5NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES A447 CONTROLLED LEADING & TRAILING EDGE DELAY MODULE 5 TAP

AVAILABLE IN FAST LOGIC REQUEST A427 SERIES

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

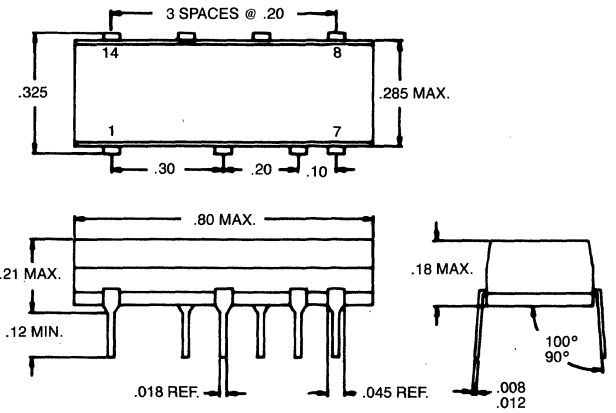
ELECTRICAL CHARACTERISTICS

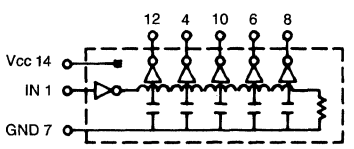
Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
20% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request





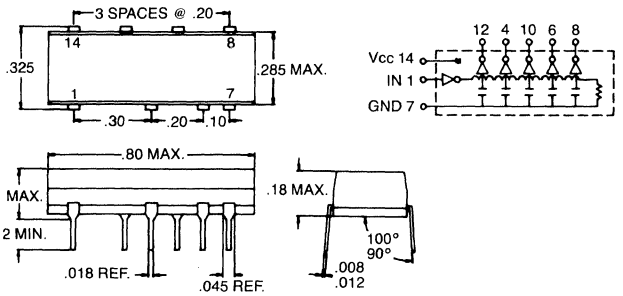
Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time/Fall Time 2, 3
A447-0025-A1	25NS	5NS	4NS
A447-0030-A1	30NS	6NS	4NS
A447-0040-A1	40NS	8NS	4NS
A447-0050-A1	50NS	10NS	4NS
A447-0060-A1	60NS	12NS	4NS
A447-0070-A1	70NS	14NS	4NS
A447-0080-A1	80NS	16NS	4NS
A447-0090-A1	90NS	18NS	4NS
A447-0100-A1	100NS	20NS	4NS
A447-0125-A1	125NS	25NS	4NS
A447-0150-A1	150NS	30NS	4NS
A447-0200-A1	200NS	40NS	4NS
A447-0250-A1	250NS	50NS	4NS
A447-0300-A1	300NS	60NS	4NS
A447-0400-A1	400NS	80NS	4NS
A447-0450-A1	450NS	90NS	4NS
A447-0500-A1	500NS	100NS	5NS

1 Delays measured at 1.5 Volts level on Leading and Trailing Edge.
2 Rise and Fall Times measured from .75 Volts to 2.4 Volts.
3 Measured with 1 STTL (15 PF) load per tap.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES A447 LOW POWER MODULE 20 MA TYP 5 TAP/FIXED DELAY



TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	20.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

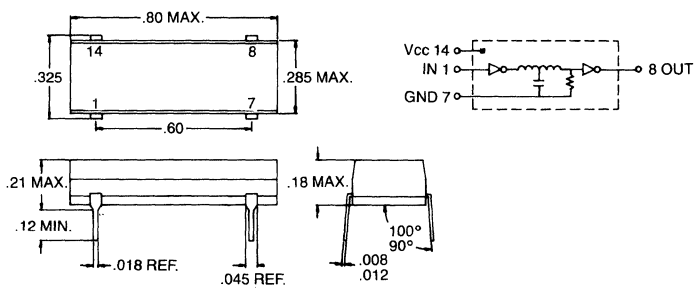
ELECTRICAL CHARACTERISTICS

Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Logic 1 Input Current
20 Microamp max.
Logic 0 Input Current
– 0.4 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%
10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request

5 TAP

Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
A447-0025-09	25NS	5NS	8NS
A447-0050-09	50NS	10NS	8NS
A447-0100-09	100NS	20NS	8NS
A447-0150-09	150NS	30NS	8NS
A447-0200-09	200NS	40NS	8NS
A447-0250-09	250NS	50NS	8NS
A447-0300-09	300NS	60NS	8NS
A447-0350-09	350NS	70NS	8NS
A447-0400-09	400NS	80NS	8NS
A447-0450-09	450NS	90NS	8NS
A447-0500-09	500NS	100NS	8NS



FIXED DELAY

Part Number	Total Delay 1, 3	Rise Time 2, 3	Part Number	Total Delay 1, 3	Rise Time 2, 3
A447-0010-08	10NS	8NS	A447-0125-08	125NS	8NS
A447-0020-08	20NS	8NS	A447-0150-08	150NS	8NS
A447-0030-08	30NS	8NS	A447-0175-08	175NS	8NS
A447-0040-08	40NS	8NS	A447-0200-08	200NS	8NS
A447-0050-08	50NS	8NS	A447-0250-08	250NS	8NS
A447-0060-08	60NS	8NS	A447-0300-08	300NS	8NS
A447-0070-08	70NS	8NS	A447-0350-08	350NS	8NS
A447-0080-09	80NS	8NS	A447-0400-08	400NS	8NS
A447-0090-08	90NS	8NS	A447-0450-08	450NS	8NS
A447-0100-08	100NS	8NS	A447-0500-08	500NS	8NS

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Rise Times measured from .8 Volts to 2 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES A447 TRIPLE OUTPUT MODULE

AVAILABLE IN FAST LOGIC
REQUEST A427 SERIES

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	Constant "0" in 115 mA max Constant "1" in 90 mA max.
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Output
As Specified In Table
Performance Characteristics apply at above listed Test Conditions.

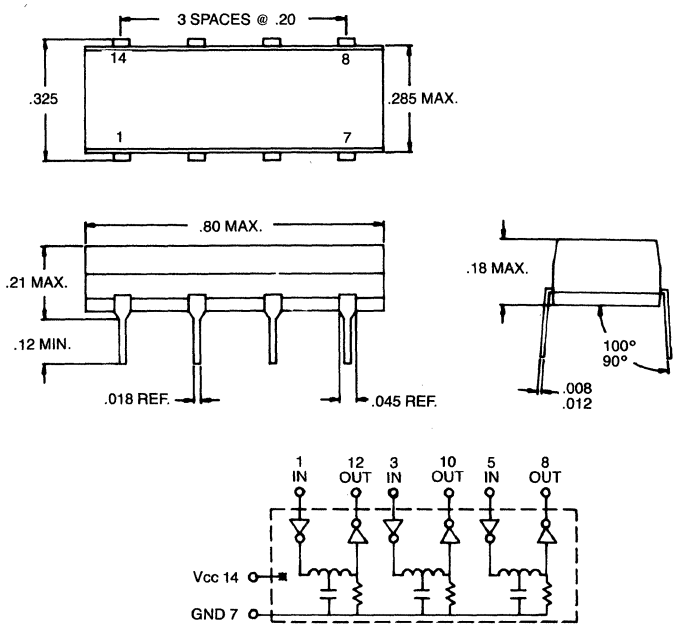
ELECTRICAL CHARACTERISTICS

Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient of Total Delay
1200PPM/°C Typical
Minimum Input Pulse Width
100% of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Output max.
10 TTL Loads/Unit max.

–Compatible with TTL and DTL circuits
–Other delays and tolerances upon request



Part Number	Total Delay 1, 3	Rise Time 2, 3
A447-0010-A3	10 NS ± 1.5 NS	3 NS
A447-0020-A3	20 NS ± 1.5 NS	3 NS
A447-0030-A3	30 NS ± 2.0 NS	3 NS
A447-0040-A3	40 NS ± 2.0 NS	3 NS
A447-0050-A3	50 NS ± 2.5 NS	3 NS
A447-0060-A3	60 NS ± 3.0 NS	4 NS
A447-0070-A3	70 NS ± 3.5 NS	4 NS
A447-0080-A3	80 NS ± 4.0 NS	4 NS
A447-0090-A3	90 NS ± 4.0 NS	4 NS
A447-0100-A3	100 NS ± 5.0 NS	4 NS

1 Delays measured at 1.5 Volt Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with 1 STTL load (15PF) on each output.

pecifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0462 8-PIN SINGLE-IN-LINE 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

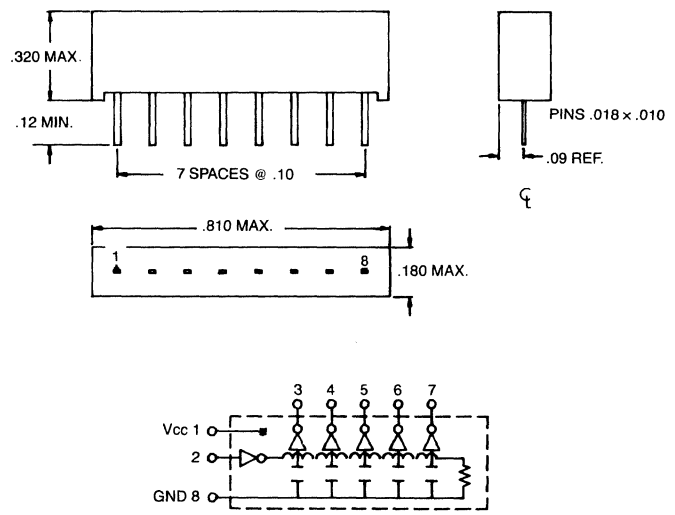
ELECTRICAL CHARACTERISTICS

Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0462-0025-02	25NS	5NS	4NS
0462-0030-02	30NS	6NS	4NS
0462-0040-02	40NS	8NS	4NS
0462-0050-02	50NS	10NS	4NS
0462-0060-02	60NS	12NS	4NS
0462-0070-02	70NS	14NS	4NS
0462-0080-02	80NS	16NS	4NS
0462-0090-02	90NS	18NS	4NS
0462-0100-02	100NS	20NS	4NS
0462-0125-02	125NS	25NS	4NS
0462-0150-02	150NS	30NS	4NS
0462-0200-02	200NS	40NS	4NS
0462-0250-02	250NS	50NS	4NS
0462-0300-02	300NS	60NS	4NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES A463 8 PINS 5 TAP

AVAILABLE IN FAST LOGIC REQUEST A428 SERIES

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

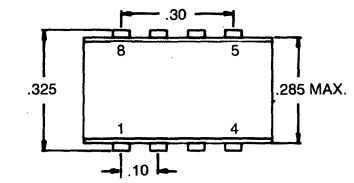
ELECTRICAL CHARACTERISTICS

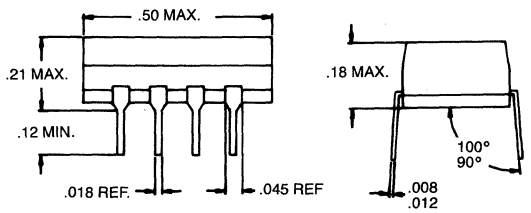
Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

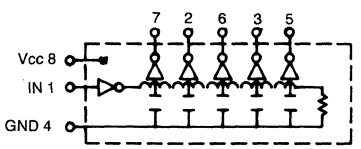
DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits.
—Other delays and tolerances upon request







Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
A463-0025-02	25NS	5NS	4NS
A463-0030-02	30NS	6NS	4NS
A463-0040-02	40NS	8NS	4NS
A463-0050-02	50NS	10NS	4NS
A463-0060-02	60NS	12NS	4NS
A463-0070-02	70NS	14NS	4NS
A463-0080-02	80NS	16NS	4NS
A463-0090-02	90NS	18NS	4NS
A463-0100-02	100NS	20NS	4NS
A463-0125-02	125NS	25NS	4NS
A463-0150-02	150NS	30NS	4NS
A463-0200-02	200NS	40NS	4NS
A463-0250-02	250NS	50NS	4NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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SMD DIGITAL DELAY LINE 5 TAP SERIES S423

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

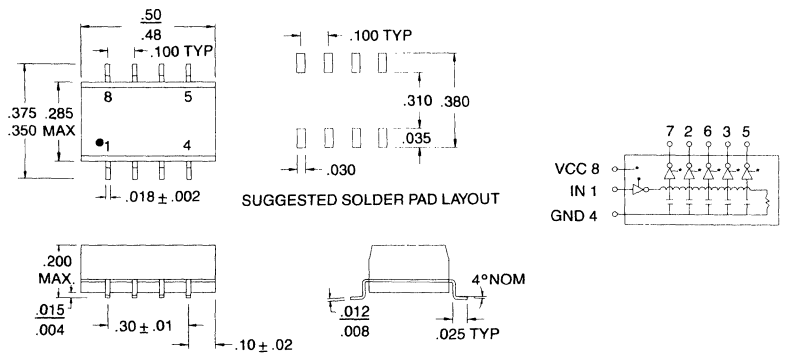
ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request

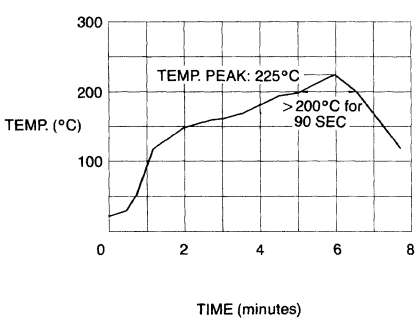


Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
S423-0025-02	25NS	5NS	4NS
S423-0030-02	30NS	6NS	4NS
S423-0040-02	40NS	8NS	4NS
S423-0050-02	50NS	10NS	4NS
S423-0060-02	60NS	12NS	4NS
S423-0070-02	70NS	14NS	4NS
S423-0080-02	80NS	16NS	4NS
S423-0090-02	90NS	18NS	4NS
S423-0100-02	100NS	20NS	4NS
S423-0125-02	125NS	25NS	4NS
S423-0150-02	150NS	30NS	4NS
S423-0200-02	200NS	40NS	4NS
S423-0250-02	250NS	50NS	4NS

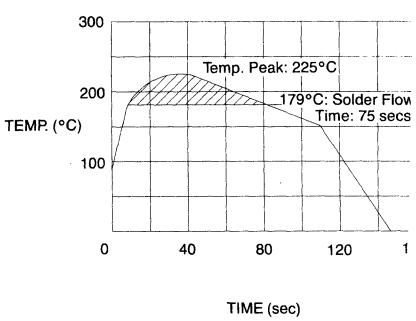
1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

SOLDERING TEMPERATURE PROFILE

INFRA RED



VAPOR PHASE



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SMD DIGITAL DELAY LINE 10 TAP SERIES S422

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	120.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

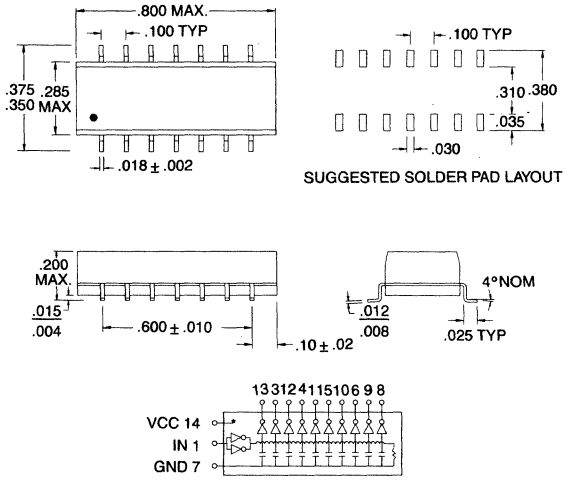
ELECTRICAL CHARACTERISTICS

Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Logic 1 Input Current
100 Microamp max.
Logic 0 Input Current
– 4 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

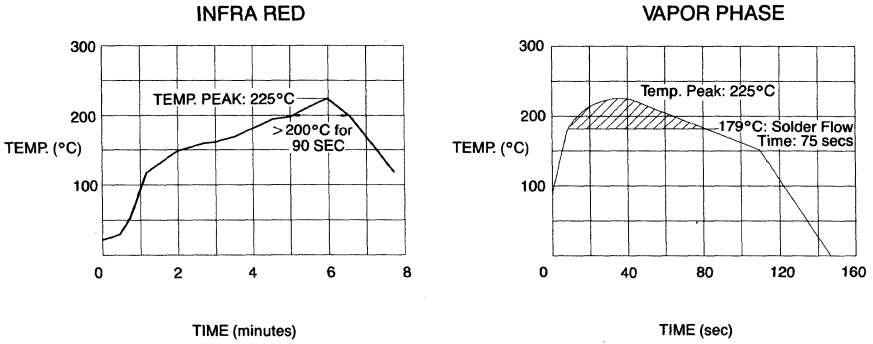
—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
S422-0050-10	50NS	5NS	4NS
S422-0100-10	100NS	10NS	4NS
S422-0150-10	150NS	15NS	4NS
S422-0200-10	200NS	20NS	4NS
S422-0250-10	250NS	25NS	4NS
S422-0300-10	300NS	30NS	4NS
S422-0350-10	350NS	35NS	4NS
S422-0400-10	400NS	40NS	4NS
S422-0500-10	500NS	50NS	5NS

1 Delays measured at 1.5 Volt level Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on Taps.

SOLDERING TEMPERATURE PROFILE



Specifications Subject To Change Without Notice

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LUMPED CONSTANT DELAY LINE SERIES 0446 AND A446 10 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	3.0 x Total Delay
Pulse Period	4 x Pulse Width
Pulse Voltage	1 Volt
Rise Time	2.0 Nsec (10%-90%)
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

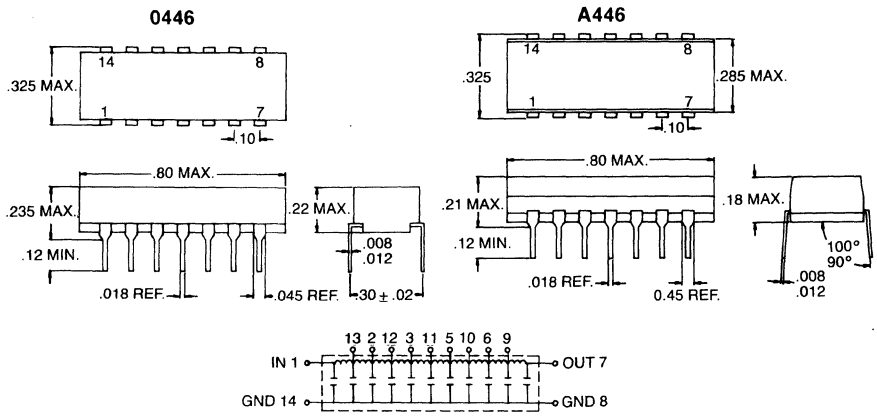
Distortion 10% max.

Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Operating Temperature Range
−55°C To +125°C
Temperature Coefficient
100PPM/°C Typical
Dielectric Withstanding Voltage
50 Volt

—Compatible with TTL and ECL circuits
—Other delays and impedances upon request
—Untapped units available on request
—Other Pinouts Available Upon request



Total Delay ±5%	Tap to Tap Delay	Attenuation Max.	Impedance ± 10% 50 OHMS *	100 OHMS *	200 OHMS *
5NS	.5±.3NS	5%	0446-0005-50 Tr = 3	0446-0005-01 Tr = 3	0046-0005-02 Tr = 3.5
10NS	1±.35NS	5%	0446-0010-50 Tr = 3.8	0446-0010-01 Tr = 3.8	0446-0010-02 Tr = 4
20NS	2±1NS	5%	0446-0020-50 Tr = 5	0446-0020-01 Tr = 5	0446-0020-02 Tr = 5
30NS	3±1NS	5%	0446-0030-50 Tr = 7	0446-0030-01 Tr = 7	0446-0030-02 Tr = 7
40NS	4±1NS	5%	0446-0040-50 Tr = 8.5	0446-0040-01 Tr = 8.5	0446-0040-02 Tr = 8.5
50NS	5±2NS	5%	0446-0050-50 Tr = 10	0446-0050-01 Tr = 10	0446-0050-02** Tr = 10
60NS	6±2NS	8%	0446-0060-50 Tr = 12	0446-0060-01 Tr = 12	0446-0060-02 Tr = 12
70NS	7±2NS	8%	0446-0070-50 Tr = 14	0446-0070-01 Tr = 14	0446-0070-02 Tr = 14
80NS	8±2NS	8%	0446-0080-50 Tr = 16	0446-0080-01 Tr = 16	0446-0080-02 Tr = 16
90NS	9±2NS	8%	0446-0090-50 Tr = 18	0446-0090-01 Tr = 18	0446-0090-02 Tr = 18
100NS	10±3NS	10%	0446-0100-50 Tr = 20	0446-0100-01** Tr = 20	0446-0100-02 Tr = 20
150NS	15±3NS	10%	0446-0150-50 Tr = 30	0446-0150-01 Tr = 30	0446-0150-02 Tr = 30
200NS	20±3NS	10%	0446-0200-50** Tr = 40	0446-0200-01 Tr = 40	0446-0200-02 Tr = 40
250NS	25±3NS	10%	0446-0250-50 Tr = 50	0446-0250-01 Tr = 50	0446-0250-02 Tr = 50
300NS	30±3NS	10%	0446-0300-50 Tr = 60	0446-0300-01 Tr = 60	0446-0300-02 Tr = 60
400NS	40±3NS	10%	0446-0400-50 Tr = 80	0446-0400-01 Tr = 80	0446-0400-02 Tr = 80
500NS	50±3NS	10%	0446-0500-50 Tr = 100	0446-0500-01 Tr = 100	0446-0500-02 Tr = 100

* Auto insertable package part number starts with A446.
Rise time measured from 10% to 90% of the pulse.
** Max. delay for Auto insertable package.

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LUMPED CONSTANT DELAY LINES SINGLE IN-LINE SERIES 0401

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	3 x Total Delay
Pulse Period	4 x Pulse Width
Rise Time	2.0 NSec (10%-90%)
Pulse Voltage	1 Volt
Ambient Temperature	20°C

PERFORMANCE CHARACTERISTICS

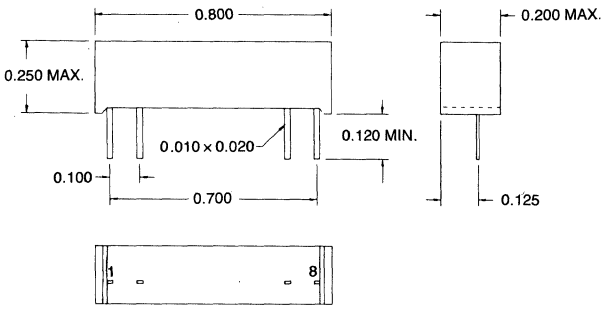
Distortion	10% max.
Rise Time (True)	See Table

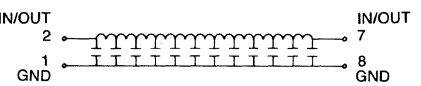
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Operating Temperature Range
– 55°C To 125°C
Temperature Coefficient
100PPM/°C Typical
Dielectric Withstanding Voltage
50 Volt

—Compatible with TTL and ECL circuits
—Other delays and impedances upon request





Time Delay (ns)	Tolerance (Max.) (ns)	Max.* Rise Time (ns)	DCR (Ohms) (Max.)	Impedance Ohms (Zo) ±10%	Part Number
0.0	+0.25	1.0	1.0	100	0401-1403-01
0.5	±0.25	1.0	1.0	100	0401-1403-02
1.0	±0.25	1.0	1.0	100	0401-1403-03
1.5	±0.25	1.0	1.0	100	0401-1403-04
2.0	±0.25	1.0	1.0	100	0401-1403-05
2.5	+0.25	1.0	1.0	100	0401-1403-06
3.0	±0.25	1.0	1.0	100	0401-1403-07
3.5	±0.25	1.0	1.0	100	0401-1403-08
4.0	±0.25	1.0	1.0	100	0401-1403-09
4.5	±0.25	1.0	1.0	100	0401-1403-10
5.0	+0.25	1.1	1.0	100	0401-1403-11
5.5	±0.25	1.2	1.0	100	0401-1403-12
6.0	±0.25	1.3	1.0	100	0401-1403-13
6.5	±0.25	1.4	1.0	100	0401-1403-14
7.0	±0.25	1.5	1.0	100	0401-1403-15
7.5	+0.25	1.6	1.0	100	0401-1403-16
8.0	±0.25	1.7	1.0	100	0401-1403-17
8.5	±0.25	1.8	1.0	100	0401-1403-18
9.0	±0.25	1.9	1.0	100	0401-1403-19
9.5	±0.25	2.0	1.0	100	0401-1403-20
10.0	±0.25	2.0	1.0	100	0401-1403-21
11.0	±0.25	2.2	2.0	100	0401-1403-23
12.0	±0.25	2.3	2.0	100	0401-1403-25
13.0	±0.25	2.5	2.0	100	0401-1403-27
14.0	±0.25	2.6	2.0	100	0401-1403-29
15.0	±0.25	2.8	2.0	100	0401-1403-31
16.0	±0.25	3.0	2.5	100	0401-1403-33
17.0	±0.25	3.2	2.5	100	0401-1403-35
18.0	±0.25	3.4	2.5	100	0401-1403-37
19.0	±0.25	3.6	2.5	100	0401-1403-39
20.0	±0.50	3.8	2.5	100	0401-1403-40
25.0	±0.50	4.5	4.0	100	0401-1403-46
30.0	±0.50	5.5	4.5	100	0401-1403-51
35.0	±0.50	6.4	5.5	100	0401-1403-56
40.0	±0.50	7.4	6.0	100	0401-1403-61

*Rise Time measured from 10% to 90% of the pulse (True)

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LUMPED CONSTANT DELAY LINES SINGLE IN-LINE SERIES 0438

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	3.0 x Total Delay
Pulse Period	4 x Pulse Width
Rise Time	2.0 NSec (10%-90%)
Pulse Voltage	1 Volt
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

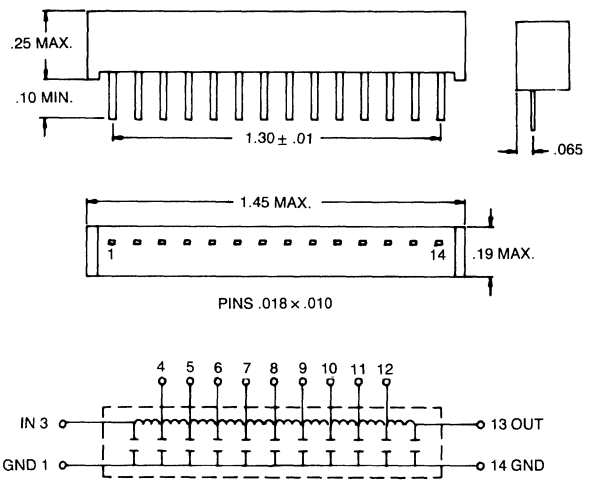
Distortion 10% max.

Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Operating Temperature Range
– 55°C To 125°C
Temperature Coefficient
100PPM/°C Typical
Dielectric Withstanding Voltage
50 Volt DC

—Compatible with TTL and ECL circuits
—Other delays and impedances upon request



Time Delay ±5%	Tap to Tap Delay	Rise Time* 1.	Z_o ± 10% In OHMS	D.C.R. In OHMS	Part Number
10NS	1 ± .25NS	2.5NS	50	.8	0438-0010-50
20NS	2 ± .4NS	4NS	50	1	0438-0020-50
50NS	5 ± 1.5NS	9NS	50	2	0438-0050-50
100NS	10 ± 2NS	18NS	50	3	0438-0100-50
10NS	1 ± .25NS	2.5NS	100	1.6	0438-0010-01
20NS	2 ± .4NS	4NS	100	2	0438-0020-01
50NS	5 ± 1.5NS	9NS	100	4	0438-0050-01
100NS	10 ± 2NS	19NS	100	9	0438-0100-01
20NS	2 ± .4NS	4.5NS	200	5	0438-0020-02
50NS	5 ± 1.5NS	10NS	200	12	0438-0050-02
100NS	10 ± 2NS	20NS	200	17	0438-0100-02

* Rise Time measured from 10% to 90% of the pulse

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LUMPED CONSTANT DELAY LINE 0432 PICOLINE AND 0402 SERIES

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	3.0 x Total Delay, 5.0 Nsec min.
Pulse Period	4 x Pulse Width
Rise Time	1.0 NSec (10%-90%)
Pulse Voltage	1 Volt
Ambient Temperature	25°C

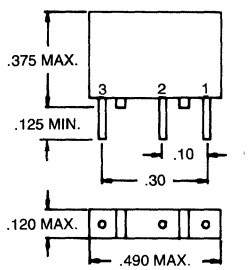
PERFORMANCE CHARACTERISTICS

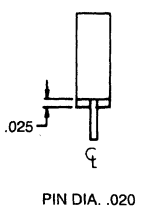
Distortion 10% max.
Performance Characteristics apply at above listed Test Conditions.

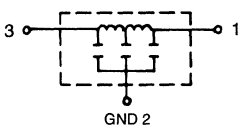
ELECTRICAL CHARACTERISTICS

Operating Temperature Range
– 55°C To 125°C
Temperature Coefficient Of Total Delay
100PPM/°C Typical
Dielectic Withstanding Voltage
50 Volt DC
Operation
Bidirectional

—Compatible with TTL and ECL circuits
—Other delays and impedances upon request
—Gold coated pins for excellent conductivity for time delays of 100 to 1000 PS.







Part Number	Time Delay	*Rise Time	DCR Max (OHMS)	$Z_o \pm 10\%$ (OHMS)
0432-0100-55	100 ± 50 PS	0.9 NS	0.20	55
0432-0200-55	200 ± 50 PS	0.9 NS	0.20	55
0432-0300-55	300 ± 50 PS	0.9 NS	0.20	55
0432-0400-55	400 ± 50 PS	1.0 NS	0.20	55
0432-0500-55	500 ± 50 PS	1.0 NS	0.22	55
0432-0600-55	600 ± 60 PS	1.1 NS	0.24	55
0432-0700-55	700 ± 70 PS	1.2 NS	0.26	55
0432-0800-55	800 ± 80 PS	1.3 NS	0.28	55
0432-0900-55	900 ± 90 PS	1.4 NS	0.30	55
0432-1000-55	1000 ± 100 PS	1.5 NS	0.30	55

*Rise time measured from 20% to 80% of the pulse.

Part Number 55 OHMS ± 10%	Part Number 93 OHMS ± 10%	Time Delay	*Rise Time	DCR Max (OHMS)
0402-0001-55	0402-0001-93	1 ± .2NS	1.6NS	0.20
0402-0002-55	0402-0002-93	2 ± .2NS	1.6NS	0.25
0402-0003-55	0402-0003-93	3 ± .2NS	1.7NS	0.37
0402-0004-55	0402-0004-93	4 ± .2NS	1.7NS	0.50
0402-0005-55	0402-0005-93	5 ± .25NS	1.8NS	0.62
0402-0006-55	0402-0006-93	6 ± .3NS	2.0NS	0.75
0402-0007-55	0402-0007-93	7 ± .3NS	2.2NS	0.80
0402-0008-55	0402-0008-93	8 ± .3NS	2.4NS	0.85
0402-0009-55	0402-0009-93	9 ± .3NS	2.6NS	0.90
0402-0010-55	0402-0010-93	10 ± .3NS	2.8NS	0.95

*Rise Time measured from 20% to 80% of the pulse.

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DIGITAL DELAY LINE SERIES 0449 TTL PROGRAMMABLE LOGIC DELAY MODULE 3 BIT

TECHNICAL INFORMATION

TEST CONDITIONS

Driving Signal	Schottky TTL Buffer
Pulse Width	1.5 x Maximum Delay
Pulse Period	5 x Pulse Width
Supply Current	50.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Programmable Delay Tolerance
±2 Nsec or 5% whichever is greater

Performance Characteristics apply at above listed Test Conditions.

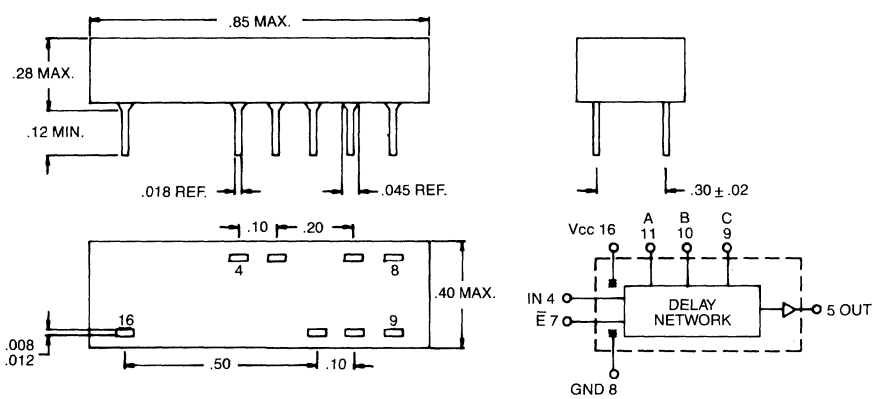
ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Voltage
2.5 Volts min.
5.5 Volts max.
Logic 0 Input Voltage
.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Non Buffered Input

DRIVE CAPABILITIES

10 TTL Loads/Tap max.

—Compatible with TTL and DTL circuits.
—Other delays and tolerances upon request
—Buffered Input Available upon request



Part Number	* Min. Delay (NOM) 1, 2	** Max. Delay (NOM) 1, 2	ΔDelay / Step 1, 2
0449-0014-03	7NS	14NS	1 ± .5NS
0449-0021-03	7NS	21NS	2 ± .6NS
0449-0028-03	7NS	28NS	3 ± .7NS
0449-0035-03	7NS	35NS	4 ± .8NS
0449-0042-03	7NS	42NS	5 ± 1.0NS
0449-0049-03	7NS	49NS	6 ± 1.2NS
0449-0056-03	7NS	56NS	7 ± 1.4NS
0449-0063-03	7NS	63NS	8 ± 1.6NS
0449-0070-03	7NS	70NS	9 ± 1.8NS
0449-0077-03	7NS	77NS	10 ± 2.0NS

1 Delays measured at 1.5 Volt level on leading edge only.
2 Measured with no loads on output.

CONTROL SIGNAL TABLE

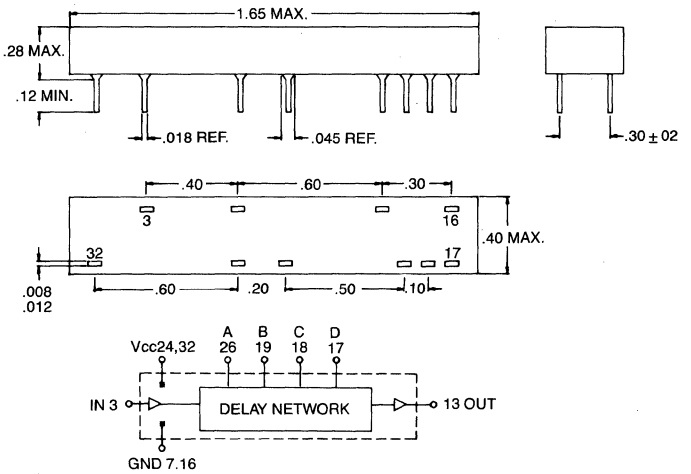
C	B	A	
0	0	0	*
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	**

* Minimum Delay Code
** Maximum Delay Code

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DIGITAL DELAY LINE SERIES 0449 TTL PROGRAMMABLE LOGIC DELAY MODULE 4 BIT



TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.5 x Maximum Delay
Pulse Period	5 x Pulse Width
Supply Current	100.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Programmable Delay Tolerance
±2 Nsec or 5% whichever is greater
Performance Characteristics apply at above listed Test conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Voltage
2.0 Volts min.
Logic 0 Input Voltage
.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical

DRIVE CAPABILITIES

10 TTL Loads maximum

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request

Part Number	* Min. Delay 1, 2	** Max. Delay (NOM) 1, 2	ΔDelay / Step 1, 2
0449-0030-04	15±1NS	30NS	1± .7NS
0449-0045-04	15±1NS	45NS	2± .7NS
0449-0060-04	15±1NS	60NS	3± .7NS
0449-0075-04	15±1NS	75NS	4± .8NS
0449-0090-04	15±1NS	90NS	5±1.0NS
0449-0105-04	15±1NS	105NS	6±1.2NS
0449-0120-04	15±1NS	120NS	7±1.4NS
0449-0135-04	15±1NS	135NS	8±1.6NS
0449-0150-04	15±1NS	150NS	9±1.8NS
0449-0165-04	15±1NS	165NS	10±2.0NS

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Measured with no loads on output.

CONTROL SIGNAL TABLE

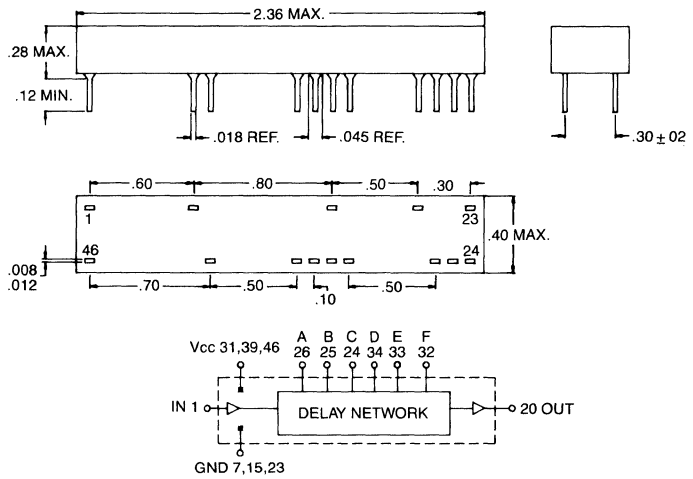
D	C	B	A
0	0	0	0 *
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
0	1	1	1
1	0	0	0
1	0	0	1
1	0	1	0
1	0	1	1
1	1	0	0
1	1	0	1
1	1	1	0
1	1	1	1**

* Minimum Delay Code
** Maximum Delay Code

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0449 TTL PROGRAMMABLE LOGIC DELAY MODULE 6 BIT



TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.5 x Maximum Delay
Pulse Period	5 x Pulse Width
Supply Current	120.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Programmable Delay Tolerance
± 2 Nsec or 5% whichever is greater
Performance Characteristics apply at above listed Test conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Voltage
2.0 Volts min.
Logic 0 Input Voltage
0.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient
500PPM/°C Typical

DRIVE CAPABILITIES

10 TTL Loads maximum

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request

Part Number	* Min. Delay 1, 2	** Max. Delay (NOM) 1, 2	ΔDelay Per Step 1, 2
0449-0078-06	15NS ± 1	78NS	1 ± .7NS
0449-0141-06	15NS ± 1	141NS	2 ± .7NS
0449-0204-06	15NS ± 1	204NS	3 ± .7NS
0449-0267-06	15NS ± 1	267NS	4 ± .8NS
0449-0330-06	15NS ± 1	330NS	5 ± 1.0NS
0449-0393-06	15NS ± 1	393NS	6 ± 1.2NS
0449-0456-06	15NS ± 1	456NS	7 ± 1.4NS
0449-0519-06	15NS ± 1	519NS	8 ± 1.6NS
0449-0582-06	15NS ± 1	582NS	9 ± 1.8NS
0449-0645-06	15NS ± 1	645NS	10 ± 2.0NS

1 Delays measured at 1.5 Volt level Leading Edge only.
2 Measured with no loads on output.

CONTROL SIGNAL TABLE

F	E	D	C	B	A	
0	0	0	0	0	0	*
0	0	0	0	0	1	
0	0	0	0	1	0	
0	0	0	0	1	1	
0	0	0	1	0	0	
1	1	1	1	0	0	
1	1	1	1	0	1	
1	1	1	1	1	0	
1	1	1	1	1	1	**

64 STEPS

* Minimum Delay Code
** Maximum Delay Code

Specifications Subject To Change Without Notice

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PULSE WIDTH GENERATOR SERIES A456 TTL COMPATIBLE

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	10 Nsec
Pulse Period	4 x Output Pulse Width
Supply Current	60.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Output Width Tolerance
± 2 Nsec or 5% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

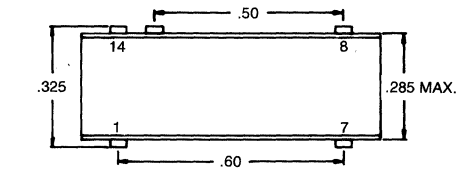
ELECTRICAL CHARACTERISTICS

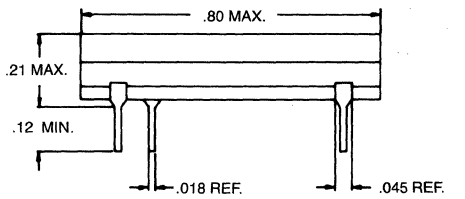
Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Voltage
2.0 Volts min.
Logic 0 Input Voltage
0.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Output Pulse Width
1200PPM/°C Typical

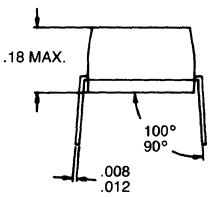
DRIVE CAPABILITIES

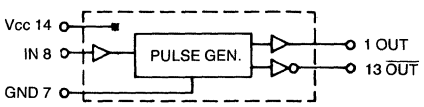
8 TTL Loads/Output max.

—Compatible with TTL and DTL circuits
—Other pulse widths and tolerances upon request
—Positive edge trigger









Part Number	Pulse Width (NS) 1, 2	Maximum Pulse Rate (MHz)
A456-0005-01	5	66
A456-0006-01	6	58
A456-0007-01	7	52
A456-0008-01	8	47
A456-0009-01	9	43
A456-0010-01	10	40
A456-0015-01	15	28
A456-0020-01	20	22
A456-0025-01	25	18
A456-0030-01	30	15
A456-0035-01	35	13
A456-0040-01	40	11
A456-0045-01	45	10
A456-0050-01	50	9
A456-0060-01	60	8
A456-0070-01	70	7
A456-0080-01	80	6
A456-0090-01	90	5
A456-0100-01	100	4

1 Pulse Width measured at 1.5 Volt on both Leading and Trailing Edge.
2 Measured with no load on outputs.

Specifications Subject To Change Without Notice

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SQUARE WAVE GENERATOR SERIES A457 TTL COMPATIBLE

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise/Fall Time	3.0 Nsec (10%-90%)
Supply Current	60.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts ±5%
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Output Frequency Tolerance
±2%
Performance Characteristics apply at above listed Test Conditions.

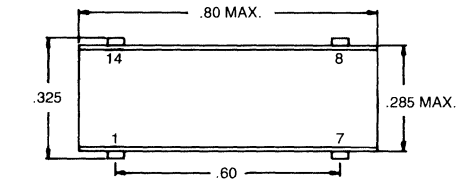
ELECTRICAL CHARACTERISTICS

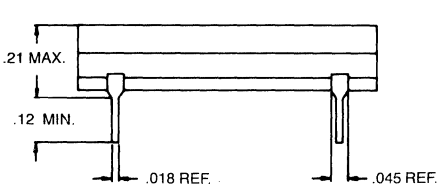
Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Voltage
2.0 Volts min.
Logic 0 Input Voltage
0.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Output Frequency
500PPM/°C Typical

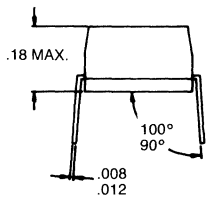
DRIVE CAPABILITIES

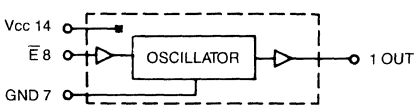
10 TTL Loads max.

—Compatible with TTL and DTL circuits
—Output wave train is synchronized with random gating signal
—Enable input "high" will result in a constant "high" at output
—First output "low" appears one half cycle after input goes "low"
—Other frequencies upon request









Part Number	Output Frequency
A457-0002-01	2 MHz
A457-0003-01	3 MHz
A457-0004-01	4 MHz
A457-0005-01	5 MHz
A457-0006-01	6 MHz
A457-0007-01	7 MHz
A457-0008-01	8 MHz
A457-0009-01	9 MHz
A457-0010-01	10 MHz
A457-0011-01	11 MHz
A457-0012-01	12 MHz
A457-0013-01	13 MHz
A457-0014-01	14 MHz
A457-0015-01	15 MHz
A457-0020-01	20 MHz
A457-0025-01	25 MHz
A457-0030-01	30 MHz
A457-0035-01	35 MHz
A457-0040-01	40 MHz
A457-0045-01	45 MHz
A457-0050-01	50 MHz

Specifications Subject To Change Without Notice

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DIGITAL DELAY OSCILLATOR SERIES 0458

This delay oscillator works as an asynchronous start-stop free running clock pulse generator. The oscillator is intended as the primary control element of state machines used in digital controllers. The assertion of the input (high) trigger causes the oscillator to free run, producing TR thru T4 clock pulses for as long as the input is asserted. Oscillation ceases when the input trigger is negated.

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	5.0 Nsec min.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

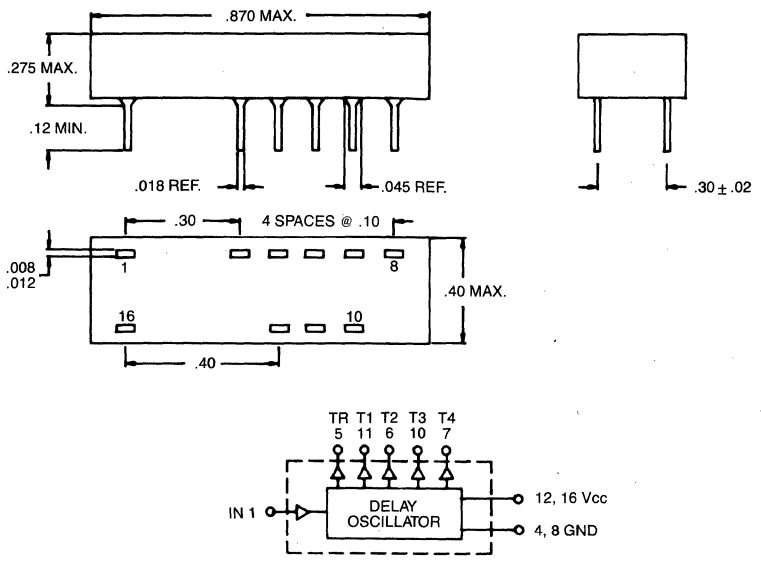
PERFORMANCE CHARACTERISTICS

Period Tolerance
± 7%
Delay Tolerance From Tap To Tap
± 2 Nsec or 5% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 To 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical

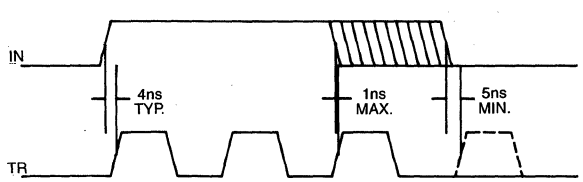
—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request
—Square wave on all outputs



Part Number	Period 1, 3	Tap 1 1, 3, 4	Tap 2 1, 3, 4	Tap 3 1, 3, 4	Tap 4 1, 3, 4	Rise Time 2,3
0458-0060-01	60NS	20NS	30NS	40NS	50NS	4NS
0458-0070-01	70NS	20NS	35NS	50NS	60NS	4NS
0458-0080-01	80NS	20NS	40NS	60NS	70NS	4NS
0458-0090-01	90NS	20NS	45NS	65NS	80NS	4NS
0458-0100-01	100NS	30NS	50NS	70NS	90NS	4NS
0458-0110-01	110NS	30NS	55NS	75NS	100NS	4NS

1 All times measured at 1.5V leading edge only
2 Rise time measured from .75V to 2.4V level
3 Measured with no loads on taps
4 Delays are relative to Tap R (The delay from input to Tap R is 4NS TYP)

TIMING DIAGRAM



Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0450 CMOS DELAY MODULE 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	5.0 Volts
Rise Time	6.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	10.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

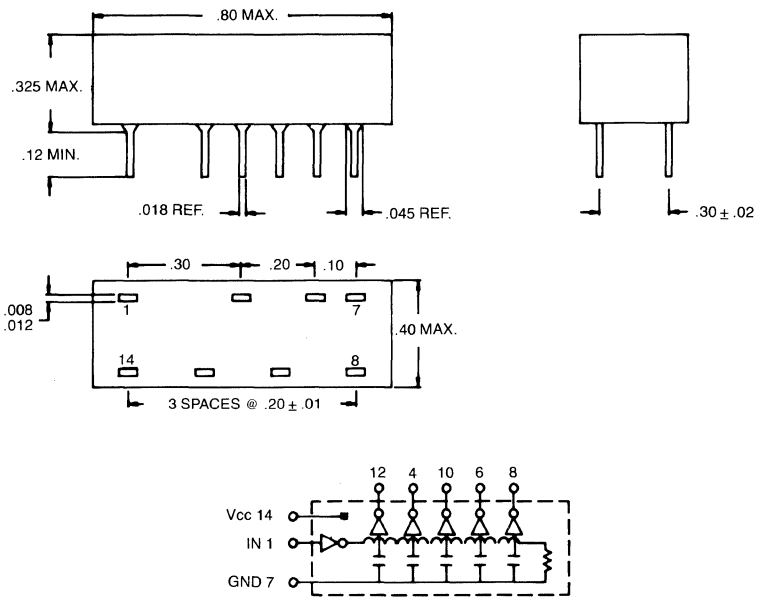
ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Output Voltage
4.0 Volts min.
Logic 0 Output Voltage
0.3 Volts max.
Input Leakage Current
±1 Microamp max.
Operating Temperature Range
−40°C To 85°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 LSTTL Loads min.

—Compatible with 5V CMOS and TTL circuits
—Diode protection on input
—Low power consumption
—Low input current
—Other delays and tolerances upon request



Part Number	Total Delay 1, 3,	Delay/Tap 1, 3	Rise Time 2, 3
0450-0075-02	75NS	15NS	6NS
0450-0100-02	100NS	20NS	6NS
0450-0125-02	125NS	25NS	6NS
0450-0150-02	150NS	30NS	6NS
0450-0175-02	175NS	35NS	6NS
0450-0200-02	200NS	40NS	6NS

1 Delays measured at 50% of the pulse on the leading edge only.
2 Rise times measured from 10% to 90% of the pulse.
3 Measured with No Load on Taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0443 ECL 10K DELAY MODULE 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	−0.9 Volts
Logic 0	−1.8 Volts
Rise Time	2.0 Nsec (20% to 80%)
Pulse Width	Total Delay + 10.0 Nsec
Pulse Period	4 × Pulse Width
Supply Voltage, Vee	−5.2 Volts
Output Terminations	50 Ohm ±1% to −2 Volts
Ambient Temperature	25°C

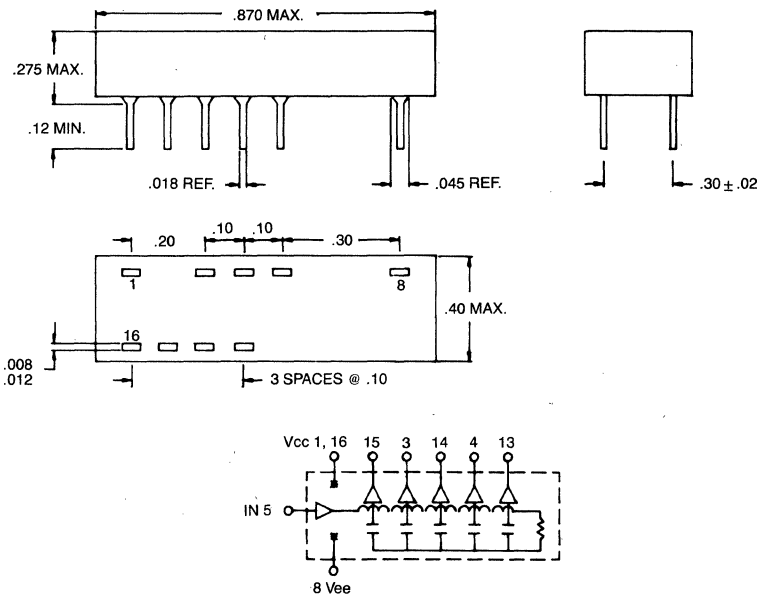
PERFORMANCE CHARACTERISTICS

Delay Tolerances
As Specified in Table
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
−4.94 To −5.46 Volts
Logic 1 Input Voltage
−0.98 Volts min.
Logic 1 Input Current
265 Microamp max.
Logic 1 Output Voltage
−0.96 Volts min.
Logic 0 Input Voltage
−1.63 Volts max.
Logic 0 Input Current
0.5 Microamp min.
Logic 0 Output Voltage
−1.65 Volts max.
Operating Temperature Range
−30°C To 85°C
Temperature Coefficient Of Total Delay
300PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

—Compatible with ECL 10K circuits
—Other delays and tolerances upon request



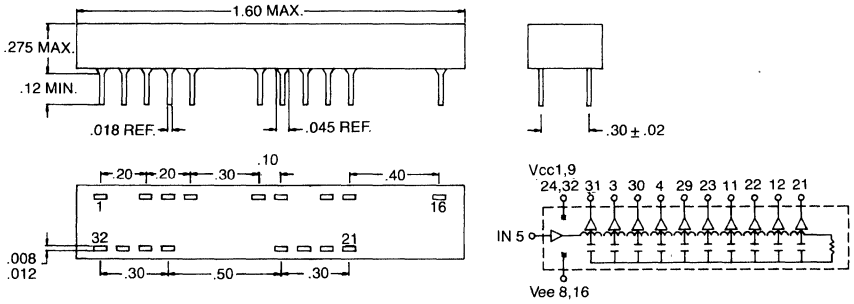
Part Number	Tap 1 1, 3, 4	Tap 2 1, 3, 4	Tap 3 1, 3, 4	Tap 4 1, 3, 4	Output 1, 3, 4	Rise Time 2, 3, 4
0443-0006-02	2±.5	3±.5	4±1	5±1	6±1	4
0443-0010-02	2±.5	4±1	6±1	8±2	10±2	4
0443-0015-02	3±1	6±1	9±2	12±2	15±2	4
0443-0020-02	4±1	8±2	12±2	16±2	20±2	4
0443-0025-02	5±1	10±2	15±2	20±2	25±2	4
0443-0030-02	6±1	12±2	18±2	24±2	30±2	4
0443-0035-02	7±1	14±2	21±2	28±2	35±2	4
0443-0040-02	8±2	16±2	24±2	32±2	40±2	4
0443-0045-02	9±2	18±2	27±2	36±2	45±2	5
0443-0050-02	10±2	20±2	30±2	40±2	50±2	5
0443-0075-02	15±2	30±2	45±2	60±3	75±3	5
0443-0100-02	20±2	40±2	60±3	80±3	100±3	10
0443-0125-02	25±2	50±2	75±3	100±3	125±4	15
0443-0150-02	30±2	60±3	90±3	120±4	150±5	15
0443-0175-02	35±2	70±3	105±4	140±5	175±5	20
0443-0200-02	40±2	80±3	120±4	160±5	200±6	20
0443-0225-02	45±2	90±3	135±4	180±6	225±7	25
0443-0250-02	50±2	100±3	150±5	200±6	250±8	25
0443-0300-02	60±3	120±4	180±5	240±7	300±9	30
0443-0350-02	70±3	140±5	210±7	280±9	350±11	30
0443-0400-02	80±3	160±5	240±7	320±10	400±12	35
0443-0450-02	90±3	180±6	270±8	360±11	450±14	35
0443-0500-02	100±3	200±6	300±9	400±12	500±15	40

1 Delays measured at 50% of the pulse on leading edge only.
2 Rise time measured from 20% to 80% of the pulse.
3 All timing in NS

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0443 ECL 10K DELAY MODULE 10 TAP



TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	– 0.9 Volts
Logic 0	– 1.8 Volts
Rise Time	2.0 Nsec (20% to 80%)
Pulse Width	Total Delay + 10.0 Nsec
Pulse Period	4 × Pulse Width
Supply Voltage, Vee	– 5.2 Volts
Output Terminations	50 Ohm ± 1% to – 2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerances
As Specified In Table
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
– 4.94 To – 5.46 Volts
Logic 1 Input Voltage
– 0.98 Volts min.
Logic 1 Input Current
265 Microamp max.
Logic 1 Output Voltage
– 0.96 Volts min.
Logic 0 Input Voltage
– 1.63 Volts max.
Logic 0 Input Current
0.5 Microamp min.
Logic 0 Output Voltage
– 1.65 Volts max.
Operating Temperature Range
– 30°C To 85°C
Temperature Coefficient Of Total Delay
300PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

—Compatible with ECL10K
—Other delays and tolerances upon request

Part Number	Tap 1 1, 3, 4	Tap 2 1, 3, 4	Tap 3 1, 3, 4	Tap 4 1, 3, 4	Tap 5 1, 3, 4	Tap 6 1, 3, 4
0443-0011-10	2±.5	3±.5	4±.5	5±1	6±1	7±1
0443-0020-10	2±.5	4±.5	6±1	8±2	.10±2	12±1
0443-0030-10	3±.5	6±1	9±2	12±2	15±2	18±2
0443-0040-10	4±.5	8±2	12±2	16±2	20±2	24±2
0443-0050-10	5±1	10±2	15±2	20±2	25±2	30±2
0443-0060-10	6±1	12±2	18±2	24±2	30±2	36±2
0443-0070-10	7±1	14±2	21±2	28±2	35±2	42±2
0443-0080-10	8±2	16±2	24±2	32±2	40±2	48±2
0443-0090-10	9±2	18±2	27±2	36±2	45±2	54±2
0443-0100-10	10±2	20±2	30±2	40±2	50±2	60±3
0443-0150-10	15±2	30±2	45±2	60±3	75±3	90±3
0443-0200-10	20±2	40±2	60±3	80±3	100±3	120±4
0443-0250-10	25±2	50±2	75±3	100±3	125±4	150±4
0443-0300-10	30±2	60±3	90±3	120±4	150±5	180±6
0443-0350-10	35±2	70±3	105±4	140±5	175±5	210±7
0443-0400-10	40±2	80±3	120±4	160±5	200±6	240±7
0443-0450-10	45±2	90±3	135±4	180±6	225±7	270±8
0443-0500-10	50±2	100±3	150±5	200±6	250±8	300±9

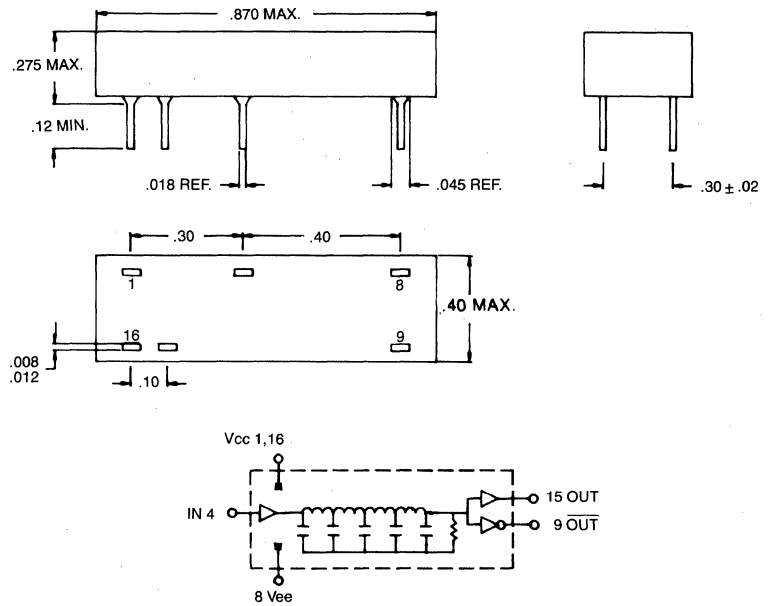
Part Number	Tap 7 1, 3, 4	Tap 8 1, 3,4	Tap 9 1, 3, 4	Output 1, 3, 4	Rise Time 2, 3, 4
0443-0011-10	8±2	9±2	10±2	11±2	4
0443-0020-10	14±2	16±2	18±2	20±2	4
0443-0030-10	21±2	24±2	27±2	30±2	4
0443-0040-10	28±2	32±2	36±2	40±2	4
0443-0050-10	35±2	40±2	45±2	50±2	4
0443-0060-10	42±2	48±2	54±2	60±3	4
0443-0070-10	49±2	56±2	63±3	70±3	4
0443-0080-10	56±2	64±3	72±3	80±3	4
0443-0090-10	63±3	72±3	81±3	90±3	5
0443-0100-10	70±3	80±3	90±3	100±3	5
0443-0150-10	105±4	120±4	135±4	150±5	8
0443-0200-10	140±5	160±5	180±5	200±6	10
0443-0250-10	175±5	200±6	225±7	250±8	15
0443-0300-10	210±7	240±7	270±8	300±9	15
0443-0350-10	245±8	280±9	315±10	350±11	20
0443-0400-10	280±9	320±10	360±11	400±12	20
0443-0450-10	315±10	360±11	405±12	450±14	25
0443-0500-10	350±11	400±12	450±14	500±15	25

1 Delays measured at 50% of the pulse on leading edge only.
2 Rise Times measured from 20% to 80% of the pulse.
3 All timing in NS.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0464 ECL 10K DELAY MODULE DUAL OUTPUTS



TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	– 0.9 Volts
Logic 0	– 1.8 Volts
Rise Time	2.0 Nsec (20% to 80%)
Pulse Width	2 x Delay
Pulse Period	4 x Pulse Width
Supply Voltage, Vee	– 5.2 Volts
Output Terminations	50 Ohm ± 1% to – 2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerances
As Specified in Table
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
– 4.94 To – 5.46 Volts
Logic 1 Input Voltage
– 0.98 Volts min.
Logic 1 Input Current
245 Microamp max.
Logic 1 Output Voltage
– 0.96 Volts min.
Logic 0 Input Voltage
– 1.63 Volts max.
Logic 0 Input Current
0.5 Microamp min.
Logic 0 Output Voltage
– 1.65 Volts max.
Operating Temperature Range
– 30°C To 85°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
100% Of Total Delay
Maximum Duty Cycle
50%

—Compatible with ECL 10K circuits
—Other delays and tolerances upon request

Part Number	Rise Time 2, 3	Delay 1, 3	Part Number	Rise Time 2, 3	Delay 1, 3
0464-0004-01	3	4±.5	0464-0035-01	7	35±2
0464-0005-01	3	5±1	0464-0040-01	8	40±2
0464-0006-01	3	6±1	0464-0045-01	8	45±2
0464-0007-01	3	7±1	0464-0050-01	9	50±2
0464-0008-01	3	8±1.5	0464-0055-01	9	55±2
0464-0009-01	3	9±1.5	0464-0060-01	10	60±2
0464-0010-01	4	10±1.5	0464-0065-01	10	65±2.5
0464-0011-01	4	11±1.5	0464-0070-01	11	70±2.5
0464-0012-01	4	12±1.5	0464-0075-01	11	75±2.5
0464-0013-01	4	13±1.5	0464-0080-01	12	80±2.5
0464-0014-01	4	14±1.5	0464-0085-01	13	85±3
0464-0015-01	5	15±1.5	0464-0090-01	13	90±3
0464-0016-01	5	16±1.5	0464-0095-01	14	95±3
0464-0017-01	5	17±1.5	0464-0100-01	15	100±3
0464-0018-01	5	18±1.5	0464-0125-01	18	125±4
0464-0019-01	5	19±1.5	0464-0150-01	20	150±5
0464-0020-01	5	20±2	0464-0200-01	25	200±6
0464-0021-01	6	21±2	0464-0250-01	25	250±8
0464-0022-01	6	22±2	0464-0300-01	30	300±10
0464-0023-01	6	23±2	0464-0350-01	30	300±10
0464-0024-01	6	24±2	0464-0400-01	30	400±12
0464-0025-01	6	25±2	0464-0450-01	30	450±14
0464-0030-01	7	30±2	0464-0500-01	30	500±15

1 Delays measured at 50% of the pulse on Leading Edge.
2 Rise time measured from 20% to 80% of the pulse.
3 All timing in NS.

Specifications Subject To Change Without Notice

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PULSE GENERATOR SERIES 0452 ECL 10K

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	– 0.9 Volts
Logic 0	– 1.8 Volts
Rise Time	2.0 Nsec (20% to 80%)
Pulse Width	5 Nsec
Pulse Period	4 x Output Pulse Width
Supply Voltage, Vee	– 5.2 Volts
Output Terminations	50 Ohm ± 1% to – 2 Volts
Ambient Temperature	25°C

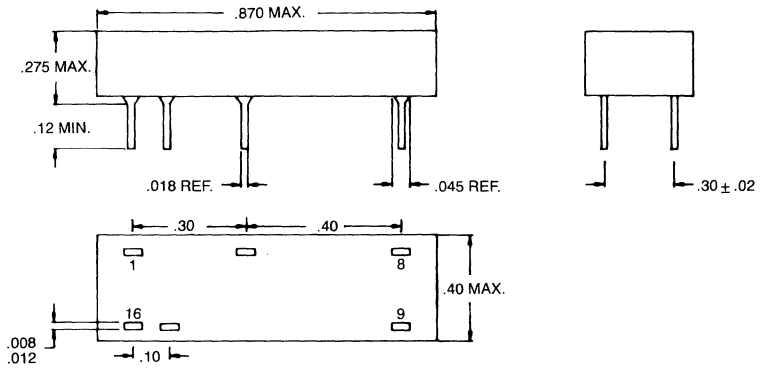
PERFORMANCE CHARACTERISTICS

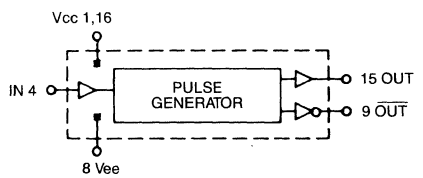
Pulse Width Tolerances
As Specified in Table
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
– 4.94 To – 5.46 Volts
Logic 1 Input Voltage
– 0.98 Volts min.
Logic 1 Input Current
265 Microamp max.
Logic 1 Output Voltage
– 0.96 Volts min.
Logic 0 Input Voltage
– 1.63 Volts max.
Logic 0 Input Current
.50 Microamp min.
Logic 0 Output Voltage
– 1.65 Volts max.
Operating Temperature Range
– 30°C To 85°C
Temperature Coefficient Of Output Pulse Width
300PPM/°C Typical

—Compatible with ECL 10K circuits
—Other pulse widths and tolerances upon request





Part Number	Pulse Width (NS) 1	Maximum Pulse Rate (MHZ)
0452-0005-01	5 ± 1	76
0452-0006-01	6 ± 1	66
0452-0007-01	7 ± 1	56
0452-0008-01	8 ± 1	50
0452-0009-01	9 ± 1	45
0452-0010-01	10 ± 1	42
0452-0015-01	15 ± 1	30
0452-0020-01	20 ± 1	23
0452-0025-01	25 ± 1	18
0452-0030-01	30 ± 1	15
0452-0035-01	35 ± 1.5	13
0452-0040-01	40 ± 1.5	11
0452-0045-01	45 ± 1.5	10
0452-0050-01	50 ± 1.5	9
0452-0060-01	60 ± 1:5	8
0452-0070-01	70 ± 2.0	7
0452-0080-01	80 ± 2.0	6
0452-0090-01	90 ± 3.0	5
0452-0100-01	100 ± 3.0	4

1 Measured at 50% level.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE
SERIES 0459
HIGH SPEED
ECL 10KH DELAY MODULE
5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	– 0.9 Volts
Logic 0	– 1.8 Volts
Rise Time	1.0 Nsec (20%-80%)
Pulse Width	Total Delay + 10.0 Nsec
Pulse Period	4 x Pulse Width
Supply Voltage, Vee	– 5.2 Volts
Output Terminations	50 Ohm ±1% to – 2 Volts
Ambient Temperature	25°C

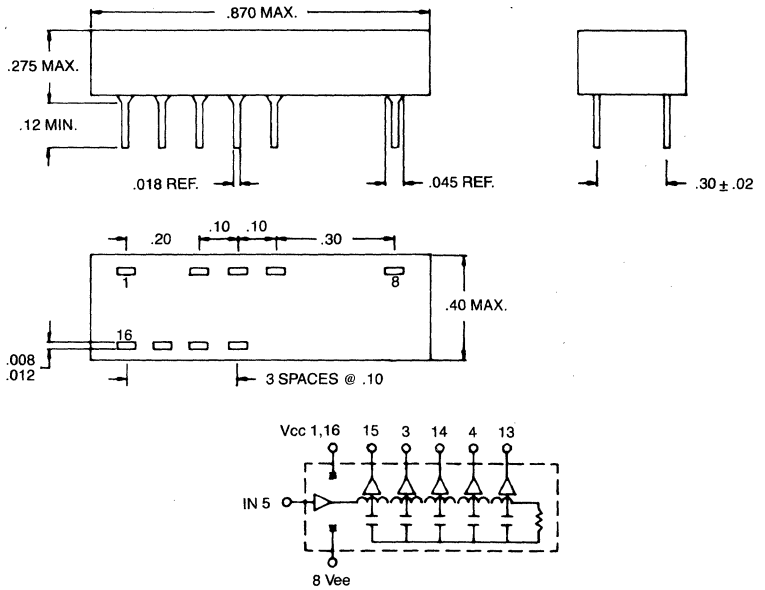
PERFORMANCE CHARACTERISTICS

Delay tolerances
As Specified In Table
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
– 4.94 To 5.46 Volts
Logic 1 Input Voltage
– 1.13 Volts min.
Logic 1 Input Current
310 Microamp max.
Logic 1 Output Voltage
– 0.98 Volts min.
Logic 0 Input Voltage
– 1.48 Volts max.
Logic 0 Output Voltage
– 1.63 Volts max.
Logic 0 Input Current
0.5 Microamp min.
Operating Temperature Range
0°C To 75°C
Temperature Coefficient Of Total Delay
300PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

—Compatible with ECL 10KH circuits.
—Other delays and tolerances upon request



Part Number	Tap 1 1, 3	Tap 2 1, 3	Tap 3 1, 3	Tap 4 1, 3	Output 1, 3	Rise Time 2, 3
0459-0006-02	2±.5	3±.5	4±1	5±1	6±1	2
0459-0010-02	2±.5	4±1	6±1	8±2	10±2	2
0459-0015-02	3±1	6±1	9±2	12±2	15±2	2
0459-0020-02	4±1	8±2	12±2	16±2	20±2	2
0459-0025-02	5±1	10±2	15±2	20±2	25±2	3
0459-0030-02	6±1	12±2	18±2	24±2	30±2	3
0459-0035-02	7±1	14±2	21±2	28±2	35±2	3
0459-0040-02	8±2	16±2	24±2	32±2	40±2	3
0459-0045-02	9±2	18±2	27±2	36±2	45±2	4
0459-0050-02	10±2	20±2	30±2	40±2	50±2	4
0459-0075-02	15±2	30±2	45±2	60±3	75±3	5
0459-0100-02	20±2	40±2	60±3	80±3	100±3	8
0459-0125-02	25±2	50±2	75±3	100±3	125±4	8
0459-0150-02	30±2	60±3	90±3	120±4	150±5	10
0459-0175-02	35±2	70±3	105±4	140±5	175±5	10
0459-0200-02	40±2	80±3	120±4	160±5	200±6	12
0459-0225-02	45±2	90±3	135±4	180±6	225±7	13
0459-0250-02	50±2	100±3	150±5	200±6	250±8	14
0459-0300-02	60±3	120±4	180±5	240±7	300±9	15
0459-0350-02	70±3	140±5	210±7	280±9	350±11	15
0459-0400-02	80±3	160±5	240±7	320±10	400±12	18
0459-0450-02	90±3	180±6	270±8	360±11	450±14	18
0459-0500-02	100±3	200±6	300±9	400±12	500±15	20

1 Delays measured at 50% of the pulse on leading edge only.
2 Rise time measured from 20% to 80% of the pulse.
3 All timing in NS.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0453 ECL 10KH PROGRAMMABLE LOGIC DELAY MODULE 3 BIT

TECHNICAL INFORMATION

TEST CONDITIONS

Driving Signal	ECL 10KH Buffer
Pulse Width	1.5 x Total Delay
Pulse Period	1000 Nsec
Supply Voltage, Vee	−5.2 Volts
Output Terminations	50 Ohm ±1% to −2 Volts
Ambient Temperature	25°C

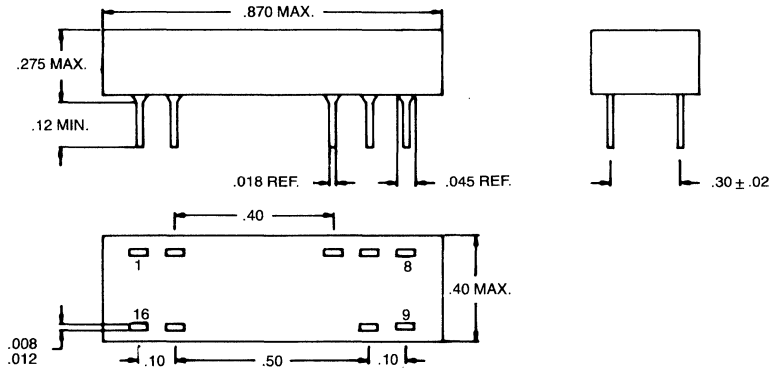
PERFORMANCE CHARACTERISTICS

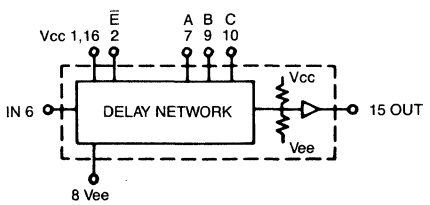
Delay tolerances
As Specified In Table
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
−4.94 To 5.46 Volts
Logic 1 Input Voltage
−1.13 Volts min.
Logic 1 Output Voltage
−0.98 Volts min.
Logic 0 Input Voltage
−1.48 Volts max.
Logic 0 Output Voltage
−1.63 Volts max.
Input Impedance
100 Ohms ±5%
Operating Temperature Range
0°C To 75°C
Temperature Coefficient Of Total Delay
150PPM/°C Typical

—Compatible with ECL 10KH circuits.
—Other delays and tolerances upon request.





Part Number	*Min. Delay (Nom.) 1	** Max. Delay (Nom.) 1	Δ Delay /Step 1	Total Programmable Delay and its Tolerance 1
0453-0009-03	1.5NS	8.5NS	1±.3NS	7±.4NS
0453-0016-03	1.5NS	15.5NS	2±.4NS	14±.6NS
0453-0023-03	1.5NS	22.5NS	3±.5NS	21±.8NS
0453-0030-03	1.5NS	29.5NS	4±.5NS	28±.9NS
0453-0037-03	1.5NS	36.5NS	5±.5NS	35±.1NS
0453-0044-03	1.5NS	43.5NS	6±.6NS	42±1.2NS
0453-0051-03	1.5NS	50.5NS	7±.7NS	49±1.4NS
0453-0058-03	1.5NS	57.5NS	8±.8NS	56±1.6NS
0453-0065-03	1.5NS	64.5NS	9±.9NS	63±1.8NS
0453-0072-03	1.5NS	71.5NS	10±1NS	70±2.0NS

1 Delays measured at 50% of the pulse on leading edge only.

CONTROL SIGNAL TABLE

C	B	A	
0	0	0	*
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	**

* Minimum delay code
** Maximum delay code

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0453 ECL 10KH PROGRAMMABLE LOGIC DELAY MODULE 4 BIT

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	– 0.9 Volts
Logic 0	– 1.8 Volts
Rise Time 20% to 80%	1.0 Nsec
Pulse Width	1.5 x Total Delay
Pulse Period	1000 Nsec
Supply Voltage, Vee	– 5.2 Volts
Output Terminations	50 Ohm ± 1% to – 2 Volts
Ambient Temperature	25°C

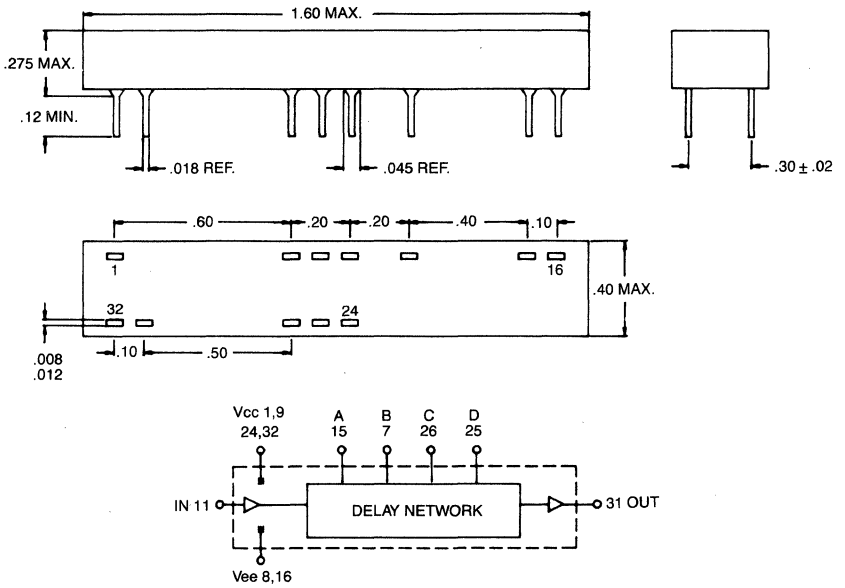
PERFORMANCE CHARACTERISTICS

Delay Tolerances
As Specified in Table
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
– 4.94 To – 5.46 Volts
Logic 1 Input Voltage
– 1.13 Volts min.
Logic 1 Input Current
600 Microamp max.
Logic 1 Output Voltage
– 0.98 Volts min.
Logic 0 Input Voltage
– 1.48 Volts max.
Logic 0 Input Current
1 Microamp min.
Logic 0 Output Voltage
– 1.63 Volts max.
Operating Temperature Range
0°C To 75°C
Temperature Coefficient Of Total Delay
150PPM/°C Typical

—Compatible with ECL 10KH circuits.
—Other delays and tolerances upon request.



Part Number	* Min. Delay (Nom.) 1	** Max. Delay (Nom.) 1	Δ Delay /Step 1	Total Programmable Delay and its Tolerance 1
0453-0020-04	5 ± 1NS	20NS	1 ± .4NS	15 ± .8NS
0453-0035-04	5 ± 1NS	35NS	2 ± .5NS	30 ± 1.2NS
0453-0050-04	5 ± 1NS	50NS	3 ± .5NS	45 ± 1.6NS
0453-0065-04	5 ± 1NS	65NS	4 ± .6NS	60 ± 1.8NS
0453-0080-04	5 ± 1NS	80NS	5 ± .6NS	75 ± 2.0NS
0453-0095-04	5 ± 1NS	95NS	6 ± .8NS	90 ± 2.4NS
0453-0100-04	5 ± 1NS	100NS	7 ± .8NS	105 ± 2.8NS
0453-0125-04	5 ± 1NS	125NS	8 ± 1NS	120 ± 3.2NS
0453-0140-04	5 ± 1NS	140NS	9 ± 1NS	135 ± 3.6NS
0453-0155-04	5 ± 1NS	155NS	10 ± 1NS	150 ± 4.0NS

1 Delays measured at 50% of the pulse on leading edge only.

CONTROL SIGNAL TABLE

D	C	B	A	
0	0	0	0	*
0	0	0	1	
0	0	1	0	
1	1	1	0	
1	1	1	1	**

16 STEPS

* Minimum delay code
** Maximum delay code

Specifications Subject To Change Without Notice

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PULSE GENERATOR SERIES 0454 HIGH SPEED ECL 10KH

TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	– 0.9 Volts
Logic 0	– 1.8 Volts
Rise Time 20% to 80%	1.0 Nsec
Pulse Width	5 Nsec
Pulse Period	4 x Output Pulse Width
Supply Voltage, Vee	– 5.2 Volts
Output Terminations	50 Ohm ±1% to – 2 Volts
Ambient Temperature	25°C

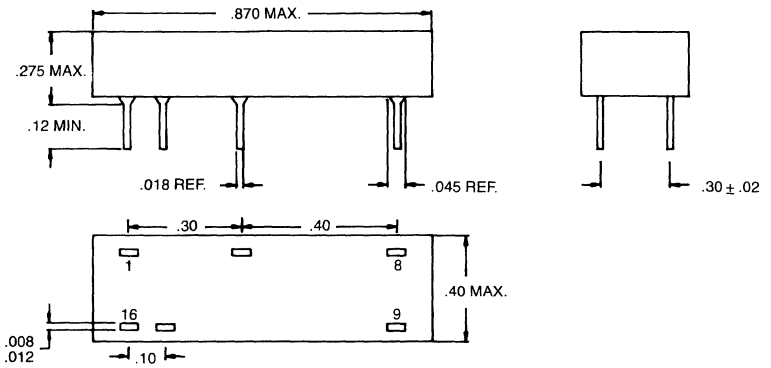
PERFORMANCE CHARACTERISTICS

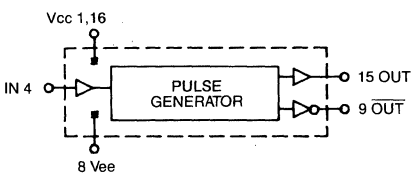
Pulse Width Tolerances
As Specified in Table
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
– 4.94 To – 5.46 Volts
Logic 1 Input Voltage
– 1.13 Volts min.
Logic 1 Input Current
265 Microamp max.
Logic 1 Output Voltage
– 0.98 Volts min.
Logic 0 Input Voltage
– 1.48 Volts max.
Logic 0 Input Current
0.5 Microamp min.
Logic 0 Output Voltage
– 1.63 Volts max.
Operating Temperature Range
0°C To 75°C
Temperature Coefficient Of Output Pulse Width
300PPM/°C Typical

—Compatible with ECL 10KH circuits
—Other pulse widths and tolerances upon request





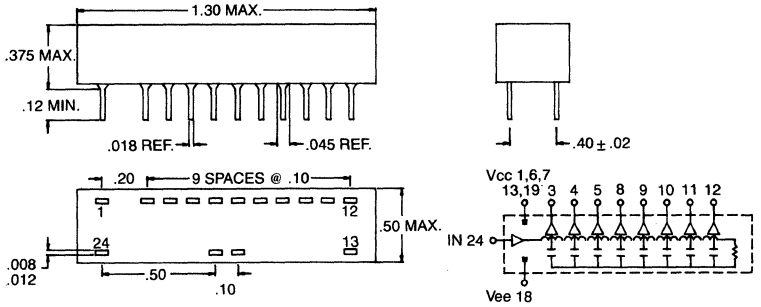
Part Number	Pulse Width (NS) 1	Maximum Pulse Rate (MHz)
0454-0005-01	5 ± 1.0	98
0454-0006-01	6 ± 1.0	80
0454-0007-01	7 ± 1.0	70
0454-0008-01	8 ± 1.0	60
0454-0009-01	9 ± 1.0	54
0454-0010-01	10 ± 1.0	49
0454-0015-01	15 ± 1.0	32
0454-0020-01	20 ± 1.0	24
0454-0025-01	25 ± 1.0	19
0454-0030-01	30 ± 1.0	15
0454-0035-01	35 ± 1.5	13
0454-0040-01	40 ± 1.5	11
0454-0045-01	45 ± 1.5	10
0454-0050-01	50 ± 1.5	9
0454-0060-01	60 ± 1.5	8
0454-0070-01	70 ± 2.0	7
0454-0080-01	80 ± 2.0	6
0454-0090-01	90 ± 3.0	5
0454-0100-01	100 ± 3.0	4

1 Measured at 50% level.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES 0461 ECL 100K DELAY MODULE 8 TAP



TECHNICAL INFORMATION

TEST CONDITIONS

Logic 1	– 0.9 Volts
Logic 0	– 1.7 Volts
Rise Time 20% to 80%	1.0 Nsec
Pulse Width	Total Delay ± 10.0 Nsec
Pulse Period	4 x Pulse Width
Supply Voltage, Vee	– 4.5 Volts
Output Terminations	50 Ohm ± 1% to – 2 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerances
As Specified In Table
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Supply Voltage, Vee
– 4.2 To – 4.8 Volts
Logic 1 Input Voltage
– 1.165 Volts min.
Logic 1 Input Current
350 Microamp max.
Logic 1 Output Voltage
– 1.025 Volts min.
Logic 0 Input Voltage
– 1.475 Volts max.
Logic 0 Input Current
0.5 Microamp min.
Logic 0 Output Voltage
– 1.62 Volts max.
Operating Temperature Range
0°C To 85°C
Temperature Coefficient Of Total Delay
300PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

—Compatible with ECL 100K circuits.
—Other delays and tolerances upon request

Part Number	Rise Time 2, 3	Tap 1 1, 3	Tap 2 1, 3	Tap 3 1, 3	Tap 4 1, 3
0461-0016-01	2.0	2±.5	4±.5	6±1	8±1
0461-0020-01	2.0	2.5±.5	5±.5	7.5±1	10±1.5
0461-0024-01	2.0	3±.5	6±1	9±1	12±1.5
0461-0028-01	2.0	3.5±.5	7±1	10.5±1.5	14±1.5
0461-0032-01	2.5	4±.5	8±1	12±1.5	16±1.5
0461-0036-01	2.5	4.5±.5	9±1	13.5±1.5	18±1.5
0461-0040-01	2.5	5±.5	10±1.5	15±1.5	20±1.5
0461-0044-01	3.0	5.5±1	11±1.5	16.5±1.5	22±2
0461-0048-01	3.0	6±1	12±1.5	18±1.5	24±2
0461-0052-01	3.0	6.5±1	13±1.5	19.5±1.5	26±2
0461-0056-01	3.0	7±1	14±1.5	21±2	28±2
0461-0060-01	4.0	7.5±1	15±1.5	22.5±2	30±2
0461-0064-01	4.0	8±1	16±1.5	24±2	32±2
0461-0068-01	4.0	8.5±1	17±1.5	25.5±2	34±2
0461-0072-01	4.5	9±1	18±1.5	27±2	36±2
0461-0076-01	4.5	9.5±1	19±1.5	28.5±2	38±2
0461-0080-01	4.5	10±1.5	20±2	30±2	40±2

Part Number	Tap 5 1, 3	Tap 6 1, 3	Tap 7 1, 3	Output 1, 3
0461-0016-01	10±1.5	12±1.5	14±1.5	16±1.5
0461-0020-01	12.5±1.5	15±1.5	17.5±1.5	20±2
0461-0024-01	15±1.5	18±1.5	21±2	24±2
0461-0028-01	17.5±1.5	21±2	24.5±2	28±2
0461-0032-01	20±2	24±2	28±2	32±2
0461-0036-01	22.5±2	27±2	31.5±2	36±2
0461-0040-01	25±2	30±2	35±2	40±2
0461-0044-01	27.5±2	33±2	38.5±2	44±2
0461-0048-01	30±2	36±2	42±2	48±2
0461-0052-01	32.5±2	39±2	45.5±2	52±2
0461-0056-01	35±2	42±2	49±2	56±2
0461-0060-01	37.5±2	45±2	52.5±2	60±2.5
0461-0064-01	40±2	48±2	56±2	64±2.5
0461-0068-01	42.5±2	51±2	59.5±2	68±2.5
0461-0072-01	45±2	54±2	63±2.5	72±3
0461-0076-01	47.5±2	57±2	66.5±2.5	76±3
0461-0080-01	50±2	60±2.5	70±3	80±3

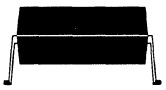
1 Delays measured at 50% of the pulse on leading edge only.
2 Rise Times measured from 20% to 80%.
3 All timing in NS.

Specifications Subject To Change Without Notice

All Silicon Active Delay Lines



8 PIN DIP
14 PIN DIP
16 PIN DIP
(300 MIL)



8 PIN GULLWING
14 PIN GULLWING
16 PIN GULLWING

ALSO AVAILABLE IN DIE FORM



16 PIN SOIC
(300 MIL)



8 PIN SOIC
(150 MIL)

- All silicon time delays
- Leading and trailing edge accuracy
- Auto–insertable, low profile
- Tape and reel available
- Extended temperature range available
- Vapor phase, IR and wave solderable
- TTL/CMOS compatible, low power CMOS
- Custom delays available

Specification temp. 0° to 70°C ■ Operating temp. –40°C to +85°C ■ Storage temp. –55°C to +125°C ■ Soldering temp. 260°C for 10 s				
DS1000 **5 Tap Silicon Delay Line** ALSO AVAILABLE IN DIE FORM	• Delay tolerance ±5% or 2ns • 5 Taps equally spaced • Leading and trailing edge accuracy • Custom delays available • Extended temperature range available • Tighter tolerances available	14–Pin DIP 14–Pin DIP Sheared NC 8–Pin DIP 14–Pin GULLWING 8–Pin GULLWING 16–Pin SOIC 8–Pin SOIC	DS1000–XXX DS1000K–XXX DS1000M–XXX DS1000G–XXX DS1000H–XXX DS1000S–XXX DS1000Z–XXX*	XXX=25 to 500ns XXX=25 to 500ns XXX=25 to 500ns XXX=25 to 500ns XXX=25 to 500ns XXX=25 to 500ns XXX=25 to 500ns
DS1003 **4 Tap Silicon Delay Line for RISC Applications** ALSO AVAILABLE IN DIE FORM	• 4 Delayed clock phases • Support of 50% duty cycle clocks • Leading and trailing edge controlled • Tap to tap tolerance ±0.5ns • CMOS compatible output • Vapor phase, IR and wave solderable • Custom values available	14–Pin DIP 14–Pin DIP 8–Pin DIP 8–Pin DIP 8–Pin DIP 8–Pin GULLWING 8–Pin GULLWING 8–Pin GULLWING 8–Pin GULLWING 8–Pin GULLWING	DS1003–16 DS1003–20 DS1003M–25 DS1003M–33 DS1003M–40* DS1003H–16 DS1003H–20 DS1003H–25 DS1003H–33 DS1003H–40*	16=RISC – 16 20=RISC – 20 25=RISC – 25 33=RISC – 33 40=RISC – 40 16=RISC – 16 20=RISC – 20 25=RISC – 25 33=RISC – 33 40=RISC – 40
DS1005 **5Tap Silicon Delay Line Voltage Compensated** ALSO AVAILABLE IN DIE FORM	• Delay tolerance ±2ns or ±2% • 5 Taps equally spaced • Leading and trailing edge accuracy • Custom delays available • Extended temperature range available • Tighter tolerances available	14–Pin DIP 14–Pin DIP Sheared NC 8–Pin DIP 14–Pin GULLWING 8–Pin GULLWING 16–Pin SOIC	DS1005–XXX DS1005K–XXX DS1005M–XXX DS1005G–XXX DS1005H–XXX DS1005S–XXX	XXX=60 to 250ns XXX=60 to 250ns XXX=60 to 250ns XXX=60 to 250ns XXX=60 to 250ns XXX=60 to 250ns
DS1007 **7–in–1 Silicon Delay Line** ALSO AVAILABLE IN DIE FORM	• 7 independent buffered delays • Delay tolerance ±2ns • 4 delays can be custom set from 3ns to 10ns • 3 delays can be custom set from 9ns to 40ns • Tighter tolerances available	16–Pin DIP 16–Pin GULLWING 16–Pin SOIC	DS1007–XXX DS1007G–XXX DS1007S–XXX	XXX=3 to 40ns XXX=3 to 40ns XXX=3 to 40ns

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CUSTOM DELAYS

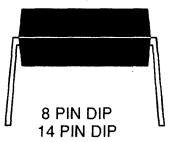
LPP LATE PACKAGE PROGRAMMING

1 WEEK PROTOTYPE SERVICE
TELEPHONE (214) 450–5348
FAX (214) 450–3715

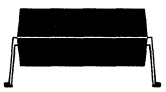
DALLAS SEMICONDUCTOR

4401 South Beltwood Parkway
Dallas Texas, 75244–3292
Telephone 214–450–0400
FAX 214–450–0470

Six Years Experience Making Silicon Delay Lines



8 PIN DIP
14 PIN DIP
16 PIN DIP
(300 MIL)



8 PIN GULLWING
14 PIN GULLWING
16 PIN GULLWING

ALSO AVAILABLE IN DIE FORM



16 PIN SOIC
(300 MIL)



8 PIN SOIC
(150 MIL)

- All silicon time delays
- Leading and trailing edge accuracy
- Auto–insertable, low profile
- Tape and reel available
- Extended temperature range available
- Vapor phase, IR and wave solderable
- TTL/CMOS compatible, low power CMOS
- Custom delays available

Specification temp. 0° to 70°C ■ Operating temp. –40°C to +85°C ■ Storage temp. –55°C to +125°C ■ Soldering temp. 260°C for 10 s

DS1010 **10 Tap Silicon Delay Line** ALSO AVAILABLE IN DIE FORM	• 10 taps equally spaced • Delay tolerance ±5% or 2ns • Leading and trailing edge accuracy • Custom delays available • Extended temperature range available • Tighter tolerances available	14–Pin DIP 14–Pin GULLWING 16–Pin SOIC	DS1010–XXX DS1010G–XXX DS1010S–XXX	XXX=50 to 1000ns XXX=50 to 1000ns XXX=50 to 1000ns
DS1012 **2–in–1 Sub–Miniature Silicon Delay Line with Logic** ALSO AVAILABLE IN DIE FORM	• Two independent buffered delays per input • Option of timed AND, NAND, OR, NOR, XOR, XNOR, HALF–XOR, and HALF X–NOR outputs • Option of complemented outputs • Low power • Custom delays or logic options available	8–Pin DIP 8–Pin GULLWING 8–Pin SOIC	DS1012M–XXX DS1012H–XXX DS1012S–XXX	XXX=3 to 60ns XXX=3 to 60ns XXX=3 to 60ns
DS1012–DXX **Pulse Doubler** ALSO AVAILABLE IN DIE FORM	• Wide range of frequencies • Fixed–width pluse for any input transition • Doubles specific frequencies • Low–power	8–Pin DIP 8–Pin GULLWING 8–Pin SOIC	DS1012M–DXX* DS1012H–DXX* DS1012S–DXX*	DXX=16 to 50 MHz DXX=16 to 50 MHz DXX=16 to 50 MHz
DS1012–VXX **Voltage–Controlled Oscillator** ALSO AVAILABLE IN DIE FORM	• Low power VCO • Quasi–Linear • 5 volt frequencies from 20 to 50 MHz • Oscillates from 1V to 5.5V	8–Pin DIP 8–Pin GULLWING 8–Pin SOIC	DS1012M–FXX* DS1012H–FXX* DS1012S–FXX*	FXX=20 to 50 MHz FXX=20 to 50 MHz FXX=20 to 50 MHz

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CUSTOM DELAYS

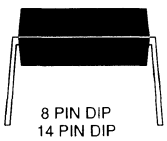
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Dallas Texas, 75244–3292
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FAX 214–450–0470

Single Silicon Timing Solutions



8 PIN DIP
14 PIN DIP
16 PIN DIP
(300 MIL)



8 PIN GULLWING
14 PIN GULLWING
16 PIN GULLWING

ALSO AVAILABLE IN DIE FORM



16 PIN SOIC
(300 MIL)



8 PIN SOIC
(150 MIL)

- All silicon time delays
- Leading and trailing edge accuracy
- Auto–insertable, low profile
- Tape and reel available
- Extended temperature range available
- Vapor phase, IR and wave solderable
- TTL/CMOS compatible, low power CMOS
- Custom delays available

Specification temp. 0° to 70°C ■ Operating temp. –40°C to +85°C ■ Storage temp. –55°C to +125°C ■ Soldering temp. 260°C for 10 s				
DS1013 **3–in–1 Silicon Delay Line** **Voltage Compensated** ALSO AVAILABLE IN DIE FORM	• Three independent buffered delays • Delay tolerance ±2ns or 3% • Leading and trailing edge accuracy • Custom delays available • Extended temperature range available • Tighter tolerances available	14–Pin DIP 8–Pin DIP 14–Pin GULLWING 8–Pin GULLWING 16–Pin SOIC	DS1013–XXX DS1013M–XXX DS1013G–XXX DS1013H–XXX DS1013S–XXX	XXX=15 to 100ns XXX=15 to 100ns XXX=15 to 100ns XXX=15 to 100ns XXX=15 to 100ns
DS1020 **8–Bit Programmable** **Silicon Delay Line** ALSO AVAILABLE IN DIE FORM	• 0.25ns, 0.5ns, 1ns and 2ns steps • Programmable using 3–wire serial port • Programmable using 8–bit parallel port • 10ns minimum delay • 256 increments	16–Pin DIP 16–Pin GULLWING 16–Pin SOIC	DS1020–XXX DS1020G–XXX DS1020S–XXX	XXX: 025=0.25ns 050=0.50ns 100=1.00ns 200=2.00ns
DS1040 (Preliminary) **Programmable Pulse** **Generator** ALSO AVAILABLE IN DIE FORM	• Rising edge triggered • 5 evenly spaced pulse width • Parallel programmable • Maximum pulse widths from 25ns to 500ns • Inverted and non–inverted outputs • Custom available (non–evenly spaced intermediate pulse widths, non–standard maximum widths)	8–Pin DIP 8–Pin GULLWING 8–Pin SOIC	DS1040M–XXX* DS1040H–XXX* DS1040Z–XXX*	XXX=25 to 500ns XXX=25 to 500ns XXX=25 to 500ns
DS1045 (Preliminary) **4–Bit Programmable** **Delay Line** ALSO AVAILABLE IN DIE FORM	• Instant update • 16 equal delays • Steps from 3 to 10ns • Compensated	14–Pin DIP 14–Pin GULLWING 16–Pin SOIC	DS1045–XXX* DS1045G–XXX* DS1045S–XXX*	XXX=5 to 50ns

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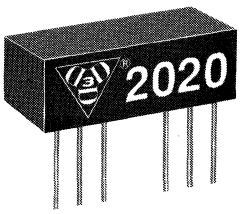
CUSTOM DELAYS
LPP LATE PACKAGE PROGRAMMING
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FAX 214–450–0470

data delay devices *New Dimensions in Delay Line Techniques*

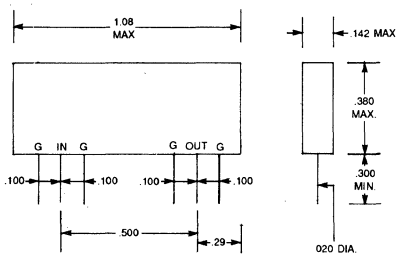
PICO Seconds Delay Lines

NEW



Specifications:

- **Delay range:** 100 ps to 1750 ps.
- **Delay tolerance:** 2% or 10 ps.
- **Frequency response:** Greater than 350 MHZ.
- **Ripple in pass-band:** Approximately .2 db.
- **Temperature range:** –65 to +125°C.
- **Temperature coefficient:** <100 PPM/°C.
- **Dielectric breakdown:** >500 V.
- **Meets or exceeds MIL-D-23859C.**
- **Epoxy encapsulated.**



Programmable Pulse Discriminator

Features:

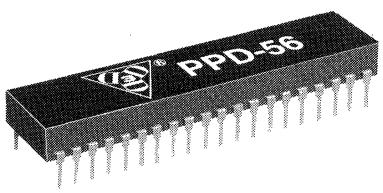
Unit Can Be Programmed To Digitally Discriminate:

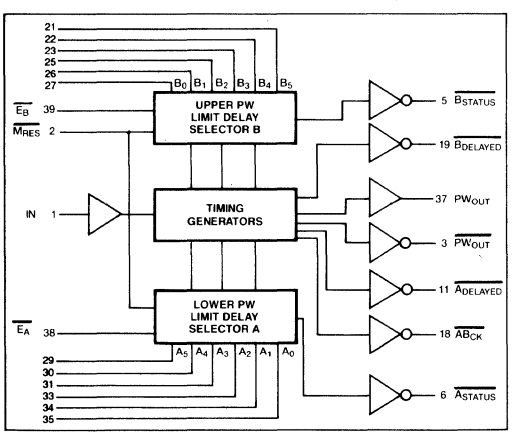
- All pulses below a certain pulse-width.
  or
- All pulses above a certain pulse-width.
  or
- All pulses other than a pulse-width window.

Specifications:

- **Microprocessor compatible.**
- **Input signal:** Schottky TTL
- **Output load:** TTL Schottky loads.
- **No. bits:** 6
- **Pulse width increment:** 0.5 ns to 10 ns.
- **Operating temperature:** 0° to 70°C (–55°C to +125°C on request
- **Temperature coefficient:** 100 PPM/°C
- **Power supply:** 5 Vdc.

NEW





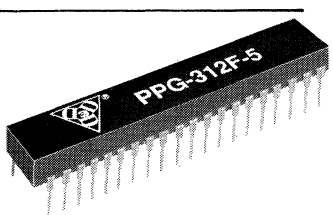
Vcc = 24, 28, 32, 36, 40 GRD = 4, 8, 12, 16, 20

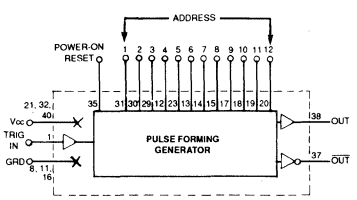
12 BIT Programmable Pulse Generator

Specifications:

- **Trigger inherent delay:** 13 ns typ.
- **Inherent pulse-width:** 19 ns typ.
- **Pulse-width variation:** monotonic in one direction.
- **Programmed pulse-width tolerance:** ±2% or 2 ns whichever is greater.
- **Supply voltage (Vcc):** 5 Vdc.
- **Operating temperature:** 0° C to 70° C.
- **Temperature coefficient:** 100 PPM/° C.
- **Supply current: Icc:** 200 ma.
- **Pulse-width increments:** 0.5 ns to 50 ns.

NEW



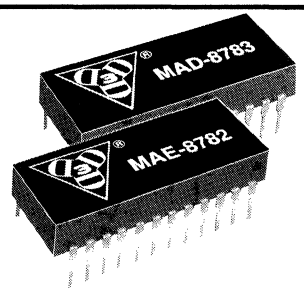


DATA DELAY DEVICES ■ 3 Mt. Prospect Avenue, Clifton, New Jersey 07013 ■ (201) 773-2299 ■ FAX (201) 773-9672

data delay devices

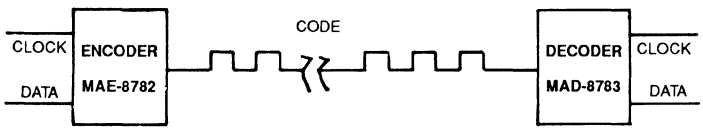
New Dimensions in Delay Line Techniques

1553 Manchester Encoder/Decoder Set

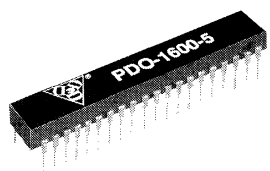


Specifications:

- **Very stable.**
- **20 MBAUD.**
- **24 pins DIP.**
- **TTL IN/OUT**
- **High speed optics.**
- **Military/commercial aircraft applications.**

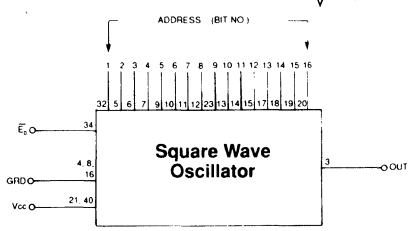


16 BIT Programmable Gated-Oscillator

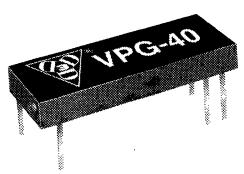


Specifications:

- **Period variation:** monotonic in one direction.
- **Duty cycle:** 50%.
- **Period tolerance:** ±5%.
- **Inherent period** = period increment.
- **Power dissipation:** 1.1 W max.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Operating temperature:** 0-70°C.
- **Temperature coefficient:** 100 PPM/° C.
- **Inherent delay (T_{DO})** = 12 ns.

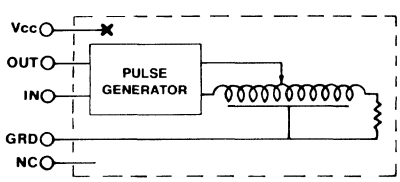


Variable Pulse Generator

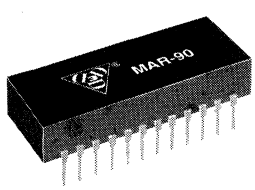


Specifications:

- **Screwdriver adjustment.**
- **Inherent pulse-width (PW_0):** 15 ns typ.
- **Trigger-inherent delay (TD_0):** 6 ns typ.
- **Pulse-width resolution:** .12 ns.
- **Output rise-time:** 2 ns typ.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** 0°C to 70°C standard. (–55°C to +125°C on request)
- **Supply voltage:** 5.0 Vdc ± 5%.
- **Power dissipation:** 300 mw max.

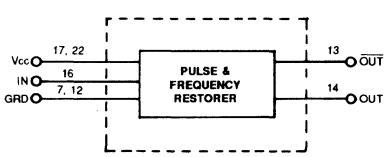


Manchester Repeater



Specifications:

- **Input signal requirement:** TTL logic.
- **Output fan-out:** STD-TTL Schottky loads.
- **Operating temperature:** 0°C – 70°C. (–55°C to +125°C on request).
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage, Vcc:** 5Vdc ±5%.
- **Power dissipation:** 350 mw typical.
- **Input frequency range:** ±5%.
- **Input pulse-width range:** ±20%.
- **Inherent delay** = 1/ (4 × baud rate).
- **Output lock-on time** = Inherent delay.



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data delay devices

New Dimensions in Delay Line Techniques

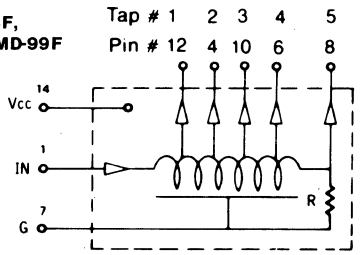
ACTIVE DELAY LINES (FAST-TTL LOGIC)

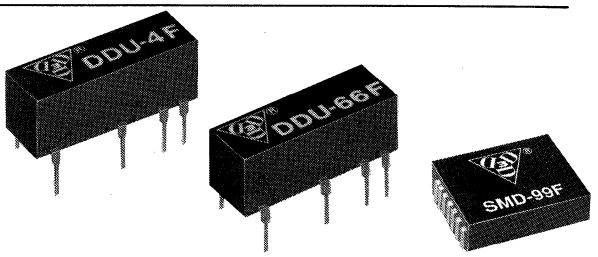
5 Equal Taps

Specifications:

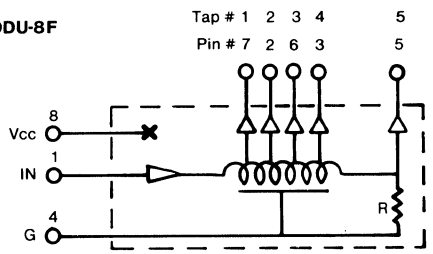
- **Outputs:** 5, equally spaced.
- **Delay Tolerance:** see table.
- **Rise time:** 2 NS typically.
- **Minimum pulse width:** 20% of total delay for DDU-4F.
  40% of total delay for rest.
- **Temperature range:** 0°C to + 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Supply current:**
  I_{CCL}: 32 ma.
  I_{CCH}: 7 ma.

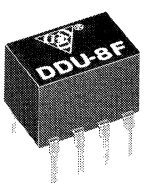
Series DDU-4F, DDU-66F-, SMD-99F



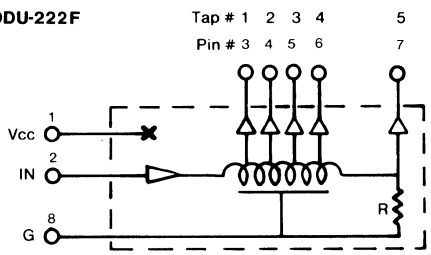


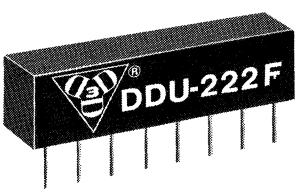
Series DDU-8F





Series DDU-222F





Part Numbers					Total Delay
DDU-4F-5004	DDU-8F-5004	DDU-66F-4	SMD-99F-5004	DDU-222F-4	4
DDU-4F-5006	DDU-8F-5006	DDU-66F-6	SMD-99F-5006	DDU-222F-6	6
DDU-4F-5008	DDU-8F-5008	DDU-66F-8	SMD-99F-5008	DDU-222F-8	8
DDU-4F-5010	DDU-8F-5010	DDU-66F-10	SMD-99F-5010	DDU-222F-10	10
DDU-4F-5012	DDU-8F-5012	DDU-66F-12	SMD-99F-5012	DDU-222F-12	12
DDU-4F-5016	DDU-8F-5016	DDU-66F-16	SMD-99F-5016	DDU-222F-16	16
DDU-4F-5020	DDU-8F-5020	DDU-66F-20	SMD-99F-5020	DDU-222F-20	20
DDU-4F-5025	DDU-8F-5025	DDU-66F-25	SMD-99F-5025	DDU-222F-25	25
DDU-4F-5030	DDU-8F-5030	DDU-66F-30	SMD-99F-5030	DDU-222F-30	30
DDU-4F-5035	DDU-8F-5035	DDU-66F-35	SMD-99F-5035	DDU-222F-35	35
DDU-4F-5040	DDU-8F-5040	DDU-66F-40	SMD-99F-5040	DDU-222F-40	40
DDU-4F-5045	DDU-8F-5045	DDU-66F-45	SMD-99F-5045	DDU-222F-45	45
DDU-4F-5050	DDU-8F-5050	DDU-66F-50	SMD-99F-5050	DDU-222F-50	50
DDU-4F-5060	DDU-8F-5060	DDU-66F-60	SMD-99F-5060	DDU-222F-60	60
DDU-4F-5075	DDU-8F-5075	DDU-66F-75	SMD-99F-5075	DDU-222F-75	75
DDU-4F-5100	DDU-8F-5100	DDU-66F-100	SMD-99F-5100	DDU-222F-100	100
DDU-4F-5125	DDU-8F-5125	DDU-66F-125	SMD-99F-5125	DDU-222F-125	125
DDU-4F-5150	DDU-8F-5150	DDU-66F-150	SMD-99F-5150	DDU-222F-150	150
DDU-4F-5175	DDU-8F-5175	DDU-66F-175	SMD-99F-5175	DDU-222F-175	175
DDU-4F-5200	DDU-8F-5200	DDU-66F-200	SMD-99F-5200	DDU-222F-200	200
DDU-4F-5250	DDU-8F-5250	DDU-66F-250	SMD-99F-5250	DDU-222F-250	250
DDU-4F-5300					300
DDU-4F-5350					350
DDU-4F-5400					400
DDU-4F-5450					450
DDU-4F-5500					500

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New Dimensions in Delay Line Techniques

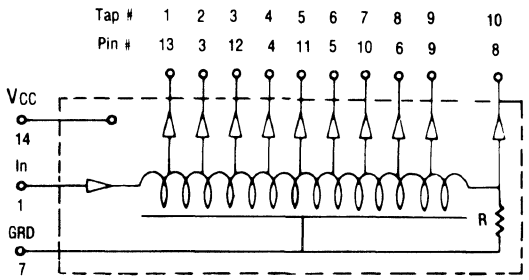
ACTIVE DELAY LINES (FAST-TTL LOGIC)

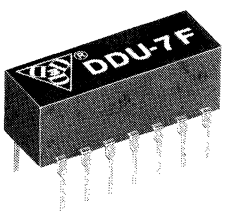
10 Taps

Specifications:

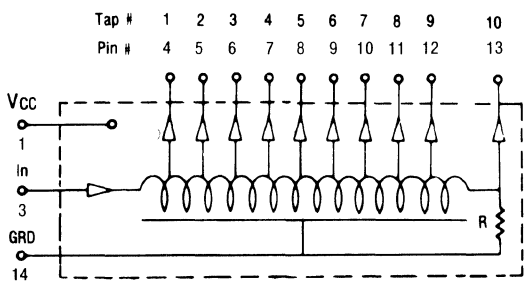
- **No. Taps:** 10 equally spaced taps
- **Total Delay Tolerance:** ± 5% or better, or 2 NS whichever is greater
- **Rise time:** 2 NS typically
- **Temperature coefficient:** 100 PPM/° C
- **Temperature range:** 0° to + 70° C
- **Minimum pulse-width:** 20% of total delay
- **input signal requirement:** TTL logic
- **Output fan-out:** TTL Schottky load.
- **Supply voltage:** 4.75 to 5.25 V
- **Supply Current:**
  I_{CCL}: 50 ma.
  I_{CCH}: 15 ma.

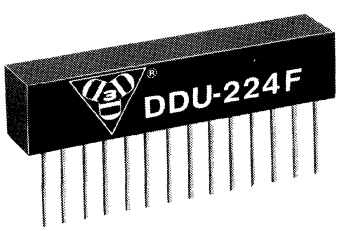
Series DDU-7F





Series DDU-224F





Part Numbers		Tap Delay	Total Delay
DDU-7F-10	DDU-224F-10	1	9
DDU-7F-20	DDU-224F-20	2	18
DDU-7F-25	DDU-224F-25	2.5	22.5
DDU-7F-50	DDU-224F-50	5	45
DDU-7F-100	DDU-224F-100	10	100
DDU-7F-150	DDU-224F-150	15	150
DDU-7F-200	DDU-224F-200	20	200
DDU-7F-250	DDU-224F-250	25	250
DDU-7F-300	DDU-224F-300	30	300
DDU-7F-400	DDU-224F-400	40	400
DDU-7F-500	DDU-224F-500	50	500

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New Dimensions in Delay Line Techniques

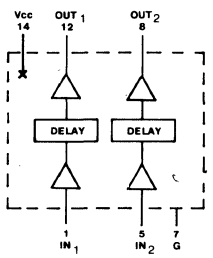
ACTIVE DELAY LINES (FAST-TTL LOGIC)

Multiple Delay Lines

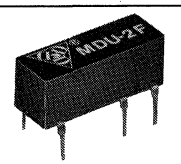
Specifications:

- **Delay Tolerance: ±5% or 2 NS whichever** is greater.
- **Rise-time:** 2 NS typically.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** 0° to + 70°C.
- **Input signal requirement:** TTL logic.
- **Input pulse width:** Min. 100% of total delay.
- **Input rep. rate** = min. 3 × pulse width.
- **Output fan-out:** TTL loads.
- **Supply voltage:** 5Vdc ± 5%.
- **Supply current:** see Table 2.

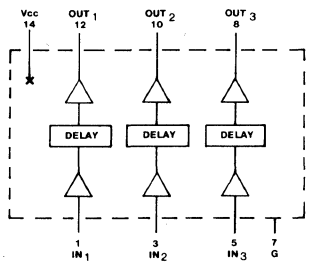
Series MDU-2F
Series MDU-28F

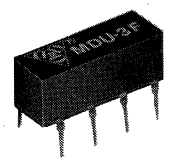




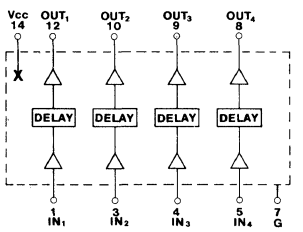


Series MDU-3F





Series MDU-4F



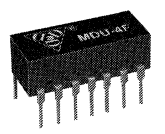


Table 1

Part Numbers				
MDU-28F	MDU-2F	MDU-3F	MDU-4F	Delay Per Line (ns)
MDU-28F-5	MDU-2F-5	MDU-3F-5	MDU-4F-5	.5
MDU-28F-6	MDU-2F-6	MDU-3F-6	MDU-4F-6	6
MDU-28F-8	MDU-2F-8	MDU-3F-8	MDU-4F-8	8
MDU-28F-10	MDU-2F-10	MDU-3F-10	MDU-4F-10	10
MDU-28F-12	MDU-2F-12	MDU-3F-12	MDU-4F-12	12
MDU-28F-15	MDU-2F-15	MDU-3F-15	MDU-4F-15	15
MDU-28F-16	MDU-2F-16	MDU-3F-16	MDU-4F-16	16
MDU-28F-20	MDU-2F-20	MDU-3F-20	MDU-4F-20	20
MDU-28F-25	MDU-2F-25	MDU-3F-25	MDU-4F-25	25
MDU-28F-30	MDU-2F-30	MDU-3F-30	MDU-4F-30	30
MDU-28F-35	MDU-2F-35	MDU-3F-35	MDU-4F-35	35
MDU-28F-40	MDU-2F-40	MDU-3F40	MDU-4F-40	40
MDU-28F-45	MDU-2F-45	MDU-3F-45	MDU-4F-45	45
MDU-28F-50	MDU-2F-50	MDU-3F-50	MDU-4F-50	50
MDU-28F-60	MDU-2F-60	MDU-3F-60	MDU-4F-60	60
MDU-28F-75	MDU-2F-75	MDU-3F-75	MDU-4F-75	75
MDU-28F-100	MDU-2F-100	MDU-3F100	MDU-4F-100	100
MDU-28F-125	MDU-2F-125			125
MDU-28F-150	MDU-2F-150			150
MDU-28F-175	MDU-2F-175			175
MDU-28F-200	MDU-2F-200			200
MDU-28F-250	MDU-2F-250			250

Series	I_{CCH}	I_{CCL}
MDU-28F	12 MA	54 MA
MDU-2F	12 MA	54 MA
MDU-3F	14 MA	74 MA
MDU-4F	24 MA	110 MA

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New Dimensions in Delay Line Techniques

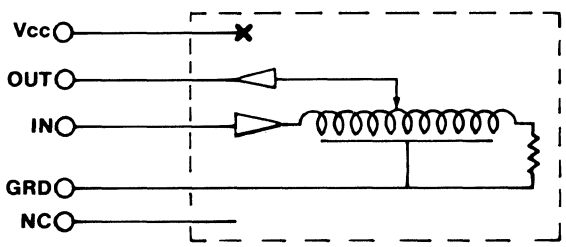
ACTIVE DELAY LINES (FAST-TTL LOGIC)

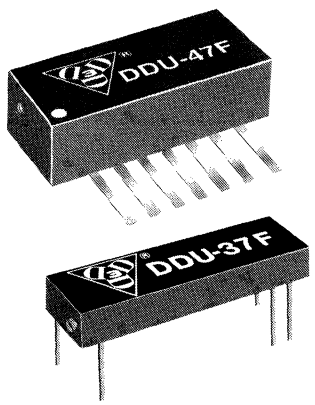
Trimmer Delay

Specifications:

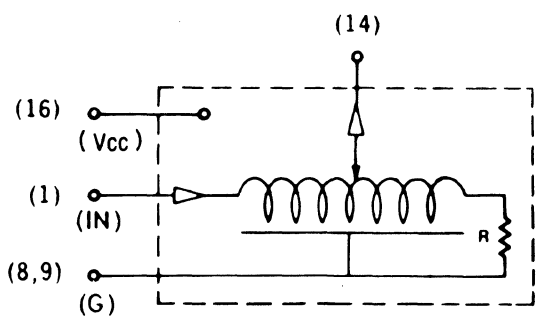
- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Inherent delay:** 10 NS typ.
- **Delay resolution:** .12 NS.
- **Output rise-time:** 4 NS typ.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** 0°C to 70°C standard. (−55°C to +125°C on request)
- **Supply voltage:** 5.0 Vdc ± 5%.
- **Power dissipation:** 230 MW max.

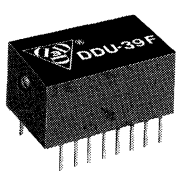
Series DDU-37F, Series DDU-47F





Series DDU-39F





Part No.	Min. Delay Variation (NS)
DDU-37F-25	15
DDU-37F-30	20
DDU-37F-40	30
DDU-37F-50	40
DDU-37F-60	50
DDU-37F-70	60
DDU-37F-80	70
DDU-37F-100	90
DDU-37F-120	100
DDU-37F-150	140
DDU-37F-200	180

Part No.	Inherent Delay Typ.	Adjustment Range Typ.
DDU-39F	7 ns	7 ns to 25 ns
DDU-47F	5 ns	5 ns to 25 ns

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New Dimensions in Delay Line Techniques

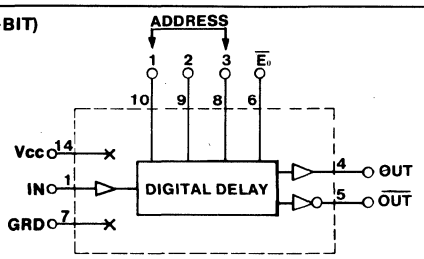
ACTIVE DELAY LINES (FAST-TTL LOGIC)

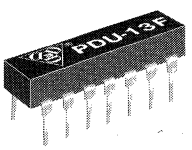
Digitally Programmable (3 - 8 BIT)

Specifications:

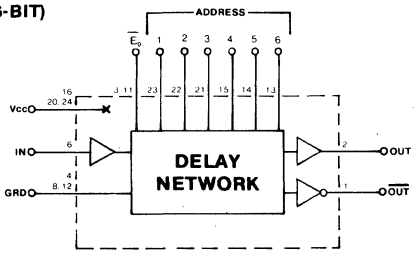
- **Input signal requirement:** TTL logic
- **Propagation delay:**
  Address to output = 7 NStyp.
  Enable to output = 6 NS typ.
- **Output fan-out:** TTL Schottky load
- **Delay variation:** Monotonic in one direction
- **Programmed delay tolerance:** ± 5% or 1 NS whichever is greater
- **Operating temperature:** 0-70°C
- **Temperature coefficient:** 100 PPM/°C
- **Supply current:** see Table 2
- **Supply voltage:** 4.75 to 5.25 Vdc.

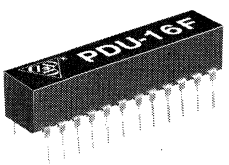
Series PDU-13F (3-BIT)



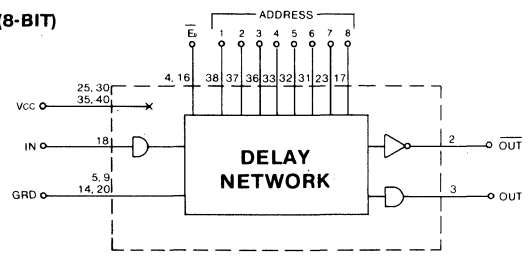


Series PDU-16F (6-BIT)





Series PDU-18F (8-BIT)



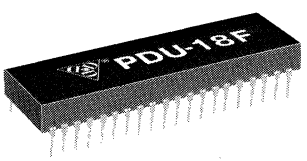


TABLE 1

Part Numbers						
PDU-13F	PDU-14F	PDU-15F	PDU-16F	PDU-17F	PDU-18F	Delay Increment
PDU-13F-.5	PDU-14F-.5	PDU-15F-0.5	PDU-16F-0.5	PDU-17F-.5	PDU-18F-.5	5 NS
PDU-13F-1	PDU-14F-1	PDU-15F-1	PDU-16F-1	PDU-17F-1	PDU-18F-1	1 NS
PDU-13F-2	PDU-14F-2	PDU-15F-2	PDU-16F-2	PDU-17F-2	PDU-18F-2	2 NS
PDU-13F-3	PDU-14F-3	PDU-15F-3	PDU-16F-3	PDU-17F-3	PDU-18F-3	3 NS
PDU-13F-4	PDU-14F-4	PDU-15F-4	PDU-16F-4	PDU-17F-4	PDU-18F-4	4 NS
PDU-13F-5	PDU-14F-5	PDU-15F-5	PDU-16F-5	PDU-17F-5	PDU-18F-5	5 NS
PDU-13F-6	PDU-14F-6	PDU-15F-6	PDU-16F-6	PDU-17F-6	PDU-18F-6	6 NS
PDU-13F-7	PDU-14F-7	PDU-15F-7	PDU-16F-7	PDU-17F-7	PDU-18F-7	7 NS
PFU-13F-8	PDU-14F-8	PDU-15F-8	PDU-16F-8	PDU-17F-8	PDU-18F-8	8 NS
PDU-13F-9	PDU-14F-9	PDU-15F-9	PDU-16F-9	PDU-17F-9	PDU-18F-9	9 NS
PDU-13F-10	PDU-14F-10	PDU-15F-10	PDU-16F-10	PDU-17F-10	PDU-18F-10	10 NS
PDU-13F-12	PDU-14F-12	PDU-15F-12				12 NS
PDU-13F-15	PDU-14F-15	PDU-15F-15				15 NS
PDU-13F-20	PDU-14F-20	PDU-15F-20				20 NS
PDU-13F-25	PDU-14F-25					25 NS
PDU-13F-30	PDU-14F-30					30 NS
PDU-13F-35	PDU-14F-35					35 NS
PDU-13F-40	PDU-14F-40					40 NS
PDU-13F-45	PDU-14F-45					45 NS
PDU-13F-50	PDU-14F-50					50 NS
	PDU-14F-60					60 NS
	PDU-14F-80					80 NS
	PDU-14F-100					100 NS

TABLE 2

Series No.	ICCH (MA)	ICCL (MA)	TDO (NS)
PDU-13F	20	45	4
PDU-14F	30	74	9
PDU-15F	30	74	13
PDU-16F	30	74	13
PDU-17F	68	86	14
PDU-18F	65	130	14

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New Dimensions in Delay Line Techniques

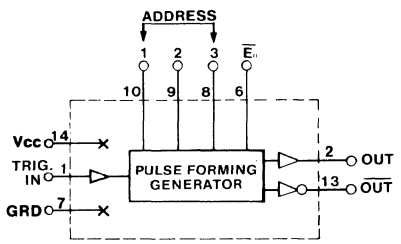
ACTIVE PULSE-WIDTH GENERATORS (FAST-TTL LOGIC)

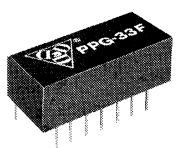
Programmable (3 - 8BITS)

Specifications:

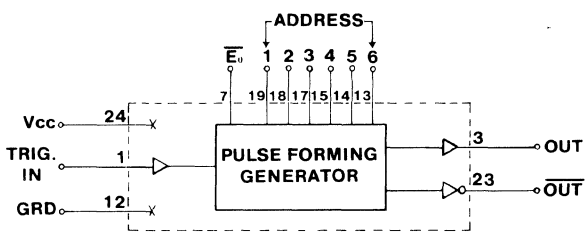
- **Input signal requirement:** TTL rising-edge.
- **Output fan-out:** TTL Schottky loads.
- **Trigger inherent delay:** 6 NS Typ.
- **Inherent pulse-width:** 11 NS Typ.
- **Pulse-width variation:** monotonic in one direction.
- **Programmed pulse-width tolerance:** ± 5% or 1 NS whichever is greater.
- **Propagation delay:**
  Address to output = 7 ns Typ.
  Enable to output = 6 ns Typ.
- **Min. PRR** = PW_{OUT} + 10 ns min.
- **Min. down-time** = 1 X programmed PW.
- **Supply voltage:** 5 Vdc.
- **Operating temperature:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Power dissipation:** see Table 2.

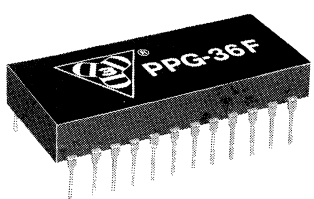
Series PPG-33F (3-BIT)





Series PPG-36F (6-BIT)





Series PPG-38F (8-BIT)

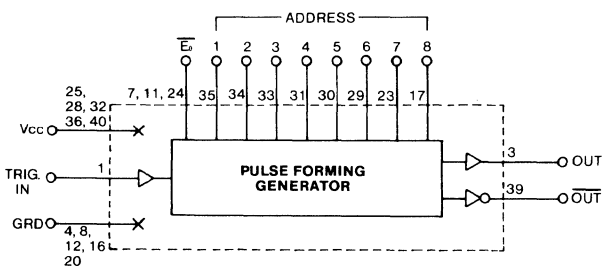




Table 1

Part Numbers			Incremental Pulse-Width
PPG-33F-.5	PPG-36F-.5	PPG-38F-.5	.5 NS
PPG-33F-1	PPG-36F-1	PPG-38F-1	1 NS
PPG-33F-2	PPG-36F-2	PPG-38F-2	2 NS
PPG-33F-3	PPG-36F-3	PPG-38F-3	3 NS
PPG-33F-4	PPG-36F-4	PPG-38F-4	4 NS
PPG-33F-5	PPG-36F-5	PPG-38F-5	5 NS
PPG-33F-6	PPG-36F-6	PPG-38F-6	6 NS
PPG-33F-7	PPG-36F-7	PPG-38F-7	7 NS
PPG-33F-8	PPG-36F-8	PPG-38F-8	8 NS
PPG-33F-9	PPG-36F-9	PPG-38F-9	9 NS
PPG-33F-10	PPG-36F-10	PPG-38F-10	10 NS
PPG-33F-15			15 NS
PPG-33F-20			20 NS
PPG-33F-40			40 NS
PPG-33F-50			50 NS

Table 2

Part Numbers	I_{CCL} (MA)	I_{CCH} (MA)
PPG-33F	41	20
PPG-36F	72	27
PPG-38F	150	42

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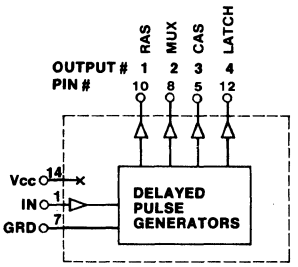
New Dimensions in Delay Line Techniques

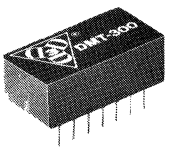
ACTIVE MODULES

Dram Timer (Schottky-TTL Logic)
Series DMT-300

Specifications:

- **Input requirement:** TTL logic, rising-edge triggered.
- **Input pulse width:** 4 NS min.
- **Max. rep. rate of (MREQ) =** T_E of latch strobe.
- **Output fan-out:** TTL Schottky load.
- **Time delay tolerance:** ± 5% or 2 NS whichever is greater.
- **Supply voltage (Vcc): 5 Vdc** ± 5%.
- **Operating temperature:**) C to 70 C.
- **Temperature Coefficient:** 100 PPM/ C.
- **Power dissipation:** 740 MW max.





Part No.	Output 1 (RAS) LE	TE	Output 2 (MUX control) LE	TE	Output 3 (CAS) LE	TE	Output 4 (Latch Strobe) LE	TE
DMT-301-1	15	190	40	190	65	190	140	190
DMT-301-2	15	165	40	165	65	165	115	215
DMT-301-3	15	190	40	190	65	190	190	240
DMT-301-4	15	215	40	215	65	215	165	265
DMT-301-5	15	265	40	265	115	265	215	315
DMT-301-6	15	215	40	215	65	215	165	335
DMT-301-7	15	165	30	165	50	165	115	265
DMT-301-8	15	135	30	135	50	135	85	235
DMT-301-9	15	275	40	275	65	275	220	370
DMT-302-1	15	265	65	265	90	265	215	315
DMT-302-2	15	290	75	290	115	290	240	340
DMT-303-1	25	300	75	300	125	300	250	350

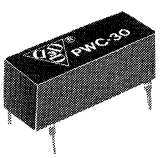
Pulse Width Controller (Fast-TTL Logic)
Series PWC-30

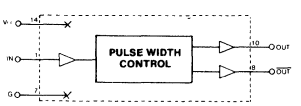
Specifications:

- **Input signal:** TTL.
- **Output fan-out:** 10 TTL loads.
- **Trigger inherent delay:** 5 NS typ.
- **Pulse-width tolerance** = 5% or 2 NS (others on request)
- **Min. PRR** = 1.1 × PW
- **Supply voltage:** 5 Vdc.
- **Supply current:**
  I_{CCL}: 32 ma.
  I_{CCH}: 7 ma.
- **Operating temperature:** 0 C to 70 C (−55 C to 125 C on request).*
- **Temperature coefficient:** 100 PPM/ C.
- **Output rise-time:** 2 NS typ.

*DIL package used.

Part No.	Pulse Width
PWC-30-5	5 NS
PWC-30-10	10 NS
PWC-30-15	15 NS
PWC-30-20	20 NS
PWC-30-30	30 NS
PWC-30-40	40 NS
PWC-30-50	50 NS
PWC-30-60	60 NS
PWC-30-75	75 NS
PWC-30-100	100 NS
PWC-30-125	125 NS
PWC-30-150	150 NS
PWC-30-175	175 NS
PWC-30-200	200 NS
PWC-30-250	250 NS
PWC-30-300	300 NS
PWC-30-350	350 NS
PWC-30-400	400 NS
PWC-30-500	500 NS

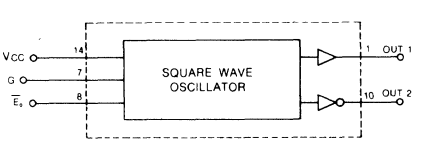


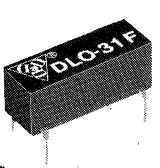


Gated-Oscillator (Fast-TTL Logic)
Series DLO-31F

Specifications:

- **Frequencies:** See table; others on request.
- **Tolerance:** ± 2%.
- **Temperature coefficient:** 100 PPM/ C.
- **Operating temperature:** 0 - 70 C.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Supply current:** 40 ma.
- **Storage temperature:** −55 C to 125 C.
- **Enable signal:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Inherent delay:** 4 NS typ.





Part Number	Frequency	Part Number	Frequency
DLO-31F-2	2. MHz	DLO-31F-10	10 MHz
DLO-31F-2.5	2.5 MHz	DLO-31F-11	11 MHz
DLO-31F-3	3 MHz	DLO-31F-12	12 MHz
DLO-31F-3.5	3.5 MHz	DLO-31F-13	13 MHz
DLO-31F-4	4 MHz	DLO-31F-14	14 MHz
DLO-31F-4.5	4.5 MHz	DLO-31F-15	15 MHz
DLO-31F-5	5 MHz	DLO-31F-20	20 MHz
DLO-31F-5.5	5.5 MHz	DLO-31F-25	25 MHz
DLO-31F-6	6 MHz	DLO-31F-30	30 MHz
DLO-31F-7	7 MHz	DLO-31F-35	35 MHz
DLO-31F-8	8 MHz	DLO-31F-40	40 MHz
DLO-31F-9	9 MHz		

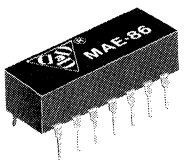
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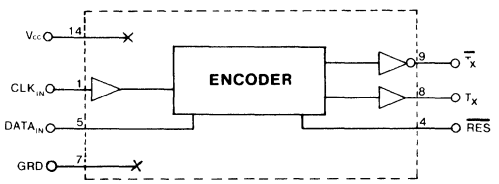
ACTIVE MODULES (SCHOTTKY-TTL LOGIC)

Manchester Encoder Series MAE-86

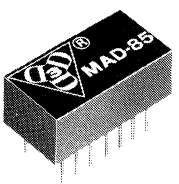


Specifications:

- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Operating temperature:** 0° to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage V_{CC}:** 5 Vdc ± 5%.
- **Power dissipation:** 300 MW max.
- **CLK_{IN}** = 1 X operating data rates (15 NS min. PW).
- **Data rates up to 30 MB/S.**

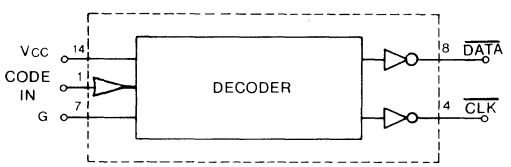


Manchester Decoder Series MAD-85



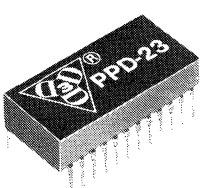
Specifications:

- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Operating temperature:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/° C.
- **Supply voltage V_{CC}:** 5Vdc ± 5%.
- **Power dissipation:** 740 MW max.



Part No.	Operating Data Rates	Part No.	Operating Data Rates	Part No.	Operating Data Rates
MAD-85-1	1 MB/S	MAD-85-10	10 MB/S	MAD-85-18	18 MB/S
MAD-85-2	2 MB/S	MAD-85-11	11 MB/S	MAD-85-19	19 MB/S
MAD-85-3	3 MB/S	MAD-85-12	12 MB/S	MAD-85-20	20 MB/S
MAD-85-4	4 MB/S	MAD-85-13	13 MB/S	MAD-85-21	21 MB/S
MAD-85-5	5 MB/S	MAD-85-14	14 MB/S	MAD-85-22	22 MB/S
MAD-85-6	6 MB/S	MAD-85-15	15 MB/S	MAD-85-23	23 MB/S
MAD-85-7	7 MB/S	MAD-85-16	16 MB/S	MAD-85-24	24 MB/S
MAD-85-8	8 MB/S	MAD-85-17	17 MB/S	MAD-85-25	25 MB/S
MAD-85-9	9 MB/S				

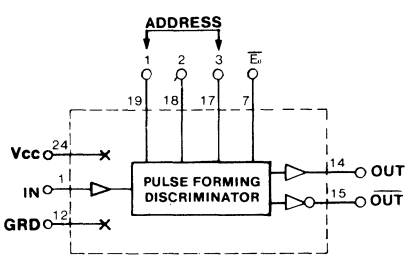
Programmable Pulse Discriminator Series PPD-23



Specifications:

- **Input requirement:** TTL logic.
- **Inherent pulse width:** 5 NS typ.
- **Supply voltage:** 5 Vdc ± 5%.
- **Operating temperatures:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Power dissipation:** 850 MW max.

Part Number	Incremental Pulse Width Per Step	Total Programmed Pulse Width
PPD-23-1	1 NS ± .4NS	7 NS
PPD-23-2	2 NS ± .4NS	14 NS
PPD-23-3	3 NS ± .5NS	21 NS
PPD-23-5	5 NS ± .6NS	35 NS
PPD-23-10	10 NS ± 1.0 NS	70 NS
PPD-23-15	15 NS ± 1.3 NS	105 NS
PPD-23-20	20 NS ± 1.5 NS	140 NS
PPD-23-40	40 NS ± 2.0 NS	280 NS
PPD-23-50	50 NS ± 2.5 NS	350 NS



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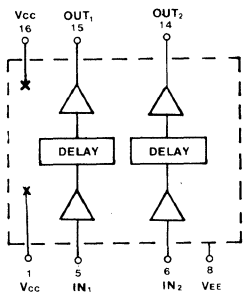
ACTIVE DELAY LINES (ECL-LOGIC)

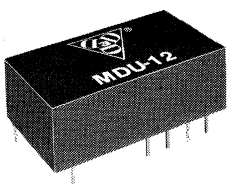
Multiple Delay Lines
Series MDU-12, MDU-13 (10KH ECL)

Specifications:

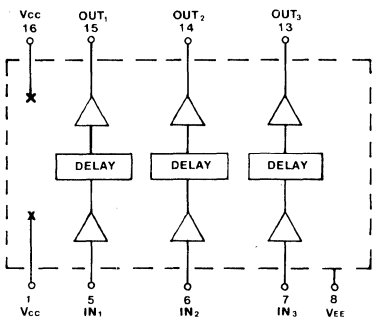
- **Total Delay Tolerance:** ± 5% or better, or 1 NS whichever is greater.
- **Rise-time:** 2 NS typical.
- **Logic 1 voltage:** –.96V
- **Logic 1 current:** .26 MA
- **Logic 0 current:** .5μA
- **Logic 0 voltage:** –1.65V
- **Supply voltage:** –5.2V
- **Operating Temperature:** –30°C to 85°C
- **Temperature Coefficient:** 100 PPM/°C

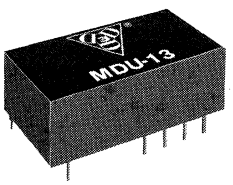
Part No.	Delay Per Line (NS)
MDU-12-5	5
MDU-12-10	10
MDU-12-15	15
MDU-12-20	20
MDU-12-25	25
MDU-12-30	30
MDU-12-35	35
MDU-12-40	40
MDU-12-45	45
MDU-12-50	50
MDU-12-60	60
MDU-12-75	75
MDU-12-100	100
MDU-12-125	125
MDU-12-150	150
MDU-12-200	200
MDU-12-250	250





Part No.	Delay Per Line (NS)
MDU-13-5	5
MDU-13-10	10
MDU-13-15	15
MDU-13-20	20
MDU-13-25	25
MDU-13-30	30
MDU-13-35	35
MDU-13-40	40
MDU-13-45	45
MDU-13-50	50



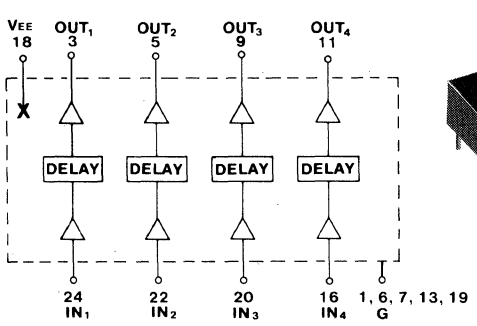


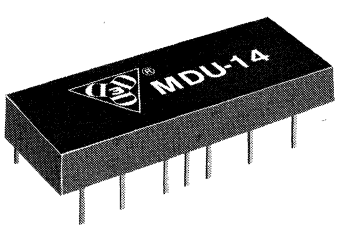
Series: MDU-14 (100K ECL)

Specifications:

- **Total delay tolerance:** ±5% or 1 NS whichever is greater.
- **Rise time:** 1 NS typ.
- **Input pulse width:** 40% of total delay.
- **Input pulse voltage:** .8V p-p (–.9V to –1.7V).
- **Logic 1 input voltage:** –1.16V min.
- **Logic 0 input voltage:** –1.47V max.
- **Logic 1 output voltage:** –1.02V min.
- **Logic 0 output voltage:** –1.62V max.
- **Supply voltage (Vee):** –5V.
- **Operating Temperature:** 0°C to + 85°C.
- **Temperature Coefficient:** 100 PPM/°C.
- **Fan-out capabilities:** 70 ECL.

Part No.	Delay Per Line (NS)
MDU-14-2	2
MDU-14-2.5	2.5
MDU-14-3	3
MDU-14-4	4
MDU-14-5	5
MDU-14-6	6
MDU-14-7	7
MDU-14-8	8
MDU-14-9	9
MDU-14-10	10
MDU-14-12.5	12.5
MDU-14-15	15
MDU-14-20	20
MDU-14-25	25





data delay devices

New Dimensions in Delay Line Techniques

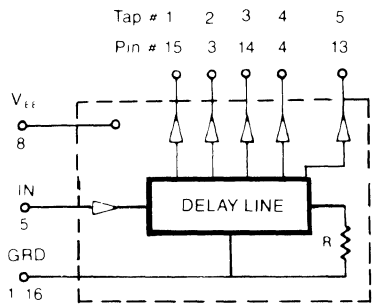
ACTIVE DELAY LINES (ECL-LOGIC)

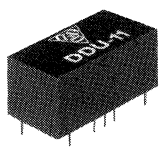
Multi Taps

Specifications:

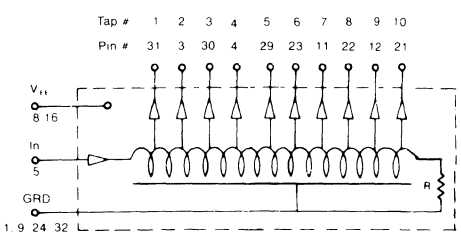
- **Total Delay Tolerance:** ± 5% or better, or 2 NS whichever is greater.
- **No. Taps:** 5 - 10
- **Rise-Time:** 2 NS typical
- **Supply Voltage:** −5.2V
- **Operating Temperature:** −30°C to 85°C
- **Temperature Coefficient:** 100 PPM/°C
- **Family Type:** 10K ECL (DDU-11 & 12)
  100K ECL (DDU-18)

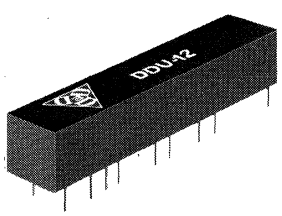
Part No.	Total Delay NS	Tap Delay NS
DDU-11-5	4	1
DDU-11-10	8	2
DDU-11-20	16	4
DDU-11-25	20	5
DDU-11-50	50	10
DDU-11-75	75	15
DDU-11-100	100	20
DDU-11-150	150	30
DDU-11-200	200	40
DDU-11-250	250	50
DDU-11-300	300	60
DDU-11-400	400	80
DDU-11-500	500	100



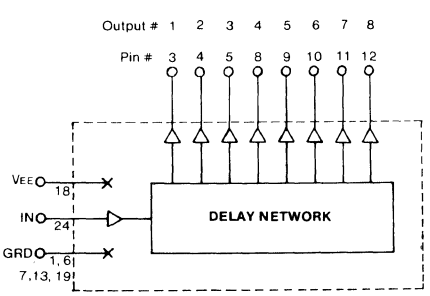


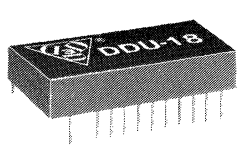
Part No.	Total Delay NS	Delay Tap NS
DDU-12-10	9	1
DDU-12-20	18	2
DDU-12-25	22.5	2.5
DDU-12-40	36	4
DDU-12-50	45	5
DDU-12-75	75	7.5
DDU-12-100	100	10
DDU-12-150	150	15
DDU-12-200	200	20
DDU-12-250	250	25
DDU-12-300	300	30
DDU-12-400	400	40
DDU-12-500	500	50
DDU-12-750	750	75
DDU-12-1000	1000	100
DDU-12-1500	1500	150





Part No.	Delay Increment NS	Total Delay NS
DDU-18-4	.5	3.5
DDU-18-8	1	7.0
DDU-18-12	1.5	10.5
DDU-18-16	2	16
DDU-18-20	2.5	20
DDU-18-24	3	24
DDU-18-32	4	32
DDU-18-40	5	40
DDU-18-48	6	48
DDU-18-56	7	56
DDU-18-64	8	64
DDU-18-72	9	72
DDU-18-80	10	80
DDU-18-100	12.5	100
DDU-18-120	15	120
DDU-18-160	20	160
DDU-18-200	25	200





data delay devices

New Dimensions in Delay Line Techniques

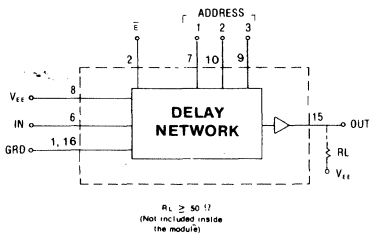
ACTIVE DELAY LINES (10KH-ECL LOGIC)

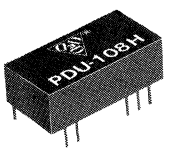
Programmable Delay Lines (3-8 BIT)

Specifications:

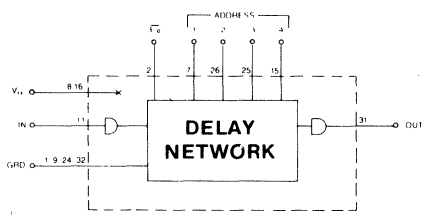
- **Input signal requirement:** ECL logic
- **Output fan-out:** ECL loads
- **Delay variation:** Monotonic in one direction
- **Programmed delay tolerance:** ±5% or 1 NS whichever is greater
- **Inherent delay:** see Table 2
- **Propagation delay:**
  Address to output = 3.6 NS typ
  Enable to output = 1.7 NS typ
- **Power dissipation:** see Table 2
- **Supply voltage:** −5Vdc ± 5%
- **Operating Temperature:** 0-70°C
- **Temperature Coefficient:** 100 PPM/°C

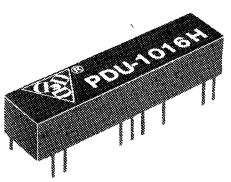
Series PDU-108H



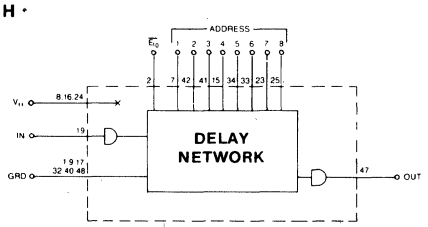


Series PDU-1016H





Series PDU-10256H



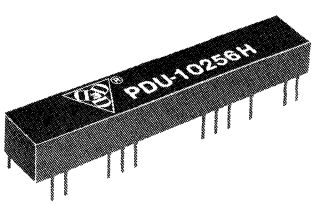


Table 1

Part Numbers			Delay Increment
PDU-108H-.5	PDU-1016H-.5	PDU-10256H-.5	.5 NS
PDU-108H-1	PDU-1016H-1	PDU-10256H-1	1 NS
PDU-108H-2	PDU-1016H-2	PDU-10256H-2	2 NS
PDU-108H-3	PDU-1016H-3	PDU-10256H-3	3 NS
PDU-108H-4	PDU-1016H-4	PDU-10256H-4	4 NS
PDU-108H-5	PDU-1016H-5	PDU-10256H-5	5 NS
PDU-108H-6	PDU-1016H-6	PDU-10256H-6	6 NS
PDU-108H-7	PDU-1016H-7	PDU-10256H-7	7 NS
PDU-108H-8	PDU-1016H-8	PDU-10256H-8	8 NS
PDU-108H-9	PDU-1016H-9	PDU-10256H-9	9 NS
PDU-108H-10	PDU-1016H-10	PDU-10256H-10	10 NS
PDU-108H-12	PDU-1016H-12		12 NS
PDU-108H-15	PDU-1016H-15		15 NS
PDU-108H-20	PDU-1016H-20		20 NS
PDU-108H-25	PDU-1016H-25		25 NS
PDU-108H-30	PDU-1016H-30		30 NS
PDU-108H-35	PDU-1016H-35		35 NS
PDU-108H-40	PDU-1016H-40		40 NS
PDU-108H-45	PDU-1016H-45		45 NS
PDU-108H-50	PDU-1016H-50		50 NS
	PDU-1016H-60		60 NS
	PDU-1016H-80		80 NS
	PDU-1016H-100		100 NS

Table 2

Series	Power Dissipation	Inherent Delay
PDU-108H	290 MW	2.8 NS
PDU-1016H	615 MW	5.5 NS
PDU-1032H	615 MW	5.5 NS
PDU-1064H	925 MW	12 NS
PDU-10256H	925 MW	12 NS

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New Dimensions in Delay Line Techniques

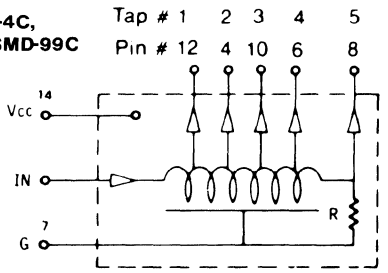
ACTIVE DELAY LINES (H-CMOS)

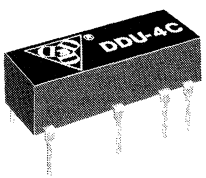
5 Taps

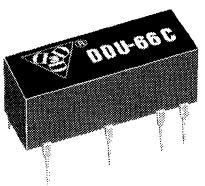
Specifications:

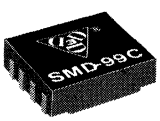
- **No. Taps:** 5 equally spaced taps.
- **Total delay tolerance:** 5% or 2 NS whichever is greater.
- **Rise-time:** 8 NS typ.
- **Temperature coefficient:** 300 PPM/°C.
- **Temperature range:** 0°C to + 70°C.
- **Supply voltage:** 5 Vdc ± 5%.
- **Logic 1 input:** 3.2V.
- **Logic 0 input:** .9V.
- **Logic 1 output:** 4.5V.
- **Logic 0 output:** 0.1V.
- **Input current:** 1 μa max.
- **Supply current:**
  I_{CCH} = 5 MA
  I_{CCL} = 20 μa
- **Fan-out:** 10 LSTTL loads min.

Series DDU-4C, DDU-66C, SMD-99C

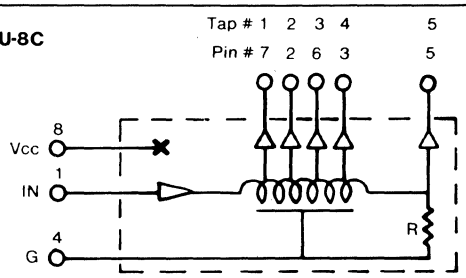


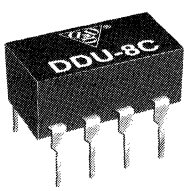




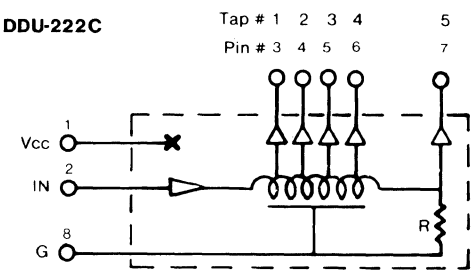


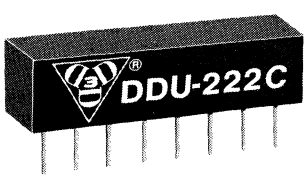
Series DDU-8C





Series DDU-222C





Part Numbers					Total Delay (NS)
DDU-8C-5050	DDU-4C-5050	DDU-66C-50	SMD-99C-5050	DDU-222C-50	50
DDU-8C-5060	DDU-4C-5060	DDU-66C-60	SMD-99C-5060	DDU-222C-60	60
DDU-8C-5075	DDU-4C-5075	DDU-66C-75	SMD-99C-5075	DDU-222C-75	75
DDU-8C-5100	DDU-4C-5100	DDU-66C-100	SMD-99C-5100	DDU-222C-100	100
DDU-8C-5125	DDU-4C-5125	DDU-66C-125	SMD-99C-5125	DDU-222C-125	125
DDU-8C-5150	DDU-4C-5150	DDU-66C-150	SMD-99C-5150	DDU-222C-150	150
DDU-8C-5175	DDU-4C-5175	DDU-66C-175	SMD-99C-5175	DDU-222C-175	175
DDU-8C-5200	DDU-4C-5200	DDU-66C-200	SMD-99C-5200	DDU-222C-200	200
DDU-8C-5250	DDU-4C-5250	DDU-66C-250	SMD-99C-5250	DDU-222C-250	250

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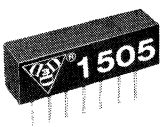
New Dimensions in Delay Line Techniques

PASSIVE DELAY LINES (SIP-TYPE)

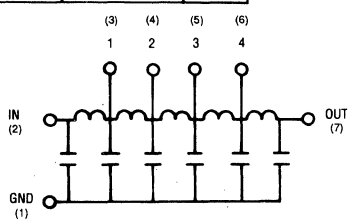
Series 1505

Specifications:

- **5 Equal taps**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** −55°C to + 125°C
- **Storage temperature range:** −55°C to + 125°C
- **Temperature coefficient:** 100 PPM/°C
- **Dielectric breakdown:** 50 Vdc.
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%



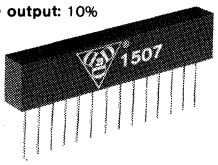
Part No.	Total Delay (NS)	Imp. Ω
1505-A	5	50
1505-10A	10	50
1505-20A	20	50
1505-30A	30	50
1505-40A	40	50
1505-50A	50	50
1505-60A	60	50
1505-70A	70	50
1505-80A	80	50
1505-90A	90	50
1505-100A	100	50
1505-5B	5	100
1505-10B	10	100
1505-20B	20	100
1505-30B	30	100
1505-40B	40	100
1505-50B	50	100
1505-60B	60	100
1505-75B	75	100
1505-100B	100	100
1505-30C	30	200
1505-50C	50	200
1505-60C	60	200
1505-100C	100	200
1505-50G	50	500
1505-100G	100	500
1505-200G	200	500
1505-300G	300	500



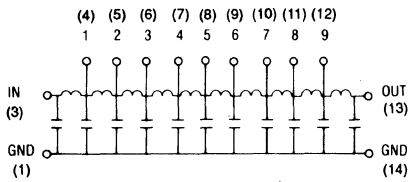
Series 1507

Specifications:

- **10 Equal taps**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** −55 C to +125°C
- **Storage temperature range:** −55°C to + 125°C
- **Temperature coefficient:** 100 PPM/°C
- **Dielectric breakdown:** 50 Vdc
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%



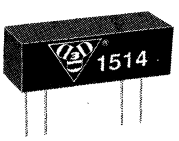
Part No.	Total Delay (NS)	Imp. Ω
1507-20A	20	50
1507-40A	40	50
1507-50A	50	50
1507-100A	100	50
1507-150A	150	50
1507-200A	200	50
1507-20B	20	100
1507-50B	50	100
1507-100B	100	100
1507-200B	200	100
1507-250B	250	100
1507-20C	20	200
1507-50C	50	200
1507-100C	100	200
1507-200C	200	200
1507-50G	50	500
1507-100G	100	500
1507-200G	200	500
1507-300G	300	500
1507-500G	500	500

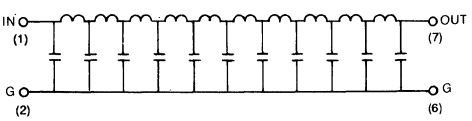


Series 1514

Specifications:

- **Meets or exceeds:** MIL-D-23859C.
- **Operating temperature:** −55 C to + 125 C.
- **Storage temperature:** −55 C to + 125 C.
- **Temperature coefficient:** 100 PPM/ C.
- **Dielectric breakdown:** 50 Vdc.
- **Epoxy encapsulated.**
- **Distortion @ output:** 10% max.
- **Rise-time:** 1 NS or 20% of TD (whichever is greater).
- **Delay tolerance:** 5% or 1 NS whichever is greater.





Part No.	Delay (ns)	Imp. Ω	Part No.	Delay (ns)	Imp.	Part No.	Delay (ns)	Imp. Ω	Part No.	Delay (ns)	Imp. Ω
1514-2.5A	2.5	50	1514-3.5Y	3.5	75	1514-5B	5	100	1514-50D	50	250
1514-5A	5	50	1514-7.5Y	7.5	75	1514-10B	10	100	1514-70D	70	250
1514-10A	10	50	1514-15Y	15	75	1514-20B	20	100	1514-120D	120	250
1514-15A	15	50	1514-22.5Y	22.5	75	1514-30B	30	100	1514-130D	130	250
1514-20A	20	50	1514-30Y	30	75	1514-40B	40	100	1514-150D	150	250
1514-25A	25	50	1514-37.5Y	37.5	75	1514-50B	50	100	1514-170D	170	250
1514-30A	30	50	1514-45Y	45	75	1514-60B	60	100	1514-270D	270	250
1514-40A	40	50	1514-60Y	60	75	1514-80B	80	100	1514-70E	70	300
1514-50A	50	50	1514-75Y	75	75	1514-100B	100	100	1514-140E	140	300
1514-60A	60	50	1514-90Y	90	75	1514-120B	120	100	1514-45G	45	500
1514-70A	70	50	1514-105Y	105	75	1514-140B	140	100	1514-50G	50	500
1514-80A	80	50	1514-120Y	120	75	1514-150B	150	100	1514-80G	80	500
1514-90A	90	50	1514-135Y	135	75				1514-100G	100	500
1514-100A	100	50	1514-150Y	150	75				1514-190G	190	500

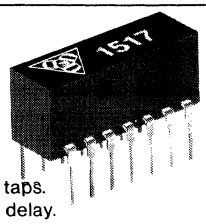
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New Dimensions in Delay Line Techniques

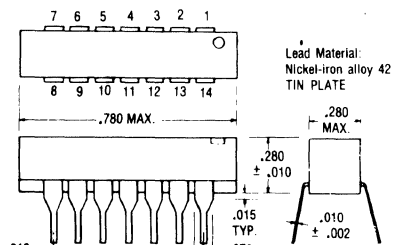
DIP-TAPPED DELAY LINES

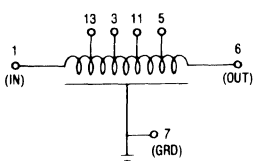
SERIES 1517
5 Taps



Specifications

- **Delay accuracy:** ± 5% (others on request).
- **No. taps:** 5 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10%.(others on request).
- **Rise-Time:** 30% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.

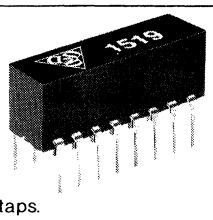




TAPS - CONNECTION

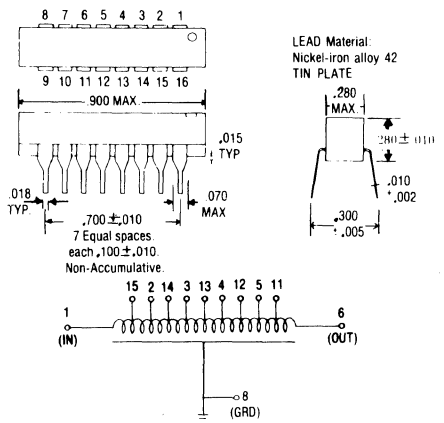
Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1517-10A	10	50	0.6	1517-150D	150	250	8.5
1517-15A	15	50	0.6	1517-15E	15	300	2.5
1517-20A	20	50	0.7	1517-30E	30	300	3.0
1517-30A	30	50	0.7	1517-50E	50	300	4.0
1517-40A	40	50	0.9	1517-60E	60	300	4.0
1517-5B	5	100	0.5	1517-75E	75	300	4.5
1517-10B	10	100	0.7	1517-90E	90	300	5.5
1517-15B	15	100	0.7	1517-120E	120	300	8.0
1517-20B	20	100	0.9	1517-130E	130	300	9.0
1517-25B	25	100	1.0	1517-180E	180	300	11.0
1517-30B	30	100	1.5	1517-220E	220	300	13.0
1517-40B	40	100	1.8	1517-20F	20	400	4.5
1517-50B	50	100	2.0	1517-40F	40	400	5.0
1517-60B	60	100	2.0	1517-60F	60	400	5.0
1517-75B	75	100	2.5	1517-80F	80	400	8.0
1517-10C	10	200	1.5	1517-100F	100	400	9.0
1517-20C	20	200	2.0	1517-120F	120	400	10.0
1517-30C	30	200	2.5	1517-160F	160	400	13.0
1517-40C	40	200	3.0	1517-180F	180	400	14.0
1517-50C	50	200	3.0	1517-240F	240	400	19.0
1517-60C	60	200	3.5	1517-300F	300	400	23.0
1517-80C	80	200	3.5	1517-25G	25	500	3.0
1517-90C	90	200	5.0	1517-50G	50	500	5.0
1517-120C	120	200	5.0	1517-75G	75	500	8.0
1517-150C	150	200	8.0	1517-100G	100	500	15.0
1517-25D	25	250	2.5	1517-125G	125	500	9.0
1517-37D	37	250	3.0	1517-150G	150	500	13.0
1517-50D	50	250	3.5	1517-200G	200	500	21.0
1517-60D	60	250	4.0	1517-225G	225	500	23.0
1517-75D	75	250	4.0	1517-300G	300	500	29.0
1517-100D	100	250	5.0				

SERIES 1519
10 Taps



Specifications

- **Delay Accuracy:** ± 5% (others on request)
- **No. taps:** 10 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10% (others on request).
- **Rise-Time:** 20% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.



Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1519-20A	20	50	1.0	1519-200D	200	250	10.0
1519-25A	25	50	1.0	1519-225D	225	250	11.0
1519-30A	30	50	1.2	1519-300D	300	250	17.0
1519-40A	40	50	1.5	1519-375D	375	250	20.0
1519-45A	45	50	1.5	1519-500D	500	250	24.0
1519-50A	50	50	1.5	1519-30E	30	300	5.0
1519-60A	60	50	1.5	1519-60E	60	300	6.0
1519-75A	75	50	1.8	1519-90E	90	300	7.0
1519-100A	100	50	2.0	1519-120E	120	300	8.0
1519-10B	10	100	1.0	1519-150E	150	300	9.0
1519-20B	20	100	1.5	1519-180E	180	300	11.0
1519-30B	30	100	1.5	1519-240E	240	300	16.0
1519-40B	40	100	1.8	1519-270E	270	300	18.0
1519-50B	50	100	2.0	1519-360E	360	300	21.0
1519-60B	60	100	3.0	1519-450E	450	300	25.0
1519-80B	80	100	3.5	1519-600E	600	300	40.0
1519-90B	90	100	3.5	1519-40F	40	400	8.5
1519-100B	100	100	4.0	1519-80F	80	400	9.0
1519-120B	120	100	4.0	1519-120F	120	400	9.0
1519-150B	150	100	5.0	1519-160F	160	400	16.0
1519-200B	200	100	6.0	1519-200F	200	400	18.0
1519-250B	250	100	7.0	1519-240F	240	400	20.0
1519-20C	20	200	3.0	1519-320F	320	400	26.0
1519-40C	40	200	4.0	1519-360F	360	400	28.0
1519-60C	60	200	4.5	1519-480F	480	400	38.0
1519-80C	80	200	5.5	1519-600F	600	400	45.0
1519-100C	100	200	6.0	1519-800F	800	400	40.0
1519-120C	120	200	6.5	1519-50G	50	500	6.0
1519-160C	160	200	7.0	1519-100G	100	500	10.0
1519-180C	180	200	8.5	1519-150G	150	500	16.0
1519-200C	200	200	9.0	1519-200G	200	500	30.0
1519-240C	240	200	9.5	1519-250G	250	500	18.0
1519-300C	300	200	16.0	1519-300G	300	500	26.0
1519-400C	400	200	16.0	1519-400G	400	500	42.0
1519-50D	50	250	5.5	1519-450G	450	500	45.0
1519-75D	75	250	6.0	1519-500G	500	500	55.0
1519-100D	100	250	7.0	1519-600G	600	500	58.0
1519-125D	125	250	8.0	1519-750G	750	500	50.0
1519-150D	150	250	8.5	1519-1000G	1000	500	65.0

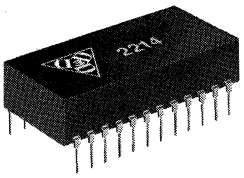
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data delay devices

New Dimensions in Delay Line Techniques

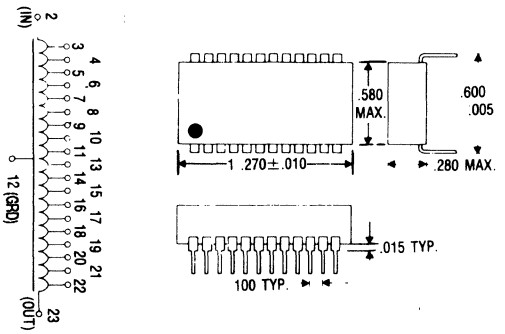
DIP-TAPPED DELAY LINES

SERIES 2214
20 Taps



Specifications

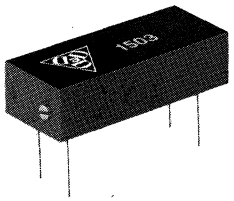
- **20 Equally spaced taps.**
- **Td/Tr = 10/1.**
- **Delay tolerance:** ± 5% or 1 NS whichever is greater.
- **Tap tolerance:** ± 5% or 1 NS whichever is greater.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -55°C to +125°C.
- **Dielectric breakdown:** 50 Vdc.
- **Meets or exceeds MIL-D-23859C.**
- **Epoxy encapsulated.**



Part No.	Imp. (Ω)	Total Delay (NS)	Tap Increment (NS)	Rdc (Ω)
2214-50A	50	50	2.5	3.2
2214-60A	50	60	3.0	3.6
2214-80A	50	80	4.0	5.0
2214-100A	50	100	5.0	6.0
2214-150A	50	150	7.5	6.0
2214-200A	50	200	10.0	7.0
2214-50B	100	50	2.5	6.0
2214-60B	100	60	3.0	6.0
2214-80B	100	80	4.0	6.5
2214-100B	100	100	5.0	7.0
2214-150B	100	150	7.5	8.0
2214-200B	100	200	10.0	8.5
2214-300B	100	300	15.0	11.0
2214-400B	100	400	20.0	12.0
2214-40C	200	40	2.0	7.0
2214-80C	200	80	4.0	8.0
2214-120C	200	120	6.0	10.0
2214-200C	200	200	10.0	13.0
2214-300C	200	300	15.0	12.0
2214-400C	200	400	20.0	15.0
2214-500C	200	500	25.0	17.0
2214-600C	200	600	30.0	23.0
2214-800C	200	800	40.0	38.0
2214-50D	250	50	2.5	7.0
2214-100D	250	100	5.0	10.0
2214-150D	250	150	7.5	12.0
2214-200D	250	200	10.0	22.0
2214-250D	250	250	12.5	21.0
2214-300D	250	300	15.0	23.0
2214-400D	250	400	20.0	26.0
2214-500D	250	500	25.0	30.0
2214-600D	250	600	30.0	37.0
2214-800D	250	800	40.0	41.0
2214-1000D	250	1000	50.0	47.0
2214-200G	500	200	10.0	20.0
2214-300G	500	300	15.0	37.0
2214-400G	500	400	20.0	40.0
2214-500G	500	500	25.0	45.0
2214-600G	500	600	30.0	52.0
2214-800G	500	800	40.0	80.0
2214-1000G	500	1000	50.0	100.0
2214-1200G	500	1200	60.0	110.0
2214-1500G	500	1500	75.0	130.0
2214-2000G	500	2000	100.0	156.0

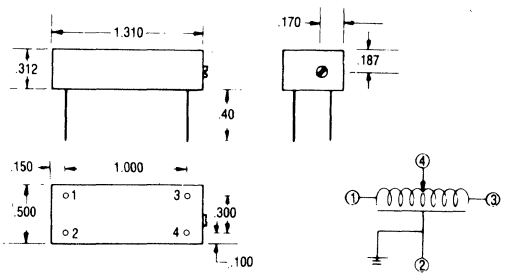
CONTINUOUSLY VARIABLE DELAY LINES

SERIES 1503



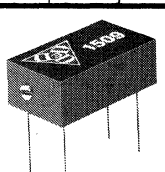
Specifications

- **Continuously variable delay.**
- **Multi-turn adjusting screw** (40 turns approx.).
- **Temperature coefficient:** 100 PPM/°C.
- **Rise-time:** 20% of time delay.
- **Flat leads** (.020 x .010).
- **Withstanding voltage:** 50 Vdc.
- **Resolution:** .12 NS approx.



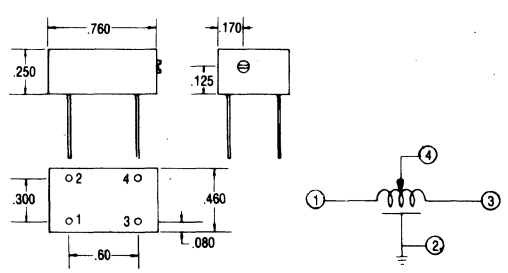
Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)
1503-15A	15	50	.7	1503-100B	100	100	6.0
1503-25A	25	50	.8	1503-120B	120	100	8.0
1503-30A	30	50	1.0	1503-160B	160	100	10.0
1503-40A	40	50	1.5	1503-200B	200	100	14.0
1503-50A	50	50	1.7	1503-30C	30	200	4.0
1503-60A	60	50	2.0	1503-60C	60	200	8.0
1503-80A	80	50	3.0	1503-100C	100	200	14.0
1503-100A	100	50	3.5	1503-20D	20	250	5.0
1503-15B	15	100	1.0	1503-20E	20	300	5.0
1503-30B	30	100	2.0	1503-30F	30	350	8.0
1503-50B	50	100	3.0	1503-25G	25	400	8.0
1503-60B	60	100	4.0	1503-40H	40	500	12.0
1503-80B	80	100	5.0				

SERIES 1509



Specifications

- **Low cost unit.**
- **Fits standard DIP sockets.**
- **Continuously variable.**
- **20 Turns approx.**
- **Resolution — .15 NS.**
- **Withstanding voltage — 100 Vdc.**
- **Temperature coefficient — 200 PPM/°C.**
- **Flat leads (.020 x .010).**



Part No.	Td (NS)	Impedance (Ω)	TR (NS)	Rdc (Ω)
1509-05B	5	100	3	.4
1509-20C	20	200	8	1.0
1509-30F	30	400	10	7.0
1509-40H	40	500	15	13.0

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ELMEC FIXED DELAY LINES

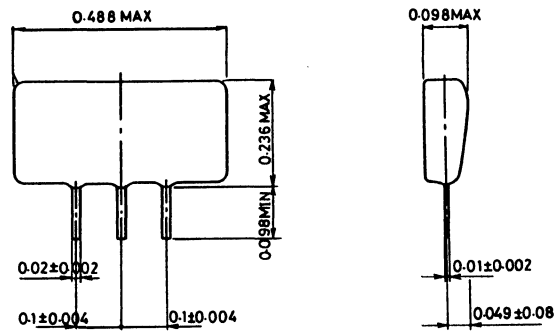
FDC SERIES—ULTRA HIGH-SPEED FIXED DELAY LINES

COMMON SPECIFICATIONS

- **Distortion of waveform: (Over-shoot/pre-shoot)** — under ±20%
- **Delay time temperature coefficient:** — ±100ppm/°C
- **Insulation resistance:** — DC 50V, 100M Ω
- **Durable voltage:** — DC 50V, 1 minute
- **Operating temperature range:** — −10°C ~ +80°C
- **Storage temperature range:** — −40°C ~ +120°C

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



SPECIFICATIONS

Part Number	Impedance	Time Delay	Output Rise Time (20% - 80%)	Pass Band −3dB
FDC 00505	50Ω ± 10%	50ps ± 25ps	150ps or Less	2.5GHz or More
FDC 0105		100ps ± 25ps	150ps or Less	2.5GHz or More
FDC 01505		150ps ± 25ps	150ps or Less	2.0GHz or More
FDC 0205		200ps ± 25ps	150ps or Less	2.0GHz or More
FDC 02505		250ps ± 25ps	150ps or Less	2.0GHz or More
FDC 0305		300ps ± 25ps	150ps or Less	2.0GHz or More
FDC 03505		350ps ± 25ps	150ps or Less	2.0GHz or More
FDC 0405		400ps ± 25ps	150ps or Less	2.0GHz or More
FDC 04505		450ps ± 25ps	200ps or Less	1.5GHz or More
FDC 0505		500ps ± 25ps	200ps or Less	1.5GHz or More
FDC 05505		550ps ± 25ps	200ps or Less	1.5GHz or More
FDC 0605		600ps ± 50ps	200ps or Less	1.5GHz or More
FDC 0705		700ps ± 50ps	200ps or Less	1.5GHz or More
FDC 0805		800ps ± 50ps	200ps or Less	1.0GHz or More
FDC 0905		900ps ± 50ps	200ps or Less	1.0GHz or More
FDC 1005		1.0ns ± 50ps	200ps or Less	1.0GHz or More
FDC 1105		1.1ns ± 50ps	250ps or Less	900MHz or More
FDC 1205		1.2ns ± 50ps	250ps or Less	900MHz or More
FDC 1305		1.3ns ± 50ps	250ps or Less	900MHz or More
FDC 1405		1.4ns ± 50ps	250ps or Less	900MHz or More
FDC 1505		1.5ns ± 50ps	250ps or Less	900MHz or More
FDC 1605		1.6ns ± 50ps	300ps or Less	800MHz or More
FDC 1705		1.7ns ± 50ps	300ps or Less	800MHz or More
FDC 1805		1.8ns ± 50ps	300ps or Less	800MHz or More
FDC 1905		1.9ns ± 50ps	300ps or Less	800MHz or More
FDC 2005		2.0ns ± 50ps	300ps or Less	800MHz or More
FDC 2505		2.5ns ± 0.20ns	500ps or Less	700MHz or More
FDC 3005		3.0ns ± 0.20ns	500ps or Less	700MHz or More
FDC 3505		3.5ns ± 0.25ns	600ps or Less	600MHz or More
FDC 4005		4.0ns ± 0.30ns	700ps or Less	600MHz or More
FDC 4505		4.5ns ± 0.30ns	700ps or Less	600MHz or More
FDC 5005		5.0ns ± 0.30ns	700ps or Less	600MHz or More
FDC 0510	100Ω ± 10%	0.5ns ± 0.10ns	300ps or Less	1.5GHz or More
FDC 1010		1.0ns ± 0.10ns	300ps or Less	1.0GHz or More
FDC 1510		1.5ns ± 0.15ns	400ps or Less	900MHz or More
FDC 2010		2.0ns ± 0.20ns	400ps or Less	800MHz or More
FDC 2510		2.5ns ± 0.20ns	500ps or Less	700MHz or More
FDC 3010		3.0ns ± 0.20ns	500ps or Less	700MHz or More
FDC 3510		3.5ns ± 0.25ns	600ps or Less	600MHz or More
FDC 4010		4.0ns ± 0.30ns	700ps or Less	600MHz or More
FDC 4510		4.5ns ± 0.30ns	700ps or Less	600MHz or More
FDC 5010		5.0ns ± 0.30ns	700ps or Less	600MHz or More

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ELMEC FIXED DELAY LINES

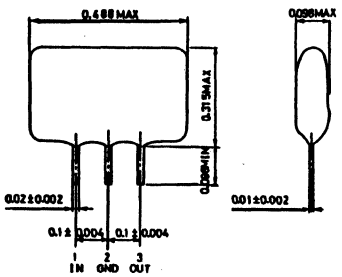
FDD SERIES—ULTRA HIGH-SPEED FIXED DELAY LINES

COMMON SPECIFICATIONS

- **Distortion of waveform: (Over-shoot/pre-shoot)** under ±20%
- **Delay time temperature coefficient:** −400±200ppm/°C
- **Insulation resistance:** DC 50V, 100MΩ
- **Durable voltage:** DC 50V, 1 minute
- **Operating temperature range:** −10°C ~ +80°C
- **Storage temperature range:** −40°C ~ +120°C

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



SPECIFICATIONS

Part Number	Impedance	Time Delay	Output Rise Time (20% - 80%)	Pass Band −3dB
FDD 5505	50Ω ± 10%	5.5ns ± 0.3ns	800ps or Less	400MHz or More
FDD 6005		6.0ns ± 0.3ns	900ps or Less	400MHz or More
FDD 6505		6.5ns ± 0.4ns	900ps or Less	350MHz or More
FDD 7005		7.0ns ± 0.4ns	1000ps or Less	350MHz or More
FDD 7505		7.5ns ± 0.4ns	1000ps or Less	330MHz or More
FDD 8005		8.0ns ± 0.4ns	1100ps or Less	330MHz or More
FDD 8505		8.5ns ± 0.5ns	1200ps or Less	300MHz or More
FDD 9005		9.0ns ± 0.5ns	1300ps or Less	300MHz or More
FDD 9505		9.5ns ± 0.5ns	1300ps or Less	250MHz or More
FDD 10005		10.0ns ± 0.5ns	1400ps or Less	250MHz or More
FDD 10505		10.5ns ± 0.5ns	1400ps or Less	200MHz or More
FDD 11005		11.0ns ± 0.5ns	1400ps or Less	200MHz or More
FDD 11505		11.5ns ± 0.5ns	1500ps or Less	170MHz or More
FDD 12005		12.0ns ± 0.5ns	1500ps or Less	170MHz or More
FDD 12505		12.5ns ± 0.5ns	1600ps or Less	150MHz or More
FDD 13005		13.0ns ± 0.5ns	1600ps or Less	150MHz or More
FDD 13505		13.5ns ± 0.5ns	1700ps or Less	150MHz or More
FDD 14005		14.0ns ± 0.5ns	1700ps or Less	150MHz or More
FDD 14505		14.5ns ± 0.5ns	1800ps or Less	150MHz or More
FDD 15005		15.0ns ± 0.5ns	1800ps or Less	150MHz or More
FDD 5510	100Ω ± 10%	5.5ns ± 0.3ns	800ps or Less	400MHz or More
FDD 6010		6.0ns ± 0.3ns	900ps or Less	400MHz or More
FDD 6510		6.5ns ± 0.4ns	900ps or Less	350MHz or More
FDD 7010		7.0ns ± 0.4ns	1000ps or Less	350MHz or More
FDD 7510		7.5ns ± 0.4ns	1000ps or Less	330MHz or More
FDD 8010		8.0ns ± 0.4ns	1100ps or Less	330MHz or More
FDD 8510		8.5ns ± 0.5ns	1200ps or Less	300MHz or More
FDD 9010		9.0ns ± 0.5ns	1300ps or Less	300MHz or More
FDD 9510		9.5ns ± 0.5ns	1300ps or Less	250MHz or More
FDD 10010		10.0ns ± 0.5ns	1400ps or Less	250MHz or More

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ELMEC FIXED DELAY LINES

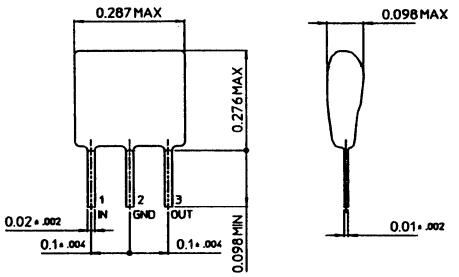
FDE SERIES—VERY HIGH-SPEED FIXED DELAY LINES

COMMON SPECIFICATIONS

- **Distortion of waveform:** Over-shoot/pre-shoot under ± 20%
- **Insulation resistance:** DC 50V, 100MΩ
- **Durable voltage:** DC 50V, 1 minute
- **Operating temperature range:** −40°C ~ +85°C
- **Storage temperature range:** −40°C ~ +120°C

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



SPECIFICATIONS

Part Number	Impedance	Delay Time	Rise Time (20% ~ 80%)	−3dB Pass Band	Temperature Coefficient
FDE 0505	50Ω ± 10%	0.5 ns ± 0.25 ns	400 ps or less	1 GHz or more	−400 ± 100 ppm/°C
FDE 1005		1.0 ns ± 0.25 ns	400 ps or less	900 MHz or more	
FDE 1505		1.5 ns ± 0.25 ns	500 ps or less	800 MHz or more	
FDE 2005		2.0 ns ± 0.25 ns	500 ps or less	700 MHz or more	−400 ± 200 ppm/°C
FDE 2505		2.5 ns ± 0.25 ns	600 ps or less	600 MHz or more	
FDE 3005		3.0 ns ± 0.25 ns	600 ps or less	600 MHz or more	
FDE 3505		3.5 ns ± 0.25 ns	800 ps or less	400 MHz or more	
FDE 4005		4.0 ns ± 0.30 ns	800 ps or less	400 MHz or more	
FDE 4505		4.5 ns ± 0.35 ns	1000 ps or less	300 MHz or more	
FDE 5005		5.0 ns ± 0.40 ns	1000 ps or less	300 MHz or more	

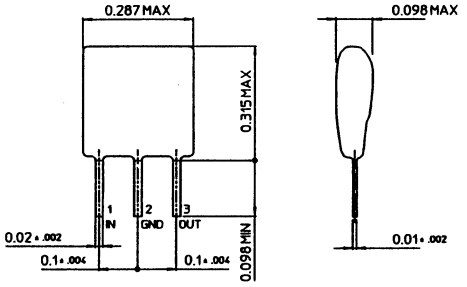
FDF SERIES—VERY HIGH-SPEED FIXED DELAY LINES

COMMON SPECIFICATIONS

- **Distortion of waveform:** Over-shoot/pre-shoot under ± 20%
- **Delay time temp. coefficient:** −400 ± 200 ppm/°C
- **Insulation resistance:** DC 50V, 100MΩ
- **Durable voltage:** DC 50V, 1 minute
- **Operating temperature range:** −40°C ~ +85°C
- **Storage temperature range:** −40°C ~ +120°C

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



SPECIFICATIONS Delay Time Temperature Coefficient: −400 ± 200 ppm/°C

Part Number	Impedance	Delay Time	Rise Time (20% ~ 80%)	−3dB Pass Band
FDF 5505	50Ω ± 10%	5.5 ns ± 0.40 ns	1.2 ns or less	200 MHz or more
FDF 6005		6.0 ns ± 0.45 ns	1.2 ns or less	200 MHz or more
FDF 6505		6.5 ns ± 0.50 ns	1.4 ns or less	200 MHz or more
FDF 7005		7.0 ns ± 0.50 ns	1.4 ns or less	200 MHz or more
FDF 7505		7.5 ns ± 0.50 ns	1.6 ns or less	150 MHz or more
FDF 8005		8.0 ns ± 0.50 ns	1.6 ns or less	150 MHz or more

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ELMEC FIXED DELAY LINES

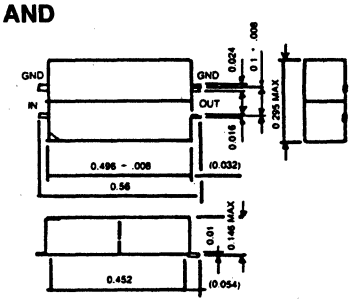
FDR SERIES
ULTRA HIGH-SPEED SURFACE MOUNT FIXED DELAY LINES

COMMON SPECIFICATIONS

- **Distortion of waveform: (Over-shoot/pre-shoot)** under ± 20%
- **Applied voltage:** DC 50V at maximum
- **Operating temperature range:** −10°C to + 80°C
- **Storage temperature range:** −40°C to + 120°C
- **Delay time temperature coefficient:** ±100 ppm/°C

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



Part Number	Impedance	Delay Time	Output Rise Time (20%-80%)	Pass Band −3dB
FDR 0505	50 Ω ± 10%	0.5ns ± 0.10ns	300ps or Less	800MHz or More
FDR 1005		1.0ns ± 0.10ns	300ps or Less	800MHz or More
FDR 1505		1.5ns ± 0.15ns	400ps or Less	550MHz or More
FDR 2005		2.0ns ± 0.20ns	400ps or Less	550MHz or More
FDR 2505		2.5ns ± 0.20ns	500ps or Less	450MHz or More
FDR 3005		3.0ns ± 0.20ns	500ps or Less	450MHz or More
FDR 3505		3.5ns ± 0.25ns	600ps or Less	400MHz or More
FDR 4005		4.0ns ± 0.30ns	700ps or Less	350MHz or More
FDR 4505		4.5ns ± 0.30ns	700ps or Less	350MHz or More
FDR 5005		5.0ns ± 0.30ns	700ps or Less	350MHz or More

Part Number	Impedance	Delay Time	Output Rise Time (20%-80%)	Pass Band −3dB
FDR 0510	100 Ω ± 10%	0.5ns ± 0.10ns	300ps or Less	800MHz or More
FDR 1010		1.0ns ± 0.10ns	300ps or Less	800MHz or More
FDR 1510		1.5ns ± 0.15ns	400ps or Less	550MHz or More
FDR 2010		2.0ns ± 0.20ns	400ps or Less	550MHz or More
FDR 2510		2.5ns ± 0.20ns	500ps or Less	450MHz or More
FDR 3010		3.0ns ± 0.20ns	500ps or Less	450MHz or More
FDR 3510		3.5ns ± 0.25ns	600ps or Less	400MHz or More
FDR 4010		4.0ns ± 0.30ns	700ps or Less	350MHz or More
FDR 4510		4.5ns ± 0.30ns	700ps or Less	350MHz or More
FDR 5010		5.0ns ± 0.30ns	700ps or Less	350MHz or More

FDY SERIES—ULTRA HIGH-SPEED FIXED DELAY LINES

- **Standard 16-pin DIP equivalent package**
- **Impedance:** 50Ω ± 10%
- **Distortion of waveform: (over-shoot/pre-shoot)** under ±20%
- **DC maximum voltage:** DC 50V max.
- **Temperature coefficient:** within ±100 ppm/°C
- **Operating temperature:** −10°C to +80°C
- **Storage temperature** −40°C to +120°C

Part Number	Delay Time	Delay Time Tolerance	Rise Time (20%-80%)	Impedance	Pass Band −3dB
(A)* FDY 0005	Δ td = 130ps	± 30ps	200ps or Less	50 Ω ± 10%	1GHz or More
FDY 1005	1ns + Δtd	± 50ps	350ps or Less		600MHz or More
FDY 2005	2ns + Δtd	±100ps	350ps or Less		600MHz or More
FDY 2505	2.5ns + Δtd	±150ps	400ps or Less		550MHz or More
FDY 3005	3ns + Δtd	±150ps	400ps or Less		550MHz or More
FDY 4005	4ns + Δtd	±200ps	450ps or Less		500MHz or More
FDY 5005	5ns + Δtd	±200ps	500ps or Less		450MHz or More
FDY 6005	6ns + Δtd	±200ps	500ps or Less		450MHz or More

Note: (A)*FDY 0005 is only used in case of the combined application with VDK 2010.
(B) The delay time of the FDY type represents a value with 130ps of the FDY 0005 delay time added in consideration of the use of FDY combined with VDK 2010. This addition is not a problem for ordinary use of FDY as a fixed delay line.

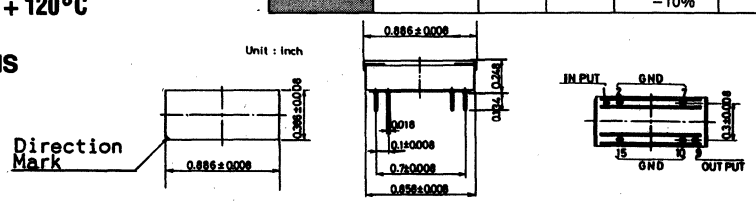
FDS SERIES—HIGH-SPEED FIXED DELAY LINES

- **Standard 16-pin DIP equivalent package**
- **Rise time:** (1)*10%-90%,(2)*20%-80%
- **Distortion of waveform: (over-shoot/pre-shoot)** under ±20%
- **DC maximum voltage:** DC 50V max.
- **Operating temperature:** −10°C to +80°C
- **Storage temperature:** −40°C to +120°C

Part Number	Time Delay ea	Rise Time ea Max.		Impedance	Temperature Coefficient ppm/°C
FDS 1310	13±5%	(1)*	2ns	100±10%	±100 MAX
FDS 2110	20±5%	(1)*	3ns	100±10%	−400±200
FDS 1500S	15+1ns −0	(2)*	1.5ns	50+15% −10%	−400±200
FDS 1800S	18±1.5%	(2)*	1.7ns	50+15% −10%	−400±200

FDY, FDS TYPE EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



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ELMEC VARIABLE DELAY LINES

SDU SERIES
ULTRA HIGH-SPEED DIGITAL VARIABLE DELAY LINES

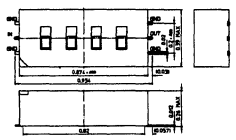
COMMON SPECIFICATIONS

- **Step accuracy:** 50ps ± 25ps
- **IN/OUT impedance:** 50 Ω ± 10%
- **Distortion of waveform:** Over-shoot/Pre-shoot under ± 10%
- **Insulation Resistance:** DC 50V, 100M Ω
- **Durable votage:** DC 50V, 1 minute
- **Operating temperature range:** −10°C ~ +80°C
- **Storage temperature range:** −40°C ~ +120°C

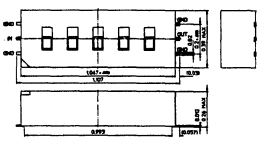
EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch

SDU 4050



SDU 5050



SPECIFICATIONS

Part Number	Delay Time Variable Range	Increment Resolution	Rise Time (20% ~ 80%)	−3dB Pass Band	Residual Delay Time
SDU 4050	0 ~ 750ps ± 5%	50ps, 16 steps	150ps or less	2GHz or more	350ps or less
SDU 5050	0 ~ 1.55ns ± 5%	50ps, 32 steps	200ps or less	1GHz or more	400ps or less

LOGIC 1: SW ON LOGIC 0: SW OFF

STEP	SWITCH					PART NUMBER	
	SW_0	SW_1	SW_2	SW_3	SW_4	SDU 4050	SDU 5050
0	0	0	0	0	0	0 (ps)	0 (ps)
1	1	0	0	0	0	50	50
2	0	1	0	0	0	100	100
3	1	1	0	0	0	150	150
4	0	0	1	0	0	200	200
5	1	0	1	0	0	250	250
• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •
13	1	0	1	1	0	650	650
14	0	1	1	1	0	700	700
15	1	1	1	1	0	750 ps ± 5%	750
• • •	• • •	• • •	• • •	• • •	• • •		• • •
29	1	0	1	1	1		1450
30	0	1	1	1	1		1500
31	1	1	1	1	1		1550 ps ± 5%

*There is no SW_4 on SDU 4050

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ELMEC VARIABLE DELAY LINES

QDG SERIES—VOLTAGE-CONTROL VARIABLE DELAY LINES

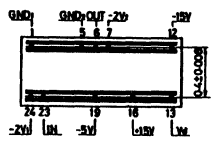
COMMON SPECIFICATIONS

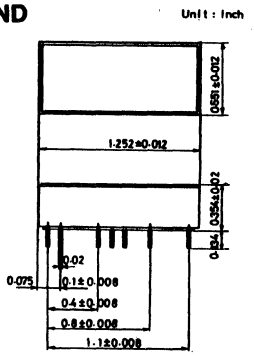
- **Variable range of analog voltage:** 0V (delay time max.) to −10V (delay time min.)
- **Rise time, fall time:** ECL 10KH compatible
- **Supply voltage:** −4.5V ~ −5.7V, −2V ± 5%
- **Power consumption:** −2V: 65mA typical, −5V: 20mA typical, +15V: 5mA typical, −15V: 10mA typical
- **Delay time change by temperature rise:** Less than 5ps/°C (25°C to 45°C)
- **Operating temperature:** −10°C to +60°C
- **Storage temperature:** −40°C to 120°C

Part Number	Time Delay Min.	Pulse Width Min.	Residual Time Delay	Guaranteed Frequency for Time Delay
QDG 0501	0-0.5ns	2.0ns	3.4ns	1KHz-200MHz
QDG 1001	0-1.0ns	2.0ns	3.7ns	1KHz-200MHz
QDG 2001	0-2.0ns	2.0ns	5.5ns	1KHz-120MHz
QDG 3001	0-3.0ns	3.0ns	6.5ns	1KHz-100MHz
QDG 4001	0-4.0ns	3.0ns	7.5ns	1KHz- 70MHz

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch





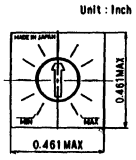
VDJ 1010—ULTRA HIGH-SPEED VARIABLE DELAY LINES

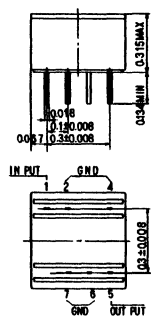
COMMON SPECIFICATIONS

- **DC max. voltage:** DC 2.5V max. constantly
- **−3dB band width:** 1 GHz or more
- **Residual delay time:** 230ps max. at the minimum point within the variable range.
- **Distortion of waveform: (Over-shoot/pre-shoot)** under ±20%
- **Delay time temp. coefficient:** ±100ppm/°C
- **Operating temperature range:** −10° to +80°C
- **Storage temperature range:** −40°C to +120°C

OUTER DIMENSIONS AND PIN ARRANGEMENT

Unit: inch





Part Number	Delay Time Range ±10%	Increment Resolution	Rise Time (20% - 80%)	Input Impedance	Output Impedance	Logic Family Preferred
VDJ 1010	0 ~ 1.0ns	33 ps, 30 steps	300ps or Less	50 Ω ±10%	100 Ω ±10%	ECL 100K

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ELMEC VARIABLE DELAY LINES

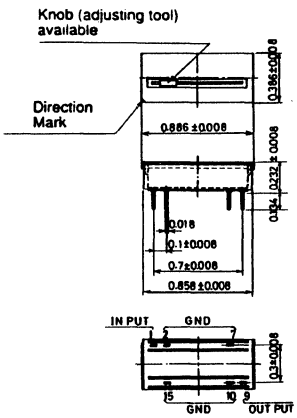
VDK SERIES—ULTRA HIGH-SPEED VARIABLE DELAY LINES

COMMON SPECIFICATIONS

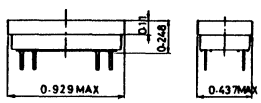
- Standard 16-pin DIP equivalent package
- 40 settings in equal delay increments
- Simple, quick time delay adjustments
- Band width (−3dB): 800MHz min.
- Residual delay time: 220ps max. at the minimum point within the variable range.
- Distortion of waveform: (Over-shoot/pre-shoot) under ±20%
- DC maximum voltage: DC 2.5V max.
- Temperature coefficient: within ±100ppm/°C
- Operating temperature range: −10°C to +80°C
- Storage temperature range: −40°C to +120°C

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



Dimensions with plastic cap



Part Number	Time Delay ns +20% −0%	Increment Resolution ps	Rise Time (20% - 80%) ps Max.	Input Impedance ±10%	Output Impedance ±10%	Logic Family Preferred
VDK 0510	0−0.5ns	12.5ps	300ps	50 Ω	100 Ω	ECL 100K
VDK 2010	0−2.0ns	50ps	300ps	50 Ω	100 Ω	ECL 100K
VDK 0515	0−0.5ns	12.5ps	300ps	75 Ω	150 Ω	CML
VDK 2015	0−2.0ns	50ps	300ps	75 Ω	150 Ω	CML

VDS SERIES—HIGH-SPEED VARIABLE DELAY LINES

COMMON SPECIFICATIONS

- Standard 16-PIN DIP equivalent package
  *External dimension and PIN configuration is same as VDK type
- 40 delay increment settings with 20 delay line sections
- Simple, quick time delay adjustments
- Rise time: (B)* 20%-80%, (C)* 10%-90%
- Residual time delay: 450ps max. at the minimum point within the variable range.
- Distortion of waveform: (Over-shoot/pre-shoot) under ±20%
- Operating temperature range: −10°C to +80°C
- Storage temperature: −40°C to +120°C

Part Number	Time Delay ns ±20% −0%	(A)* Increment Resolution ps		Rise Time ns max.		Input Impedance ±10%	Output Impedance ±10%	DC Max Voltage V Max.	Logic Family Preferred	Temperature Coefficient
		1.75%	3.25%							
VDS 5010	0−5ns	88ps	163ps	(B)*	0.8ns	50 Ω	100 Ω	2.5V	ECL 10KH	±100ppm/°C
VDS 1110	0−10ns	175ps	325ps	(B)*	1.3ns	50 Ω	100 Ω	2.5V	ECL 10KH	±100ppm/°C
VDS 2110	0−20ns	350ps	650ps	(B)*	2.3ns	50 Ω	100 Ω	2.5V	ECL 10K	−400±200ppm/°C
VDS 5020	0−5ns	88ps	163ps	(C)*	2.0ns	100 Ω	200 Ω	4.5V	TTL FAST	±100ppm/°C
VDS 1120	0−10ns	175ps	325ps	(C)*	2.5ns	100 Ω	200 Ω	4.5V	TTL FAST	±100ppm/°C
VDS 2120	0−20ns	350ps	650ps	(C)*	3.5ns	100 Ω	200 Ω	4.5V	TTL FAST	−400±200ppm/°C

(A)* VDS has alternate increments of 1.75% and 3.25%.

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ELMEC PROGRAMMABLE DELAY LINES

PDL 6 SERIES
ULTRA HIGH-SPEED PROGRAMMABLE DELAY LINES

COMMON SPECIFICATIONS

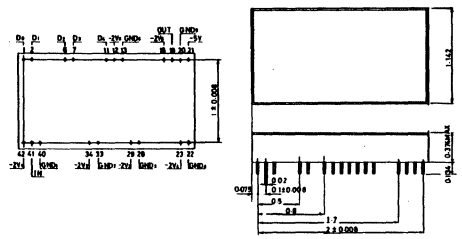
- **Guaranteed frequency for step accuracy:** 80 MHz.
- **Number of steps:** 64 steps
- **VEE voltage:** −4.5V ~ −5.7V (Standard Test Condition: −5V)
- **Residual delay time:** 7ns Max.
- **Output rise time:** ECL 10 KH compatible
- **Power consumption:** −2V: 90mA (TYP) −2V: 120mA (TYP)
- **Delay time temperature coefficient:** ±100ppm/°C
- **Operating temperature range:** −10°C ~ +60°C
- **Storage temperature range:** −40°C ~ +120°C

SPECIFICATIONS LOGIC 1 : ECL (H) LEVEL LOGIC 0 : ECL (L) LEVEL

STEP	ADDRESS						PART NUMBER			
	D_0	D_1	D_2	D_3	D_4	D_5	PDL 6050	PDL 6100	PDL 6125	PDL 6500
0	0	0	0	0	0	0	0 (ps)	0 (ps)	0 (ps)	0 (ps)
1	1	0	0	0	0	0	50	100	125	0.5
2	0	1	0	0	0	0	100	200	250	1.0
3	1	1	0	0	0	0	150	300	375	1.5
4	0	0	1	0	0	0	200	400	500	2.0
5	1	0	1	0	0	0	250	500	625	2.5
6	0	1	1	0	0	0	300	600	750	3.0
7	1	1	1	0	0	0	350	700	875	3.5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
61	1	0	1	1	1	1	3050	6100	7625	30.5
62	0	1	1	1	1	1	3100	6200	7750	31.0
63	1	1	1	1	1	1	3150±5%	6300±5%	7875±5%	31.5±5%
Step accuracy; ± ½ LSB up to 80 MHz							50ps±25ps	100ps±50ps	125ps±62.5ps	0.5ps±0.25ns

**Higher frequency is available at wider range of accuracy. For reference: ± 1 LSB at 150 MHz.

EXTERNAL DIMENSION AND PIN CONFIGURATION



NOTES

- Be sure to adjust the delay time at the rise portion of the output waveform.
- The radiation plate is installed on the top surface of the products.
- Inputs and outputs are buffered at the ECL gate.
- Be sure to use all the −2V's.
- Be sure to terminate the input and address in accordance with the external impedance.

STANDARD MEASUREMENT CONDITIONS

- PW = 8ns • Clock frequency: 1 MHz

PDE 6-BIT SERIES
ULTRA HIGH-SPEED PROGRAMMABLE DELAY LINES

COMMON SPECIFICATIONS

- **Guaranteed frequency for step accuracy:** 100MHz
- **Number of steps:** 64 steps
- **Supply voltage:** −4.2V ~ −5.2V −2V ±5%
- **Residual delya time:** 6ns ± 1ns
- **Output rise time:** ECL 100K compatible
- **Power consumption:** −2V: 90mA typical −5V: 170mA typical
- **Delay time temperature coefficient:** ±100ppm/°C
- **Operating temperature range:** −10°C to +60°C
- **Storage temperature range:** −40°C to +120°C

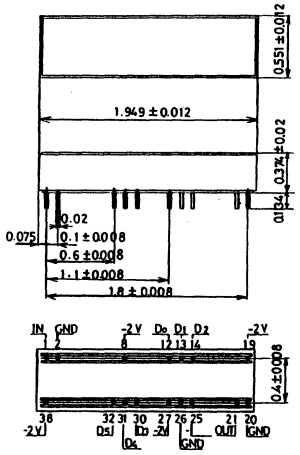
Logic 1: ECL (H) Level, Logic 0: ECL (L) Level

Step	Address						Part Number				
	D_0	D_1	D_2	D_3	D_4	D_5	PDE 6050	PDE 6100	PDE 6125	PDE 6250	PDE 6500
0	0	0	0	0	0	0	0 (ps)	0 (ps)	0 (ps)	0 (ns)	0 (ns)
1	1	0	0	0	0	0	50	100	125	0.25	0.5
2	0	1	0	0	0	0	100	200	250	0.50	1.0
3	1	1	0	0	0	0	150	300	375	0.75	1.5
4	0	0	1	0	0	0	200	400	500	1.00	2.0
5	1	0	1	0	0	0	250	500	625	1.25	2.5
6	0	1	1	0	0	0	300	600	750	1.50	3.0
7	1	1	1	0	0	0	350	700	875	1.75	3.5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
61	1	0	1	1	1	1	3050	6100	7625	15.25	30.5
62	0	1	1	1	1	1	3100	6200	7750	15.50	31.0
63	1	1	1	1	1	1	3150±5%	6300±5%	7875±5%	15.75±5%	31.5±5%
Step accuracy: ±1/2 LSB up to 100MHz							50ps±25ps	100ps±50ps	125ps±62.5ps	0.25ns±0.125ns	0.5ns±0.25ns

**Higher frequency is available at wider range of accuracy. For reference: ±1 LSB at 150MHz.

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



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ELMEC PROGRAMMABLE DELAY LINES

PDH 6-BIT SERIES
ULTRA HIGH-SPEED PROGRAMMABLE DELAY LINES

COMMON SPECIFICATIONS

- Guaranteed frequency for Step accuracy: 80 MHz
- No. of steps: 64 steps
- Supply voltage −4.5V ~ −5.7V, −2V ± 5%
- Residual delay time: 7ns Max.
- Output rise time: ECL 10KH compatible
- Power consumption: −2V: 90mA typical, −5V: 120mA typical
- Delay time temperature coefficient: ±100ppm/°C
- Operation temperature range: −10°C to 60°C
- Storage temperature range: −40°C to 120°C

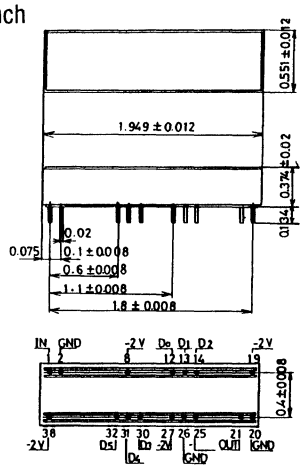
SPECIFICATIONS LOGIC 1: ECL (H) Level, LOGIC 0: ECL (L) Level

STEP	ADDRESS						PART NUMBER				
	D_0	D_1	D_2	D_3	D_4	D_5	PDH 6050	PDH 6100	PDH 6125	PDH 6200	PDH 6500
0	0	0	0	0	0	0	0(ps)	0(ps)	0(ps)	0(ns)	0(ns)
1	1	0	0	0	0	0	50	100	125	0.2	0.5
2	0	1	0	0	0	0	100	200	250	0.4	1.0
3	1	1	0	0	0	0	150	300	375	0.6	1.5
4	0	0	1	0	0	0	200	400	500	0.8	2.0
5	1	0	1	0	0	0	250	500	625	1.0	2.5
6	0	1	1	0	0	0	300	600	750	1.2	3.0
7	1	1	1	0	0	0	350	700	875	1.4	3.5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
61	1	0	1	1	1	1	3050	6100	7625	12.2	30.5
62	0	1	1	1	1	1	3100	6200	7750	12.4	31.0
63	1	1	1	1	1	1	3150±5%	6300±5%	7875±5%	12.6±5%	31.5±5%
Step accuracy; ± 1/2 LSB up to 80 MHz							50ps±25ps	100ps±50ps	125ps±62.5ps	0.2ns±0.1ns	0.5ns±0.25ns

**Higher frequency is available at wider range of accuracy. For reference ± 1 LSB at 150 MHz.

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



PDH 4-BIT SERIES
ULTRA HIGH-SPEED PROGRAMMABLE DELAY LINES

COMMON SPECIFICATIONS

- Guaranteed frequency for Step accuracy: 80 MHz
- No of steps: 16 steps
- Supply voltage −4.5V ~ −5.7V, −2V ± 5%
- Residual delay time: 4.5 ns Max.
- Output rise time: ECL 10KH compatible
- Power consumption: −2V: 40 mA typical, −5V: 85 mA typical
- Delay time temperature coefficient: ±100ppm/°C
- Operation temperature range: −10°C to 60°C
- Storage temperature range: −40°C to 120°C

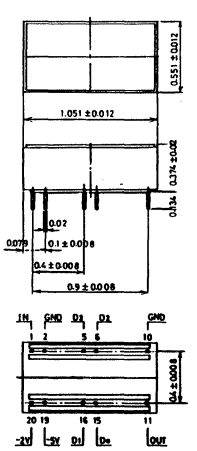
SPECIFICATIONS LOGIC 1: ECL (H) Level, LOGIC 0: ECL (L) Level

STEP	ADDRESS				PART NUMBER					
	D_0	D_1	D_2	D_3	PDH 4050	PDH 4100	PDH 4125	PDH 4250	PDH 4500	PDH 4102
0	0	0	0	0	0(ps)	0(ps)	0(ps)	0(ps)	0(ns)	0(ns)
1	1	0	0	0	50	100	125	250	0.5	1
2	0	1	0	0	100	200	250	500	1.0	2
3	1	1	0	0	150	300	375	750	1.5	3
4	0	0	1	0	200	400	500	1000	2.0	4
5	1	0	1	0	250	500	625	1250	2.5	5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
13	1	0	1	1	650	1300	1625	3250	6.5	13
14	0	1	1	1	700	1400	1750	3500	7.0	14
15	1	1	1	1	750±5%	1500±5%	1875±5%	3750±5%	7.5±5%	15±5%
Step accuracy; ± 1/2 LSB up to 80 MHz					50ps±25ps	100ps±50ps	125ps±62.5ps	250ps±125ps	0.5ns±0.25ns	1ns±0.5ns

**Higher frequency is available at wider range of accuracy. For reference ± 1 LSB at 150 MHz.

EXTERNAL DIMENSIONS AND PIN CONFIGURATION

Unit: inch



ELMEC TECHNOLOGY OF AMERICA, INC. 1255 Corporate Center Dr., Suite 406 Monterey Park, CA 91754 Phone: (213) 265-1861 Fax: (213) 265-1908

ESC

DELAY LINES

ESC DELAY LINES – SINCE 1953

THE FOLLOWING PAGES REPRESENT A MINIMUM VARIETY OF ESC'S CURRENTLY AVAILABLE DELAY LINES

Most ESC DELAY LINES are available for MIL applications!

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A•1559	DIP-16	10 Tap-16 Pin DIP	A•1559	SIL-14	10 Tap-14 Pin SIL
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A•1560	DIP 24	20 Tap-24 Pin DIP	A•1561	8GSA-8GSB	Trimming-4 Pin-Gull Leads-SMD
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A•1563	14TDL	TTL-Low-Low Profile-14 Pin DIP	A•1565	14HTD	TTL-Hi-Performance-14 Pin DIP
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A•1566	9G	TTL-Low Profile-MIL use	A•1567	8G(D)	TTL-8 Pin DIL
A•1567	5G	TTL-3 Pin SIL	A•1570	16EG(C)	ECL-16 Pin DIL
A•1562	14LG(C)(D)	L.P. Schottky-14 Pin DIL			
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A•1562	14D(C)(D)	TTL-14 Pin DIL	A•1562	14LD(C)(D)	L.P. Schottky-14 Pin DIL
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TRIPLE OUTPUT DELAY LINES					
A•1562	14P(C)(D)	TTL-14 Pin DIL	A•1566	9LP	TTL-Low Power-MIL use
A•1562	14LP(C)(D)	L.P. Schottky-14 Pin DIL	A•1570	16EP(C)	ECL-16 Pin DIL
A•1566	9P	TTL-Low Profile-MIL use			
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A•1571	PTT4(C)	TTL-4 Bit	A•1571	PEC4(C)	ECL-4 Bit "10,000"
A•1571	PTT6(C)	TTL-6 Bit	A•1571	PEC6(C)	ECL-6 Bit "10,000"

(D) Denotes availability in Auto-Insertable DIP package
(C) Denotes availability for high temperature, MIL applications

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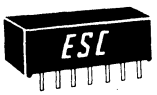
DELAY LINES

SERIES SIL-7 –Single-in-line 5 taps/SERIES SIL-14 –Single-in-line 10 taps

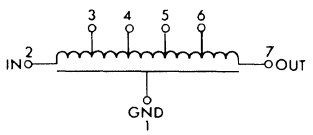
COMMON SPECIFICATIONS

- Output Time Delay Tolerance:
  ± 5% for 20ns and above
  ± 10% or .25ns whichever is greater, for 10ns and less
- Distortion: ± 10% at output
- Attenuation: 0.5db max
- Temperature Coefficient: 100 ppm/°C max
- Operating Temperature Range: – 55°C to + 125°C
- Dielectric Strength: 50 VDC
- Size: SIL-7: .80L x .20W x .25H
  SIL-14: 1.50L x .20W x .25H

SERIES SIL-7

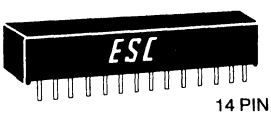


7 PIN

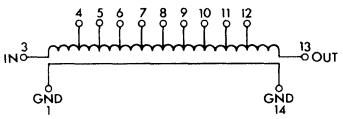


TD (ns)	Rise Time max (ns)	No. of Taps	TD/Tap (ns)	Atten. max %	MODEL NO.	
					50Ω ± 10%	100Ω ± 10%
1	1.5	none	—	2.0	SLA-1	SLB-1
2	1.5	none	—	2.0	SLA-2	SLB-2
3	1.5	none	—	2.0	SLA-3	SLB-3
4	2.0	none	—	2.0	SLA-4	SLB-4
5	2.0	5	1.0 ± 0.3	2.0	SLA-5	SLB-5
10	3.0	5	2.0 ± 0.4	2.0	SLA-10	SLB-10
20	6.0	5	4.0 ± 0.5	2.0	SLA-20	SLB-20
30	9.0	5	6.0 ± 1.0	2.0	SLA-30	SLB-30
40	12.0	5	8.0 ± 1.0	2.0	SLA-40	SLB-40
50	15.0	5	10.0 ± 1.0	2.5	SLA-50	SLB-50
60	18.0	5	12.0 ± 1.5	3.0	—	SLB-60
70	22.0	5	14.0 ± 1.5	4.0	—	SLB-70
80	25.0	5	16.0 ± 1.5	4.5	—	SLB-80
90	28.0	5	18.0 ± 2.0	4.5	—	SLB-90
100	30.0	5	20.0 ± 2.0	5.0	—	SLB-100

SERIES SIL-14



14 PIN



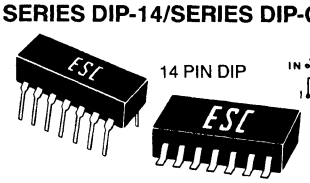
TD (ns)	Rise Time max (ns)	TD/Tap (ns)	Atten. max %	MODEL NO.	
				50Ω ± 10%	100Ω ± 10%
10	2.0	1.0 ± 0.5	2.5	SLA14-10	—
20	4.0	2.0 ± 0.5	2.5	SLA14-20	SLB14-20
25	5.0	2.5 ± 1.0	2.5	SLA14-25	SLB14-25
30	6.0	3.0 ± 1.0	2.5	SLA14-30	SLB14-30
40	8.0	4.0 ± 1.0	2.5	SLA14-40	SLB14-40
50	10.0	5.0 ± 1.0	3.0	SLA14-50	SLA14-50
60	12.0	6.0 ± 1.0	3.5	SLA14-60	SLB14-60
70	14.0	7.0 ± 1.0	3.5	SLA14-70	SLB14-70
75	15.0	7.5 ± 1.0	4.0	SLA14-75	SLB14-75
80	16.0	8.0 ± 1.0	4.5	SLA14-80	SLB14-80
90	18.0	9.0 ± 1.0	4.5	SLA14-90	SLB14-90
100	20.0	10.0 ± 1.0	4.5	SLA14-100	SLB14-100
150	30.0	15.0 ± 2.0	8.0	—	SLB14-150
200	40.0	20.0 ± 2.0	10.0	—	SLB14-200

SERIES DIP-14 –10 Taps/SERIES DIP-G14 –Surface Mounting G Leads
SERIES DIP-16 –Extended Delay 10 Taps/SERIES DIP-G16 –Surface Mounting G Leads

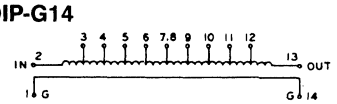
COMMON SPECIFICATIONS

- Operating Temperature: – 55°C to + 125°C
- Temperature Coefficient: 100 ppm/°C max
- Attenuation: 1dB max
- Distortion (at max delay): ± 10% max
- Dielectric Strength: 50VDC
- Size: DIP14: .785L x .285W x .250H
  DIP16: .890L x .285W x .280H

SERIES DIP-14/SERIES DIP-G14

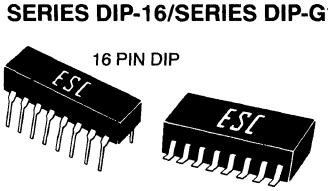


14 PIN DIP

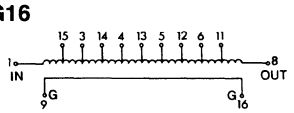


IMPEDANCE ± 10% →				50	75	100	200
Time Delay (nsec) ± 5%	Rise Time (nsec)	No. of Taps	Delay per Tap (nsec) non-cumulative	MODEL NO.			
10 ± 5%	2.0	10	1.0 ± .5	5P10	7P10	1P10	—
20	4.0	10	2.0 ± .5	5P20	7P20	1P20	2P20
30	6.0	10	3.0 ± 1	5P30	7P30	1P30	2P30
40	7.0	10	4.0 ± 1	5P40	7P40	1P40	2P40
50	8.0	10	5.0 ± 1	5P50	7P50	1P50	2P50
100	6.0	10	10.0 ± 1.5	5P100	7P100	1P100	2P100
150	25.0	10	15.0 ± 1.5	5P150	7P150	1P150	2P150
200	35.0	10	20.0 ± 2	5P200	7P200	1P200	2P200
250	42.0	10	25.0 ± 2.5	5P250	7P250	1P250	2P250
300	50.0	10	30.0 ± 3.0	5P300	7P300	1P300	2P300

SERIES DIP-16/SERIES DIP-G16



16 PIN DIP



IMPEDANCE ± 10% ⟶				100	200	300	500
Time Delay (ns) ± 5%	Rise Time (ns)	No. of Taps	Delay per Tap (ns) ± 2ns or 5% (whichever is greater)	MODEL NO.			
250	45	10	25	1N25	2N25	3N25	5N25
300	55	10	30	1N30	2N30	3N30	5N30
350	65	10	35	1N35	2N35	3N35	5N35
400	70	10	40	1N40	2N40	3N40	5N40
450	80	10	45	1N45	2N45	3N45	5N45
500	90	10	50	1N50	2N50	3N50	5N50
600	110	10	60	1N60	2N60	3N60	5N60
800	145	10	80	1N80	2N80	3N80	5N80
1000	180	10	100	1N100	2N100	3N100	5N100

Intermediate Delay Values Available Upon Request.

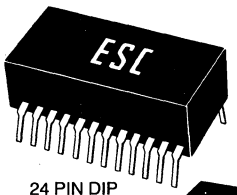
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NEW JERSEY 07650 ● (201) 947-0400 ● TWX: 710-991-9780 ● FAX: 201-947-0406

ESC DELAY LINES

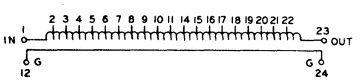
SERIES DIP-24 –to 2000 Nsec 20 taps/SERIES DIP-G24 –Surface Mounting G Leads

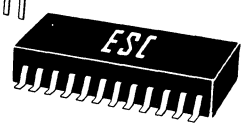
SPECIFICATIONS:

- Operating Temperature: –55°C to +125°C
- Temperature Coefficient: 100 ppm/°C max
- Attenuation: 1 dB max
- Distortion: 10% max
- Dielectric Strength: 50 VDC
- Size: 1.3L x .580W x .300H



24 PIN DIP



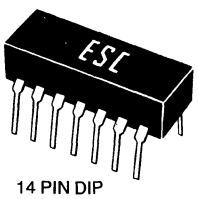


For Gull Wing Surface Mount Package add letter G following 1st 3 digits. Example: 124-5 converts to 124G-5.

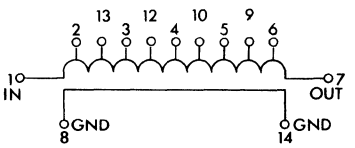
IMPEDANCE ±10% (OHMS) ⟶			100	200	500
Time Delay ±5%	Rise Time (nsec) Max	Delay per Tap ±% or 1nsec WIG	MODEL NO.		
200	17	10.0	124-2	224-2	524-2
250	21	12.5	124-2.5	224-2.5	524-2.5
400	34	20.0	124-4	224-4	524-4
500	42	25.0	124-5	224-5	524-5
600	50	30.0	124-6	224-6	524-6
750	63	37.5	124-7.5	224-7.5	524-7.5
800	67	40.0	124-8	224-8	524-8
1000	84	50.0	124-10	224-10	524-10
1200	110	60.0	124-12	224-12	524-12
1500	125	75.0	124-15	224-15	524-15
2000	170	100.0	—	224-20	524-20

SERIES MIL-23 –low profile

- Total Time Delay Tolerance: ±2 ns Below 40 ns Delay
  ±5% Above 40 ns Delay
- No. of Taps: 10 Equally Spaced
- Temperature Coefficient: 100 ppm/°C max.
- Operating Temp. Range: –55°C to +125°C
- Distortion at max delay: ±10% max.
- Attenuation: 10% max.
- Dielectric Strength: 50 VDC
- Size: 14 Pin, .750L x .300W x .187H



14 PIN DIP



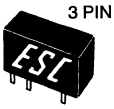
Total Td ns	Rise Time max(ns)	IMPEDANCE ±10%		
		50Ω	100Ω	200Ω
10	3	A002	B102	—
15	4	A003	B103	—
20	5.5	A004	B104	—
25	6	A005	B105	—
30	6.5	A006	B106	—
35	7	A007	B107	—
40	8	A008	B108	C208

Total Td ns	Rise Time max(ns)	IMPEDANCE ±10%		
		50Ω	100Ω	200Ω
45	9	A009	B109	C209
50	10	A010	B110	C210
60	12	A012	B112	C212
80	16	A016	B116	C216
100	20	A020	B120	C220
120	24	A022	B122	C222
140	28	A024	B124	C224
150	30	A025	B125	C225
160	32	A026	B126	—
180	36	A028	B128	—
200	40	A030	B130	—
220	45	—	B132	—
240	50	—	B134	—
250	50	—	B135	—
260	55	—	B136	—
280	60	—	B138	—
300	60	—	B140	—
330	70	—	B143	—

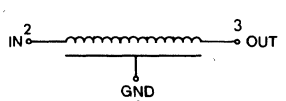
SERIES SAT/SERIES SBT –miniature singles

SPECIFICATIONS:

- Delay Tolerance: ±.25ns
- Operating Temperature: –55°C to +125°C
- Attenuation: 0.25 db max
- Dielectric Strength: 50 VDC
- Temp. Coefficient: 100 ppm/°C
- Band Width: 200 MHz (–3dB)
- Size: .56L x .25W x .20H



3 PIN SIL



Intermediate Delay Values Available Upon Request.

Miniature trimming delay lines in increments of 0.5 ns for your fine "tweeking."

Td(ns)	Impedance ±10%	
	50Ω	100Ω
1.0	SAT-10	SBT-10
1.5	SAT-15	SBT-15
2.0	SAT-20	SBT-20
2.5	SAT-25	SBT-25
3.0	SAT-30	SBT-30
3.5	SAT-35	SBT-35
4.0	SAT-40	SBT-40
4.5	SAT-45	SBT-45
5.0	SAT-50	SBT-50

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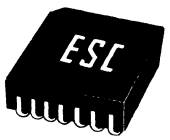
ESC

DELAY LINES

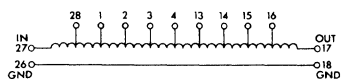
SERIES JSA/SERIES JSB –low profile, 10 taps, surface mounting, J leads

SPECIFICATIONS:

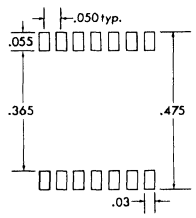
- Operating Temperature Range: – 55°C to + 125°C
- Temperature Coefficient: 100 ppm/°C max
- Terminals: Electro tin plated, Alloy 42 .020w x .010 th.
- Distortion (at max delay): ± 10% max
- Dielectric Strength: 50 VDC



10 TAPS



Size: 450L x .450W x .175H



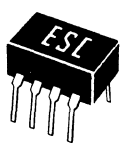
Suggested PC Board Solder Pads

Time Delay (ns) ± 2ns or 5%	Rise Time (ns)	Attenuation (db) max	Delay per Tap (ns)	IMPEDANCE ± 10%	
				100Ω Model No.	200Ω Model No.
25	5	3%	2.5 ± 0.5	JSA25	JSB25
30	6	3%	3.0 ± 0.5	JSA30	JSB30
35	7	3%	3.5 ± 0.5	JSA35	JSB35
40	8	3%	4.0 ± 0.5	JSA40	JSB40
45	9	3%	4.5 ± 0.5	JSA45	JSB45
50	10	3%	5.0 ± 1.0	JSA50	JSB50
60	12	5%	6.0 ± 1.0	JSA60	JSB60
75	15	5%	7.5 ± 1.0	JSA75	JSB75
100	20	5%	10.0 ± 2.0	JSA100	JSB100
125	25	8%	12.5 ± 2.0	JSA125	JSB125
150	30	8%	15.0 ± 2.0	JSA150	JSB150
175	35	10%	17.5 ± 2.0	JSA175	JSB175
200	40	12%	20.0 ± 2.0	JSA200	JSB200
250	50	12%	25.0 ± 2.0	JSA250	JSB250

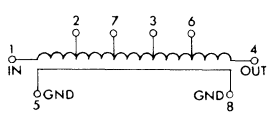
SERIES 8A/SERIES 8B –machine insertable, DIP, delay lines, 8 pin package, 5 taps

SPECIFICATIONS:

- Delay Tolerance: ± 1ns or ± 5% whichever is greater
- Distortion (at max delay): ± 10% max
- Attenuation: 0.5dB max
- Dielectric Strength: 50VDC
- Temperature Coefficient: 100ppm/°C max
- Operating Temperature Range: – 55°C to + 125°C
- Terminals: HTD alloy 42. 020w x .010th.



8 PIN



Size: .500L x .285W x .250H

Delay (ns)	Delay per Tap (ns)	Rise Time	IMPEDANCE ± 10%	
		(ns) max	50Ω	100Ω
5	1	2	8A05	8B05
10	2	3	8A10	8B10
15	3	5	8A15	8B15
20	4	7	8A20	8B20
25	5	8	8A25	8B25
30	6	10	8A30	8B30
35	7	12	8A35	8B35
40	8	13	8A40	8B40
50	10	17	8A50	8B50

Total Time Delay Tolerance: ± 1ns or ± 5%, whichever is greater.

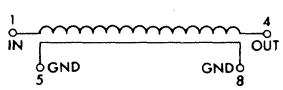
SERIES 8GSA/SERIES 8GSB –low profile, 8 pin, package surface mounting G leads

SPECIFICATIONS

- Band Width: 200MHz (– 3dB)
- Delay Tolerance: ± .25ns
- Attenuation: 0.25dB max
- Dielectric Strength: 50VDC
- Operating Temperature: – 55°C to + 125°C
- Temp. Coefficient: 100ppm/°C max
- Terminals: Electro tin plated alloy 42



4 PIN



Size: .500L x .285W x .200H

Delay (ns) ± .25ns	Impedance	
	50Ω	100Ω
1.0	8GSA-10	8GSB-10
1.5	8GSA-15	8GSB-15
2.0	8GSA-20	8GSB-20
2.5	8GSA-25	8GSB-25
3.0	8GSA-30	8GSB-30
3.5	8GSA-35	8GSB-35
4.0	8GSA-40	8GSB-40
4.5	8GSA-45	8GSB-45
5.0	8GSA-50	8GSB-50

Intermediate Delay Values Available Upon Request.

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NEW JERSEY 07650 ● (201) 947-0400 ● TWX: 710-991-9780 ● FAX: 201-947-0406

ESC

DELAY LINES

DIGITAL DELAY LINES

COMMON SPECIFICATIONS:

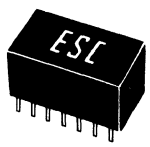
	14 Series	14L Series
Supply voltage	5V ±5%	5V ±5%
Supply current	70mA max	25mA max
Rise & Fall Time	4ns max	6ns max
Operating Temp.	0 to 70°C	0 to 70°C
Size	.8 x .4 x .28	.8 x .4 x .28
Delay tolerance: ±5% or 2ns, whichever is greater		

ESC can also supply these devices with ceramic IC's that have been screened to MIL-STD-833 for −55°C to +125°C operation. Case size will be .82L x .40W x .36H. When ordering add letter "C" after fourth digit in part number.
Example: 14LP10 converts to 14LPC10.
14T100 converts to 14TC100.
All items above available in the low profile auto-insertable package. Contact Plant.

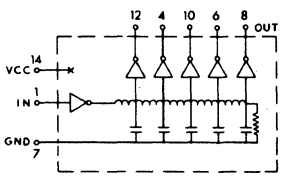
SERIES 14T –digital
TTL, 5-taps

TTL, DTL

Model No.	Delay (ns)	Delay/ Tap (ns)
14T25	25	5
14T30	30	6
14T35	35	7
14T40	40	8
14T45	45	9
14T50	50	10
14T75	75	15
14T100	100	20
14T150	150	30
14T200	200	40
14T250	250	50
14T300	300	60
14T500	500	100
14T750	750	150
14T1000	1000	200



14 PIN



SERIES 14LT –low power
Shottky, 5taps

Low power schottky

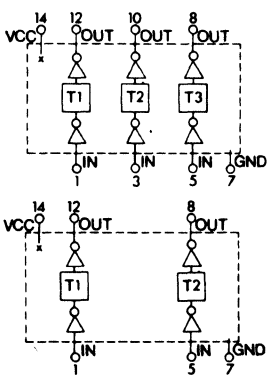
Model No.	Delay (ns)	Delay/ Tap (ns)
14LT50	50	10
14LT75	75	15
14LT100	100	20
14LT150	150	30
14LT200	200	40
14LT250	250	50
14LT300	300	60
14LT500	500	100

SERIES 14P/SERIES 14D–
digital, TTL, triplets and dual

TTL, DTL

Model No.		*Delay
14P Series	14D Series	(ns)
14P5	14D5	5
14P10	14D10	10
14P15	14D15	15
14P20	14D20	20
14P25	14D25	25
14P50	14D50	50
14P75	14D75	75
14P100	14D100	100

*Per Line



SERIES 14LP/SERIES 14LD–
low power schottky triplets and dual

Low power schottky

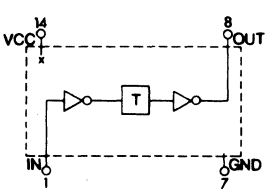
Model No.		*Delay
14LP Series	14LD Series	(ns)
14LP5	14LD5	5
14LP10	14LD10	10
14LP15	14LD15	15
14LP20	14LD20	20
14LP25	14LD25	25
14LP50	14LD50	50
14LP75	14LD75	75
14LP100	14LD100	100

*Per Line

SERIES 14G/SERIES 14LG–
digital, TTL, single output

Model No.	Delay
14G5	5
14G10	10
14G20	20
14G25	25
14G50	50
14G75	75
14G100	100
14G150	150
14G200	200
14G500	500
14G750	750
14G1000	1000

Intermediate Delay Values Available Upon Request.



SERIES 14LG –low power
schottky single output

Model No.	Delay
14LG10	10
14LG20	20
14LG25	25
14LG50	50
14LG75	75
14LG100	100
14LG150	150
14LG200	200
14LG300	300
14LG500	500

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ESC

DELAY LINES

MACHINE INSERTABLE LOW PROFILE DIP DIGITAL DELAY LINES

COMMON SPECIFICATIONS:

- Supply Voltage: 5.0VDC ± 5%
- Delay Tolerance: ± 2ns or ± 5% WIG
- Rise Time: 4ns max
- Minimum Pulse Width: 20% of total delay (10 taps)
  40% of total delay (5 taps)
- Maximum Duty Cycle: 50%
- Operating Temp. Range: 0°C to + 70°C
- Temp. Coeff. of Delay: 1.0ns + 500ppm/°C
- Terminals: HTD alloy 42. 020w x .010th.

The auto-insertable versions of the single output 14G Series and the triplet 14P Series are available as 14GD & 14PD respectively.

DC PARAMETERS		LIMITS Min.	LIMITS Max.
V_{oh}	V_{cc} = min, I_{oh} = 1.0 mA	2.5V	—
V_{ol}	V_{cc} = min, I_{ol} = 20 mA	—	0.5V
I_{ih}	V_{cc} = max, V_{ih} = 2.7V	—	50 µA
I_{il}	V_{cc} = max, V_{il} = 0.5V	– 2.0 mA	—

COMMON TEST CONDITIONS

- Vcc = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- All outputs loaded with 15pf
- Input Test Pulse: Pulse voltage: 3.0V
  Pulse rise time: 2 ns
  Pulse width: 1.2 × max Td
  Pulse spacing: 5 × max Td

The low-low profile series is available as above (14TDL) and in the single output 14GDL Series only.

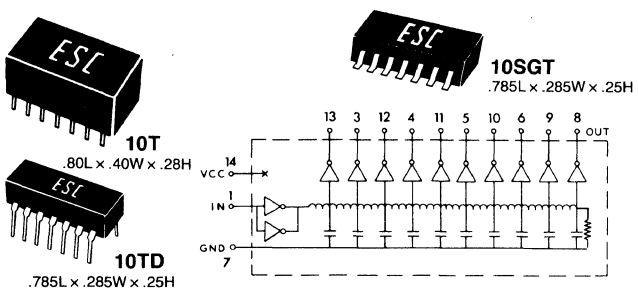
DC PARAMETERS		LIMITS Min.	LIMITS Max.
I_i	V_{cc} = max, V_i = 5.5V	—	1.0 mA
V_i	V_{cc} = min, I_{in} = – 18 madc	– 1.2Vdc	—
I_{cc}	V_{cc} = max, outputs low	Series 10T Series 10TD Series 10SGT Series 14TD Series 14TDL	140 mA 140 mA 140 mA 70 mA 70 mA

SERIES 10T/SERIES 10TD –digital TTL compatible 10 taps, 14 pin, package
SERIES 10SGT –surface mounting G lead

Also available in Low Power Schottky-Series 10LT, 10LTD, or 10LSGT

ESC can also supply the 10T Series with ceramic IC's that have been screened to MIL-STD-883 for – 55°C to + 125°C operation.

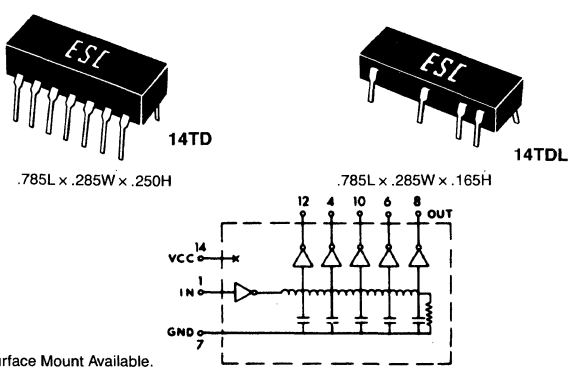
The height will increase to .32 inches. When specifying, add letter "C" after "T". Example: 10T50 converts to 10TC50.



Model Nos. Series 10T	Series 10TD	Series 10SGT	Delay (ns)	Delay/ Tap (ns)
10T50	10TD50	10SGT50	50	5
10T60	10TD60	10SGT60	60	6
10T70	10TD70	10SGT70	70	7
10T80	10TD80	10SGT80	80	8
10T90	10TD90	10SGT90	90	9
10T100	10TD100	10SGT100	100	10
10T200	10TD200	10SGT200	200	20
10T250	10TD250	10SGT250	250	25
10T300	10TD300	10SGT300	300	30
10T350	10TD350	10SGT350	350	35
10T400	10TD400	10SGT400	400	40
10T450	10TD450	10SGT450	450	45
10T500	10TD500	10SGT500	500	50
10T750	10TD750	10SGT750	750	75
10T1000	10TD1000	10SGT1000	1000	100

For variations in delay from above listing, modify part number by changing delay.
Example: 375ns, 10SGT series becomes 10SGT375

SERIES 14TD –TTL/DTL compatible, 5 taps, 14 pin package, low profile
SERIES 14TDL –low-low profile



Note: Surface Mount Available.

Intermediate Delay Values Available Upon Request.

Model Nos. Series 14TD	Series 14TDL	Delay (ns)	Delay/ Tap (ns)
14TD25	14TDL25	25	5
14TD30	14TDL30	30	6
14TD35	14TDL35	35	7
14TD40	14TDL40	40	8
14TD45	14TDL45	45	9
14TD50	14TDL50	50	10
14TD75	14TDL75	75	15
14TD100	14TDL100	100	20
14TD150	14TDL150	150	30
14TD200	14TDL200	200	40
14TD250	14TDL250	250	50
14TD300	14TDL300	300	60
14TD500	14TDL500	500	100
14TD750	N/A	750	150
14TD1000	N/A	1000	200

For variations in delay from above listing, modify part number by changing delay.
Example: 400ns, 14TDL Series becomes 14TDL400

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ESC

DELAY LINES

LOW PROFILE MILITARY APPLICATIONS

COMMON SPECIFICATIONS:

- Supply Voltage (Vcc): 5.0VDC ± 5%
- Delay Tolerance: ± 2ns or ± 5% wig
- Rise Time: 4ns max
- Minimum Pulse Width: JSMTC Series: 40% of Td
  10TCL Series: 20% of Td
- Maximum Duty Cycle: 50%
- Operating Temp. Range: – 55°C to + 125°C
- Temp. coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: .020w × .010th

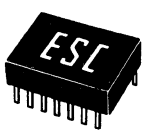
DC PARAMETERS		LIMITS MIN.	LIMITS MAX.
V_{oh}	V_{cc} = min I_{oh} = 1.0 mA	2.5V	—
V_{ol}	V_{cc} = min I_{ol} = 20 mA	—	0.5V
I_{ih}	V_{cc} = max V_{ih} = 2.7V	—	50 µA
I_{il}	V_{cc} = max V_{il} = 0.5V	– 2.0 mA	—

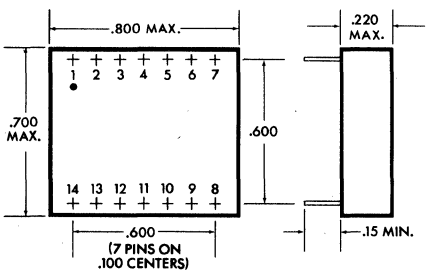
COMMON TEST CONDITIONS

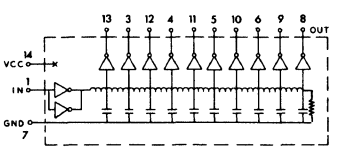
- Temperature: 25° ± 5°C, V_{cc} = 5.0VDC
- Input pulse width: 1.2 times the total delay time
- Pulse spacing: 5 times the total delay time
- Input rise time: 2ns; input pulse amplitude 3.0VDC
- All outputs loaded with 15pf
- Time delays measured at the 1.5 volts on the leading edges
- Rise time measured from .75 to 2.4V

DC PARAMETERS		LIMITS MIN.	LIMITS MAX.
I_i	V_{cc} = max V_i = 5.5V	—	1.0 mA
V_i	V_{cc} = min I_{in} = – 18 madc	– 1.2Vdc	—
I_{cc}	V_{cc} = max outputs low	JSMTC Series 10TCL Series	70mA 140mA

SERIES 10TCL –TTL digital, 10 taps





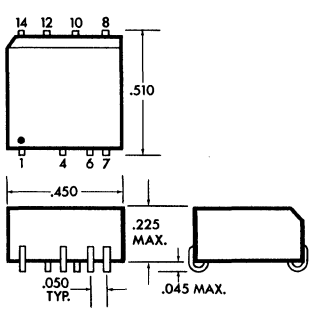


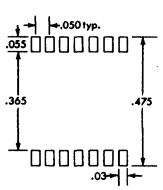
MODEL NOS.	DELAY (ns)	DELAY/TAP (ns)
10TCL50	50	5
10TCL60	60	6
10TCL70	70	7
10TCL80	80	8
10TCL90	90	9
10TCL100	100	10
10TCL200	200	20
10TCL250	250	25
10TCL300	300	30
10TCL350	350	35
10TCL400	400	40
10TCL450	450	45
10TCL500	500	50

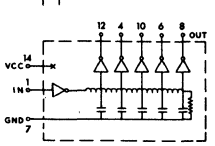
SERIES JSMTC –5 taps, surface mounting



5 TAPS







MODEL NOS.	DELAY (ns)	DELAY/TAP Tap (ns)
JSMTC25	25	5
JSMTC50	50	10
JSMTC75	75	15
JSMTC100	100	20
JSMTC125	125	25
JSMTC150	150	30
JSMTC200	200	40
JSMTC250	250	50

Intermediate Delay Values Available Upon Request.

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DELAY LINES

HIGH PERFORMANCE DIGITAL DELAY LINES—DELAY TOLERANCE CONTROLLED AT LEADING AND TRAILING EDGES

COMMON SPECIFICATIONS:

	14HT 14HTD	14HLT
Supply Voltage	5 ± 5%	5V ± 5%
Supply Current	70mA Max	25mA Max
Rise & Fall Time	4ns Max	6ns Max
Operating Temp.	0 to 70°C	0 to 70°C
Delay Tolerance	± 5% or 2ns*	± 5% or 3ns*
Min. Pulse Width: 20% of TD		
Max Duty Cycle: 50%		
Temp. Coeff. of Delay: 1.0ns + 500ppm/°C		
Operating Temperature: 0 to 70°C		

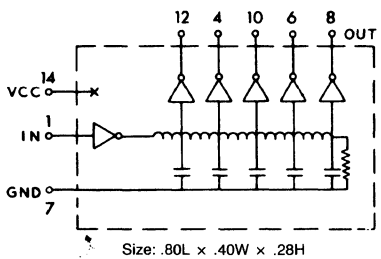
*Whichever is greater

ESC can supply the 14HT and 14HLT series with ceramic IC's that have been screened to MIL-STD-883 for −55°C to +125°C operation. Case size will be .82L x .40W x .36H. When ordering add suffix "C" (14HTC, 14HLTC.)

SERIES 14HT –high performance TTL compatible, 5 taps



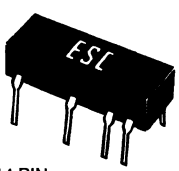
14 PIN



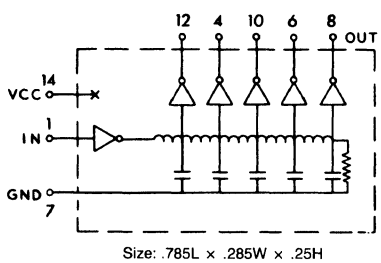
Size: .80L x .40W x .28H

MODEL NO.	DELAY (ns)	DELAY/ Tap (ns)
14HT25	25	5
14HT30	30	6
14HT35	35	7
14HT40	40	8
14HT45	45	9
14HT50	50	10
14HT75	75	15
14HT100	100	20
14HT150	150	30
14HT200	200	40
14HT250	250	50
14HT300	300	60
14HT500	500	100
14HT750	750	150
14HT1000	1000	200

SERIES 14HTD –low profile, DIP package, TTL compatible, 5 taps



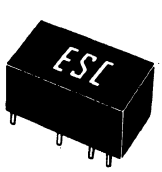
14 PIN



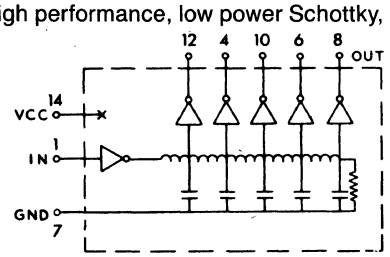
Size: .785L x .285W x .25H

MODEL NO.	DELAY (ns)	DELAY/ Tap (ns)
14HTD25	25	5
14HTD30	30	6
14HTD35	35	7
14HTD40	40	8
14HTD45	45	9
14HTD50	50	10
14HTD75	75	15
14HTD100	100	20
14HTD150	150	30
14HTD200	200	40
14HTD250	250	50
14HTD300	300	60
14HTD500	500	100
14HTD750	750	150
14HTD1000	1000	200

SERIES 14HLT –high performance, low power Schottky, 5 taps



14 PIN



Size: .80L x .40W x .28H

MODEL NO.	DELAY (ns)	DELAY/ Tap (ns)
14HLT50	50	10
14HLT75	75	15
14HLT100	100	20
14HLT150	150	30
14HLT200	200	40
14HLT250	250	50
14HLT300	300	60
14HLT500	500	100

Available as Machine Insertable SERIES 14HLTD

Intermediate Delay Values Available Upon Request.

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ESC

DELAY LINES

LOW PROFILE DIGITAL DELAY LINES FOR MILITARY APPLICATIONS

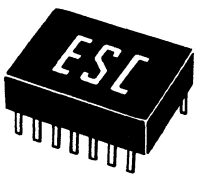
COMMON SPECIFICATIONS:

	9 Series	9L Series
Supply Voltage	5.0 VDC ± 5%	5.0 VDC ± 5%
Supply Current	70mA Max	25mA Max
Rise & Fall Time	4.0 ns Max	6ns Max
Operating Temp.	– 55°C to + 125°C	– 55°C to + 125°C
Size * *	.80L × .50W × .165H	
Delay Tolerance	± 5% or 2 ns whichever is greater	

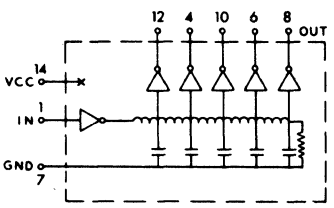
* * Height of 9P, 9LP is .200

These devices are supplied with ceramic IC's that have been screened to MIL-STD-883 for – 55°C to + 125°C operation.

SERIES 9T –TTL compatible, 5 taps



14 PIN



MODEL NO.	DELAY (ns)	DELAY/ TAP (ns)
9T25	25	5
9T30	30	6
9T35	35	7
9T40	40	8
9T45	45	9
9T50	50	10
9T75	75	15
9T100	100	20
9T150	150	30
9T200	200	40

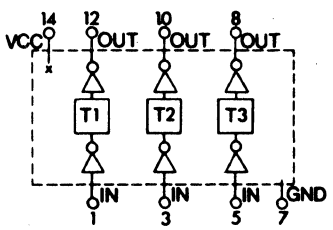
SERIES 9LT –low power schottky, 5 taps

MODEL NO.	DELAY (ns)	DELAY/ TAP (ns)
9TL50	50	10
9TL75	75	15
9TL100	100	20
9TL150	150	30
9TL200	200	40

SERIES 9P –TTL compatible triplets

MODEL NO.	DELAY * PER LINE (ns)
9P5	5
9P10	10
9P15	15
9P20	20
9P25	25
9P50	50

*Per Line



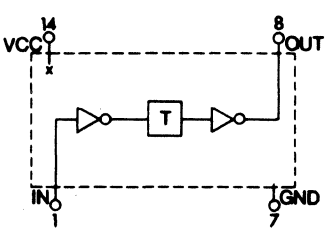
SERIES 9LP –low power schottky triplets

MODEL NO.	DELAY * PER LINE (ns)
9LP10	10
9LP15	15
9LP20	20
9LP25	25
9LP50	50

*Per Line

SERIES 9G –TTL compatible single output

MODEL NO.	DELAY PER LINE (ns)
9G5	5
9G10	10
9G20	20
9G25	25
9G50	50
9G100	100
9G200	200



SERIES 9LG –low power schottky single output

MODEL NO.	DELAY PER LINE (ns)
9LG10	10
9LG20	20
9LG25	25
9LG50	50
9LG100	100
9LG200	200

Intermediate Delay Values Available Upon Request.

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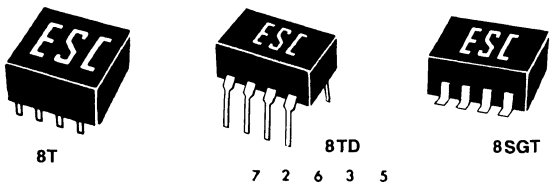
DELAY LINES

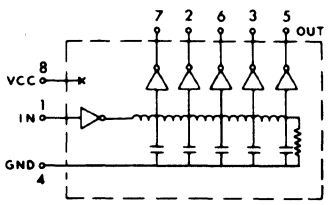
SERIES 8T/SERIES 8TD –digital, TTL compatible, 5 taps, 8 pin package, dual-in-line or auto insertable
SERIES 8SGT –surface mounting G leads

SPECIFICATIONS:

- Supply voltage: 5.0VDC ± 5%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise Time: 4ns Max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- Operating temp. range: 0°C to + 70°C
- Temp. Coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: Electro tinplated alloy 42 .020w × .010th

Note: 1–All packages can be supplied in the single-output type as Series 8G, 8GD or 8SGG or dual-output types as Series 8D,8DD or 8SGD.
*2–For – 55°C to 125°C operation specify Series 8TC.





8T Size: .50L × .40W × .25H
8TD Size: .50L × .28W × .25H
8SGT Size: .50L × .28W × .25H

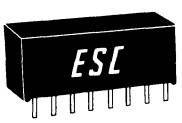
MODEL NOS.			DELAY	DELAY/
SERIES 8T	SERIES 8TD	SERIES 8SGT	(ns)	TAPS (ns)
8T25	8TD25	8SGT25	25	5
8T30	8TD30	8SGT30	30	6
8T40	8TD40	8SGT40	40	8
8T50	8TD50	8SGT50	50	10
8T75	8TD75	8SGT75	75	15
8T100	8TD100	8SGT100	100	20
8T200	8TD200	8SGT200	200	40
8T250	8TD250	8SGT250	250	50
8T300	8TD300	8SGT300	300	60
8T400	8TD400	8SGT400	400	80
8T500	8TD500	8SGT500	500	100

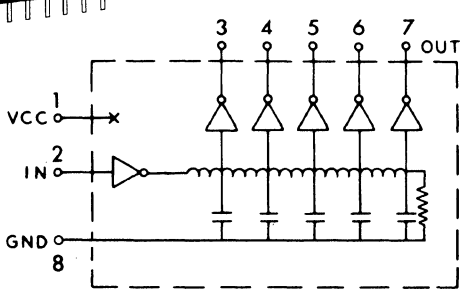
For variations in delay from above listing, modify part number by changing delay.
Example: 350ns, 8T Series becomes 8T350

SERIES 5T –digital TTL compatible, 5 taps

SPECIFICATIONS:

- Supply voltage: 5V ± 5%
- Logic 1 input current: 50µA max.
- Logic 0 input current: 2 mA max.
- Logic 1 voltage out: 2.4V min.
- Logic 0 voltage out: 0.5V max.
- Operating temperature: 0 to + 70°C
- Fan-out capabilities max: 10 TTL loads/tap, 20 TTL loads/unit
- Delay tolerances: ± 2 ns or ± 5% whichever is greater
- Rise Time: 4 ns max





Size: .81L × .18W × .34H

MODEL NO.	TD (ns)	TD/TAP (ns)
5T25	25	5
5T30	30	6
5T35	35	7
5T40	40	8
5T45	45	9
5T50	50	10
5T75	75	15
5T100	100	20
5T150	150	30
5T200	200	40
5T250	250	50
5T300	300	60
5T350	350	70
5T400	400	80

Also available as a single output Series 5G

Looking for LC Filters? See our pages in Section 2700.

Intermediate Delay Values Available Upon Request.

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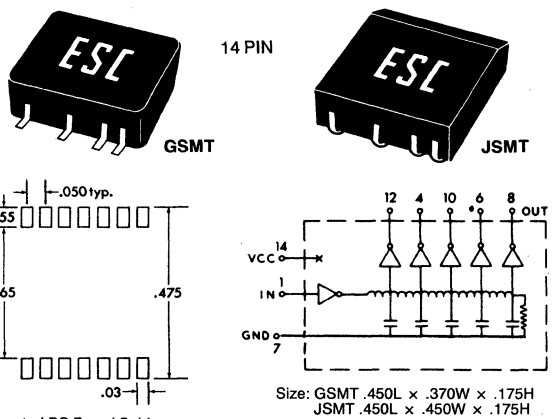
ESC

DELAY LINES

SERIES GSMT –surface mounting, TTL compatible, 5 taps, G leads
SERIES JSMT –surface mounting, TTL compatible, 5 taps, J leads

SPECIFICATIONS:

- Supply voltage (Vcc): 5.0VDC ± 5%
- Delay tolerance: ± 2 or ± 5% whichever is greater
- Rise Time: 4ns max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- Operating temp. range: 0 to + 70°C
- Temp. coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: .020w × .010th.



Size: GSMT .450L × .370W × .175H
JSMT .450L × .450W × .175H

Suggested PC Board Solder Pads

TEST CONDITIONS:

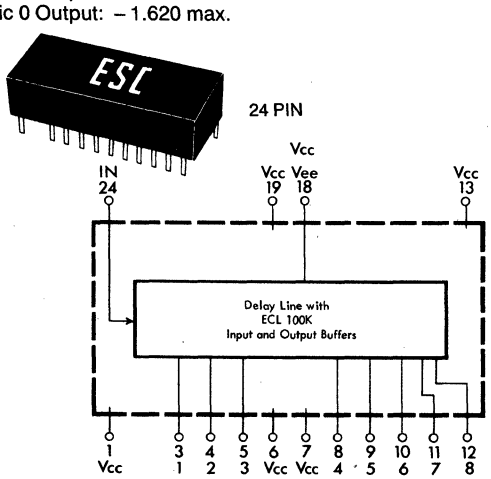
- Temperature: 25° ± 5°C, V_{cc} = 5.0VDC
- Input pulse width: 1.2 times the total delay time
- Pulse spacing: 5 times the total delay time
- Input rise time: 2ns; input pulse amplitude 3.0VDC
- All outputs loaded with 15pf
- Time delays measured at the 1.5 volts level on the leading edges
- Rise time measured from .75 to 2.4V

MODEL NOS.		TOTAL	DELAY/
G STYLE	J STYLE	DELAY (ns)	TAP (ns)
GSMT25	JSMT25	25	5
GSMT30	JSMT30	30	6
GSMT45	JSMT45	45	9
GSMT50	JSMT50	50	10
GSMT75	JSMT75	75	15
GSMT100	JSMT100	100	20
GSMT125	JSMT125	125	25
GSMT150	JSMT150	150	30
GSMT200	JSMT200	200	40
GSMT250	JSMT250	250	50

SERIES 24ECL –ECL "100K" compatible, 8 taps

SPECIFICATIONS:

- 100K ECL Input and Output
- Operating Temp.: 0°C to + 85°C
- Storage Temp: – 55°C to + 125°C
- Vee: – 4.5VDC ± 5%
- Logic 1 Output: – 1.025 min.
- Logic 0 Output: – 1.620 max.



Size: 1.3L × .50W × .375H

Intermediate Delay Values Available Upon Request.

TEST CONDITIONS:

- Pulse Width: 2 × total Td
- Pulse Spacing: 5 × total Td
- Pulse Amplitude: (– 1.475 max to – 1.165 min)
- Vee: – 4.5VDC
- Vcc: 0VDC
- Temperature: + 25°C

Outputs connected to external 50 ohms pulldown resistor to – 2.0V

Model No.	Total Delay (ns)	Delay/ Tap (ns)	Delay Tolerances*
24ECL8	10	**1	± .5ns or ± 5%
24ECL16	17	**2	± .5ns or ± 5%
24ECL24	24	3	± 1.0ns or ± 5%
24ECL32	32	4	± 1.5ns or ± 5%
24ECL40	40	5	
24ECL48	48	6	
24ECL56	56	7	
24ECL64	64	8	
24ECL72	72	9	
24ECL80	80	10	
24ECL160	160	20	
24ECL200	200	25	

*Whichever is greater
**First tap is 3.0 nsec.

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ESC

DELAY LINES

HIGH SPEED CMOS DIGITAL DELAY LINES

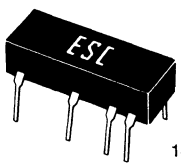
This series of digital hybrid delay lines are contained in a 14 Pin DIP package using High Speed CMOS series circuits.

SERIES 14CMOS – 5 tap, 14 pin package

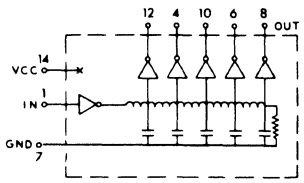
SPECIFICATIONS:

- Supply voltage: 5.0VDC ± 5%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise Time: 3ns max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- **Operating temp. range: 0°C to + 70°C
- Temp. coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: HTD alloy 42. 020w x .010th

**Also available for – 55°C to + 125°C operation. The dimensions will change to .82L × .40W × .36H.



14 PIN



Size: .785L × .285W × .250H

DC PARAMETERS		LIMITS	
		Min.	Max.
Voh	Vcc = min Ioh = 4.0mA	4.0V	—
Vol	Vcc = min Iol = 4.0mA	—	.3V
Vih	Vcc = min-max	2.0V	—
Vil	Vcc = min-max	—	.8V
IL	Vcc = max	—	+/– 1.0μA
Icc	Vcc = max outputs low	—	15mA
max load	Vcc = max Voh = 4.0V	10 LSTTL Loads	

TEST CONDITIONS:

- V_{cc} = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- All outputs loaded with 15pf
- Input Test Pulse: Pulse voltage: 3.0V
  Pulse rise time: 2 ns
  Pulse width 1.2 × max Td
  Pulse spacing: 5 × max Td

MODEL NO.	DELAY (ns)	DELAY/ TAP (ns)
14CMTD32	32	*5
14CMTD36	36	*6
14CMTD40	40	*7
14CMTD44	44	*8
14CMTD48	48	*9
14CMTD52	52	*10
14CMTD60	60	12
14CMTD75	75	15
14CMTD100	100	20
14CMTD125	125	25
14CMTD150	150	30
14CMTD175	175	35
14CMTD200	200	40
14CMTD250	250	50
14CMTD300	300	60
14CMTD350	350	70
14CMTD400	400	80
14CMTD420	420	84
14CMTD440	440	88
14CMTD450	450	90
14CMTD500	500	100

*Residual Delay first tap-12ns.

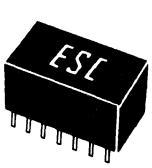
FAST TTL LOGIC DELAY LINES

SERIES 14FT – fast, TTL compatible, 14 pin package, 5 taps

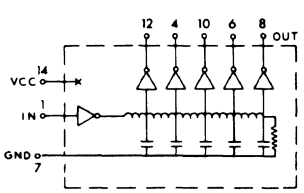
For variations in delay from above listing, modify part number by changing delay. Example: 400ns, 14FT series becomes 14FT400.

SPECIFICATIONS:

- Supply voltage: 5.0VDC ± 5%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise Time: 3ns max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- Operating temp. range: 0°C to + 70°C
- Temp. coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: Electro tin plated alloy 42 .020w × .010th



14 PIN



Size: .80L × .40W × .28H

Intermediate Delay Values Available Upon Request.

TEST CONDITIONS:

- V_{cc} = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- All outputs loaded with 15pf
- Input Test Pulse: Pulse voltage: 3.0V
  Pulse rise time: 2 ns
  Pulse width 1.2 × max Td
  Pulse spacing: 5 × max Td

MODEL NO.	DELAY (ns)	DELAY/ TAP (ns)
14FT25	25	5
14FT30	30	6
14FT35	35	7
14FT40	40	8
14FT45	45	9
14FT50	50	10
14FT75	75	15
14FT100	100	20
14FT150	150	30
14FT200	200	40
14FT250	250	50
14FT300	300	60
14FT500	500	100

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ESC

DELAY LINES

ECL "10,000" DIGITAL DELAY LINES — 16 PIN DIL



SPECIFICATIONS:

- Cumulative delay tolerances: ±1ns or ±5% whichever is greater
- Log 1 (output): −.96V
- Logic 0 (output): −1.65V max
- Logic 1 (input): −.98V min
- Logic 0 (input): −1.63V max
- Output rise time: 3ns max
- Supply voltage: −5.2V ±5%
- Supply current: EC series: 65mA max, EG series: 70mA, ED series: 100mA, EP series:140mA
- *Operating temperature: 0°C to +70°C
- Delay temp. coefficient: 1.0ns +500ppm/°C
- Terminals: Electro tin plated alloy 42 .020w × .010th

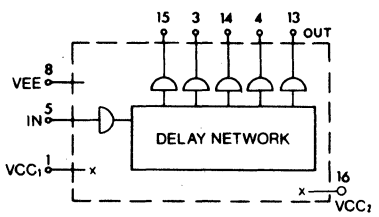
*Available for −55°C to +125°C operation with dimensions increased to .360 high × .820 long. Specify 16ECC, 16EPC, 16EDC, or 16EPC when ordering.

TEST CONDITIONS:

- Temp. = 25°C Vee = −5.2VDC Vcc = GND
- **Input Amplitude: 1.0V (−.75V to −1.75V)
- Pulse Width: 3 × max Td
- Pulse Spacing: 5 × max Td
- Time delays measured at the −1.3V level
- Output terminals connected through an external pulldown resistor of 100Ω to −2VDC

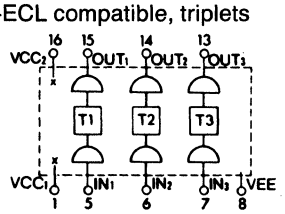
**Input pulse is provided by standard open emitter ECL 10,000 gate.

SERIES 16EC –ECL compatible, 5 taps



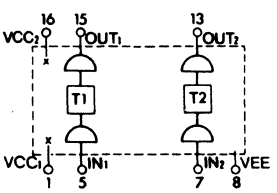
MODEL NO.	DELAY (ns)	DELAY/TAP (ns)
16EC10	10	2
16EC15	15	3
16EC20	20	4
16EC25	25	5
16EC30	30	6
16EC40	40	8
16EC50	50	10
16EC60	60	12
16EC80	80	16
16EC100	100	20

SERIES 16EP –ECL compatible, triplets



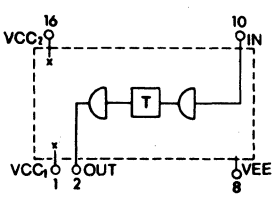
MODEL NO.	DELAY PER LINE (ns)
16EP5	5
16EP10	10
16EP15	15
16EP20	20
16EP25	25
16EP50	50

SERIES 16ED –ECL compatible, dual



MODEL NO.	DELAY PER LINE (ns)
16ED5	5
16ED10	10
16ED15	15
16ED20	20
16ED25	25
16ED50	50
16ED60	60
16ED80	80
16ED100	100

SERIES 16EG –ECL compatible, single output



MODEL NO.	DELAY (ns)
16EG5	5
16EG10	10
16EG15	15
16EG20	20
16EG25	25
16EG50	50
16EG75	75
16EG100	100

Intermediate Delay Values Available Upon Request.

ESC ELECTRONICS CORP. ● 534 BERGEN BOULEVARD ● PALISADES PARK ● TOLL FREE 1-800-631-0853 (EXCEPT N.J.)
NEW JERSEY 07650 ● (201) 947-0400 ● TWX: 710-991-9780 ● FAX: 201-947-0406

ESC

DELAY LINES

SERIES PTT3/SERIES PTT4/SERIES PTT6 –TTL compatible programmable delay lines

This series of programmable hybrid delay lines utilize TTL Schottky circuits. The PTT's are offered in 3, 4 & 6 Bit Series.

SPECIFICATIONS:

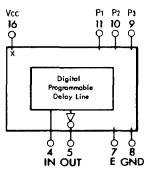
- Logic 1 (output): 2.4 min
- Logic 0 (output): .50 VDC max
- Operating Temp. Range: 0°C to + 70°C*
- Storage Temp. Range: – 55°C to + 125°C

*For – 55°C to + 125°C operation – Contact Plant

TEST CONDITIONS:

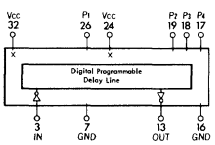
- Vcc = 5 VDC Temp. = 25°C
- Input Pulse Width: 3 × max Td
- Input Rise Time: 2ns max
- Input Pulse Spacing: 5 × max Td
- Td measured at 1.5 V level
- Output loaded with 15pf

3 BIT



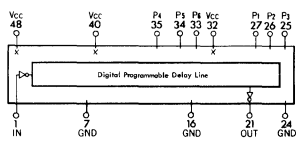
Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT3-1	7±2	14	1±.5
PTT3-2		21	2±.5
PTT3-3		28	3±.6
PTT3-4		35	4±.8
PTT3-5		42	5±1
PTT3-6		49	6±1
PTT3-7		56	7±1
PTT3-8		63	8±1
PTT3-9		70	9±1
PTT3-10		77	10±1

4 BIT



Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT4-1	15±2	30	1±.5
PTT4-2		45	2±.5
PTT4-3		60	3±.6
PTT4-4		75	4±.8
PTT4-5		90	5±1
PTT4-6		105	6±1
PTT4-7		120	7±1
PTT4-8		135	8±1
PTT4-9		150	9±1
PTT4-10		165	10±1

6 BIT



Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT6-1	20±2	83	1±.5
PTT6-2		146	2±.5
PTT6-3		209	3±.6
PTT6-4		272	4±.8
PTT6-5		335	5±1

SERIES PEC3/SERIES PEC4/SERIES PEC6 –ECL compatible programmable delay lines

This series of programmable hybrid delay lines utilize ECL 10,000 Series IC's. The PEC's are offered in 3, 4 & 6 Bit Series.

SPECIFICATIONS:

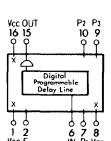
- Logic 1 (output): – .96 V min
- Logic 0 (output): – 1.65 V max
- Operating Temp. Range: – 0°C to + 70°C
- Storage Temp. Range: – 55°C to + 125°C

Also available for – 55°C to + 125°C operation as Series PECC3, PECC4 and PECC6.

TEST CONDITIONS:

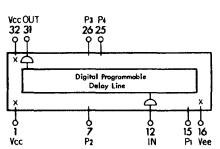
- Input Pulse Width: 3 × max delay time
- Input Pulse Spacing: 5 × delay time
- Input Rise Time: 2 ns max
- Input Pulse Voltage: 1.0 V (– .75 V to – 1.75 V)
- Vee: – 5.2 VDC
- Output connected to – 2 VDC through 100 ohms.
- Time delays measured at – 1.3 Volt Level.

3 BIT



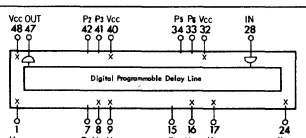
Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC3-1	3±2	10	1±.5
PEC3-2		17	2±.5
PEC3-3		24	3±.6
PEC3-4		31	4±.8
PEC3-5		38	5±1

4 BIT



Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC4-1	10±2	25	1±.5
PEC4-2		40	2±.5
PEC4-3		55	3±.6
PEC4-4		70	4±.8
PEC4-5		85	5±1

6 BIT



Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC6-1	20±2	71	1±.5
PEC6-2		134	2±.5
PEC6-3		197	3±.6
PEC6-4		260	4±.8
PEC6-5		323	5±1

Intermediate delay values available upon request.

ESC ELECTRONICS CORP. ● 534 BERGEN BOULEVARD ● PALISADES PARK ● TOLL FREE 1-800-631-0853 (EXCEPT N.J.)
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jbm

See the next 6 pages for a representative listing of JBM's broad selection of types and ratings.

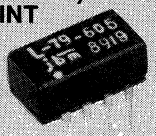
DELAY LINE HEADQUARTERS

JBM produces one of the industry's broadest lines of active (digital) and passive magnetic delay lines for use in computers, communications equipment, military instrumentation, etc.

In addition to hundreds of standard models, we offer extensive capabilities for the design and production of custom units for special applications.

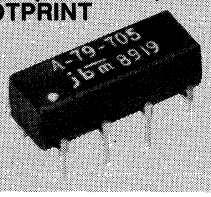
3 INDEPENDENT DELAY LINES

STYLE L-79-6XX
8 PIN (5 to 50ns)
FOOTPRINT



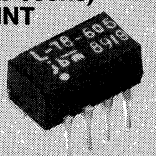
8 PIN PART NUMBER	14 PIN PART NUMBER	(ns) TOTAL DELAY
L-79-605	A-79-705	5.0 ± 1
L-79-606	A-79-706	6.0 ± 1
L-79-607	A-79-707	7.0 ± 1.5
L-79-608	A-79-708	8.0 ± 1.5
L-79-609	A-79-709	9.0 ± 2
L-79-610	A-79-710	10.0 ± 2
L-79-615	A-79-715	15.0 ± 2
L-79-620	A-79-720	20.0 ± 2
L-79-625	A-79-725	25.0 ± 2.5
L-79-630	A-79-730	30.0 ± 3
L-79-640	A-79-740	40.0 ± 3
L-79-650	A-79-750	50.0 ± 3

STYLE A-79-7XX
14 PIN (5 to 100ns)
FOOTPRINT



SINGLE OUTPUT

STYLE L-78-6XX
8 PIN (5 to 500ns)
FOOTPRINT



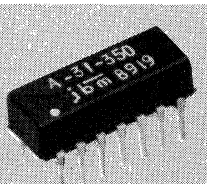
STYLE A-78-7XX
14 PIN (5 to 500ns)
FOOTPRINT



8 PIN PART NUMBER	14 PIN PART NUMBER	TOTAL (ns) DELAY TIME
L-78-605	A-78-705	5.0 ± 1ns
L-78-610	A-78-710	10.0 ± 2ns
L-78-615	A-78-715	15.0 ± 2ns
L-78-620	A-78-720	20.0 ± 2ns
L-78-625	A-78-725	25.0 ± 2ns
L-78-630	A-78-730	30.0 ± 2ns
L-78-640	A-78-740	40.0 ± 2ns
L-78-650	A-78-750	50.0 ± 2.5ns
L-78-652	A-78-752	60.0 ± 3ns
L-78-656	A-78-756	75.0 ± 4ns
L-78-659	A-78-759	100.0 ± 5ns
L-78-661	A-78-761	150.0 ± 7.5ns
L-78-663	A-78-763	200.0 ± 10ns
L-78-665	A-78-765	250.0 ± 12.5ns
L-78-666	A-78-766	300.0 ± 15ns
L-78-668	A-78-768	400.0 ± 20ns
L-78-670	A-78-770	500.0 ± 25ns

AUTOINSERTABLE

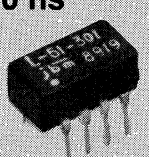
A-31-3XX
10 TAP ACTIVE DELAY LINE
DELAY RANGE 50 ns to 250 ns
14 PIN DIP



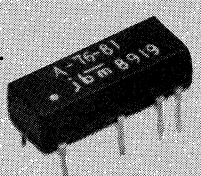
JBM PART NUMBER	TOTAL DELAY TIME	10 TAP DELAY TIME
A-31-350	50 ± 5%	5.0 ± 2ns
A-31-351	75 ± 5%	7.5 ± 2.5ns
A-31-352	100 ± 5%	10.0 ± 3ns
A-31-353	125 ± 5%	12.5 ± 3ns
A-31-354	150 ± 5%	15.0 ± 3ns
A-31-355	175 ± 5%	17.5 ± 3ns
A-31-356	200 ± 5%	20.0 ± 3ns
A-31-357	250 ± 5%	25.0 ± 3ns

5 TAP ACTIVE

25 ns to 500 ns
L-51-3XX
8 PIN
FOOTPRINT



A-76-XX
14 PIN
FOOTPRINT



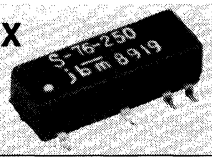
8 PIN PART NUMBER	DELAY TIME IN NANOSECONDS (ns) TAP 1	TAP 2	TAP 3	TAP 4	TAP 5	14 PIN – P/N
L-51-301	5 ± 2ns	10 ± 2ns	15 ± 2ns	20 ± 2ns	25 ± 2ns	A-76-81
L-51-302	6 ± 2ns	12 ± 2ns	18 ± 2ns	24 ± 2ns	30 ± 2ns	A-76-82
L-51-303	7 ± 2ns	14 ± 2ns	21 ± 2ns	28 ± 2ns	35 ± 2ns	A-76-83
L-51-304	8 ± 2ns	16 ± 2ns	24 ± 2ns	32 ± 2ns	40 ± 2ns	A-76-84
L-51-305	9 ± 2ns	18 ± 2ns	27 ± 2ns	36 ± 2ns	45 ± 2ns	A-76-85
L-51-306	10 ± 2ns	20 ± 2.5ns	30 ± 2.5ns	40 ± 2.5ns	50 ± 2.5ns	A-76-86
L-51-307	12 ± 2.5ns	24 ± 2.5ns	36 ± 2.5ns	48 ± 2.5ns	60 ± 3ns	A-76-87
L-51-308	15 ± 2.5ns	30 ± 2.5ns	45 ± 2.5ns	60 ± 3ns	75 ± 3.5ns	A-76-88
L-51-309	20 ± 2.5ns	40 ± 2.5ns	60 ± 3ns	80 ± 4ns	100 ± 5ns	A-76-89
L-51-310	25 ± 3.0ns	50 ± 3ns	75 ± 3.5ns	100 ± 5ns	125 ± 6ns	A-76-90
L-51-311	30 ± 3ns	60 ± 3ns	90 ± 4ns	120 ± 6ns	150 ± 7ns	A-76-91
L-51-312	40 ± 3ns	80 ± 4ns	120 ± 6ns	160 ± 8ns	200 ± 10ns	A-76-92
L-51-313	50 ± 3ns	100 ± 5ns	150 ± 7ns	200 ± 10ns	250 ± 12ns	A-76-93
L-51-314	60 ± 4ns	120 ± 6ns	180 ± 9ns	240 ± 12ns	300 ± 15ns	A-76-94
L-51-315	70 ± 4ns	140 ± 7ns	210 ± 10ns	260 ± 14ns	350 ± 17ns	A-76-95
L-51-316	80 ± 4ns	160 ± 8ns	240 ± 12ns	320 ± 16ns	400 ± 20ns	A-76-96
L-51-317	90 ± 5ns	180 ± 9ns	270 ± 13ns	360 ± 18ns	450 ± 22ns	A-76-97
L-51-318	100 ± 5ns	200 ± 10ns	300 ± 15ns	400 ± 20ns	500 ± 25ns	A-76-98

JBM Electronics, Inc. • 1 Commerce Drive • Bedford, NH 03110
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Active & Passive Delay Lines

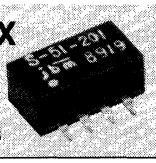
SURFACE MOUNT

STYLE S-76-2XX
5 TAP
SURFACE MOUNT



DELAY TIME IN NANOSECONDS (ns)					
TAP 1	TAP 2	TAP 3	TAP 4	TAP 5	JBM P/N
5±2	10±2	15±2	20±2	25±2	S-76-250
6±2	12±2	18±2	24±2	30±2	S-76-251
7±2	14±2	21±2	28±2	35±2	S-76-252
8±2	16±2	24±2	32±2	40±2	S-76-253
9±2	18±2	27±2	36±2	45±2	S-76-254
10±2	20±2	30±2	40±2	50±2.5	S-76-255
12±2	24±2	36±2	48±2.5	60±3	S-76-256
15±2	30±2	45±2	60±3	75±3.5	S-76-257
20±2	40±2	60±3	80±4	100±5	S-76-258
25±2.5	50±2.5	75±3.5	100±5	125±6	S-76-259
30±3	60±3	90±4	120±6	150±7	S-76-260
40±3	80±4	120±6	160±8	200±10	S-76-261
50±3	100±5	150±7	200±10	250±12	S-76-262
60±4	120±6	180±9	240±12	300±15	S-76-263
70±4	140±7	210±10	280±14	350±17	S-76-264
80±4	160±8	240±12	320±16	400±20	S-76-265
90±5	180±9	270±13	360±18	450±22	S-76-266
100±5	200±10	300±15	400±20	500±25	S-76-267

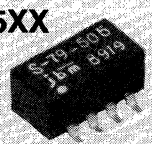
STYLE S-51-2XX
(8 pins)
Delay Range
25 thru 500 nsec
5 equally-spaced taps



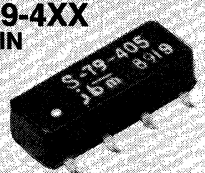
DELAY TIME IN NANOSECONDS (ns)					
JBM Part Number	TAP 1	TAP 2	TAP 3	TAP 4	TAP 5
S-51-201	5±2	10±2	15±2	20±2	25±2
S-51-202	6±2	12±2	18±2	24±2	30±2
S-51-203	7±2	14±2	21±2	28±2	35±2
S-51-204	8±2	16±2	24±2	32±2	40±2
S-51-205	9±2	18±2	27±2	36±2	45±2
S-51-206	10±2	20±2	30±2	40±2	50±2.5
S-51-207	12±2	24±2	36±2	48±2.5	60±3
S-51-208	15±2	30±2	45±2	60±3	75±3.5
S-51-209	20±2	40±2	60±3	80±4	100±5
S-51-210	25±2.5	50±2.5	75±3.5	100±5	125±6
S-51-211	30±3	60±3	90±4	120±6	150±7
S-51-212	40±3	80±4	120±6	160±8	200±10
S-51-213	50±3	100±5	150±7	200±10	250±12
S-51-214	60±4	120±6	180±9	240±12	300±15
S-51-215	70±4	140±7	210±10	280±14	350±17
S-51-216	80±4	160±8	240±12	320±16	400±20
S-51-217	90±5	180±9	270±13	360±18	450±22
S-51-218	100±5	200±10	300±15	400±20	500±25

STYLE S-79
Multi-Buffered
3 INDEPENDENT DELAY LINES

S-79-5XX
8 PIN

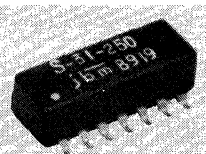


S-79-4XX
14 PIN



DELAY SPECIFICATIONS (all times in nanoseconds)		
8 PIN PART NUMBER	14 PIN PART NUMBER	(ns) TOTAL DELAY
S-79-505	S-79-405	5.0±1
S-79-506	S-79-406	6.0±1
S-79-507	S-79-407	7.0±1.5
S-79-508	S-79-408	8.0±1.5
S-79-509	S-79-409	9.0±2
S-79-510	S-79-410	10.0±2
S-79-515	S-79-415	15.0±2
S-79-520	S-79-420	20.0±2
S-79-525	S-79-425	25.0±2.5
S-79-530	S-79-430	30.0±3.0
S-79-540	S-79-440	40.0±3.0
S-79-550	S-79-450	50.0±3

STYLE S-31-2XX
(14 pin)
Delay Range
50 thru 250 nsec
10 equally-spaced taps
TTL AND DTL Compatible



JBM PART NUMBER	TOTAL DELAY (ns±5%)	TAP INTERVAL (nsec)	RISE TIME (ns MAX) (.8 to 2.0V)
S-31-250	50ns±5%	5.0±2ns	2.0
S-31-251	75ns±5%	7.5±2.5ns	2.0
S-31-252	100ns±5%	10±3ns	2.0
S-31-253	125ns±5%	12.5±3ns	2.5
S-31-254	150ns±5%	15.0±3ns	2.5
S-31-255	175ns±5%	17.5±3ns	3.0
S-31-256	200ns±5%	20±3ns	3.0
S-31-257	250ns±5%	25±3ns	3.0

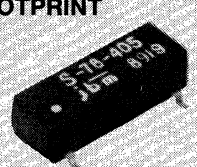
*or ±5%, whichever is greater.

STYLE S-78-5XX
8 PIN
Delay Range
5 ns to 500 ns



SINGLE OUTPUT

STYLE S-78-4XX
14 PIN
FOOTPRINT



SINGLE OUT PUT DELAY LINES		
8 PIN PART NUMBER	14 PIN PART NUMBER	TOTAL (ns) DELAY TIME
S-78-505	S-78-405	5.0±1ns
S-78-510	S-78-410	10.0±2ns
S-78-515	S-78-415	15.0±2ns
S-78-520	S-78-420	20.0±2ns
S-78-525	S-78-425	25.0±2ns
S-78-530	S-78-430	30.0±2ns
S-78-540	S-78-440	40.0±2ns
S-78-550	S-78-450	50 ±2.5ns
S-78-552	S-78-452	60 ±3ns
S-78-556	S-78-456	75 ±4ns
S-78-559	S-78-459	100 ±5ns
S-78-561	S-78-461	150 ±7.5ns
S-78-563	S-78-463	200 ±10ns
S-78-565	S-78-465	250 ±12.5ns
S-78-566	S-78-466	300 ±15ns
S-78-568	S-78-468	400 ±20ns
S-78-570	S-78-470	500 ±25ns

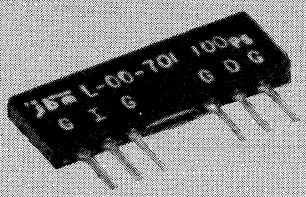
JBM Electronics, Inc. • 1 Commerce Drive • Bedford, NH 03110
603-623-0222 • Fax: 603-623-0446

jbm Active & Passive Delay Lines

NEW...

PICOLINE

L-00-7XX



L#	DELAY	TOLERANCE
L-00-701	100ps	± 50ps
L-00-702	200ps	± 50ps
L-00-703	300ps	± 50ps
L-00-704	400ps	± 50ps
L-00-705	500ps	± 50ps
L-00-706	600ps	± 50ps
L-00-707	700ps	± 50ps
L-00-708	800ps	± 50ps
L-00-709	900ps	± 50ps

STYLE L-21

(14-pin DIP)

10 equally-spaced taps
Td/Tr = 5:1 (typ.)



STYLE L-22

(16-pin DIP)

10 equally-spaced taps
Td/Tr = 5:1 (typ.)



TOTAL DELAY (nsec)	TAP INTERVALS (nsec)	RISE TIME @ OUT (nsec) MAX	JBM PART NUMBER L-21/22—XXX NOMINAL TERMINATING IMPEDANCE (±10%) 50Ω	75Ω	100Ω	200Ω	500Ω
5.0 ± 1ns	0.50 ± .35ns	2.5	250	260	270	—	—
7.5	0.75	3.0	251	261	271	—	—
10.0	1.00	3.5	252	262	272	282	—
12.5	1.25	4.0	253	263	273	283	—
15.0	1.50	4.5	254	264	274	284	—
17.5	1.75 ± .35ns	5.0	255	265	275	285	—
20.0 ± 1ns	2.0 ± 20%	5.5	256	266	276	286	—
25.0 ± 5%	2.5	6.0	257	267	277	287	—
30.0	3.0	6.5	258	268	278	288	—
35.0	3.5	7.0	259	269	279	289	—
40.0	4.0	8.0	10	—	280	290	—
45.0	4.5 ± 20%	9.0	—	—	281	281	—
50.0	5.0 ± 1ns	10.0	11	—	21	31	41
60.0	6.0	12.0	12	—	22	32	42
70.0	7.0	14.0	13	—	23	33	43
80.0	8.0	16.0	14	—	24	34	44
90.0	9.0	18.0	15	—	25	35	45
100.0	10.0 ± 1ns	20.0	16	—	26	36	46
125.0	12.5 ± 10%	25.0	17	—	27	37	47
150.0	15.0	30.0	18	—	28	38	48
175.0	17.5	35.0	19	—	—	—	—
200.0	20.0	40.0	20	—	29	39	49
300.0	30.0	60.0	—	—	30	40	50
350.0	35.0	70.0	650	654	661	671	—
400.0	40.0	80.0	651	655	662	672	—
450.0	45.0	90.0	652	656	663	673	—
500.0	50.0	100.0	653	657	664	674	—
600.0	60.0	120.0	—	658	665	675	—
700.0	70.0	140.0	—	659	666	676	
750.0	75.0	150.0	—	660	667	677	—
800.0	80.0	160.0	—	—	668	—	—
900.0	90.0	180.0	—	—	669	—	—
1000 ± 5%	100.0 ± 10%	200.0	—	—	670	—	—

STYLE L-23

(24-pin DIP)

20 equally-spaced taps
Td/Tr = 10:1 (typ.)

STYLE L-33

(14-pin DIP)

10 equally-spaced taps
Td/Tr = 10:1 (typ.)

STYLE L-34

(16-pin DIP)

10 equally-spaced taps
Td/Tr = 10:1 (typ.)



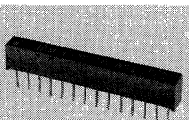
Compatible with Various Logic Systems Including TTL and Video Circuits.

TOTAL DELAY nsec ± 5%	TAP INTERVALS* (nsec) L-23	L-33/34	RISE TIME @ OUT (nsec) MAX	JBM PART NUMBER L-23-XX / L-33/34-XX 50Ω L-23	L-33/34	75Ω L-23	L-33/34	100Ω L-23	L-33/34	200Ω L-23	L-33/34	350Ω L-23	L-33/34
50	—	5.0	5.0	—	L-33/34-00	—	L-33/34-15	—	L-33/34-32	—	—	—	—
75	—	7.5	7.5	—	L-33/34-01	—	L-33/34-16	—	L-33/34-33	—	—	—	—
100	5.0	10.0	10.0	—	L-33/34-02	L-23-10	L-33/34-17	L-23-14	L-33/34-34	—	L-33/34-51	—	—
125	—	12.5	12.5	—	L-33/34-03	—	L-33/34-18	—	L-33/34-35	—	L-33/34-52	—	—
150	7.5	15.0	15.0	—	L-33/34-04	L-23-11	L-33/34-19	L-23-15	L-33/34-36	—	L-33/34-53	—	—
175	—	17.5	17.5	—	L-33/34-05	—	L-33/34-20	—	L-33/34-37	—	L-33/34-54	—	—
200	10.0	20.0	20.0	—	L-33/34-06	L-23-12	L-33/34-21	L-23-16	L-33/34-38	L-23-20	L-33/34-55	—	—
225	—	22.5	22.5	—	L-33/34-07	—	L-33/34-22	—	L-33/34-39	—	L-33/34-56	—	—
250	12.5	25.0	25.0	—	L-33/34-08	L-23-13	L-33/34-23	L-23-17	L-33/34-40	L-23-21	L-33/34-57	—	—
300	15.0	30.0	30.0	—	L-33/34-09	—	L-33/34-24	L-23-18	L-33/34-41	L-23-22	L-33/34-58	—	—
350	17.5	35.0	35.0	—	L-33/34-10	—	L-33/34-25	L-23-19	L-33/34-42	L-23-23	L-33/34-59	L-23-28	—
400	20.0	40.0	40.0	—	L-33/34-11	—	L-33/34-26	—	L-33/34-43	L-23-24	L-33/34-60	L-23-29	—
450	22.5	45.0	45.0	—	—	—	—	—	—	—	—	L-23-30	—
500	25.0	50.0	50.0	—	L-33/34-12	—	L-33/34-27	—	L-33/34-44	L-23-25	L-33/34-61	L-23-31	—
600	30.0	—	60.0	—	—	—	—	—	—	L-23-26	—	L-23-32	—
700	35.0	—	70.0	—	—	—	—	—	—	L-23-27	—	L-23-33	—
750	—	75.0	75.0	—	L-33/34-13	—	L-33/34-28	—	L-33/34-45	—	L-33/34-62	—	—
800	40.0	—	80.0	—	—	—	—	—	—	—	—	L-23-34	—
900	45.0	—	90.0	—	—	—	—	—	—	—	—	L-23-35	—
1000	50.0	100.0	100.0	—	L-33/34-14	—	L-33/34-29	—	L-33/34-46	—	L-33/34-63	L-23-36	—
1100	55.0	—	110.0	—	—	—	—	—	—	—	—	L-23-37	—
1200	60.0	—	120.0	—	—	—	—	—	—	—	—	L-23-38	—
1250	—	—	125.0	—	—	—	L-33/34-30	—	L-33/34-47	—	L-33/34-64	—	—
1500	—	—	150.0	—	—	—	L-33/34-31	—	L-33/34-48	—	L-33/34-65	—	—
1750	—	—	175.0	—	—	—	—	—	L-33/34-49	—	—	—	—
2000	—	—	200.0	—	—	—	—	—	L-33/34-50	—	—	—	—

* ± 10% or ± 1 ns, whichever is greater.
Consult factory for other parameters, tolerances and pin outs.

STYLE L-26 (14-pin SIP)

10 equally-spaced taps
Td/Tr = 5:1 (typ.)



TOTAL DELAY (nsec)	TAP INTERVALS (nsec)	RISE TIME @ OUT (nsec) MAX	JBM PART NUMBER L-26-XX NOMINAL TERMINATING IMPEDANCE (±10%) 50Ω	75Ω	100Ω	200Ω
5.0 ± 1ns	0.50 ± .35ns	2.5	L-26-50	L-26-80	L-26-110	L-26-150
7.5	0.75	3.0	L-26-51	L-26-81	L-26-111	L-26-151
10.0	1.00	2.5	L-26-52	L-26-82	L-26-112	L-26-152
12.5	1.25	4.0	L-26-53	L-26-83	L-26-113	L-26-153
15.0	1.50	4.5	L-26-54	L-26-84	L-26-114	L-26-154
17.5	1.75 ± .35ns	5.0	L-26-55	L-26-85	L-26-115	L-26-155
20.0 ± 1ns	2.0 ± 20%	5.5	L-26-56	L-26-86	L-26-116	L-26-156
25.0 ± 5%	2.5	6.0	L-26-57	L-26-87	L-26-117	L-26-157
30.0	3.0	6.5	L-26-58	L-26-88	L-26-118	L-26-158
35.0	3.5	7.0	L-26-59	L-26-89	L-26-119	L-26-159
40.0	4.0	8.0	L-26-60	L-26-90	L-26-120	L-26-160
45.0	4.5	9.0	L-26-61	L-26-91	L-26-121	L-26-161
50.0	5.0 ± 20%	10.0	L-26-62	L-26-92	L-26-122	L-26-162
60.0	6.0 ± 1ns	12.0	L-26-63	L-26-93	L-26-123	L-26-163
70.0	7.0	14.0	L-26-64	L-26-94	L-26-124	L-26-164
80.0	8.0	16.0	L-26-65	L-26-95	L-26-125	L-26-165
90.0	9.0	18.0	L-26-66	L-26-96	L-26-126	L-26-166
100.0	10.0 ± 1ns	20.0	L-26-67	L-26-97	L-26-127	L-26-167
125.0	12.5 ± 10%	25.0	L-26-68	L-26-98	L-26-128	L-26-168
150.0	15.0	30.0	L-26-69	L-26-99	L-26-129	L-26-169
175.0	17.5	35.0	L-26-70	L-26-100	L-26-130	L-26-170
200.0	20.0	40.0	L-26-71	L-26-101	L-26-131	L-26-171
300.0	30.0	60.0	L-26-72	L-26-102	L-26-132	L-26-172
350.0	35.0	70.0	L-26-73	L-26-103	L-26-133	L-26-173
400.0	40.0	80.0	L-26-74	L-26-104	L-26-134	L-26-174
450.0 ± 5%	45.0 ± 10%	90.0	L-26-75	L-26-105	L-26-135	L-26-175

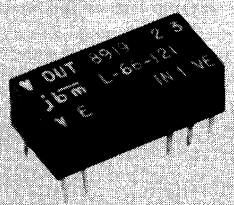
Consult factory for other parameters, tolerances and pin outs.

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Active & Passive Delay Lines

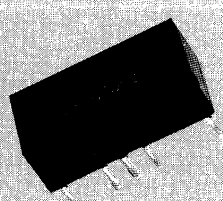
10K/100K ECL PRODUCT

L-66-100 SERIES
10K ECL 3 Bit Programmables



DELAY SPECIFICATIONS IN (ns) NANOSECONDS												
Program Pins / Part Numbers	0 3 0 2 0 1 0	1 0 0 1	2 0 1 0	3 0 1 1	4 1 0 0	5 1 0 1	6 1 1 0	7 1 1 1	Tot. of Prog. Delay	Delay Time Per Step	Delay Time Step Tot.	Maximum Delay Nominal Ref. IN
L-66-121	3±1ns	1	2	3	4	5	6	7	±1ns	1ns	±.3ns	10ns
L-66-122	3±1ns	2	4	6	8	10	12	14	±1ns	2ns	±.4ns	17ns
L-66-123	3±1ns	3	6	9	12	15	18	21	±1ns	3ns	±.5ns	24ns
L-66-124	3±1ns	4	8	12	16	20	24	28	±1.5ns	4ns	±.5ns	31ns
L-66-125	3±1ns	5	10	15	20	25	30	35	±1.7ns	5ns	±.5ns	38ns
L-66-126	3±1ns	6	12	18	24	30	36	42	±2ns	6ns	±.6ns	45ns
L-66-127	3±1ns	7	14	21	28	35	42	49	±2.4ns	7ns	±.7ns	52ns
L-66-128	3±1ns	8	16	24	32	40	48	56	±2.6ns	8ns	±.8ns	59ns
L-66-129	3±1ns	9	18	27	36	45	54	63	±3.1ns	9ns	±.9ns	66ns
L-66-130	3±1ns	10	20	30	40	50	60	70	±3.5ns	10ns	±1ns	73ns
L-66-131	3±1ns	12	24	36	48	60	72	84	±4.2ns	12ns	±1.2ns	87ns

Active STYLE L-82-XX
(16-pin DIP)
5-Tap ECL
Delay Range
2 thru 500ns



Delay Characteristics

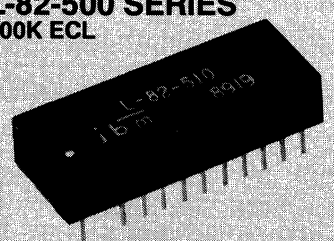
Input Characteristics:
- V_{IH} Logic "1" Input Voltage.....-.98V min.
- V_{IL} Logic "0" Input Voltage .....-1.63V max.
- I_{IH} Logic "1" Input Current.....265µA max.
- I_{IH} Logic "0" Input Current.....-.5µA max.

Output Characteristics:
- V_{OH} Logic "1" Output Voltage.....-.96V min.
- V_{OH} Logic "0" Output Voltage ...-1.65V max.

Environmental:
- Operating Temp.....-30°C to + 85°C
- Storage Temp.....-55°C to +125°C
- Operating Supply Voltage.....-4.94 to-5.46V

DELAY SPECIFICATIONS IN (ns) NANOSECONDS					
JBM P/N	TAP 1 PIN 15	TAP 2 PIN 3	TAP 3 PIN 14	TAP 4 PIN 4	OUTPUT PIN 13
L-82-50	2±.5	4±.5	6±.5	8±.5	10±.5
L-82-51	3±.5	6±.5	9±.5	12±.5	15±.5
L-82-52	4±.5	8±.5	12±.5	16±1	20±1
L-82-53	5±1	10±1	15±1	20±1	25±4%
L-82-54	6±1	12±1	18±1	24±1	30±4%
L-82-55	7±1	14±1	21±1	28±4%	35±4%
L-82-56	8±1	16±1	24±1	32±4%	40±4%
L-82-57	9±1	18±1	27±4%	36±4%	45±4%
L-82-58	10±1	20±1	30±4%	40±4%	50±4%
L-82-59	12±1	24±1	36±4%	48±4%	60±4%
L-82-60	15±1	30±4%	45±4%	60±4%	75±4%
L-82-61	20±1	40±4%	60±4%	80±4%	100±4%
L-82-62	25±4%	50±4%	75±4%	100±4%	125±4%
L-82-63	30±4%	60±4%	90±4%	120±4%	150±4%
L-82-64	35±4%	70±4%	105±4%	140±4%	175±4%
L-82-65	40±4%	80±4%	120±4%	160±4%	200±4%
L-82-66	45±4%	90±4%	140±4%	180±4%	225±4%
L-82-67	50±4%	100±4%	160±4%	200±4%	250±4%
L-82-68	60±4%	120±4%	180±4%	240±4%	300±4%
L-82-69	70±4%	140±4%	210±4%	280±4%	350±4%
L-82-70	80±4%	160±4%	240±4%	320±4%	400±4%
L-82-71	90±4%	180±4%	270±4%	360±4%	450±4%
L-82-72	100±4%	200±4%	300±4%	400±4%	500±4%

L-82-500 SERIES
100K ECL



DELAY TIMES & TOLERANCES VEE −4.5V ± .05V AND −1.3V LEVEL @ 25°C								
JBM P/N	TAP 1 PIN 3	TAP 2 PIN 4	TAP 3 PIN 5	TAP 4 PIN 8	TAP 5 PIN 9	TAP 6 PIN 10	TAP 7 PIN 11	OUTPUT PIN 12
L-82-510	2.0± .5	4.0± .5	6.0± .6	8.0± .8	10.0±1	12.0±1	14.0±1	16.0±1
L-82-511	2.5± .5	5.0± .5	7.5± .75	10.0±1	12.5±1	15.0±1	17.5±1	20.0±1
L-82-512	3.0± .5	6.0± .6	9.0± .9	12.0±1	15.0±1	18.0±1	21.0±1.2	24.0±1.5
L-82-513	3.5± .5	7.0± .7	10.5±1	14.0±1	17.5±1	21.0±1.2	24.5±1.5	28.0±1.5
L-82-514	4.0± .7	8.0± .8	12.0±1	16.0±1	20.0±1	24.0±1.2	28.0±1.5	32.0±1.5
L-82-515	4.5± .7	9.0± .9	13.5±1	18.0±1	22.5±1.2	27.0±1.5	31.5±1.5	36.0±1.5
L-82-516	5.0± .7	10.0±1	15.0±1	20.0±1	25.0±1.2	30.0±1.5	35.0±1.5	40.0±2
L-82-517	6.0± .8	12.0±1	18.0±1	24.0±1.2	30.0±1.5	36.0±1.5	42.0±2	48.0±2
L-82-518	7.0± .8	14.0±1	21.0±1.2	28.0±1.5	35.0±1.5	42.0±2	49.0±2	56.0±2.5
L-82-519	8.0±1	16.0±1	24.0±1.2	32.0±1.5	40.0±2	48.0±2	56.0±2.5	64.0±3
L-82-520	9.0±1	18.0±1	27.0±1.5	36.0±1.5	45.0±2	54.0±2.5	63.0±3	72.0±3.5
L-82-521	10.0±1	20.0±1	30.0±1.5	40.0±2	50.0±2.5	60.0±3	70.0±3.5	80.0±4
L-82-522	12.5±1.5	25.0±1.5	37.5±1.5	50.0±2.5	62.5±3	75.0±3.5	87.5±4.5	100.0±5
L-82-523	15.0±1.5	30.0±1.5	45.0±2	60.0±3	75.0±3.5	90.0±4.5	105.0±5	120.0±6
L-82-524	17.5±1.5	35.0±1.5	52.5±2.5	70.0±3.5	87.5±4.5	105.0±5	122.5±6	140.0±7
L-82-525	20.0±1.5	40.0±2	60.0±3	80.0±4	100.0±5	120.0±6	140.0±7	160.0±8
L-82-526	25.0±1.5	50.0±2.5	75.0±3.5	100.0±5	125.0±6	150.0±7	175.0±9	200.0±10

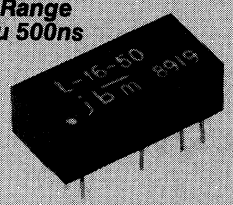
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Active & Passive Delay Lines

High-Speed, CMOS STYLE L-16

(14-pin DIP)

Delay Range 12 thru 500ns



Delay Line Characteristics

Input Test Conditions:

Pulse Width .....2×Td
Input Rise Time (90/10%) 6ns
Input Fall Time (90/10%) 6ns
Input Voltage 3.2V
Vcc .....5.0V ± .05V

Environment:

Operating Temp. .....–40° C to +85°C
Storage Temp. .....–55°C to +125°C
Operating Supply Voltage ....4.75V to 5.25V

Output Characteristics:

Logic "0" .....4V max.
Logic "1" .....3.85V min.

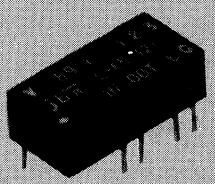
DELAY TIMES IN (ns) NANOSECONDS @ 25°C

JBM P/N	TAP 1 PIN 12	TAP 2 PIN 4	TAP 3 PIN 10	TAP 4 PIN 6	OUTPUT PIN 8
L-16-50	12 ± 2ns	24 ± 2ns	36 ± 2ns	48 ± 3ns	50 ± 4%
L-16-51	15 ± 2ns	30 ± 2ns	45 ± 3ns	60 ± 3ns	75 ± 4%
L-16-52	20 ± 2ns	40 ± 3ns	60 ± 3ns	80 ± 4%	100 ± 4%
L-16-53	25 ± 3ns	50 ± 3ns	75 ± 3ns	100 ± 4%	125 ± 4%
L-16-54	30 ± 3ns	60 ± 3ns	90 ± 4%	120 ± 4%	150 ± 4%
L-16-55	35 ± 3ns	70 ± 3ns	105 ± 4%	140 ± 4%	175 ± 4%
L-16-56	40 ± 3ns	80 ± 4%	120 ± 4%	160 ± 4%	200 ± 4%
L-16-57	45 ± 3ns	90 ± 4%	140 ± 4%	180 ± 4%	225 ± 4%
L-16-58	50 ± 3ns	100 ± 4%	160 ± 4%	200 ± 4%	250 ± 4%
L-16-59	60 ± 3ns	120 ± 4%	180 ± 4%	240 ± 4%	300 ± 4%
L-16-60	70 ± 5%	140 ± 4%	210 ± 4%	280 ± 4%	350 ± 4%
L-16-61	80 ± 5%	160 ± 4%	240 ± 4%	320 ± 4%	400 ± 4%
L-16-62	90 ± 5%	180 ± 4%	270 ± 4%	360 ± 4%	450 ± 4%
L-16-13	100 ± 5%	200 ± 4%	300 ± 4%	400 ± 4%	500 ± 4%

Consult factory for other delays, tolerances and logic families.

L-65-100 SERIES

TTL 3 Bit Programmables



DELAY SPECIFICATIONS IN (ns) NANOSECONDS

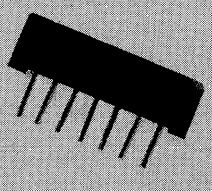
Program Pins / Part Number	0 3 2 1	1 0 0 0	2 0 0 1	3 0 1 1	4 1 0 0	5 1 0 1	6 1 1 0	7 1 1 1	Tot. of Prog. Delay	Delay Time Per Step	Delay Time Step Tot.	Maximum Delay Nominal Ref. IN
L-65-121	7 ± 1ns	1	2	3	4	5	6	7	± .5ns	1ns	± .3ns	14ns
L-65-122	7 ± 1ns	2	4	6	8	10	12	14	± .6ns	2ns	± .4ns	21ns
L-65-123	7 ± 1ns	3	6	9	12	15	18	21	± .7ns	3ns	± .5ns	28ns
L-65-124	7 ± 1ns	4	8	12	16	20	24	28	± .9ns	4ns	± .5ns	35ns
L-65-125	7 ± 1ns	5	10	15	20	25	30	35	± 1ns	5ns	± .5ns	42ns
L-65-126	7 ± 1ns	6	12	18	24	30	36	42	± 1.2ns	6ns	± .6ns	49ns
L-65-127	7 ± 1ns	7	14	21	28	35	42	49	± 1.4ns	7ns	± .7ns	56ns
L-65-128	7 ± 1ns	8	16	24	32	40	48	56	± 1.6ns	8ns	± .8ns	63ns
L-65-129	7 ± 1ns	9	18	27	36	45	54	63	± 1.8ns	9ns	± .9ns	70ns
L-65-130	7 ± 1ns	10	20	30	40	50	60	70	± 2.0ns	10ns	± 1ns	77ns
L-65-131	7 ± 1ns	12	24	36	48	60	72	84	± 2.0ns	12ns	± 1.2ns	91ns

*Steps 1 to 7 Reference to Zero

Mini Sip STYLE L-52

(7-pin SIP)

Delay Range 5-250ns



Compatible With Various Logic Systems Including TTL and Video Circuits.

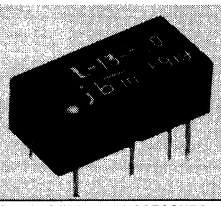
- Tapped/Untapped
- Impedance Tolerance = + 10%
- Temperature Coefficient of Delay = 100 PPM/°C Max
- Operating Temperature Range = -55°C to + 125°C
- Voltage Rating = 50WVDC
- Typical attenuation = 10%
- Td/Tr Ratio = 5:1 or 3:1
- Designed & manufactured to meet MIL-D23859
- Epoxy encapsulated
- Package Length - only .800" nom.

JBM PART NUMBER 5 TAP BY IMPEDANCE				TAP 1 PIN 3	TAP 2 PIN 4	TAP 3 PIN 5	TAP 4 PIN 6	OUT *	RISE TIME	JBM PART NUMBER TD ONLY BY IMPEDANCE			
50Ω	75Ω	100Ω	200Ω	(DELAY TIMES IN NANOSECONDS)					OUT	50Ω	75Ω	100Ω	200Ω
L-52-101	-131	-161	—	1.0 ± .4	2.0 ± .5	3.0 ± .6	4 ± .8	5.0 ± 1	2.5	-601	-631	-661	—
L-52-102	-132	-162	-192	2.0 ± .4	4.0 ± .6	6.0 ± .8	8.0 ± 1	10.0 ± 1	3.5	-602	-632	-662	-692
L-52-103	-133	-163	-193	3.0 ± .6	6.0 ± .8	9.0 ± .9	12.0 ± 1	15.0 ± 1	5.0	-603	-633	-663	-693
L-52-104	-134	-164	-194	4.0 ± .8	8.0 ± .1	12.0 ± 1	16.0 ± 1	20.0 ± 1	5.5	-604	-634	-664	-694
L-52-105	-135	-165	-195	4.0 ± .8	8.0 ± .1	12.0 ± 1	16.0 ± 1	20.0 ± 1	7.5	-605	-635	-665	-695
L-52-106	-136	-166	-196	5.0 ± 1	10.0 ± 1	15.0 ± 1.5	20.0 ± 1.5	25.0 ± 1.5	8.0	-606	-636	-666	-696
L-52-107	-137	-167	-197	5.0 ± 1	10.0 ± 1	15.0 ± 1.5	20.0 ± 1.5	25.0 ± 1.5	8.5	-607	-637	-667	-697
L-52-108	-138	-168	-198	6.0 ± 1	12.0 ± 1.5	18.0 ± 1.5	24.0 ± 1.5	30.0 ± 1.5	6.5	-608	-638	-668	-698
L-52-109	-139	-169	-199	6.0 ± 1	12.0 ± 1.5	18.0 ± 1.5	24.0 ± 1.5	30.0 ± 1.5	10.0	-609	-639	-669	-699
L-52-110	-140	-170	-200	7.0 ± 1	14.0 ± 1.5	21.0 ± 1.5	28.0 ± 1.5	35.0 ± 1.8	7.0	-610	-640	-670	-700
L-52-111	-141	-171	-201	7.0 ± 1	14.0 ± 1.5	21.0 ± 1.5	28.0 ± 1.5	35.0 ± 1.8	12.0	-611	-641	-671	-701
L-52-112	-142	-172	-202	8.0 ± 1	16.0 ± 1.5	24.0 ± 1.5	32.0 ± 5%	40.0 ± 2.0	8.0	-612	-642	-672	-702
L-52-113	-143	-173	-203	8.0 ± 1	16.0 ± 1.5	24.0 ± 1.5	32.0 ± 5%	40.0 ± 2.0	13.0	-613	-643	-673	-703
L-52-114	-144	-174	-204	9.0 ± 1	18.0 ± 1.5	27.0 ± 1.5	36.0 ± 5%	45.0 ± 5%	9.0	-614	-644	-674	-704
L-52-115	-145	-175	-205	9.0 ± 1	18.0 ± 1.5	27.0 ± 1.5	36.0 ± 5%	45.0 ± 5%	15.0	-615	-645	-675	-705
L-52-116	-146	-176	-206	10.0 ± 1	20.0 ± 1.5	30.0 ± 5%	40.0 ± 5%	50.0 ± 5%	10.0	-616	-646	-676	-706
L-52-117	-147	-177	-207	10.0 ± 1	20.0 ± 1.5	30.0 ± 5%	40.0 ± 5%	50.0 ± 5%	17.0	-617	-647	-677	-707
L-52-118	-148	-178	-208	12.0 ± 1.5	24.0 ± 1.5	36.0 ± 5%	48.0 ± 5%	60.0 ± 5%	12.0	-618	-648	-678	-708
L-52-119	-149	-179	-209	12.0 ± 1.5	24.0 ± 1.5	36.0 ± 5%	48.0 ± 5%	60.0 ± 5%	20.0	-619	-649	-679	-709
L-52-120	-150	-180	-210	15.0 ± 1.5	30.0 ± 5%	45.0 ± 5%	60.0 ± 5%	75.0 ± 5%	15.0	-620	-650	-680	-710
L-52-121	-151	-181	-211	15.0 ± 1.5	30.0 ± 5%	45.0 ± 5%	60.0 ± 5%	75.0 ± 5%	25.0	-621	-651	-681	-711
L-52-122	-152	-182	-212	20.0 ± 1.5	40.0 ± 5%	60.0 ± 5%	80.0 ± 5%	100.0 ± 5%	20.0	-622	-652	-682	-712
L-52-123	-153	-183	-213	20.0 ± 1.5	40.0 ± 5%	60.0 ± 5%	80.0 ± 5%	100.0 ± 5%	33.0	-623	-653	-683	-713
L-52-124	-154	-184	-214	25.0 ± 2	50.0 ± 5%	75.0 ± 5%	100.0 ± 5%	125.0 ± 5%	25.0	-624	-654	-684	-714
L-52-125	-155	-185	-215	25.0 ± 2	50.0 ± 5%	75.0 ± 5%	100.0 ± 5%	125.0 ± 5%	42.0	-625	-655	-685	-715
L-52-126	-156	-186	-216	30.0 ± 3	60.0 ± 5%	90.0 ± 5%	120.0 ± 5%	150.0 ± 5%	30.0	-626	-656	-686	-716
L-52-127	-157	-187	-217	30.0 ± 3	60.0 ± 5%	90.0 ± 5%	120.0 ± 5%	150.0 ± 5%	50.0	-627	-657	-687	-717
L-52-128	-158	-188	-218	40.0 ± 4	80.0 ± 5%	120 ± 5%	160 ± 5%	200 ± 5%	40.0	-628	-658	-688	-718
L-52-129	-159	-189	-219	50.0 ± 5	100 ± 5%	150 ± 5%	200 ± 5%	250 ± 5%	50.0	-629	-659	-689	-719

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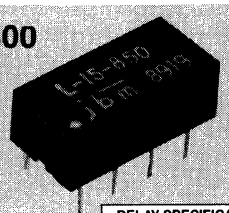
Military Hi-Reliability Lines

L-13-800
5-Tap, Fast Rise Time



DELAY SPECIFICATIONS IN (ns) NANOSECONDS					
JBM P/N	TAP 1 PIN 12	TAP 2 PIN 4	TAP 3 PIN 10	TAP 4 PIN 6	OUTPUT PIN 8
L-13-820	5±2	10±2	15±2	20±2	25±2
L-13-821	6±2	12±2	18±2	24±2	30±2
L-13-822	8±2	16±2	24±2	32±2	40±2
L-13-823	10±2	20±2	30±2	40±2	50±5%
L-13-824	12±2	24±2	36±2	48±5%	60±5%
L-13-825	15±2	30±2	45±5%	60±5%	75±5%
L-13-826	20±2	40±2	60±5%	80±5%	100±5%
L-13-827	25±2	50±5%	75±5%	100±5%	125±5%
L-13-828	30±2	60±5%	90±5%	120±5%	150±5%
L-13-829	40±2	80±5%	120±5%	160±5%	200±5%
L-13-830	50±5%	100±5%	150±5%	200±5%	250±5%
L-13-831	60±5%	120±5%	180±5%	240±5%	300±5%
L-13-832	70±5%	140±5%	210±5%	280±5%	350±5%
L-13-833	80±5%	160±5%	240±5%	320±5%	400±5%
L-13-834	90±5%	180±5%	270±5%	360±5%	450±5%
L-13-835	100±5%	200±5%	300±5%	400±5%	500±5%

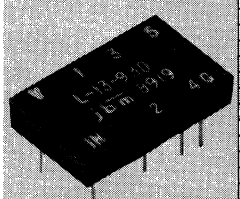
STYLE L-15-800
Multi-Buffered



FEATURES
- Low power
- Fast rise time
- Low supply current
- High drive capability
- Excellent noise margin
- Utilizes hermetic/ceramic integrated circuits screened to MIL-STD-883, LEVEL B

DELAY SPECIFICATIONS (all times in nanoseconds)		
JBM P/N	@25°C	−55/+125°C
L-15-850	5±1.5	5±2.5
L-15-851	6±1.5	6±2.5
L-15-852	7±1.5	7±2.5
L-15-853	8±1.5	8±2.5
L-15-854	9±1.5	9±2.5
L-15-855	10±1.5	10±2.5
L-15-856	15±1.5	15±2.5
L-15-857	20±2.0	20±3.0
L-15-860	50±3.0	50±4.0
L-15-863	75±3.5	75±5.0
L-15-866	100±5.0	100±7.0
L-15-868	150±7.5	150±10.0

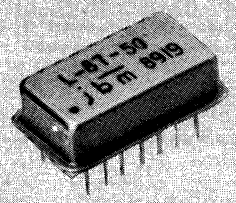
L-13-900
(8 pins)
Delay Range 25 thru 500 nsec
5 equally-spaced taps
TTL Thin Dip



TOTAL DELAY (nsec±5%)	TAP INTERVALS	RISE TIME (ns MAX) (0.8 to 2.0V)	JBM P/N
25±2	5±2	2.0	L-13-904
30±2	6±2	2.0	L-13-905
35±2	7±2	2.0	L-13-906
40±2	8±2	2.0	L-13-907
45±2	9±2	2.0	L-13-908
50±2.5	10±2	2.0	L-13-909
60±3	12±2	2.5	L-13-927
75±3.5	15±2	3.0	L-13-910
100±5	20±2	3.0	L-13-911
125±6	25±2.5	3.5	L-13-912
150±7	30±3	4.0	L-13-913
200±10	40±3	4.0	L-13-915
250±10	50±3	4.0	L-13-917
300±10	60±4	4.0	L-13-918
350±10	70±4	4.0	L-13-919
400±10	80±4	4.0	L-13-920
450±10	90±5	4.0	L-13-921
500±10	100±5	4.0	L-13-922

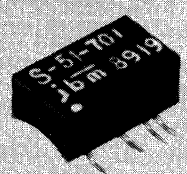
L-87-SERIES
10 Tap Delay Line
Hermetic Sealed

TTL and DTL Compatible



Delay Times in (ns)@VCC=5.0VDC, @25°C			
JBM P/N	TOTAL DELAY (ns±5%)	TAP INTERVALS	RISE TIME @.8/2.0V)
L-87-50	50	5.0±2ns	2.0ns
L-87-51	75	7.5±2ns	2.0ns
L-87-52	100	10.0±2ns	2.0ns
L-87-53	125	12.5±3ns	2.5ns
L-87-54	150	15.0±3ns	2.5ns
L-87-55	175	17.5±3ns	3.0ns
L-87-56	200	20.0±3ns	3.0ns
L-87-57	250	25.0±3ns	3.0ns
L-87-58	300	30.0±3ns	3.5ns
L-87-59	350	35.0±3.5ns	3.5ns
L-87-60	400	40.0±4ns	4.0ns
L-87-61	450	45.0±4.5ns	4.0ns
L-87-62	500	50.0±5ns	4.0ns
L-87-63	600	60.0±6ns	4.5ns
L-87-64	700	70.0±7ns	4.5ns
L-87-65	750	75.0±7.5ns	4.5ns
L-87-66	800	80.0±8ns	5.0ns
L-87-67	900	90.0±9ns	5.0ns
L-87-68	1000	100.0±10ns	5.0ns

S-51-700 SERIES (5 Tap)
Surface Mount
MINI



FEATURES
- Delay from 25ns to 500ns
- Utilizes ceramic IC's screened to MIL-STD-883, Level B
- Military temperature
- Temp. coefficient 550PPM/°C
- 14 pin 05 configuration
- Surface mountable

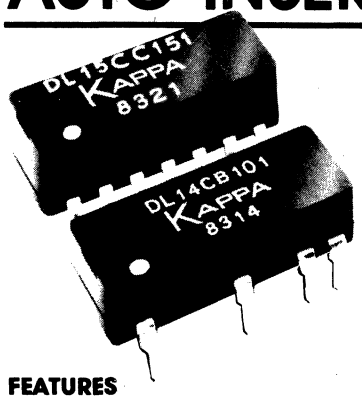
DELAY SPECIFICATIONS IN (ns) NANOSECONDS					
JBM P/N	TAP 1 PIN 12	TAP 2 PIN 4	TAP 3 PIN 10	TAP 4 PIN 6	TAP 5 PIN 8
S-51-701	5±2	10±2	15±2	20±2	25±2
S-51-702	6±2	12±2	18±2	24±2	30±2
S-51-703	7±2	14±2	21±2	28±2	35±2
S-51-704	8±2	16±2	24±2	32±2	40±2
S-51-705	9±2	18±2	27±2	36±2	45±2
S-51-706	10±2	20±2	30±2	40±2	50±2.5
S-51-707	12±2	24±2	36±2	48±2.5	60±3
S-51-708	15±2	30±2	45±5%	60±3	75±3.5
S-51-709	20±2	40±2	60±3	80±4	100±5
S-51-710	25±2.5	50±2.5	75±3.5	100±5	125±6
S-51-711	30±3	60±3	90±4	120±6	150±7
S-51-712	40±3	80±4	120±6	160±8	200±10
S-51-713	50±3	100±5	150±7	200±10	250±12
S-51-714	60±4	120±6	180±9	240±12	300±15
S-51-715	70±4	140±7	210±10	280±14	350±17
S-51-716	80±4	160±8	240±12	320±16	400±20
S-51-717	90±5	180±9	270±13	360±18	450±22
S-51-718	100±5	200±10	300±15	400±20	500±25

Delay will vary 2% or 1ns max for 5% change in VCC.

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SERIES DL14/DL15 TTL SCHOTTKY (14-PIN) 5-TAP/10-TAP

AUTO-INSERTABLE DELAY LINES



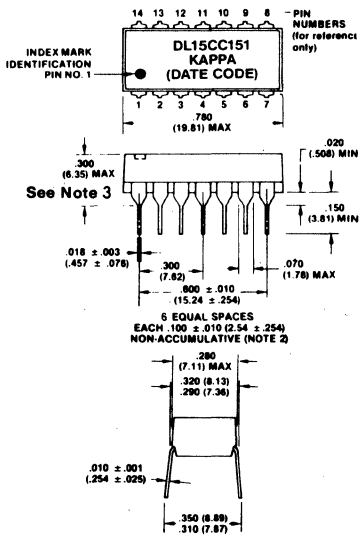
ABSOLUTE MAXIMUM RATINGS (Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied).

	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	7.0	V
V_{IN}	Input voltage	−0.5 to +5.5	V
I_{IN}	Input current	−30 to +5	mA
V_{OUT}	Voltage applied to output in HIGH output state	−0.5 to +V_{CC}	V
T_w	Pulse width, of Total Delay (High or Low)	40/20	%
d	Duty Cycle	50	%
T_A	Operating free-air temperature range	0 to 70	°C

FEATURES

- Auto-Insertable 14-pin package
- TTL Schottky interfaced
- 5/10 equally spaced taps
- Risetime: 4 ns max(5) (6)
- Tap delays from 1–100 ns

MARKINGS AND DIMENSIONS, in (mm)



Marking and dimension notes:

1. A notch may be substituted for PIN #1 Dot Index.
2. Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.
3. **Also available in .200 in. max mounting height as DL14CA and .165 in. max mounting height as DL14CZ.**

RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

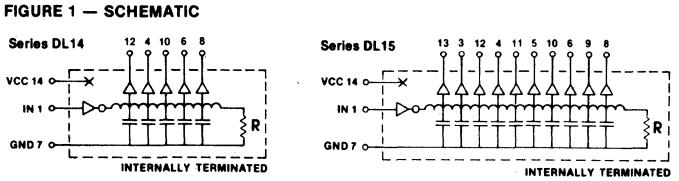
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30/60	45/75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65/120	75/150	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

PART NUMBER	Total Delay (ns)(1) (2)	Tap Delay (ns)(1) (2)
DL14CB250	25	5
DL14CB500	50	10
DL14CB750	75	15
DL14CB101	100	20
DL14CB251	250	50
DL14CB501	500	100
DL15CC500	50	5
DL15CC101	100	10
DL15CC151	150	15
DL15CC201	200	20
DL15CC251	250	25
DL15CC501	500	50

Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ± 5% or ± 2 ns whichever is greater, referenced from input and guaranteed only under the following test conditions: V_{CC}=T_{YP},T_A=T_{YP}, E_{IN}=3.2V, T_{RI}=2 ns, T_w=T_d, d=33%, R_L=1 megohm and C_L=15 pf.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: TC= 300 + (25,000/T_d), in ppm/°C.
4. Delay will vary approximately 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.

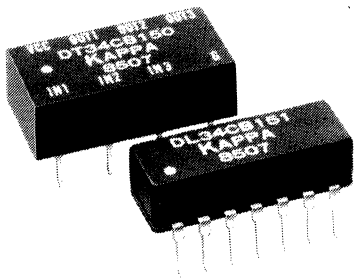
FIGURE 1 — SCHEMATIC



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SERIES DL34/DT34 TTL SCHOTTKY • 3 INDEPENDENT DELAYS

TRIPLE DELAY LINES (14-PIN)



ABSOLUTE MAXIMUM RATINGS (Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied).

	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	7.0	V
V_{IN}	Input voltage	−0.5 to +5.5	V
I_{IN}	Input current	−30 to +5	mA
V_{OUT}	Voltage applied to output in HIGH output state	−0.5 to +V_{CC}	V
T_w	Pulse width, of Total Delay (High or Low)	100	%
d	Duty Cycle	50	%
T_A	Operating free-air temperature range	0 to 70	°C

FEATURES

- Available in auto-insertable (DL34) and standard (DT34) 14-Pin package
- Risetime: 4 ns max[5][6]
- 3 independent equal delays
- TTL Schottky interfaced
- Delay times from 5-250 ns

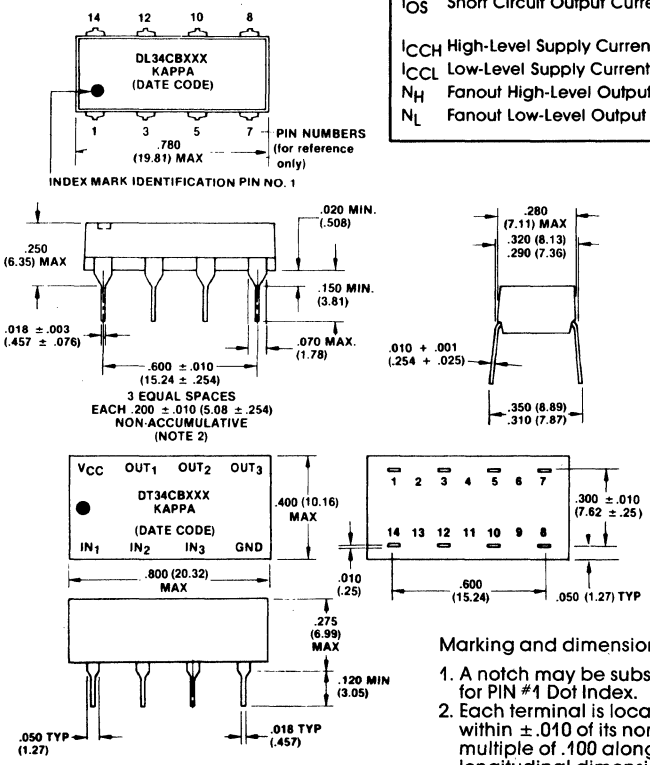
RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

DC ELECTRICAL CHARACTERISTICS

		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	µA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN			90	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0			115	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			10	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

MARKINGS AND DIMENSIONS, in (mm)



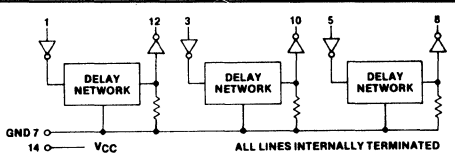
PART NUMBER[7]	Total Delay (ns)[1] [2]
DL34/DT34CB250	25
DL34/DT34CB500	50
DL34/DT34CB750	75
DL34/DT34CB101	100
DL34/DT34CB251	250

Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ± 5% or ± 2 ns whichever is greater, referenced from input and guaranteed only under the following test conditions: V_{CC}=T_{YP},T_A=T_{YP}, E_{IN}=3.2V, T_{RI}=2 ns, T_w=1.5 T_d, d=25%, R_L=1 megohm and C_L=15 pf.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: TC= 300 + (25,000/T_d), in ppm/°C.
4. Delay will vary approximately 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads.

Marking and dimensions notes:

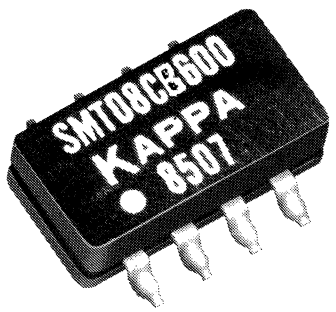
1. A notch may be substituted for PIN #1 Dot Index.
2. Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.



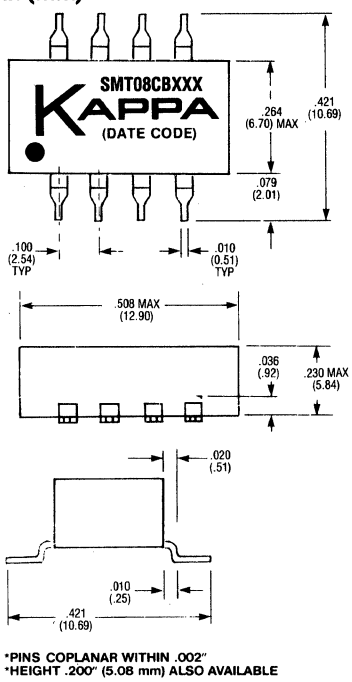
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SURFACE MOUNTED DELAY LINE

SERIES SMT08 TTL SCHOTTKY (8-PIN) 5-TAP



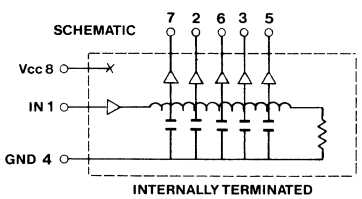
MARKINGS AND DIMENSIONS, in (mm)



*PINS COPLANAR WITHIN .002"
*HEIGHT .200" (5.08 mm) ALSO AVAILABLE

FEATURES

- 8-pin SMD package
- TTL Schottky Interfaced
- 5 equally-spaced taps
- Tap delays from 1-50 ns
- Risetime: 4ns max.(5)(6)



ABSOLUTE MAXIMUM RATINGS (Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied).

	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	7.0	V
V_{IN}	Input voltage	−0.5 to +5.5	V
I_{IN}	Input current	−30 to +5	mA
V_{OUT}	Voltage applied to output in HIGH output state	−0.5 to +V_{CC}	V
T_w	Pulse width, of Total Delay (High or Low)	40	%
d	Duty Cycle	50	%
T_A	Operating free-air temperature range	0 to 70	°C

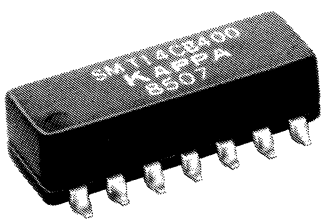
RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	C

DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	µA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30	45	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65	75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

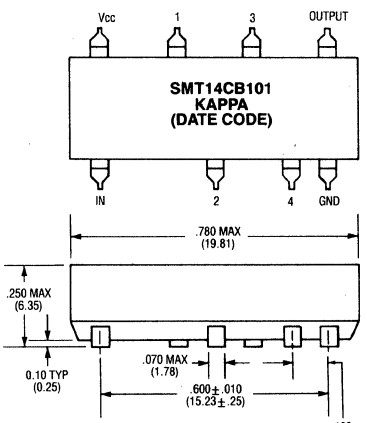
PART NUMBER(7)	Total Delay (ns) (1) (2)	Tap Delay (ns) (1) (2)
SMT08CB250	25	5
SMT08CB500	50	10
SMT08CB750	75	15
SMT08CB101	100	20
SMT08CB251	250	50

Notes:
1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ±5% or ±2 ns, whichever is greater, referenced from input and guaranteed only under the following test conditions: V_{CC} = Typ, T_A = Typ, E_{IN} = 3.2V, T_{RI} = 2ns, T_W = T_d, d = 25%, R_L = 1 megohm and C_L = 15pF.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula. TC + 300 + (25,000/T_d), in ppm/°C.
4. Delay will inversely vary about 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.

SERIES SMT14 TTL SCHOTTKY (14-PIN) 5-TAP



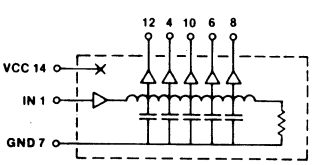
MARKINGS AND DIMENSIONS, in (mm)



*PINS COPLANAR WITHIN .002"
*HEIGHT .200" (5.08 mm) ALSO AVAILABLE

FEATURES

- 14-pin SMD package
- TTL Schottky Interfaced
- 5 equally-spaced taps
- Risetime: 4ns max.(5)(6)
- Tap delays from 1-100 ns



ABSOLUTE MAXIMUM RATINGS (Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied).

	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	7.0	V
V_{IN}	Input voltage	−0.5 to +5.5	V
I_{IN}	Input current	−30 to +5	mA
V_{OUT}	Voltage applied to output in HIGH output state	−0.5 to +V_{CC}	V
T_w	Pulse width, of Total Delay (High or Low)	40	%
d	Duty Cycle	50	%
T_A	Operating free-air temperature range	0 to 70	°C

RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	C

DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	µA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30	45	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65	75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

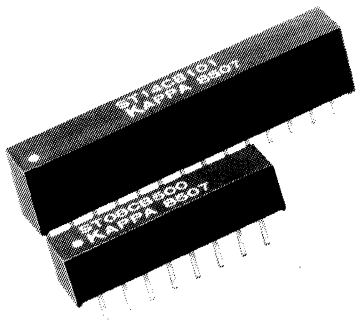
PART NUMBER(7)	Total Delay (ns) (1) (2)	Tap Delay (ns) (1) (2)
SMT14CB250	25	5
SMT14CB500	50	10
SMT14CB600	60	12
SMT14CB750	75	15
SMT14CB101	100	20
SMT14CB151	150	30

Notes:
1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ±5% or ±2 ns, whichever is greater, referenced from input and guaranteed only under the following test conditions: V_{CC} = Typ, T_A = Typ, E_{IN} = 3.2V, T_{RI} = 2ns, T_W = T_d, d = 25%, R_L = 1 megohm and C_L = 15pF.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula. TC + 300 + (25,000/T_d), in ppm/°C.
4. Delay will inversely vary about 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.

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SERIES ST08C/ST14C TTL SCHOTTKY (8-PIN/14-PIN)

5-&10-TAP SIP DELAY LINES



ABSOLUTE MAXIMUM RATINGS (Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied).

	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	7.0	V
V_{IN}	Input voltage	−0.5 to +5.5	V
I_{IN}	Input current	−30 to +5	mA
V_{OUT}	Voltage applied to output in HIGH output state	−0.5 to +V_{CC}	V
T_w	Pulse width, of Total Delay (High or Low)	40/20	%
d	Duty Cycle	50	%
T_A	Operating free-air temperature range	0 to 70	°C

RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	°C

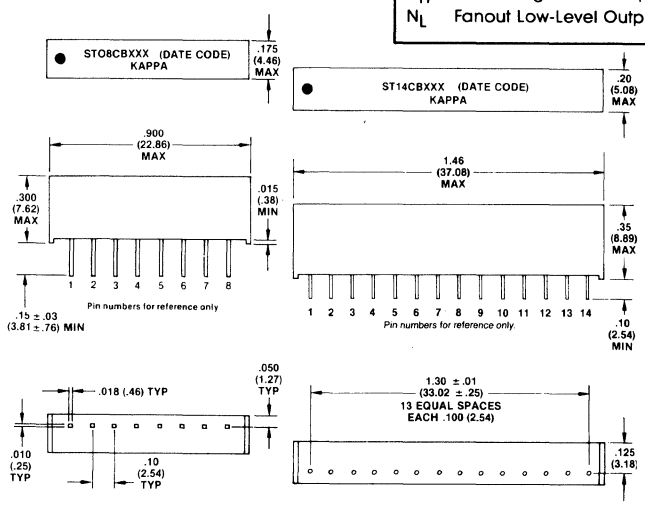
DC ELECTRICAL CHARACTERISTICS

		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IH} =min, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OL} =max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30/60	45/75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65/120	75/150	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

FEATURES

- 8-Pin (ST08C) and 14-Pin (ST14C) SIP Package
- TTL Schottky interfaced
- 5/10 equally-spaced taps
- Risetime: 4 ns max(5)(6)
- Tap delays from 1–100 ns

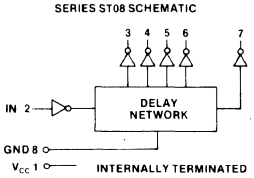
MARKINGS AND DIMENSIONS, in (mm)



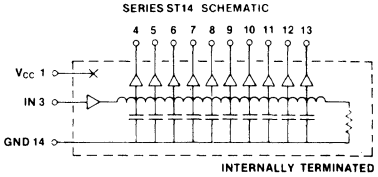
24 AWG round leads may be used.

PART NUMBER(7)	Total Delay (ns)(1) (2)	Tap Delay (ns)(1) (2)
ST08CB250	25	5
ST08CB500	50	10
ST08CB750	75	15
ST08CB101	100	20
ST08CB251	250	50
ST08CB501	500	100
ST14CD500	50	5
ST14CD101	100	10
ST14CD151	150	15
ST14CD201	200	20
ST14CD251	250	25
ST14CD501	500	50
ST14CD102	1000	100

SERIES ST08 SCHEMATIC



SERIES ST14 SCHEMATIC



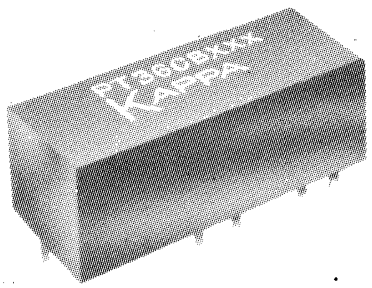
Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ± 5% or ± 2 ns whichever is greater, referenced from input and guaranteed only under the following test conditions: V_{CC}=T_{YP}, T_A=T_{YP}, E_{IN}=3.2V, T_{RI}=2 ns, T_w=T_d, d=25%, R_L=1 megohm and C_L=15 pf.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: TC= 300 + (25,000/T_d), in ppm/°C.
4. Delay will vary approximately 4% for every 5% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.

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SERIES PT36 TTL SCHOTTKY (16-PIN)

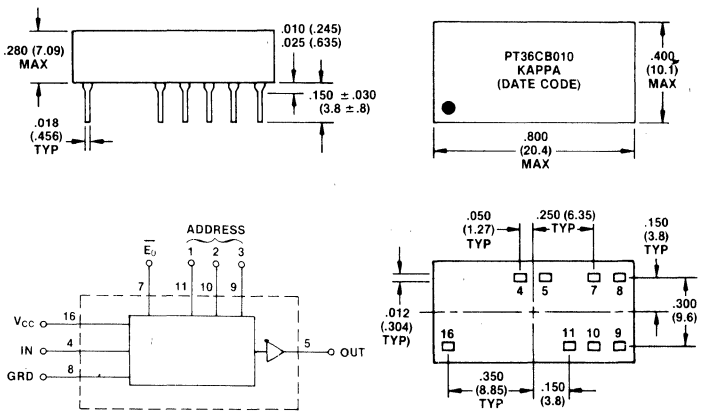
3-BIT PROGRAMMABLE DELAY LINE



FEATURES

- Inherent Delay: 7 ns ±2ns
- 16-Pin DIL package
- Total Delay Tolerance: ±5% or ±1 ns, WIG
- TTL Schottky Interfaced

MARKINGS AND DIMENSIONS, in (mm)



ABSOLUTE MAXIMUM RATINGS (Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied).

PARAMETER		RATING	UNIT
V_{CC}	Supply voltage	7.0	V
V_{IN}	Input voltage	−0.5 to +5.5	V
I_{IN}	Input current	−30 to +5	mA
V_{OUT}	Voltage applied to output in HIGH output state	−0.5 to +V_{CC}	V
T_w	Pulse width, of Total Delay (High or Low)	50	%
d	Duty Cycle	50	%
T_A	Operating free-air temperature range	0 to 70	°C

RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage	2.0			V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature	0	+25	+70	C

DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	μA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN			90	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0			115	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load

FUNCTION TABLE

Enable	Address (Bit No.) 3	2	1	Delay Out
L	L	L	L	T_0
L	L	L	H	T_1
L	L	H	L	T_2
L	L	H	H	T_3
L	H	L	L	T_4
L	H	L	H	T_5
L	H	H	L	T_6
L	H	H	H	T_7
H	X	X	X	L

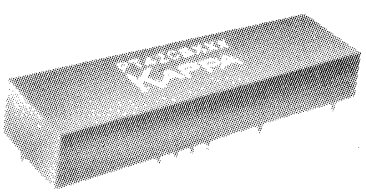
H = High L = Low X = Don't care
T_0 = Reference or Inherent delay of circuit.
T_1 to T_7 = Multiplier of incremental delay.

Part[2] Number	Incremental Delay Per Step[3]	Total Delay[1] Change
PT36CB010	1 ns ± .4 ns	7 ns
PT36CB020	2 ns ± .4 ns	14 ns
PT36CB030	3 ns ± .5 ns	21 ns
PT36CB050	5 ns ± .6 ns	35 ns
PT36CB100	10 ns ±1.0 ns	70 ns
PT36CB150	15 ns ±1.3 ns	105 ns
PT36CB200	20 ns ±1.5 ns	140 ns
PT36CB400	40 ns ±2.0 ns	280 ns
PT36CB500	50 ns ±2.5 ns	350 ns

1. This delay value does not include the T_0 delay.
2. Delay tolerances: ± 5% or ± 2 ns, whichever is greater, referenced from input and guaranteed only under the following test conditions: V_{CC} = Typ, T_A = Typ, E_{IN} = 3.2V, T_{Pi} = 2 ns, T_w = T_d, d = 25%, R_L = 1 megohm and C_L = 15 pf.

SERIES PT42 TTL SCHOTTKY (32-PIN)

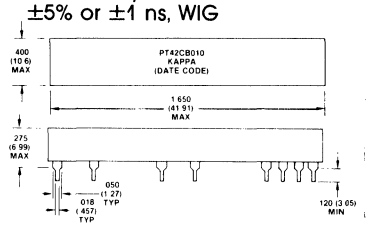
4-BIT PROGRAMMABLE DELAY LINE

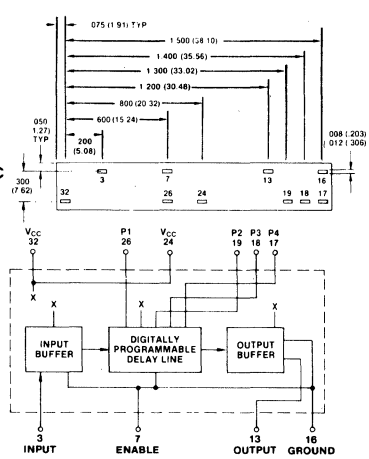


FEATURES

- Inherent Delay: 15 ns ±2ns
- Input signal requirements: TTL logic
- Output fan-out: TTL Schottky load
- Total Delay Tolerance: ±5% or ±1 ns, WIG

MARKINGS AND DIMENSIONS, in (mm)





Recommended Operating Conditions–See Series PT36 above
DC Electrical Characteristics–See Series PT36 above
Absolute Maximum Ratings–See Series PT36 above

FUNCTION TABLE

Enable	Address (Bit No.) 4	3	2	1	Delay Out
L	L	L	L	L	T_0
L	L	L	L	H	T_1
L	L	L	H	L	T_2
L	L	L	H	H	T_3
L	L	H	L	L	T_4
L	L	H	L	H	T_5
L	L	H	H	L	T_6
L	L	H	H	H	T_7
L	H	L	L	L	T_8
L	H	L	L	H	T_9
L	H	L	H	L	T_{10}
L	H	L	H	H	T_{11}
L	H	H	L	L	T_{12}
L	H	H	L	H	T_{13}
L	H	H	H	L	T_{14}
L	H	H	H	H	T_{15}
H	X	X	X	X	L

L = Logic 0
H = Logic 1
X = Don't care
T_0 = Reference or Inherent delay of circuit.
T_1 to T_{15} = Multiplier of incremental delay.

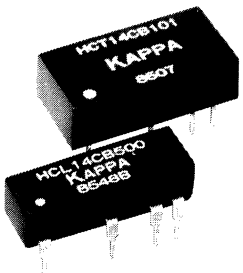
Part[2] Number	Incremental Delay Per Step[3]	Total Delay[1] Change
PT42CB010	1 ns	15 ns
PT42CB020	2 ns	30 ns
PT42CB030	3 ns	45 ns
PT42CB040	4 ns	60 ns
PT42CB050	5 ns	75 ns
PT42CB060	6 ns	90 ns
PT42CB080	8 ns	120 ns
PT42CB100	10 ns	150 ns
PT42CB120	12 ns	180 ns
PT42CB150	15 ns	225 ns
PT42CB200	20 ns	300 ns
PT42CB250	25 ns	375 ns
PT42CB300	30 ns	450 ns
PT42CB350	35 ns	525 ns
PT42CB400	40 ns	600 ns
PT42CB450	45 ns	675 ns
PT42CB500	50 ns	750 ns
PT42CB600	60 ns	900 ns
PT42CB800	80 ns	1,200 ns
PT42CB101	100 ns	1,500 ns

1. This delay value does not include the T_0 delay.
2. Delay tolerances: ± 5% or ± 2 ns, whichever is greater, referenced from input and guaranteed only under the following test conditions: V_{CC} = Typ, T_A = Typ, E_{IN} = 3.2V, T_{Pi} = 2 ns, T_w = T_d, d = 25%, R_L = 1 megohm and C_L = 15 pf.

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SERIES HCL14/HCT14 (14-PIN) 5-TAP

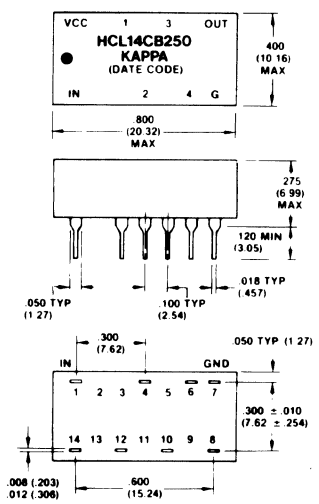
HCMOS DELAY LINES



FEATURES

- HCMOS logic interfaced
- Tap Delay from 1-100 ns
- 5 equally-spaced taps
- Available in auto-insertable (HCL14) and standard (HCT14) packages
- Risetime: 8 ns typ (3) (4)
- Compatible with standard LS TTL family

MARKINGS AND DIMENSIONS, in (mm)



ABSOLUTE MAXIMUM RATINGS Absolute Maximum Ratings are those values beyond which permanent damage to the device may occur. These are stress ratings only and functional operation of the device at or beyond them is not implied. Long exposure to these conditions may affect device reliability.

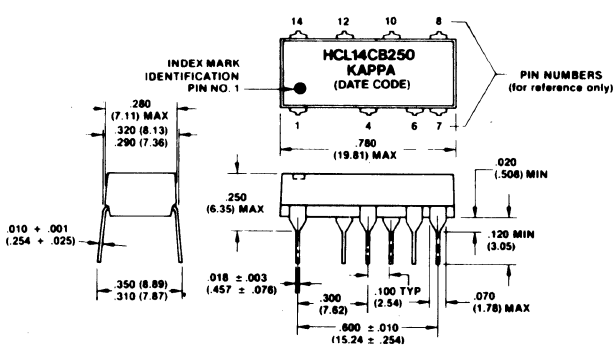
Symbol	Characteristic	Ratings	Unit
V_{CC}	Supply Voltage Range	−0.5 to +7.0	V
I_{ik}	DC Input Diode Current ($V_I < -0.5V$ or $V_I > V_{CC}+0.5$)	±20	mA
I_{ok}	DC Output Diode Current ($V_O < -0.5V$ or $V_O > V_{CC}+0.5V$)	±20	mA
I_O	Continuous Output Current Per Pin ($-0.5V < V_O < V_{CC}+0.5V$)	±35	mA
	Continuous Current Through V_{CC} or GND pins	±125	mA
T_w	Pulse width of Total Delay (High or Low)	40	%
d	Duty Cycle	50	%
T_{stg}	Storage Temperature Range	−55 to +125	°C

RECOMMENDED OPERATING CONDITIONS

PARAMETER		TEST CONDITIONS	V_{CC}	MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage			4	5	6	V
V_{IH}	High-Level Input Voltage		4V	1.5			V
			5V	3.15			
			6V	4.2			
V_{IL}	Low-Level Input Voltage		4V	0		0.3	
			5V	0		0.9	V
			6V	0		1.2	
V_I	Input Voltage			0		V_{CC}	V
V_O	Output Voltage			0		V_{CC}	V
I_{IK}	Input Diode Current	$V_I<0$ or $V_I>V_{CC}$				±20	mA
I_{OK}	Output Diode Current	$V_O<0$ or $V_O>V_{CC}$				±20	mA
I_O	Continuous Output Current	V_O = 0 to V_{CC}				±25	mA
T_A	Operating Free-Air Temperature			−40	+25	+85	°C

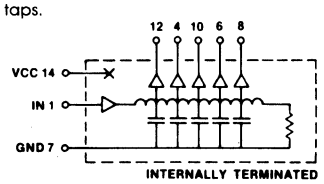
DC ELECTRICAL CHARACTERISTICS

V_{OH}	High-Level Output Voltage	$V_I = V_{IH}$ or V_{IL}, $I_{OH} = -20\mu A$	4V	1.9			
			5V	4.4			
			6V	5.9			
		$V_I = V_{IH}$ or V_{IL}, I_{OH} = 4mA	5V	3.84			V
		$V_I = V_{IH}$ or V_{IL}, I_{OH} = 5.2mA	6V	5.34			
I_{OH}	High-Level Output Current	$V_I = V_{IH}$ or V_{IL}, $V_O = V_{CC}$	6V			5	μA
V_{OL}	Low-Level Output Voltage	$V_I = V_{IH}$ or V_{IL}, $I_{OL} = 20\mu A$	4V			0.1	
			5V			0.1	
			6V			0.1	
		$V_I = V_{IH}$ or V_{IL}, I_{OL} = 4mA	5V			0.4	V
		$V_I = V_{IH}$ or V_{IL}, I_{OL} = 5.2mA	6V			0.4	
I_I	Input Current	V_I = 0 to V_{CC}	6V			±1.0	μA
I_{CC}	Supply Current	$V_I = V_{CC}$ or 0, I_O = 0	6V		5	10	mA
N	Fanout	$V_O = V_{OL}$ to V_{OH}, V_{CC} = min-to-max				10	LS TTL Loads



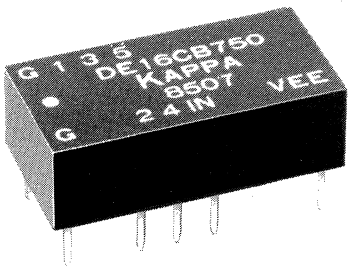
Notes:

1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ±5% or ±2 ns, whichever is greater, referenced from input and guaranteed only under the following test conditions: $V_{CC} = T_{YP}$, $T_A = T_{YP}$, E_{IN} = 3.2V, T_{RI} = 2 ns, $T_w = T_d$, d = 33%, R_L = 1 megohm and 15 pf.
3. Risetime measured from 0.75V to 2.4V level.
4. Measured with no load on delay taps.

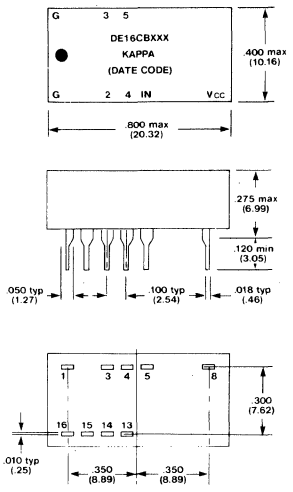


SERIES DE16CB (16-PIN) 5-TAP

ECL 10K DIGITAL DELAY LINE

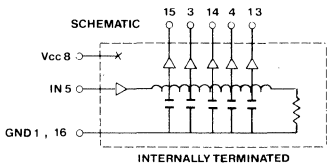


MARKINGS AND DIMENSIONS, in (mm)



FEATURES

- ECL 10K interfaced
- Tap delays from 0.5–100 ns
- 5 equally spaced delay taps
- Standard 16-pin package
- Power dissipation: 200 mWT_{yp} (no load)



ABSOLUTE MAXIMUM RATINGS (Operation beyond the limits set forth in this table may impair useful life of the device. Unless otherwise noted, these limits are specified over the operating ambient temperature range.)

SYMBOL	CHARACTERISTIC	RATING	UNIT
V_{EE}	Supply voltage	−8.0	V
V_{IN}	Input voltage (V_{IN} should never be more negative than V_{EE})	0 to V_{EE}	V
I_O	Output source current	−50	mA
T_W	Pulse width of Total Delay (High or Low)	40	%
d	Duty Cycle	50	%
T_S	Storage temperature	−55 to +125	°C

RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{EE}	Supply Voltage	−5.72	−5.20	−4.68	Vdc
V_{IH}	High-Level Input Voltage	−1.105		−0.810	Vdc
V_{IL}	Low-Level Input Voltage	−1.850		−1.475	Vdc
T_A	Operating Temperature (with 500 LFPM air flow)	−30	+25	+85	C

DC ELECTRICAL CHARACTERISTICS[1]		TEST CONDITIONS				
I_E	Supply Current				75	mAdc
I_{IH}	High-Level Input Current	V_{IH} = −0.810V			425	µAdc
I_{IL}	Low-Level Input Current	V_{IL} = −1.850V		0.5		µAdc
V_{OH}	High-Level Output Voltage	V_{IH} = −0.810V		−1.060	−0.700	Vdc
V_{OL}	Low-Level Output Voltage	V_{IL} = −1.850V		−1.890	−1.615	Vdc
N	Fanout				85	ECL loads

AC ELECTRICAL CHARACTERISTICS

PART NUMBER	Total Delay (ns)[2] [3] [5]	Tap Delay (ns)[2] [3] [5]	Max Output Risetime (ns)[4] [5]	Max Output Falltime (ns)[4] [5]
DE16CB100	10	2.0	4.0	4.0
DE16CB200	20	4.0	4.0	4.0
DE16CB250	25	5.0	4.0	4.0
DE16CB500	50	10.0	4.0	4.0
DE16CB750	75	15.0	5.0	5.0
DE16CB101	100	20.0	6.0	6.0
DE16CB151	150	30.0	7.0	7.0
DE16CB201	200	40.0	8.0	8.0
DE16CB251	250	50.0	10.0	10.0
DE16CB301	300	60.0	15.0	15.0
DE16CB401	400	80.0	15.0	15.0
DE16CB501	500	100.0	20.0	20.0

Notes:

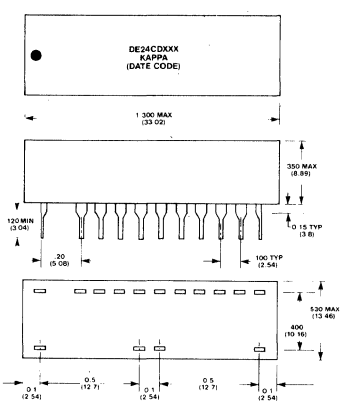
1. All DC electricals are specified over the operating temperature range at V_{EE} = −5.2V ± 0.01V
2. Delay measured at − 1.3V level on leading only, V_{IH} = MIN, V_{IL} = MAX, V_{EE} = Typ, V_{CC} = GND, T_A = Typ, T_W = T_d, d = 33%, T_{RI} = T_{FI} = 2 ns, R_L = 100 OHMS and C_L = 3 pf.
3. Delay tolerance: ±5% or ±1.0 ns, whichever is greater, referenced to input.
4. Risetime measured from 20% to 80%, and Falltime measured from 80% to 20%, V_{EE} = −5.2V, V_{CC} = GND, T_A = +25 C.
5. Output terminals terminated with 100 Ω to −2.0 Volts.

SERIES DE24 (24-PIN) 8-TAP

ECL 100K DELAY LINE

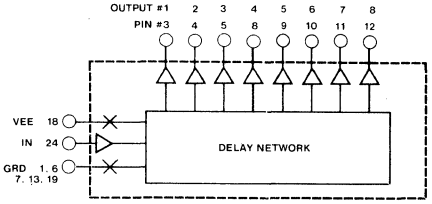


MARKINGS AND DIMENSIONS, in (mm)



FEATURES

- ECL 100K Input and Output
- 24-Pin Package
- 8 Equally-Spaced Delay Taps
- 70 ECL Fan Out Capability
- Operating temperature range: 0°C to +85°C



ABSOLUTE MAXIMUM RATINGS (Operation beyond the limits set forth in this table may impair useful life of the device. Unless otherwise noted, these limits are specified over the operating ambient temperature range.)

SYMBOL	CHARACTERISTIC	RATING	UNIT
V_{EE}	Supply voltage (V_{CC1} = V_{CC2} = GND)	−7.0 to 0	V
V_{IN}	Input voltage (V_{IN} should never be more negative than V_{EE})	V_{EE} to +0.5V	
I_O	Output source current	−55	mA
T_W	Pulse width of Total Delay (High or Low)	100	%
d	Duty Cycle	50	%
T_S	Storage temperature	−65 to +150	°C

RECOMMENDED OPERATING CONDITIONS		MIN	TYP	MAX	UNIT
V_{EE}	Supply Voltage		−4.5		V
V_{CC}	Ground		0		V
T_A	Operating Free-Air Temperature	0	+25	+85	C
V_{IH}	High-Level Input Voltage	−1.16			V
V_{IL}	Low Level Input Voltage			−1.63	V

DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{IN} = V_{IH} (MAX)		−1.02		V
V_{OL}	Low-Level Output Voltage	V_{IN} = V_{IL} (MIN)			−1.62	V
I_{IH}	High-Level Input Current	V_{IN} = V_{IH} (MAX)			18	mA
I_{IL}	Low-Level Input Current	V_{IN} = V_{IL} (MIN)		0.5		µA
I_{EE}	Supply Current	V_{IN} = Open			100	mA

Notes:

1. All DC Electricals are specified over the operating temperature range at V_{EE} = −4.5V ± 0.01V.
2. Delay measured at − 1.3V level on leading edge only, V_{IH} = MIN, V_{IL} = MAX, V_{EE} = Typ, V_{CC} = GND, T_A = Typ, T_W = 3T_d, d = 33%, T_{RI} = T_{FI} = 1 ns, R_L = 500 OHMs and C_L = 3 pf.
3. Delay tolerance: ± 5% or ± 1.0ns, whichever is greater, referenced to input.
4. Risetime measured from 20% to 80% and Falltime measured from 80% to 20%, V_{EE} = Typ, V_{CC} = GND, T_A = Typ.
5. Output terminals terminated with 50Ω to −2.0V.

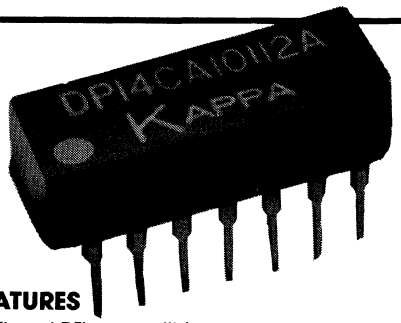
PART NUMBER	Total Delay (ns)	Tap Delay ± (ns)
DE24CD080	8	1 ± 0.5
DE24CD160	16	2
DE24CD240	24	3
DE24CD320	32	4
DE24CD400	40	5
DE24CD480	48	6
DE24CD560	56	7
DE24CD640	64	8
DE24CD720	72	9
DE24CD800	80	10
DE24CD161	160	20
DE24CD201	200	25

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SERIES DP14C/DP16C ANALOG 10-TAP

14-PIN & 16-PIN DIP DELAY LINES

(available in full-MIL conformance as Series DP14M/DP16M)



FEATURES

- TTL and DTL compatible
- Meets applicable requirements of MIL-D-23859
- 5/1 Delay-to-Risetime Ratio
- 10 Equally-Spaced Taps
- Wide Operating Temperature Range
- Low cost

ELECTRICAL SPECIFICATIONS

Total Delay: 10 to 1000 ns
Tap Delays: 10% increments standard (other increments available upon request)
Risetime: 20% maximum of total delay (see Table 1)
Characteristic Impedance: 50 to 500 ohms (±10%)
Attenuation: 2dB max (see Table 1)
Distortion: ±10% max
Temperature Coefficient of Delay: 100ppm/°C max
Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +130°C
Insulation Resistance: 1000 megohms min @ 50VDC @ 25°C
Dielectric Strength: 50VDC

MECHANICAL SPECIFICATIONS

Case Configuration: See FIGURE 2
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See FIGURE 2)
Terminal Material: Kovar or equivalent, tin-plated
Pin Connections: See TABLE II and III
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number and date code (See FIGURE 2)

PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, Impedance, and Pin Sequence Code.

EXAMPLE: DP14CA10112A

(100 ns, 100 ohm, 0.200" (5.08 mm) Max. Height, using the code "A" Pin Sequence)

DP14(16)C A 101 12 A

- **DP14C is 14-Pin DIP**
  DP16C is 16-Pin DIP
- **MOUNTING HEIGHT CODE** (See Table IV)
- **DELAY TIME:** Expressed in nanoseconds (ns). First two digits are significant figures. Last digit specifies number of zeros to follow.
- **IMPEDANCE:** Expressed in ohms (Ω). First digit is significant. Last digit specifies number of zeros to follow.
- **PIN SEQUENCE CODE** (See Table II and III). "STANDARD" Pin Sequence if omitted.

TABLE I

Td (ns)(1) (±5%)	Td/tap (ns)(2)(3) (±10%)	Tr (ns) MAX	ATTENUATION (%) TYPICAL PER IMPEDANCE (Ω) 50	100	200	300	500
10	1	3		5			
20	2	5.5	3	5	5		
30	3	6.5	3	5	5		
40	4	8	3	5	5	5	
50	5	10	3	5	5	5	7
60	6	12	3	5	5	5	7
75	7½	15	3	5	5	5	7
100	10	20	3	5	5	7	7
120	12	24	3	5	6	7	8
150	15	30	3	5	6	7	8
180	18	36	4	5	6	7	8
200	20	40	4	5	6	7	8
220	22	44	4	5	6	7	8
250	25	50	4	5	6	7	8
300	30	60		5	8	10	10
375	37½	75		7	8	10	10
500	50	100		8	10	12	12
600	60	120				15	15
750	75	150				15	20
1000	100	200					20

(1) Or ±2 ns, whichever is greater. (2) Or ±1 ns, whichever is greater. (3) For 10-tap lines only.

TABLE II. PIN-NUMBER SEQUENCE (FOR DP14C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
Standard	14	2	12	3	11	4	5	10	6	9	7	1, 8
A	1	2	13	3	12	4	10	5	9	6	7	14
B	2	3	4	5	6	7	9	10	11	12	13	1, 14
C	7	9	6	10	5	11	12	3	13	2	14	1, 8
D	1	13	2	12	3	11	4	10	5	9	6	7, 8, 14
E	2	3	4	5	6	7, 8	9	10	11	12	13	1, 14
F	1	13	2	12	3	11	4	10	5	9	6	7
G	2	13	3	12	4	11	5	10	6	9	7	8, 14
H	2	3	4	5	6	7	9	10	11	12	13	1
I	1	13	2	12	3	11	5	10	6	9	7	8, 14
J	1	2	13	3	12	4	10	5	9	6	7	8, 14
U	2	3	4	5	6	8	9	10	11	12	13	1, 7
V	2	3	4	5	6	8	9	10	11	12	13	1
W	1	13	2	12	3	11	4	10	5	9	6	7, 14

*Other pin sequences available upon request.

TABLE III. PIN-NUMBER SEQUENCE (FOR DP16C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
A	15	2	14	3	13	4	5	11	6	10	7	1, 9
B	1	15	2	14	3	13	4	12	5	11	6	8
C	1	15	3	14	4	13	5	12	6	11	8	9, 16

*Other pin sequences available upon request.

TABLE IV
MOUNTING HEIGHT

CODE	DIMENSION (MAX)
A	.200 (5.08)
B	.250 (6.35)
C	.300 (7.62)

FIGURE 1 — SCHEMATIC

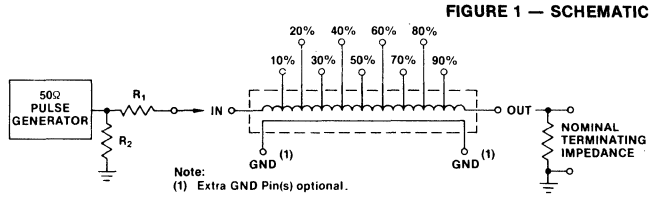
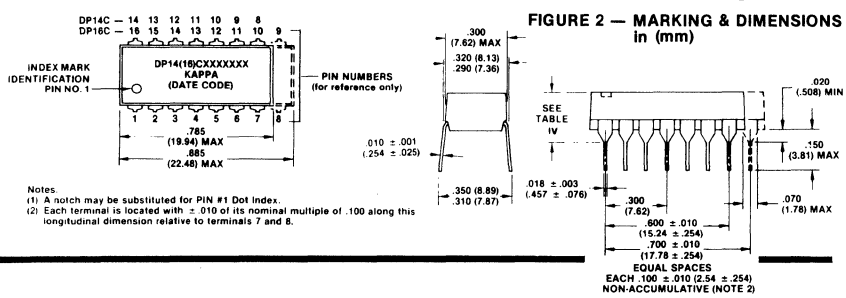


FIGURE 2 — MARKING & DIMENSIONS in (mm)



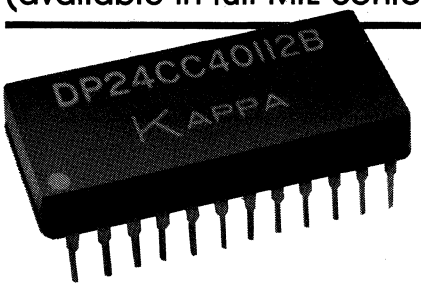
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U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (908) 396-9400, Toll Free 800-223-0603 • FAX 908-388-4786

SERIES DP24C ANALOG 20-TAP

24-PIN DIP DELAY LINE

(available in full-MIL conformance as Series DP24M)



ELECTRICAL SPECIFICATIONS

Total Delay: 20 to 2000 ns
Tap Delays: 5% increments standard
(other increments available upon request)
Risetime: 10% maximum of total delay (see Table 1)
Characteristic Impedance: 50 to 200 ohms (±10%)
Attenuation: 2dB max (see Table 1)
Distortion: ±10% max
Temperature Coefficient of Delay: 100ppm/°C max
Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +130°C
Insulation Resistance: 1000 megohms min @ 50VDC @ 25°C
Dielectric Strength: 50VDC

MECHANICAL SPECIFICATIONS

Case Configuration: See FIGURE 2
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See FIGURE 2)
Terminal Material: Kovar or equivalent, tin-plated
Pin Connections: See TABLE II
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number and date code (See FIGURE 2)

TABLE I

PART NUMBER	TD (ns)(1) (±5%)	Td/tap (ns)(2) (±10%)	Tr (ns) (Max)	Zo (ohms) (±10%)
20051	20	1	3	
40051	40	2	4	
60051	60	3	6	50
80051	80	4	8	
10151	100	5	10	
20151	200	10	20	
20012	20	1	3	
40012	40	2	4	
60012	60	3	6	
80012	80	4	8	
10112	100	5	10	
20112	200	10	20	
30112	300	15	30	
40112	400	20	40	100
50112	500	25	50	
60112	600	30	60	
80112	800	40	80	
10212	1000	50	100	
12212	1200	60	120	
15212	1500	75	150	
40022	40	2	4	
60022	60	3	6	
80022	80	4	8	
10122	100	5	10	
20122	200	10	20	
30122	300	15	30	
40122	400	20	40	200
50122	500	25	50	
60122	600	30	60	
80122	800	40	80	
10222	1000	50	100	
12222	1200	60	120	
15222	1500	75	150	
20222	2000	100	200	

*Notes: (1)Or ±2 ns, whichever is greater. (2)Or ±1 ns, whichever is greater.

TABLE II. PIN-NUMBER SEQUENCE*

CODE	TAP #	IN	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	OUT	GND
A		2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	21	22	23	1, 24
B		2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	22	23	12
C		1	2	3	4	5	6	7	8	9	10	11	14	15	16	17	18	19	20	21	22	23	12, 24

*Other pin sequences available upon request.

FIGURE 1 — SCHEMATIC

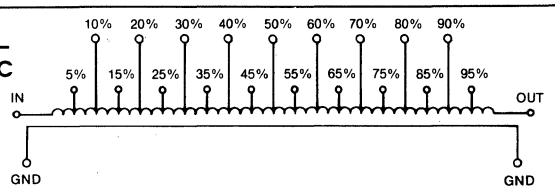
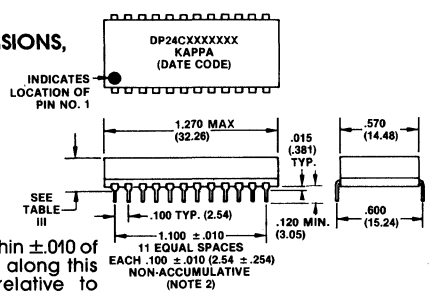


FIGURE 2 — MARKINGS AND DIMENSIONS, in (mm)



Notes:

1. A notch may be substituted for PIN #1 Dot index.
2. Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 12 and 13.

TABLE III. MOUNTING HEIGHT

CODE	DIMENSION (MAX)
B	.250 (6.35)
C	.300 (7.62)

HOW TO ORDER

1. Select MOUNTING HEIGHT CODE from Table III.
2. Select PART NUMBER CODE from Table I.
3. Select PIN-NUMBER SEQUENCE CODE from Table II.
4. Construct the MODEL NUMBER. (See example below.)

This example, Model DP24CB-40112B, identifies a 400 ns, 100-ohm line with 0.300" mounting height and the "B" pin-number sequence.

DP24C	C	40112	B
BASIC SERIES NUMBER	MOUNTING HEIGHT CODE (Table III)	PART NUMBER (Table I)	PIN-NUMBER SEQUENCE (Table II)

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SERIES DV24 (24-PIN) & DV28 (28-PIN)

DELAY LINES FOR BIO-MEDICAL AND VIDEO APPLICATIONS

ELECTRICAL SPECIFICATIONS (@ +25°C)

Total Delay @ f_r: 100-500 ns (SEE TABLE 1)
Tap Delay @ f_r: 4%(DV28) or 5%(DV24) increments
Group Delay (f_r to f_o): ± 2%
Insertion Loss @ f_r (100Khz): See Table 1
Amplitude Slope (f_r to f_o): –3db MAX. @ f_o (see Table 1)
Amplitude Ripple (f_r to f_o): ±.1db(DV28) ±.15db(DV24)
Impedance @ f_r: 75 to 200Ω, ± 10% (See Table 1)
Return Loss (f_r to f_o): –20db MIN.
Working Voltage: 35Vrms Max., Continuous
Dielectric Withstanding Voltage: 100Vdc (≤ 6 secs)
DC Current Carrying Capacity: 50mA Max.
Insulation Resistance: ≥10GΩ @ 50Vdc
Operating Temperature Range: 0°C to +70°C
Storage Temperature Range: –55°C to +125°C
Temperature Coefficient of Delay: 0.005%/°C Max.

MECHANICAL SPECIFICATIONS

Package Configuration: See FIGURE 3
Package Material: Flame-Retardant D.A.P.
Terminal Material: Alloy 42, Sn63 Solder-Coated
Encapsulation: 100% Epoxy-Filled
Marking: Mfr's Name, Part #, Date code, Index Dot

TABLE 1

PART NUMBER (see Note 1)	TOTAL DELAY (ns) ± 2%	TAP(2) DELAY (ns) ± 5%	Max I.L. (db) @ f_r			f_o min. (MHz)
			75Ω	100Ω	200Ω	
DV24CC101xx	100	5	.15	.15	.20	48.0
DV24CC151xx	150	7.5	.15	.20	.25	32.0
DV24CC201xx	200	10	.20	.25	.30	24.0
DV24CC251xx	250	12.5	.25	.30	.35	19.2
DV24CC301xx	300	15	.30	.35	.40	16.0
DV24CC401xx	400	20	.40	.45	.50	12.0
DV24CC501xx	500	25	.45	.50	.60	9.6
DV28CC101xx	100	4	.20	.20	.25	60.0
DV28CC151xx	150	6	.20	.25	.30	40.0
DV28CC201xx	200	8	.25	.30	.35	30.0
DV28CC251xx	250	10	.30	.35	.40	24.0
DV28CC301xx	300	12	.40	.45	.50	20.0
DV28CC401xx	400	16	.45	.50	.55	15.0
DV28CC501xx	500	20	.50	.55	.65	12.0

(1) Add Impedance Code ("xx"): "75" = 75Ω "12" = 100Ω "22" = 200Ω
(2) Or ±1ns, whichever is greater, referenced from input.

FIGURE 1 - DV24 SERIES

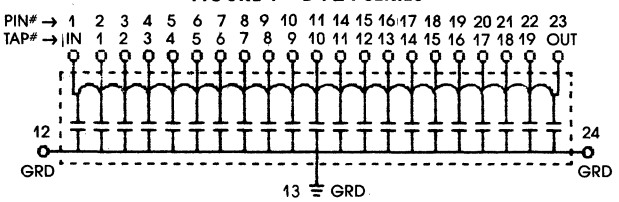
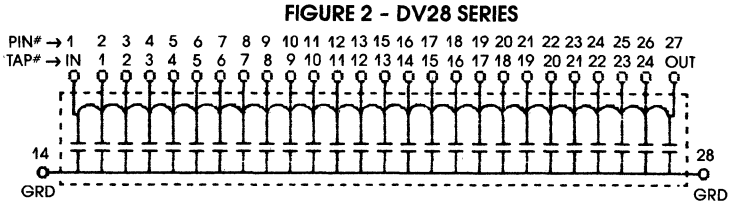


FIGURE 2 - DV28 SERIES



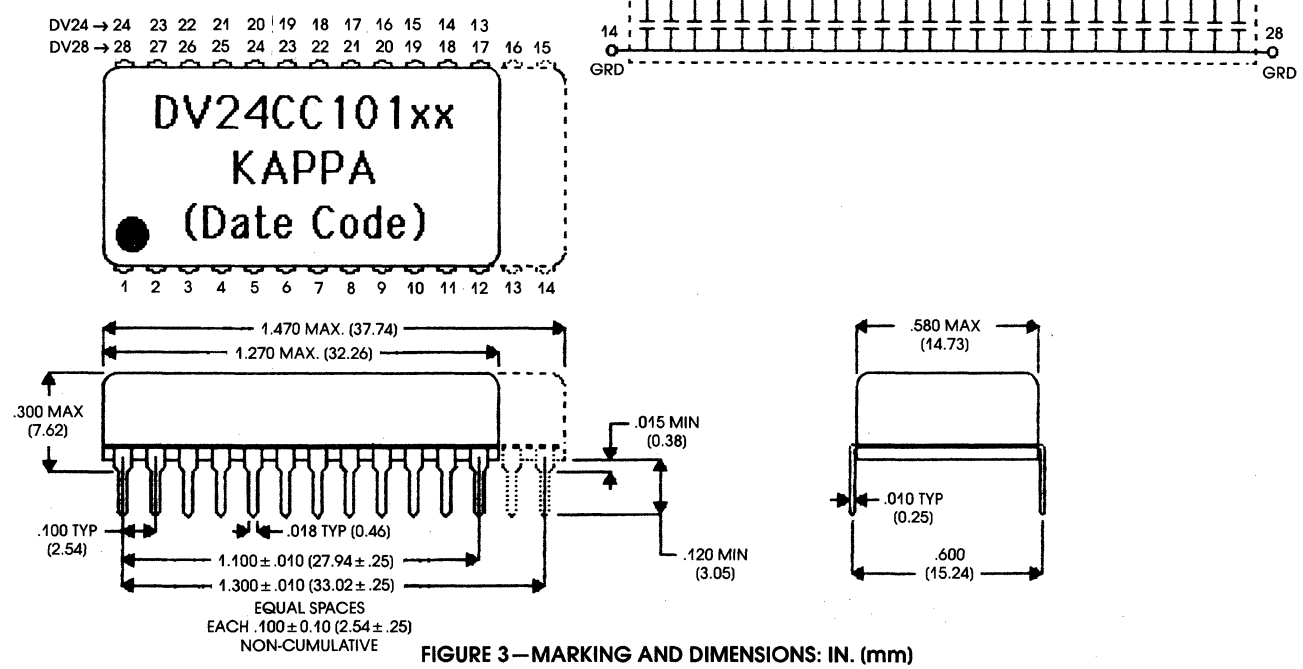


FIGURE 3—MARKING AND DIMENSIONS: IN. (mm)

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CUSTOM MINIATURE & PRECISION DELAY LINES...

Optimization of Most Critical Parameters as Required.

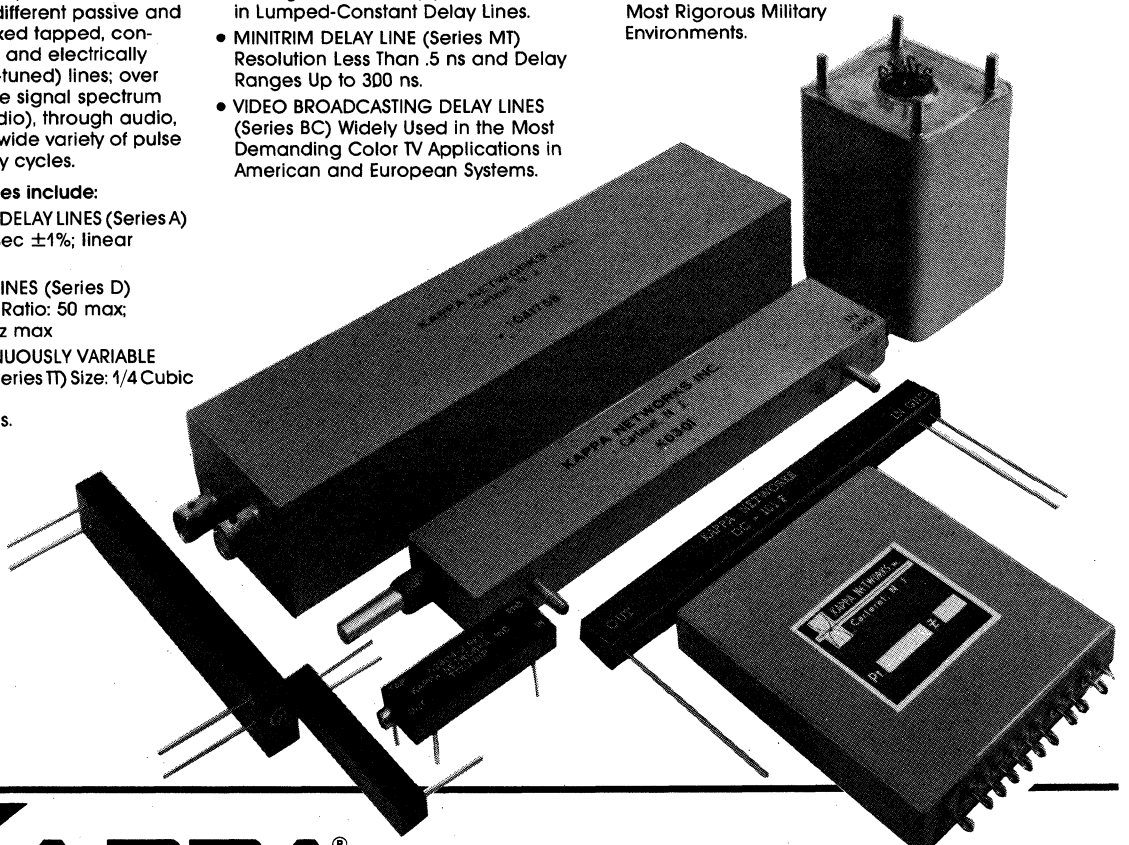
DESCRIPTION	PRECISION AUDIO/SONAR	VIDEO BROADCAST	LOW DISTORTION	STD. DIST. CONSTANT	SUPER η	CONTINUOUS VARIABLE	STD. LUMPED CONSTANT	MINI® TRIM	TINY® TRIM
SERIES NUMBER	**A**	**BC**	**D**	**DC**	**H**	**K**	**LC**	**MT**	**TT**
DELAY RANGE (in microseconds)	500 to 10^6	.05 to 10	up to 100	up to 3	.5 to 500	up to .5	.05 to 10^6	up to .25	up to .12
STANDARD DELAY TOLERANCES (±%)	1	2	1	5	5	+10/−0	5	+10/−0	+10/−0
IMPEDANCE RANGE (in ohms)	500 to 10K	75	100 to 1K	300 to 2K	50 to 2K	100 to 1K	100 to 20K	50 to 1K	300 to 500
STANDARD IMPEDANCE TOLERANCES (±%)	5	2	5	10	5	10	5	10	10
DELAY RESOLUTION	N/A	N/A	N/A	N/A	N/A	> of .1% or 1 ns	N/A	.25 ns	.25 ns
DELAY-to-RISETIME RATIO (max)	N/A	N/A	50	11	150	8	200	7	4
DELAY LINEARITY (±%)	.05 to .25	.025 to 1	.25	N/A	1	N/A	.5	N/A	N/A
BANDWIDTH (max)	70 KHz	20 MHz	50 MHz	30 MHz	10 MHz	25 MHz	250 MHz	100 MHz	70 MHz
ATTENUATION (in dB)	A.S.	A.S.	A.S.	*	A.S.	*	A.S.	<.5 dB	<25 dB
DISTORTION (±%)	N/A	A.S.	1 to 2	*	10	15	10	15	15
DIELECTRIC STRENGTH (VDC)	100	100	100	100 or A.S.	100 or A.S.	100 or A.S.	A.S.	100	100
OPERATING TEMP. RANGE (°C)	−55/+85 A.S.	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125
DELAY STABILITY vs. TEMPERATURE (ppm/°C)	50	50	50	200	50	50 or 200	50	200	200

Abbreviations: A.S. = As Specified; N/A = Not Applicable; * = See Data Sheet.

Over the past two decades, **Kappa** has optimized, packaged, and critically tested literally thousands of specific variations of several hundred different passive and hybrid delay lines: fixed tapped, continuously adjustable, and electrically trimmable (varactor-tuned) lines; over virtually the complete signal spectrum from control (subaudio), through audio, sonar, RF, HF, and a wide variety of pulse rates widths and duty cycles.

Typical design families include:

- PRECISION SONAR DELAY LINES (Series A) 500 μsec to 10^6 μsec ±1%; linear to ±0.05%
- LOW-DISTORTION LINES (Series D) Delay-to-Risetime Ratio: 50 max; Bandwidth: 50 MHz max
- MINIATURE CONTINUOUSLY VARIABLE DELAY TRIMMERS (Series TT) Size: 1/4 Cubic Inch; up to 120 ns; resolution ≤0.25 ns.
- SUPER-η™ DELAY LINES (Series H) Embody New Design Principle Providing the Highest Efficiency yet Obtainable in Lumped-Constant Delay Lines.
- MINITRIM DELAY LINE (Series MT) Resolution Less Than .5 ns and Delay Ranges Up to 300 ns.
- VIDEO BROADCASTING DELAY LINES (Series BC) Widely Used in the Most Demanding Color TV Applications in American and European Systems.
- TRANSPONDER/TACAN/DME (Series C) Designed to Meet the Requirements of MIL-D-23859 and to Withstand the Most Rigorous Military Environments.



11

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14 Pin DIP 5 Tap TTL Compatible Active Delay Lines

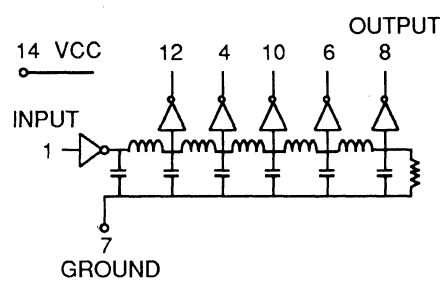
TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER	TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER
5, 10, 15, 20	25	EP8200	80, 160, 240, 320	400	EP8208
6, 12, 18, 24	30	EP8213	84, 168, 252, 336	420	EP8218
7, 14, 21, 28	35	EP8214	88, 176, 264, 352	440	EP8222
8, 16, 24, 32	40	EP8215	90, 180, 270, 360	450	EP8209
9, 18, 27, 36	45	EP8216	94, 188, 282, 376	470	EP8223
10, 20, 30, 40	50	EP8201	100, 200, 300, 400	500	EP8210
12, 24, 36, 48	60	EP8211	110, 220, 330, 440	550	EP8230
15, 30, 45, 60	75	EP8217	120, 240, 360, 480	600	EP8224
20, 40, 60, 80	100	EP8202	130, 260, 390, 520	650	EP8231
25, 50, 75, 100	125	EP8219	140, 280, 420, 560	700	EP8225
30, 60, 90, 120	150	EP8203	150, 300, 450, 600	750	EP8229
35, 70, 105, 140	175	EP8220	160, 320, 480, 640	800	EP8226
40, 80, 120, 160	200	EP8204	170, 340, 510, 680	850	EP8232
45, 90, 135, 180	225	EP8221	180, 360, 540, 720	900	EP8227
50, 100, 150, 200	250	EP8205	190, 380, 570, 760	950	EP8233
60, 120, 180, 240	300	EP8206	200, 400, 600, 800	1000	EP8228
70, 140, 210, 280	350	EP8207			

Delay times referenced from input to leading edges at 25°C, 5.0V.

DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		75	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
		Td > 500 nS		5	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic



Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

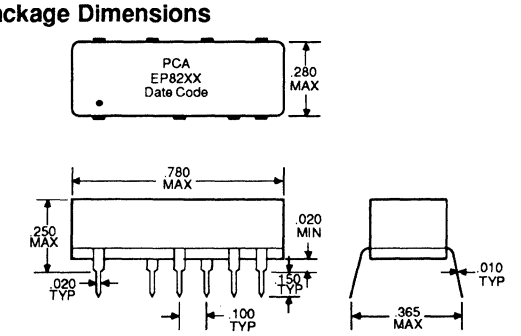
**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 200 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 200 nS	100	KHz
V_{CC}	Supply Voltage	5.0	Volts

EP8200 10/90

Package Dimensions



PCA ELECTRONICS INC.
16799 SCHOENBORN ST.
SEPULVEDA, CA 91343
TEL: (818) 892-0761
FAX: (818) 894-5791
TWX: (910) 496-1525

14 Pin DIP 10 Tap TTL Compatible Active Delay Modules

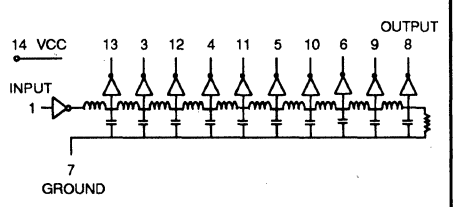
TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER	TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER
5	50	EP8301	44	440	EP8322
6	60	EP8311	45	450	EP8309
7.5	75	EP8317	47	470	EP8323
10	100	EP8302	50	500	EP8310
12.5	125	EP8319	55	550	EP8330
15	150	EP8303	60	600	EP8324
17.5	175	EP8320	65	650	EP8331
20	200	EP8304	70	700	EP8325
22.5	225	EP8321	75	750	EP8329
25	250	EP8305	80	800	EP8326
30	300	EP8306	85	850	EP8332
35	350	EP8307	90	900	EP8327
40	400	EP8308	95	950	EP8333
42	420	EP8318	100	1000	EP8328

Delay times referenced from input to leading edges at 25°C, 5.0V.

DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.2V	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		150	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		150	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
		Td > 500 nS		5	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic



Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

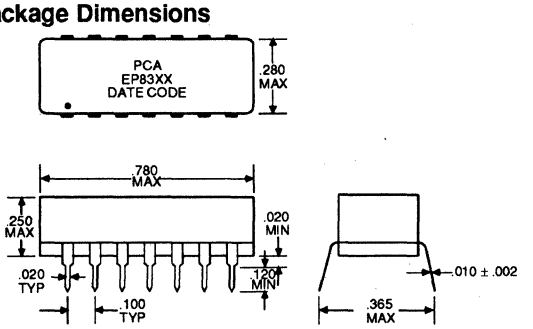
**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 200 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 200 nS	100	KHz
V_{CC}	Supply Voltage	5.0	Volts

8301 10/90

Package Dimensions



PCA ELECTRONICS INC.
16799 SCHOENBORN ST.
SEPULVEDA, CA 91343
TEL: (818) 892-0761
FAX: (818) 894-5791
TWX: (910) 496-1525

Mini SIL Single Output TTL Compatible Active Delay Lines

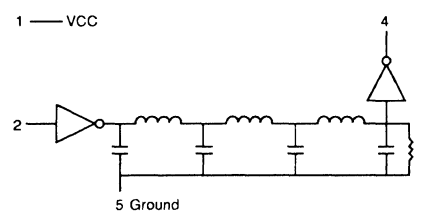
TIME DELAYS * (nS) ±5% or ±2 nS	PART NUMBER	TIME DELAYS * (nS) ±5% or ±2 nS	PART NUMBER
5	EP9748-5	60	EP9748-60
10	EP9748-10	75	EP9748-75
15	EP9748-15	100	EP9748-100
20	EP9748-20	125	EP9748-125
25	EP9748-25	150	EP9748-150
30	EP9748-30	175	EP9748-175
35	EP9748-35	200	EP9748-200
40	EP9748-40	225	EP9748-225
45	EP9748-45	250	EP9748-250
50	EP9748-50		

** Delay times referenced from input to leading edges at 25°C, 5.0V.*

DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.2V	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0.	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		75	mA
T_{RO}	Output Rise Time	V_{CC} = 5.0 V (.75 - 2.4 Volts)		4	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic

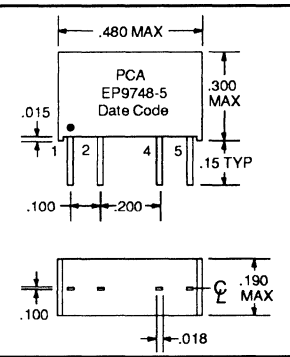


Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

**These two values are inter-dependent.*

Package Dimensions



Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 200 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 200 nS	100	KHz
V_{CC}	Supply Voltage	5.0	Volts

EP9748 10/90

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16 Pin DIP 3 Bit Programmable TTL Delay Lines (Auto-Insertable)

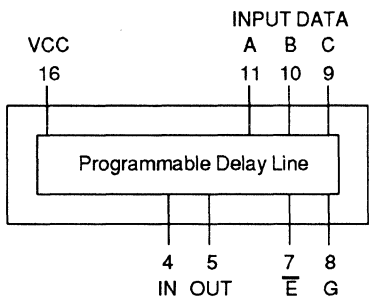
PART NUMBER	MIN DELAY ±2 nS	MAX DELAY nS	STEP	OUTPUT DELAY TIME PROGRAMMING (nS) DATA INPUT (CBA) 000	001	010	011	100	101	110	111
EP8076-1	7	14	1 ± .5 nS	7	8	9	10	11	12	13	14
EP8076-2	7	21	2 ± .5 nS	7	9	11	13	15	17	19	21
EP8076-3	7	28	3 ± .6 nS	7	10	13	16	19	22	25	28
EP8076-4	7	35	4 ± .8 nS	7	11	15	19	23	27	31	35
EP8076-5	7	42	5 ± 1.0 nS	7	12	17	22	27	32	37	42
EP8076-6	7	49	6 ± 1.0 nS	7	13	19	25	31	37	43	49
EP8076-7	7	56	7 ± 1.0 nS	7	14	21	28	35	42	49	56
EP8076-8	7	63	8 ± 1.0 nS	7	15	23	31	39	47	55	63
EP8076-9	7	70	9 ± 1.0 nS	7	16	25	34	43	52	61	70
EP8076-10	7	77	10 ± 1.0 nS	7	17	27	37	47	57	67	77

Max delay tolerances ±2 nS or ±5% whichever is greater
All delays measured at 1.5V level on leading edge, no load (enable = "0"), at 25°C, 5.0Vdc

DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = II_K		-1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		10	mA
		V_{CC} = max. V_{IN} = 5.25V		15	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		15	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		45	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		90	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic

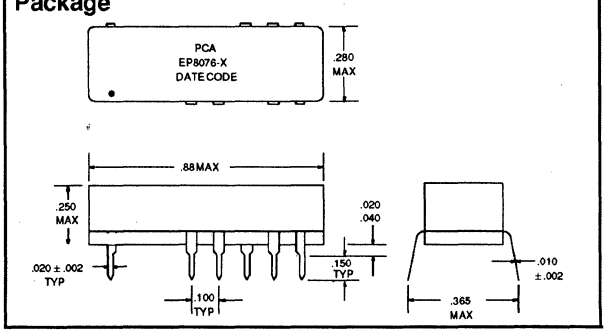


Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	100		%
d*	Duty Cycle		20	%
T_A	Operating Free-Air Temperature	0	+70	°C

These two values are inter-dependent.

Package



Input Pulse Test Conditions

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	150	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 500 nS	1.0	MHz
V_{CC}	Supply Voltage	5.0	Volts

EP8076 10/90

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14 Pin DIL 5 Tap High Speed CMOS (HCT) Compatible Active Delay Lines

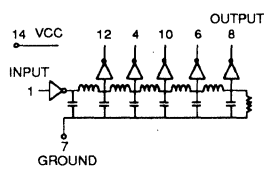
Tap Delays ±5% or ±2 nS				Total Delay ±5% or ±2 nS	Part Number
12*	17	22	27	32	EPA220-32
12*	18	24	30	36	EPA220-36
12*	19	26	33	40	EPA220-40
12*	20	28	36	44	EPA220-44
12*	21	30	39	48	EPA220-48
12*	22	32	42	52	EPA220-52
12*	24	36	48	60	EPA220-60
15	30	45	60	75	EPA220-75
19	38	57	76	95	EPA220-95

Tap Delays ±5% or ±2 nS				Total Delay ±5% or ±2 nS	Part Number
20	40	60	80	100	EPA220-100
25	50	75	100	125	EPA220-125
30	60	90	120	150	EPA220-150
35	70	105	140	175	EPA220-175
40	80	120	160	200	EPA220-200
50	100	150	200	250	EPA220-250
60	120	180	240	300	EPA220-300
70	140	210	280	350	EPA220-350

** Inherent Delay • Delay times referenced from input to leading edges ay 25°C, 5.0V.*

DC Electrical Characteristics Parameter		Test Conditions	Min	Max	Unit
V_{IH}	High Level Input Voltage	V_{CC}=4.5 to 5.5	2.0		Volt
V_{IL}	Low Level Input Voltage	V_{CC}=4.5 to 5.5		0.8	Volt
V_{OH}	High Level Output Voltage	V_{CC}=4.5V,I_O=-4.0mA@V_{IH} or V_{IL}	4.0		Volt
V_{OL}	Low Level Output Voltage	V_{CC}=4.5V,I_O= 4.0mA@V_{IH} or V_{IL}		0.3	Volt
I_L	Input Leakage Current	V_{CC}=5.5V @V_{IH} or V_{IL}		±1.0	uA
I_{CC}	Supply Current	V_{CC}=5.5V,V_{IN}=0		15	mA
T_{RO}	Output Rise Time	≤550 nS (.75 - 2.4 Volts)		4	nS
		>550 nS		5	nS
N_H	High Fanout	V_{CC}=5.5V,V_{OH}=4.0V	10	LSTTL Load	

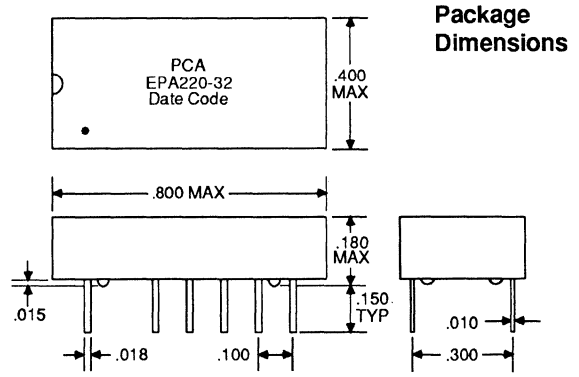
Schematic



Recommended Operating Conditions		Min	Max	Unit
V_{CC}	DC Supply Voltage	4.5	5.5	Volt
V_I	DC Input Voltage Range	0	V_{CC}	Volt
V_O	DC Output Voltage Range	0	V_{CC}	Volt
I_O	DC Output Source/Sink Current		25	mA
P_W*	Pulse Width % of Total Delay	40		%
D*	Duty Cycle		40	%
T_A	Operating Free Air Temperature	0	70	°C

**These two values are inter-dependent.*

Package Dimensions



Input Pulse Test Conditions @ 25°C (Taps Unloaded)		
E_{IN}	Pulse Input Voltage	3.2 Volts
P_W	Pulse Width % of Total Delay	150%
T_{RI}	Input Rise Time (0.75 - 2.4 Volts)	2.0 nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 200nS	1.0 MHz
	Pulse Repetition Rate @ Td > 200nS	300 KHz
V_{CC}	Supply Voltage	5.0 Volts

EPA220 10/90

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SEPULVEDA, CA 91343
TEL: (818) 892-0761
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8 Pin Single-in-Line Passive Delay Lines

Zo OHMS ±10%	DELAY NS MAX	DELAY TOL NS	RISE TIME NS MAX (Calculated)	DCR OHMS MAX	PCA PART NUMBER	Zo OHMS ±10%	DELAY NS MAX	DELAY TOL NS	RISE TIME NS MAX (Calculated)	DCR OHMS MAX	PCA PART NUMBER
100	0.0	+0.25	1.0	1.0	EP123101	100	9.0	±0.25	1.9	1.0	EP123119
100	0.5	±0.25	1.0	1.0	EP123102	100	9.5	±0.25	2.0	1.0	EP123120
100	1.0	±0.25	1.0	1.0	EP123103	100	10.0	±0.25	2.0	1.0	EP123121
100	1.5	±0.25	1.0	1.0	EP123104	100	11.0	±0.25	2.2	2.0	EP123123
100	2.0	±0.25	1.0	1.0	EP123105	100	12.0	±0.25	2.3	2.0	EP123125
100	2.5	±0.25	1.0	1.0	EP123106	100	13.0	±0.25	2.5	2.0	EP123127
100	3.0	±0.25	1.0	1.0	EP123107	100	14.0	±0.25	2.6	2.0	EP123129
100	3.5	±0.25	1.0	1.0	EP123108	100	15.0	±0.25	2.8	2.0	EP123131
100	4.0	±0.25	1.0	1.0	EP123109	100	16.0	±0.25	3.0	2.5	EP123133
100	4.5	±0.25	1.0	1.0	EP123110	100	17.0	±0.25	3.2	2.5	EP123135
100	5.0	±0.25	1.1	1.0	EP123111	100	18.0	±0.25	3.4	2.5	EP123137
100	5.5	±0.25	1.2	1.0	EP123112	100	19.0	±0.25	3.6	2.5	EP123139
100	6.0	±0.25	1.3	1.0	EP123113	100	20.0	±0.50	3.8	2.5	EP123141
100	6.5	±0.25	1.4	1.0	EP123114	100	25.0	±0.50	4.5	4.0	EP123146
100	7.0	±0.25	1.5	1.0	EP123115	100	30.0	±0.50	5.5	4.5	EP123151
100	7.5	±0.25	1.6	1.0	EP123116	100	35.0	±0.50	6.4	5.5	EP123156
100	8.0	±0.25	1.7	1.0	EP123117	100	40.0	±0.50	7.4	6.0	EP123161
100	8.5	±0.25	1.8	1.0	EP123118	100	45.0	±1.0	8.0	6.5	EPA594

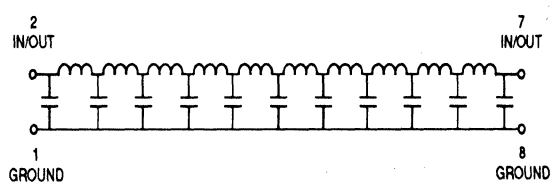
DC Electrical Characteristics	Min	Max	Unit
Distortion		±10	%
Temperature Coefficient of Delay		100	PPM/°C
Insulation Resistance @ 100 Vdc	1K		Meg Ohms
Dielectric Strength		100	Vdc

Recommended Operating Conditions		Min	Max	Unit
P_W*	Pulse Width % of Total Delay	200		%
D*	Duty Cycle		40	%
T_A	Operating Free Air Temperature	0	70	°C

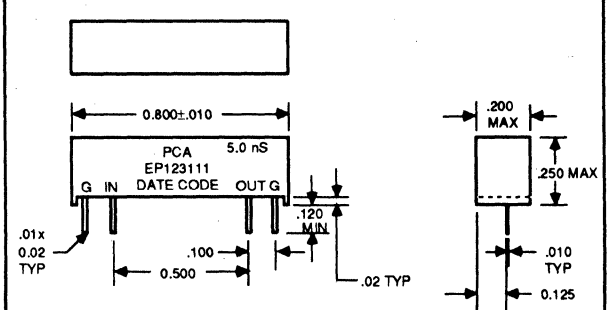
**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25°C		
V_{IN}	Pulse Input Voltage	10 Volts
P_W	Pulse Width % of Total Delay	300 %
T_{RI}	Input Rise Time (10 - 90%)	2.0 nS
P_{RR}	Pulse Repetition Rate	1.0 MHz

Schematic



Package Dimensions



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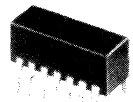
EP123101 7/88

RCD delay lines...the low cost of high quality. Now at prices starting below $1.00!

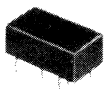
Active (Digital) Delay Lines–4nS to 2000nSec



Series A01–Single Delay
Designed to meet MIL-D-23859 utilizing a molded DIP case, in 8-pin or 14-pin package sizes, standard delay times range from 10nS to 500nS.



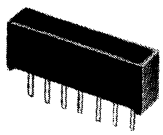
Series A03–Triple Delay
Features 3 isolated delays in a single 14-pin DIP package size, standard delay times range from 10nS to 100nS.



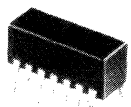
Series A1405 14-pin DIP, 5-Tap
Designed to meet MIL-D-23859, in encapsulated and molded versions. Wide range of delay times from 4nS to 1000nS.



Series A0805 8 pin DIP, 5-Tap
Miniature 5-tap delay line is available in a wide range of values from 4nS to 500nS.



Series SA0805 8 pin SIP, 5-Tap
Space-saving SIP package offers a range of delay times from 4nS to 250nS.



Series A1410 14-pin DIP, 10-Tap
Features 10 uniform taps in a 14-pin package, in a wide range of delay times from 5nS to 1000nS.

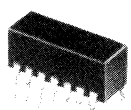
Passive (Analog) Delay Lines–0.1nS to 2000nSec



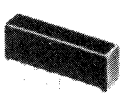
Series S01–Single Delay SIP
Lumped-constant design per MIL-D-23859 offers a delay range of 1nS to 10nS in a small 3-pin SIP. 100Ω impedance is standard, 50Ω & 200Ω available.



Series P01–Single Delay DIP
Available in standard 14-pin DIP package size (0.800″ long) or new ultra miniature 4-pin DIP (0.220″). Delay times range from 100pS to 100nS. Impedance values of 50Ω-500Ω.



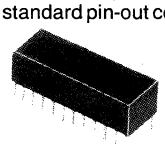
Series P1410 14-pin DIP, 10-Tap
Features 10 uniform taps in a 14-pin molded DIP (standard or low-profile). Values range from 10nS to 1000nS, impedances of 50Ω to 500Ω, and 4 standard pin-out configurations.



Series SP05 7-pin SIP, 5-Tap
Features 5 uniform taps in a molded 7-pin SIP case. Delay times range from 1nS to 100nS, in 50Ω and 100Ω impedance values.



Series SP10 14-pin SIP, 10-Tap
Designed to meet applicable portions of MIL-D-23859 in delay times ranging from 10nS to 250nS, impedance values of 50Ω to 200Ω.

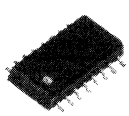


Series P2420 24-pin DIP, 20-Tap
Features 20 uniform taps in a standard 24-pin molded DIP package. Delay times range from 1nS to 1000nS, in 50Ω to 200Ω impedance values. 3 standard pin-out configurations.

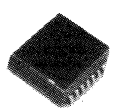
Surface Mount Delay Lines–0.1nS to 500nSec



SMP01 Chip, Single Delay Passive
Miniature delay line chip is the first of its kind in the industry, offering very small time adjustments in ECL circuits. Value range from 0.1nS to 1nS in 50Ω and 75Ω impedance values. Available on plastic Tape & Reel.



SMP1405 14-pin, 5-Tap, Passive
SMP1410 14-pin, 10-Tap, Passive
SMP1610 16-pin, 10-Tap, Passive
Feature small-outline molded package (.050″ pin spacing), from 1nS to 200nS, 50Ω to 200Ω in 3 standard pin-out configurations. Available on plastic Tape & Reel.

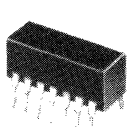


SMA0805 8-pin, 5-Tap, Active
SMA1405 14-pin, 5-Tap, Active
SMA1410 14-pin, 10-Tap, Active
SMA2805 PLCC, 5-Tap, Active
Feature small-outline and PLCC molded packages with .050″ pin spacing, from 2.5nS to 250nS. Available on plastic Tape & Reel.

Custom Delay Lines



Programmable



10K & 100K ECL

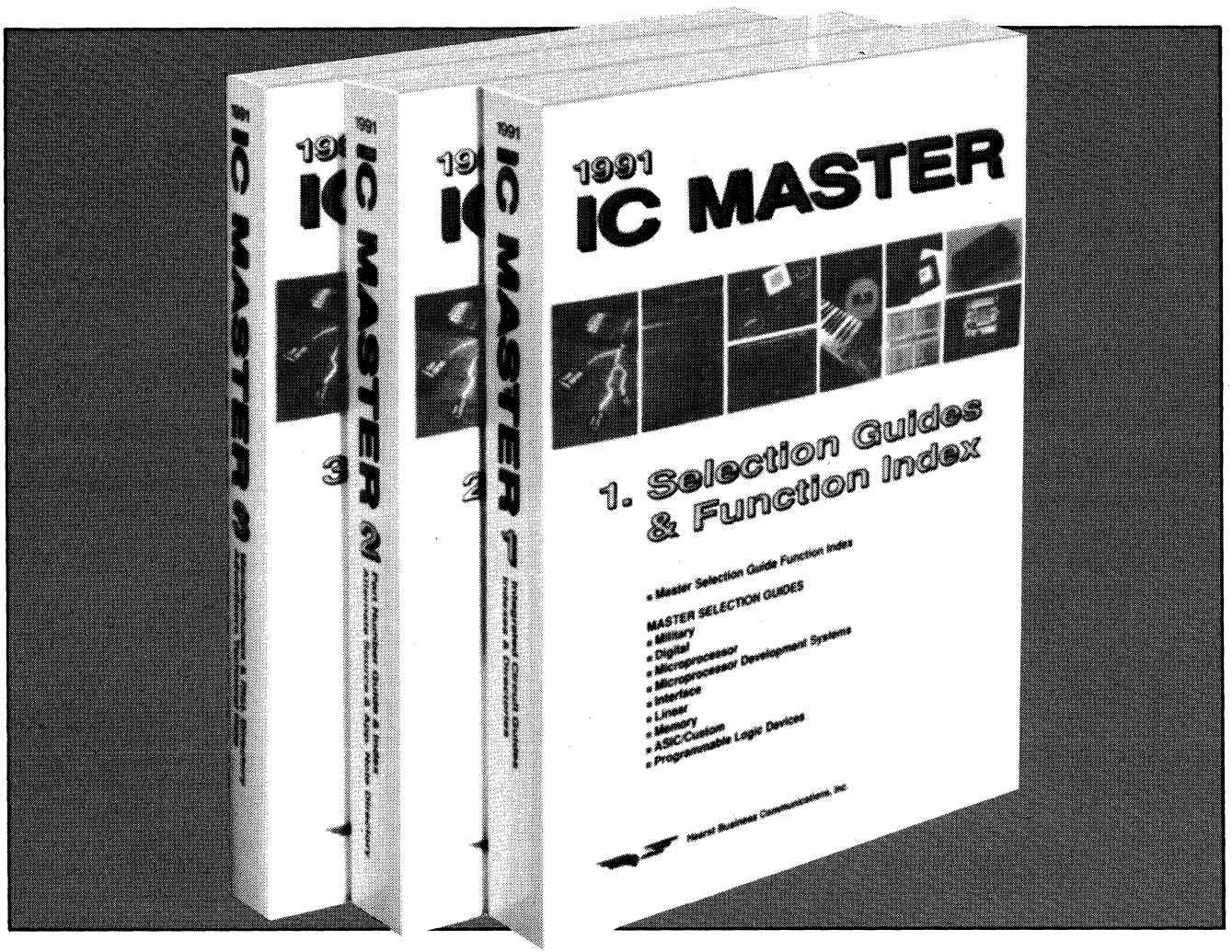


Hi-Speed CMOS

Refer to EEM section 1800 for RCD quality coils and inductors.
Refer to EEM section 4700 for RCD quality resistors and networks.

RCD COMPONENTS INC. *520 E. Industrial Park Dr., Manchester, N.H. 03103 USA TEL (603) 669-0054 FAX (603) 669-5455*

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Do we have good news for you! Get your hands on the latest annual copy of the IC Master. The Master will save you both time and money. Here's how.

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There's more! The Master has a section on microprocessor development tools with complete performance parameters. There's another section on programmable logic devices giving you everything from output configuration to PLD development systems.

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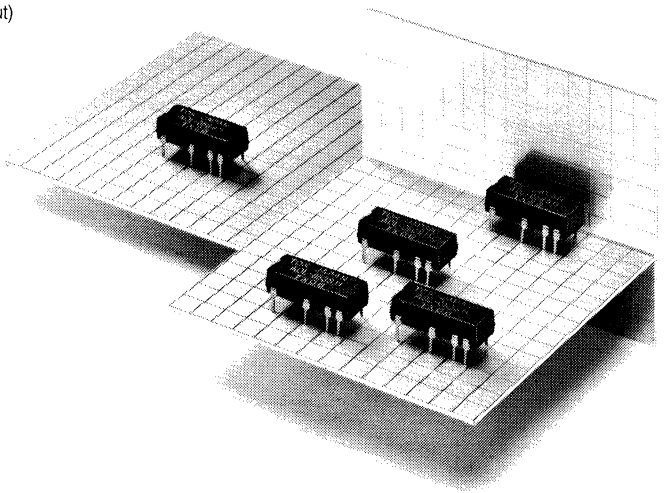
IC MASTER

ACTIVE DELAY LINES (ADL-H/EDL SERIES)

TDK CORPORATION OF AMERICA 1600 Feehanville Drive, Mount Prospect, IL 60056, U.S.A. Phone: 708-803-6100 **INDIANAPOLIS** Phone: 317-872-0370 **NEW YORK** Phone: 516-625-0151 **LOS ANGELES** Phone: 213-539-6631 **DETROIT** Phone: 313-462-1210 **NEW JERSEY** Phone: 201-736-0023 **BOSTON** Phone 508-624-4262 **HUNTSVILLE** Phone: 205-464-0222 **GREENSBORO** Phone: 919-292-0012 **DALLAS** Phone: 214-506-9800 **SAN FRANCISCO** Phone: 408-437-9585
GERMANY·FRANCE·ITALY·U.K.·KOREA·TAIWAN·HONGKONG·SINGAPORE·THAILAND·P.R. OF CHINA·BRAZIL TDK CORPORATION Tokyo, Japan

ACTIVE DELAY LINES (ADL-H/EDL SERIES)

TDK Active Delay Line ADL-H/EDL Series are 5-output (EDL: 2-output) lumped constant type delay lines with built-in TTL logic elements (Schottky type). In addition. TDK multilayer chip inductors are employed as inductance elements, and by combining these with multilayer chip capacitors, a compact, high reliability construction has been obtained.



Features

- Contained in DUAL-IN-LINE type package.
- Excellent quality due to transfer molding using high quality resin.
- A low height of only 5.08mm maximum is realized as a result of using TDK chip inductors and multi-layer chip capacitors.
- Since a TTL IC is built in, waveform shaping is not required.
- IC autoamtic insertion equipment can be used.
  Weight (ADL-H: 2g max., EDL: 1.5g max.)

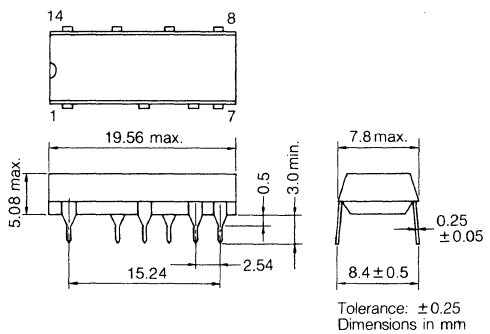
Maximum rating

Power supply voltage (Vcc) 7.0V
Input voltage (V_I) . . . . . −0.5 to +5.5V
Operating temperature (Ta) . . . . . 0 to +70°C
Storage temperature (Tstg.) . . . . . −55 to +125°C

Applications

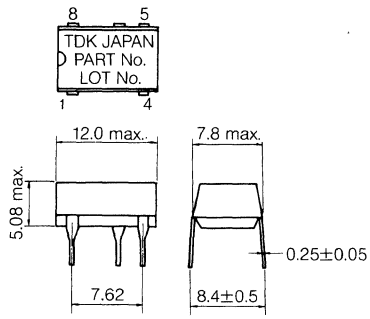
- D-RAM controllers
- Pulse width convertion
- Multiphase clock OSC.

ADL-H SERIES



Tolerance: ±0.25
Dimensions in mm

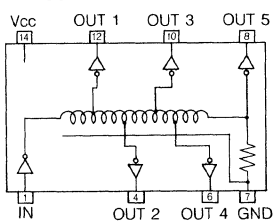
EDL SERIES



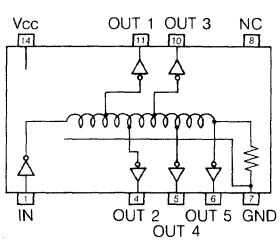
Tolerance: ±0.25
Dimensions in mm

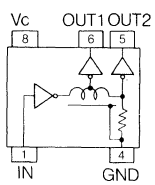
Connection and Pin Numbering

S Type



L Type





Part No.	Total delay time (ns) ±5%	Delay time between taps (ns) ±3ns	Rise time (ns) max.	Input pulse width (ns) min.
ADL-020□H	20±2ns	4±2ns	4	8
ADL-025□H	25±3ns	5±2ns	4	10
ADL-050□H	50±3ns	10±2ns	4	20
ADL-060□H	60±3ns	12	4	24
ADL-075□H	75	15	4	30
ADL-100□H	100	20	4	40
ADL-125□H	125	25	4	50
ADL-150□H	150	30	4	60
ADL-200□H	200	40	4	80
ADL-250□H	250	50	4	100

□: *S or L*

Part No.	Delay time between IN-OUT2 (ns)	Delay time between IN-OUT1 (ns)	Rise time (ns) max.
EDL-040B	40±4	20±3	4
EDL-050B	50±5	30±4	4
EDL-060B	60±5	30±4	4
EDL-070B	70±5	30±4	4
EDL-080B	80±5	30±4	4
EDL-090B	90±5	40±4	4
EDL-100B	100±6	40±4	4
EDL-110B	110±6	50±5	4
EDL-120B	120±7	60±6	4
EDL-150B	150±9	70±7	4

(VCC: 50±0.1V, Ta: 25±1°C, each tap no load)

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

Technitrol delay-module performance is widely known and highly regarded by both military and commercial users. Many models, such as the ultrastable STTLDL shown below, are unmatched in performance and reliability. Designed primarily for high-performance applications, the STTLDL has very high output stability over a wide range of temperature and input-voltage variations. Increasingly, the STTLDL is selected as a commercial prototype for brand-new designs — and then written in because of the superior performance it offers.

We invite you to consider the STTLDL as an example of Technitrol capability. Its technology is an integral part of all our delay modules.

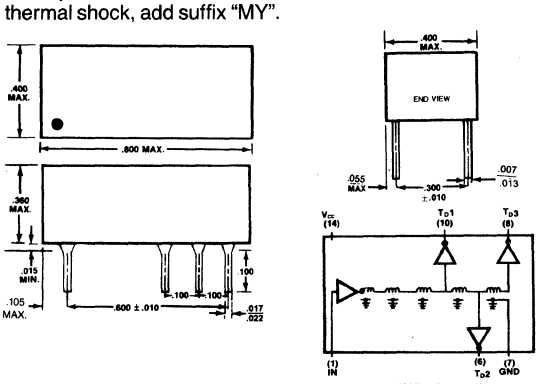
ULTRA-STABLE TTL DELAY MODULES

- Ultra stable. ±1 ns or ±1% delay variance over 0 to +70°C at 5V supply ±10%.
- 15 to 1000 ns delays available.
- Three-tap, lumped constant, active.
- For Schottky TTL, FAST, TTL, and low-power Schottky TTL circuits.
- Transfer-molded – reliable.
- Designed for leading edge timing. Trailing-edge timing available.
- 14-pin DIP package.
- For delay lines qualified to Mil-D-83532, see volume B.
- Military models with temperature range −55 to +125°C and ceramic package IC to meet Mil Std 883C but not screened to that specification, add Suffix "M" to part number.
- Military models as above, but with ceramic package IC screened to Mil Std 883C and 38510. Add suffix "MX" to part number.
- Military models as "MX" above, but with in-house burn-in and thermal shock, add suffix "MY".

Temperature coefficient at maximum delay	±1 ns or ±1%, WIG*
Operable input-supply-voltage variance from 5V rated	±10%

Part No.	NANOSECONDS T_{D1}	T_{D2}	T_{D3}	All Taps (Max.) T_R+	T_R-
STTLDL025	15.0	20.0	25.0	2.0	2.0
STTLDL050	30.0	40.0	50.0	2.0	2.0
STTLDL075	45.0	60.0	75.0	2.0	2.0
STTLDL100	60.0	80.0	100.0	2.0	2.0
STTLDL125	75.0	100.0	125.0	2.0	2.0
STTLDL150	90.0	120.0	150.0	2.0	5.0
STTLDL200	120.0	160.0	200.0	2.0	5.0
STTLDL250	150.0	200.0	250.0	2.0	5.0
STTLDL500	300.0	400.0	500.0	2.0	9.0

Delay characteristics measured at V_{CC} = 5.0 ±.01V, 25°C, no load, @ 1.5V level.
Delay tolerance ±1.5 ns or 5%, WIG.
Rise time measured @ 0.8V to 2.0V levels.
For minimum input pulse width–contact factory.



*Whichever is greater.

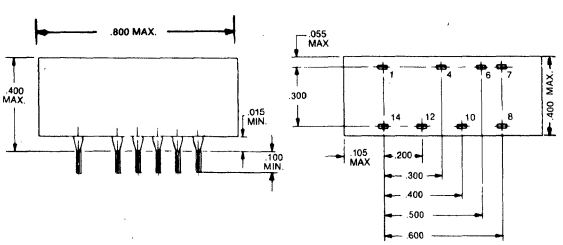
HIGH-PERFORMANCE TTL DELAY MODULES

- ±1.5 ns or ±5% delay tolerance (whichever is greater) @ 25°C.
- Five-tap, lumped constant, active.
- For Schottky TTL, FAST, TTL, and low-power Schottky TTL circuits.
- Transfer-molded – reliable.
- Designed for leading edge timing. Trailing-edge timing available.
- 14-pin DIP package.
- For delay lines qualified to Mil-D-83532, see volume B.
- Military models with temperature range −55 to +125°C and ceramic package IC to meet Mil Std 883C but not screened to that specification, add Suffix "M" to part number.
- Military models as above, but with ceramic package IC screened to Mil Std 883C and 38510. Add suffix "MX" to part number.
- Military models as "MX" above, but with in-house burn-in and thermal shock, add suffix "MY".
- Available in low profile, .250 inch high military series (MX) for delays up to 100ns.

Temperature coefficient at maximum delay	±2 ns or ±2%, WIG
Operable input-supply-voltage variance from 5V rated	±10%

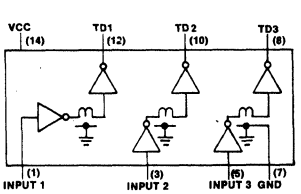
Part No.	NANOSECONDS T_{D1}	T_{D2}	T_{D3}	T_{D4}	T_{D5}	All Taps TR+	& TR−
TTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0 nsec.
TTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0 nsec.
TTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0 nsec.
TTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0 nsec.
TTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0 nsec.
TTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0 nsec.
TTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0 nsec.
TTLDL250	50.0	100.0	150.0	200.0	250.0	2.0	5.0 nsec.
TTLDL500	100.0	200.0	300.0	400.0	500.0	2.0	9.0 nsec.

Delay characteristics measured at V_{CC} = 5.0 ±.01V, 25°C, with 15 pf load per tap @ 1.5V level.
Delay tolerance ±1.5 ns or 5%, WIG.
Rise time measured @ 0.8V to 2.0V levels.
For minimum input pulse width–contact factory.

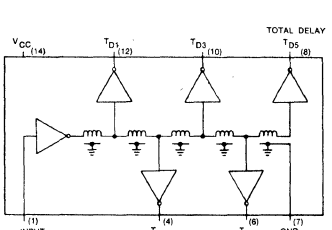


TRIPLE-OUTPUT DELAY MODULES

Technitrol TTL buffered delay modules are available with three individual inputs and outputs in delays from 5 to 250 ns per delay.



Lead material: electro tin plated (alloy 42)



CONNECTION DIAGRAM 5 TAP VERSION

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

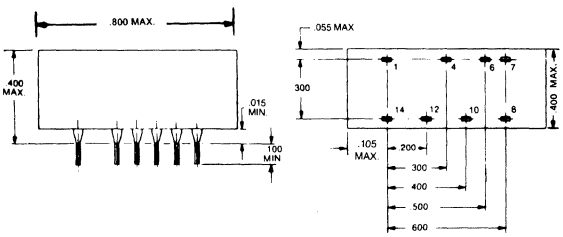
HIGH-PERFORMANCE FAST DELAY MODULES

- ±1.5 ns or ±5% delay tolerance (whichever is greater) @ 25°C.
- Temperature coefficient ±1ns or ±2% WIG. at max. delay, 0 to 70°C.
- Five-tap, lumped constant, active.
- For Schottky TTL, FAST, TTL, and low-power Schottky TTL circuits.
- Transfer-molded – reliable.
- 14-pin DIP package.
- For delay lines qualified to Mil-D-83532, see volume B.
- Designed for leading edge timing. Trailing-edge timing available.
- Military models with temperature range −55 to +125°C and ceramic package IC to meet Mil Std 883C but not screened to that specification, add Suffix "M" to part number.
- Military models as above, but with ceramic package IC screened to Mil Std 883C and 38510. Add suffix "MX" to part number.
- Military models as "MX" above, but with in-house burn-in and thermal shock, add suffix "MY".

Temperature coefficient at maximum delay	±1 ns or ±2%, WIG
Operable input-supply-voltage variance from 5V rated	±10%

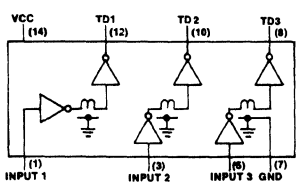
	NANOSECONDS					All Taps	
Part No.	T_D1	T_D2	T_D3	T_D4	T_D5	TR+	& TR−
FSTDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0 nsec.
FSTDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0 nsec.
FSTDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0 nsec.
FSTDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0 nsec.
FSTDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0 nsec.
FSTDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0 nsec.
FSTDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0 nsec.
FSTDL250	50.0	100.0	150.0	200.0	250.0	2.0	5.0 nsec.
FSTDL500	100.0	200.0	300.0	400.0	500.0	2.0	9.0 nsec.

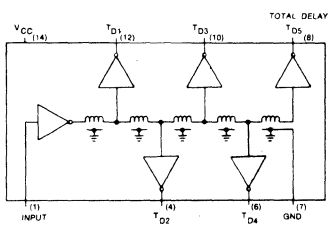
Delay characteristics measured at V_{CC} = 5.0 ±.01V, 25°C, with 15 pf load per tap @ 1.5V level.
Delay tolerance ±1.5 ns or 5%, WIG.
Rise time measured @ 0.8V to 2.0V levels.
For minimum input pulse width–contact factory.



TRIPLE-OUTPUT DELAY MODULES

Technitrol TTL buffered delay modules are available with three individual inputs and outputs in delays from 5 to 250 ns per delay.





CONNECTION DIAGRAM 5 TAP VERSION

TTL PROGRAMMABLE DELAY MODULES

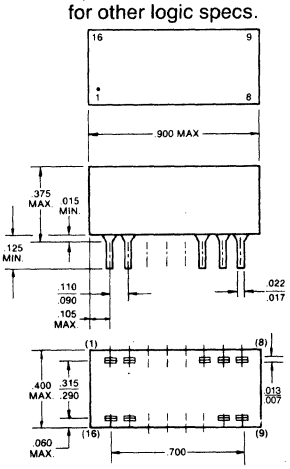
For delay adjustments via BCD programming. Simplifies minor adjustments and adds flexibility. Although indicated below that programmable modules are available up to 3-bit, 6-bit modules are available through a simple combination of modules.

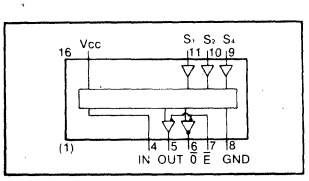
- 3-bit binary (1, 2, 4) programming gives 7 equal step delays.
- Low on $\bar{E}$ enables output.
- Available in standard step delays from 1 to 10 ns.
- Additional step delays from 15 to 50 ns available upon request.
- Designed for leading edge timing.
- Low inherent delay from:
  Input to output = 6.0 ± 1.5 ns.
  Input to output = 3.0 ± 1.5 ns.
  $\bar{E}$ to output = 10.0 ns Maximum
  Sn to output = 13.0 ns Maximum
- Military models with temperature range −55 to +125°C available.
- Specifications are for Schottky TTL Logic only, contact factory for other logic specs.

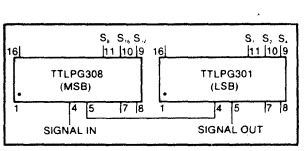
Technitrol Part No.	Step ns ±ns	Max. Delay ns ±ns	Output Rise Time (ns)
TTLPG301	1.0 ±.4	13.0 ±2.0	2.0
TTLPG302	2.0 ±.6	20.0 ±2.0	2.0
TTLPG303	3.0 ±1.0	27.0 ±2.0	2.0
TTLPG304	4.0 ±1.0	34.0 ±2.0	2.0
TTLPG305	5.0 ±1.5	41.0 ±2.0	2.0
TTLPG306	6.0 ±1.5	48.0 ±2.5	2.0
TTLPG307	7.0 ±1.5	55.0 ±2.5	2.0
TTLPG308	8.0 ±1.5	62.0 ±3.0	2.0
TTLPG309	9.0 ±1.5	69.0 ±3.5	2.0
TTLPG310	10.0 ±1.5	76.0 ±4.0	2.0

Delay characteristics @ V_{cc} = 5.0V and T_a = 25°C. no load.
Delay time measured at 1.5V level.
Rise time measured @ 0.8V to 2.0V levels.
For minimum input pulse width–contact factory.

Lead material: electro tin plated (alloy 42)







Example of a 6-bit cascade with 63 steps of 1.0 ns delay with an inherent (or reference) delay of 12.0 ns (2 × 6.0 ns).

See Volume B (military section), page **B**•1028 and **B**•1029 for information on Technitrol QPL delay lines. See this volume, pages **A**•1600, 1601, 1602, 1604, and 1605 for information on Technitrol surface-mount delay lines. Contact factory for delay line catalog No. 1001B or surface-mount delay line catalog No. 1002SM-A.

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

HIGH-PERFORMANCE SURFACE-MOUNT TTL DELAY MODULES

LOGICS SUPPORTED: • SCHOTTKY TTL • FAST • FACT

- Transfer-molded packaging – for highest reliability.
- Designed for leading edge timing. Trailing edge timing available.
- Compatible with Schottky TTL, FAST, FACT, TTL, ALS, AS and low-power Schottky TTL circuits.
- Pin compatible to 74/54 series 14 – PIN DIP.
- Military models with temperature range −55 to +125°C and ceramic package IC to meet Mil-Std-883C but not screened to that specification, add Suffix "M" to part number.
- Military models as above, but with ceramic package IC screened to Mil-Std-883C and 38510. Add suffix "MX" to part number.
- Military models as "MX" above, but with in-house burn-in and thermal shock, add suffix "MY".
- Fanout: Logic 1–20 loads; logic 0–10 loads.
- Temperature coefficient ± 2ns or ± 4% (whichever is greater) at maximum delay, 0 to 70°C.
- Designed for vapor phase reflow soldering, up to 217°C.

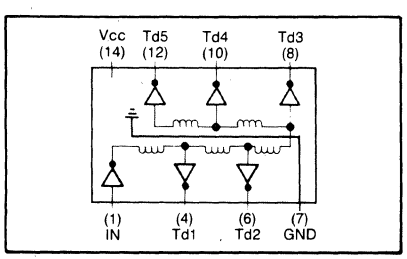
HIGH-PERFORMANCE 5-TAP TTL DELAY MODULES – 1/8″ HEIGHT

Part No.	NANOSECONDS					All Taps (Max.)	
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+	T_R-
GCTTLDL025AMX	5.0	10.0	15.0	20.0	25.0	2.0	2.0
GCTTLDL050AMX	10.0	20.0	30.0	40.0	50.0	2.0	2.0
GCTTLDL075AMX	15.0	30.0	45.0	60.0	75.0	2.0	2.0
GCTTLDL100AMX	20.0	40.0	60.0	80.0	100.0	2.0	5.0
GCTTLDL125AMX	25.0	50.0	75.0	100.0	125.0	2.0	6.0
GCTTLDL150AMX	30.0	60.0	90.0	120.0	150.0	2.0	7.0
GCTTLDL200AMX	40.0	80.0	120.0	160.0	200.0	2.0	8.0

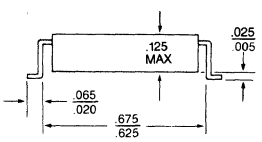
Delay Characteristics measured @ V_{CC} = 5.0V, 25°C no load, @1.5 volt level
Delay Tolerance ± 2ns or 5% (whichever is greater).
For minimum input pulse width–contact factory

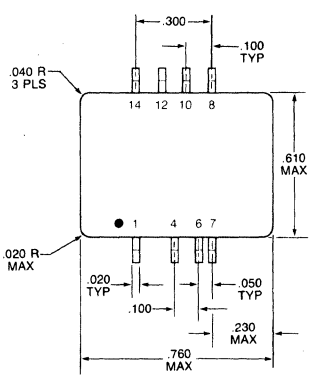
Ultra Thin Delay Module

SCHEMATIC AND PIN-OUT FOR GCTTLDLXXXAMX



GULL WING GCTTLDLXXXAMX





Lead material: electro tin plated (alloy 42)
Note: Pin numbers shown are for reference only and not necessarily marked on unit.

See Volume B (military section), pages **B**•1028 and **B**•1029 for information on Technitrol QPL delay lines.
Contact factory for delay line catalog No. 1001B or surface-mount delay line catalog No. 1002SM-A.

Technitrol

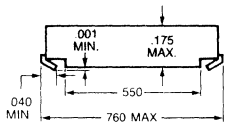
1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

HIGH-PERFORMANCE 5-TAP TTL DELAY MODULES — ¾″ SQ.

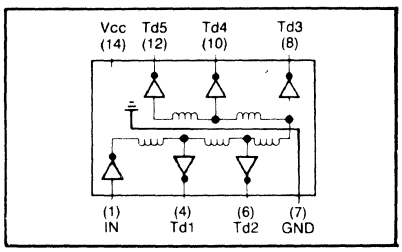
Part No.	NANOSECONDS					All Taps (Max.)	
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+	T_R-
CTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
CTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
CTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
CTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	5.0
CTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	5.0
CTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	6.0
CTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	7.0

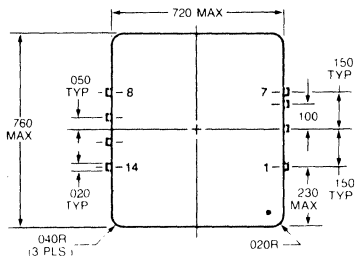
Delay Characteristics measured @ V_{CC} = 5.0V, 25°C no load, @1.5 volt level.
Delay Tolerance ± 2ns or 5% (whichever is greater).
For minimum input pulse width–contact factory.

C-LEAD CTTLDL



SCHEMATIC AND PIN-OUT FOR CTTLDL



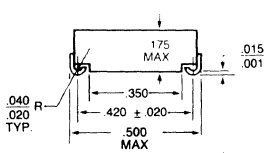


HIGH-PERFORMANCE 5-TAP TTL DELAY MODULES – ½″ SQ.

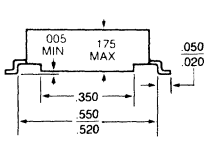
Part No.	Part No.	Part No.	NANOSECONDS					All Taps (Max.)	
			T_D1	T_D2	T_D3	T_D4	T_D5	T_R+	T_R-
BJTTLDL025	GBTTLDL025	BTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
BJTTLDL050	GBTTLDL050	BTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
BJTTLDL075	GBTTLDL075	BTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
BJTTLDL100	GBTTLDL100	BTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	5.0
BJTTLDL125	GBTTLDL125	BTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	6.0
BJTTLDL150	GBTTLDL150	BTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	7.0
BJTTLDL200	GBTTLDL200	BTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	8.0

Delay Characteristics measured @ V_{CC} = 5.0V, 25°C no load, @1.5 volt level.
Delay Tolerance ± 2ns or 5% (whichever is greater).
For minimum input pulse width–contact factory.

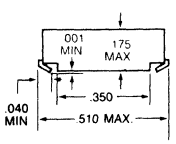
J-LEAD BJTTLDL

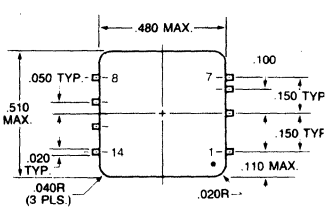


GULL WING GBTTLDL

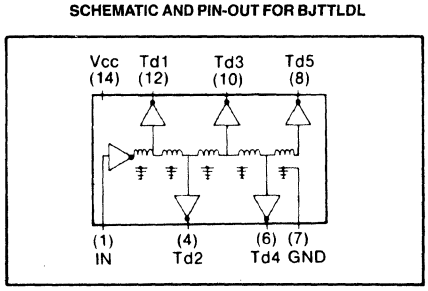


C-LEAD BTTLDL

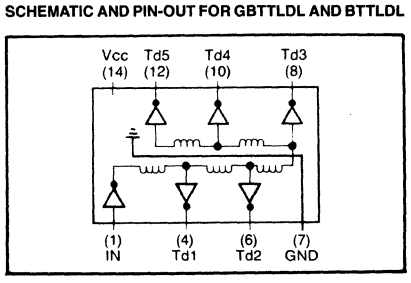




SCHEMATIC AND PIN-OUT FOR BJTTLDL



SCHEMATIC AND PIN-OUT FOR GBTTLDL AND BTTLDL



Lead material: electro tin plated (alloy 42) Note: Pin numbers shown are for reference only and not necessarily marked on unit.

See Volume B (military section), pages **B**•1028 and **B**•1029 for information on Technitrol QPL delay lines.
Contact factory for delay line catalog No. 1001B or surface-mount delay line catalog No. 1002SM-A.

Technitrol

1952 East Allegheny Avenue
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Telephone (215) 426-9105
FAX (215) 426-2836

SURFACE-MOUNT TTL PROGRAMMABLE DELAY MODULES

TTL PROGRAMMABLE DELAY MODULES — GULL WING

For delay adjustments via BCD programming. Simplifies minor adjustments and adds flexibility. Although indicated below that programmable modules are available up to 3-bit,

- Available in new .125" height package.
- 3-bit binary (1, 2, 4) programming gives 7 equal step delays.
- Low on $\overline{E}$ enables output.
- Complementary output available.
- Available in 11 step delays from 1 to 15 ns.
- Designed for leading edge timing.

Technitrol Part No.	Technitrol Part No.	Step ns ± ns	Max. Delay ns ± ns	Output Rise Time (ns)
GCTTLPG301AMX	GTTLPG301MX	1.0 ± .4	13.0 ± 2.0	2.0
GCTTLPG302AMX	GTTLPG302MX	2.0 ± .6	20.0 ± 2.0	2.0
GCTTLPG303AMX	GTTLPG303MX	3.0 ± 1.0	27.0 ± 2.0	2.0
GCTTLPG304AMX	GTTLPG304MX	4.0 ± 1.0	34.0 ± 2.0	2.0
GCTTLPG305AMX	GTTLPG305MX	5.0 ± 1.5	41.0 ± 2.0	2.0
GCTTLPG306AMX	GTTLPG306MX	6.0 ± 1.5	48.0 ± 2.5	2.0
GCTTLPG307AMX	GTTLPG307MX	7.0 ± 1.5	55.0 ± 2.5	2.0
GCTTLPG308AMX	GTTLPG308MX	8.0 ± 1.5	62.0 ± 3.0	2.0
GCTTLPG309AMX	GTTLPG309MX	9.0 ± 1.5	69.0 ± 3.5	2.0
GCTTLPG310AMX	GTTLPG310MX	10.0 ± 1.5	76.0 ± 4.0	2.0
GCTTLPG315AMX	GTTLPG315MX	15.0 ± 1.5	111.0 ± 5.0	2.0

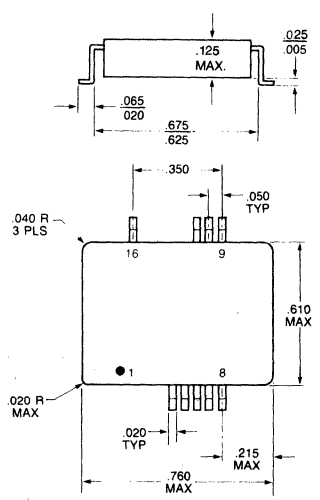
Delay characteristics @ V_{cc} = 5.0V and T_a = 25°C, no load.
Delay time measured at 1.5V level.
Rise time measured @ 0.8V to 2.0V levels.

Logics Supported • Schottky TTL • FAST • FACT

6-bit delay modules are available through a simple combination of cascaded modules.

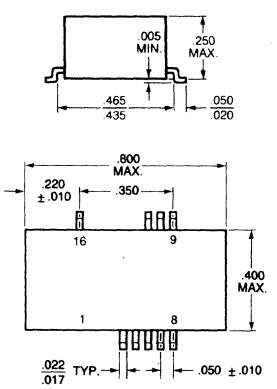
- Low inherent delay from:
  Input to output = 6.0 ± 1.5ns $\overline{E}$ to output = 10.0 ns Maximum
  Input to output = 3.0 ± 1.5ns Sn to output = 13.0 ns Maximum
- Transfer molded packaging — for highest reliability.
- MX suffix designates military models with temperature range —55° to +125°C and ceramic package IC screened to Mil-Std-883C and 38510.
- Military models as MX above, but with in-house burn-in and thermal shock, add suffix "MY" to part number.
- Designed for vapor phase relfow soldering, up to 217°C.
- Specifications are for Schottky TTL Logic only. Contact factory for other logic specs.

LOW PROFILE GULL WING GCTTLPGXXXAMX

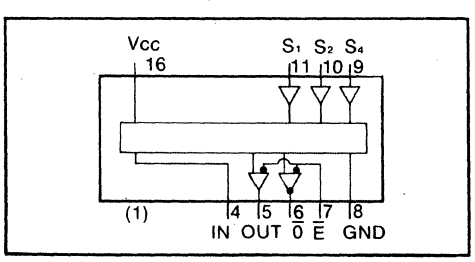




GULL WING GTTLPGXXXMX



SCHEMATIC AND PIN-OUT FOR GTTLPG AND GCTTLPG



Lead material: electro tin plated (alloy 42)
Note: Pin numbers shown are for reference only and not necessarily marked on unit.

See Volume B (military section), pages **B**•1028 and **B**•1029 for information on Technitrol QPL delay lines.
Contact factory for delay line catalog No. 1001B or surface-mount delay line catalog No. 1002SM-A.

Technitrol

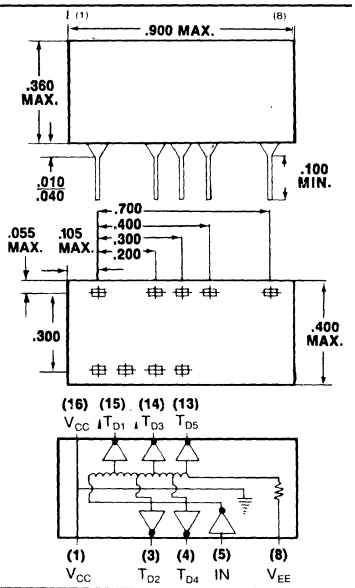
1952 EAST Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

10K ECL DELAY MODULES

Part No.	NANOSECONDS T_D1	T_D2	T_D3	T_D4	T_D5	All Taps (Max.) T_R+	& T_R−
ECLDL025	5	10	15	20	25	4	4
ECLDL050	10	20	30	40	50	4	4
ECLDL075	15	30	45	60	75	5	5
ECLDL100	20	40	60	80	100	6	6
ECLDL125	25	50	75	100	125	7	7
ECLDL150	30	60	90	120	150	7	7
ECLDL200	40	80	120	160	200	8	8
ECLDL250	50	100	150	200	250	10	10
ECLDL300	60	120	180	240	300	15	15
ECLDL350	70	140	210	280	350	15	15
ECLDL400	80	160	240	320	400	15	15
ECLDL450	90	180	270	350	450	20	20
ECLDL500	100	200	300	400	500	20	20

Delay characteristics measured at V_{ee} = −5.2V ±.01V, T_a = 25°C, no load.
*T_R = Measured form 20% to 80%. T_D measured at −1.3V level.
Delay tolerance ±1.5 ns or 5%, W.I.G.
For minimum input pulse width–contact factory.

- 5-tap line provides delays from 5 ns to 500 ns.
- 10k ECL buffered input and output in 16-pin transfer-molded DIP.
- Military models available.



ELECTRICAL CHARACTERISTICS

Over operating temperature range and Vee = −5.2 ±0.01V with 500 linear FPM air flow and all output terminals with 50Ω to −2.0 VDC.

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{EE}	Supply Current		−85	mA	
I_{IH}	Input Current HIGH		425	µA	V_{IH} = −0.810V
I_{IL}	Input Current LOW	.5		µA	V_{IL} = −1.850V
V_{OH}	Logic "1" Output Voltage	−1.060	−0.700	VDC	V_{IH} = −0.810
V_{OL}	Logic "0" Output Voltage	−1.890	−1.615	VDC	V_{IL} = −1.850

All specifications are subject to change without notice.

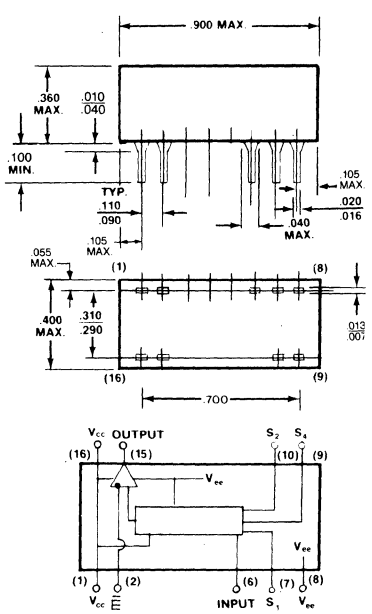
Recommended Operating Conditions	Min.	Typ.	Max.
Vee	−5.72	−5.2	−4.68
Operating temp. range With Airflow 500 LFPM	−30°C	25°C	80°C
Fan Out			85 ECL Loads

10K ECL PROGRAMMABLE DELAY MODULES

Technitrol Part No.	Step Delay ns ± ns	Max. Delay ns ± ns	Output Rise Time Max. (ns)
ECLPG301	1.0 ± 0.4	11.0 ± 1.5	3.6
ECLPG302	2.0 ± 0.6	17.0 ± 1.5	3.6
ECLPG303	3.0 ± 1.0	24.0 ± 1.5	3.6
ECLPG304	4.0 ± 1.0	31.0 ± 2.0	3.6
ECLPG305	5.0 ± 1.5	38.0 ± 2.0	3.6
ECLPG306	6.0 ± 1.5	45.0 ± 2.5	3.6
ECLPG307	7.0 ± 1.5	52.0 ± 2.5	3.6
ECLPG308	8.0 ± 1.5	59.0 ± 3.0	3.6
ECLPG309	9.0 ± 1.5	66.0 ± 3.5	3.6
ECLPG310	10.0 ± 1.5	73.0 ± 4.0	3.6

Delay characteristics measured at V_{ee} = −5.2V, ±.01V, T_a = 25°C, no load.
Rise time measured from 20% to 70%. T_d measured at −1.3V level.
For minimum input pulse width–contact factory

- 3-bit binary gives 7 equal step delays.
- Available in standard step delays from 1 ns to 10 ns.
- Additional step delays from 15 to 50 ns available upon request.
- Low inherent delay (T_o); T_o = 3.0 ±1.5 ns.
- Military models available.
- Input is internally terminated, therefore delay module driver does not require a pull down resistor.
- .250" high surface mount device or package available. Contact factory for details.



ELECTRICAL CHARACTERISTICS

Over operating temperature range and V_{ee} = −5.2 ±0.01V with 500 linear FPM air flow and all output terminals with 50Ω to −2.0 VDC.

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{EE}	Supply Current		−100	mA	
I_{IH}	Input Current HIGH		13.5	mA	V_{IH} = −0.700V
I_{IL}	Input Current LOW		2.0	mA	V_{IL} = −1.850V
V_{OH}	Logic "1" Output Voltage	−1.060	−0.700	VDC	V_{IH} = −0.810
V_{OL}	Logic "0" Output Voltage	−1.890	−1.615	VDC	V_{IL} = −1.850

All specifications subject to change without notice.

Lead material: electro tin plated (alloy 42)

See Volume B (military section), page **B**•1028 and **B**•1029 for information on Technitrol QPL delay lines. See this volume, pages **A**•1600, 1601, 1602, 1604, and 1605 for information on Technitrol surface-mount delay lines. Contact factory for del line catalog No. 1001B or surface-mount delay line catalog N 1002SM-A.

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

PASSIVE DELAY LINES

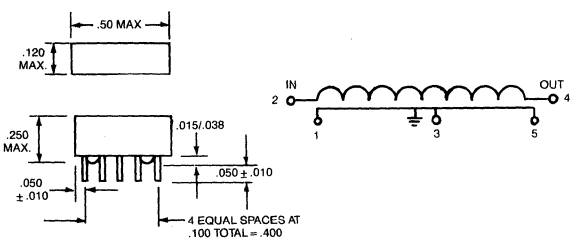
GENERAL SPECIFICATIONS FOR THROUGH-HOLE MOUNT AND SURFACE MOUNT PASSIVE DELAY LINES

- Temperature coefficient: 100 ppm/°C, maximum.
- Standard impedance 100 ohms. Also available in 50 and 200 ohms. Others available.
- For delay lines qualified to Mil-D-83531, see volume B.
- Insulation resistance: 10k meg. ohms.
- Military temperature range: −55 to +125°C.
- Lead material: alloy 42, bright tin plate.
- Some models available with delays of less than one ns, contact factory.
- Minimum pulse width 2.5 × output rise time.
- To compensate for the low expansion coefficient of ceramic-substrate thick-film hybrids, contact the factory about our GCF10·2 delay line series.
- Surface mount delay lines designed for vapor phase reflow soldering.

½" PICO-SECOND DELAY LINE

Part Number	Delay Time (ps)	Rise Time (ps) Max.	Delay Tolerance ± (ps)
PB010A	100	150	25
PB020A	200	150	25
PB030A	300	150	25
PB040A	400	150	25
PB050A	500	250	25

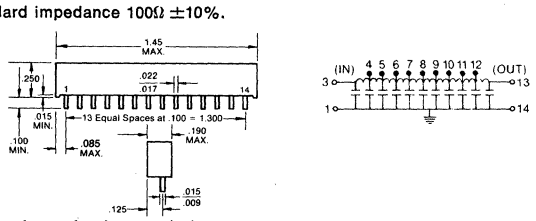
For delay values ranging from 600ps to 3000 ps–contact factory.
Test Conditions: Input Pulse Time of 40 ps max. Pulse width of 10 ns min.



10-TAP PASSIVE DELAY LINE (SIP)

Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	DCR (Ohms Max.)
SF10D1[2]	10	1.0	2.0	1.0
SF10F1[2]	20	2.0	4.0	1.0
SF10G1[2]	25	2.5	5.0	1.0
SF10K1	50	5.0	10.0	1.5
SF10M1	100	10.0	20.0	3.2
SF10P1	200	20.0	40.0	4.1
SF10Q1	250	25.0	50.0	5.0
SF10R1	500	50.0	100.0	7.5
SF10S1	1000	100.0	200.0	10.0

)elay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.
:tandard impedance 100Ω ±10%.



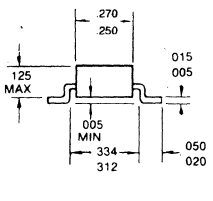
:ontact factory for pin-out and tolerances.
:ontact factory for tolerances.

10-TAP PASSIVE DELAY LINE (DIP)

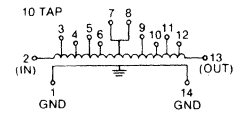
Part No.	Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	Impedance (Ohms) ±10%	DCR (Ohms (Max.)
GLF10D1[1]	LF10D1[1]	10	1.0	2.2	100	1.0
GLF10E1[1]	LF10E1[1]	12.5	1.2	2.5	100	1.0
GLF10F1[1]	LF10F1[1]	20	2.0	4.0	100	1.5
GLF10G1[2]	LF10G1[2]	25	2.5	5.0	100	1.5
GLF10K1	LF10K1	50	5.0	10.0	100	2.5
GLF10M1	LF10M1	100	10.0	20.0	100	5.0
GLF10Q1	LF10P1	200	20.0	40.0	100	11.5

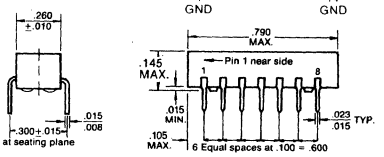
Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.

GLF10-1 GULL-WING



LF10 Series



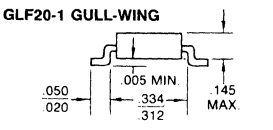


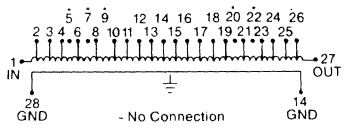
20-TAP PASSIVE DELAY LINE (DIP)

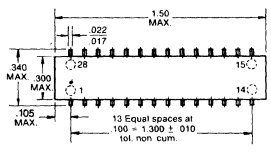
Part No.	Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	Impedance (Ohms) ±10%	DCR (Ohms (Max.)
GLF20D1[1]	LF20D1[1]	10	0.50	1.5	100	2.0
GLF20F1[1]	LF20F1[1]	20	1.0	2.7	100	3.0
GLF20G1[2]	LF20G1[1]	25	1.25	3.3	100	3.0
GLF20K1	LF20K1	50	2.50	6.4	100	5.0
GLF20M1	LF20M1	100	5.0	13.0	100	5.0
GLF20Q1	LF20Q1	200	10.0	25.0	100	10.0

Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.

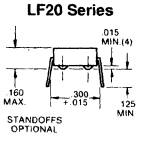
GLF20-1 GULL-WING







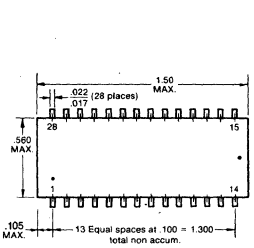
LF20 Series

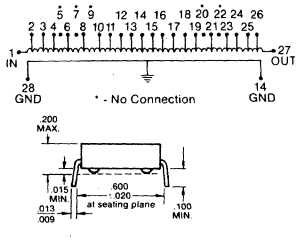


UP-TO-2μS 20-TAP PASSIVE DELAY LINE (DIP)

Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	Impedance (Ohms) ±10%	DCR (Ohms (Max.)
LF20Q2	200.0	10.0	25.0	100	5.0
LF20S2	300.0	15.0	38.0	100	5.0
LF20U2	400.0	20.0	50.0	100	5.0
LF20W2	500.0	25.0	63.0	100	8.0
LF20X2	600.0	30.0	75.0	100	10.0
LF20Y2	1000.0	50.0	125.0	100	16.0
LF20Z2	2000.0	100.0	250.0	100	20.0

Delay tolerance ±1.5 ns or 5% W.I.G. Measured from 50% to 50%.





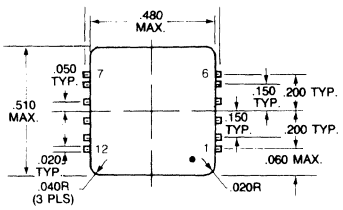
ee Volume B (military section), page **B**•1028 and **B**•1029 for formation on Technitrol QPL delay lines. See this volume, ages **A**•1600, 1601, 1602, 1604, and 1605 for information on Technitrol surface-mount delay lines. Contact factory for delay line catalog No. 1001B or surface-mount delay line catalog No. 1002SM-A..

Technitrol

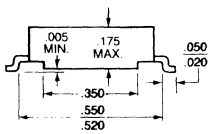
1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

PASSIVE SURFACE-MOUNT DELAY LINES

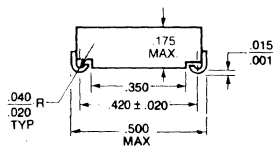
10-TAP CHIP-CARRIER PASSIVE DELAY LINE — ½"



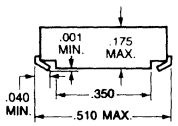
GBF10 GULL-WING



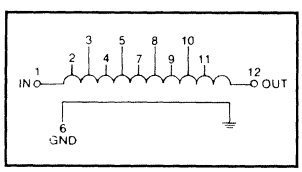
BJF10 J-LEAD



BF10 C-LEAD



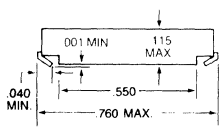
Part No.	Part No.	Part No.	Total Delay T_D (ns)	Tap Delay (ns)	Rise Time T_R (ns)	DCR (Ohms Max.)
BJF10D1[1]	GBF10D1[1]	BF10D1[1]	10.0	1.0	2.2	1.0
BJF10F1[2]	GBF10F1[2]	BF10F1[2]	20.0	2.0	4.0	2.0
BJF10G1[2]	GBF10G1[2]	BF10G1[2]	25.0	2.5	5.0	3.0
BJF10K1	GBF10K1	BF10K1	50.0	5.0	10.0	5.0
BJF10L1	GBF10L1	BF10L1	75.0	7.5	15.0	6.5
BJF10M1	GBF10M1	BF10M1	100.0	10.0	20.0	8.0

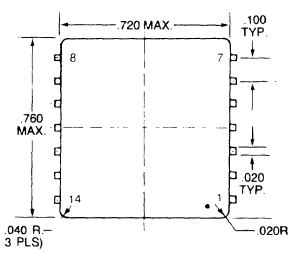


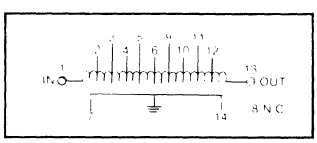
Delay tolerance ± 1.5 ns or 5% W.I.G. Measured from 50% to 50%.
Standard impedance 100Ω ± 10%.

10-TAP CHIP-CARRIER PASSIVE DELAY LINE — ¾"

CF10__1 C-LEAD





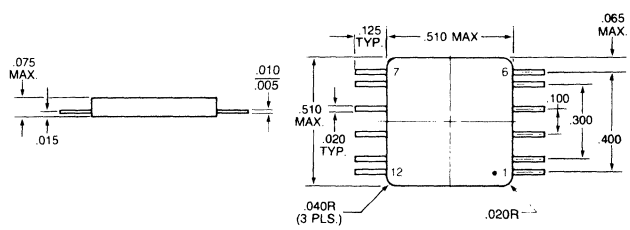


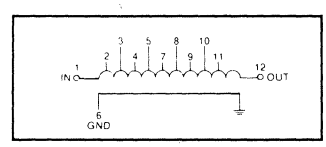
Part No.	Total Delay T_D (ns)	Tap Delay (ns)	Rise Time T_R (ns)	DCR (Ohms Max.)
CF10D1[1]	10.0	1.0	2.2	1.0
CF10F1[1]	20.0	2.0	4.0	2.0
CF10G1[2]	25.0	2.5	5.0	3.0
CF10K1	50.0	5.0	10.0	5.0
CF10M1	100.0	10.0	20.0	8.0
CF10N1	125.0	12.5	25.0	9.0
CF10P1	150.0	15.0	30.0	10.0
CF10Q1	200.0	20.0	40.0	12.0

Delay tolerance ± 1.5 ns or 5% W.I.G. Measured from 50% to 50%. Standard impedance 100Ω ± 10%.

10-TAP ULTRA-THIN PASSIVE DELAY LINE

BF10 FLAT PACK





Part No.	Total Delay T_D (ns)	Tap Delay (ns)	Rise Time T_R (ns)	DCR (Ohms Max.)
BF10D2[1]	10.0	1.0	2.2	1.0
BF10F2[2]	20.0	2.0	4.0	2.0
BF10G2[2]	25.0	2.5	5.0	3.0
BF10K2	50.0	5.0	10.0	5.0
BF10L2	75.0	7.5	15.0	6.5

Delay tolerance ± 1.5 ns or 5% W.I.G. Measured from 50% to 50%.
Standard impedance 100Ω ± 10%.
[1]Contact factory for pin-out and tolerances.
[2]Contact factory for tolerance.

Lead material: electro tin plated (alloy 42)
Note: Pin numbers shown are for reference only and not necessarily marked on unit.

The following note applies to the Surface Mount Delay Lines listed on pages 1620, 21, 23, 24, 26. Designed for vapor phase reflow soldering up to 217°C

See Volume B (military section), pages **B**•1028 and **B**•1029 for information on Technitrol QPL delay lines.
Contact factory for delay line catalog No. 1001B or surface-mount delay line catalog No. 1002SM-A.

VALOR SILICON DELAY LINES

FEATURES

- **Monolithic, all Silicon Time Delay**
- Quality Standard ≤ 100 ppm
- CMOS, 1.5 Micron Technology
- Auto Insert or Surface Mount Available
- Stable Performance Characteristics over Temperature (Tc ≤ 500 ppm)
- Industry Standard Packages and Pinouts
- Reliability: 100 FIT MAX

ELECTRICAL SPECIFICATIONS AND RATINGS (Guaranteed: 0°C to 70°C)

Duty Cycle	20%–80%
Rise Time	2.0 nSec MAX
Loading	10 TTL Loads MAX
Operating Temperature	0°C to 70°C
Supply Current	30 mA MAX
Storage Temperature	–55°C to 125°C
Operating Frequency	1–20 MHz
Tap to Tap Tolerance	±2.0 nSec
Input to Tap Tolerance	±2.0 nSec
Leading Edge/Trailing Edge	3.0 nSec MAX

TEST CONDITIONS

Amplitude	3.2 V +/– 0.1V
Rise Time*	2.0 nSec MAX
Input Pulse Width	110 nSec MIN
Input Period	440 nSec
Vcc	5V +/–0.1V

* Rise time is measured between 0.75V and 2.4V levels and delays are measured at 1.5V levels of a positive and negative going transition using 1M Ohm (3pf MAX) probes and an interval counter with a resolution of <1.0 pS.

VALOR ADVANTAGES

The VALOR Silicon based, IC Delay Lines have many advantages over traditional hybrid delay lines and other IC based delay lines.

- Stable, consistent performance over temperature.
- 20% to 80% duty cycle, better than hybrid delay lines.
- VERY LOW power consumption. 165 mW worst case.
- High reliability, 1.5 micron CMOS monolithic design.
- Low cost solutions for your timing requirements.

OTHER VALOR DELAY LINES

- 5 and 10 TAP hybrid designs in SIL packages.
- Single and Dual Output 14 PIN designs.
- 3 in 1 digital delay modules.
- Programmable delay modules.
- Passive delay lines in DIP and SIL packages.

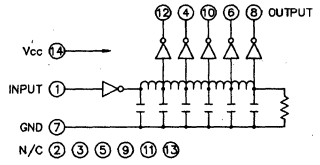
OTHER VALOR PRODUCTS

- Data communications transformers
- Local area networking filters
- DC/DC Converters for telecommunications

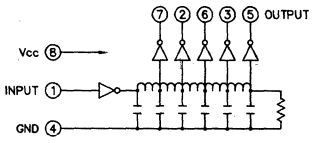
ABOUT VALOR ELECTRONICS

Valor Electronics, Inc. was founded in 1983. The corporate headquarters is located in San Diego, California. Since its founding, Valor has grown into a worldwide supplier of delay lines and magnetic based interface components for the Data Communications and Computer Markets. Valor maintains engineering design staffs in the United States and Hong Kong, with regional sales offices in San Diego, Redwood City (CA), München (FRG) and Hong Kong. Valor has 7 manufacturing locations and over 2,000 employees worldwide with a vast network of manufacturers' representatives and stocking distributors.

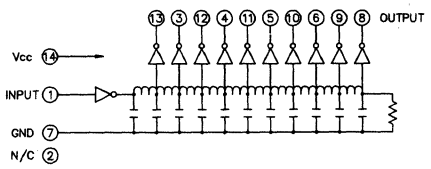
CONFIGURATIONS (DIP and GULLWING)



5 TAP/14 PIN

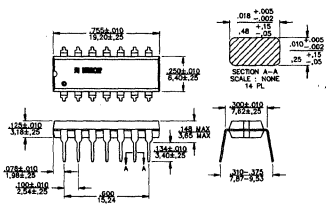


5 TAP/8 PIN

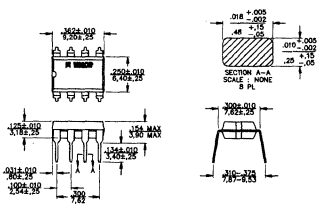


10 TAP/14 PIN

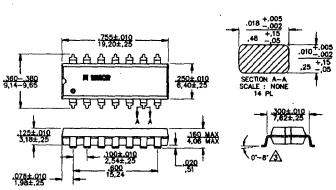
PACKAGES



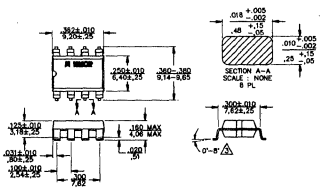
14 PIN DIP



8 PIN DIP



14 PIN GULLWING



8 PIN GULLWING

5 TAP

Total Delay (ns)	Delay/ TAP (ns)	Part Numbers			
		14 PIN DIP	14 PIN GLW	8 PIN DIP	8 PIN GLW
25	5	DL9074	SG9074	DL9041	SG9041
50	10	DL9079	SG9079	DL9046	SG9046
100	20	DL9083	SG9083	DL9050	SG9050
150	30	DL9085	SG9085	DL9052	SG9052
200	40	DL9087	SG9087	DL9054	SG9054

10 TAP

Total Delay (ns)	Delay/ TAP (ns)	Part Numbers	
		14 PIN DIP	14 PIN GLW
50	5	DL9026	SG9026
100	10	DL9031	SG9031
200	20	DL9035	SG9035

VALOR
Valor Electronics, Inc. 6275 Nancy Ridge Drive, San Diego, CA 92121-2245 TEL: (619) 458-1471 FAX: (619) 458-0875

VALOR EUROPE
Valor Electronics GmbH Gruenwalder Str. 14, 8000 München 90, Federal Republic of Germany TEL: 49-89-6923122 FAX: 49-89-6926542

VALOR ASIA
Valor East Electronics Flat B, 7/F.K.K. Industrial Bldg. 5, Mok Cheong St., Tokwawan Kowloon, Hong Kong TEL: 852-3330127 FAX: 852-3-636206

DELAY LINES

3-IN-1 DIGITAL DELAY MODULES

3 independent logic buffered delays for multiple source requirements

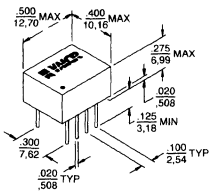
Features

- 3 independent logic buffered delays
- 8 or 14 pin package
- TTL compatible
- Minimum pulse width: 40% of total delay

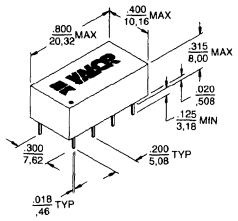
Supply Current

- High level output: 40 mA MAX
- Low level output: 100 mA MAX

Packages



8-PIN



14-PIN

Electrical Specifications (25°C and Vcc = 5.0V)

Delay Per[2,3] Output (ns)	Rise Time[4] (ns Max.)	14 Pin DIL	8 Pin DIL
5	3	DL2357	DL3200
10	3	DL2358	DL3201
12	3	DL2425	DL3202
15	3	DL2441	DL3203
20	3	DL2229	DL3204
25	3	DL2445	DL3205
30	3	DL2352	DL3206
40	3	DL2353	DL3207
45	3	DL2454	DL3208
50	3	DL2230	DL3209
60	3	DL2328	DL3210
65	3	DL2325	DL3211
70	3	DL2354	DL3212
75	3	DL2442	DL3213
80	3	DL2355	DL3214
90	3	DL2356	DL3215
100	3	DL2231	DL3216
125	4	DL2359	—
134	4	DL2455	—
150	4	DL2452	—
175	4	DL2451	—
200	4	DL2349	—

NOTES: (1) Catalog information subject to change without notice.
(2) Delays measured at 1.5 V levels of positive going edge.
(3) Tolerance of 10% or 2 ns, whichever is greater.
(4) Rise time measured from .75 to 2.4 V levels.

DIP SERIES PASSIVE DELAY LINES

Designed to match specific line impedances

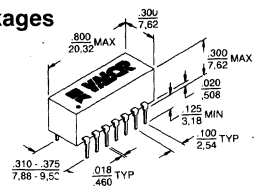
Features

- ECL and TTL compatible
- 10 equally spaced taps
- Maximum distortion of 10%
- 50 and 100 ohm impedance available
- Designed to meet MIL-D-23859

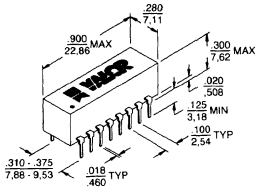
Electrical Characteristics

- Rise Time = 20% T_D MAX (Typ)
- Dielectric withstanding voltage: 100 VDC @ 50 mA, 5 sec MIN.
- Insulation resistance: 10,000 Mohm MIN @ 50 VDC

Packages



14-PIN



16-PIN

Electrical Specifications (25°C)

Total Delay (ns±5%)	Tap Delay (ns)	Char.[2] Impedance (ohms)	Rise Time[3] (ns MAX)	Attn. % (MAX)	14 Pin DIP	16 Pin DIP
10	1.0±0.25	50	3.0	1	DL1717	—
20	2.0±0.5	50	4.5	2	DL1721	—
50	5.0±1.0	50	8.5	4	DL1619	—
100	10.0±2.0	50	20.0	10	DL3328	—
150	15.0±2.0	50	30.0	10	DL3329	—
200	20.0±2.0	50	40.0	15	DL3330	—
250	25.0±2.5	50	50.0	20	DL3331	—
10	1.0±0.25	100	3.5	1	DL1706	—
20	2.0±0.5	100	4.5	2	DL1715	DL2035
25	2.5±0.5	100	5.0	2	DL1707	DL2036
50	5.0±1.0	100	7.5	2	DL1708	DL2037
50	5.0±1.0	100	8.5	2	DL1598	DL2038
75	7.5±1.5	100	12.5	4	DL1720	DL2039
80	8.0±2.0	100	13.0	4	—	DL2040
90	9.0±2.0	100	15.0	5	—	DL2041
100	10.0±2.0	100	17.0	5	DL1597	DL2042
100	10.0±2.0	100	15.0	5	DL1716	—
125	12.5±2.0	100	21.0	5	DL1709	DL2043
150	15.0±2.0	100	25.0	5	DL1704	DL2044
200	20.0±3.0	100	40.0	10	DL1703	DL2045
250	30.0±3.0	100	34.0	10	DL1611	DL2046

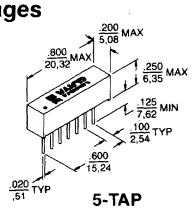
NOTES: (1) Catalog information subject to change without notice.
(2) Tolerance ±10% of characteristic impedance.
(3) Rise time measured from 10% to 90% of the leading edge.

SIL PASSIVE DELAY LINES

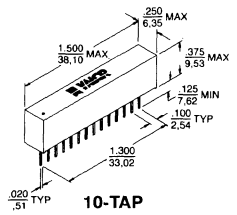
Features

- 5 and 10 taps available
- Characteristic impedance of 100 ohms[2]
- Maximum distortion of 10%
- Temperature coefficient of 100 PPM/°C
- Insulation resistance: 10,000 Mohm MIN at 50 VDC
- Dielectric withstanding voltage: 100 VDC MAX at 50 mA, 5 sec MIN

Packages



5-TAP



10-TAP

Electrical Specifications (25°C)

5 TAP					10 TAP				
Total Delay (ns±5%)	Tap Delay (ns)	Rise Time[3] (ns MAX)	Atten-uation (% MAX)	Part[4] Number	Total Delay (ns±5%)	Tap Delay (ns)	Rise Time[3] (ns MAX)	Atten-uation (% MAX)	Part[4] Number
5	1.0±0.3	2.0	2	DL2261	10	1.0±0.3	3.0	2	DL2250
10	2.0±0.4	3.3	2	DL2262	20	2.0±0.5	5.0	2	DL2251
20	4.0±0.6	6.0	2	DL2263	25	2.5±0.75	5.0	2	DL2252
25	5.0±1.0	8.0	3	DL3165	30	3.0±1.0	6.5	2	DL2253
30	6.0±1.0	9.0	3	DL2264	40	4.0±1.0	8.0	3	DL2254
40	8.0±1.0	12	3	DL2265	50	5.0±1.0	10	4	DL2255
50	10.0±1.8	15	5	DL2266	60	6.0±1.0	12	4	DL2173
60	12.0±2.0	19	5	DL3166	70	7.0±1.0	15	5	DL2256
70	14.0±2.0	23	5	DL3167	75	7.5±1.0	15	6	DL2257
75	15.0±2.0	24	5	DL3168	80	8.0±2.0	16	6	DL2258
80	16.0±2.0	26	5	DL3169	90	9.0±2.0	18	7	DL2259
90	18.0±2.0	29	5	DL3170	100	10.0±2.0	19	8	DL2260
100	20.0±2.0	31	5	DL3171	100	10.0±2.0	19	8	DL2249
120	24.0±2.4	38	5	DL3172	120	12.0±2.0	22	8	DL2249

NOTES: (1) Catalog information subject to change without notice.
(2) Tolerance ± 10% of characteristic impedance.
(3) Rise time measured from 10% to 90% of the leading edge.
(4) Pins are centered on the packages.

VALOR
Valor Electronics, Inc. 6275 Nancy Ridge Drive, San Diego, CA 92121-2245 TEL: (619) 458-1471 FAX: (619) 458-0875

VALOR EUROPE
Valor Electronics GmbH Gruenwalder Str. 14, 8000 München 90, Federal Republic of Germany TEL: 49-89-6923122 FAX: 49-89-6926542

VALOR ASIA
Valor East Electronics Flat B, 7/F.K.K. Industrial Bldg. 5, Mok Cheong St., Tokwawan Kowloon, Hong Kong TEL: 852-3330127 FAX: 852-3-636206

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-	NA	S	2.1	685	1.8	200	[h]
temperature	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

POWER LINE FILTERS

Manufacturer	Starting EEM Page No.	EMI		RFI		Modules											International Adapters	Approvals
								Features										
		AC	DC	AC	DC	Power Entry	International	Power Switch	Fuse Holder	Voltage Selector	Dual Mode	PC Mount	Surface Mount	Cord Conn.	Lighted	Custom		
Aerovox	A•1618	√	√	√	√	√	√	√	√	√	√	√			√	√		UL, CSA, VDE, TUV
Corcom Inc.	A•1609	√		√		√	√	√	√	√	√							UL, CSA, VDE, SEV,
Delta Products	A•1612	√				√	√	√	√	√	√	√		√				UL, CSA, VDE, TUV, SEV
Eichhoff Electronics Inc.	A•1614	√	√			√	√	√	√	√		√				√		UL, CSA, VDE
Elpac	A•1619	√	√	√	√													Custom Configurations
Filter Concepts, Inc.	A•1620	√	√	√	√		√							√		√		UL, CSA, TUV, MIL STD 461
Genisco	A•1624	√	√	√	√													UL
JMK Filters	A•1626	√	√	√	√		√	√	√			√		√		√		UL, CSA, VDE, TUV MIL STD 461
Power Dynamics	A•1628	√	√	√	√	√	√	√	√	√	√	√		√	√			UL, VDE, CSA, SEV, SEMCO, TUV,
RFI Corp.	A•1633	√	√	√	√	√		√										MIL F 15733
Schaffner EMC	A•1634	√	√	√	√	√	√	√	√	√		√		√		√		UL, CSA VDE, SEV, SEMCO, TUV
Schurter, Inc.	A•1638	√		√		√	√	√	√	√	√			√	√	√		UL, CSA, VDE, SEV, SEMCO
Tamura	A•1641	√		√			√					√		√		√		UL, CSA, VDE, WIRE, TAB, PINS, SCREEN TERMINAL TYPE CONNECTORS
TDK Corp.	A•1644	√	√	√	√	√			√									UL, CSA, VDE, TUV. SEMCO, SEV
Tri-Mag Inc.	A•1646	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		CSA, VDE, UL, TUV Bauart Gepruft MIL-F-15733

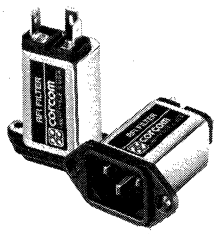
corcom
RFI Power Line Filters

Corcom, Inc.
1600 Winchester Road
Libertyville, Illinois 60048 USA
TEL: 708-680-7400 FAX: 708-680-8169

See Section 2100 for Filtered Power Entry Modules

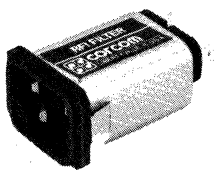
New Products

EEA/EEB Series



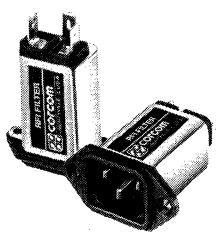
Susceptibility filters for general purpose, small size, two performance levels; low cost, current ratings 1-10 amps. Also available load side at 90° angle and wire leads.

EAS/EBS Series



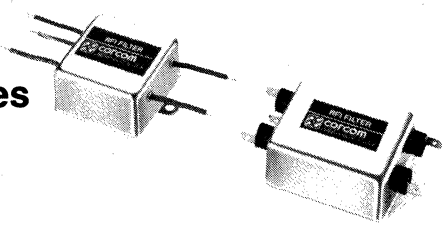
Snap-in version of EEA/EEB, labor saving compact design; two performance levels current ratings 1-10 amps.

EAH/EBH Series



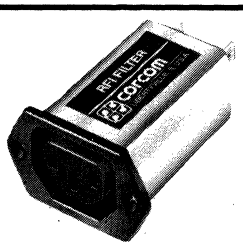
Health care filters with very low leakage current; small size, IEC Connector; 1-10 amp current rating; two performance levels case styles A and B from following page.

DK series



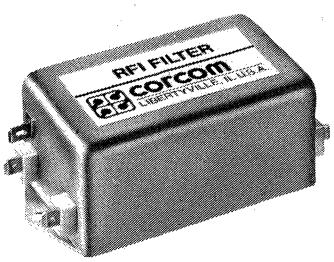
General purpose susceptibility filter with higher differential mode performance. Available 1-20 amps, case styles include fastons, wire leads and screw terminals.

EBF Series



Load input filter; general purpose for accessory outlet, 1-6 amps, fastons or wire leads.

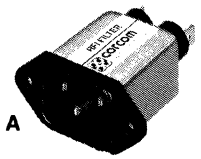
T Series

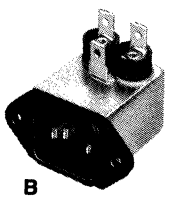


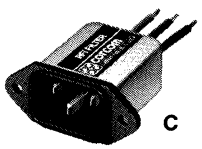
High performance emissions filter, smaller package than similar filters, designed for switching power supplies. Available with fastons, wire leads, screw terminals and IEC Connector, 3-30 amp standard leakage and low leakage models. Optional ground choke available.

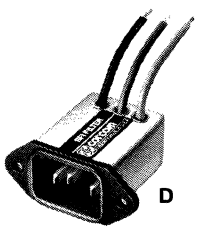
corcom
RFI Power Line Filters

Corcom, Inc.
1600 Winchester Road
Libertyville, Illinois 60048 USA
TEL: 708-680-7400 FAX: 708-680-8169


A


B


C

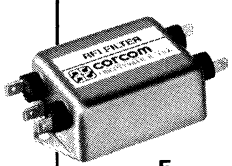

D

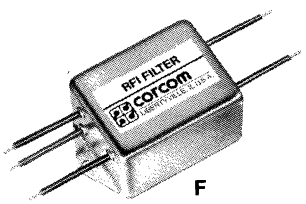
Corcom offers over 300 models of RFI filters—each designed and tested for susceptibility and/or emissions applications. As a world leader in RFI technology, Corcom offers a wide range of filters specifically designed to bring equipment (even those with switching power supplies) into compliance with strict FCC and VDE restrictions.

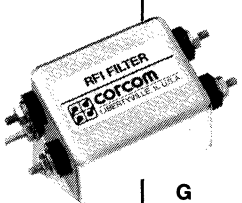
All Corcom filters receive approvals from major safety agencies throughout the world including UL, CSA, and VDE. Most have low leakage options with SEV approval.

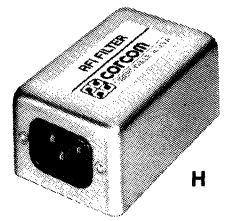
Catalog filters are available off-the-shelf from over 175 distributor locations in the United States, and a strong network of reps and sales offices worldwide.

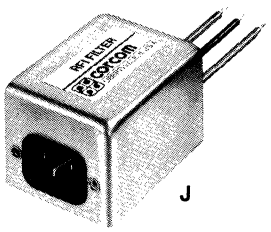
For more information, call or write for our free catalog: *RFI Power Line Filters.*

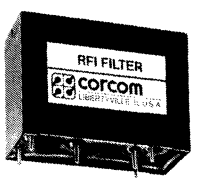

E


F


G


H


J


K

Susceptibility Filters

Series	Application	Std. Leakage	Low Leakage	Case† Styles	Current Ratings
H	Health care applications; very low leakage		EH	A,B,C,D,E	6-10
B	General purpose; small size; low cost	VB	EB	E,F,G	1-30
EF	General purpose; compact design; IEC connector		EF	A,B,C,D	1-10
ED	High performance; compact design; IEC connector		ED	A,B,C,D	1-10
K	Common mode & differential; general purpose	VK	EK	E,F,G,H	1-30
EC	High differential & common mode; general purpose		EC	A,B,C,D	1-10
R	Dual section; premium performance; common & differential mode	VR	ER	E,F,G,H	1-20
S,V,W	High industrial applications	VS,VV,VW		E	3-20

Emissions Filters

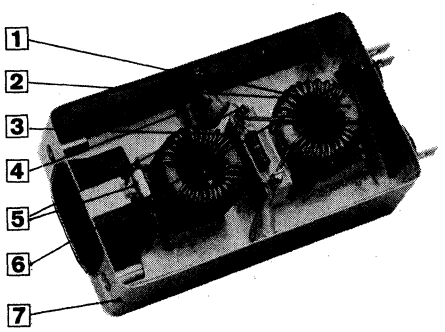
Series	Application	Std. Leakage	Low Leakage	Case Styles	Current Ratings
SK	FCC A level emissions standard	VSK	ESK	E,F,G	3-30
EP	VDE A level, FCC B level switching power supplies		EP	E,F,G	3-10
X,Y,Z	3 performance levels for SMPS; compact design; PC board mount		EX,EY,EZ	E,K	1-6
G	SMPS FCC A level; Frequency >50kHz		EG	E	6-10
N	SMPS FCC B level; Frequency >50kHz	VN		E	6-10
Q	Premium performance; SMPS VDE B level	VQ	EQ	E,F,J	3-6
AQ	Commercial TEMPEST applications	VAQ		F,J* *with fuse	3-6
A	High performance 3-phase for Wye and Delta applications	AYP,AYT		Screw Terminals	20-60

† For susceptibility filters, not all case styles are available for all current ratings.

DELTA QUALITY MAKES THE DIFFERENCE

EMI FILTERS

FEATURES AND BENEFITS FOR THE OEM USER



FEATURES

- ALL UNITS 100% tested for hipot, leakage current, and insertion loss before and after potting
- Defect rate below 200 ppm
- Superior mechanical construction, corrosion-proof case
- Molded core cover to separate toroid windings
- Precision balance between choke windings
- Use low leakage current, high voltage temperature-stable capacitors for excellent operating performance

1. UL, CSA, VDE And SEV Safety Standards
All Delta filters are designed to meet UL standard 1283, CSA standards C22.2 No. 0, No. 8, and VDE standard 0565 parts 1, 2 and 3, including conformity to temperature range HPF (– 25°C to + 85°C) and full current rating usage at both 115 VAC *and* 250 VAC.

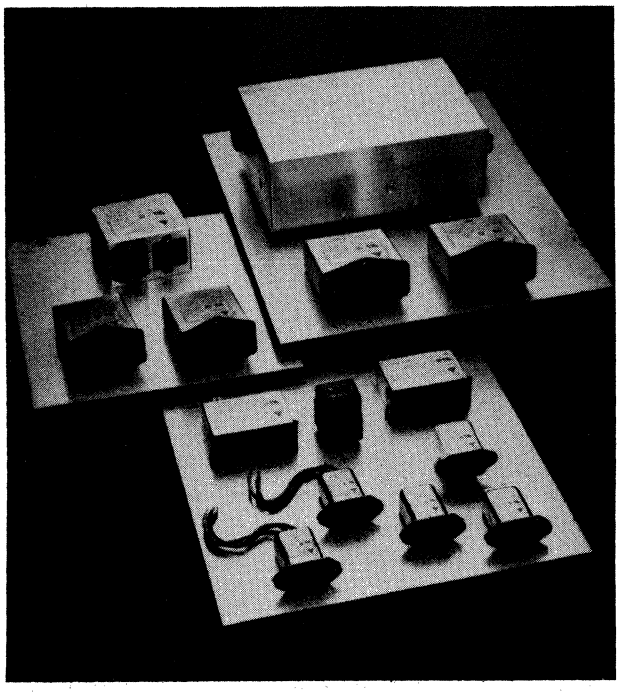
All filters in this catalog are UL recognized and CSA certified, and over 300 types are VDE approved under the following file numbers:

UL file no. E79109
CSA file no. LR48852
VDE file no. 11641-4730

Additionally, the DE series is SEV approved under file no. 85.12244.

2. FCC And VDE Emission Compliance
Delta offers a wide range of filter characteristics, both in standard and custom form, to help you meet all applicable FCC and VDE conducted emission standards, including FCC and VDE class B requirements.

3. Construction and Design
—Toroid cover for perfect insulation, with built-in spacers to maintain creepage distance between windings. (see Fig. 1 1)
—Precision balance of inductance between windings to prevent core saturation at full load. 2
—Only capacitors that comply with VDE 0565-1 are used. 3
—Low leakage current. 4
—Both crimped and soldered connections. 5
—Anti-rotation terminals to prevent open connections. 6
—Corrosion-proof case. 7

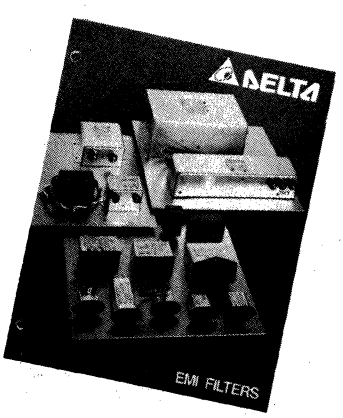


4. Quality control
—100% tested for Hipot, leakage current and insertion loss before and after potting.
—Less than 200 parts-per-million (ppm) defect rate.
—Approved for Ship-to-Stock program (no incoming inspection) at major computer manufacturers' facilities.

5. Availability
Standard items are maintained in stock in Northern California for immediate shipment to OEM customers and distributors throughout North America.

6. Price
Delta filters are very competitively priced due to mass production techniques and cost-saving designs.

7. Custom Design and Testing Services
Delta has engineering labs and shield rooms in Taipei and Northern California. These facilities allow us to design and fabricate custom filters to meet special requirements not met by standard filters, and to test customers' equipment for compliance with FCC and VDE conducted emission requirements. (see Fig. 2)



Call Delta For All Your EMI Filter Needs

OVER 400 EMI FILTERS UL CSA VDE APPROVED / SEND FOR YOUR FREE CATALOG OR CONSULT FACTOR FOR INFORMATION.
REFER TO OUR OTHER EEM PAGES IN SECTION 2100 C•1346/SECTION 2600 C•1610-11/SECTION 4000 D•1706-07

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EAST COAST OFFICE: 170 WILLOWBROOK OFFICE PARK, FAIRPORT NY 14450 U.S.A. TEL: (716) 383-8883 FAX: (716) 383-8033
2000 AERIAL CENTER PKWY, SUITE 114, MORRISVILLE, NC 27560 U.S.A. TEL: (919) 380-8883 FAX: (919) 380-8383

DELTA QUALITY MAKES THE DIFFERENCE

DELTA EMI FILTERS

SERIES

AK Power Module Filters
AR High Performance Power Module Filters
CK Power Module Filters
CR High Performance Power Module Filters
BE Fused Connector Filters
BR Super Performance Power Module Filters
DE IEC Connector Files
GE IEC Connector Filters, High Performance
KE IEC Connector Filters, High Performance
SE IEC Connector Filters, Two Stage
DH Medical Filters
DB Common Mode Filters
SK General Purpose Filters
DK General Purpose Filters

SERIES

DR High Performance Filters
DP Switching Transient Filters
ME PC Board Mounting Filters
MK High Performance PC Board Mounting Filters
EK High Performance Power Entry Module EMI Filters
EB Power Entry Module EMI Filters
A Power Modules, Plastic Case
AN Power Modules, Metal Case
C Power Entry Modules
LE Power Entry Module Filters
L Power Entry Modules
Distributors and Representatives
TY 3 Phase Filters
TD 3 Phase Filters

CURRENT & FREQUENCY RATINGS

Series	Current Rating (A)	Frequency—MHz					
		0.15	0.50	1.0	5.0	10	30
AK	6	16	25	30	42	50	40
AR	6	34	60	60	45	40	30
CK	2	40	40	40	40	40	30
	3	35	40	40	40	40	35
	6	30	40	40	40	40	35
	10	15	25	30	40	45	35
CR	2	60	60	60	50	45	35
	3	50	60	55	45	45	32
	6	40	55	55	45	40	32
	10	12	40	50	50	40	35
DE(V)	1	22	30	35	46	55	50
	3	15	25	30	50	55	55
	6	8	20	25	41	48	55
DE(E)	1	22	35	40	45	45	50
	3	18	28	32	45	45	50
	6	12	20	25	40	45	50
DE(B)	1	28	40	45	45	45	45
	3	22	30	35	45	45	45
	6	12	20	25	40	45	45
	10	4	15	18	30	38	45
DE(R)	1	7	15	20	40	45	45
	3	5	10	18	35	45	55
	6	2	5	10	30	40	50
	10	0	1	2	18	28	40
GE(E)	1	28	35	38	38	40	40
	3	20	25	30	38	40	40
	6	12	18	24	35	40	40
	10	4	10	13	28	35	40
SE	1	45	66	70	70	65	60
	3	42	65	70	70	65	55
	6	25	50	60	70	65	55
BE	2	25	35	40	55	55	55
	4	26	35	40	50	55	50
	6	24	30	35	50	55	45
DH	6	12	20	20	24	24	18
DB	1–5	20	30	38	50	50	45
	10	20	30	35	50	50	45

CURRENT & FREQUENCY RATINGS

Series	Current Rating (A)	Frequency—MHz					
		0.15	0.50	1.0	5.0	10	30
DK	1–5	22	30	38	50	55	50
	10	22	26	33	45	50	50
	20	14	19	28	42	45	50
DR	1–5	45	65	70	70	65	55
	10	35	60	70	65	55	50
	20	20	40	50	70	60	50
DP(S)	3	50	70	70	65	60	40
DP	3	60	75	75	70	60	40
	6	58	70	70	70	60	50
	10	58	70	70	70	70	30
BR	3–5	50	60	55	45	40	30
HB	8	26	32	40	45	46	30
	15	10	25	32	40	45	25
HK(L)	10	27	32	35	45	55	22
(M)	15	15	30	36	42	50	30
(S)	15	11	25	33	40	45	26
(L)	20	12	16	22	36	50	25
ME	1	25	35	40	50	52	55
	3	23	30	35	50	50	55
	6	12	22	30	45	50	55
MK	1	40	45	40	40	40	33
	2	35	45	40	40	40	32
	3	30	45	40	40	40	32

3 PHASE FILTERS

Series	Current Rating	Frequency—MHz						
		0.05	0.15	0.50	1.0	5.0	10	30
TY	20	25	40	50	50	55	55	45
	30	20	30	40	40	45	45	35
	60	8	15	30	30	30	30	30
TD	10		25	35	40	40	40	30
	20		20	30	40	40	40	30
	30		20	20	30	40	40	30
	40		20	30	30	35	40	35
	50		20	30	30	35	40	35



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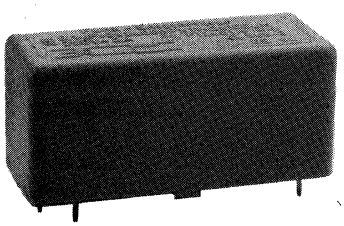
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PCB Mount

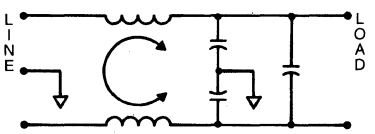


- PC Board Mountable
- Hermetically Sealed in Polyester Resin
- Other insertion loss versions and pin arrangements available

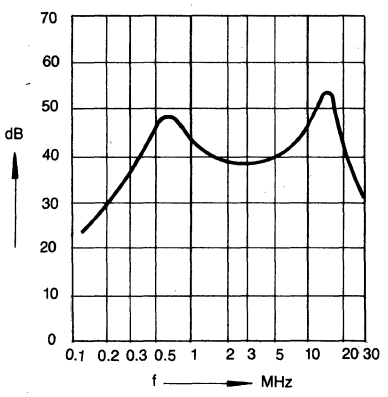
Specifications

Rated current to VDE	Part Number	Case Size		
		L	W	H
2	F 12.010	1.32	1.14	1.06
4	F 12.011	1.32	1.14	1.06
6	F 12.012	1.79	1.52	1.18
1.6	F 12.401/1	2	.79	.87
2	F 12.401/9	2	.79	.87
2.5	F 132.401/3	2	.79	.87
4	F 12.401/10	2	.79	.87

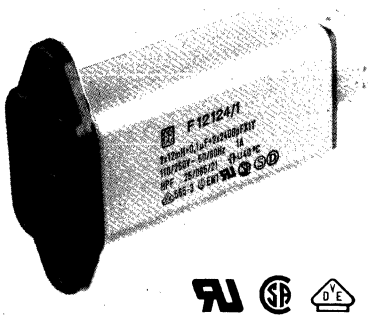
Electrical Schematic



Insertion Loss
Common Mode



Power Entry Filter

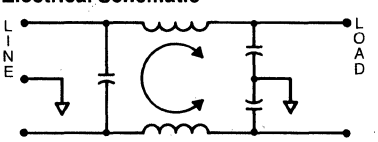


- Faston or solder connections
- Hermetically Sealed in Polyester-Resin
- Other connections, insertion loss versions, and case sizes available

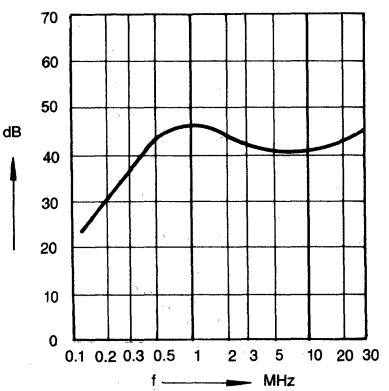
Specifications

Rated current to VDE	Part Number	Case Size		
		L	W	H
1	F 12124	2.20	1.12	.85
2	F 12129	2.20	1.12	.85
4	F 12135	2.20	1.12	.85
6	F 12137	2.20	1.12	.85

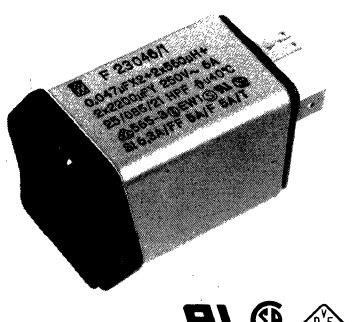
Electrical Schematic



Insertion Loss
Common Mode



Power Entry Filter With 1 or 2 Fuses

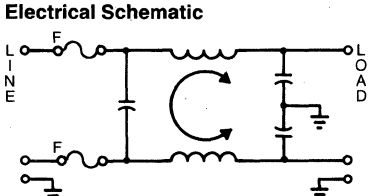


- Faston or solder connections
- Hermetically Sealed in Polyester-Resin
- Other connections, insertion loss versions, and case sizes available

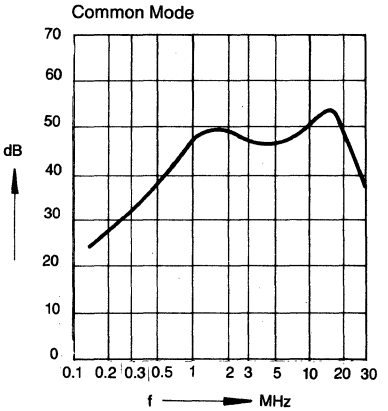
Specifications

Rated current to VDE	Part Number	Case Size		
		L	W	H
1	F 23041	2.0	1.14	1.30
2	F 23042	2.0	1.14	1.30
3	F 23043	2.0	1.14	1.30
4	F 23044	2.0	1.14	1.30
6	F 23046	2.0	1.14	1.30

Electrical Schematic



Insertion Loss
Common Mode



Eichhoff Electronics, Inc.
205 Hallene Road, Warwick, RI 02886
Tel (401) 738-1440
Fax (401) 738-7154

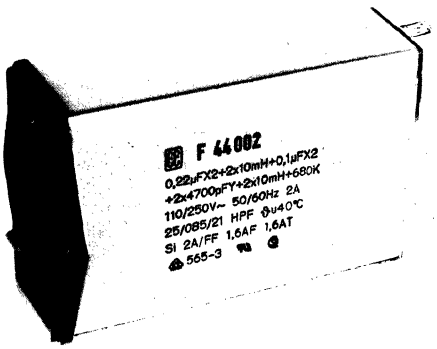
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Power Entry Filter with Fuse Holder and 1 or 2 Pole Power Switch

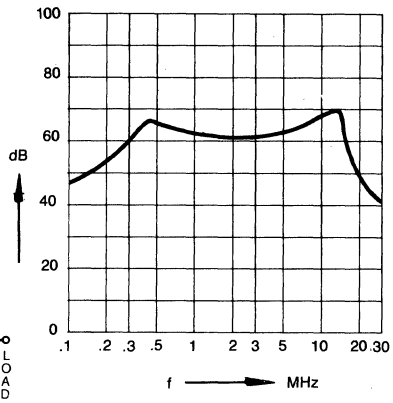


- General Purpose, High Performance and Premium Performance versions
- Faston connection
- Hermetically Sealed in Polyester Resin
- Other insertion loss versions and case sizes available

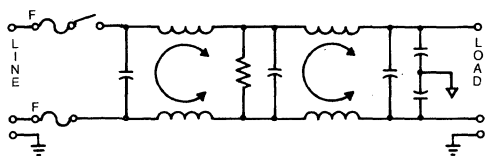
Specifications

Rated current to VDE	Part Number	Case Size		
		L	W	H
1	F44001	3.62	1.14	2.38
2	F44002	3.62	1.14	2.38
3	F44003	3.62	1.14	2.38
4	F44004	3.62	1.14	2.38
6	F44006	3.62	1.14	2.38

Insertion Loss
Common Mode

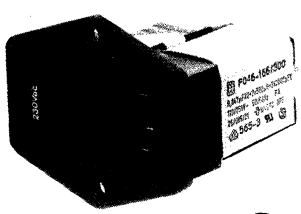


Electrical Schematic



Modular Power Entry with Power Switch, Fuse Holder, Voltage Selector (optional)



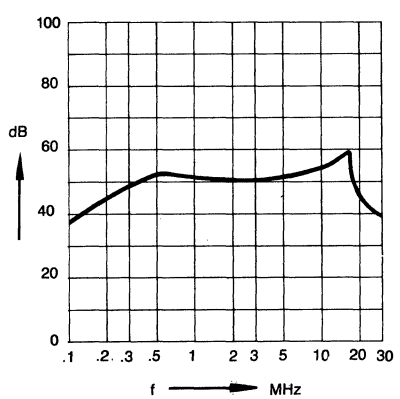


- General Purpose, High Performance and UL544 Medical versions.
- Faston and solder connections
- Hermetically Sealed in Polyester Resin
- Other connections, insertion loss versions, and case sizes available

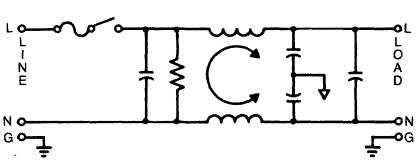
Specifications

Rated current to VDE	Part Number	Case Size		
		L	W	H
1	F 46...1	2.16	1.12	2.12
2	F 46...2	2.16	1.12	2.12
3	F 46...3	2.16	1.12	2.12
4	F 46...4	2.16	1.12	2.12
6	F 46...6	2.16	1.12	2.12
10	F 46...0	2.16	1.12	2.12

Insertion Loss
Common Mode



Electrical Schematic



Eichhoff Electronics, Inc.
205 Hallene Road, Warwick, RI 02886
Tel (401) 738-1440
Fax (401) 738-7154

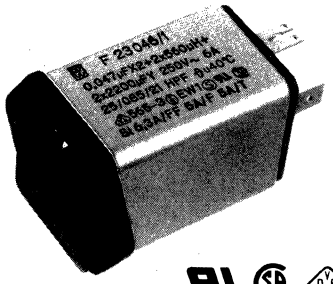
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Filter for UL 544 Medical Equipment

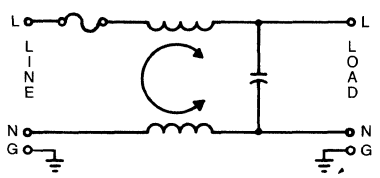


- General Purpose and High Performance versions with 1 or 2 fuses.
- Other insertion loss versions and case designs available
- Faston or solder connections
- Hermetically Sealed in Polyester-Resin

Specifications

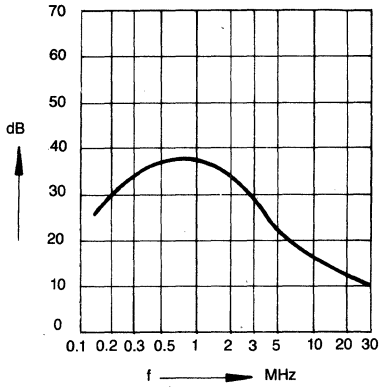
Rated current to VDE	Part Number	Case Size		
		L	W	H
1	F 23041	1.70	1.42	1.30
2	F 23042	1.70	1.42	1.30
3	F 23043	1.70	1.42	1.30
4	F 23044	1.70	1.42	1.30
6	F 23046	1.70	1.42	1.30

Electrical Schematic

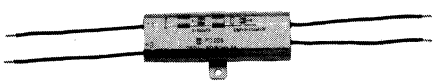


Insertion Loss

Common Mode



Power Line Filter - Slim Line

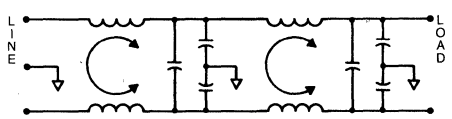


- Compact design
- For usage in small space constraints
- Customized filters available
- Termination options: Leads, fast-on connectors, or combinations thereof
- Polyester resin sealed

Specifications

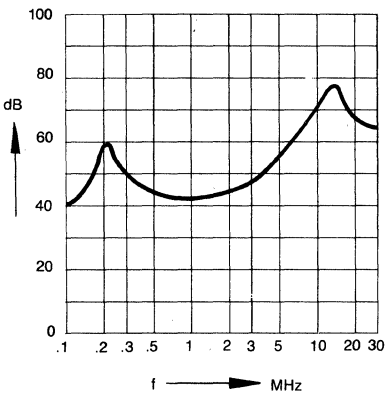
Rated current to VDE	Part Number	Case Size		
		L	W	H
1A	F 11.226	.59	1.14	3.5
2A	F 11.180	.59	1.19	3.5
4A	F 11.180/50			

Electrical Schematic

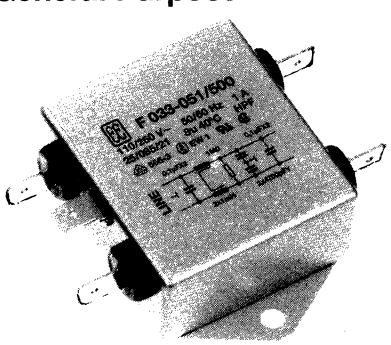


Insertion Loss

Common Mode



General Purpose

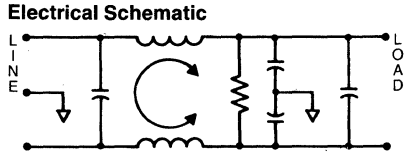


- Faston, Solder, Lead Connection
- Other connections, insertion loss versions and case sizes available. Filters also available for 20A and above.
- Hermetically Sealed in Polyester-Resin

Specifications

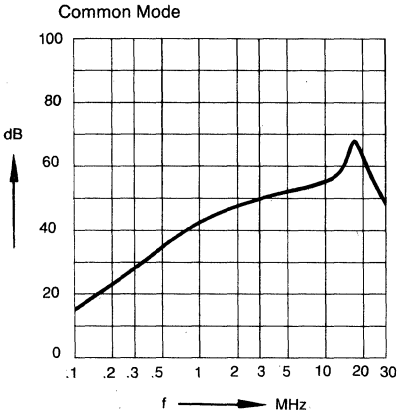
Rated current to VDE	Part Number	Case Size		
		L	W	H
1	F 33.051	2.05	1.81	.9
2	F 33.052	2.05	1.81	.9
4	F 33.054	2.05	1.81	.9
6	F 33.056	2.05	1.81	.9
10	F 33.060	2.05	2.05	1.18
18	F 33.066	2.09	2.52	1.54

Electrical Schematic



Insertion Loss

Common Mode



Eichhoff Electronics, Inc.
205 Hallene Road, Warwick, RI 02886
Tel (401) 738-1440
Fax (401) 738-7154

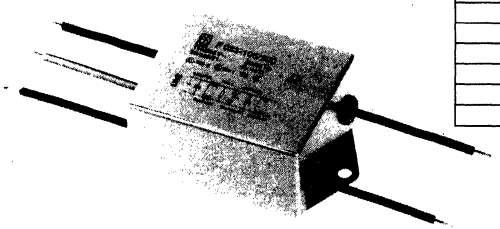
Toll Free 800-678-1040

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Complete engineering capability for application assistance.

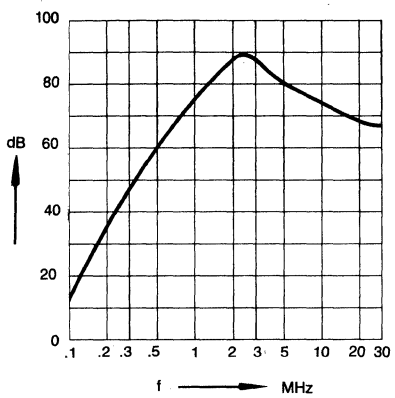
Filters for Switching Power Supplies, SCR and T²L Circuits



Specifications

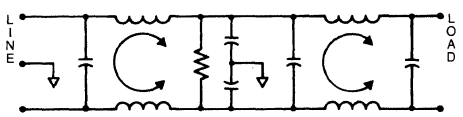
Rated current to VDE	Part Number	Case Size		
		L	W	H
1	F 33.151	1.77	2.05	1.18
2	F 33.152	1.77	2.05	1.18
4	F 33.154	2.09	2.52	1.18
6	F 33.156	2.09	2.52	1.18
10	F 33.160	2.09	2.52	1.18
16	F 33.166	2.09	3.35	1.54

Insertion Loss
Common Mode

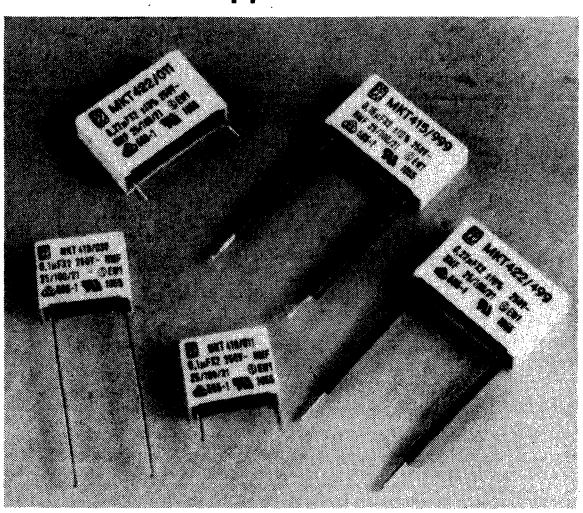


- Faston, Solder, Lead Connection
- Other insertion loss versions and case sizes available
- Hermetically Sealed in Polyester Resin

Electrical Schematic



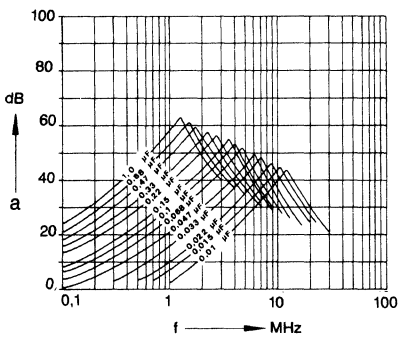
Line To Line Suppression Class X Film Capacitors



Specifications

Capacitance	W (mm)	H (mm)	L (mm)	PCM* (mm)	
0,010 µF	5	11	18	15	KMT 254/954–310/011
0,015 µF	5	11	18	15	KMT 254/954–315/011
0,022 µF	5	11	18	15	KMT 254/954–322/011
0,033 µF	5	11	18	15	KMT 254/954–333/011
0.047 µF	6	12	18	15	KMT 254/954–347/011
0,068 µF	7.5	13.5	18	15	KMT 254/954–368/011
0,1 µF	8.5	14.5	18	15	KMT 254/755–410/011
0,15 µF	7	15	26.5	22.5	KMT 254/755–415/011
0,22 µF	8.5	17	26.5	22.5	KMT 254/755–422/011
0,33 µF	11	20	31	27.5	KMT 254/756–433/011
0,47 µF	12	20	31	27.5	KMT 254/756–447/011
0,68 µF	14.5	25	31	27.5	KMT 254/756–468/011
1,0 µF	16.5	28.5	31	27.5	KMT 254/756–510/011

Insertion Loss (50 Ω systems) wire length 6 mm



- UL 1283
  DIN 57 565 Part 1/VDE 0565 Part 1
  IEC-Publication 384-14(1981)
  DIN 40 040
- Polyester film with vapor deposited aluminium enclosed in flame retardent (UL 94 VO) epoxy resin seal and case
- Tinned copper wire
  Solid/Stranded AWG 20, TR32, insulated
  Choice of quick connect terminals

Eichhoff Electronics, Inc.
205 Hallene Road, Warwick, RI 02886
Tel (401) 738-1440
Fax (401) 738-7154

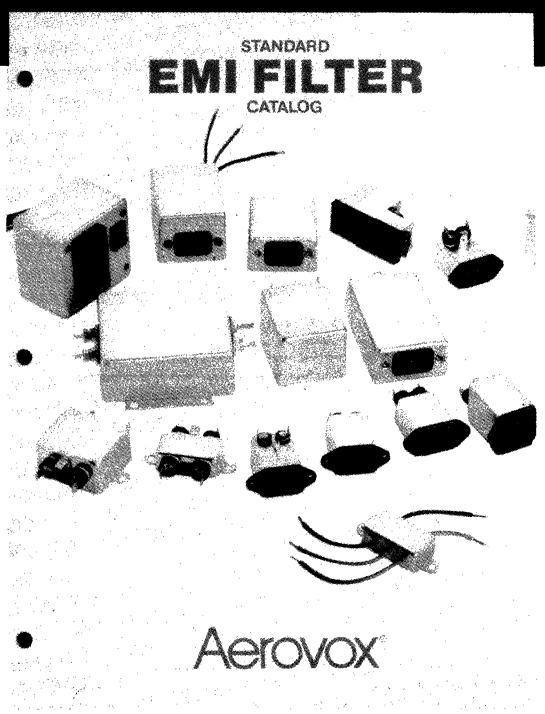
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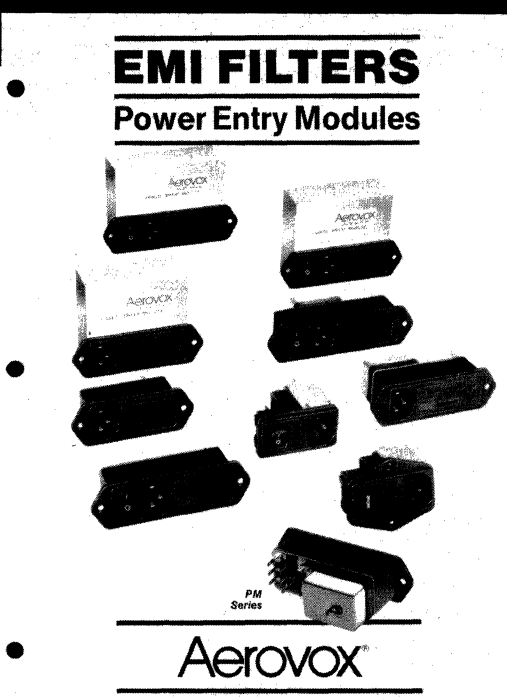
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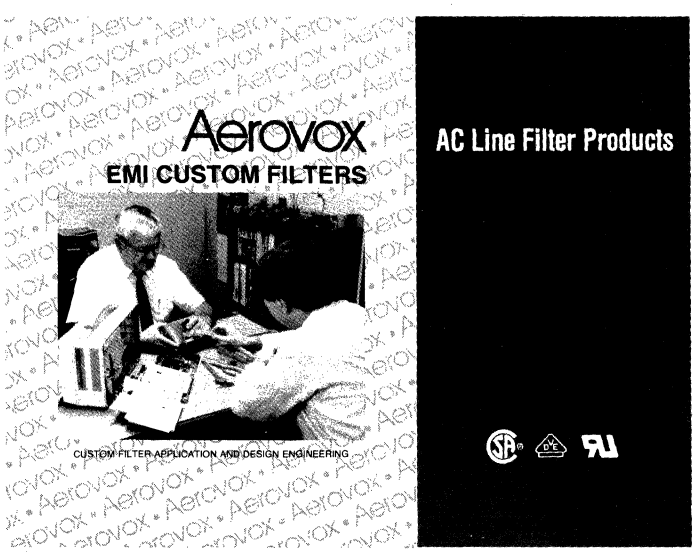
FAST EMI FILTER SOLUTIONS?

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Aerovox® INC.

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(508) 994-9661 FAX 508-994-9635

ELPAC COMPONENTS 32 YEARS OF EXCELLENCE

EMI FILTERS MADE EASY

EMI AND EMI FILTERS

EMI stands for electromagnetic interference. EMI is unwanted electromagnetic energy, usually in the frequency range used for communications, 10 KHz to 2 GHz.

EMI can disrupt the operation of electric and electronic equipment. This is when EMI filters are needed. They shield equipment from harmful EMI and they reduce EMI emissions.

WHAT ABOUT EMI REGULATIONS?

Major industrialized countries have established limits for EMI. In the United States, industrial and consumer products are governed by the Federal Communications Commission. FCC 20780 is the specification for RF interference of electronic devices. This specification is for Class A computing devices (commercial, industrial or business) and Class B devices (residential).

For military products, the U.S. Department of Defense standards are MIL-STD-461. This regulation specifies limits on electromagnetic interference emissions and susceptibility characteristics. There are nine categories ranging from aircraft (Class A1) to commercial equipment (Class C3).

In Europe, the accepted regulatory agency is Verband Deutscher Electrotechniker (VDE).

There are often special EMI restrictions for equipment used to process secure information. The most widely used limits for data security are the U.S. Government's Tempest standards. The word "Tempest" refers to the study and containment of emissions which, if intercepted and analyzed, could reveal sensitive information.

WHAT EMI FILTERS ARE NEEDED?

The right filter depends on (1) the system requirements and (2) the specifications of the appropriate regulatory agency. For example, a normal electronic system environment might only require.

- ☐ subsystems operating compatibly with each other.
- ☐ adequate enclosure shielding to comply with the radiation limits of either FCC 20780, VDE 08871/0875, or MIL-STD-461.

A more stringent, Tempest secure system might require:

- ☐ complete EMI filtering of every incoming and outgoing signal line.
- ☐ total shielding of radiated emissions by EMI gasketing.
- ☐ a completely secure metal enclosure.
- ☐ a high insertion loss AC power line filter to eliminate signal noise back onto the AC power line.

For either application, or for systems that fall in between, the best approach usually requires custom filter technology provided by a company such as ELPAC.

WHY ELPAC?

ELPAC has an extensive line of standard filter components. However, most of our customers need a custom design. That is where ELPAC's 32 years of experience really pays off. We specialize in custom signal and power line filters, particularly applications requiring minimum size and weight.

ELPAC can quickly prototype and manufacture custom filters. One reason is our highly trained engineering staff. Another is our use of state-of-the-art equipment for computer simulation, computer aided design, and spectrum analyses. Still another is our design and manufacture of the film capacitors used in our filters. Our control of capacitor design and manufacturing helps us achieve the high performance standards of our filter products.

Our filter products are used in most commercial and military aircraft as well as in the NASA Space Shuttle.

ELPAC has earned an outstanding reputation for quality and customer satisfaction.

THE DESIGN AND MANUFACTURING PROCESS

From start to finish, ELPAC's design and manufacturing process provides the highest standards of quality and performance. Here is how we do it:

STEP 1: Understanding the Customer's System

We begin by talking to the customer about system requirements. Typically, we determine the applicable regulatory agencies, size limits for the filters, and the frequency range and insertion loss requirements.

STEP 2: Simulating The Filter

ELPAC analyzes the system requirements and uses computer simulation to design a filter network. This results in a prototype filter design that does the job with the fewest components.

STEP 3: Fabricating The Prototype

Next, ELPAC fabricates the prototype filter. This filter is tested at ELPAC to the customer's system requirements. The process usually involves "fine-tuning" the filter elements to optimize filter performance. This testing takes place in accord with MIL-STD-220, under a quiet EMI environment and with both a 50 ohm source and load impedance.

STEP 4: Customer Testing

The customer now tests the prototype filter. In most cases, the prototype filter meets or exceeds all the system requirements. When the customer's system is dramatically different from the ELPAC testing environment, small design changes may be necessary.

STEP 5: Production Manufacturing

After the customer approves the prototype, the filter is released to ELPAC's manufacturing division. Each step of the filter process is monitored by a computerized MRP system. Manufacture of the filter is accomplished by experienced personnel in accordance with the MIL-I-45208 quality system. As part of this manufacturing cycle, ELPAC provides component certification, in-process and final article source inspection, and 100% electrical testing.

STEP 6: The Customer Takes Delivery

Here is where it all pays off. The toughest part of the job has been completed and the customer can look forward to delivery of the manufactured product. On time! Within the specifications! And at a competitive price!

ELPAC'S CUSTOM SOLUTIONS FOR COMPLEX FILTER APPLICATIONS

A partial list of applications for filter products include:

- ☐ Ground missile control system
- ☐ NASA Space Shuttle
- ☐ Shipboard fire-control system
- ☐ Aircraft power distribution system
- ☐ Avionics communication system
- ☐ Underwater missile control system
- ☐ Land vehicle, high energy discharge system
- ☐ Aircraft data computer
- ☐ Very high temperature, commercial avionics

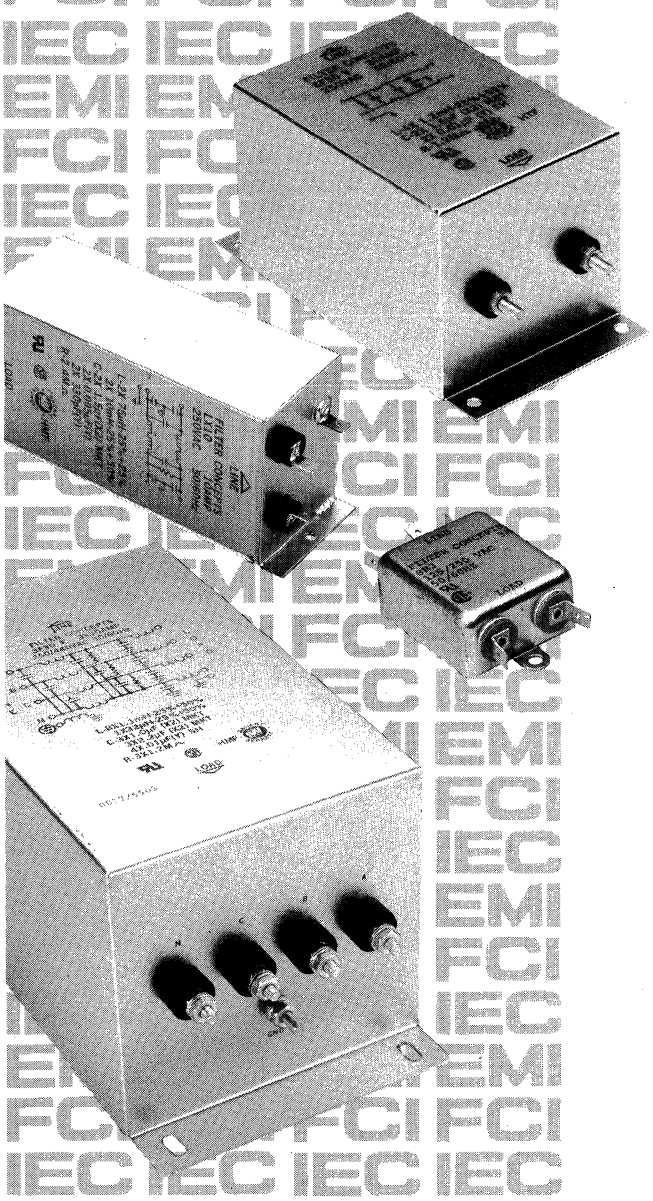
ELPAC thrives on technical challenge. We regularly tackle the "impossible" jobs. Our 32 year track record proves ELPAC is a name you can trust.

We welcome your inquiry. Call us.

ELPAC COMPONENTS
A DIVISION OF ELPAC ELECTRONICS, INC.
3131 S. STANDARD AVENUE, SANTA ANA, CA 92705
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FILTER CONCEPTS INC.

- **Industry's Widest Selection of Standard Power Line EMI Filters for single and 3Ø applications.**
- **Custom AC and DC Power Line Filters from 1 to 150 Amps.**
- **Applications Oriented to solve emmission problems in Switch Mode Power Supplies, Motor Controllers, Medical Equipment, Lasers, UPS's, etc.**



π FILTERS

LE SERIES
ECONOMICAL LOW LEAKAGE π SECTION FILTER

FCI's most economical and compact π section filter provides a useful combination of differential (L/L) and common mode (L/G) performance in a low leakage current design.

LE Series filters are designed for general purpose applications including supplementary filtering of switch mode power supplies with internal EMI filters.

Part No.	Current	Case	Leakage
LE5	5.0A	7/8x1-3/4x3-3/16	.30mA
LE10	10.0A	1-1/8x1-3/4x3-3/16	.30mA
LE15	15.0A	1-1/2x2x3-11/16	.30mA
LE20	20.0A	1-13/16x2-3/16x4	.30mA
LE30	30.0A	2x2-15/16x4-1/4	.45mA
LE40	40.0A	1-3/4x4-1/8x5-1/16	.45mA
LE75	75.0A	2-1/4x4-1/4x8-1/16	1.2mA
LE100	100.A	3x5-1/2x9-1/16	1.2mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	8db	12db	45db	65db	65db	60db
L/G	10db	20db	32db	40db	45db	50db

LF SERIES
HIGH PERFORMANCE LOW LEAKAGE SWITCH MODE EMI FILTER

LF Series π section filters offer enhanced differential mode (L/L) and common mode (L/G) insertion loss for applications subject to the conducted limits of FCC and VDE while maintaining low ground leakage current.

The LF Series filter can function as a stand alone filter for switch mode applications or in conjunction with the power supply's internal EMI filter.

Part No.	Current	Case	Leakage
LF2	2.0A	7/8x1-3/4x3-3/16	.45mA
LF3	3.0A	1-1/4x2x3-3/16	.45mA
LF5	5.0A	1-1/2x2x3-11/16	.45mA
LF7	7.5A	1-1/2x2x3-11/16	.45mA
LF10	10.0A	1-13/16x2-3/16x4	.45mA
LF15	15.0A	2x2-15/16x4-1/4	.45mA
LF20	20.0A	1-1/2x4-1/8x5-1/16	.80mA
LF40	40.0A	3x5-1/2x9-1/16	1.4mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	6db	33db	60db	60db	60db	60db
L/G	18db	30db	42db	50db	50db	50db

LX SERIES
ENHANCED PERFORMANCE LOW LEAKAGE SWITCH MODE EMI FILTER

LX Series π section filters feature additional line inductors providing up tp 30db of enhanced performance at the low frequency end of the VDE 0871/B conducted EMI spectrum.

The LX Series filter can augment existing EMI filters in switch mode power conversion/regulation equipment or function as the equipment's stand alone filter.

Part No.	Current	Case	Leakage
LX1	1.5A	1-1/4x2x3-3/16	.45mA
LX3	3.0A	1-1/2x2x3-11/16	.45mA
LX6	6.0A	2x2-15/16x4-1/4	.45mA
LX10	10.0A	2x2-3/4x6-7/16	.80mA
LX15	15.0A	3x3x6-13/16	1.5mA
LX20	20.0A	3x3x8-13/16	1.5mA
LX24	24.0A	2-1/4x4-1/4x11-1/16	1.5mA
LX30	30.0A	4x4x8-13/16	1.5mA
LX45	45.0A	4-3/4x5x13-1/4	1.5mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	45db	65db	65db	65db	65db	60db
L/G	30db	42db	50db	50db	50db	50db

GF SERIES
SYSTEM EMI FILTER WITH GROUND ISOLATOR

A system filter with good general purpose performance. The GF Series was designed for AC input and distribution applications.

GF filters include an alternate ground termination for the AC input power to isolate AC mains' high frequency low impedance ground noise.

Part No.	Current	Case	Leakage
GF10	10.0A	1-1/2x2x3-11/16	1.0mA
GF20	20.0A	2x2-15/16x4-1/4	1.0mA
GF30	30.0A	2x2-15/16x4-1/4	1.5mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	6db	20db	45db	55db	55db	50db
L/G	10db	22db	32db	45db	50db	50db

CORD CONNECTED

CF SERIES
HIGH ENERGY POWER LINE FILTER/CONDITIONER

CF filters provide convenient protection and isolation from power line disturbances including high voltage transients which saturate the typical internal EMI filter in electronic equipment.

The low cutoff freguency and high energy capability of the CF Series protects office equipment and laboratory instruments, reducing component failures and ghost faults.

Standard NEMA or CEE plug and receptacle interface is available for convenient installation.

Part No.	Rated Voltage	Current	Leakage
CF151	125VAC	15.0A	.50mA
CF152	250VAC	15.0A	1.0mA
CF201	125VAC	20.0A	.50mA

Insertion Loss: (50 ohms, typical)

	.02MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	20db	50db	65db	65db	65db	65db
L/G	18db	40db	60db	60db	60db	60db

FCI reserves the right to make specification changes without notice. Consult the factory for current information.

FILTER CONCEPTS INC.
2624 S. Rousselle St. ■ Santa Ana ■ California 92707 USA Fax (714) 545-4607 Tele. (714) 545-7003

T FILTERS

SE SERIES
SWITCH MODE POWER SUPPLY FILTER

Our most compact and economical T section filter for applications using switch mode conversion & regulation technology and subject to FCC conducted EMI specifications.

SE Series EMI filters are designed to provide balanced differential (L/L) and common mode (L/G) insertion loss for maximum performance at 450KHz and above.

Available in standard packages from 3Amps to 60Amps, the SE Series is an excellent performer for many domestic applications.

Part No.	Current	Case	Leakage
SE3	3.0A	7/8x1-3/4x3-3/16	.80mA
SE7	7.5A	1-1/4x2x3-3/16	.80mA
SE15	15.0A	1-1/2x2x3-11/16	.80mA
SE20	20.0A	1-13/16x2-3/16x4	.80mA
SE30	30.oA	2x2-15/16x4-1/4	1.4mA
SE45	45.0A	2-3/4x3x6-1/16	1.4mA
SE50	50.0A	3x3x6-1/16	1.4mA
SE60	60.0A	3x3x6-13/16	1.6mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	7db	15db	50db	60db	55db	50db
L/G	7db	15db	50db	65db	65db	55db

SF SERIES
HIGH PERFORMANCE SWITCH MODE EMI FILTER

SF Series T section filters are designed to effectivly attenuate differential (L/L) and common mode (L/G) noise from switch mode power conversion & regulation circuits subject to FCC and VDE 0871/A conducted EMI limits.

Part No.	Current	Case	Leakage
SF3	3.0A	1-1/4x2x3-3/16	.80mA
SF7	7.5A	1-1/2x2x3-11/16	.80mA
SF10	10.0A	1-13/16x2-3/16x4	.80mA
SF15	15.0A	2x2-15/16x4-1/4	.80mA
SF20	20.0A	1-1/2x4-1/8x5-1/16	.80mA
SF24	24.0A	2-1/4x3-1/16x6-1/4	1.0mA
SF30	30.0A	2-3/4x3x6-1/16	1.4mA
SF45	45.0A	2-3/4x3x8-13/16	1.4mA
SF60	60.0A	4x4x8-13/16	1.6mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	15db	45db	60db	60db	65db	60db
L/G	8db	45db	65db	65db	65db	60db

SX SERIES
ENHANCED PERFORMANCE SWITCH MODE EMI FILTER

With additional line inductors the SX Series T section filters provide up to 15db of enhanced performance to solve severe conducted EMI problems in the FCC and VDE 0871/A spectrums.

SX Series filters are available in standard current ratings of 3Amps to 60Amps providing high performance over a wide range of load currents and source impedances.

Part No.	Current	Case	Leakage
SX3	3.0A	1-1/2x2x3-11/16	.80mA
SX7	7.5A	2x2x5	.80mA
SX15	15.0A	2-3/4x3x6-1/16	1.4mA
SX20	20.0A	2-3/4x3x6-13/16	1.4mA
SX30	30.0A	2-3/4x3x8-13/16	1.4mA
SX45	45.0A	4x4x8-13/16	1.8mA
SX60	60.0A	4-3/4x5x10-1/4	1.8mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	30db	60db	65db	65db	60db	50db
L/G	20db	60db	65db	65db	60db	55db

SW SERIES
WIDE BAND HIGH PERFORMANCE FILTER

Extended high and low frequency insertion loss is provided with the SW Series of power line filters.

Designed to provide wide band EMI performance for VDE 0871/B and MIL STD 461 ground equipment, the SW Series maintains moderate leakage current for enhanced safety. Available in current ratings from 3Amps to 45Amps, the SW Series remains effective independent of wide variations in impedances and noise characteristics.

Part No.	Current	Case	Leakage
SW3	3.0A	1-13/16x2-3/16x4	2.4mA
SW5	5.0A	2x2x5	2.4mA
SW10	10.0A	2-3/4x3x6-1/16	2.4mA
SW20	20.0A	2-3/4x3x8-13/16	2.4mA
SW30	30.0A	4x4x8-13/16	2.4mA
SW45	45.0A	4-3/4x5x13-1/4	3.5mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.50MHz	1.5MHz	5.0MHz	50MHz	0.1GHz
L/L	50db	65db	65db	65db	60db	50db
L/G	35db	65db	65db	65db	60db	50db

TF SERIES
HIGH PERFORMANCE LOW LEAKAGE EMI FILTER

TF Series filters provide high performance differential (L/L) and common mode (L/G) insertion loss for switch mode power conversion & regulation circuits with a requirement for reduced leakage currents.

TF Series filters feature inductive common mode (L/G) and capacitive differential mode (L/L) output impedance for minimized rectifier commutation noise.

Part No.	Current	Case	Leakage
TF1	1.0A	7/8x1-3/4x3-3/16	.45mA
TF2	2.0A	1-1/8x1-3/4x3-3/16	.45mA
TF3	3.0A	1-1/4x2x3-3/16	.45mA
TF5	5.0A	1-1/2x2x3-11/16	.45mA
TF10	10.0A	2x2-15/16x4-1/4	.45mA
TF20	20.0A	2-3/4x3x6-1/16	.80mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	15db	45db	55db	60db	60db	60db
L/G	10db	50db	65db	65db	65db	60db

DC FILTERS

DS SERIES
HIGH PERFORMANCE DC POWER FILTER

The DS Series of EMI filters provides effective attenuation in applications requiring DC power conversion.

The DS Series can be used successfully as an input or output filter in many applications.

Part No.	Current	Case
DS7	7.5A	7/8x1-3/4x3-3/16
DS15	15.0A	1-1/4x2x3-3/16
DS20	20.0A	1-1/4x2x3-3/16
DS30	30.0A	1-1/2x2x3-11/16
DS60	60.0A	2x2-15/16x4-1/4
DS100	100.A	2-3/4x3x6-1/16
DS150	150.A	4x4x6-13/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	40db	60db	60db	60db	60db	50db

DC SERIES
HIGH PERFORMANCE DC POWER FILTER

The DC Series provides two independent π section EMI filters for effective attenuation of switch mode converter & regulator EMI on power inputs or outputs.

DC Series π sections work equally well with balanced or unbalanced load currents, with chassis returns or with positive or negative polarities.

Part No.	Current	Case
DC3	3.0A	1-1/8x1-3/4x3-3/16
DC7	7.5A	1-1/4x2x3-3/16
DC15	15.0A	1-1/2x2x3-11/16
DC20	20.0A	1-13/16x2-3/16x4
DC30	30.0A	2x2-15/16x4-1/4
DC60	60.0A	2-3/4x3x6-1/16
DC100	100.A	4x4x8-13/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	40db	60db	60db	60db	60db	55db

DP SERIES
HIGH PERFORMANCE DC INPUT FILTERS

DP Series filters are designed for use as balanced input filters for DC input power supplies. By providing a very low impedance to their active loads, DP Series filters avoid power input overshoot and output regulation loop stability problems common to conventional EMI filters.

Polarity reversal and over voltage protection are additional features od the DP Series filters.

Part No.	Current	Case
DP5	5.0A	7/8x1-3/4x3-3/16
DP10	10.0A	1-1/8x1-3/4x3-3/16
DP15	15.0A	1-1/2x2x3-11/16
DP20	20.0A	1-13/16x2-3/16x4
DP30	30.0A	2x2-15/16x4-1/4
DP45	45.0A	3x3x6-1/16

Rated Voltage: 50 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	40db	60db	60db	60db	50db	50db
L/G	20db	30db	45db	50db	45db	40db

DF SERIES
DC OUTPUT FILTER

DF Series filters provide an economical solution to output noise from typical multiple output switch mode power supplies.

Available in 4 and 6 conductor models, the DF Series can also isolate sensitive analog circuits from noisy system power buses.

Part No.	Current	Case
DF104	4x10A	1-1/4x3-1/16x2-13/16
DF106	6x10A	1-1/2x3-1/16x3-5/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	1db	10db	25db	35db	45db	40db
L/G	15db	25db	35db	50db	50db	50db

DL SERIES
MULTI CHANNEL DC INPUT/OUTPUT FILTER

DL Series filters provide independent multiple filter sections suitable for DC power or control lines.

Part No.	Current	Case
DL64	4x6.0A	1-1/4x3-1/16x2-13/16
DL66	6x6.0A	1-1/2x3-1/16x3-5/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	20db	36db	56db	60db	55db

FCI reserves the right to make specification changes without notice. Consult the factory for current information.

FILTER CONCEPTS INC.
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MIL PERFORMANCE

A2T SERIES
PREMIUM PERFORMANCE SEVERE ENVIRONMENT EMI FILTER

A2T Series power line filters are designed for typical switch mode power converters & regulators subject to MIL STD 461 conducted emission specifications in a MIL STD 462 type test environment.

A2T Series filters are designed for 50Hz to 400Hz AC power. The moderate ground leakage design of the A2T Series minimizes EMI ground currents and provides enhanced safety.

Part No.	Current	Case	Leakage
A2T2	2.5A	1-1/2x2x6-3/16	1.8mA
A2T5	5.0A	1-3/4x2-3/4x8-11/16	1.8mA
A2T10	10.0A	2-1/4x3-3/4x11-3/8	1.8mA
A2T15	15.0A	4x4x8-13/16	2.4mA
A2T30	30.0A	4-3/4x5x15-1/4	3.5mA

Rated Voltage: 250VAC, 50/60Hz
125VAC, 400Hz
Insertion Loss: (50 ohms, typical)

	.02MHz	.05MHz	.15MHz	1.5MHz	5.0MHz	50MHz
L/L	20db	40db	65db	65db	65db	60db
L/G	20db	50db	65db	65db	65db	60db

A3T SERIES
3 PHASE DELTA SEVERE ENVIRONMENT EMI FILTER

A3T Series 3 phase power line filters are designed to filter typical switch mode power conversion devices required to meet MIL STD 461 conducted emissions while maintaining low ground leakage currents.

Part No.	Current	Case	Leakage
A3T5	5.0A/PH	4x4x8-13/16	2.0mA

Rated Voltage: 250VAC, 50/60Hz
125VAC, 400Hz
Insertion Loss: (50 ohms, typical)

	.02MHz	.05MHz	.15MHz	1.5MHz	5.0MHz	50MHz
L/L	24db	34db	65db	65db	65db	60db
L/G	21db	50db	65db	65db	65db	60db

A4T SERIES
3 PHASE WYE SEVERE ENVIRONMENT EMI FILTER

A4T Series 3 phase power line filters are designed to filter typical switch mode power conversion devices required to meet MIL STD 461 conducted emissions while maintaining low ground leakage currents.

Part No.	Current	Case	Leakage
A4T5	5.0A/PH	4x4x10-13/16	2.0mA

Rated Voltage: 250/440VAC, 50/60Hz
125/220VAC, 400Hz
Insertion Loss: (50 ohms, typical)

	.02MHz	.05MHz	.15MHz	1.5MHz	5.0MHz	50MHz
L/N	22db	35db	50db	65db	65db	60db
L/G	21db	50db	65db	65db	65db	60db

D1L SERIES
HIGH PERFORMANCE SEVERE ENVIRONMENT DC POWER FILTER

D1L Series filters are designed for applications subject to MIL STD 461 conducted emissions limits.

The non-polar design of the D1L Series allows complete applications flexibility.

Part No.	Current	Case
D1L5	5.0A	1-1/4x2x3-3/16
D1L10	10.0A	1-1/2x2x3-11/16
D1L20	20.0A	2x2x5
D1L40	40.0A	2-3/4x3x6-1/16

Rated Voltage: 60VAC
Insertion Loss: (50 ohms, typical)

	.02MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	50MHz
L/G	22db	55db	60db	60db	60db	50db

D2L SERIES
HIGH PERFORMANCE SEVERE ENVIRONMENT DC POWER FILTER

D2L Series dual filters are designed for typical DC switch mode power conversion & regulation applications subject to MIL STD 461 conducted emissions specifcations.

D2L Series functions equally well with balanced or unbalanced load currents, with chassis returns or with positive or negative polarities.

Part No.	Current	Case
D2L5	5.0A	1-13/16x2-3/16x4
D2L10	10.0A	2x2x5
D2L20	20.0A	2-3/4x3x6-1/16
D2L40	40.0A	4x4x6-13/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.02MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	50MHz
L/G	22db	55db	60db	60db	60db	50db

3Ø FILTERS

3E SERIES
3 PHASE SWITCH MODE EMI FILTER

3E Series T section filters are designed to attenuate differential (L/N) and common mode (L/G) EMI from switch mode power circuits and power supplies in balanced or unbalanced 3 phase load configurations.

The 3E Series is available in Wye or Delta configurations. The Wye version can also be used for Delta applications.

Part No.	Current	Case	Leakage
3E15	15A/PH	3x3x6-1/16	1.2mA
3E20	20A/PH	4x4x6-13/16	1.2mA
3E30	30A/PH	4x4x6-13/16	1.4mA
3E45	45A/PH	4x4x8-13/16	1.6mA
3E60	60A/PH	4-3/4x5x10-1/4	1.6mA
3E80	80A/PH	4-3/4x6-1/2x12-1/4	2.4mA
3E100	100A/PH	4-3/4x6-1/2x14-1/4	2.4mA
3E150	150A/PH	5-3/4x7-1/2x14-1/2	3.5mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	12db	22db	50db	55db	50db	50db
L/G	3db	25db	55db	60db	50db	50db

3F SERIES
HIGH PERFORMANCE 3 PHASE SWITCH MODE EMI FILTER

With extended low frequency performance, 3F Series EMI filters provide enhanced differential (L/N) and common mode (L/G) insertion loss for switch mode power circuits and supplies subject to FCC and VDE 0871/A spectrums. The 3F Series is available in Wye or Delta configurations.

3F Series filters are reliable performers with either balanced or unbalanced 3 phase load currents.

Part No.	Current	Case	Leakage
3F7	7.5A/PH	3x3x6-13/16	.80mA
3F15	15A/PH	4x4x8-13/16	.80mA
3F30	30A/PH	4-3/4x5x10-1/4	1.4mA
3F45	45A/PH	4-3/4x5x13-1/4	1.4mA
3F60	60A/PH	4-3/4x6-1/2x14-1/4	1.6mA
3F75	75A/PH	4-3/4x6-1/2x14-1/4	2.4mA
3F80	80A/PH	4-3/4x6-1/2x17-1/4	2.4mA
3F100	100A/PH	5-3/4x7-1/2x17-1/2	2.4mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	15db	50db	60db	60db	60db	55db
L/G	10db	50db	65db	65db	65db	60db

3X SERIES
ENHANCED PERFORMANCE 3 PHASE FILTER

The 3X Series of T section 3 phase EMI filters feature additional line inductors, providing up to 15db of enhanced performance, for severe EMI requirements such as VDE 0871/A while maintaining moderate leakage current.

3X Series filters are available in Wye or Delta configurations.

Part No.	Current	Case	Leakage
3X3	3A/PH	3x3x6-13/16	.80mA
3X7	7.5A/PH	4x4x8-13/16	1.2mA
3X15	15A/PH	4-3/4x5x10-1/4	1.2mA
3X30	30A/PH	4-3/4x6-1/2x14-1/4	1.6mA
3X40	40A/PH	4-3/4x6-1/2x17-1/4	1.6mA
3X60	60A/PH	5-3/4x7-1/2x17-1/2	2.4mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	30db	65db	65db	65db	60db	55db
L/G	20db	60db	65db	65db	60db	60db

3W SERIES
3 PHASE WIDE BAND HIGH PERFORMANCE FILTER

3W Series provides extended high and low frequency insertion loss while maintaining low ground leakage currents:

The unique design of the 3W filter maintains performance over a wide range of impedances.

Part No.	Current	Case	Leakage
3W10	10A/PH	4x4x10-13/16	2.4mA
3W20	20A/PH	4-3/4x5x15-1/4	3.2mA
3W30	30A/PH	4-3/4x6-1/2x17-1/4	3.2mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	50MHz
L/N	52db	65db	65db	65db	65db	60db
L/G	40db	60db	65db	65db	65db	60db

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3Ø FILTERS

3B SERIES
3 PHASE ECONOMICAL
π SECTION FILTER

FCI's most economical and compact 3 phase filter provides both differential and common mode performance in a π section circuit configuration. 3B Series filters are designed for general purpose applications including supplementary filtering at the system level.

Part No.	Current	Case	Leakage
3B8D	8A/PH	2-1/8 x 1-3/4 x 3-5/8	.80mA
3B16D	16A/PH	3 x 2 x 4	1.4mA
3B30D	30A/PH	4-1/8 x 1-3/4 x 4	1.4mA
3B60D	60A/PH	4-1/4 x 2-1/4 x 7-3/4	1.4mA
3B100D	100A/PH	5-1/2 x 3 x 9	1.4mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	12db	20db	40db	60db	50db	50db
L/G	4db	18db	38db	44db	50db	50db

3L SERIES
3 PHASE ENHANCED
PERFORMANCE FILTER

The 3L Series 3 phase π section filters are for use with switch mode loads of all types. 3L Series filters provide stand alone or enhancement level performance for FCC and VDE 0871/A requirements.

Part No.	Current	Case	Leakage
3L15	15A/PH	2-1/4x4-1/4x8-1/16	.80mA
3L30	30A/PH	3x5-1/2x9-1/16	1.1mA
3L45	45A/PH	4-3/4x5x10	1.4mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	20db	35db	60db	60db	60db	55db
L/G	15db	30db	42db	60db	60db	55db

3V SERIES
PREMIUM PERFORMANCE
3 PHASE π FILTER

The 3V Series provides extended low frequency performance for VDE 0871/B type applications with switch mode power supplies.

3V Series filters operate equally well with balanced or unbalanced loads and provides significant attenuation in the 10KHz to 150KHz band.

Part No.	Current	Case	Leakage
3V16	16A/PH	4x4x10-13/16	1.8mA
3V24	24A/PH	4-3/4x5x15-1/4	1.8mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	40db	55db	60db	65db	50db	55db
L/G	22db	40db	50db	55db	55db	45db

3H SERIES
HIGH VOLTAGE
3 PHASE POWER FILTER

3H Series filters are designed for equipment in an industrial environment powered by 480 VAC 3 phase AC power. Typical applications include motor controllers, laser power supplies and uninterruptable power supplies.

Part No.	Current	Case	Leakage
3H15	15A/PH	4x4x6-13/16	3.9mA
3H30	30A/PH	4-3/4x5x10-1/4	3.9mA
3H45	45A/PH	4-3/4x5x13-1/4	3.9mA
3H60	60A/PH	4-3/4x6-1/2x14-1/4	3.9mA
3H100	100A/PH	5-3/4x7-1/2x17-1/2	3.9mA

Rated Voltage: 480VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	10db	40db	60db	60db	60db	55db
L/G	10db	50db	60db	60db	60db	55db

3C SERIES
3 PHASE SCR FILTER

SCR phase regulation input line filter designed to suppress transients generated by thyristor circuit commutation currents.

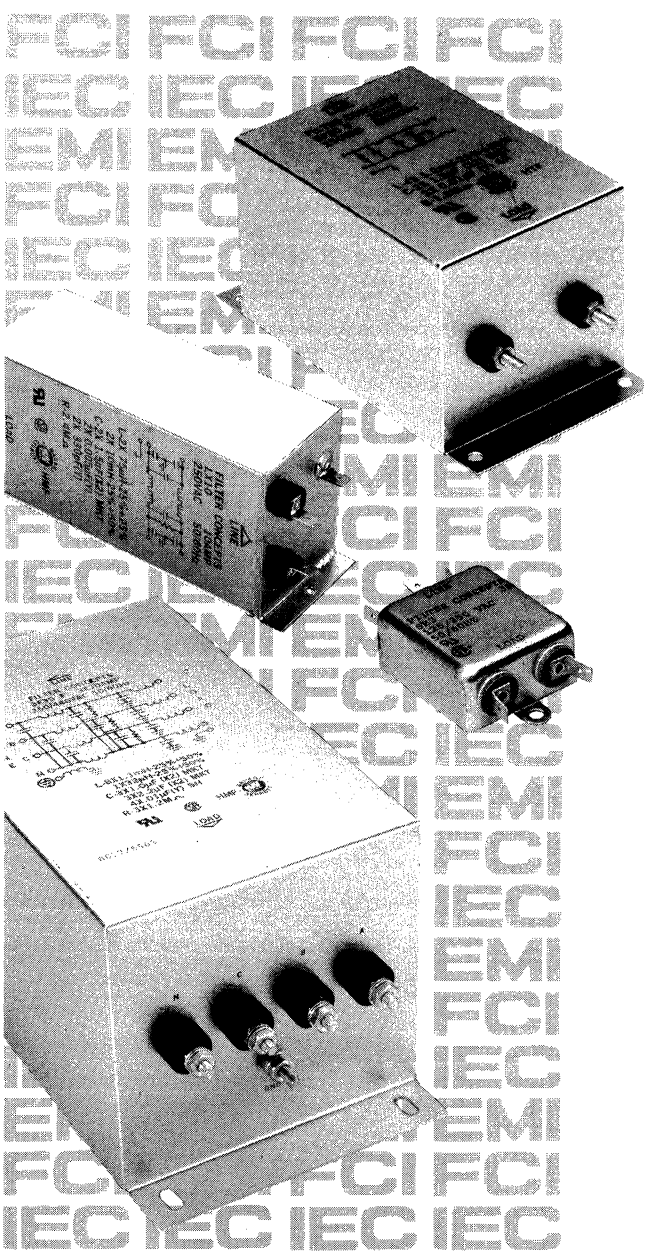
Part No.	Current	Case	Leakage
3C20D	20A/PH	4x4x8-13/16	1.6mA
3C40D	40A/PH	4-3/4x5x13-1/4	2.4mA
3C60D	60A/PH	4-3/4x6-1/2x14-1/4	2.4mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	50db	60db	65db	65db	65db	60db
L/G	5db	18db	40db	55db	60db	50db

FILTER CONCEPTS INC.

- **Industry's Widest Selection of Standard Power Line EMI Filters for single and 3Ø applications.**
- **Custom AC and DC Power Line Filters from 1 to 150 Amps.**
- **Applications Oriented to solve emmission problems in Switch Mode Power Supplies, Motor Controllers, Medical Equipment, Lasers, UPS's, etc.**



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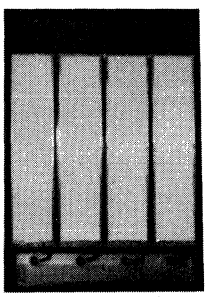
GENISCO ELECTRONICS CORPORATION
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FILTERS—Facility Filters—Capacitive Input/EMI Powerline Filters UL Listed

APPLICABLE SPECIFICATIONS

MIL-F-15733	General specification for filters, military	**MIL-STD-202**	Test methods for component parts, military
MIL-STD-220A	Test method of insertion loss, military	**MIL-STD-285**	Test method for shielding effectiveness
NFPA 70-1987	National Electrical Code, standards	**UL1283**	Underwriters Lab filter requirements

GFP58201 100dB SERIES GFP58221 60dB SERIES—FACILITY FILTERS



FILTERS

- UL Listed In Accordance With UL1283
- Enlosed terminations
- Multi-circuit
- 100 dB or 60 dB series Insertion Loss per MIL-STD-220A over the frequency range of 14KHz to 10GHz with extended range buffer network
- Manufactured and tested per the applicable portions of MIL-F-15733
- Hermetically sealed with welded and soldered seams for shielding effectiveness
- Bleeder resistors incorporated to eliminate potential shock hazard

ENCLOSURES/PANELS

- UL Listed Filter panel assembly
- Modified NEMA type constructed of not less than 14 gauge cold rolled steel
- RF tight inner area secured with RF gasket for 100 dB minimum shielding effectiveness, 14 KHz to 10 GHz
- Prewired standoffs and lugs
- Lifting ears included on heavier enclosures
- Front cover access to filters and standoffs

FUNCTIONAL CHARACTERISTICS

- **Voltage Rating:** 120/208 VAC, (50/60, 400 Hz) 277/480 VAC, (50/60 Hz)
- **Voltage Drop:** 2% maximum at full rated (UPF) AC load
- **Harmonic Distortion:** 4% maximum at full rated (UPF) AC load
- **Temperature Rating:** MIL-F-15733 and UL1283
- **Current Overload:** 140% maximum current rating
- **RF Radiation:** Greater than 100 dB isolation
- **Dielectric Withstanding Voltage:** 2200 VDC minimum per UL1283
- **Insulation Resistance:** MIL-F-15733 (w/o discharge ckts)

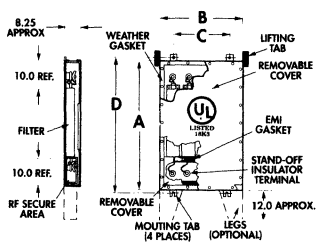


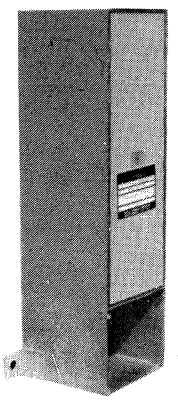
TABLE II

Voltage Rating
B 120/208 VAC, 50/60 Hz
C 120/208 VAC, 400 Hz
D 277/480 VAC, 50/60 Hz

TABLE I

NO. OF FILTERS AND CURRENT RATING	A	B	C	D	WEIGHT, LBS. APPROX.
2×5 AMP & 10 AMP	42.0	12.0	6.00	43.25	150
3×5 AMP & 10 AMP	42.0	18.0	12.00	43.25	208
4×5 AMP & 10 AMP	42.0	23.0	17.00	43.25	290
5×5 AMP & 10 AMP	42.0	29.0	23.00	43.25	390
2×20 AMP & 30 AMP	44.0	12.0	6.00	45.25	170
3×20 AMP & 30 AMP	44.0	18.0	12.00	45.25	220
4×20 AMP & 30 AMP	44.0	23.0	17.00	45.25	310
5×20 AMP & 30 AMP	44.0	29.0	23.00	45.25	410
2×50 AMP & 60 AMP	48.0	12.0	6.00	49.25	208
3×50 AMP & 60 AMP	48.0	18.0	12.00	49.25	300
4×50 AMP & 60 AMP	48.0	23.0	17.00	49.25	400
5×50 AMP & 60 AMP	48.0	29.0	23.00	49.25	500
2×100 AMP	48.0	16.0	10.00	49.25	220
3×100 AMP	48.0	24.0	18.00	49.25	400
4×100 AMP	48.0	31.0	25.00	49.25	490
5×100 AMP	48.0	39.0	33.00	49.25	650
2×150 AMP	60.0	22.0	16.00	61.25	330
3×150 AMP	60.0	32.0	26.00	61.25	630
4×150 AMP	60.0	42.0	36.00	61.25	875
5×150 AMP	60.0	52.0	46.00	61.25	1200
2×200 AMP TO 250 AMP	68.0	22.0	16.00	69.25	600
3×200 AMP TO 250 AMP	68.0	32.0	26.00	69.25	850
4×200 AMP TO 250 AMP	68.0	42.0	36.00	69.25	1100
5×200 AMP TO 250 AMP	68.0	52.0	46.00	69.25	1450
2×300 & 400 AMP	100.0	21.0	N/A	N/A	900
3×300 & 400 AMP	100.0	30.0	N/A	N/A	1600
4×300 & 400 AMP	100.0	39.0	N/A	N/A	1850
2×600 TO 800 AMP	100.0	39.0	N/A	N/A	1850
3×600 TO 800 AMP	100.0	57.0	N/A	N/A	2300
4×600 TO 800 AMP	100.0	72.0	N/A	N/A	3000

GFUL58260—EMI POWERLINE FILTERS



FEATURES

- UL-Listed in accordance with UL1283
- Low cost
- Manufactured and tested to the applicable portions of MIL-F-15733
- Hermetically sealed with welded and soldered seams for shielding effectiveness
- Bleeder resistors incorporated to eliminate potential shock hazard
- Two discrete circuits provided in the same case for 5 A through 30 A configurations
- Threaded steel penetration included with filter case
- Factory prewired lead through pipe penetration included
- Removable input cover for easy access to terminal
- Electro-plated over cold rolled steel filter case
- Mounting tabs provided for easy wall mounting
- Double knock outs provided on filter case input
- Power factor correction coils available for 400 Hz filters
- 100 dB, 14 KHz to 10 GHz per MIL-STD-220A utilizing extended range buffer networks over the frequency range of 14 KHz to 20 MHz

FUNCTIONAL CHARACTERISTICS

- **Insertion loss:** ≥100 dB from 14 KHz through 10 GHz when measured in accordance with MIL-STD-220A test procedure with extended range buffer networks
- **Voltage Ratings:** 120/208 VAC (50/60, 400 Hz) 277/480 VAC (50/60) Hz
- **Voltage Drop:** 2% at full rated AC (UPF) load
- **Harmonic Distortion:** 4% max at full rated AC (UPF) load
- **Temperature Rating:** Per MIL-F-15733 and UL1283
- **Current Overload:** 140% maximum current rating per MIL-F-15733
- **RF Radiation:** 100dB isolation shielding effectiveness
- **Dielectric Withstanding:** 2200 VDC per MIL-F-15733 and UL1283
- **Insulation Resistance** MIL-F-15733 (w/o discharge ckts)
- **AC Current Ratings:** 5A To 250A—See Table I

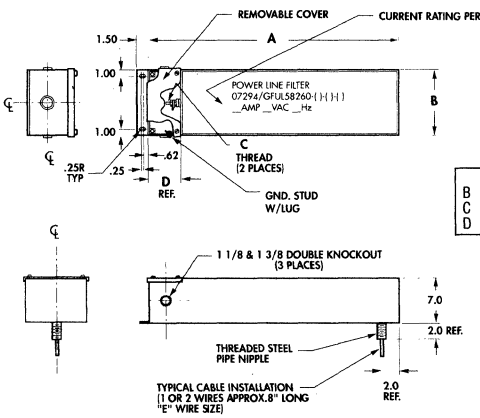


TABLE II

Voltage Rating
B 120/208 VAC 50/60 Hz
C 120/208 VAC 400 Hz
D 277/480 VAC 50/60 Hz

TABLE I

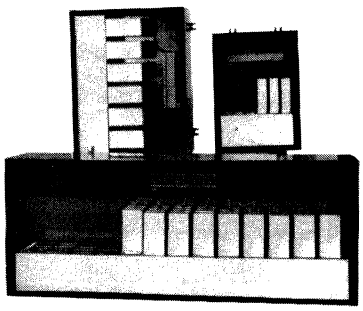
NUMBER OF CIRCUITS AND CURRENT RATING	A	B	C	D	E Wire GA	APPROX. WT.
1×5 & 10 AMP	36.0	4.50	10-32	6.00	14	35 Lbs.
2×5 & 10 AMP	36.0	9.00	10-32	6.00	14	50 Lbs.
1×20 & 30 AMP	38.0	4.50	10-32	6.00	8	36 Lbs.
2×20 & 30 AMP	38.0	9.00	10-32	6.00	8	52 Lbs.
1×50 & 60 AMP	42.0	4.50	3/8	6.00	3	65 Lbs.
1×100 AMP	45.0	6.50	3/8	9.00	1	70 Lbs.
1×150 AMP	53.0	9.00	3/8	9.00	3/0	150 Lbs.
1×200 AMP	67.0	9.00	3/8	15.00	250 MCM	200 Lbs.
1×225 AMP	67.0	9.00	3/8	15.00	300 MCM	200 Lbs.
1×250 AMP	67.0	9.00	3/8	15.00	400 MCM	200 Lbs.

SEE OUR PAGES IN SECTION 2750 & 2460.

GENISCO ELECTRONICS CORPORATION
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FILTERS—Signal Line Filters

GFP7072



ENCLOSURES/PANELS
- 20 standard enclosures holding from 1 to 900 signal line filters
- Welded NEMA type enclosures with wall or floor mounting
- Prewired push pin terminal blocks or 8-32 screw terminations
- EMI gasketing to insure 100 dB shielding effectiveness per MIL-STD-285, NSA and TEMPEST Requirements
- Lifting ears included on heavier enclosures

APPLICABLE SPECIFICATIONS
MIL-F-15733 EMI/RFI Filter Specification, Military
MIL-F-18327 General EMI/RFI Filter Specification, Military
MIL-STD-220A Test Method of Insertion Loss, Military
MIL-STD-285 Test Method for Shield Effectiveness

OPTIONS
Various Impedances
Standard Baud Rates
Special Response Curves
Legs (12.0 Inch Standard)
EMP, MOV and Surge Arrestors Available
Hub or Penetration Installation

FILTERS
- Over 100 signal line filter types available for telephone, fire alarm, data, communications and control application
- Manufactured and tested to the applicable portions of MIL-F-15733
- Hermetically sealed for high reliability
- Different filter types are interchangable in the same enclosure
- Single, Dual, or Multi-circuit arrangements to 5.0 AMP available
- 100 dB up to 10 GHz per MIL-STD-220A

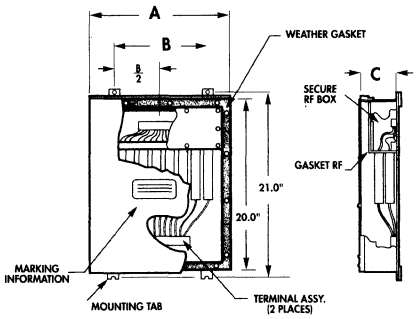
DATA FILTERS (Dual Circuit)

PART NO.	GF56993-1	GF57738-1	GF56972-2	GF57686-1	GF57598-1	GF56973-2	GF58040	GF57580
IMPEDANCE, L-L L-G	600Ω 300Ω	600Ω 300Ω	600Ω 300Ω	600Ω 300Ω	600Ω 300Ω	600Ω 300Ω	600Ω 300Ω	124Ω 62Ω
VOLTAGE, MAX	400 VDC 125 VAC	400 VDC 125 VAC	400 VDC 125 VAC	400 VDC 125 VAC	400V 125 VAC	400V 125 VAC	400V 125 VAC	400V 125 VAC
CURRENT, MAX	400mA	400mA	400mA	500mA	500mA	1 Amp	1 Amp	1 Amp
DC RESISTANCE	≤15Ω	<4Ω	≤2.5Ω	≤1.2Ω	≤1Ω	≤0.50Ω	≤0.5Ω	≤0.25Ω
PASS BAND	0-3 KHz	0-6 KHz	0-12 KHz	0-24 KHz	0-48 KHz	0-100 KHz	0-140 KHz	0-256 KHz
INSERTION LOSS,	≥100dB	≥100dB	≥100dB	≥100dB	≥100dB	≥100dB	≥100dB	≥100dB
(Per MIL-STD-220)	14KHz-10GHz	40KHz-10GHz	80KHz-10GHz	150KHz-10GHz	300KHz-10GHz	600KHz-10GHz	1MHz-10GHz	5MHz-10GHz
BAUD RATE	1.2K	2.4K	4.8K	9.6K	19.2K	38.4K	56K	128K

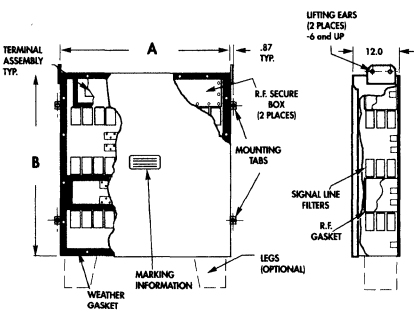
	TELEPHONE LINE FILTERS (Dual Circuit)			P.A. SYSTEM FILTERS (Dual Circuit)	
PART NO.	GFS7262	GFS7216	GF57977	GF58150-1	GF58150-2
IMPEDANCE, L-L L-G	600Ω 300Ω	600Ω 300Ω	600Ω 300Ω	16Ω 8Ω	32Ω 16Ω
VOLTAGE, MAX	400VDC 125VAC	400VDC 125VAC	400VDC 125VAC	100VDC	100VDC
CURRENT, MAX	500mA	400mA	500mA	1.5 AMP	1.5 AMP
DC RESISTANCE	≤12Ω	≤8Ω	≤6Ω	≤0.5Ω	≤0.5Ω
PASSBAND	0-4KHz	0-3KHz	0-4KHz	0-3KHz	0-3KHz
INSERTION LOSS	≥100dB	≥60dB @ 14KHz ≥90dB @ 30KHz	≥100dB	≥100dB	≥100dB
(Per MIL-STD-220)	14KHz-100GHz	≥100dB 40KHz to 10GHz	14KHz-10GHz	14KHz-10GHz	14KHz-10GHz

	FIRE ALARM FILTERS (Dual Circuit)		RELAY/THERMOSTAT FILTERS (Dual Circuit)	
PART NO.	GF57685	GF57685-1	GF57978	GF58157
IMPEDANCE, L-L L-G	64Ω 32Ω	150Ω 75Ω	10Ω 5Ω	100Ω 50Ω
VOLTAGE, MAX	400VDC 125VAC	400VDC 125VAC	100VDC	400VDC 125VAC
CURRENT, MAX	1 AMP	1 AMP	4.0 AMP	400mA DC
DC RESISTANCE	≤2.0Ω	≤1.0Ω	≤0.3Ω	≤10.0Ω
INSERTION LOSS	≥100dB	≥100dB	≥100dB	≥100dB
(Per MIL-STD-220)	14KHz-10GHz	14KHz-10GHz	14KHz-10GHz	14KHz-10GHz

	GENERAL COMMUNICATIONS FILTERS (Dual Circuit)			
PART NO.	GF57218	GF57684	GF57977	GF57729
IMPEDANCE, L-L L-G	50Ω 25Ω	45Ω 22.5Ω	600Ω 300Ω	76Ω 38Ω
VOLTAGE, MAX	100VDC 30VAC	100VDC 30VAC	400VDC 125VAC	400VDC 125VAC
CURRENT, MAX	1 AMP	0.5 AMP	0.5 AMP	1 AMP
DC RESISTANCE	≤1.0Ω	≤2.0Ω	≤6.0Ω	≤1.0Ω
PASSBAND	0-3.5KHz	0-3.5KHz	0-4KHz	0-6KHz
INSERTION LOSS	≥100dB	≥100dB	≥100dB	≥100dB
(Per MIL-STD-220)	50KHz-10GHz	14KHz-10GHz	14KHz-10GHz	50KHz-10GHz



For GFP 7072-1 thru 5



For GFP 7072-6 thru 16

Dimensional Data

Part Number*	Capacity in Number of Pairs of Circuits	Dimensions (in.) A	B	C
GFP7072-1	12	14.5	8.0	9.0
GFP7072-2	20	18.0	11.5	9.0
GFP7072-3	30	25.5	19.0	9.0
GFP7072-4	50	49.5	29.0	9.0
GFP7072-5	56	52.0	40.0	9.0
GFP7072-6	81	17.00	48.0	12.0
GFP7072-7	90	18.75	48.0	12.0
GFP7072-8	99	20.50	48.0	12.0
GFP7072-9	126	25.75	48.0	12.0
GFP7072-10	171	34.50	48.0	12.0
GFP7072-11	225	45.00	48.0	12.0
GFP7072-12	279	55.0	48.0	12.0
GFP7072-13	315	63.00	48.0	12.0
GFP7072-14	369	73.50	48.0	12.0
GFP7072-15	423	84.00	48.0	12.0
GFP7072-16	459	91.00	48.0	12.0
		Width	**Height**	**Depth**
GFP7072-17	600	60.00	90.0	22.5
GFP7072-18	700	72.00	90.0	22.5
GFP7072-19	800	84.00	90.0	22.5
GFP7072-20	900	90.00	90.0	22.5

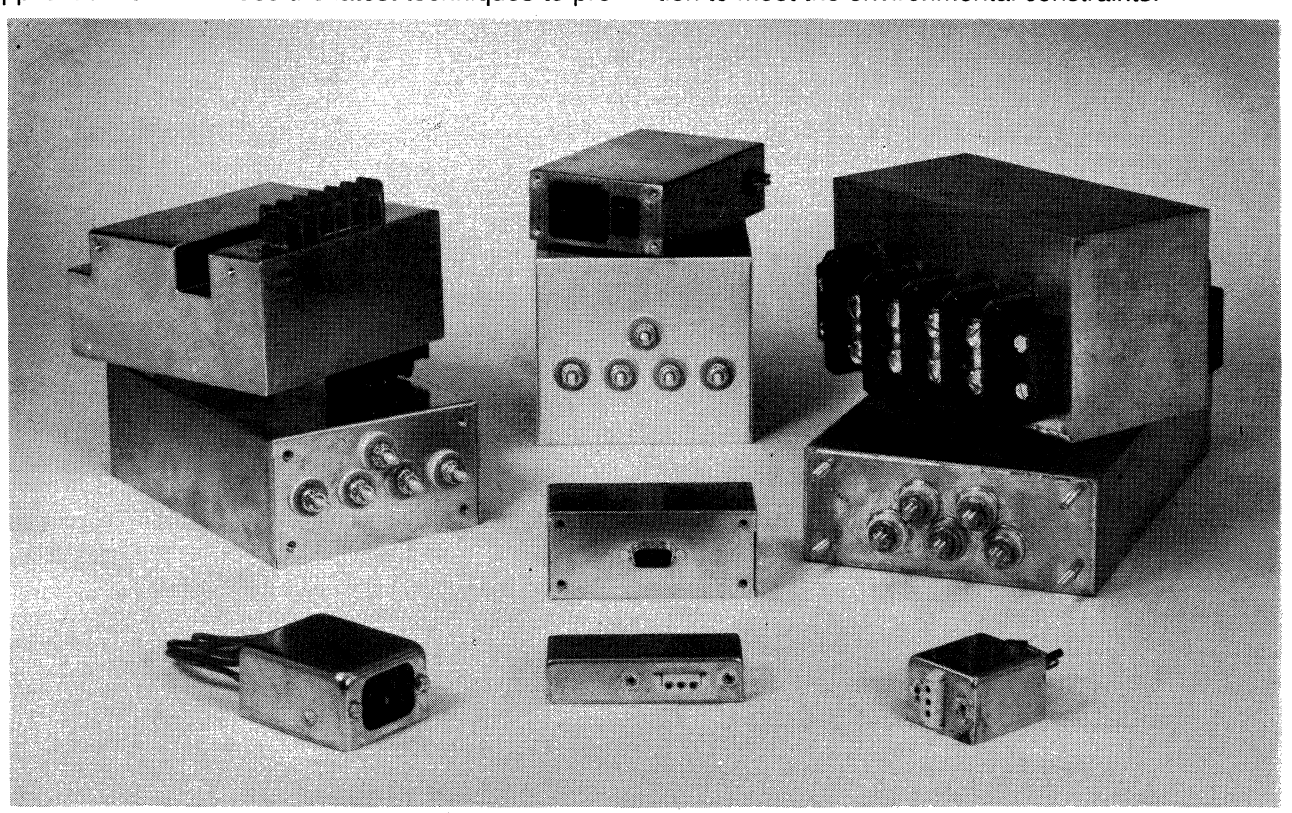
Dimensions are in inches

SEE OUR PAGES IN SECTION 2750 & 2460.

JMK INCORPORATED filters

TEMPEST AND MILITARY FILTERS designed to meet MIL-STD-461B MIL-F-15733 MIL-STD-220A

Military and tempest filters require frequency spectrum performance from as low as 500 Hz to as high as 1 GHz or higher. The requirements vary with the application. JMK will use the latest techniques to provide maximum performance in the specified size. Our engineering department is ready to help solve your interference problem and to help package the solution to meet the environmental constraints.



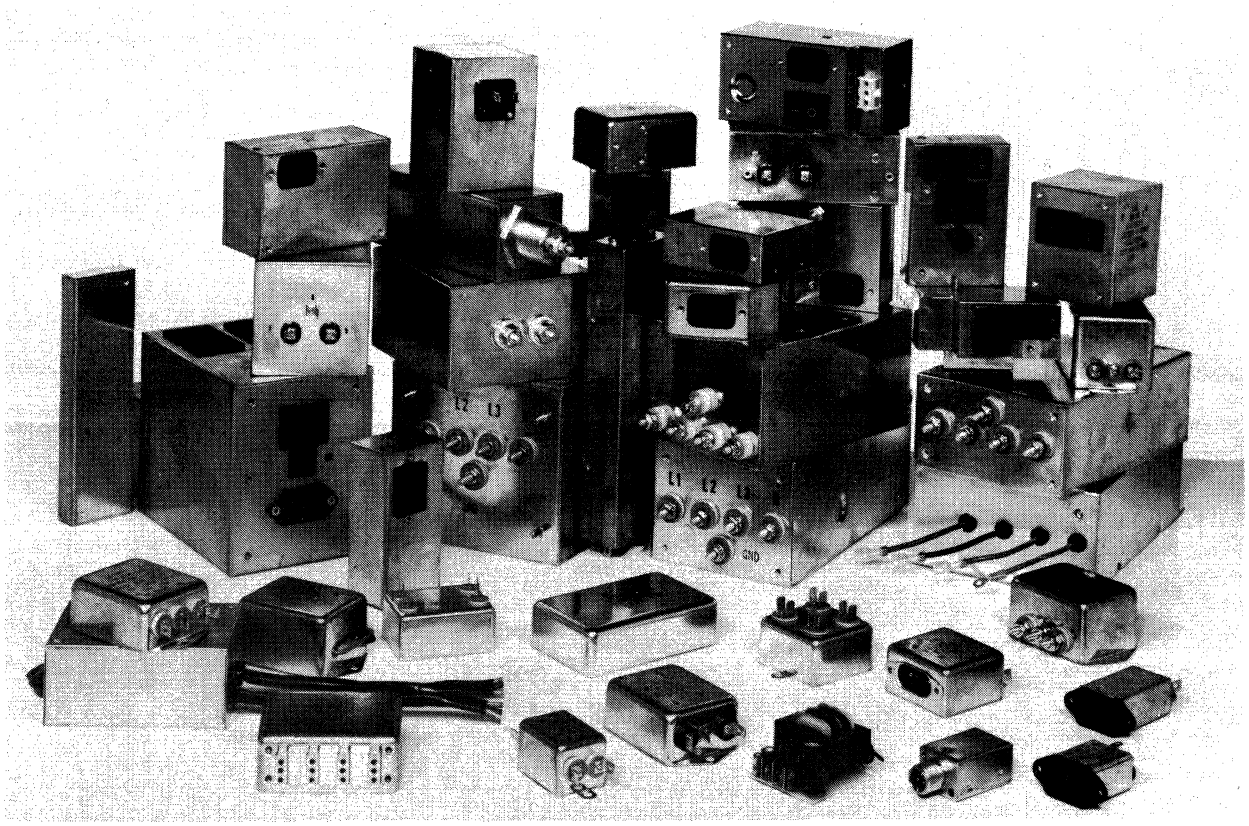
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JMK INCORPORATED filters

RF Interference
Data Line
Harmonic Distortion
Transient Suppression
Single Phase
Three Phase

FCC
VDE
CSA
UL
IEC

JMK has 25 years experience designing filters to meet special requirements. Chances are your unique requirement is a standard to us. We have many designs from 1 Amp to 200 Amp. If you have a conducted interference problem, we have the solution.



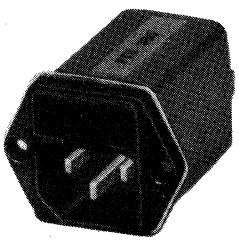
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PDI® Power Dynamics, Inc.

FILTERED POWER ENTRY MODULES

P.O. Box 539•59 Lakeside Avenue, West Orange, NJ 07052 (201) 736-5722•Fax (201) 736-8930

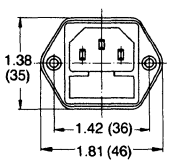
HGN-365



HGN-365 series line filters feature an IEC Connector with an integral fuse holder; available in versions with one or two 5 x 20mm fuses. (IEC 601 prescribes fusing of both lines.)

Fully enclosed metal housing presents input of high frequency noise and protects ultra-sensitive equipment.

FACE DIMENSIONS



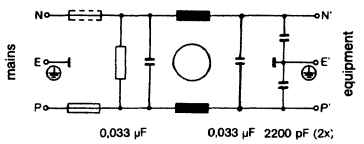
PANEL CUT-OUT DIMENSIONS

1.4 x 1.30 x R .14
(29 x 33 x R. 3.5mm)
Center-to-center screw position: 1.42 (36mm)

Technical data

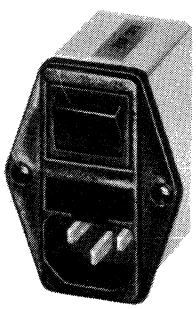
Operating voltage	250 V/50 Hz 110 V/60 Hz
Rated current	1A/2A/4A
Leakage current	<0.5 mA/250 VAC
Temperature range	– 25°C±85°C
Test voltage (VDE 0565)	1,8 kV/50 Hz-2 S

CIRCUIT

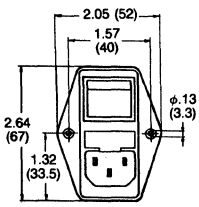


Approvals:
UL
CSA
VDE
SEV

HGN-375



The combi-filter HGN-375 protects electronic equipment from common and differential mode line interference in the range of 10KHZ up to 30MHZ. The "combi-unit" is equipped with IEC Connector, fuse holder for one or two 5 x 20mm fuses, 2 pole on/off switch and fully enclosed metal housing.



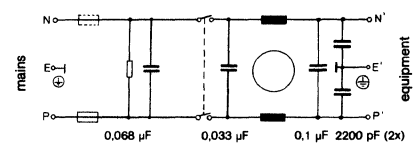
PANEL CUT-OUT DIMENSIONS

2.36 x 1.14 x R .12
(60 x 40 x R 3mm)
Center-to-center screw position: 1.57 (40mm)

Technical data

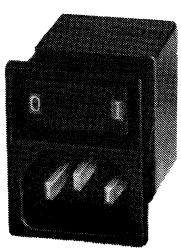
Operating voltage	250 V/50 Hz 110 V/60 Hz
Rated current	1A/2A/4A
Leakage current	<0.5 mA/250 VAC
Temperature range	– 25°C ± 85°C
Test voltage (VDE 0565)	1,8 kV/50 Hz-2 S

CIRCUIT

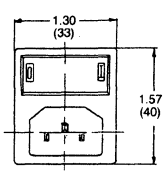


Approvals:
UL
CSA
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HGN-336



HGN-336 line filters feature an IEC Connector and a 2 pole on/off switch. The unit protects electronic equipment against malfunction due to fast common mode and differential mode interferences. Designed for labor saving snap-in mounting.



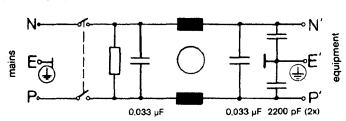
PANEL CUT-OUT DIMENSIONS

1.44 x 1.18 x R .06
(36.5 x 30 x R 1.5mm)

Technical data

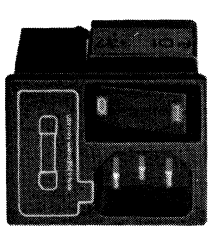
Operating voltage	250 V/50 Hz 110 V/60 Hz
Rated current	1A/2A/3A/4A/6A
Leakage current	<0.5 mA/250 VAC
Temperature range	– 25°C ± 85°C
Test voltage (VDE 0565)	1,8 kV/50 Hz-2 S

CIRCUIT

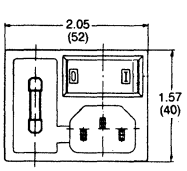


Approvals:
UL
CSA
VDE
SEV

HGN-337



HGN-337 line filter modules feature a combination IEC Connector, two pole on/off switch and fuse holder that accepts both European 5 x 20mm or 3 AG fuses in-line and neutral. The HGN-337 protects electronic equipment such as computers, terminals and typewriters from common mode and differential mode interferences.



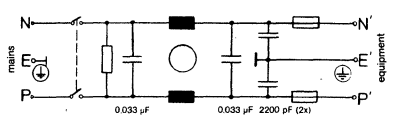
PANEL CUT-OUT DIMENSIONS

1.44 x 1.93 x R .06
(36.5 x 49 x R 1.5mm)

Technical data

Operating voltage	250 V/50 Hz 110 V/60 Hz
Rated current	1A/2A/3A/4A/6A
Leakage current	<0.5 mA/250 VAC
Temperature range	– 25°C±85°C
Test voltage (VDE 0565)	1,8 kV/50 Hz-2 S

CIRCUIT



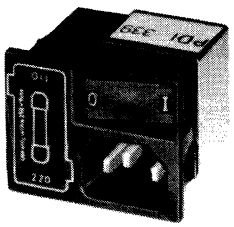
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PDI® FILTERED POWER ENTRY MODULES

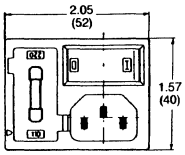
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HGN-339



HGN-339 incorporates all the features of the HGN-337 with the addition of an integral voltage selector. It is designed for use in equipment intended for export enabling the fast change to other mains voltages.

FACE DIMENSIONS



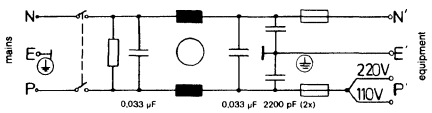
PANEL CUT-OUT DIMENSIONS
1.44 x 1.93 x R .06
(49 x 36.5 x R 1.5mm)

Technical data

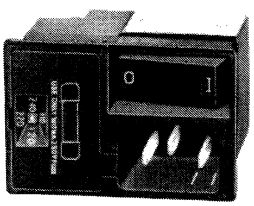
Operating voltage	250 V/50 Hz 110 V/60 Hz
Rated current	1A/2A/3A/4A/6A
Leakage current	<0.5 mA/250 VAC
Temperature range	– 25°C±85°C
Test voltage (VDE 0565)	1,8 kV/50 Hz-2 S

Approvals:
UL
CSA
VDE
SEV

CIRCUIT

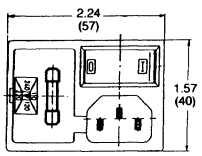


HGN-341



HGN-341 power modules feature IEC Conector, two pole on/off switch, fuse holder that accepts both European 5 x 20mm or 3 AG fuses and a voltge selector with four different voltages. The voltage selector is designed to provide a simple means to change transformer primary connections.

This high performance filter module saves labor cost, is compact and protects electronic equipment from common mode and differential mode interferences.



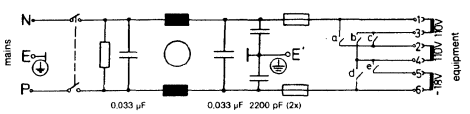
PANEL CUT-OUT DIMENSIONS
1.44 x 2.13 x R .06
(36.5 x 54 x R 1.5mm)

Technical data

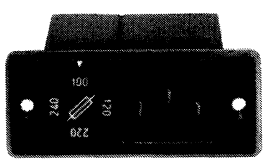
Operating voltage	250 V/50 Hz 110 V/60 Hz
Rated current	1A/2A/3A/4A/6A
Leakage current	<0.5 mA/250 VAC
Temperature range	– 25°C ± 85°C
Test voltage (VDE 0565)	1,8 kV/50 Hz-2 S

Approvals:
UL
CSA
VDE
SEV

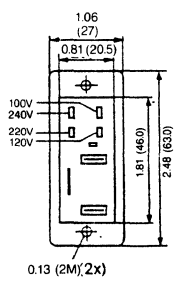
CIRCUIT



HGN-369



The line filters HGN 369 are used in applications having ON/OFF-switch on front-side but mains input at the rear-side. IEC-connector, voltage-selector for four different voltages, fuse (5 x 20mm or 3 AG optionally) and a highly efficient filter in a totally enclosed metal housing ensure best attenuation, e.g., in instruments, scales, 19'-slide-in-units.



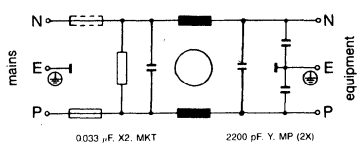
PANEL CUT-OUT DIMENSIONS
.83 x 1.83 (21 x 46.5mm)
Center-to-center screw position: 2.05 (52mm)

Technical data

Operating voltage	250 V/50 Hz 120 V/60 Hz
Rated current	1A/2A/3A/4A/6A
Leakage current	<0.5 mA/250 VAC
Temperature range	– 25°C±85°C
Test voltage (VDE 0565)	1,8 kV/50 Hz-2 S

Approvals:
UL
CSA
VDE
SEV

CIRCUIT

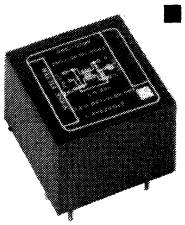


PDI® EMI/RFI FILTERS

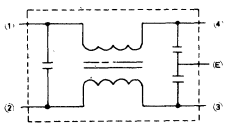
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ALL FILTERS CARRY FOLLOWING APPROVALS:

■ GNE-1019P, GNE-1039P, GNE-1069P



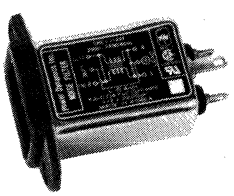
SCHEMATIC DIAGRAM



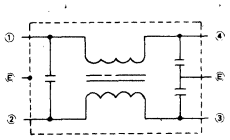
SPECIFICATIONS

Model No.	GNE-1019P	GNE-1039P	GNE-1069P
Rated voltage	250V rms 50/60Hz		
Rated current	1A	3A	6A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec		
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec		
Insulation resistance (Line to Line)	1000 M Ω min. (at 20°C 500 VDC)		
Insulation resistance (Line to Ground)	1000 M Ω min. (at 20°C 500 VDC)		
Leakage current	0.5mA max. (at 250 Vrms 60 Hz)		
Voltage drop	1.0 Vrms max.		
Temperature rise	20°C max.		
Operating temp. ran	−20 ~ +65°C		
Attenuation Common Mode (15 ~ 35°C) 20dB	0.1 ~ 30 MHz	0.3 ~ 30 MHz	1 ~ 30 MHz

■ GNE-1119L, GNE-1139L, GNE-1169L, GNE-1039L



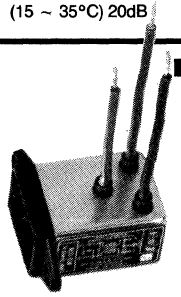
SCHEMATIC DIAGRAM



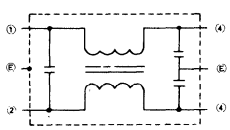
SPECIFICATIONS

Model No.	GNE-1039L	GNE-1119L	GNE-1139L	GNE-1169L
Rated voltage	250V rms 50/60Hz			
Rated current	3A	1A	3A	6A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec			
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec			
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)			
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 100 VDC)			
Leakage current	0.5mA max. (at 250 Vrms 60 Hz)			
Voltage drop	1.0 Vrms max.			
Temperature rise	30°C max.			
Operating temp. ran	−25 ~ +65°C			
Attenuation Common Mode (15 ~ 35°C) 20dB	0.2 ~ 30 MHz	0.4 ~ 30 MHz	1 ~ 30 MHz	2 ~ 30 MHz

■ GNE-2019W, GNE-2039W, GNE-2069W



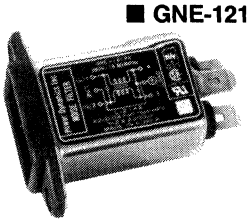
SCHEMATIC DIAGRAM



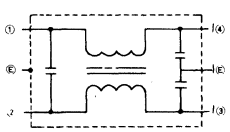
SPECIFICATIONS

Model No.	GNE-2019W	GNE-2039W	GNE-2069W
Rated voltage	250V rms 50/60Hz		
Rated current	1A	3A	6A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec		
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec		
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)		
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 100 VDC)		
Leakage current	0.5mA max. (at 250 Vrms 60 Hz)		
Voltage drop	1.0 Vrms max.		
Temperature rise	30°C max.		
Operating temp. ran	−25 ~ +65°C		
Attenuation Common Mode (15 ~ 35°C) 20dB	0.45 ~ 30 MHz	0.6 ~ 30 MHz	1 ~ 30 MHz

■ GNE-1219X, GNE-1239X, GNE-1269X



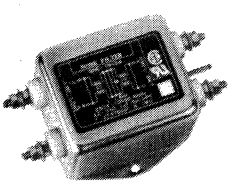
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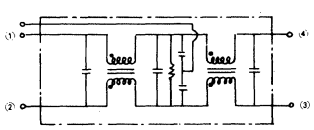
SPECIFICATIONS

Model No.	GNE-1219X	GNE-1239X	GNE-1269X
Rated voltage	250V rms 50/60Hz		
Rated current	1A	3A	6A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec		
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec		
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)		
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 100 VDC)		
Leakage current	0.5mA max. (at 250 Vrms 60 Hz)		
Voltage drop	1.0 Vrms max.		
Temperature rise	30°C max.		
Operating temp. ran	−25 ~ +65°C		
Attenuation Common Mode (15 ~ 35°C) 30dB	0.45 ~ 30 MHz	0.45 ~ 30 MHz	1 ~ 30 MHz

■ GNE-1905A, GNE-1910A, GNE-1915A



SCHEMATIC DIAGRAM



SPECIFICATIONS

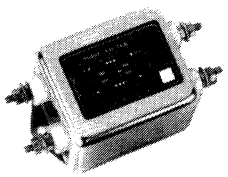
Model No.	GNE-1905A	GNE-1910A	GNE-1915A
Rated voltage	250V rms 50/60Hz		
Rated current	5A	10A	15A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec		
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec		
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)		
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 100 VDC)		
Leakage current	1.0mA max. (at 250 Vrms 60 Hz)		
Voltage drop	1.0 Vrms max.		
Temperature rise	30°C max.		
Operating temp. ran	−25 ~ +65°C		
Attenuation Common Mode (15 ~ 35°C) 20dB	0.45 ~ 30 MHz	0.45 ~ 30 MHz	0.45 ~ 30 MHz

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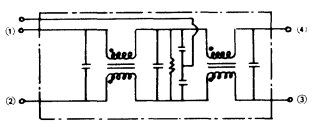
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EMI/RFI FILTERS

■ GNE-2905A, GNE-2910A, GNE-2915A



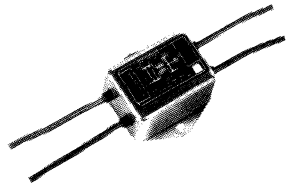
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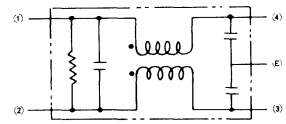
SPECIFICATIONS

Model No.	GNE-2905A	GNE-2910A	GNE-2915A
Rated voltage	250V rms 50/60Hz		
Rated current	5A	10A	15A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec		
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec		
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)		
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 500 VDC)		
Leakage current	0.5mA max. (at 250 Vrms 60 Hz)		
Voltage drop	1.0 Vrms max.		
Temperature rise	30°C max.		
Operating temp. ran	−25 ~ +65°C		
Attenuation Common Mode (15 ~ 35°C) 20dB	0.45~30 MHz	0.45~30 MHz	0.45~30 MHz

■ GNE-5019W, GNE-5039W, GNE-5069W



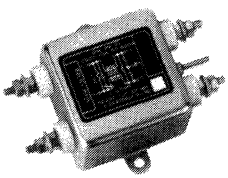
SCHEMATIC DIAGRAM



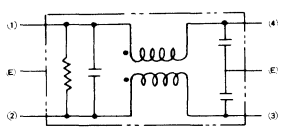
SPECIFICATIONS

Model No.	GNE-5019W	GNE-5039W	GNE-5069W
Rated voltage	250V rms 50/60Hz		
Rated current	1A	3A	6A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec		
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec		
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)		
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 100 VDC)		
Leakage current	1.0mA max. (at 250 Vrms 60 Hz)		
Voltage drop	1.0 Vrms max.		
Temperature rise	30°C max.		
Operating temp. ran	−25 ~ +65°C		
Attenuation Common Mode (15 ~ 35°C) 30dB	0.1~30 MHz	0.45~30 MHz	1~30 MHz

■ GNE-3905A, GNE-3910A, GNE-3915A



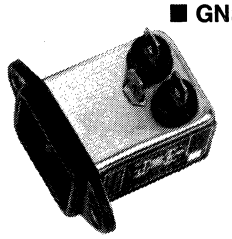
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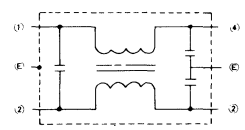
SPECIFICATIONS

Model No.	GNE-3905A	GNE-3910A	GNE-3915A
Rated voltage	250V rms 50/60Hz		
Rated current	5A	10A	15A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec		
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec		
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)		
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 100 VDC)		
Leakage current	1.0mA max. (at 250 Vrms 60 Hz)		
Voltage drop	1.0 Vrms max.		
Temperature rise	30°C max.		
Operating temp. ran	−25 ~ +65°C		
Attenuation Common Mode (15 ~ 35°C) 30dB	0.1~30 MHz	0.45~30 MHz	0.45~30 MHz

■ GNE-2019X, GNE-2039X, GNE-2069X
(QUICK DISCONNECT TERMINALS)



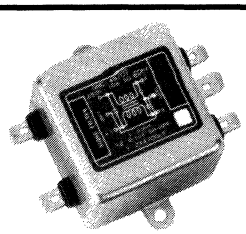
SCHEMATIC DIAGRAM



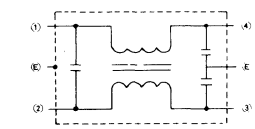
SPECIFICATIONS

Model No.	GNE-2019X	GNE-2039X	GNE-2069X
Rated voltage	250V rms 50/60Hz		
Rated current	1A	3A	6A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec		
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec		
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)		
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 100 VDC)		
Leakage current	0.5mA max. (at 250 Vrms 60 Hz)		
Voltage drop	1.0 Vrms max.		
Temperature rise	30°C max.		
Operating temp. ran	−25 ~ +65°C		
Attenuation Common Mode (15 ~ 35°C) 20dB	0.45~30 MHz	0.45~30 MHz	1~30 MHz

■ GNE-4905T, GNE-4910T



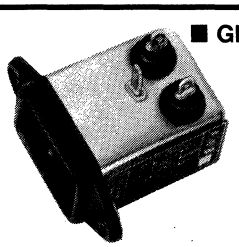
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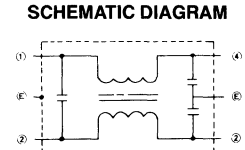
SPECIFICATIONS

Model No.	GNE-4905T	GNE-4910T
Rated voltage	250V rms 50/60Hz	
Rated current	5A	10A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec	
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec	
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)	
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 100 VDC)	
Leakage current	1.0mA max. (at 250 Vrms 60 Hz)	
Voltage drop	1.0 Vrms max.	
Temperature rise	30°C max.	
Operating temp. ran	−25 ~ +65°C	
Attenuation Common Mode (15 ~ 35°C) 30dB	0.1~30 MHz	0.45~30 MHz

■ GNE-2019L, GNE-2039L, GNE-2069L
(SOLDER TERMINALS)



SCHEMATIC DIAGRAM



SPECIFICATIONS

Model No.	GNE-2019L	GNE-2039L	GNE-2069L
Rated voltage	250V rms 50/60Hz		
Rated current	1A	3A	6A
Test voltage (Line to Line)	1000 Vrms 50/60Hz 60 sec		
Test voltage (Line to Ground)	1500 Vrms 50/60Hz 60 sec		
Insulation resistance (Line to Line)	3000 M Ω min. (at 20°C 100 VDC)		
Insulation resistance (Line to Ground)	6000 M Ω min. (at 20°C 100 VDC)		
Leakage current	0.5mA max. (at 250 Vrms 60 Hz)		
Voltage drop	1.0 Vrms max.		
Temperature rise	30°C max.		
Operating temp. ran	−25 ~ +65°C		
Attenuation Common Mode (15 ~ 35°C) 20dB	0.45~30 MHz	0.45~30 MHz	1~30 MHz

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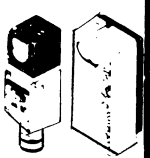
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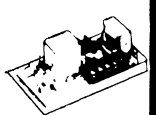
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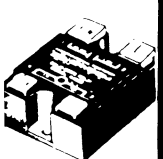
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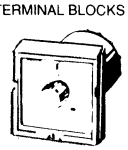

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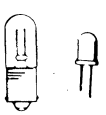
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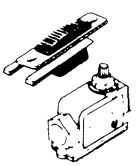
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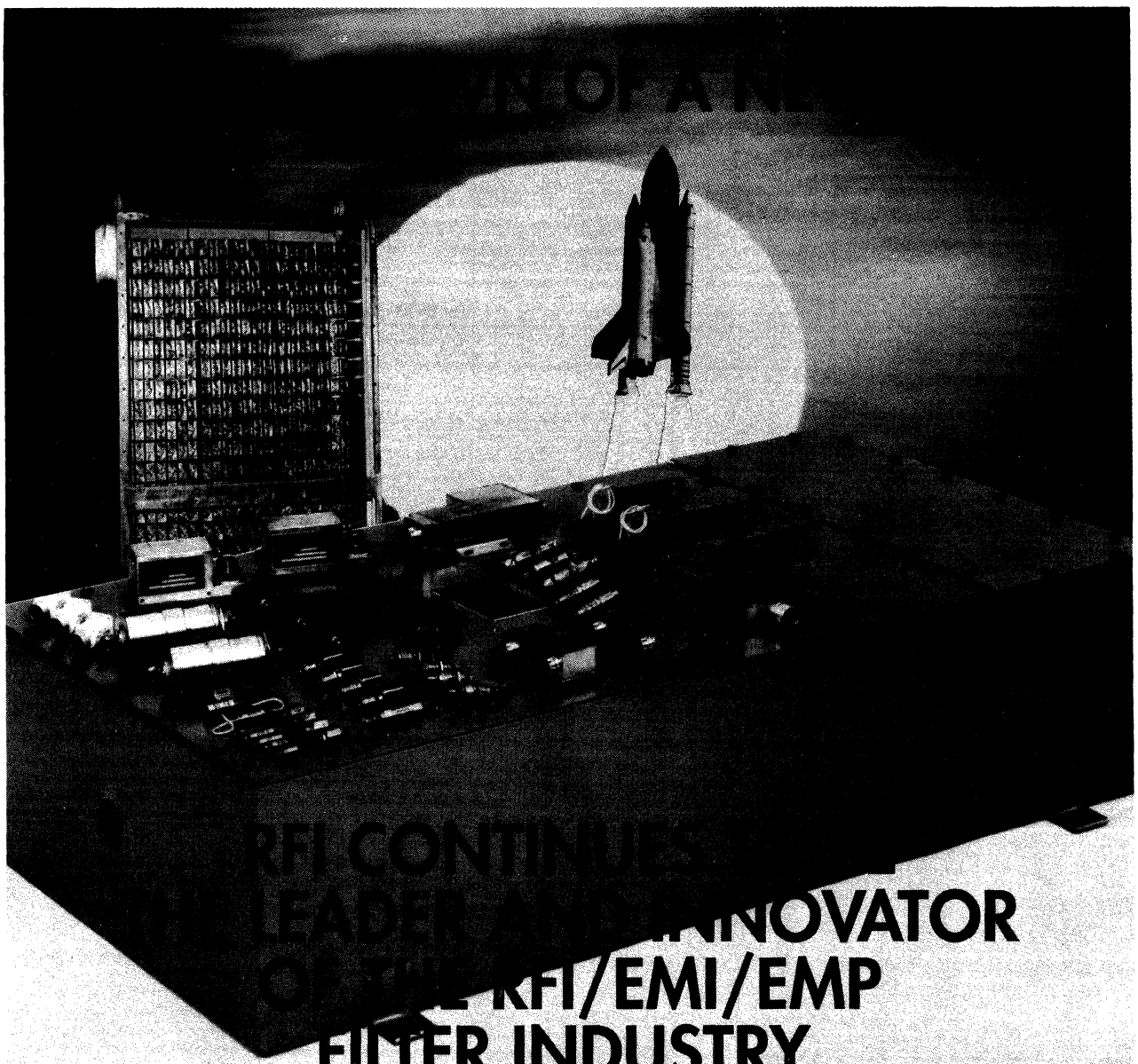

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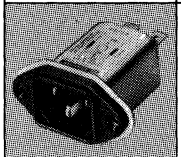
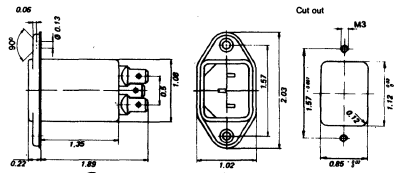
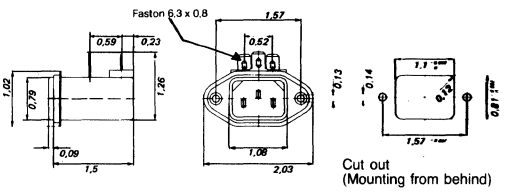
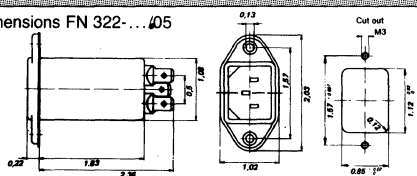
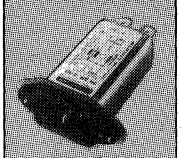
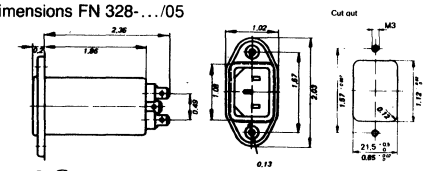
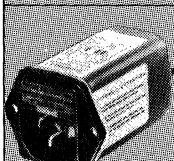
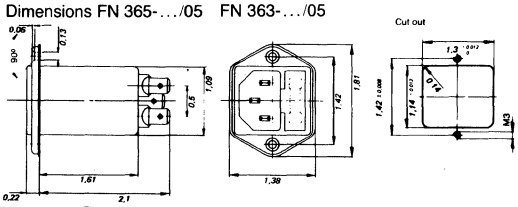
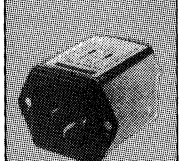
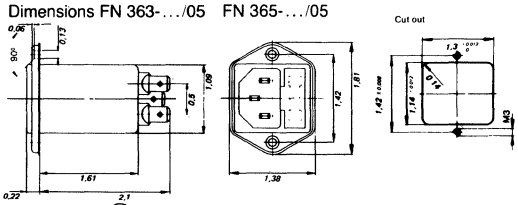
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FILTER WITH IEC CONNECTOR

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FILTER SERIES	FEATURES	FILTER NO.	AMPS	TERMINAL STYLE	DIMENSIONS/CUT OUT
 FN 323	Power line filter Compact design	FN 323- 1/01 FN 323- 1/05 FN 323- 3/01 FN 323- 3/05 FN 323- 6/01 FN 323- 6/05 FN 323-10/01 FN 323-10/05	1 1 3 3 6 6 10 10	soldering lug fast-on soldering lug fast-on soldering lug fast-on soldering lug fast-on	Dimensions FN 323-.../05  approved FN 323-10 only approved
 FN 326	Power line filter with right angle output	FN 326- 1/02 FN 326- 1/06 FN 326- 1/07 FN 326- 3/02 FN 326- 3/06 FN 326- 3/07 FN 326- 6/02 FN 326- 6/06 FN 326- 6/07 FN 326-10/06 FN 326-10/07	1 1 1 3 3 3 6 6 6 10 10	for printed circuit soldering lug wires for printed circuit soldering lug wires for printed circuit soldering lug wires soldering lug wires	Dimensions FN 326-.../06  approved/02 approved/FN 326-10 only approved
Comments: The FN 323 and 326 series of filters are intended for general purpose applications where average performance over a wide-frequency range is required. They are moderate in cost and extremely compact in design. The FN 323 and FN 326 series are available in low leakage versions for medical applications.					
 FN 322	Power line filter for normal applications	FN 322- 1/01 FN 322- 1/05 FN 322- 3/01 FN 322- 3/05 FN 322- 6/01 FN 322- 6/05 FN 322-10/01 FN 322-10/05	1 1 3 3 6 6 10 10	soldering lug fast-on soldering lug fast-on soldering lug fast-on soldering lug fast-on	Dimensions FN 322-.../05  approved
 FN 328	Power line filter for normal applications with earth line choke	FN 328- 1/01 FN 328- 1/05 FN 328- 3/01 FN 328- 3/05 FN 328- 6/01 FN 328- 6/05	1 1 3 3 6 6	soldering lug fast-on soldering lug fast-on soldering lug fast-on	Dimensions FN 328-.../05  approved
Comments: The FN 322 series is a family of filters featuring higher insertion loss than the FN 323 series. The 322 series is available in low leakage versions for medical applications. In addition to these features the FN 328 provides an earth line choke. This can significantly improve your equipment's performance.					
 FN 365	Power line filters with IEC fuse	FN 365- 2/01 FN 365- 2/05 FN 365- 4/01 FN 365- 4/05	2 2 4 4	soldering lug fast-on soldering lug fast-on	Dimensions FN 365-.../05 FN 363-.../05  approved
 FN 363	Power line filters with IEC fuse and earth line choke	FN 363- 1/01 FN 363- 1/05 FN 363- 2/01 FN 363- 2/05 FN 363- 4/01 FN 363- 4/05	1 1 2 2 4 4	soldering lug fast-on soldering lug fast-on soldering lug fast-on	Dimensions FN 363-.../05 FN 365-.../05  approved
Comments: The FN 360 series features an IEC connector with an integral fuse holder.					

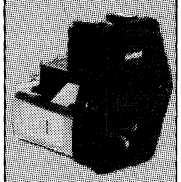
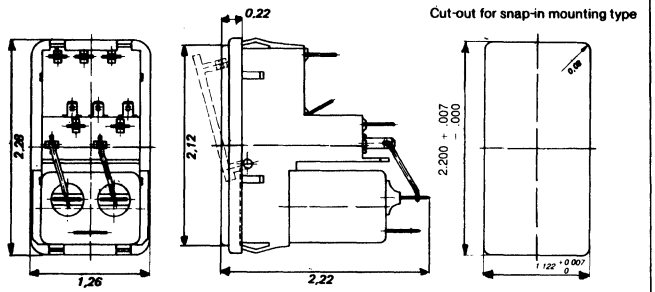
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POWER ENTRY MODULE SERIES

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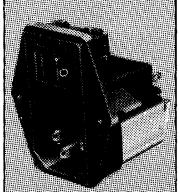
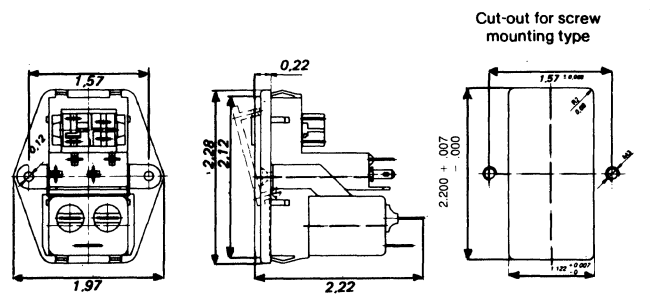
FILTER SERIES	FILTER NO.	AMPS	FUSE(S)	MOUNTING	DIMENSIONS/CUT OUT
 **FN 370**	FN 370-2/__ __	2	1	snap	Dimensions for FN 370 Series (snap in version) (For dimensions of screw mounting version see FN 380)
	FN 370-4/__ __	4	1	snap	
	FN 370-6/__ __	6	1	snap	
	FN 372-2/__ __	2	2	snap	
	FN 372-4/__ __	4	2	snap	
	FN 372-6/__ __	6	2	snap	
	FN 376-2/__ __	2	1	screw	
	FN 376-4/__ __	4	1	screw	
	FN 376-6/__ __	6	1	screw	
	FN 378-2/__ __	2	2	screw	
	FN 378-4/__ __	4	2	screw	
	FN 378-6/__ __	6	2	screw	
	FN 377-2/__ __	2	1	screw	
	FN 377-4/__ __	4	1	screw	
	FN 377-6/__ __	6	1	screw	
	FN 379-2/__ __	2	2	screw	
	FN 379-4/__ __	4	2	screw	
	FN 379-6/__ __	6	2	screw	
FEATURES Power line filter with fuses and voltage selector					

1 = Fuseholder European (DIN) style (5 x 20mm)
2 = Fuseholder US style (3 AG)

1 = Series/Series 110, 220, 240V
2 = Series/Parallel 100, 120, 220, 240V
3 = Series/Parallel 115 230V

approved

Comments: The FN 370 combi filter line protects electronic equipment from common and differential mode line interference in the range of 150 kHz to 300 Mhz. It is especially suitable for use in equipment intended for world wide export. The voltage selector is designed for two, three or four different voltages. There are also FN 370 filters for medical devices available. The FN 377 and 379 provide higher performance in attenuation.

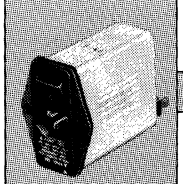
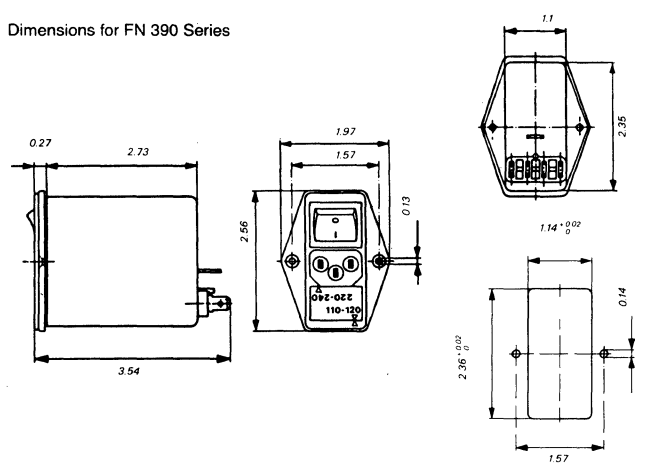
 **FN 380**	FN 380-2/__ __	2	1	snap	Dimensions for FN 380 Series (screw mounting version) (For dimensions of snap in version see FN 370)
	FN 380-4/__ __	4	1	snap	
	FN 380-6/__ __	6	1	snap	
	FN 382-2/__ __	2	2	snap	
	FN 382-4/__ __	4	2	snap	
	FN 382-6/__ __	6	2	snap	
	FN 386-2/__ __	2	1	screw	
	FN 386-4/__ __	4	1	screw	
	FN 386-6/__ __	6	1	screw	
	FN 388-2/__ __	2	2	screw	
	FN 388-4/__ __	4	2	screw	
	FN 388-6/__ __	6	2	screw	
	FN 387-2/__ __	2	1	screw	
	FN 387-4/__ __	4	1	screw	
	FN 387-6/__ __	6	1	screw	
	FN 389-2/__ __	2	2	screw	
	FN 389-4/__ __	4	2	screw	
	FN 389-6/__ __	6	2	screw	
FEATURES Power line filter with fuses and power switch					

1 = Fuseholder European (DIN) style (5 x 20mm)
2 = Fuseholder US style (3 AG)

1 Pole rocker switch
2 Pole rocker switch

approved

Comments: The space-saving, low-cost FN 380 line of combi filters is suitable for use in electric and electronic equipment. The FN 387 and 389 provide higher performance in attenuation. A version without y capacitors is available for medical devices.

 **FN 390**	FN 393-1 /05	1	1	screw	Dimensions for FN 390 Series
	FN 393-2.5/05	2.5	1	screw	
	FN 393-6 /05	6	1	screw	
	FN 394-1 /05	1	2	screw	
	FN 394-2.5/05	2.5	2	screw	
	FN 394-6 /05	6	2	screw	
	With earth line choke				
	FN 393E-1 /05	1	1	screw	
	FN 393E-2.5/05	2.5	1	screw	
	FN 393E-6 /05	6	1	screw	
	FN 394E-1 /05	1	2	screw	
	FN 394E-2.5/05	2.5	2	screw	
	FN 394E-6 /05	6	2	screw	
	High performance filter				
	FN 1393-1 /05	1	1	screw	
	FN 1393-2.5/05	2.5	1	screw	
	FN 1393-6 /05	6	1	screw	
	FN 1393-10 /05	10	1	screw	
	FN 1394-1 /05	1	2	screw	
	FN 1394-2.5/05	2.5	2	screw	
	FN 1394-6 /05	6	2	screw	
FEATURES Power line filter with on/off switch and voltage selector					

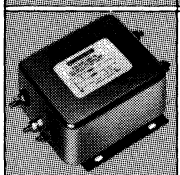
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Comments: The FN 390 series of filtered power entry modules is available in three performance levels. Standard versions incorporate IEC connectors, 2-pole rocker switches and universal voltage selector/fuse drawers.

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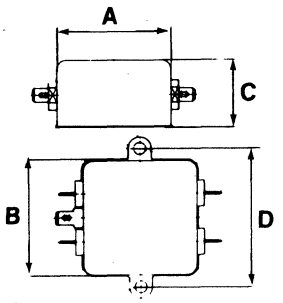
FILTER FOR CHASSIS MOUNTING

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FILTER SERIES	FILTER NO.	AMPS	TERMINAL STYLE	DIMENSIONS/CUT OUT
 FN 610	FN 610- 1/06	1	soldering lug/fast-on	Case Dimensions FN 610 Series
	FN 610- 1/07	1	wires	
	FN 610- 3/06	3	soldering lug/fast-on	
	FN 610- 3/07	3	wires	
	FN 610- 6/06	6	soldering lug/fast-on	
	FN 610- 6/07	6	wires	
	FN 610-10/06	10	soldering lug/fast-on	
	FN 610-10/07	10	wires	
	FN 610-20/06	20	soldering lug/fast-on	
	FN 610-30/03	30	clamp terminal	
	FN 610-30/10	30	screw UNC 8-32	

Part Number / Dimensions (inches)	A	B	C	D
FN 610-1/06	1.29	1.73	.75	2.13
FN 610-3/06	1.29	1.73	.75	2.13
FN 610-6/06	1.29	1.73	.75	2.13
FN 610-10/06	1.29	1.73	1.14	2.13
FN 610-20/06	2.0	2.0	1.14	2.4
FN 610-30/03	3.92	3.33	1.50	3.74

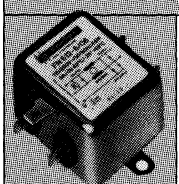
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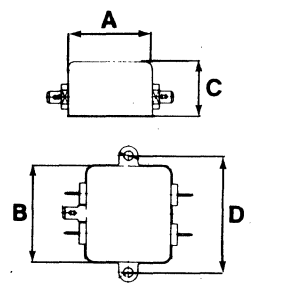
General purpose power line filter

Comments: The FN 610 series of general purpose filters has been designed to be effective in a wide variety of applications with attenuations from 150 kHz to 300 Mhz. It is available in medical versions with reduced capacitance to ground. (Very low leakage current).

 FN 612	FN 612- 1/06	1	soldering lug/fast-on	Case Dimensions FN 612 Series
	FN 612- 1/07	1	wires	
	FN 612- 3/06	3	soldering lug/fast-on	
	FN 612- 3/07	3	wires	
	FN 612- 6/06	6	soldering lug/fast-on	
	FN 612- 6/07	6	wires	
	FN 612-10/06	10	soldering lug/fast-on	
	FN 612-10/07	10	wires	
	FN 612-20/03	20	clamp terminals	
	FN 612-20/06	20	soldering lug/fast-on	
	FN 612-20/10	20	screw UNC 8-32	
	FN 612-30/03	30	clamp terminal	
	FN 612-30/10	30	screw UNC 8-32	

Part Number / Dimensions (inches)	A	B	C	D
FN 612-1/06	1.77	2.00	.87	2.4
FN 612-3/06	1.77	2.00	1.14	2.4
FN 612-6/06	1.77	2.00	1.14	2.4
FN 612-10/06	1.77	2.00	1.14	2.4
FN 612-20/06	2.05	2.64	1.57	2.95
FN 612-30/03	3.92	3.33	1.50	3.74

approved



FEATURES

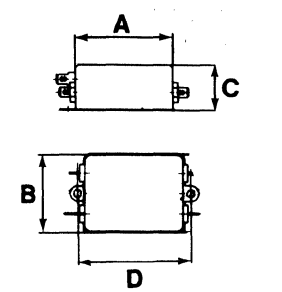
General purpose power line filter

Comments: The FN 612 series is a higher performance single stage filter as compared to the 610 series. The 612 features increased capacitance therefore higher insertion loss in the differential mode.

 FN 660	FN 660- 1/06	1	soldering lug/fast-on	Case Dimensions FN 660 Series
	FN 660- 1/07	1	wires	
	FN 660- 3/06	3	soldering lug/fast-on	
	FN 660- 3/07	3	wires	
	FN 660- 6/06	6	soldering lug/fast-on	
	FN 660- 6/07	6	wires	
	FN 660-10/06	10	soldering lug/fast-on	
	FN 660-10/07	10	wires	
	FN 660-16/03	16	clamp terminals	
	FN 660-16/06	16	soldering lug/fast-on	
	FN 660-16/10	16	screw UNC 8-32	
	FN 660-20/03	20	clamp terminal	
	FN 660-20/06	20	soldering lug/fast-on	
	FN 660-20/10	20	screw UNC 8-32	

Part Number / Dimensions (inches)	A	B	C	D
FN 660-1/06	2.0	1.77	1.14	2.4
FN 660-3/06	2.63	2.04	1.18	2.95
FN 660-6/06	2.63	2.04	1.18	2.95
FN 660-10/06	2.63	2.04	1.57	2.95
FN 660-16/06	2.63	2.04	1.57	2.95
FN 660-20/06	3.92	3.32	1.49	3.74

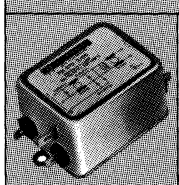
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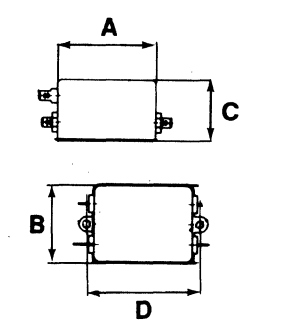
Power line filter with high attenuation

Comments: The FN 660 series of two-stage filters has been designed to provide significantly higher performance than is possible with a single stage filter.

 FN 670	FN 670- 1.8/06	1.8	soldering lug/fast-on	Case Dimensions FN 670 Series
	FN 670- 1.8/07	1.8	wires	
	FN 670- 3 /06	3	soldering lug/fast-on	
	FN 670- 3 /07	3	wires	
	FN 670- 6 /06	6	soldering lug/fast-on	
	FN 670- 6 /06C	6	soldering lug/fast-on	
	FN 670- 6 /07	6	wires	
	FN 670- 6 /07C	6	wires	
	FN 670-10 /06	10	soldering lug/fast-on	
	FN 670-10 /06C	10	soldering lug/fast-on	
	FN 670-10 /07	10	wires	
	FN 670-10 /07C	10	wires	

Part Number / Dimensions (inches)	A	B	C	D
FN 670-1.8/06	2.63	2.04	1.57	2.95
FN 670-3/06	2.63	2.04	1.57	2.95
FN 670-6/06	2.63	2.04	1.57	2.95
FN 670-6/06C	5.23	2.00	1.77	5.62
FN 670-10/06	3.92	3.32	1.49	3.74
FN 670-10/06C	5.23	2.00	1.77	5.62

approved



FEATURES

Power line filter for wideband interference suppression

Comments: The FN 670 series of two stage filters has been designed specifically for use with switch mode power supplies. It has been designed for extremely low leakage current (less than half a milliamp). Therefore, it will not be affected by the high peak current which results from switching power supplies.

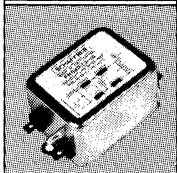
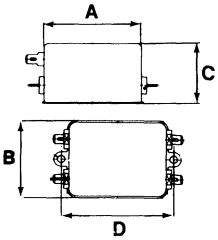
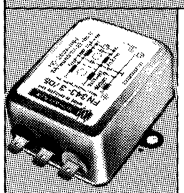
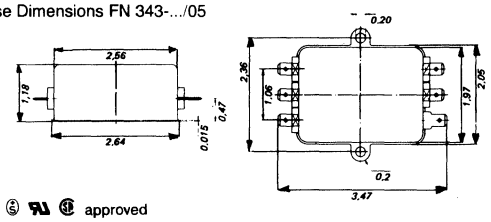
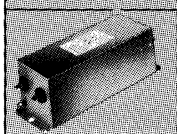
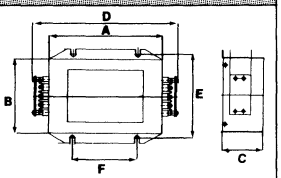
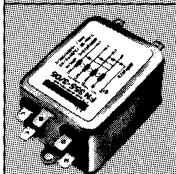
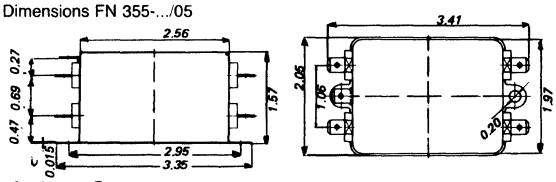
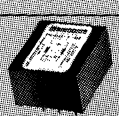
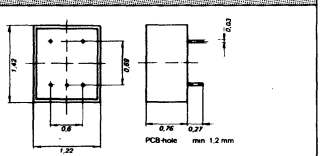
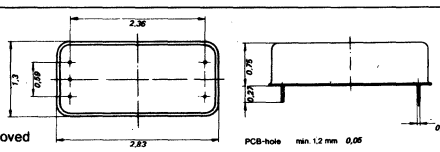
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FILTER FOR CHASSIS MOUNTING

SCHAFFNER

FILTER SERIES	FEATURES	FILTER NO.	AMPS	TERMINAL STYLE	DIMENSIONS/CUT OUT
 **FN 680 FN 682**	Line filters for switching mode power supplies	FN 680- 1 /06 FN 680- 1 /07 FN 680- 2.5/06 FN 680- 2.5/07 FN 682- 4 /06 FN 682- 4 /07 FN 682- 6.5/06 FN 682- 6.5/07 FN 682-10 /06 FN 682-10 /07	1 1 2.5 2.5 4 4 6.5 6.5 10 10	soldering lug/fast-on wires soldering lug/fast-on wires soldering lug/fast-on wires soldering lug/fast-on wires soldering lug/fast-on wires	Case Dimensions FN 680/FN 682 Part Number / Dimensions (inches): A 2.00 2.01 1.14 2.4; FN 680-2.5/06: 2.56 2.05 1.57 2.95; FN 682-4/06: 2.56 2.05 1.57 2.95; FN 682-6.5/06: 3.88 3.33 1.5 3.74; FN 682-10/06: 3.88 3.33 2.23 3.74  approved
Comments: The FN 680 series of two stage high performance filters has been designed specifically to meet the requirements of VDE class B, which extends down to 10 kHz. These filters have no resonances above 20 kHz, and are especially effective against the switching transients which occur from switch mode power supplies.					
 **FN 343**	Power line filter with earth line choke	FN 343- 1/01 FN 343- 1/05 FN 343- 3/01 FN 343- 3/05 FN 343- 6/01 FN 343- 6/05 FN 343-10/05 FN 343-10/01	1 1 3 3 6 6 10 10	soldering lug fast-on soldering lug fast-on soldering lug fast-on soldering lug fast-on	Case Dimensions FN 343-.../05  approved
Comments: The FN 343 is a two stage filter whose excellent performance is primarily due to the additional earth line choke in ground lead. This gives dramatically improved performance in the common mode as compared to that of a similar filter without an earth line choke.					
 **FN 352Z FN 353Z**	Power line filter with high attenuation and surge voltage protection	FN 352Z-10/03 FN 352Z-20/03 FN 353Z-30/03	10 20 30	screw screw screw	Case Dimensions FN 352Z/FN 353Z Part Number / Dimensions (inches): FN 352Z-10 03 5.9 3.93 2.16 7.68 4.4 3.35; FN 352Z-20 03 7.87 4.72 2.56 9.84 5.31 4.53; FN 353Z-30 03 7.87 4.72 2.56 9.84 5.31 4.53  approved
Comments: The FN 352Z series of filters have been designed for extremely high performance. They provide the greatest maximum protection for electronic equipment. The three stage filters feature both differential and common mode chokes, as well as a varistor to attenuate transient voltage surges on the power line.					
 **FN 355**	3 phase power line filter	FB 355- 3/01 FN 355- 3/05 FN 355- 6/01 FN 355- 6/05 FN 355-10/01 FN 355-10/05 FN 355-20/03	3 3 6 6 10 10 20	soldering lug fast-on soldering lug fast-on soldering lug fast-on clamp terminal	Dimensions FN 355-.../05  approved
Comments: The FN 355 series of filters are three-phase filters designed for moderate performance. This filter is available with four lines and may be used for either a "y" or delta configuration.					
 **FN 405**	Power line filter for PCB mounting	FN 405-0.5/02 FN 405-1 /02 FN 405-3 /02 FN 405-6 /02	0.5 1 3 6	Pins 0.8 x 0.8 mm For printed circuit boards	Dimensions FN 405 Series  approved
 **FN 410**	Power line filter for PCB mounting	FN 410-0.5/02 FN 410-1 /02 FN 410-3 /02 FN 410-6 /02	0.5 1 3 6	Pins 0.8 x 0.8 mm For printed circuit boards	Dimensions FN 410 Series  approved
Comments: The FN 405 and 410 filter series protect electronic circuits against malfunction of power line interference. This series is suitable for mounting onto the printed circuit boards of all electronic equipment.					

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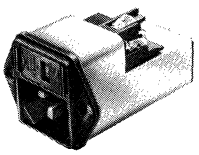
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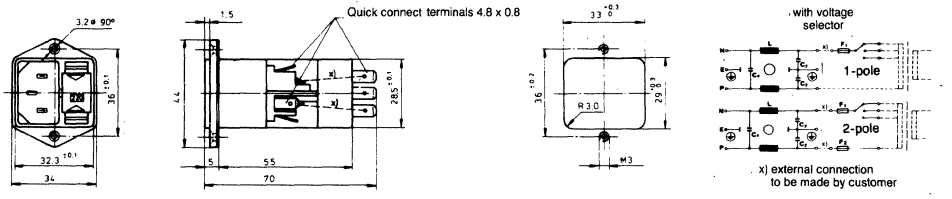
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POWER ENTRY MODULES WITH RFI FILTER • CS Australia

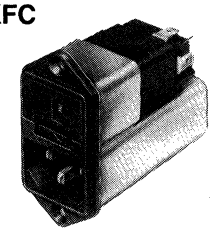
KFA ≙ AC Power Connector with 1 or 2 pole fuseholder and optional voltage selector. KFC, CD ≙ AC Power Connector with 1 or 2 pole fuseholder for 5×20mm or ¼×1¼" fuses and optional 2-3 position voltage selector (up to 4 pos. for the CD). CD includes integral or remote on/off switch.

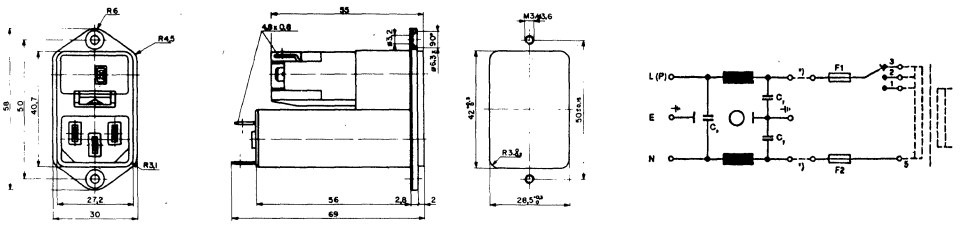
KFA with voltage selector



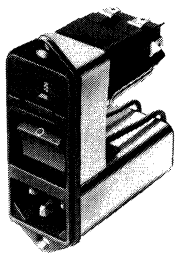


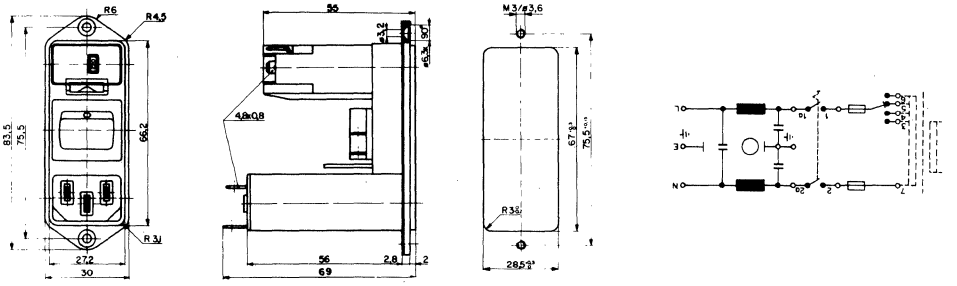
KFC



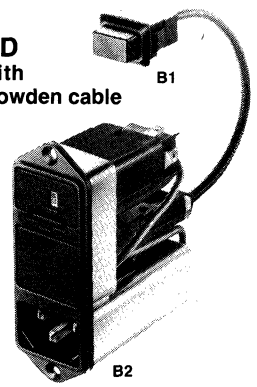


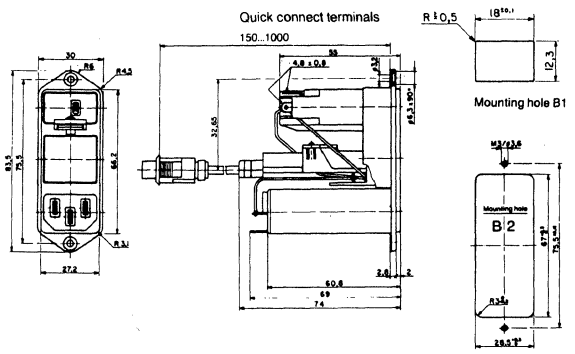
CD



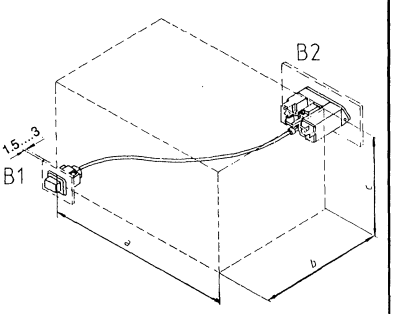


CD with Bowden cable





Mounting



KFA, KFC, CD Order Numbers (Casings, fusedrawer, and Bowden cable ordered separately)

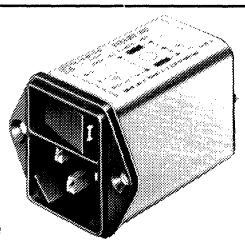
Casings, 2-pole, standard or low-leakage (medical) filters			Fusedrawers					
<0.5mA @ 250V/50Hz	<5µA @ 250V/50Hz	I_N(A)	KFA, with voltage selector for 5×20mm fuses, markings 110, 150, 220		KFA, without voltage selector for 5×20mm fuses		Standard	Medical (IEC 601-1 VDE 0750-1)
			2-pole	2-pole with shorting bar	2-pole	2-pole with shorting bar		
KFA 4301.5041		1	4301.1014.01	4301.3536.01	4301.1401	4301.1413	•	
KFA 4301.5042	KFA 4301.5243	2	4301.1024.01	4301.3537.01	4301.1403	4301.1415		•
KFA 4301.5043	KFA 4301.5245	4	KFC, CD w/voltage selector markings 100, 120, 220, 240 for 5×20mm fuses		KFC, CD without voltage selector for 5×20mm fuses			
KFA 4301.5044		6	2-pole	2-pole with shorting bar	2-pole	2-pole with shorting bar		
KFC 4303.5021		1	4303.2014.01	4303.2036.01	4303.2401	4303.2411	•	
KFC 4303.5022	KFC 4303.5223	2	4303.2024.01	4303.2037.01	4303.2403	4303.2413		•
KFC 4303.5023	KFC 4303.5225	4	KFC, CD w/voltage selector markings 100, 120, 220, 240 for ¼×1¼" fuses		KFC, CD without voltage selector for ¼×1¼" fuses			
KFC 4303.5024		6	2-pole	2-pole with shorting bar	2-pole	2-pole with shorting bar		
CD 14.4101.151		1	4303.2714.01	4303.2736.01	4303.2902	4303.2912	•	
CD 24.4101.151	CDA4.4101.151	2	4303.2724.01	4303.2737.01	4303.2904	4303.2914		•
CD 34.4101.151	CDC4.4101.151	4						
CD 44.4101.151		6						
CD with Bowden cable			**BOWDEN CABLE**					
CD 14.4199.151		1	886.0101	Standard cable <500mm	886.xxxx Custom cable (Note: for optimum actuation, specify according to guidelines in full-line catalog)			
CD 24.4199.151		2	886.0501	Standard cable >500mm				
CD 34.4199.151		4						
CD 44.4199.151		6						

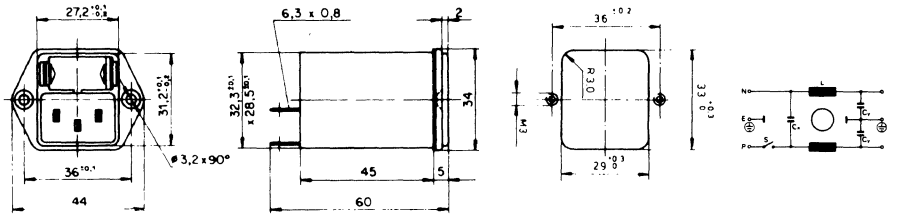
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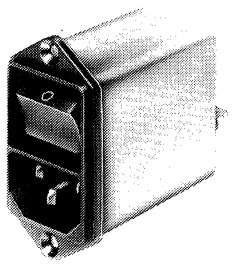
KFB ≙ AC Power Connector with 1 or 2 pole switch. Optional 125V or 250V red or green lighted switch. CE, CG ≙ AC Power Connector with 1 or 2 pole fuseholder for 5×20mm or ¼×1¼" fuses and optional 2-4 position series-parallel voltage selector. CG includes integral or remote on/off switch.

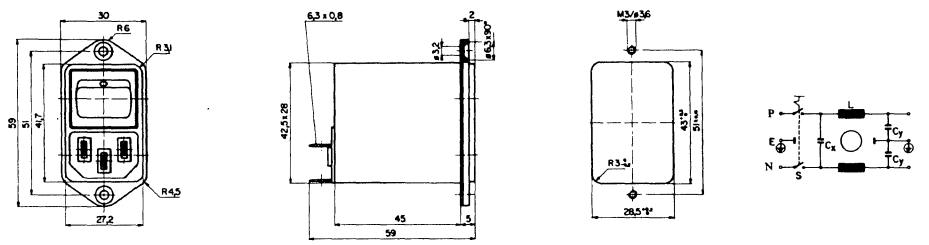
KFB 1-pole



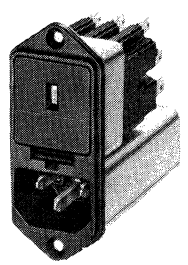


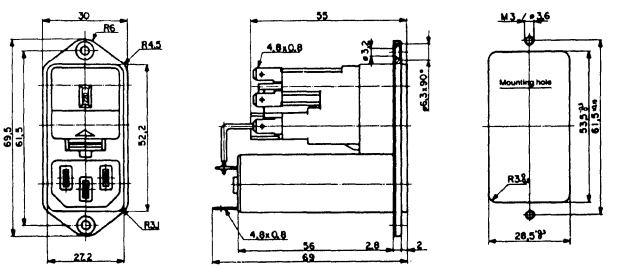
KFB 2-pole



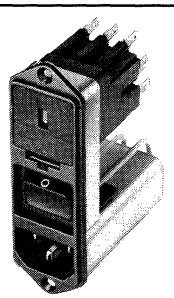


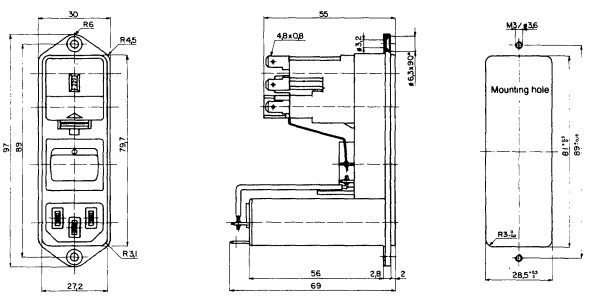
CE



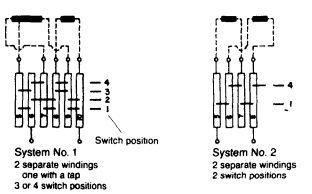


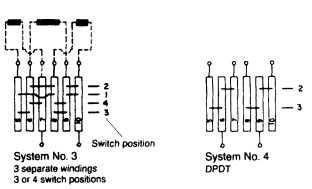
CG





VOLTAGE SELECTOR SYSTEMS





KFB Order Numbers

KFB 1-Pole <0.5mA @ 250v/50Hz Unlighted	<0.5mA @ 250v/50Hz red 125V	<0.5mA @ 250v/50Hz red 250V	Unlighted low-leakage filter <5µA @ 250v/50Hz	I_N(A)	KFB 2-pole, standard filters <0.5mA @ 250v/50Hz Unlighted	<0.5mA @ 250v/50Hz red 125-250V	KFB 2-pole, low-leakage medical filters <5µA @ 250v/50Hz Unlighted	<5µA @ 250v/50Hz red 250V	I_N(A)
KFB4302.5001	KFB4302.5031	KFB4302.5011		1	KFB4302.5311	Part			1
KFB4302.5002	KFB4302.5032	KFB4302.5012	KFB4302.5203	2	KFB4302.5312	Numbers	KFB4302.5333	KFB4302.5463	2
KFB4302.5003	KFB4302.5033	KFB4302.5013	KFB4302.5205	4	KFB4302.5313	Available	KFB4302.5335	KFB4302.5465	4
KFB4302.5004	KFB4302.5034	KFB4302.5014		6	KFB4302.5314	On Request			6

CE, CG Order Numbers (Casing, Fusedrawer, and voltage selector insert ordered separately)

CE casings, standard filter <0.5mA @ 250V/50Hz 1-pole	2-pole	CE casings, low-leakage medical filter <5µA @ 250V/50Hz 2-pole	I_N(A)	CG casings, standard filter <0.5mA @ 250V/50Hz 1-pole	2-pole	CG casings, low-leakage medical filter <5µA @ 250V/50Hz 2-pole	I_N(A)
CE16.5100.151	CE10.6100.151		1	CG16.5101.151	CG10.6101.151		1
CE26.5100.151	CE20.6100.151	CEA0.6100.151	2	CG26.5101.151	CG20.6101.151	CGA0.6101.151	2
CE36.5100.151	CE30.6100.151	CEC0.6100.151	4	CG36.5101.151	CG30.6101.151	CGC0.6101.151	4
CE46.5100.151	CE40.6100.151		6	CG46.5101.151	CG40.6101.151		6

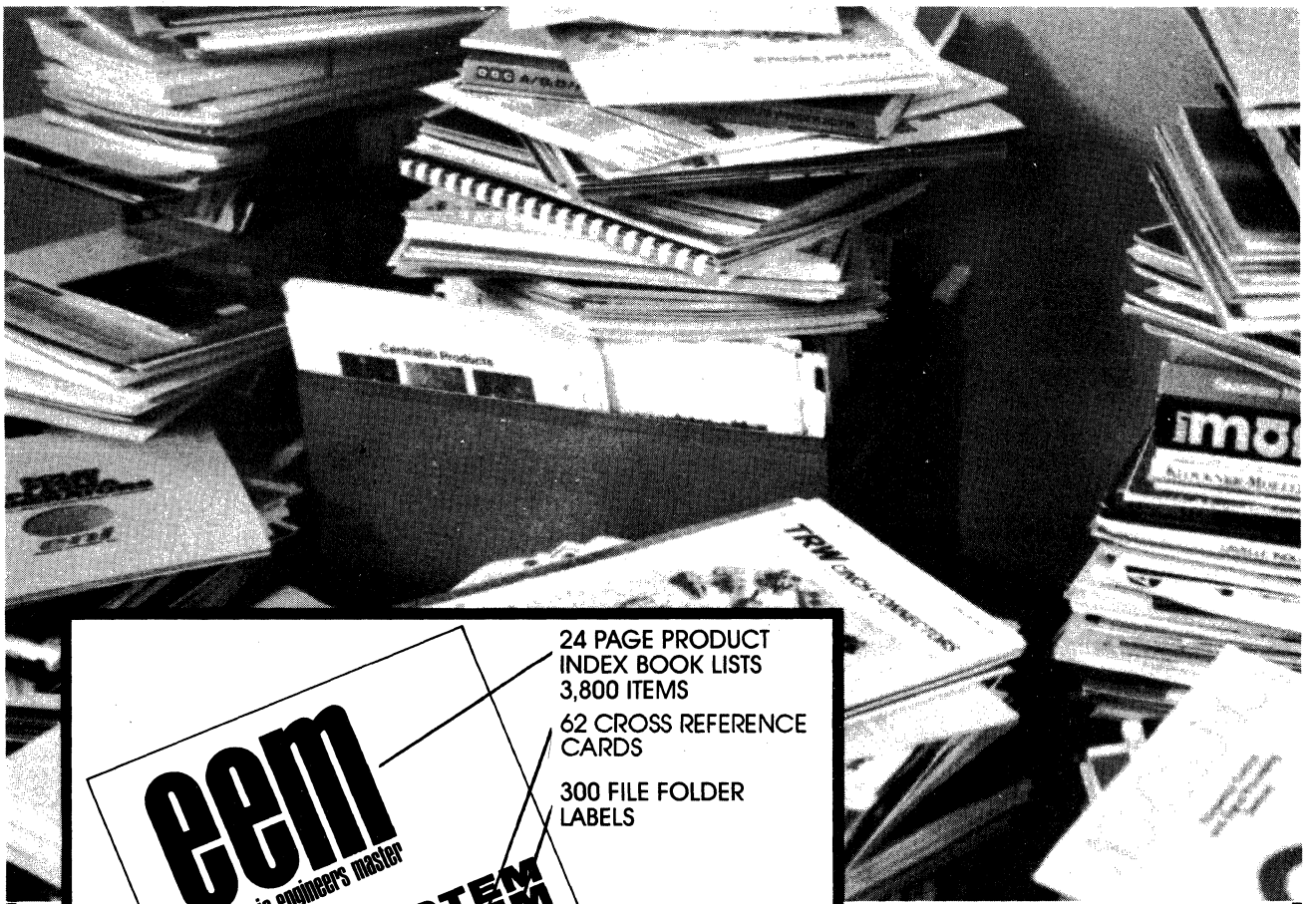
Fusedrawers

For 5×20mm fuses 1-pole black	2-pole black	2-pole black with shorting bar in the neutral side
4305.0006	4305.0001	4305.0021
For ¼×1¼" fuses		
1-pole grey	2-pole grey	2-pole grey with shorting bar in the neutral side
4305.0017	4305.0012	4305.0027

Voltage Selector Inserts

Order No.	System No.	Voltage Markings/Switch position 1	2	3	4
4305.0048.00	1,2	Without Markings			
4305.0048.01	1	100	120	220	240
4305.0048.03	2	110			220
4305.0048.05	2	115			230
4305.0050.00	3	Without Markings			
4305.0050.02	3	130	110	240	220
4305.0050.06	3	150	110		220
4305.0049.00	4	Without Markings			





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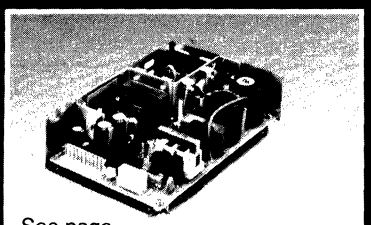
The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will be mailed to you under separate cover.

Don't waste any more time. Get organized now!

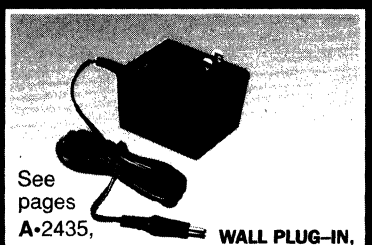
EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

TAMURA

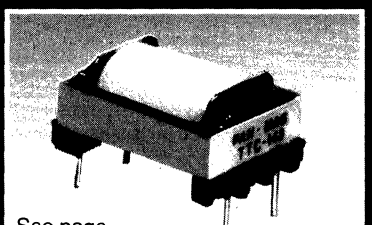
DELIVERS FROM STOCK



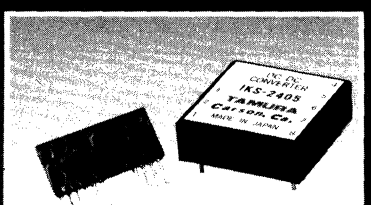
See page D•2062 — **SINGLE AND MULTI-OUTPUT SWITCHERS**



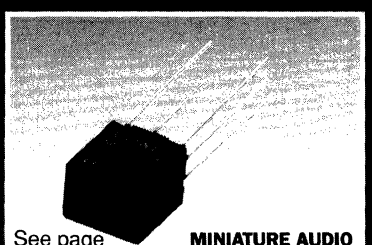
See pages A•2435, D•1495, D•2066 — **WALL PLUG-IN, AC & DC POWER**



See page A•2428 — **FCC PART 68 TELCOM LINE COUPLING**



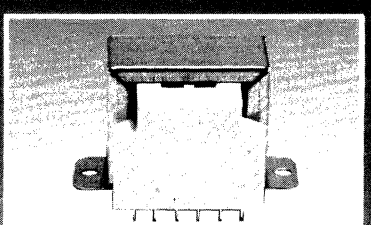
See page D•2059 — **DC/DC CONVERTERS SIP & DIP PKG**



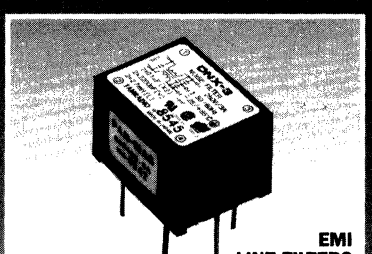
See page A•2430 — **MINIATURE AUDIO & PART 68 COUPLING**



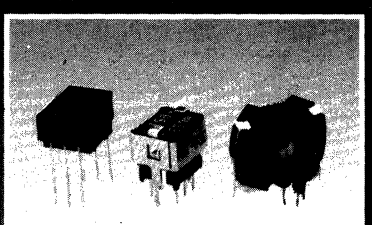
CONTACT FACTORY — **COMPUTER NETWORKING BALUNS**



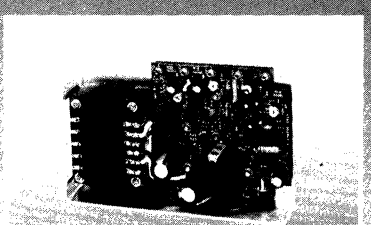
A•2432 — **INT'L PCB POWER– UL 1411, IEC, VDE, & CSA**



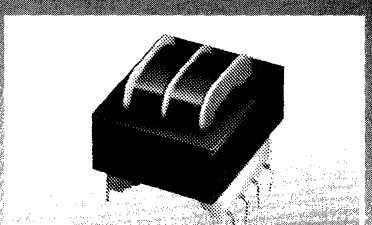
A•1643 — **EMI LINE FILTERS**



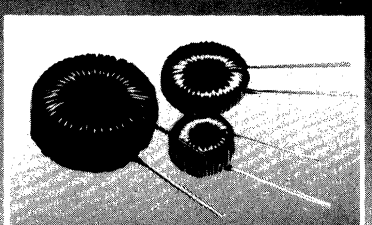
A•2431 — **WIDE BAND PULSE– T1 & DIGITAL**



D•2064 — **LINEAR POWER SUPPLIES**



A•2433 — **UL/CSA PCB POWER**



A•1270 — **NOISE, COMMON MODE & POWER LINE**

The strength of Tamura's AC and DC power conversion families lies in providing consistently dependable products. All Tamura power and magnetic devices are designed and manufactured to deliver lower AQL levels, guaranteeing you the lowest incoming rejection rates you've ever experienced. For example, last year we shipped over **100 million transformers**– most to customers using a **ship–to–stock** acceptance program.

At Tamura, we're already life testing (not just designing) tomorrow's products– today. Over 100 design engineers at our technology center are dedicated to this task, assuring you of having the most up–to–date technology in your products. Today we are already designing the robotics to build these quality products, in high volume and at low cost. Over 150 product support engineers at 16 Tamura factories see to it.

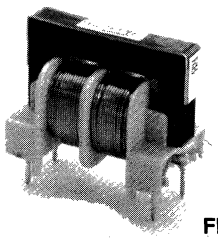
Satisfy your AC and DC requirements for today and tomorrow. Contact Tamura for your specific requirements.

Tamura quality circles the electron world.

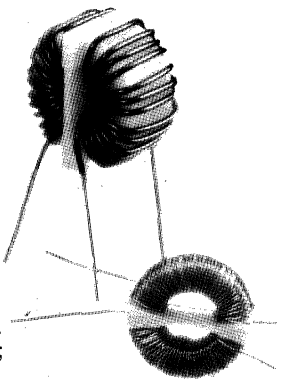
TAMURA CORPORATION OF AMERICA

1150 DOMINGUEZ ST. ❑ CARSON, CA 90746-3518 ❑ 213/638-1790 ❑ FAX: 213 6389956

TAMURA COMMON MODE COILS FOR AC LINE & EMI/RFI FILTERING, 0.1 to 50MHz.







FEATURES

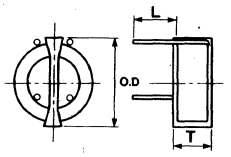
- Rated Voltage: 250VAC, 50/60 Hz.
- Rated Current: Spec'd at max. temp. rise.
- Insulation Resistance: 100 Megohms, 500VDC.
- Direct Current Resistance (DCR): Spec'd per line, input to output.
- Dielectric Voltage: 1.5kVAC (line to gnd); 2.0kVAC, CMF Series.
- Temperature Rise: ≤30˚C, CMT; ≤55˚C, CMF.
- Operating Temperature: -25˚C to +85˚C, CMT; -25˚ C to +60 ˚C, CMF.
- Creepage Distance: 3.2mm min., CMF series.

COMMON MODE NOISE FILTERING COILS

MODEL NO.	INDUCTANCE		DCR	DIA	PRICE (qty)		
	AMPS	mH min	(Ω)	mm	1-9	10-24	25-99
CMT-01102	1.0	2	0.25	0.4	$5.00	$4.50	$4.30
CMT-01104	1.0	4	0.35	0.4	5.70	5.10	4.80
CMT-01202	2.0	2	0.15	0.55	5.10	4.60	4.30
CMT-01301	3.0	1	0.10	0.7	4.70	4.20	4.00
CMT-02105	1.0	5	0.40	0.4	5.80	5.20	4.90
CMT-02107	1.0	7	0.50	0.4	6.00	5.40	5.10
CMT-02203	2.0	3	0.20	0.55	5.50	5.00	4.70
CMT-02302	3.0	2	0.10	0.7	5.10	4.60	4.30
CMT-03110	1.0	10	0.55	0.4	7.70	6.90	6.50
CMT-03305	3.0	5	0.15	0.7	7.20	6.50	6.10
CMT-03502	5.0	2	0.04	0.95	7.00	6.30	5.90
CMT-03801	8.0	1	0.02	1.2	6.70	6.00	5.70
CMF-0470	0.15	47	7.0	0.7	2.50	2.30	2.10
CMF-0330	0.2	33	6.0	0.7	2.50	2.30	2.10
CMF-0220	0.3	22	4.5	0.7	2.50	2.30	2.10
CMF-0100	0.45	10	3.0	0.7	2.50	2.30	2.10
CMF-0056	0.55	5.6	1.0	0.7	2.50	2.30	2.10
CMF-0033	0.8	3.3	0.7	0.7	2.50	2.30	2.10
CMF-6470	0.45	47	3.0	0.7	2.80	2.50	2.40
CMF-6330	0.5	33	2.5	0.7	2.80	2.50	2.40
CMF-6220	0.65	22	2.0	0.7	2.80	2.50	2.40
CMF-6100	0.9	10	0.6	0.7	2.80	2.50	2.40
CMF-6056	1.0	5.6	0.4	0.7	2.80	2.50	2.40
CMF-6033	2.0	3.3	0.3	0.7	2.80	2.50	2.40
CMF-8470	0.5	47	4.0	0.8	3.00	2.70	2.50
CMF-8330	0.65	33	3.0	0.8	3.00	2.70	2.50
CMF-8220	0.8	22	2.0	0.8	3.00	2.70	2.50
CMF-8100	1.0	10	0.7	0.8	3.00	2.70	2.50
CMF-8056	1.5	5.6	0.4	0.8	3.00	2.70	2.50
CMF-8033	2.0	3.3	0.3	0.8	3.00	2.70	2.50
CMF-2470	1.0	47	2.0	1.0	3.70	3.30	3.10
CMF-2330	1.2	33	0.8	1.0	3.70	3.30	3.10
CMF-2220	1.4	22	0.6	1.0	3.70	3.30	3.10
CMF-2100	2.2	10	0.3	1.0	3.70	3.30	3.10
CMF-2056	2.7	5.6	0.25	1.0	3.70	3.30	3.10
CMF-2033	4.0	3.3	0.08	1.0	3.70	3.30	3.10

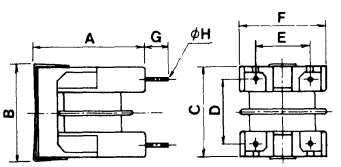
CMT SERIES (dim. mm)

SERIES PREFIX	O.D.	T	L±3mm
CMT-01	28	12.5	20
CMT-02	28	14.5	20
CMT-03	32	22	20



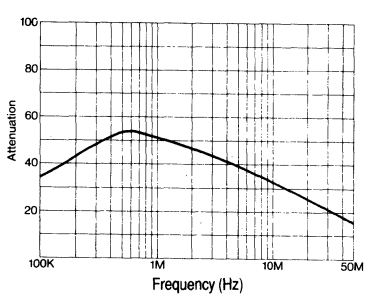
CMF SERIES (dim. mm)

SERIES PREFIX	A	B	C±1	D±1	E±.4	F±1	G±.8
CMF-0	20.5	17.5	18.0	12.5	10.0	16	4
CMF-6	28.0	22.5	18.0	12.5	10.0	18	4
CMF-8	31.0	24.0	22.0	16.0	10.0	20	4
CMF-2	33.5	38.5	37.0	30.0	12.5	21	4

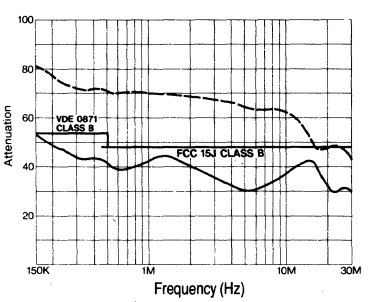


TYPICAL PERFORMANCE CHARACTERISTICS

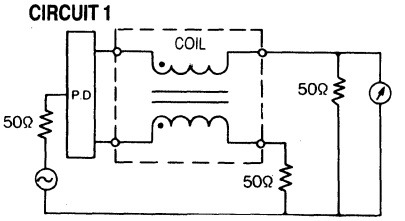
STATIC CHARACTERISTIC CMT-02105 IN CIRCUIT 1



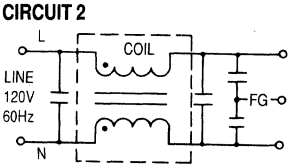
DYNAMIC CHARACTERISTIC CMT-02105 IN CIRCUIT 2



CIRCUIT 1



CIRCUIT 2



Switching Power Supply

Cy: 2200pf (line–to–FG)
Cx: 0.1μf (line–to–line)

CONTACT TAMURA for ORDERING, STOCK, OEM PRICING, DETAILED DATA SHEETS or YOUR CUSTOM REQUIREMENTS by FAX: 310/638/9956 or CALL: (310) 638-1790

TAMURA EMI/RFI LINE FILTERS

Featuring Wire, Tab, Pin & Screw Terminal Type Connectors

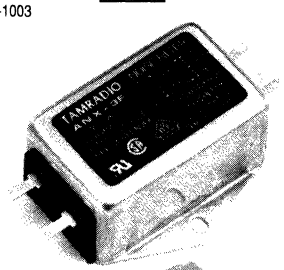
UL File No. E92559

CSA File No. LR65763

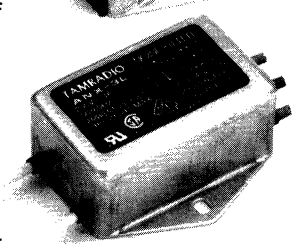
VDE File Nos. 7969-4730-1001, -1002, -1003

FEATURES*

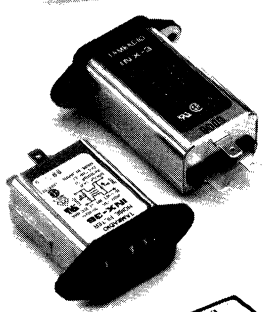
- Rated Voltage: 250VAC, 50/60 Hz.
- Output Connectors:
  ANX-L - lead wire
  ANX-F - fast-on tabs
  INX - inlet type
  ONX - pin type
- Leakage Current: ≤0.5ma.
- Insulation Resistance: 6,000 MΩ min., line-gnd, 250VDC.
- Direct Current Resistance (DCR):
  Spec'd per line, input to output.
- Dielectric Voltage: 2.0kVAC, 1 minute (line gnd);
  INX, X-S, ONX-C,D, 1.5kVAC.
- Temperature Rise: ≤30°C.
- Operating Temp: -25°C to +85°C.
- UL File No: E92559.
- CSA File No: LR65763.
- VDE File No:
  INX, ANX-L, F, ONX; 7969-4730-1001.
  INX-S; 7969-4730-1003.
  ONX-C, D; 7969-4730-1002.



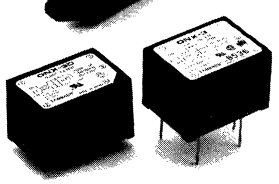
ANX-F



ANX-L



INX



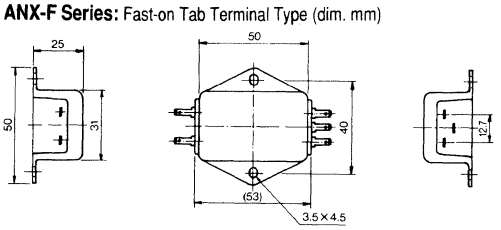
ONX

EMI/RFI LINE FILTERS RATING TABLE

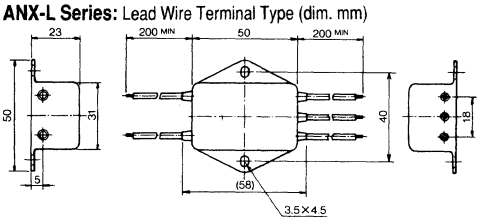
MODEL NO.	AMPS	DCR (Ω)	ATTENUATION[1]		PRICE (qty)		
			NORMAL MODE	COMMON MODE	1-9	10-24	25-99
ANX-1L,F[2]	1	0.5	25dB, 0.5-20MHz.	20dB, 0,1-10MHz.	$9.80	$8.80	$8.30
ANX-3L, F	3	0.15	25dB, 0.7-20MHz.	20dB, 0.2-10MHz.	9.80	8.80	8.30
ANX-6L	6	0.07	25dB, 1.0-20MHz.	20dB, 0.5-10MHz.	9.80	8.80	8.30
ANX-6F	6	0.05	25dB, 1.0-20MHz.	20dB, 0.5-10MHz.	9.80	8.80	8.30
INX-1	1	0.5	20dB, 1.0-20MHz.	20dB, 0,2-20MHz.	11.30	10.20	9.60
INX-3	3	0.2	20dB, 2.0-20MHz.	20dB, 0.3-20MHz.	11.30	10.20	9.60
INX-6	6	0.15	20dB, 3.0-20MHz.	20dB, 2.0-20MHz.	11.30	10.20	9.60
INX-05S	0.5	0.15	20dB, 2.0-30MHz.	20dB, 0.1-30MHz.	12.50	11.30	10.60
INX-1S	1	0.1	20dB, 3.0-30MHz.	20dB, 0.2-30MHz.	12.50	11.30	10.60
INX-3S	3	0.02	20dB, 6.0-30MHz.	20dB, 3.0-30MHz.	12.50	11.30	10.60
INX-6S	6	0.007	20dB, 8.0-30MHz.	20dB, 7.0-30MHz.	12.50	11.30	10.60
INX-10S	10	0.005	20dB, 9.0-30MHz.	20dB, 8.0-30MHz.	13.10	11.80	11.10
ONX-1	1	0.5	25dB, 0.3-20MHz.	20dB, 0.1-20MHz.	9.40	8.50	8.00
ONX-2	2	0.2	25dB, 0.4-20MHz.	20dB, 0.2-20MHz.	9.40	8.50	8.00
ONX-3	3	0.15	25dB, 0.5-20MHz.	20dB, 0.3-20MHz.	9.40	8.50	8.00
ONX-05C, D[3]	0.5	1.5	20dB, 0.3-30MHz.	25dB, 0.1-30MHz.	8.00	7.20	6.80
ONX-1C, D	1	0.4	20dB, 0.5-30MHz.	25dB, 0.1-30MHz.	8.00	7.20	6.80
ONX-2C, D	2	0.1	20dB, 1.0-30MHz.	25dB, 0.4-30MHz.	8.00	7.20	6.80
ONX-3C, D	3	0.05	20dB, 1.5-30MHz.	25dB, 2.0-30MHz.	8.00	7.20	6.80
ONX-5C, D	5	0.02	20dB, 2.0-30MHz.	25dB, 4.0-30MHz.	8.00	7.20	6.80

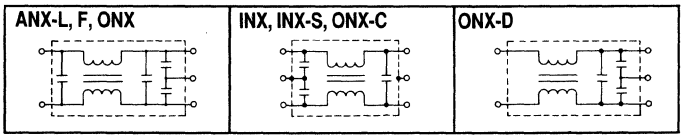
NOTE 1: Contact Tamura, Carson for static and dynamic attenuation characteristic curves.
NOTE 2: "L" or "F" suffix denotes lead wire or fast-on tab terminals, respectively... example: ANX-1L, ANX-1F.
NOTE 3: "C" or "D" suffix designates different models (example: ONX-1C, ONX-1D). "C" suffix has lower conducted emission under 3MHz while "D" suffix exhibits a flatter response above 10MHz. See note 1.

ANX-F Series: Fast-on Tab Terminal Type (dim. mm)

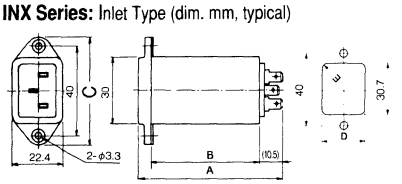


ANX-L Series: Lead Wire Terminal Type (dim. mm)





INX Series: Inlet Type (dim. mm, typical)



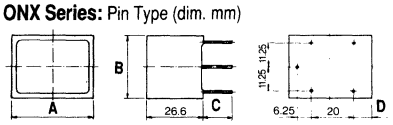
INX SERIES DIMENSIONS

SERIES PREFIX	A	B	C	D connector front/back	E connector front/back
INX	64.7±1	48	50	21.8 / 23.2	r=4 / r=5.5
INX-S	51.7±1	35	48	21.8 / 23.2	r=4 / r=5.5

ONX SERIES DIMENSIONS

SERIES PREFIX	A	B	C	D
ONX	38.5	29.5	≥15	8.3
ONX-C, D	41.4	28.7	≥4.2	9.5

ONX Series: Pin Type (dim. mm)

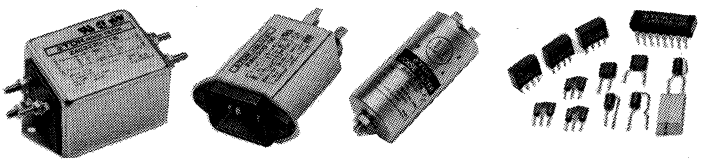


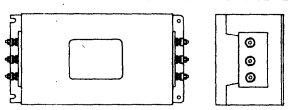
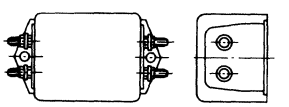
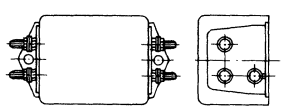
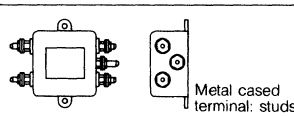
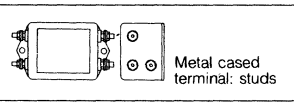
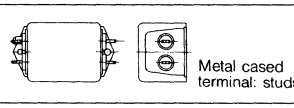
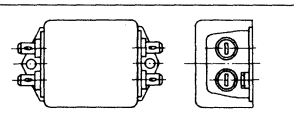
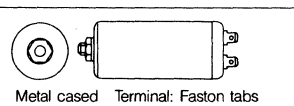
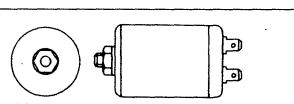
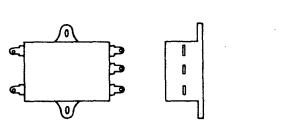
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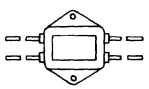
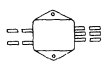
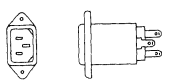
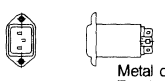
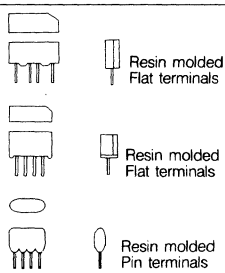
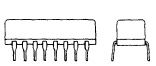
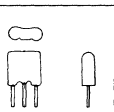
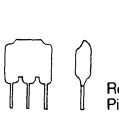
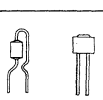
Series name	Exterior view	Function	Part No.	Rated current (A)	Rated voltage (V)	Test voltage (V)	Leakage current (mA)	Weight (g)
ZACT	 Metal cased terminal: studs	Prevention of normal and common mode EMI between 0.15 to 30 MHz. UL recognized: CSA certified: —2280-ME only	ZACT2230-ME	30	AC.250	AC.2000	<1.0 (250V 60Hz)	5,000
			ZACT2250-ME	50	AC.250	AC.2000	<1.0 (250V 60Hz)	15,000
			ZACT2280-ME	80	AC.250	AC.2000	<1.2 (250V 60Hz)	22,000
ZAC	 Metal cased terminal: studs	Prevention of normal and common mode EMI between 0.15 to 30 MHz. UL recognized: —00U UL recognized, TÜV approved. CSA certified: —11	ZAC2205-00U	5	AC.250	AC.1500	<1.0 (250V 60Hz)	240
			ZAC2206-11	6	AC.250	AC.2500	<1.0 (250V 60Hz)	270
			ZAC2210-00U	10	AC.250	AC.1500	<1.0 (250V 60Hz)	250
			ZAC2210-11	10	AC.250	AC.2500	<1.0 (250V 60Hz)	290
			ZAC2215-00U	15	AC.250	AC.1500	<1.0 (250V 60Hz)	260
			ZAC2220-11	20	AC.250	AC.2500	<1.0 (250V 60Hz)	440
			ZAC2220-00U	20	AC.250	AC.1500	<1.0 (250V 60Hz)	260
ZAG-S ZAG-H		More than 20dB attenuation for high voltage pulse such as 1.2kV, 1μs. UL recognized, TÜV approved, CSA certified. -H can use above 100MHz.	ZAG2206-11S	6	AC.250	AC.1500	<0.75 (250V 60Hz)	270
			ZAG2210-11S	10	AC.250	AC.1500	<0.75 (250V 60Hz)	300
			ZAG2220-11S	20	AC.250	AC.1500	<0.75 (250V 60Hz)	320
			*ZAG2230-11S	30	AC.250	AC.1500	<0.75 (250V 60Hz)	480
			ZAG2220-H	20	AC.250	AC.1500	<0.4 (250V 60Hz)	300
			*Applying for CSA, TÜV.					
ZAG	 Metal cased terminal: studs	Prevention of common mode EMI between 0.15 to 100 MHz and normal mode EMI between 0.15 to 30 MHz. UL recognized.	ZAG2205-11	5	AC.250	AC.1500	<1.0 (250V 60Hz)	150
			ZAG2210-11	10	AC.250	AC.1500	<1.0 (250V 60Hz)	160
			ZAG2220-11	20	AC.250	AC.1500	<1.0 (250V 60Hz)	170
ZAG-P	 Metal cased terminal: studs	Prevention of high voltage pulse EMI. UL recognized.	ZAG2205-11-P	5	AC.250	AC.1500	<1.0 (250V 60Hz)	280
			ZAG2210-11-P	10	AC.250	AC.1500	<1.0 (250V 60Hz)	280
			ZAG2220-11-P	20	AC.250	AC.1500	<1.0 (250V 60Hz)	280
ZHC	 Metal cased terminal: studs	Prevention of normal and common mode EMI between 0.15 to 30 MHz. UL recognized, TÜV approved, CSA certified.	ZHC2203-11	3	AC.250	AC.2500	<1.0 (250V 60Hz)	130
			ZHC2206-11	6	AC.250	AC.2500	<1.0 (250V 60Hz)	250
			ZHC2210-11	10	AC.250	AC.2500	<1.0 (250V 60Hz)	270
ZHG-S ZHG-H	 Metal cased Terminal: Faston tabs	More than 20dB attenuation for high voltage pulse such as 2kV, 1μs. UL recognized, TÜV approved, CSA certified. -H can use above 100MHz.	ZHG2203-11S	3	AC.250	AC.1500	<0.75 (250V 60Hz)	150
			ZHG2206-11S	6	AC.250	AC.1500	<0.75 (250V 60Hz)	270
			ZHG2210-11S	10	AC.250	AC.1500	<0.75 (250V 60Hz)	300
			ZHG2210-H	10	AC.250	AC.1500	<0.4 (250V 60Hz)	170
ZSB	 Metal cased Terminal: Faston tabs	Prevention of normal and common mode EMI between 0.15 to 30 MHz. TÜV approved, UL recognized.	ZSB2208-02	8	AC.250	AC.1500	<1.0 (250V 60Hz)	200
			ZSB2210-06	10	AC.250	AC.1500	<1.0 (250V 60Hz)	90
			ZSB2215-06U	15	AC.250	AC.1500	<1.0 (250V 60Hz)	95
ZSG ZSG-S	 Metal cased Terminal: Faston tabs	Prevention of normal and common mode EMI between 0.15 to 30 MHz. UL recognized, CSA certified.	ZSG2208-02	8	AC.250	AC.1500	<1.0 (250V 60Hz)	230
			ZSG1215-06U	15	AC.125	AC.1500	<0.5 (250V 60Hz)	100
			ZSG2215-02	15	AC.250	AC.1500	<1.0 (250V 60Hz)	90
			ZSG2215-03S	15	AC.250	AC.1500	<1.0 (250V 60Hz)	80
			ZSG2215-06S	15	AC.250	AC.1500	<1.0 (250V 60Hz)	160
ZCB ZCB-M ZCB-S	 Plastic cased Terminal: Faston tabs	Prevention of normal and common mode EMI between 0.15 to 30 MHz. Equally effective in high voltage pulse EMI attenuation to —11S type. UL recognized, TÜV approved, CSA certified.	ZCB2203-11	3	AC.250	AC.1500	<0.75 (250V 60Hz)	45
			ZCB2206-11	6	AC.250	AC.1500	<0.75 (250V 60Hz)	45
			ZCB2201-M	1	AC.250	AC.1500	<0.5 (250V 60Hz)	22
			ZCB2203-M	3	AC.250	AC.1500	<0.5 (250V 60Hz)	22
			ZCB2203-11S	3	AC.250	AC.1500	<0.75 (250V 60Hz)	55
			ZCB2206-11S	6	AC.250	AC.1500	<0.75 (250V 60Hz)	60

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EMI/RFI FILTERS

Series name	Exterior view	Function	Part No.	Rated current (A)	Rated voltage (V)	Test voltage (V)	Leakage current (mA)	Weight (g)
ZGB	 Metal cased Lead wires	Prevention of normal mode EMI between 0.15 to 30 MHz. UL recognized: —01U	ZGB22R5-01U	0.5	AC.250	AC.1500	<1.0 (250V, 60Hz)	75
			ZGB2201-01U	1	AC.250	AC.1500	<1.0 (250V, 60Hz)	75
			ZGB2202-01U	2	AC.250	AC.1500	<1.0 (250V, 60Hz)	75
			ZGB2203-01U	3	AC.250	AC.1500	<1.0 (250V, 60Hz)	75
ZMB	 Plastic cased Lead wires	Prevention of normal mode EMI between 0.15 to 30 MHz. UL recognized: —11 VDE approved: —13	ZMB22R5-11	0.5	AC.250	AC.1500	<1.0 (250V, 60Hz)	65
			ZMB2201-11	1	AC.250	AC.1500	<1.0 (250V, 60Hz)	65
			ZMB2202-11	2	AC.250	AC.1500	<1.0 (250V, 60Hz)	65
			ZMB2203-11	3	AC.250	AC.1500	<1.0 (250V, 60Hz)	65
			ZMB2201-13	1	AC.250	AC.1500	<0.4 (250V, 60Hz)	45
			ZMB2203-13	3	AC.250	AC.1500	<0.4 (250V, 60Hz)	45
ZJG	 Plastic cased Pin terminals	Prevention of normal and common mode EMI between 0.15 to 30 MHz. UL recognized, TÜV approved, CSA certified.	ZJG22R5M-P	0.5	AC.250	AC.1500	<0.5 (250V, 60Hz)	21
			ZJG2202M-P	2	AC.250	AC.1500	<0.5 (250V, 60Hz)	30
			ZJG2203M-P	3	AC.250	AC.1500	<0.5 (250V, 60Hz)	30
			ZJG2206M-P	6	AC.250	AC.1500	<0.5 (250V, 60Hz)	34
ZUB	 Metal cased Terminal: Faston tabs	Prevention of common mode EMI between 1 to 300 MHz. With fuse: —00 —F UL recognized, TÜV approved, CSA certified: —00	ZUB2203-00	3	AC.250	AC.1500	<0.5 (250V, 60Hz)	50
			ZUB2203-00-F	3	AC.250	AC.1500	<0.5 (250V, 60Hz)	70
			ZUB2206-00	6	AC.250	AC.1500	<0.5 (250V, 60Hz)	50
			ZUB2206-00-F	6	AC.250	AC.1500	<0.5 (250V, 60Hz)	70
ZUG-11	 Metal cased Terminal: Faston tabs	Prevention of normal and common mode EMI between 3 to 30 MHz. UL recognized, TÜV approved, CSA certified.	ZUG2203-11	3	AC.250	AC.1500	<0.5 (250V, 60Hz)	46
			ZUG2206-11	6	AC.250	AC.1500	<0.5 (250V, 60Hz)	46
			ZUG2203-11S	3	AC.250	AC.1500	<0.5 (250V, 60Hz)	46
			ZUG2206-11S	6	AC.250	AC.1500	<0.5 (250V, 60Hz)	46
ZJK-00 ZJK-05 ZJKD-15	 Resin molded Flat terminals / Resin molded Pin terminals	Prevention of EMI between 0.15 to 1000 MHz.	ZJK51R1-00	0.1	DC.50	DC.125		1.5
			ZJK51R5-00	0.5	DC.50	DC.125		1.5
			ZJK5103-00	3	DC.50	DC.125		1.5
			ZJK51R1-05	0.1	DC.50	DC.125		0.8
			ZJK51R5-05	0.5	DC.50	DC.125		0.8
			ZJK5103-05	3	DC.50	DC.125		0.8
			ZJKD51R1-15	0.1	DC.50	DC.125		0.4
			ZJKD51R5-15	0.5	DC.50	DC.125		0.4
			ZJKD5103-15	3	DC.50	DC.125		0.4
ZJY	 Plastic cased Flat terminals	Prevention of common mode EMI. Impedance Over 200Ω between 20 to 300 MHz.	ZJY51R5-2P	0.5	DC.50	DC.125		0.4
			ZJY51R5-4P	0.5	DC.50	DC.125		0.8
			ZJY51R5-8P	0.5	DC.50	DC.125		1.6
ZJSR	 Resin molded Pin terminals	Prevention of EMI between 50 to 300 MHz. Small size, high attenuation.	ZJSR5101-330, 470, 680, 101, 221, 331, 102, 222, 232, 472, 682, 103, 223, 333		DC.50	DC.125		1
ZJSC	 Resin molded Pin terminals	Prevention of EMI between 5 to 1000 MHz. Sharp cut-off and high attenuation for wide band over 1 GHz	ZJSC-R10-470	0.5	DC.50	DC.125		1
			ZJSC-R15-121	0.5	DC.50	DC.125		1
			ZJSC-R47-121	0.5	DC.50	DC.125		1
			ZJSC-R47-181	0.5	DC.50	DC.125		1
			ZJSC-R47-391	0.5	DC.50	DC.125		1
			ZJSC-1R0-103	0.4	DC.50	DC.125		1
			ZJSC-2R2-101	0.3	DC.50	DC.125		1
			ZJSC-220-101	0.1	DC.50	DC.125		1
			ZJSC-470-331	0.06	DC.50	DC.125		1
ZBF	 Round lead terminals	Impedance Over 30Ω between 10 to 1000 MHz. Suppression of transmission line reflection.	ZBF253S-01	3	DC.50			0.5
			ZBF503S-01	3	DC.50			0.5
			ZBF253D-01	3	DC.50			0.5
			ZBF503D-01	3	DC.50			0.5
			ZBF503S-01TA	3	DC.50			0.5

• *Specifications, materials, etc. are subject to change without notice.*

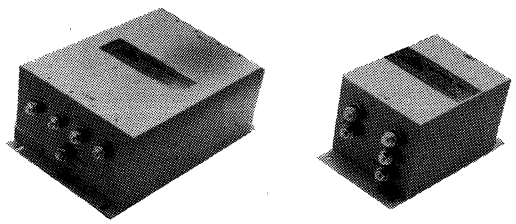
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TPY A/TPY B SERIES

THREE PHASE WYE FILTERS WITH CAPABILITIES TO ATTENUATE DIFFERENTIAL AND COMMON MODE NOISE, TO LEVEL A OR B, FROM SWITCHING POWER SUPPLIES. THIS SERIES OF "T" SECTION FILTERS HAS THE EXTENDED LOW FREQUENCY RANGE NECESSARY TO EITHER SUPPRESS SINGLE OR MULTIPLE SWITCHING POWER SUPPLIES IN BALANCED OR UNBALANCED LOAD CONFIGURATIONS.

SIMPLY SPECIFY EITHER TPYA OR TPYB FOR THE CONDUCTED LIMITS THAT YOU WANT TO MEET. THIS SERIES MAY ALSO BE CONNECTED IN A DELTA CONFIGURATION.

Part No.	Current	Case	Leakage*
TPYB7	7.5A/PH	7 x 4 x 4	2.0mA
TPYB15	15A/PH	8 x 5 x 4	2.0mA
TPYB30	30A/PH	12 x 6.5 x 4	2.4mA

Rated Voltage: 420/250 VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

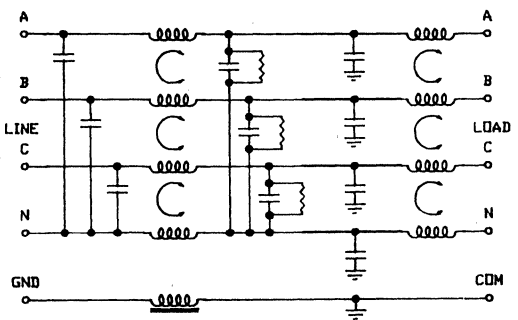
	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	20db	60db	65db	65db	60db	60db
L/L	36db	65db	65db	65db	60db	55db

Part No.	Current	Case	Leakage*
TPYA15	15A/PH	7 x 4 x 4	2.0mA
TPYA30	30A/PH	8 x 5 x 4	2.4mA
TPYA45	45A/PH	12 x 6.5 x 4	3.0mA
TPYA60	60A/PH	12 x 6.5 x 4	3.0mA

Rated Voltage: 420/250 VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	50db	65db	65db	65db	65db
L/L	20db	50db	60db	60db	50db	55db

* EACH LINE TO GND. @ 250VAC



Part No.	Current	Case	Leakage*
TPY20	20A/PH	5 × 4 × 4	2.0mA
TPY30	30A/PH	5 × 4 × 4	2.0mA
TPY45	45A/PH	8 × 5 × 4	3.0mA
TPY60	60A/PH	8 × 5 × 4	3.0mA

Rated Voltage: 420/250 VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	12db	30db	55db	60db	50db	50db
L/L	18db	29db	50db	55db	50db	50db

K SERIES

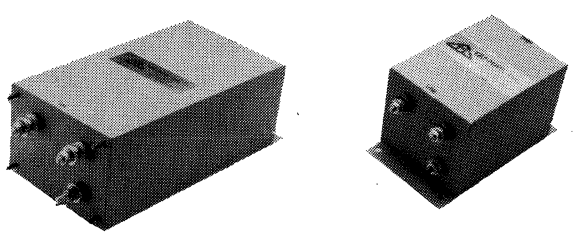
TRI-MAG's "K" SERIES, RFI/EMI, LINE FILTERS HAVE BEEN DESIGNED AND DEVELOPED TO ALLOW ELECTRONIC EQUIPMENT, USING SWITCHING POWER SUPPLIES AND OTHER LOW IMPEDANCE NOISE SOURCES. TO MEET VDE 0871 AND THE RECENTLY ADOPTED FCC REGULATIONS GOVERNING THE INTERFERENCE POTENTIAL OF COMPUTER AND SIMILAR DIGITAL ELECTRONIC EQUIPMENT TO RADIO COMMUNICATIONS.

SERIES "K" FILTERS PROVIDE HIGH INSERTION LOSS FOR BOTH LINE-TO-GROUND AND LINE-TO-LINE GENERATED RFI/EMI INTERFERENCE. THESE FILTERS ARE RECOGNIZED BY UNDERWRITERS LABORATORIES, INC. UNDER ITS COMPONENT RECOGNITION SERVICES. OTHER APPROVALS (CSA, VDE, IEC) ARE IN PROCESS.

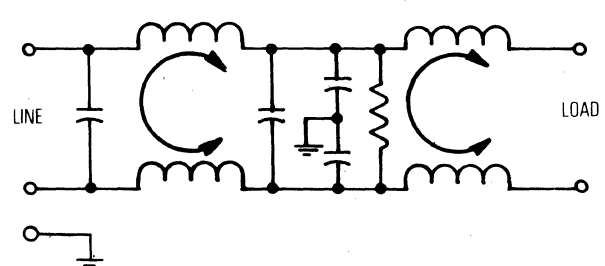
Part No.	Current	Case	Leakage*
K3	3A	2.5 × 2.0 × 1.5	1.0mA
K10	10A	2.8 × 2.2 × 1.5	1.0mA
K20	20A	3.8 × 3.3 × 1.5	1.0mA
K30	30A	4.25 × 3.0 × 2.7	1.0mA
K45	45A	8.0 × 5.0 × 4.0	1.0mA

Rated Voltage: 250VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	20db	60db	65db	65db	65db	60db
L/G	30db	60db	65db	65db	65db	60db



SERIES "K"



TRI-MAG, Inc.
your POWER Specialists

1601 N. CLANCY CT.
VISALIA, CA 93291
(209) 651-2222

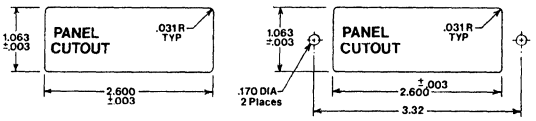
ITT TELEX NUMBER: 4994462
CABLE ADDRESS: "TRIMAG"
FAX NUMBER: (209) 651-0188

MIF SERIES

MODULAR INTEGRATED FILTERS
(POWER ENTRY MODULE WITH FILTER)

SPEED UP AND SIMPLIFY SYSTEM INTEGRATION

PEND'G



FEATURES:

- IEC CONNECTOR INPUT
- FUSED INPUT POWER
- SPARE FUSE HOLDER
- DPDT ON/OFF SWITCH
- VOLTAGE SELECTION SWITCH
- MINIMUM SPACE REQUIREMENT
- COST SAVING INTEGRATION
- SAFETY INTERLOCK ON FUSE

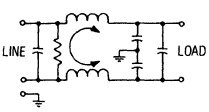
SPECIFICATIONS:

1. **Maximum Leakage Current Each**
   Line-to-Ground @ 115 VAC 60Hz, 0.5mA
   @ 250 VAC 50Hz, 1.0mA
2. **Hipot Rating** (One Minute)
   Line-to-Ground: 2000 VAC
   Line-to-Line: 1500 VDC
3. **Operating Frequency:** 47-63 Hz
4. **Rated Voltage:** 115/250 VAC

SERIES B FILTERS

TRI-MAG PART NO:	B3-12S10EA B6-12S10EA	B3-12VS10E B6-12VS10E	B3-12S10EAVS B6-12S10EAVS	B3-12SF10EA B6-12SF10EA	B3-12SF10EAVS B6-12SF10EAVS	B3-12AVS3 B6-12AVS3	1.75 2.13 Dim. "L"
RATED CURRENT 115VAC	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	
RATED CURRENT 250VAC	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	
IEC CONNECTOR	YES	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	NO	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	YES	

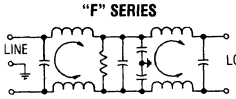
MODEL	FREQUENCY-MHz .15	.20	.50	10.0	20.0
B3	20dB	25dB	35dB	50dB	50dB
B6	20dB	25dB	35dB	50dB	50dB



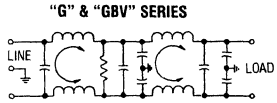
SERIES F,G & GBV FILTERS

TRI-MAG PART NO:	F6-12S10EA G3-12S10EA GBV3-12S10EA	F6-12VS10E G3-12VS10E ---	F6-12S10EAVS G3-12S10EAVS ---	F6-12SF10EA G3-12SF10EA ---	F6-12SF10EAVS G3-12SF10EAVS ---	2.13 2.13 2.13 Dim. "L"
RATED CURRENT 115VAC	6A/3A	6A/3A	6A/3A	6A/3A	6A/3A	
RATED CURRENT 250VAC	6A/3A	6A/3A	6A/3A	6A/3A	6A/3A	
IEC CONNECTOR	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	

"F" SERIES



"G" & "GBV" SERIES

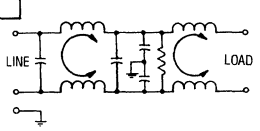


MODEL	FREQUENCY-MHz .15	.20	.50	1.0	10.0	20.0
F6	45dB	50dB	65dB	70dB	70dB	70dB
G3	20dB	20dB	50dB	60dB	70dB	70dB
GBV3	60dB	65dB	70dB	70dB	70dB	70dB

SERIES K FILTERS

TRI-MAG PART NO:	K3-12S10EA	K3-12VS10E	K3-12S10EAVS	K3-12SF10EA	K3-12SF10EAVS	2.13 Dim. "L"
RATED CURRENT 115VAC	3A	3A	3A	3A	3A	
RATED CURRENT 250VAC	3A	3A	3A	3A	3A	
IEC CONNECTOR	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	

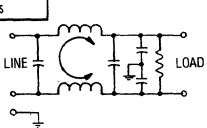
MODEL	FREQUENCY-MHz .15	.50	1.0	5.0	10.0	20.0
K3 LINE TO GROUND	60dB	65dB	65dB	65dB	65dB	65dB
K3 LINE TO LINE	50dB	65dB	65dB	65dB	65dB	65dB



MPA/MPB SERIES

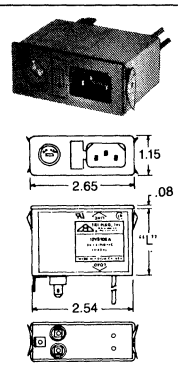
TRI-MAG PART NO:	MPA3-12S10EA MPB3-12S10EA	MPA3-12VS10E MPB3-12VS10E	MPA3-12S10EAVS MPB3-12S10EAVS	MPA3-12SF10EA MPB3-12SF10EA	MPA3-12SF10EAVS MPB3-12SF10EAVS	MPA3-12AVS3 MPB3-12AVS3	1.75 Dim. "L"
RATED CURRENT 115VAC	3A	3A	3A	3A	3A	3A	
RATED CURRENT 250VAC	3A	3A	3A	3A	3A	3A	
IEC CONNECTOR	YES	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	NO	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	YES	

MODEL	FREQUENCY-MHz .01	.02	.05	.15	.50	1.0	5.0	10.0	30.0
MPA	5dB	15dB	25dB	45dB	65dB	65dB	65dB	65dB	65dB
MPB	15dB	25dB	35dB	55dB	65dB	65dB	65dB	65dB	65dB

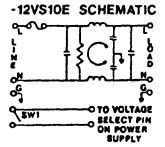


MIF CLIP MOUNT

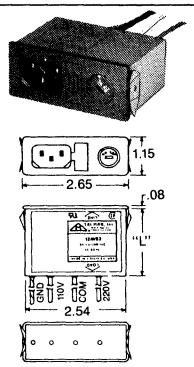
– 12VS10EA



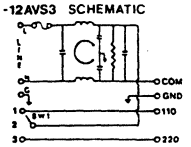
-12VS10E SCHEMATIC



– 12AVS3

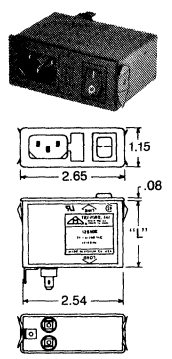


-12AVS3 SCHEMATIC

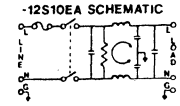


MIF CLIP MOUNT

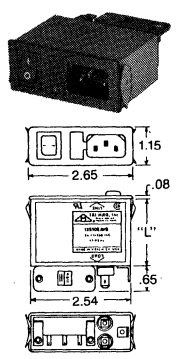
– 12S10E
– 12S10EA



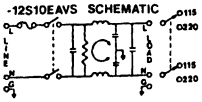
-12S10EA SCHEMATIC



– 12S10EAVS

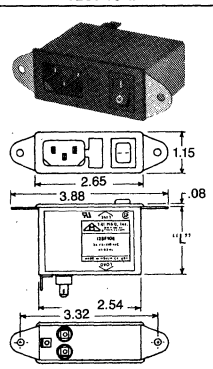


-12S10EAVS SCHEMATIC

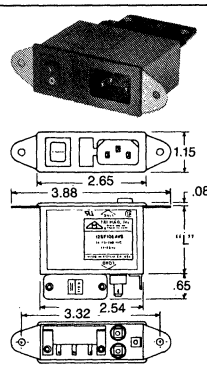


MIF FLANGE MOUNT

– 12SF10E
– 12SF10EA



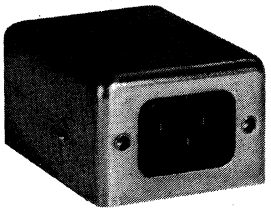
– 12SF10EAVS

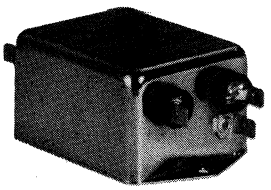


TRI-MAG, Inc.
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(209) 651-2222
ITT TELEX NUMBER: 4994462
CABLE ADDRESS: "TRIMAG"
FAX NUMBER: (209) 651-0188

PEND'G

PA/PB SERIES

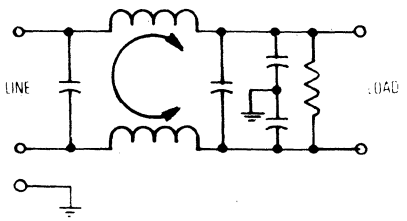




THE **TRI-MAG** PA/PB SERIES OF A.C. LINE FILTERS HAVE BEEN DEVELOPED PRIMARILY FOR COMPUTER SYSTEMS THAT USE SWITCHING POWER SUPPLIES. THE CURRENT RATINGS ARE HIGH ENOUGH TO ALLOW DESIGNERS TO PROTECT A COMPLETE COMPUTER SYSTEM FROM EXCEEDING THE CONDUCTED EMISSION LIMITS SPECIFIED EITHER BY FCC OR VDE.

THE PA IS AVAILABLE IN CURRENT RATINGS OF 1, 3, 5, 6 AND 10 AMPS AND THE PB IS AVAILABLE IN 1.3 AND 5 AMPS FOR OPERATION ON A.C. LINES OF 115 TO 250 VOLTS 50/60 Hz.

SPECIFY EITHER PA OR PB FOR THE CONDUCTED LIMITS THAT YOU WANT TO MEET.



Part No.	Current	Case	Leakage
PB1	1	2.5 × 2 × 1.5	1mA @ 250VAC
PB3	3	2.5 × 2 × 1.5	1mA @ 250VAC
PB5	5	2.8 × 2.0 × 1.5	1mA @ 250VAC

Rated Voltage: 250VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

PB	.01MHz	.01MHz	.05MHz	.15MHz	.50MHz	1.0MHz	5.0MHz	10MHz	30MHz
	30db	35db	45db	65db	65db	65d	65db	65db	65db

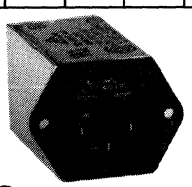
Part No.	Current	Case	Leakage
PA1	1	2.5 × 2 × 1.5	1mA @ 250VAC
PA3	3	2.5 × 2 × 1.5	1mA @ 250VAC
PA5	5	2.5 × 2 × 1.5	1mA @ 250VAC
PA6	6	2.8 × 2.2 × 1.5	1mA @ 250VAC
PA10	10	2.8 × 2.2 × 1.5	1mA @ 250VAC

Rated Voltage: 250VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

PA	.01MHz	.02MHz	.05MHz	.15MHz	.50MHz	1MHz	5MHz	10MHz	30MHz
	25db	30db	40db	60db	65db	65db	65db	65db	65db

MPA/MPB SERIES

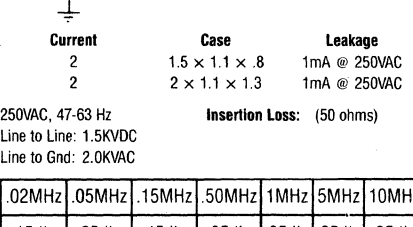




THE **TRI-MAG** MPA/MPB SERIES ARE THE "MINI" VERSIONS OF THE PA AND PB. THEY HAVE BEEN DEVELOPED TO SUPPRESS THE CONDUCTED EMISSIONS GENERATED BY SWITCHING POWER SUPPLIES. SINCE THESE SERIES ARE "MINI" IN SIZE AND COST, IT MAKES THEM IDEAL FOR COMPUTER PERIPHERALS.

THE MPA OR MPB IS AVAILABLE IN CURRENT RATINGS OF 2 AMPS FOR OPERATION ON A.C. LINES OF 115 TO 250 VOLTS, 50/60 Hz.

SPECIFY EITHER MPA OR MPB FOR THE CONDUCTED LIMITS THAT YOU WANT TO MEET.



Part No.	Current	Case	Leakage
MPA2-11	2	1.5 × 1.1 × .8	1mA @ 250VAC
MPA2-12	2	2 × 1.1 × 1.3	1mA @ 250VAC

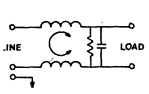
Rated Voltage: 250VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

MPB	.01MHz	.02MHz	.05MHz	.15MHz	.50MHz	1MHz	5MHz	10MHz	30MHz
	15db	25db	35db	55db	65db	65db	65db	65db	65db

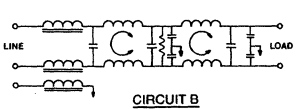
MPA	.01MHz	.02MHz	.05MHz	.15MHz	.50MHz	1MHz	5MHz	10MHz	30MHz
	5db	15db	25db	45db	65db	65db	65db	65db	65db

MEDICAL SERIES

1. **RATED VOLTAGE:** 115/250VAC, 47-63Hz
2. **TEST VOLTAGE:**
   LINE TO GROUND: 2500 VDC
   LINE TO LINE: 1500 VDC
3. **LEAKAGE CURRENT:**
   M=2μA, MA=50μA, MB=250μA @ 115VAC

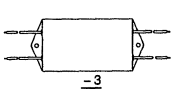


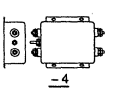
CIRCUIT A

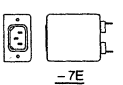


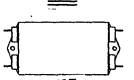
CIRCUIT B

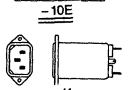


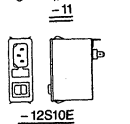












	CIRCUIT	CONFIGURATIONS AVAILABLE						
		-1	-3	-4	-7E	-10E	-11	-12S10E
M3	A	×	–	–	–	×	×	–
M6	A	×	–	–	–	–	×	–
MA3	B	–	×	–	×	×	–	×
MA6	B	–	×	–	×	×	–	–
MA10	B	–	×	–	–	×	–	–
MA15	B	–	–	×	–	–	–	–
MA20	B	–	–	×	–	–	–	–
MB3	B	–	×	–	×	×	–	×
MB6	B	–	×	–	×	×	–	–
MB10	B	–	×	–	–	×	–	–
MB15	B	–	–	×	–	–	–	–
MB20	B	–	–	×	–	–	–	–

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

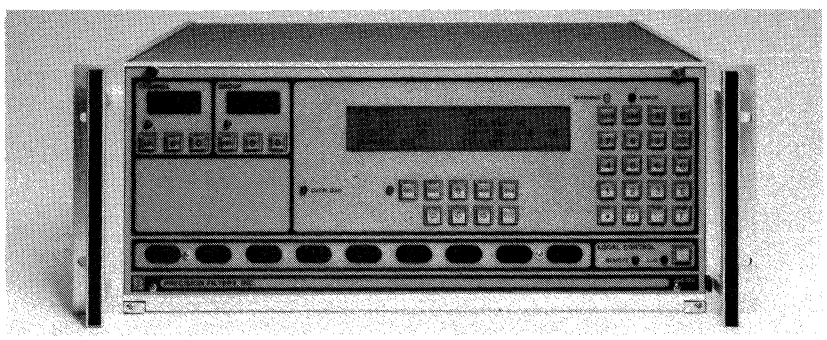
WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1701
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

Filters, Amps, Band Translators, Switch Matrices, DC to 2 MHz, 128 Channels.

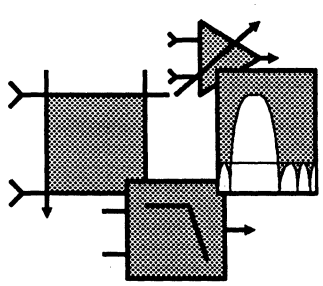
Friendly High Density
- 128 prog. filter/amp channels.
- 32 band-pass channels.
- 64 prog. amplifier channels.
- Differential input, gain, calibration, monitor, and other options, of course.
- Zero suppress.

Friendly Performance
- Band-pass with Q > 10,000.
- 2 MHz prog. filters, 80 dB/octave.
- 204.7 kHz filters, 130 dB/octave.
- Filter match 0.25° and 0.25% typ.



All In One System.

That's system friendly.
That's Precision 6000.
Get all you need today.
Change and upgrade later.



Friendly Functions
- Cal subsystem for go/no-go cal, end-to-end cal, plus diagnostics.
- Group configuration for easy control.
- Up-load and down-load for easy setup.
- Overload detection.
- System status, other reports.

Friendly Choice
- Programmable filters—HP, LP, BP, notch, anti-alias, one-third octave.
- Programmable amplifiers—pre, post, auto-gain ranging.
- Prog. frequency-band translators.
- Switch matrices—4x4 to 32x32.
- Buffered I/O to sense/control other devices.
- Proto-cards for custom circuitry.
- serial, GPIB, or parallel computer interfaces.
- Custom systems from standard proven hardware that's available.
- Buy only what you need now, add and change as needs change.

128 filters in a mainframe

Filters are offered in a wide variety of types that you can mix and match within the 16 card mainframe.

Filters come one, two, four, or eight per card, depending on resolution and other performance features.

2 MHz filters

We have a tradition of leading the way to higher frequency filters. We introduced the industry's first 2 MHz bandwidth filters for programmable use. 80 dB/octave attenuation. Time delay superior to Bessel.

Elliptics as sharp as 130 dB/octave

Precision was first to offer elliptics with 80 dB/octave attenuation. Now we're the first to add the sharper option of 130 dB/octave for frequencies up to 204 kHz.

Passband ripple is 0.044 dB p-p, and there's 1° phase match up to the cut-off frequency.

Open door policy on configuration

You can mix types of filters. You can also add a variety of preamps, post amps, gain ranging amplifiers, and transducer amplifier/filters. Refer to Section 1100 for more details.

A variety of additional system enhancements match the Precision 6000 to your requirements. Frequency-band translators, switch matrices, buffered I/O interface cards and prototype cards are available for your system. See Section 2325 for details.

Easy programming

Set up the system at the front panel. One command uploads the set-up to a host computer. Down-load later to program the system. Choice of serial, GPIB, or parallel computer interfaces.

Precision family of signal conditioners

Call Precision Filters for all your signal conditioning requirements. Signal switching systems, A/D conversion systems, and VXI-based systems are available. See Section 2325.

• See amplifier systems, transducer/amplifier systems, and auto-ranging amplifier systems in Section 1100.
• See other data acquisition systems in Section 2325.

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850
607-277-3550 Fax: 607-277-4466 Telex: 646846

SIGNAL FILTERS

Manufacturer	Starting EEM Page No.	Low Pass	High Pass	Band-pass (incl. SAW)	Band Reject	Frequency								Signal Conditioners				Other
						AF	IF	RF Micro-wave	VHF/ UHF	AM	FM	TV	Video	Program-mable	Digital	Vari-able	Equal-izer	
Allen Avionics	A•1653	√§*	√§*	√§*	√§*			√§*				√§*	√§*				√*	
A. P. Circuit Corp.	A•1654	√§	√§	√§	√§	√	√			√		√	√	√	√	√		Custom designed filters
Arco Electronics	A•1657												√					
Avens Corp.	A•1658	√§*	√§*	√§*	√§*	√§*				√§*		√	√	√*	√*	√*		
Chesterfield Products	A•1661	√§*	√§*		√§*	√*	√*	√§*	√*	√*	√*		√*				√*	
Communication Coil	A•1665	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*					
Eagle Wichita	A•1666	√	√	√	√		√	√	√	√	√	√				√		
Electronic Precision Comps. Corp.	A•1670	√*	√*	√*	√*	√*	√*	√*										
ESC Electronics	A•1671	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*			√*	√*	
Filtron Co.	A•1673	√§*	√§*	√§*	√§*			√§*					√§*					Power line interference filters and enclosures
Frequency Devices	A•1674	√	√	√	√	√§								√	√	√		Program-mable Filters
Genisco	A•1677	√*				√	√		√									
Integrated Microwave	A•1678	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§				√*	
KR Electronics Inc.	A•1682	√*	√*	√*	√*	√*	√*		√	√	√	√	√				√	
Krohn-Hite Corp.	A•1685					√	√	√						√		√		
Metuchen Capacitors	A•1686	√§*	√§*	√§*				√§*	√§*				√§*				√*	EMI/RFI Suppresion (Resin & Hermetic Seal)
Microwave Filter Co.	A•1688	√§*	√§*	√§*	√§*		√§*	√§*	√§*		√§*	√§*	√§*					
Murata Erie	A•1696	√§*	√§*	√§	√§	√	√	√	√	√	√	√	√					Filter Connectors Surface Mount Filter
NTK Technical Ceramics	A•1699			√§			√											
Oxley Inc.	A•1705	√§*																EMI Suppresion
Precision Filters, Inc.	A•1706	√	√	√	√	√	√							√	√	√		
TTE Inc.	A•1708	√	√	√	√	√	√	√	√	√	√	√	√					

§ Surface Mount * MIL Spec

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

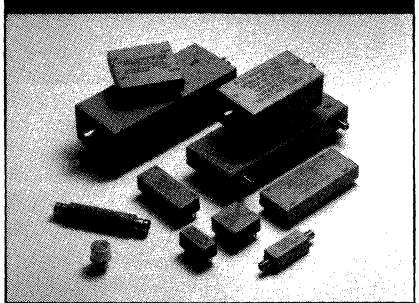
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

ALLEN AVIONICS, INC.

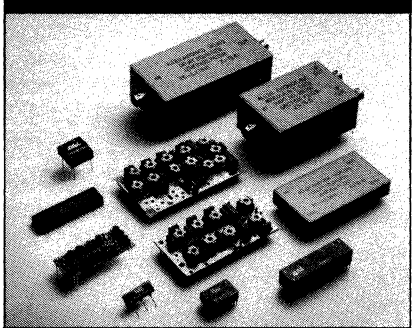
The world's most complete source of:
Video Delay Lines • General Purpose Delay Lines
Video Filters • LC Filters from 20Hz to 3GHz
Video Hum Eliminators & Isolation Transformers
Digital Delay Lines and Video Instrumentation.

LC FILTERS 20Hz TO 3GHz



- Lowpass, Highpass Bandpass Band Reject
- Linear Phase
- Delay Equalized
- Anti-Aliasing
- Low Profile
- Sub-Miniature
- TO8
- Tubular
- Butterworth, Chebyshev, Eleptic, Bessel, Gaussian
- High-Rel Space Grade
- Commercial & Military
- Amplitude & Phase Matching
- Tempest

VIDEO FILTERS



- NTSC & PAL
- General Purpose Delay Equalized Lowpass Filters
- Component Signal Processing
- Pre & Post Filters for 4:2:2 Digital Signal Processing
- Triple Filters
- Brick Wall Filters
- High Performance Filters for HDTV
- Video Networks
- Bandpass
- Bandstop
- Gaussian

VIDEO HUM ELIMINATORS (HUMBUCKER) VIDEO ISOLATION TRANSFORMERS



HEC 1000
HEC 2000
Designed to remove all 50-60 Hz hum in video signals

VNE 75
Designed for HDTV systems and other high frequency bandwidth requirements

VIT 75
Video isolation transformer designed to eliminate ground loop problems in video signals

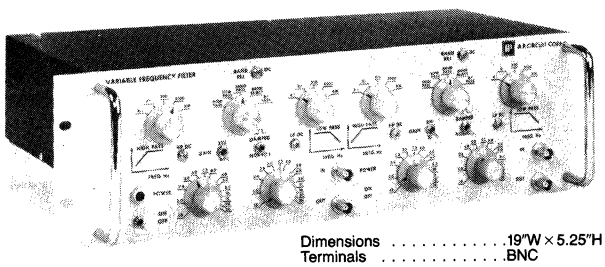
ALLEN AVIONICS, INC.

224 East Second Street, Mineola, NY 11501 • (516) 248-8080 • FAX (516) 747-6724

A.P. CIRCUIT Corporation

TEL: (718) 456-2717
397 Linden Street / Brooklyn, NY 11237

Custom-built instruments and modules.
Expert assistance in filter selection. Fast prototype service.



Dimensions .....19"W × 5.25"H × 9"D
Terminals .....BNC

DUAL CHANNEL RACKMOUNTABLE AP 200 SERIES

These are continuously tuneable multifunction Instruments with continuous cut-off frequencies ranging from 0.01Hz – 2MHz. There is no need for separate filter Instruments as each of these Instruments comes complete with:

LOWPASS HIGHPASS BYPASS
BANDPASS BANDREJECT

Provides user the added flexibility of any two independent instruments on a single standard 19" rack.

STANDARD FEATURES

Attenuation slope .....24 dB/octave
Insertion loss: Gain × 1 ..... 0 ± 1 dB
Gain × 10 .....20 ± 1dB
Maximum attenuation ..... 90 dB
Max. input signal .....8V, rms (12 V peak)
DC stability ..... 50 microvolts/°C
Internal noise
(DC – 100KHz) .....0.05 mV rms max.
Input impedance ..... 1 Megohm
Output impedance .....1 Ohm max.

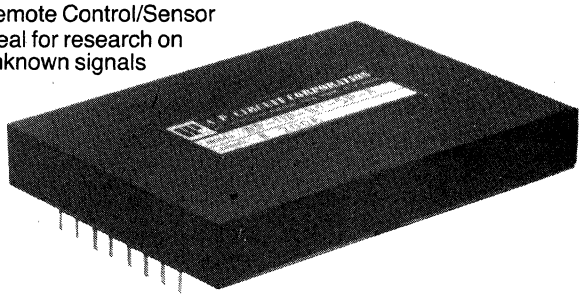
DIGITAL PROGRAMMABLE FILTERS

FEATURES

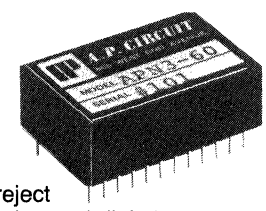
- Variable Frequency Filter
- TTL/CMOS compatible
- Implement 2 to 8 order filter functions
- Five filter functions are available: LOWPASS, HIGHPASS, BANDPASS, BANDREJECT, ALLPASS
- Response characteristics include Butterworth, Bessel, Chebyshev, Elliptic (Cauer)

APPLICATIONS

- Data Acquisition System Prefiltering
- D/A Postfiltering, and Discrete Step Smoothing
- Signal Bandwidth Control
- Signal Analyzer/Conditioner
- Multichannel Processors
- Remote Control/Sensor
- Ideal for research on unknown signals



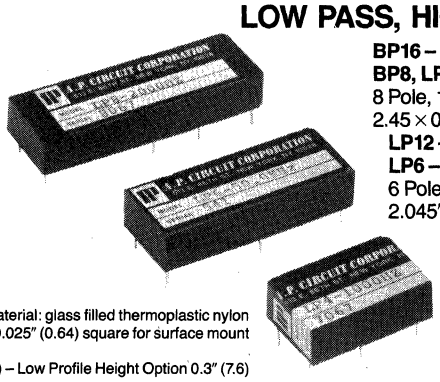
ACTIVE NOTCH FILTERS



- Dual output: Bandpass & Band-reject
- Ideal building block for mixed analog and digital systems
- Miniature size 1.25" × 0.8" × 0.4"

"MINI" ACTIVE FILTERS

LOW PASS, HIGH PASS AND BAND PASS 4-16 POLE



Material: glass filled thermoplastic nylon 0.025" (0.64) square for surface mount

(h) – Low Profile Height Option 0.3" (7.6)

BP16 – LP16 – HP16
BP8, LP8 – HP8
8 Pole, 16 Pole
2.45 × 0.77" × 0.43"

LP12 – HP12
LP6 – HP6
6 Pole, 12 Pole
2.045" × 0.8" × 0.43"

LP4 – HP4
4 Pole
1.245" × 0.8" × 0.43"

FEATURES

- Standard DIP Package 0.6" between rows of pins
- High Input Impedance (1 Mohm)
- Low Output Impedance (1 ohm)
- Frequency Cut-off Range – 100mHz – 500KHz (± 2%)
- Characteristics
  Standard: Butterworth
  Options: Chebyschev, Bessel
- Low noise 50 microvolt RMS (DC – 100KHz)
- Low profile 0.3" height, surface mount, phase and attenuation matching

THE ORIGINAL.
Units so Unique, competitors have attempted to copy and add them to their product lines. Beware of Imitations.

STANDARD DELIVERY 2 WEEKS ARO.

Arco Electronics U.S. Agent for SOSHIN SOSHIN ELECTRIC CO., LTD.

VIDEO FILTERS

FILTER FOR COMPONENT DIGITAL EQUIPMENT (4:2:2)

Arco Also Manufactures Superior Capacitors

Sampling frequency: 13.5MHz(Y), 6.75MHz(UV)

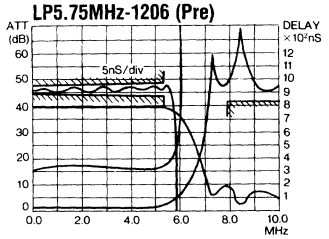
- Good group delay characteristics
- Various types including CCIR REC 601 type are available.
- Comply with a variety of customers' needs.

		CCIR REC 601 type		CCIR REC 601, compact type		Standard type		Low cost type	
Case size (mm)		78×32×13		55×22.5×10		60×30×13		39×16×10	
PRE-FILTER	75Ω	LP5.75MHz-1206	75Ω	LP5.75MHz-1324	75Ω	LP5.75MHz-0948	75Ω	LP5.75MHz-1258	
	150Ω	LP5.75MHz-0897	150Ω	LP5.75MHz-1303					
POST-FILTER (X/SIN X)	75Ω	LP5.75MHz-1207	75Ω	LP5.75MHz-1325	75Ω	LP5.75MHz-0947	75Ω	LP5.75MHz-1259	
	150Ω	LP5.75MHz-0898	150Ω	LP5.75MHz-1304					
PRE-FILTER	75Ω	LP2.75MHz-1208	75Ω	LP2.75MHz-1322	75Ω	LP2.75MHz-0918	75Ω	LP2.75MHz-1260	
	150Ω	LP2.75MHz-0895	150Ω	LP2.75MHz-1305	300Ω	LP2.75MHz-0758			
POST-FILTER (X/SIN X)	75Ω	LP2.75MHz-1209	75Ω	LP2.75MHz-1323	75Ω	LP2.75MHz-0919	75Ω	LP2.75MHz-1261	
	150Ω	LP2.75MHz-0896	150Ω	LP2.75MHz-1306	300Ω	LP2.75MHz-0759			

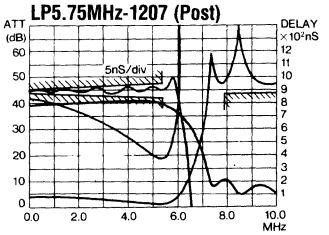
		Pre-Filter		Post-Filter	
		Luminance (Y)	Color difference (U.V)	Luminance (Y)	Color difference (U.V)
		LP5.75MHz	LP2.75MHz	LP5.75MHz	LP2.75MHz
Input/output impedance	(Ω)	150 (75)	150 (75)	150 (75)	150 (75)
Insertion loss	(dB)	4 MAX	4 MAX	6 MAX	6 MAX
Pass band ripple	(dB)	0.1p-p TYP	0.1p-p TYP	±0.1 TYP	±0.1 TYP
3 dB frequency (designed value)	(MHz)	6.05	3.15	6.25	3.25
Pass band	(MHz)	5.75	2.75	5.75	2.75
Attenuation at ½ sampling frequency		12 MIN (15 MIN)	6 MIN (7 MIN)	12 MIN	6 MIN
Attenuation	(dB)	40 MIN	40 MIN	40 MIN	40 MIN
	(MHz)	8～	4～	8～	4～
Absolute value of group delay time (designed value)	(nS)	800	1506	803	1520
Group delay ripple	(nS)	6p-p	12p-p (8p-p)	6p-p	12p-p (8p-p)
Corrected group delay band	(MHz)	5.75	2.75	5.75	2.75
Sampling frequency	(MHz)	13.5	6.75	13.5	6.75

Sampling frequency: 13.5MHz(Y), 6.75MHz(UV)

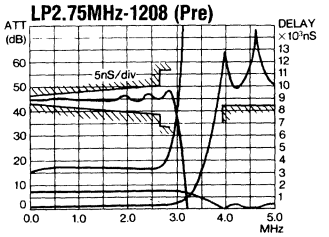
LP5.75MHz-1206 (Pre)



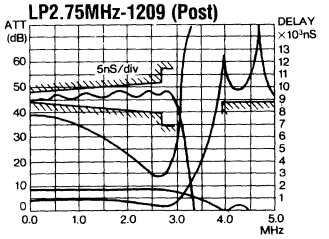
LP5.75MHz-1207 (Post)



LP2.75MHz-1208 (Pre)

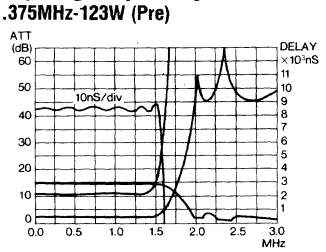


LP2.75MHz-1209 (Post)



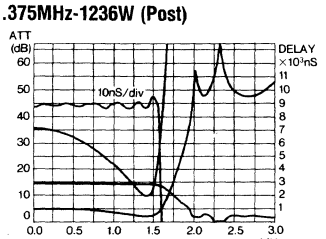
Sampling fequency: 3.375MHZ

LP1.375MHz-123W (Pre)



Impedance 150Ω
Size ..... 55×22.5×10

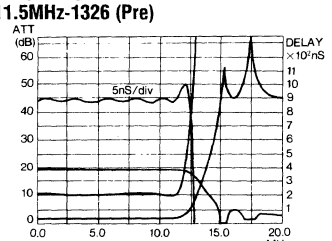
LP1.375MHz-1236W (Post)



Impedance 150Ω
Size ..... 55×22.5×10

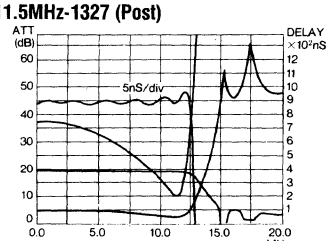
Sampling frequency: 27MHZ

LP11.5MHz-1326 (Pre)



Impedance 75Ω
Size ..... 55×22.5×10

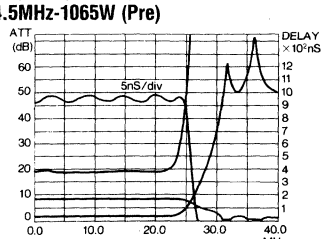
LP11.5MHz-1327 (Post)



Impedance 75Ω
Size ..... 55×22.5×10

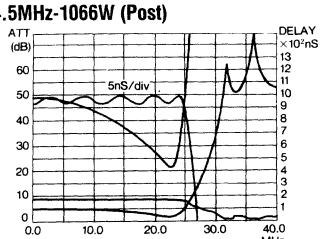
Sampling frequency: 54MHZ

LP24.5MHz-1065W (Pre)



Impedance 75Ω
Size ..... 55×22.5×10

LP24.5MHz-1066W (Post)



Impedance 75Ω
Size ..... 55×22.5×10

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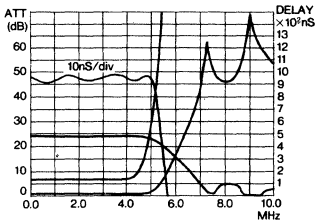
VIDEO FILTERS

FILTER FOR DIGITAL EQUIPMENT AND VIDEO SIGNAL PROCESSING -NTSC-

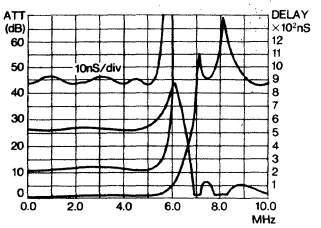
Arco Also Manufactures Superior Capacitors

Sampling frequency: 14.32MHz (pre & post)

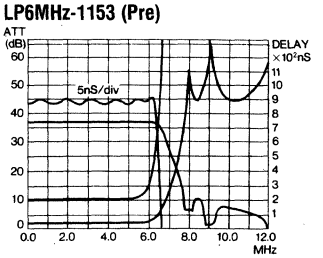
LP5MHz-0823 (Pre)



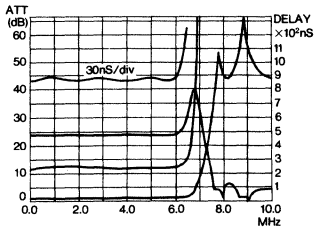
LP6MHz-0735 (Pre)



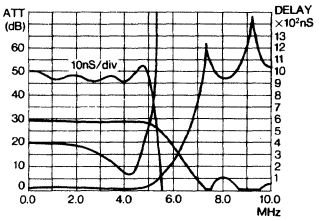
LP6MHz-1153 (Pre)



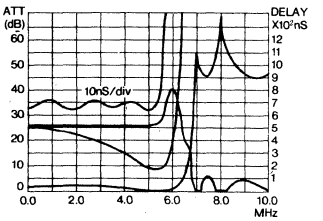
LP6MHz-1447 (Pre)



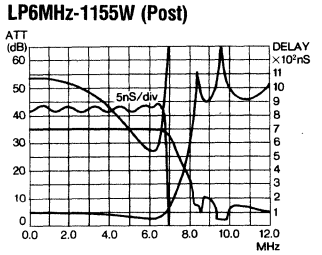
LP5MHz-0824 (Post)



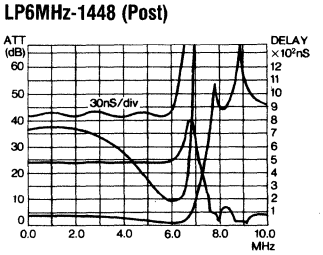
LP6MHz-0737 (Post)



LP6MHz-1155W (Post)



LP6MHz-1448 (Post)

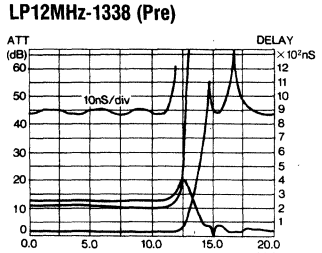


		High performance type		Standard type		Compact type		CCIR REC 601 Scale-up type ❊			
Case size (mm)		78×32×13		60×30×13		39×16×10		55×22.5×10		39×16×10	
	PRE-FILTER	75Ω	LP6MHz-0623W	75Ω	LP6MHz-0859	75Ω	LP6MHz-1251	75Ω	LP6MHz-1153W	75Ω	LP6MHz-1447
				150Ω	LP6MHz-0264W	150Ω	LP6MHz-0909				
				300Ω	LP6MHz-0735						
	POST-FILTER (X/SIN X)	75Ω	LP6MHz-0624W	75Ω	LP6MHz-1079	75Ω	LP6MHz-1252	75Ω	LP6MHz-1155W	75Ω	LP6MHz-1448
				300Ω	LP6MHz-0737	150Ω	LP6MHz-0910				
	PRE-FILTER			75Ω	LP5MHz-0906	150Ω	LP5MHz-0939W	❊ fsc/2 ≒ 12dB, delay peak is corrected			
				150Ω	LP5MHz-0823						
	POST-FILTER (X/SIN X)			75Ω	LP5MHz-0907	150Ω	LP5MHz-0938W				
				150Ω	LP5MHz-0824						

Sampling fequency: 28.63MHz

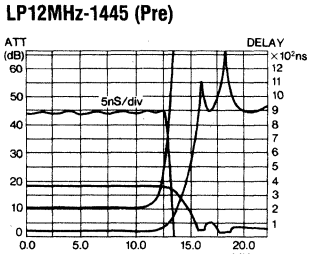
Standard Type

LP12MHz-1338 (Pre)



Impedance 75Ω
Size ..... 39 × 16 × 10
• High performance type is available

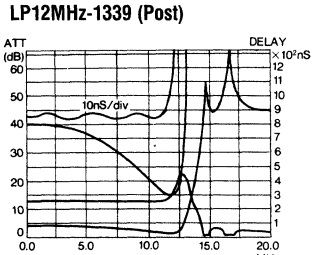
LP12MHz-1445 (Pre)



Impedance 75Ω
Size ..... 55 × 22.5 × 10

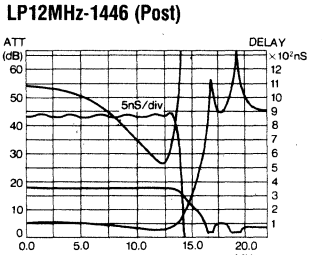
CCIR REC 601 Scale-up type

LP12MHz-1339 (Post)



Impedance 75Ω
Size ..... 39 × 16 × 10

LP12MHz-1446 (Post)



Impedance 75Ω
Size ..... 55 × 22.5 × 10

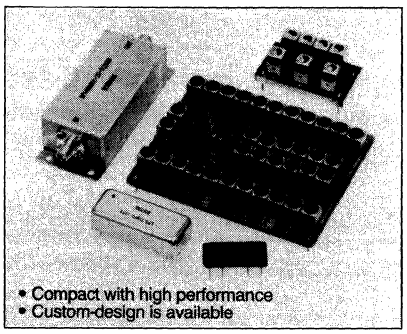
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VIDEO FILTERS

DIPPED TYPE FILTER/DELAY LINE

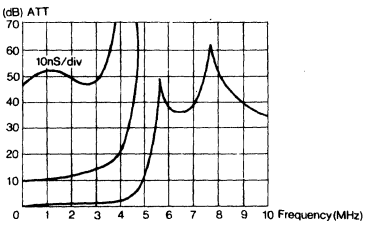
Arco Also Manufactures Superior Capacitors

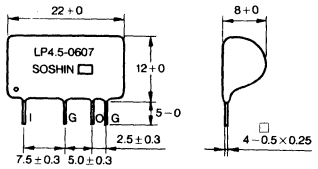


- Compact with high performance
- Custom-design is available

For Satellite broadcasting (Group delay is good since equalizer is built in.)

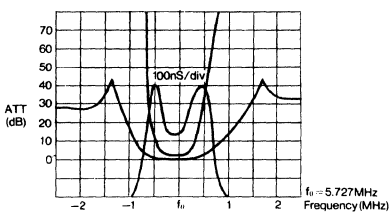
LP4.5MHz-0607 (For video signal) -NTSC-





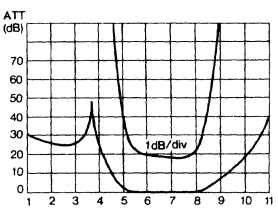
Impedance 1000Ω

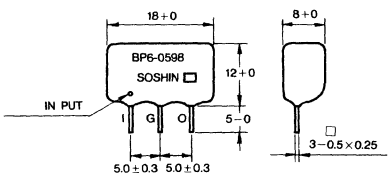
BP5.727MHz-0615 (For sound signal) -NTSC-



Impedance 150Ω

BP6MHz-0598 (For sound signal) -NTSC-

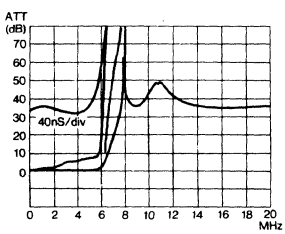


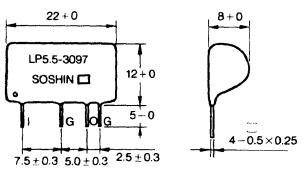


Impedance 510Ω

Note: 15kHz, 20kHz active filters are available

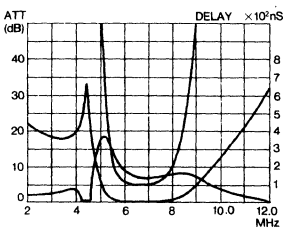
LP5.5MHz-3097 (For video signal) -PAL-

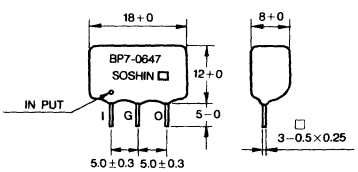




Impedance 1000Ω

BP7MHz-0647 (For sound signal) -PAL-

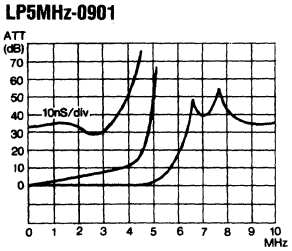


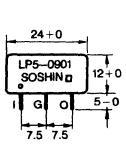


Impedance 510Ω

For video signal processing

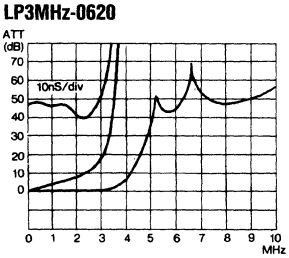
LP5MHz-0901

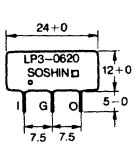




Impedance 330Ω

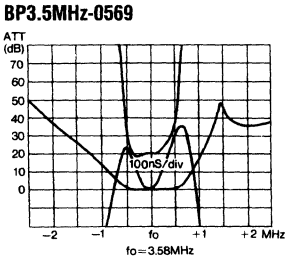
LP3MHz-0620

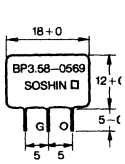




Impedance 1000Ω

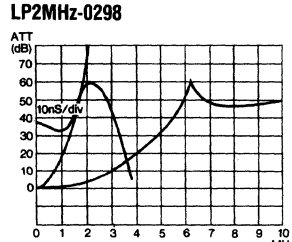
BP3.5MHz-0569

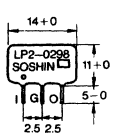




Impedance 1000Ω

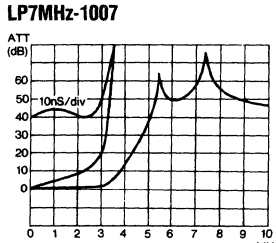
LP2MHz-0298

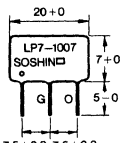




Impedance 1000Ω

LP7MHz-1007





Impedance 1000Ω

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AVENS

CUSTOM DESIGN FILTER SYSTEM & PCB MODULE

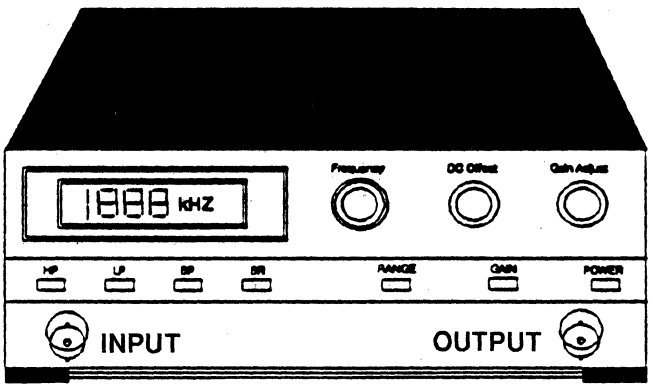
1-(800) 452-1966

MULTI-FUNCTION FILTER SYSTEM

MODEL 5200
Portable Multi-Function Filter

FEATURES:

- Single or Dual channel
- Lowpass, Highpass, Bandpass, & Band-reject
- Adjustable Bandwidth
- 3-1/2 digit display
- Cover frequencies: 0.01 Hz to 6.0 MHz
- Filter orders: 4th & 8th
- Responses: Butterworth, Bessel, Chebyshev, Elliptic, & Linear Phase Elliptic
- Pre-amplification up to 60 dB
- Single-ended or Differential input
- DC offset adjustable to 0.0
- Low noise and low DC drift
- Battery operation option
- Dimension: 9.75″L x 3.5″H x 12″D



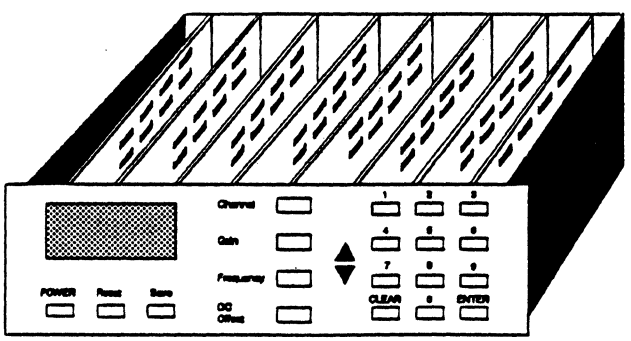
MAXIMUM RATINGS

Dynamic Range	> 90 dB
Attenuation	> 100 dB/OCT
Input Voltage	± 15.0 V.
Output Voltage	± 13.5 V.
Input Impedance	1 Megaohm (or 50 ohm matched)
Output Impedance	< 50 ohm (or 50 ohm matched)

MODEL 6000
Multi-Channel High Order Filter

FEATURES:

- Consist of one main frame and 8 plug-in cards
- Support up to 16 channel filters
- Front panel displays all parameters
- Cover frequencies: 0.01 Hz to 6.0 MHz
- Implement most responses: Butterworth, Bessel, Chebyshev, Elliptic, & Linear Elliptic
- Supply all filter functions: Lowpass, Highpass, Bandpass, & Band-reject
- Pre-amplification up to 60 dB
- Single-ended or Differential input
- DC offset adjustable to 0.0
- Magnitude & Phase matching options
- 19" Rack-mountable case
- Rear panel in/out BNC connectors
- Can be modified to customers' specifications



MAXIMUM RATINGS

Dynamic Range	> 90 dB
Attenuation	> 100 dB/OCT
Input Voltage	± 15.0 V.
Output Voltage	± 13.5 V.
Input Impedance	1 Megaohm (or 50 ohm matched)
Output Impedance	< 50 ohm (or 50 ohm matched)
Channel Crosstalk	> 60 dB
DC Offset	< 0.5 mV

AVENS SIGNAL EQUIPMENT Corp.

P.O. BOX 1057, NEW YORK, NY 10002 TEL: (718) 335-1886/FAX: (718) 429-5785

AVENS

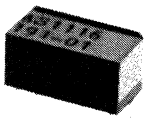
CUSTOM DESIGN FILTER SYSTEM & PCB MODULE

1-(800) 452-1966

MINIATURE ANALOG ACTIVE FILTER MODULE

MODEL AS (ANTI-ALIASING FILTER)

Small 16-pin 0.3" wide DIP
0.85"L X 0.47"W X 0.40"H



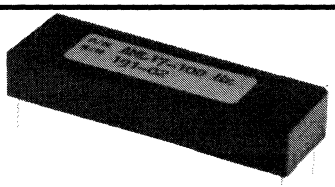
FEATURES:

- Fit STD monolithic 16-pin IC socket
- Analog RC filter (no sampling/switching)
- No external component is needed
- HI input/LO output impedances
- Unity gain output (gain available)
- Compensated DC offset (< 2mV)
- Low power consumption
- Customer modification available
- Also available in Highpass Filter

P/N	ATTENUATION	RESPONSE	TYPE
AS1102	15 dB @ 3Fc	Bessel	Lowpass
AS1103	21 dB @ 3Fc	Bessel	Lowpass
AS1104	23 dB @ 3Fc	Bessel	Lowpass
AS1105	26 dB @ 3Fc	Bessel	Lowpass
AS1106	30 dB @ 3Fc	Bessel	Lowpass
AS1112	12 dB @ 2Fc	Butterworth	Lowpass
AS1113	18 dB @ 2Fc	Butterworth	Lowpass
AS1114	24 dB @ 2Fc	Butterworth	Lowpass
AS1115	30 dB @ 2Fc	Butterworth	Lowpass
AS1116	36 dB @ 2Fc	Butterworth	Lowpass
AS1122	13 dB @ 2Fc	Chebyshev	Lowpass
AS1123	22 dB @ 2Fc	Chebyshev	Lowpass
AS1124	30 dB @ 2Fc	Chebyshev	Lowpass
AS1125	40 dB @ 2Fc	Chebyshev	Lowpass
AS1126	50 dB @ 2Fc	Chebyshev	Lowpass

MODEL AM (HIGH ORDER FILTER)

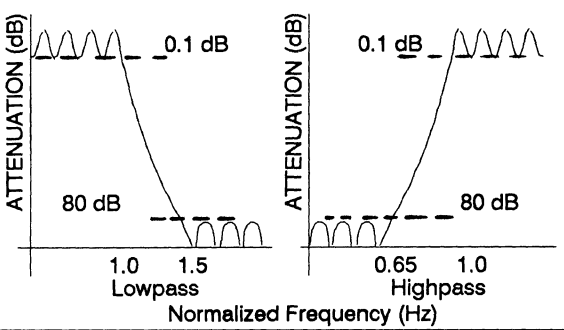
2.45"L X 0.77"W X 0.40"H



FEATURES:

- High order/High attenuation filter
- Support up to 30th order filter
- Implement most responses: Butterworth, Bessel, Chebyshev, Elliptic, Linear Elliptic
- Supply all filter functions: Lowpass, Highpass, Bandpass, & Band-reject
- Unity gain output (gain available)
- Magnitude & Phase matching options
- Compensated DC offset (<2mV)
- Operate in Single & Dual Power Supply
- Can be modified to customers' specifications

8th order ELLIPTIC Response

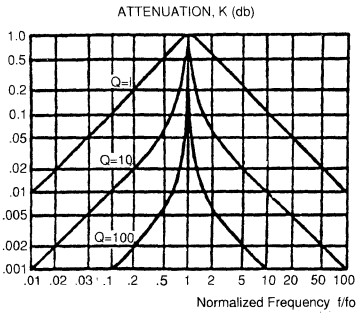


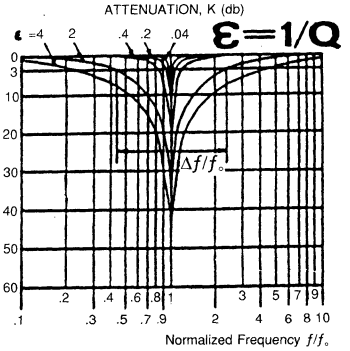
MODEL AF2 (BANDPASS & NOTCH FILTER)

1.25"L X 0.77"W X 0.40"H

FEATURES:

- 2nd order filter block
- Multi-outputs: Band-reject, Lowpass, Highpass, & Bandpass
- Adjustable Frequency & gain
- Variable Bandwidth
- Cascade to implement high order filter
- 60Hz power noise rejection
- Low noise & low DC drift
- Fast delivery (1 week)





AVENS SIGNAL EQUIPMENT Corp.
P.O. BOX 1057, NEW YORK, NY 10002 TEL: (718) 335-1886/FAX: (718) 429-5785

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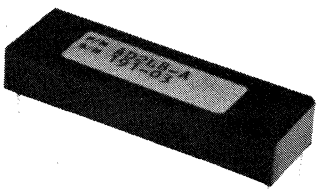
CUSTOM DESIGN FILTER SYSTEM & PCB MODULE

1-(800) 452-1966

PROGRAMMABLE ANALOG ACTIVE FILTERS/AMPLIFIERS

MODEL AD2

Miniature 2 BIT/4 settings
2.45"L X 0.77"W X 0.40"H



FEATURES:

- Binary selection: CMOS, TTL compatible
- Use analog switches (not SWITCH-CAP filter)
- Instantaneous selection (no latching)
- Filter order choices: 4th or 8th
- Available filter functions: Lowpass, Highpass, Bandpass, Band-reject
- Implements responses including: Bessel, Butterworth, and Chebyshev
- Accept input signal up to ± 15V.
- Low DC shift among settings (<2 mV)
- Customization and modification available

BINARY BIT		SELECTION SCHEME			
2	1	A	B	C	D
0	0	Fo	Fo	Fo	Fo
0	1	2Fo	2Fo	2Fo	F1
1	0	4Fo	F1	3Fo	F2
1	1	8Fo	2F1	4Fo	F3

MODEL AD3

3 BIT/8 Independent settings

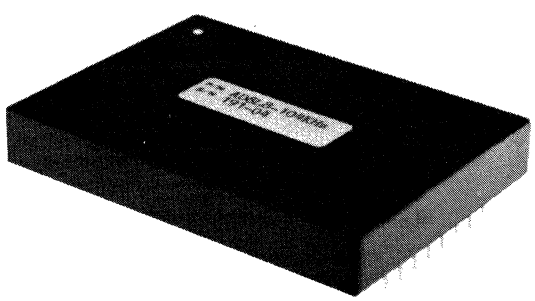
FEATURES:

- Filter order choices: 4th, 6th, & 8th
- Implement responses including: Butterworth, Bessel, Chebyshev, Elliptic, Linear Elliptic
- Dimension: 3.5"L X 2.5"W X 0.5"H
- Other features are same as AD2 (see above)

BINARY BIT			SELECTION SCHEME			
3	2	1	A	B	C	D
0	0	0	Fo	Fo	Fo	F1
0	0	1	2Fo	2Fo	2Fo	F2
0	1	0	4Fo	F1	3Fo	F3
0	1	1	8Fo	2F1	4Fo	F4
1	0	0	16Fo	F2	5Fo	F5
1	0	1	32Fo	2F2	6Fo	F6
1	1	0	64Fo	F3	7Fo	F7
1	1	1	128Fo	2F3	8Fo	F8

MODEL AD8

8 BIT/255 Continuous Settings
uP Compatible Interface

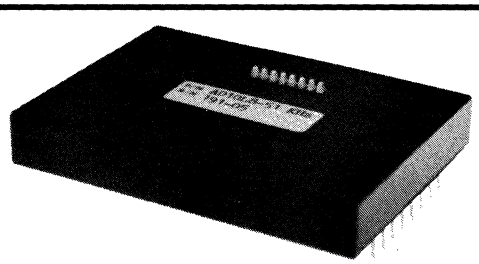


FEATURES:

- RC active filter (no SWITCH-CAP)
- Instantaneous selection (latching optional)
- Filter order choices: 4th, 6th, & 8th
- Implement responses including: Butterworth, Bessel, Chebyshev, Elliptic, & Linear Elliptic
- Provide all filter functions: Lowpass, Highpass, Bandpass, & Band-reject
- Magnitude & Phase Matching
- Dimension: 3.5"L X 2.5"W X 0.5"H
- Customization and modification available

MODEL AD10

10 BIT/1024 Continuous Settings
DIP Switch Selections



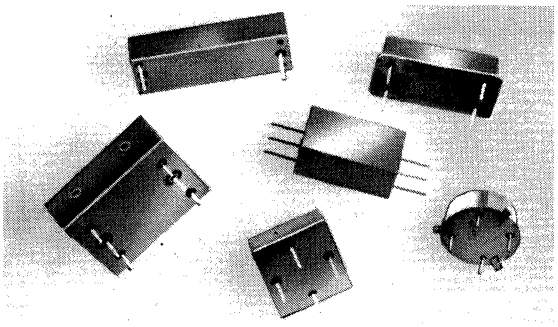
FEATURES:

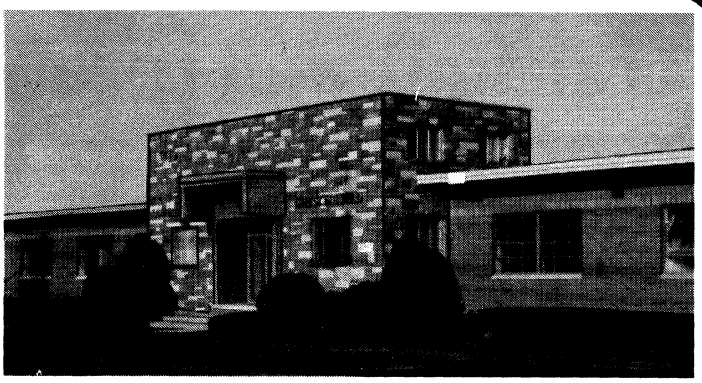
- Frequency selection via build-in DIP switch
- No clock and other components are needed
- Other features are same as AD8 (see above)

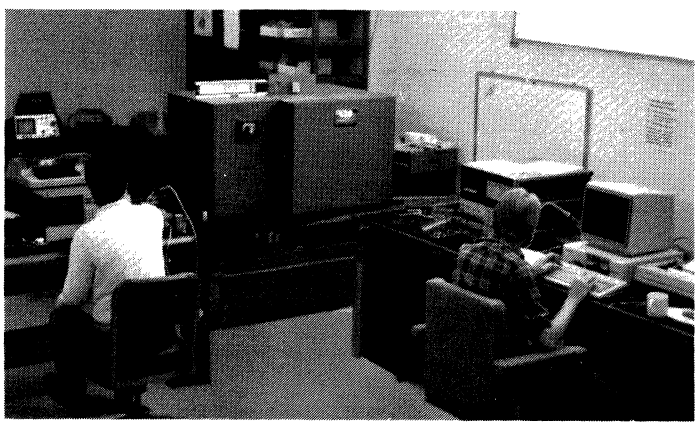
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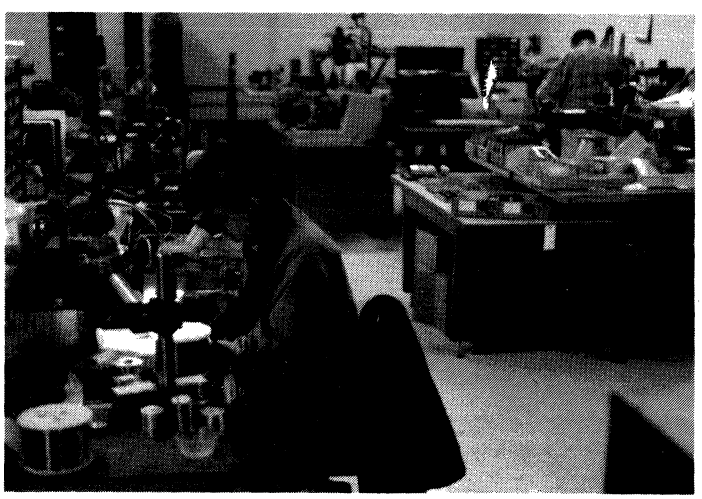
CUSTOM LC FILTERS

in standard, subminiature and surface mount packages from DC to 1.3 GHz.









CHESTERFIELD PRODUCTS, INC. manufactures a variety of custom filter types:

- **BAND PASS**
- **HIGH PASS**
- **LOW PASS**
- **BAND STOP**
- **ROOFING**
- **C-NOTCH**
- **JUNCTION**
- **ANTI-ALIAS**
- **MESSAGE**
- **IF**
- **SINX/X**
- **CRYSTAL**

CHESTERFIELD filter designs incorporate various response characteristics:

- **BUTTERWORTH**
- **BESSEL**
- **LEGENDRE**
- **CHEBYSHEV**
- **LINEAR PHASE**
- **INVERTED CHEBYSHEV**
- **ELLIPTIC**
- **GAUSSIAN**

CHESTERFIELD MIL-SPEC conformance standards include:

- **MIL-F-18327 QUALIFICATION**
- **MIL-I-45208 INSPECTION**
- **MIL-STD-45662 CALIBRATION**
- **MIL-STD-2000 CERTIFICATION**
- **MIL-STD-105 SAMPLING**

CHESTERFIELD can accomodate 15th order requirements: balanced or unbalanced versions: phase and amplitude matching: amplitude and group delay equalization: phase linearity: noise bandwidth: VSWR and return loss.

CHESTERFIELD employs state of the art design software and computer hardware to achieve optimal filter analysis and design. Our ultra-modern NBS calibrated RF signal test equipment ensures accuracy, reliability, and varification of product performance.

CHESTERFIELD filter products are fully certifiable and warranteed. Standard test data can be supplied with each unit of shipment: customer formats will be accommodated. Plotted data is available upon request.

For further information, call or write

CHESTERFIELD is geared to your special engineering needs as well as quick action response.

Since 1969, the leader in LC filters . . . . . with

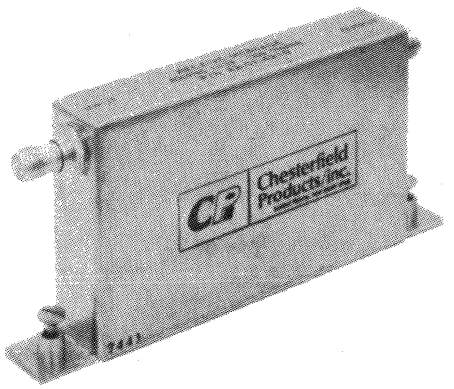
OFF-THE-SHELF AVAILABILITY

CP **Chesterfield Products/inc.**

CALL 1-800-666-9655
FAX 1-201-797-9504
37 Midland Ave., Elmwood Park, NJ 07407
Telephone: 201/797-9655

CUSTOM LC FILTERS

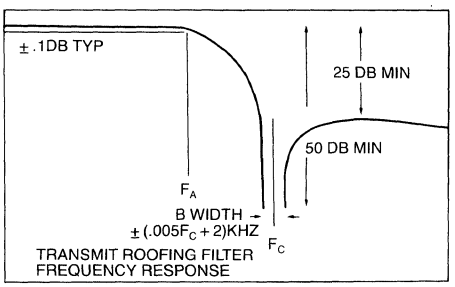
transmit and receive roofing filters



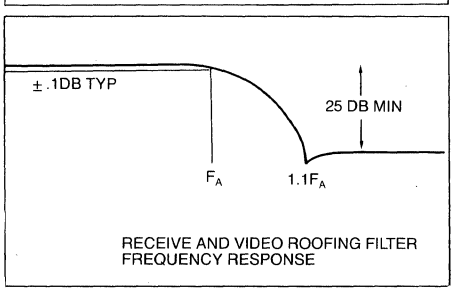
Transmit Roofing Filters are used to remove noise from the transmitted traffic bandwidth at the out-of-band frequency when out-of-band noise is measured.

Receive and Video Roofing Filters remove noise from the received baseband at frequencies 10% above the traffic bandwidth.

Below are typical roofing filters. Other channel capacities and frequencies are available at no-additional cost.



TRANSMIT ROOFING FILTER
FREQUENCY RESPONSE

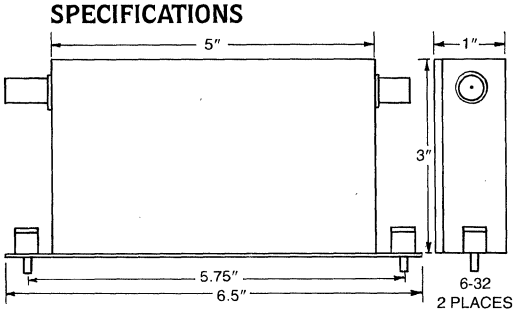


RECEIVE AND VIDEO ROOFING FILTER
FREQUENCY RESPONSE

TYPICAL ROOFING FILTERS

Channel Capacity	Transmit Roofing P/N	Receive Roofing P/N	Fc	Fa
12	22-01-4132	22-01-4232	66	60
24	22-01-4101	22-01-4201	116	108
36	22-01-4116	22-01-4216	172	156
48	22-01-4135	22-01-4235	224	204
60	22-01-4102	22-01-4202	277	252
72	22-01-4117	22-01-4217	331	300
84	22-01-4133	22-01-4233	396	360
96	22-01-4103	22-01-4203	448	408
108	22-01-4136	22-01-4236	502	456
132	22-01-4104	22-01-4204	607	552
168	22-01-4162	22-01-4262	779	708
180	22-01-4134	22-01-4234	832	756
192	22-01-4105	22-01-4205	884	804
252	22-01-4106	22-01-4206	1157	1052
312	22-01-4107	22-01-4207	1499	1300
348	22-01-4163	22-01-4263	1597	1452
360	22-01-4139	22-01-4239	1650	1520
372	22-01-4137	22-01-4237	1730	1570
432	22-01-4108	22-01-4208	1976	1796
480	22-01-4141	22-01-4241	2249	2044
552	22-01-4148	22-01-4248	2438	2216
612	22-01-4109	22-01-4209	2794	2550
792	22-01-4110	22-01-4210	3612	3284
852	22-01-4140	22-01-4240	3885	3532
972	22-01-4111	22-01-4211	4430	4028
1092	22-01-4112	22-01-4212	5380	4892
1200	22-01-4119	22-01-4219	5786	5260
1332	22-01-4149	22-01-4249	6301	5884
1500	22-01-4143	22-01-4243	7217	5661
1872	22-01-4113	22-01-4213	8932	8024
VIDEO		22-01-4214		6000
VIDEO		22-01-4215		4300
VIDEO		22-01-4218		10000

SPECIFICATIONS



OUTLINE DRAWING

Frequency: Standard filters as listed. Other frequencies available on special order.
Return Loss: 24dB Typically
Impedance: Input & Output 75 ohms
Loss: 0.8dB Typically
Frequency Response: See curve other side
Connectors: BNC or TNC as required
Size: 6½″ × 3″ × 1″

**alternative packaging available*

For further information, call or write

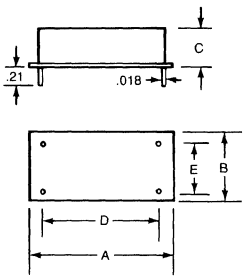
Chesterfield Products/inc.

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Telephone: 201/797-9655

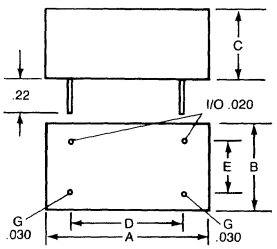
CUSTOM LC FILTERS

subminiature and surface mount packages

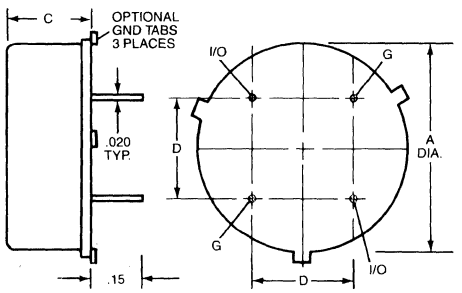
CASE 1



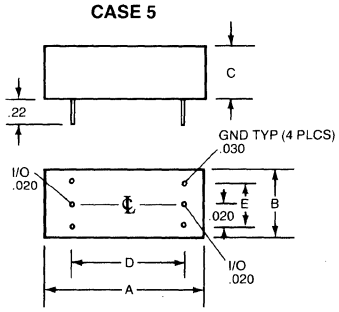
CASE 2



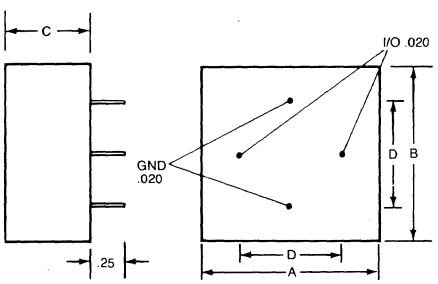
CASE 3 AND 4



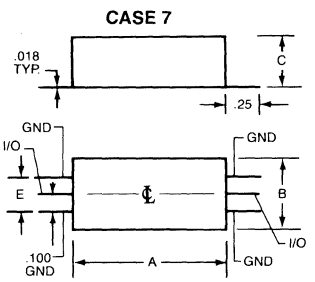
CASE 5



CASE 6



CASE 7



G–GROUND LEAD
I/O–INPUT/OUTPUT LEAD
NOTE: ALL DIMS IN INCHES

CASE STYLE		A	B	C	D	E	FREQ. RANGE	BP SECTIONS
1	1.1 1.2 1.3	.80 .97 1.37	.50 .50 .80	.28 .28 .28	.60 .70 1.10	.30 .30 .60	1-750 MHz	4
2		1.25	.50	.40	.95	.20	.5-750 MHz	6
3	T08*	.60	—	.25	.316	—	10-750 MHz	3
4	T08	.60	—	.325	.316	—		
5	5.1 5.2 5.3	1.00 1.20 1.00	.75 .75 .675	.375 .375 .500	.70 .70 .70	.40 .40 .40	.5-750 MHz	6
6	T□8	.60	.60	.325	.446	—	1-750 MHz	4
7	SMT	.755	.415	.315	—	.20	1-750 MHz	4

*Case No. 3 has three ground tabs brazed to the underside. Consult factory for specs.

Subminiature Filters Part Number Code

Example: 2 P 3011

- 3011 — Sequential 4 Digit I.D.
- P — Filter Type
- 2 — Case

FILTER TYPE

L—Low Pass
H—High Pass
P—Band Pass
S—Band Stop

CASE STYLE

1.1—Rectangular
1.2—Rectangular
1.3—Rectangular
2—Rectangular
3—T08 w/Tabs
4—T08
5—Rectangular
6—T□8
7—SMT

For further information, call or write

Chesterfield Products/inc.

CALL 1-800-666-9655
FAX 1-201-797-9504
37 Midland Ave., Elmwood Park, NJ 07407
Telephone: 201/797-9655

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

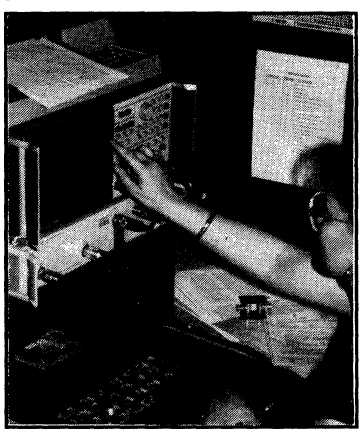
Yugoslavia Federal Institute of Standardization

LC FILTER NETWORKS

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- TIMELY DELIVERY
- MANUFACTURED TO SPEC.

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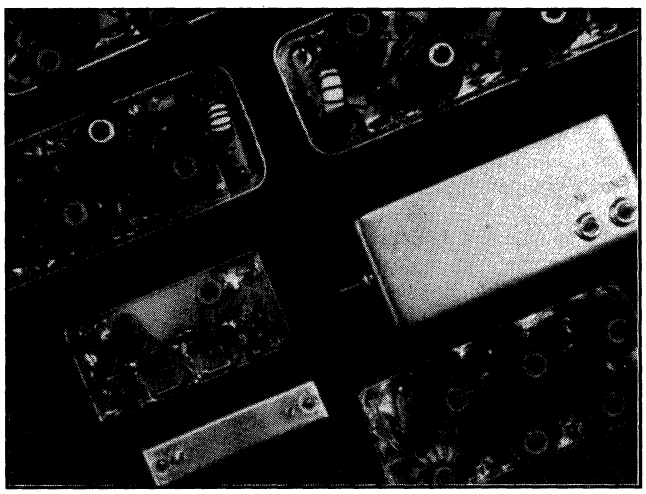


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- HI-PASS
- BAND PASS
- BAND REJECT
- NOTCH
- BESSEL
- BUTTERWORTH
- CHEBYSHEV
- ELLIPTIC
- GAUSSIAN
- PHASE MATCHING
- DELAY MATCHING
- ANTI-ALIASING
- MULTI-POLE
- LO-PROFILE
- MINIATURE
- SUBMINIATURE
- SURFACE MOUNT
- HI-SELECTIVITY
- HERMETICALLY SEALED
- MIL-I-45208
- MIL-F-18327
- MIL-Q-9858A
- MIL-F-15733

Applications

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FILTERS 1.0 MHz to 1.0 GHz

Eagle manufactures a wide variety of radio frequency filters. Our goal is to offer a wide variety of standard designs in order to ease the selection process and reduce costs to you the customer. In accordance with this goal the following unique approaches to RF filter manufacure have been taken.

Standard Frequency System-SFS™ Eagle has pioneered this in the filter industry. Basically SFS™ increments are by a fixed percentage. For example standard values would be 1.0 MHz, 1.2 MHz, 1.5 MHz rather then 1.0 , 2.0 , 3.0. As you can see by studying the cutoff frequencies this is identical as standard resistor values. Using this system as few as 46 cutoff frequencies blanket the spectrum from 1.0 MHz to 1.0 GHz. Experience has shown that 95% of the applications can use a standard filter rather than a custom design since a custom frequency can be no more then 5 % away from one of our standard frequencies..

Partially Assembled Module-PAM™ To insure quick delivery and maintain low costs Eagle has developed this concept. In this system the mechanical packages are designed for maximum flexibility both electrically and mechanically. Filter modules are partially assembled for each frequency group and installed into the proper enclosure. When an order is received the unit is trimmed to the final cutoff frequency resulting in a finished filter in days instead of weeks. Standard proven designs spare the customer of the unsurities and cost of custom units. Additionally, there are many standard, and stocked, values for each type of filter which are ready for 48 hour shipment.

Pricing-Eagle has the lowest prices for connectorized filters in low volumes. In 2-4 quantities the HLC700 lowpass filters begin at $95.20 for a standard frequency model. The tuneable filters are as low as $89.10 depending on the frequency range selected.

Due to limitations in space many filter types that are made by EAGLE are not listed here. Please write or call for the complete catalog of Eagle filters and other products.

HLC-700 Lowpass, Highpass, Bandpass and Bandstop Filters

HLC-700 Description:

Eagle HLC-700 series are compact, high performance filters. Stainless steel hardware and connectors assure that there is no corrosion due to galvanic potentials. Cases are solder sealed to keep out dust and foreign materials.

With minimum power ratings of 25 watts, and many models even higher, the spurious free dynamic range of these filters is tremendous. The filters are electrically very rugged, are resistant to ESD and EMP, and may be connected directly to antennas for receiver use or medium power transmitters.

HLC-700's are available in Lowpass, Highpass, Bandpass and Bandstop configurations. Lowpass and Bandpass filters are discussed on the following pages. Please request HLC-700 filter catalog for detailed specifications on Bandpass and Bandstop as well as complete information on Lowpass and Highpass filters.

HLC-700 Specifications:

Electrical

See appropriate data sheet

Mechanical

Dimensions:

Case A	2.0"W X 2.0"L X1.7"H
Case B	3.0"W X 6.0"L X 2.5"H
Case C	2.6"W X 4.0"L X 1.75"H

Dimensions do not include connectors

Weight: < 1.5 lbs

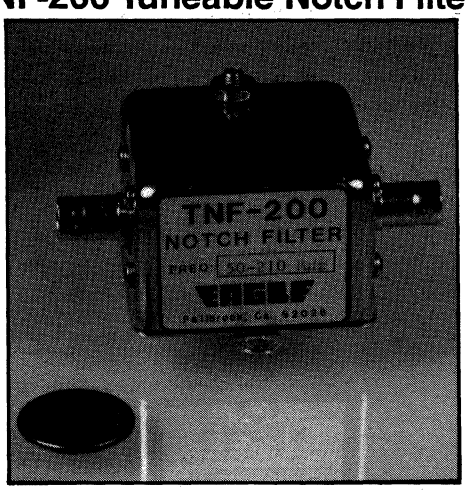
Enviromental

Temperature:

Operating:	-20° C to 70° C
Storage:	-55° C to 125° C
Humidity:	10 to 80 % non condensing.
Shock:	> 15G any axis @ 11mS MIL-E-5400T
Vibration:	> 25G 10 to 2000 Hz. MIL-E-5400T

HLC700 ORDERING- find the desired cutoff frequency in the table of standard cutoff frequencies. Then pick the number of sections desired and find the associated part number. Call the factory at the number below for price and delivery information. We will also provide engineering assistance in selecting a filter for your needs if desired.

TNF-200 Tuneable Notch Filters



Features

- Easily adjustable, multi-turn tuning element
- High rejection of notched frequency (typically 25 dB or better)
- Low VSWR for accurate measurements
- 10 Watt power rating

Specifications:

Electrical

Power rating:	10 watts at Notch, 50 watts if IL < 2.0 dB
Impedance:	50 ohms 5%
Insertion loss:	< 0.5 dB below 1.0 GHz
	< 1.0 dB below 2.0 GHz

Mechanical

Dimensions:	2.7"W X 2.0"L X 1.7"H
Weight:	6 Oz

Enviromental

Temperature:	0° C to 70° C
Humidity:	10 to 80 % non cond.

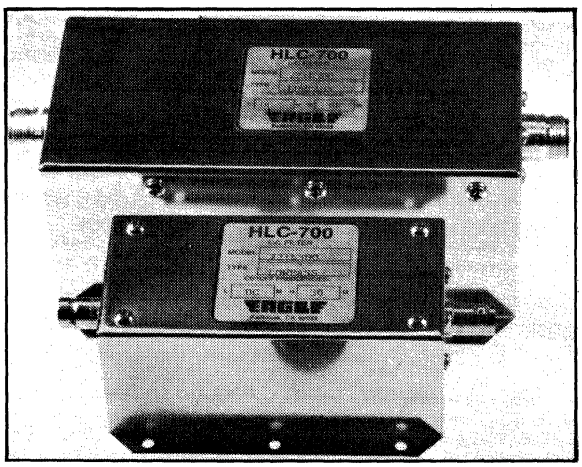
Model No VS Range Table:

Model	Frequency MHz
TNF-201	1.5 - 2.5
TNF-202	2.5 - 5.0
TNF-203	5.0 - 10.0
TNF-205	9.5 - 18
TNF-207	15 - 30
TNF-208	30 - 75
TNF-210	50 - 210
TNF-220	100 - 350
TNF-230	250 - 850

EAGLE
WICHITA

P. O. Box 9446 • Wichita, KS • 67277 • (316) 942-5100 • DATA/FAX (316) 942-5190

HLC700 Lowpass Filters-Enhanced Chebychev Topology



Features

- **46 Standard cutoff frequencies from 1.0 Mhz to 1000 Mhz**
- **Custom frequencies: $50.00 setup**
- **500 watt and 1000 watt family available**
- **7, 9, 11 or 13 sections**
- **Manufactured to MIL-STDS**

EAGLE HLC700 enhanced chebychev low pass filters are available in four configurations: these are 7, 9, 11 or 13 sections. The enhanced chebyshev design yields a steeper transistion band with no increase in insertion loss. When used as signal filters these units offer excellent immunity from internal intermodulation due to the high power rating.

Specifications

Electrical

Impedance: 50 Ω ± 5%
VSWR: <1.4:1 (<-16 dB return loss)
Insertion loss: see table below
Passband ripple: <0.30 dB cutoffs below 200 MHz
<0.40 dB cutoffs above 200 MHz
Maximum stopband freq: see table below

Mechanical & Enviromental: refer to page A•1666

Ordering information: Please see page A•1666

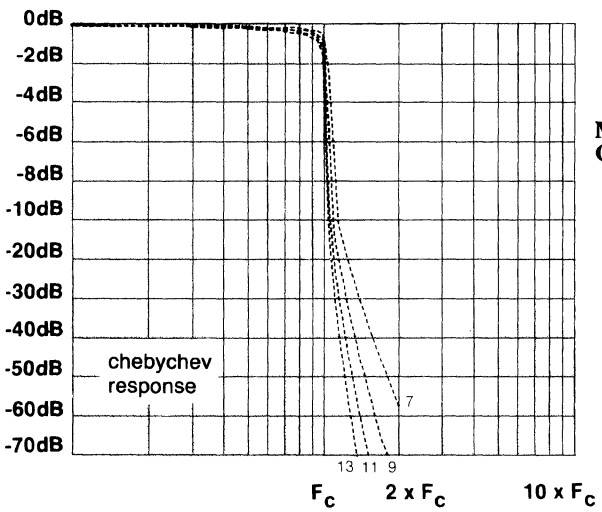


Table of Chebychev Filters by Series

Series	No of Sec	Ins loss	Power rating	stopband atten dB	Case size	Max Freq
HCA701	7	<0.4	100 W	-50	C	10 x Fc
HCB701	9	<0.5	70 W	-60	C	10 x Fc
HCC701	11	<0.6	70 W	-60	C	10 x Fc
HCD701	13	<0.8	50 W	-70	C	10 x Fc
HCA702	7	<0.4	100 W	-50	A	5 x Fc
HCB702	9	<0.5	100 W	-60	A	5 x Fc
HCC702	11	<0.5	100 W	-60	C	5 x Fc
HCD702	13	<0.8	70 W	-65	C	5 x Fc
HCA703	7	<0.5	50 W	-50	A	3 x Fc
HCB703	9	<0.7	50 W	-50	A	3 x Fc
HCC703	11	<0.8	50 W	-60	C	3 x Fc

Table of Standard Cutoff Frequencies

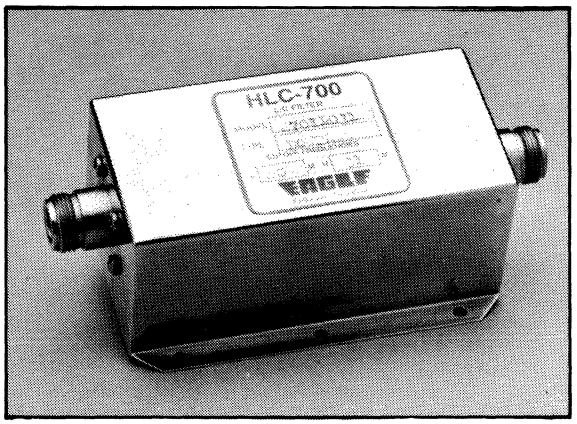
Cutoff FREQ	Seven Sec	Nine Sec	Eleven Sec	Thirteen Sec
1.0	HCA701L1R0	HCB701L1R0	HCC701L1R0	HCD701L1R0
1.2	HCA701L1R2	HCB701L1R2	HCC701L1R2	HCD701L1R2
1.5	HCA701L1R5	HCB701L1R5	HCC701L1R5	HCD701L1R5
2.2	HCA701L2R2	HCB701L2R2	HCC701L2R2	HCD701L2R2
2.7	HCA701L2R7	HCB701L2R7	HCC701L2R7	HCD701L2R7
3.3	HCA701L3R3	HCB701L3R3	HCC701L3R3	HCD701L3R3
3.9	HCA701L3R9	HCB701L3R9	HCC701L3R9	HCD701L3R9
4.7	HCA701L4R7	HCB701L4R7	HCC701L4R7	HCD701L4R7
5.1	HCA701L5R1	HCB701L5R1	HCC701L5R1	HCD701L5R1
5.6	HCA701L5R6	HCB701L5R6	HCC701L5R6	HCD701L5R6
6.2	HCA701L6R2	HCB701L6R2	HCC701L6R2	HCD701L6R2
6.8	HCA701L6R8	HCB701L6R8	HCC701L6R8	HCD701L6R8
7.5	HCA701L7R5	HCB701L7R5	HCC701L7R5	HCD701L7R5
8.2	HCA701L8R2	HCB701L8R2	HCC701L8R2	HCD701L8R2
9.1	HCA701L9R1	HCB701L9R1	HCC701L9R1	HCD701L9R1
10.0	HCA701L100	HCB701L100	HCC701L100	HCD701L100
12.0	HCA701L120	HCB701L120	HCC701L120	HCD701L120
15.0	HCA701L150	HCB701L150	HCC701L150	HCD701L150
22.0	HCA701L220	HCB701L220	HCC701L220	HCD701L220
27.0	HCA701L270	HCB701L270	HCC701L270	HCD701L270
33.0	HCA701L330	HCB701L330	HCC701L330	HCD701L330
39.0	HCA701L390	HCB701L390	HCC701L390	HCD701L390
47.0	HCA701L470	HCB701L470	HCC701L470	HCD701L470
51.0	HCA701L510	HCB701L510	HCC701L510	HCD701L510

Table of Standard Cutoff Frequencies

Cutoff FREQ	Seven Sec	Nine Sec	Eleven Sec	Thirteen Sec
56.0	HCA702L560	HCB702L560	HCC702L560	HCD702L560
62.0	HCA702L620	HCB702L620	HCC702L620	HCD702L620
68.0	HCA702L680	HCB702L680	HCC701L680	HCD702L680
75.0	HCA702L750	HCB702L750	HCC702L750	HCD702L750
82.0	HCA702L820	HCB702L820	HCC702L820	HCD702L820
91.0	HCA702L910	HCB702L910	HCC702L910	HCD702L910
100.0	HCA702L101	HCB702L101	HCC702L101	HCD702L101
120.0	HCA702L121	HCB702L121	HCC702L121	HCD702L121
150.0	HCA702L151	HCB702L151	HCC702L151	HCD702L151
220.0	HCA702L221	HCB702L221	HCC702L221	HCD702L221
270.0	HCA702L271	HCB702L271	HCC702L271	HCD702L271
330.0	HCA702L331	HCB702L331	HCC702L331	HCD702L331
390.0	HCA702L391	HCB702L391	HCC702L391	HCD702L391
470.0	HCA702L471	HCB702L471	HCC702L471	HCD702L471
510.0	HCA702L511	HCB702L511	HCC702L511	HCD702L511
560.0	HCA703L561	HCB703L561	HCC703L561	HCD703L561
620.0	HCA703L621	HCB703L621	HCC703L621	HCD703L621
680.0	HCA703L681	HCB703L681	HCC703L681	HCD703L681
750.0	HCA703L751	HCB703L751	HCC703L751	HCD703L751
820.0	HCA703L821	HCB703L821	HCC703L821	HCD703L821
910.0	HCA703L911	HCB703L911	HCC703L911	HCD703L911
1000.0	HCA703L102	HCB703L102	HCC703L102	HCD703L102

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HLC700 Lowpass Filters-Elliptical Topology



Features

- **46 Standard cutoff frequencies from 1.0 Mhz to 1000 Mhz**
- **Custom frequencies: $75.00 setup**
- **Linear phase family available**
- **Sharp cutoff**
- **Manufactured to MIL-STDS**

EAGLE HLC700 elliptical low pass filters are available in four configurations: these are 7, 9, 11 or 13 sections. These filters are ideal for applications requiring a steep transistion band. When used as signal filters these units offer excellent immunity from internal intermodulation due to the high power rating.

Specifications

Electrical

Impedance: 50 Ω ± 5%
VSWR: <1.4:1 (<-16 dB return loss)
Insertion loss: see table below
Passband ripple: <0.30 dB cutoffs below 200 MHz
<0.40 dB cutoffs above 200 MHz
Maximum stopband freq: see table below

Mechanical & Enviromental: refer to page A•1666

Ordering information: Please see page A•1666

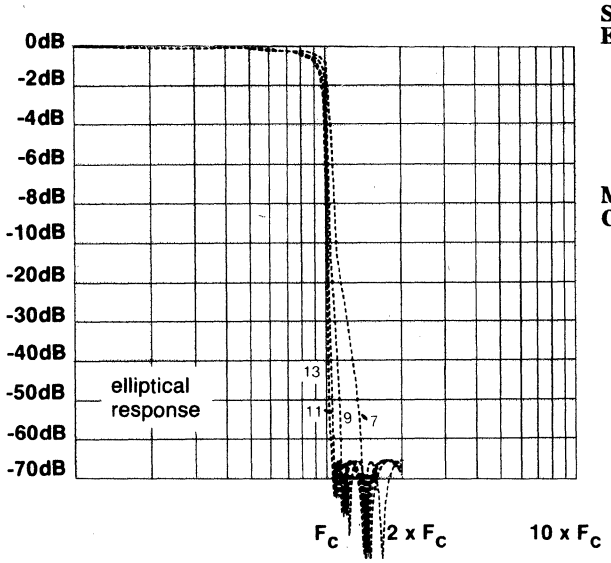


Table of Elliptical Filters by Series

Series	No of Sec	Ins loss	Power rating	stopband atten dB	Case size	Max Freq
HEA701	7	<0.4	50 W	-60	C	10 x Fc
HEB701	9	<0.5	50 W	-70	C	10 x Fc
HEC701	11	<0.6	50 W	-70	C	10 x Fc
HED701	13	<0.8	25 W	-70	C	10 x Fc
HEA702	7	<0.4	70 W	-55	A	5 x Fc
HEB702	9	<0.5	70 W	-60	A	5 x Fc
HEC702	11	<0.5	70 W	-60	C	5 x Fc
HED702	13	<0.8	50 W	-70	C	5 x Fc
HEA703	7	<0.5	50 W	-55	A	3 x Fc
HEB703	9	<0.7	50 W	-60	A	3 x Fc
HEC703	11	<0.8	50 W	-60	C	3 x Fc

Table of Standard Cutoff Frequencies

Cutoff FREQ	Seven Sec	Nine Sec	Eleven Sec	Thirteen Sec
1.0	HEA701L1R0	HEB701L1R0	HEC701L1R0	HED701L1R0
1.2	HEA701L1R2	HEB701L1R2	HEC701L1R2	HED701L1R2
1.5	HEA701L1R5	HEB701L1R5	HEC701L1R5	HED701L1R5
2.2	HEA701L2R2	HEB701L2R2	HEC701L2R2	HED701L2R2
2.7	HEA701L2R7	HEB701L2R7	HEC701L2R7	HED701L2R7
3.3	HEA701L3R3	HEB701L3R3	HEC701L3R3	HED701L3R3
3.9	HEA701L3R9	HEB701L3R9	HEC701L3R9	HED701L3R9
4.7	HEA701L4R7	HEB701L4R7	HEC701L4R7	HED701L4R7
5.1	HEA701L5R1	HEB701L5R1	HEC701L5R1	HED701L5R1
5.6	HEA701L5R6	HEB701L5R6	HEC701L5R6	HED701L5R6
6.2	HEA701L6R2	HEB701L6R2	HEC701L6R2	HED701L6R2
6.8	HEA701L6R8	HEB701L6R8	HEC701L6R8	HED701L6R8
7.5	HEA701L7R5	HEB701L7R5	HEC701L7R5	HED701L7R5
8.2	HEA701L8R2	HEB701L8R2	HEC701L8R2	HED701L8R2
9.1	HEA701L9R1	HEB701L9R1	HEC701L9R1	HED701L9R1
10.0	HEA701L100	HEB701L100	HEC701L100	HED701L100
12.0	HEA701L120	HEB701L120	HEC701L120	HED701L120
15.0	HEA701L150	HEB701L150	HEC701L150	HED701L150
22.0	HEA701L220	HEB701L220	HEC701L220	HED701L220
27.0	HEA701L270	HEB701L270	HEC701L270	HED701L270
33.0	HEA701L330	HEB701L330	HEC701L330	HED701L330
39.0	HEA701L390	HEB701L390	HEC701L390	HED701L390
47.0	HEA701L470	HEB701L470	HEC701L470	HED701L470
51.0	HEA701L510	HEB701L510	HEC701L510	HED701L510

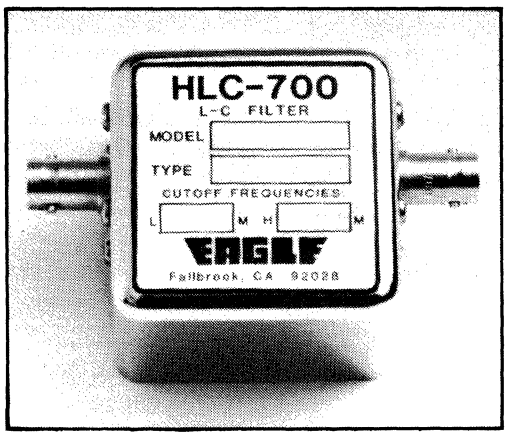
Table of Standard Cutoff Frequencies

Cutoff FREQ	Seven Sec	Nine Sec	Eleven Sec	Thirteen Sec
56.0	HEA702L560	HEB702L560	HEC702L560	HED702L560
62.0	HEA702L620	HEB702L620	HEC702L620	HED702L620
68.0	HEA702L680	HEB702L680	HEC701L680	HED702L680
75.0	HEA702L750	HEB702L750	HEC702L750	HED702L750
82.0	HEA702L820	HEB702L820	HEC702L820	HED702L820
91.0	HEA702L910	HEB702L910	HEC702L910	HED702L910
100.0	HEA702L101	HEB702L101	HEC702L101	HED702L101
120.0	HEA702L121	HEB702L121	HEC702L121	HED702L121
150.0	HEA702L151	HEB702L151	HEC702L151	HED702L151
220.0	HEA702L221	HEB702L221	HEC702L221	HED702L221
270.0	HEA702L271	HEB702L271	HEC702L271	HED702L271
330.0	HEA702L331	HEB702L331	HEC702L331	HED702L331
390.0	HEA702L391	HEB702L391	HEC702L391	HED702L391
470.0	HEA702L471	HEB702L471	HEC702L471	HCD702L471
510.0	HEA702L511	HEB702L511	HEC702L511	HCD702L511
560.0	HEA703L561	HEB703L561	HEC703L561	HED703L561
620.0	HEA703L621	HEB703L621	HEC703L621	HED703L621
680.0	HEA703L681	HEB703L681	HEC703L681	HED703L681
750.0	HEA703L751	HEB703L751	HEC703L751	HED703L751
820.0	HEA703L821	HEB703L821	HEC703L821	HED703L821
910.0	HEA703L911	HEB703L911	HEC703L911	HED703L911
1000.0	HEA703L102	HEB703L102	HEC703L102	HED703L102

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Bandpass Filter HLC700 & HDF400

HLC711 and HLC712 Narrowband Bandpass Filters



Standard Bandpass Filter families

Model Number	Avail Ctr Freq in MHz	INS Loss in dB	Bandwidth in % at dB -10	-20	-30	-40	Max Freq
HLC711Bxxx-2	1-47	<3.5	<5	<7	<9	<13	150
HLC712Bxxx-2	51-330	<4.0	<6	<8	<10	<15	750
HLC711Bxxx-5	1-47	<2.5	<6	<8	<10	<13	200
HLC712Bxxx-5	51-330	<3.0	<6	<8	<11	<15	750
HLC711Bxxx-10	1-47	<2.5	<13	<16	<19	<20	200
HLC712Bxxx-10	51-330	<3.0	<13	<17	<19	<20	750
HLC711Bxxx-15	1-47	<2.0	<18	<20	<23	<28	200
HLC712Bxxx-15	51-330	<2.5	<18	<21	<24	<30	750
HLC711Bxxx-20	1-47	<1.5	<25	<28	<30	<32	200
HLC712Bxxx-20	51-330	<2.0	<25	<29	<31	<34	750

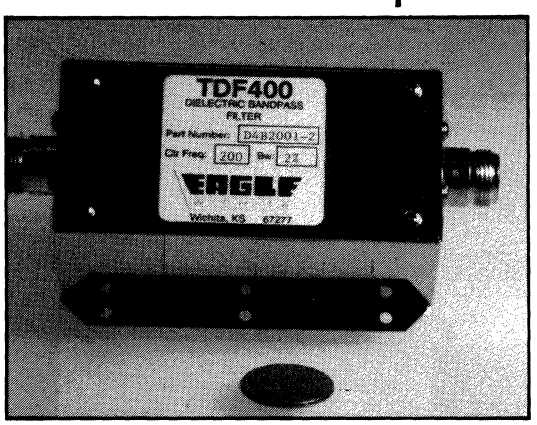
EAGLE HLC71xB Band pass filters are available from 1.0 to 330 Mhz in standard center frequencies as listed in the specification section. These filters come in standard bandwidths from 2 percent to 20 percent. The table indicates skirt performance of the various bandwidths. Other center frequencies and bandwidths are available as specials. These filters are ideal for IF filtering or other applications where small size and low cost are important.

Specifications:

Electrical Power: 25 watts pass and 10 watts stopband
Return loss: > -14 in passband
Mech: Size: HLC711Bxxx 2"x4"x1.75
HLC712Bxxx 2"x2"x1.58
Envirom: See page A • 1666
Std Freq: 1.0,1.2,1.5,1.8,2.2,2.4,2.7,3.3,3.6,3.9,4.7,5.1,5.6,6.2,6.8,7.5,8.2,9.1, 10.0,12.0,15.0,18.0,22.0,24.0,27.0,33,36,39,47, 51,56,62,68,75,82,91,100,120,150,180,220,270,330.

Insert desired center frequency in place of three small x's in the part number. For example a filter with a 8.2 Mhz cutoff would be HLC711B8R2-02.

HDF400 Dielectric Bandpass Filter



Standard Dielectric Filter Frequencies:

Part Number	CTR MHz	INS Loss	Bandwidth in Percent -10 dB	-20 dB	-30 dB	-40 dB	Max Freq
D4B1001-2	100	<1.5	4	5	7	10	500
D4B1201-2	120	<1.5	4	5	7	10	500
D4B1501-2	150	<1.5	4	5	7	10	500
D4B1801-2	180	<1.5	4	5	7	10	600
D4B2001-2	200	<1.5	4	5	7	10	600
D4B2201-2	220	<1.5	4	5	7	10	600
D4B2401-2	240	<1.5	4	5	7	10	600
D4B2701-2	270	<1.8	4	5	7	10	650
D4B3001-2	300	<1.8	4	5	7	10	650
D4B3301-2	330	<1.8	4	5	7	10	700
D4B3601-2	360	<1.8	4	5	7	10	700
D4B3901-2	390	<1.8	4	5	7	10	700
D4B4301-2	430	<1.8	4	5	7	10	700
D4B4701-2	470	<1.8	4	5	7	10	750
D4B5101-2	510	<1.8	4	5	7	10	750
D4B5601-2	560	<1.8	4	5	7	10	800
D4B6201-2	620	<1.8	4	5	7	10	850
D4B6801-2	680	<1.8	4	5	7	10	900
D4B7501-2	750	<1.8	4	5	7	10	1000

HDF400 Dielectric filters

These filters offer low insertion loss at a narrow 2% bandwidth.Using four coaxial resonators with dielectric loading to reduce size. Due to the low loss these filters make excellent preselector filters at congested facilities. These units are excellent replacements for cavities in applications where space is at a premium. With a generous 25 watt power rating in the passband, or stopband, the filters may also be utilized to clean up small transmitters.

Specifications:

Electrical: Power: 25 watts pass or stop band.
Return loss: > -14 dB in passband
Mech: Size: 2"x4"x1.75" Weight: <8 Oz
Envirom: see page 1

EAGLE
WICHITA
P. O. Box 9446 • Wichita, KS • 67277 • (316) 942-5100 • DATA/FAX (316) 942-5190

epc CORPORATION

BG ELECTRONICS

EPC CORPORATION

MANUFACTURERS OF ACTIVE AND PASSIVE FILTERS—DC TO 500MHz.
LOWPASS, HIGHPASS, BANDPASS, BANDREJECT CUSTOM OR STANDARD DESIGNS.

FILTER TYPES

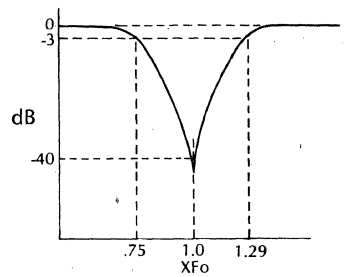
- Elliptic
- Tschebyscheff
- Butterworth
- Bessel
- Gaussian
- Legendre
- Inverted Chebychev
- Audio Frequency
- Equalizers
- Harmonic
- IF
- Video
- Telemetering
- Tone, Telegraph
- Constant group delay
- Wideband Band Pass
- Phase matched
- Attenuation matched

Components manufactured to rigid MIL-STD specifications with operating temperature range from −55°C to + 125°C.

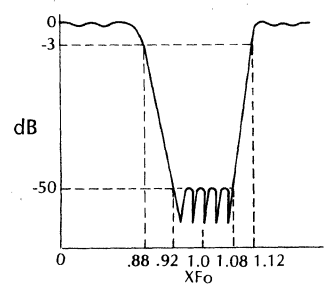
CUSTOM BUILT FILTERS PROMPT DELIVERY

The filters listed here are some of the typical units we build. We can design filters to your exact specifications. Call for more information.

ACTIVE NOTCH FILTER

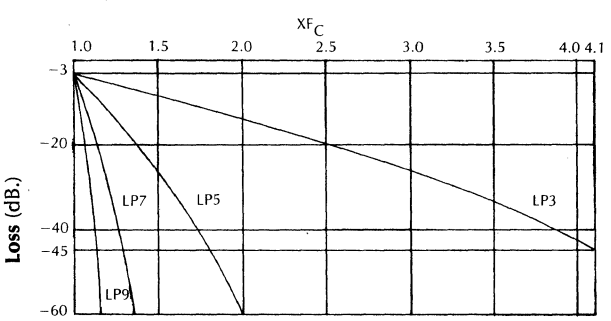


LC BAND REJECT FILTER



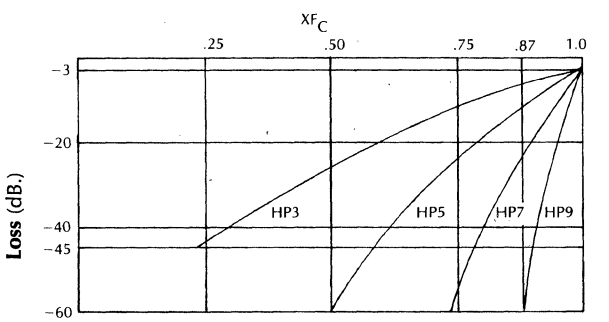
LC LOW PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
LP3	>45dB @ 4.1 Fc & above	1x1x.6"
LP5	>60dB @ 2 Fc & above	1.25x1.25x.6"
LP7	>60dB @ 1.35 Fc & above	1.5x1.5x.6"
LP9	>60dB @ 1.15 Fc & above	2x1.75x.6"



LC HIGH PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
HP3	>45dB @ .24 Fc & below	1x1x.6"
HP5	>60dB @ .5 FC & below	1.25x1.25x.6"
HP7	>60dB @ .74 Fc & below	1.5x1.5x.6"
HP9	>60dB @ .87 Fc & below	2x1.75x.6"



LC NARROW BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
NB-2	±2	.98 Fo & 1.02 Fo	.85 Fo & below 1.17 Fo & above
NB-3	±3	.97 Fo & 1.03 Fo	.80 Fo & below 1.25 Fo & above
NB-4	±4	.96 Fo & 1.04 Fo	.74 Fo & below 1.35 Fo & above

LC WIDEBAND BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
WB-25	25	.87 Fo & 1.14 Fo	.58 Fo & below 1.70 Fo & above
WB-50	50	.78 Fo & 1.28 Fo	.38 Fo & below 2.60 Fo & above
WB-100	100	.62Fo & 1.62 Fo	.21 Fo & below 4.65 Fo & above

CASE DIMENSIONS: 2"x1.75"x.6" MAX

ELECTRONIC PRECISION COMPONENTS CORPORATION
519 S. 5TH AVENUE ● MOUNT VERNON, N.Y. 10550 ● TELEPHONE: (914) 664-2333 ● FAX: (914) 664-4729

ESC

RF AND MICROWAVE FILTERS

FILTERS—DC TO 6 GHz

ESC designs and manufactures a wide variety of LC filters for commercial and military high reliability applications. Starting with computer aided design through final test on ESC's computer controlled Network Analyzer, ESC's long history of quality and experience assures maximum component efficiency and reliability. ESC has established controlled manufacturing facilities with certified operators to produce components to all levels of reliability from missile applications to space probe environments. Conformance to MIL-STD-202.

LUMPED ELEMENT BANDPASS FILTERS

Frequency Range:	0.1 MHz to 1000 MHz
Number of Sections:	2 to 10
Bandwidth 3dB:	1.0% to 90%
Nominal Impedance:	50 ohms (others available)
Power, (CW):	To 10 watts
Connectors:	SMA, N, TNC Female or PC Mounting
Filter Characteristics:	Butterworth, Chebyshev, Bessel, Gaussian and Elliptic Functions.
VSWR at Fo:	1.5:1 Maximum (50 ohms)
Size:	As required

LUMPED ELEMENT LOW PASS FILTER

3dB cut off frequency:	Up to 1000 MHz
Number of Sections:	2 to 10
Nominal Impedance:	50 ohms (others available)
VSWR:	1.5:1 maximum
Power (CW):	Up to 10 watts
Filter Characteristics:	Butterworth, Chebyshev, Bessel, Gaussian and Elliptic Function
Connectors:	SMA, N, TNC, BNC Female, PC Mounting
Size:	As required

LUMPED ELEMENT HIGH PASS FILTERS

3dB cut off frequency:	100 kHz to 750 MHz
Number of Sections:	2 to 10
Nominal Impedance:	50 ohms (others available)
VSWR:	1.5:1 maximum
Power (CW):	Up to 10 watts
Filter Characteristics:	Butterworth, Chebyshev, Bessel, Gaussian and Elliptic Function
Connectors:	SMA, N, TNC, BNC Female, PC Mounting
Size:	As required

FILTER TYPES:

• LOW PASS, • HIGH PASS, • BAND PASS, • BAND REJECT, • DIFLEXERS, • HIGH ATTENUATION, • LINEAR PHASE, • PHASE & AMPLITUDE MATCHED, • DELAY & AMPLITUDE MATCHED, • BUTTERWORTH, • CHEBYSCHEV, • BESSEL, • CAUER (ELLIPTICAL), • GAUSSIAN & OTHERS, • AUDIO, • VIDEO, • RF, • MINIATURE

INDUSTRIAL APPLICATIONS:

• DATA MODEM, • SONOBUOY, • ASW, • COMMUNICATION, • MEDICAL, • AEROSPACE, • MILITARY, • TELEPHONE INDUSTRY, • HIGH REL, • MIL-STD-202

HELICAL RESONATOR FILTERS

Frequency Range:	50 to 1000 MHz
3dB Bandwidth:	0.5% to 5% Typ.
Number of Sections:	2 to 10
Nominal Impedance:	50 ohms (others available)
Power (CW):	Up to 10 watts
Filter Characteristics:	Butterworth, Chebyshev (See Note 1)
VSWR at Fo:	1.5:1 maximum
Connectors	SMA, N, Female std. (See Note 2)
Size:	As required (including PC mount)

NOTES: 1. Bessel and Gaussian characteristics available on special request. 2. TNC, BNC and various other RF connectors available on special request.

COAXIAL CAVITY FILTERS

Frequency Range:	.750 Ghz. to 6.5 Ghz.
Number of Sections:	2 to 6
3dB Bandwidth:	0.3% to 3.5%
Tuning Method:	Fixed Tuned, Individually Tuned
Tuning Range:	12% Maximum
Nominal Impedance:	50 ohms
Power:	Up to 10 watts
VSWR at Fo:	1.35:1 maximum
Filter Characteristics:	Butterworth, Chebyshev
Connector:	SMA, N
Size:	As required

INTERDIGITAL FILTERS

Frequency Range:	1.0 Ghz to 6.0 Ghz.
3dB Bandwidth:	3% to 30%
Number of Sections:	3 to 10
Nominal Impedance:	50 ohms
Maximum VSWR at Fo:	1.35:1
Maximum Power:	Contact Factory
Connectors	SMA Standard
Size:	As required

COMBLINE FILTERS

Frequency Range:	0.1 Ghz to 6.0 Ghz.
3dB Bandwidth:	3% to 50%
Number of Sections:	2 to 10
Nominal Impedance:	50 ohms
Maximum VSWR at Fo:	1.35:1
Maximum Power:	Contact Factory
Connectors	SMA Standard
Size:	As required

SIGNAL PROCESSING COMPONENTS

ESC has also developed Signal Processing Components such as: Power Dividers, Double Balance Mixers, Electronic Switches, Mechanical Phase Shifters, Electronic Phase Shifters, Quadrature Hybrids, Phase Comparators, I and Q Networks, Up Converters and Down Converters.

WRITE OR CALL TOLL FREE 1-800-631-0853 (EXCEPT N.J.) FOR CATALOG!

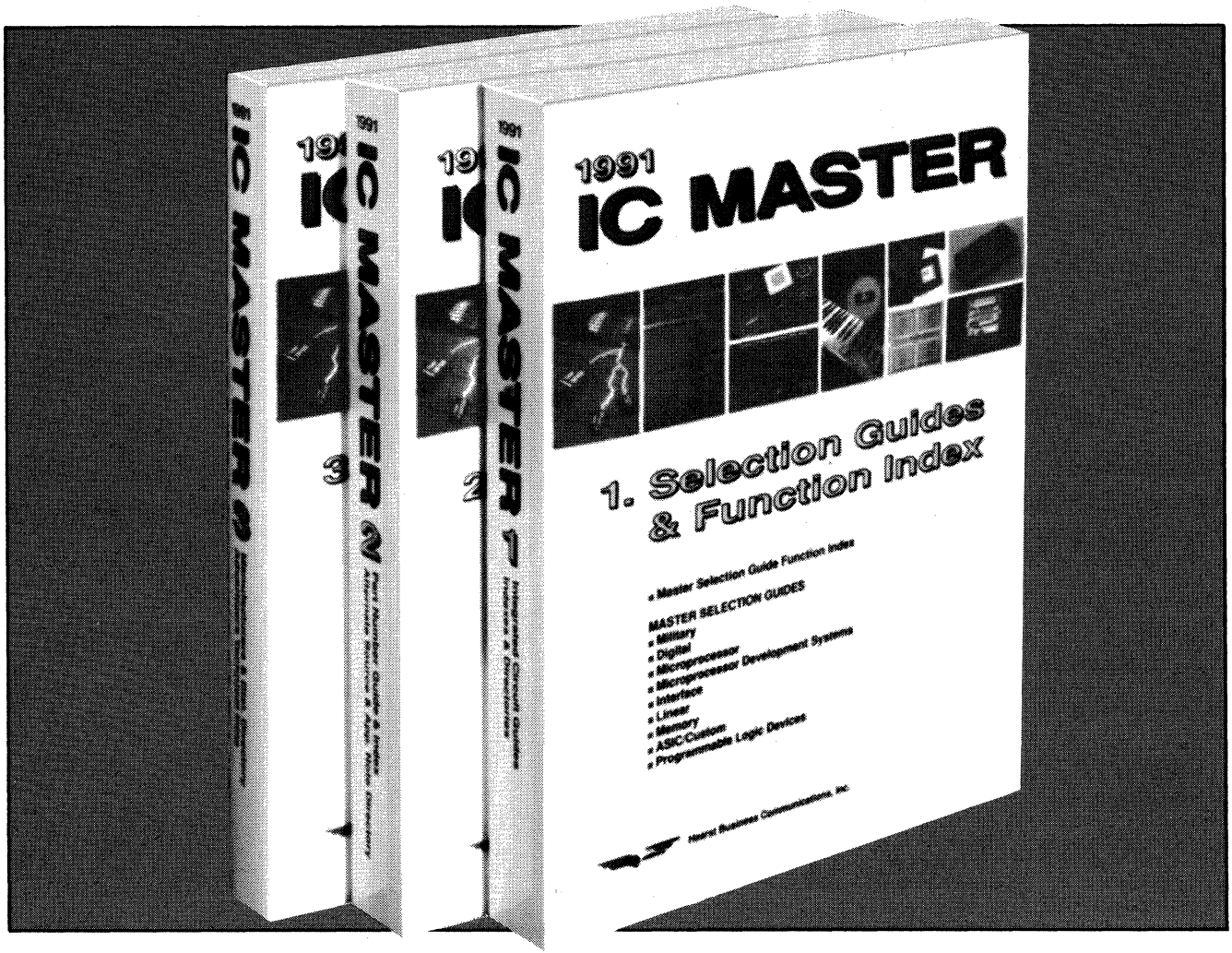


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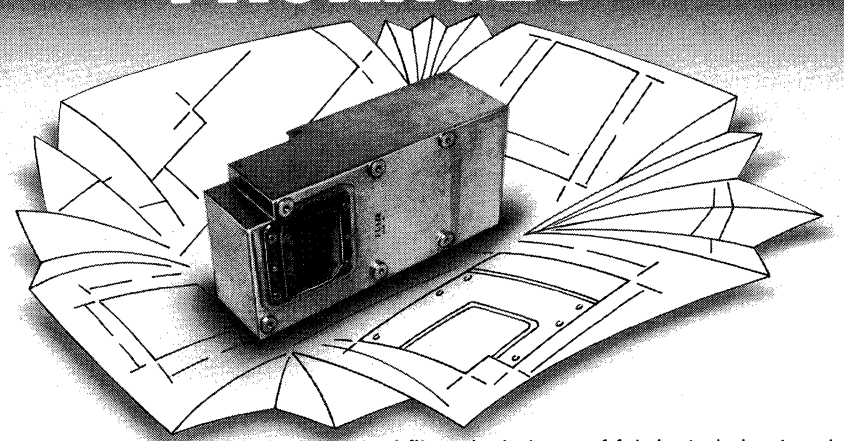
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IC MASTER

NEED A TIGHT RFI/EMC FILTER PACKAGE?



Why waste your time and money on inferior solutions to your special RFI/EMC filter needs? Go right to the pros... FILTRON. FILTRON has the talent and experience to solve a multitude of tough EMI/EMC/RFI/EMP problems. After all, we're the leader in customized multi-circuit filters in tight packages and we've got over 40,000 approved designs to back it up.

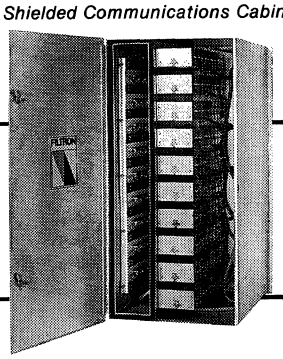
Don't need a FILTRON original? We can still help you. Our catalog of standard filters includes:

- **Powerline filters** including **U.L. Listed** for high-power installations, shielded rooms, communication centers and military areas. From 5 to 2000 Amperes.
- Signal line, data transmission, telephone and fire alarm filters for secured or TEMPEST installations pre-wired to your specifications in RF shielded cabinets.

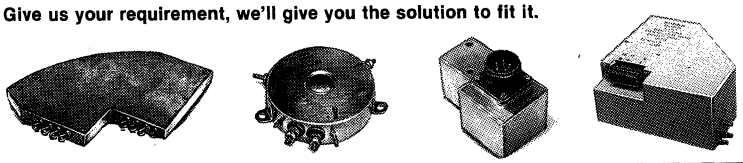
In addition, we stock a full line of fabricated sheet metal and shielded cabinets.

Whatever your filter needs... custom-designed or standard... come to the source... FILTRON. We've been doing it right since 1946. Our sales and engineering staff are ready to assist you. Call them today.

RF Shielded Communications Cabinet



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Digitally Programmable 8-Pole Active Filters

Complete with Internal Solid State Switches

848 and 878 Series—Lowpass and Highpass

A Design and Application Breakthrough

General Description

The 848 and 878 Series are digitally-programmable lowpass and highpass active filters that are tunable over a 256:1 frequency range. These units contain 8 bits CMOS clocked "D" latches which can be digitally configured to operate in any of three modes: Each unit is available with any single factory-set tuning range listed below:

- 1 Versions: 0.1 Hz to 25.6 Hz
- 2 Versions: 1.0 Hz to 256 Hz
- 3 Versions: 10 Hz to 2560 Hz
- 4 Versions: 100 Hz to 25.6 kHz
- 5 Versions: 200 Hz to 51.2 kHz

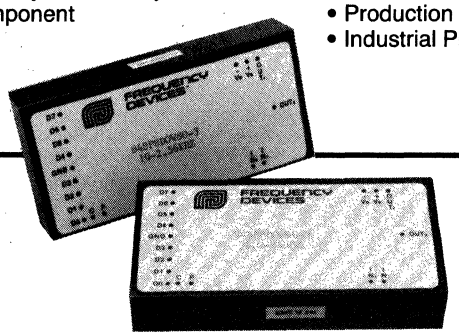
All 848/878 Series models are fully finished filters which require no external components or adjustments, and operate from non-critical ±12 to Ω18V power supplies. A 20 kΩ input impedance and a 10Ω (max.) output impedance make these compact (2.0″W × 4.0″L footprint, by 0.75″ or 1.0″H) encapsulated plug-in modules convenient and easy to use.

Features

- 8 Pole:
  Lowpass Butterworth - 848P8B
  Lowpass Bessel - 848P8L
  Lowpass Linear Phase - 848DOW
  Lowpass Elliptic - 848P8E
  Highpass Butterworth - 878P8B
  Highpass Elliptic - 878P8E
- Digitally Programmable Corner Frequency via CMOS Interface Logic
- Internally Latched Data Lines to Store Frequency Selection Data
- Most Widely Used Transfer Characteristics for Broadest Application Scope
- Plug-in Ready-to-use Fully Finished Filter Component

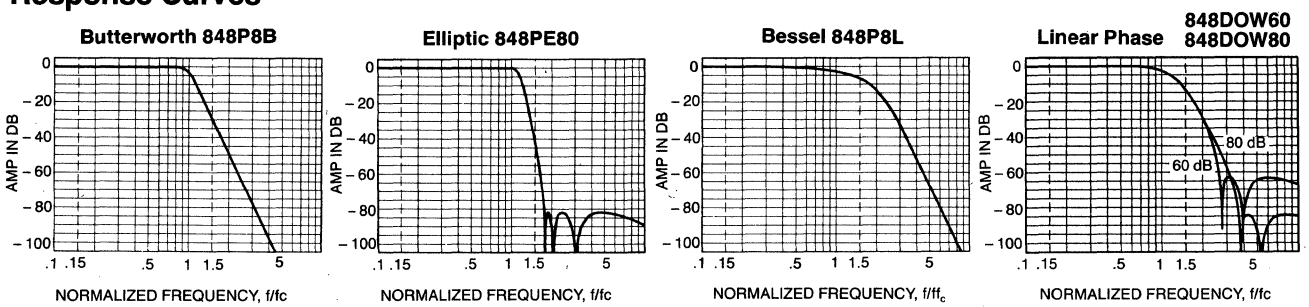
Applications

- Programmable Automatic Test
- Telecommunications Systems
- Data Acquisition Systems
- Anti-Alias Proliferating
- Real and Compressed Time Data Analysis
- Scientific Research
- Production Test Systems
- Industrial Process Control



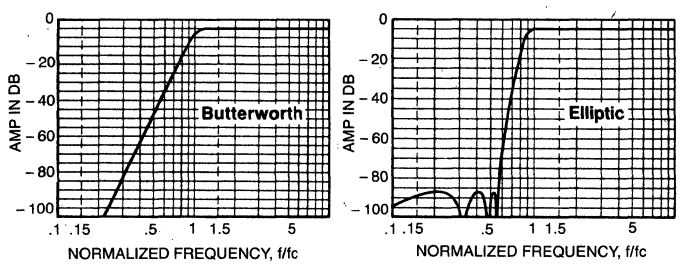
848 Low-Pass Series

Lowpass Theoretical Frequency Response Curves



878 High-Pass Series

Theoretical Highpass Butterworth & Elliptic Response Data



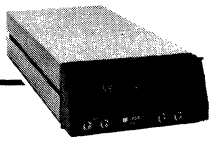
Other Frequency Devices Filter products include the following:

- Low Cost Frequency Modules
- Telecommunications
- Anti-Alias Filters
- Programmable Amplifiers
- Differential Buffer Amplifiers
- Oscillators
- Custom Filters

FOR MORE INFORMATION ON OUR CUSTOM DESIGNS CALL OR WRITE:
25 Locust Street, Haverhill, Massachusetts 01832
(508) 374-0761 • FAX (508) 521-1839

FREQUENCY DEVICES™
the Active Filter People

Dual-Channel Programmable Filter 1/2 Rack Size -115 dB/Octave Performance



The Model 9002 is a dual-channel programmable filter instrument that offers more high performance features than any other comparable instrument. Both channels are independently tunable from 0.1Hz to 102.4 KHz with an optional 204.8KHz range. The 9002 also provides a broader range of filter types than higher priced models and is mountable in half a standard 19" rack assembly. The 9002 dual-channel filter instrument proves that good filters come in small packages.

Features

- Programmable via local keypad or remote computer
- 3 ½ digit frequency resolution
- Selectable single-ended or differential input
- Gain/phase matched channels
- Non-volatile memory stores up to 8 setups per channel
- Programmable AC/DC coupling
- High resolution pre/post filter gain
- Dimensions: 3.5"H x 8.5"W x 15"L

16-Channel Programmable Filter/Amplifier Systems For Signal Conditioning And Analysis



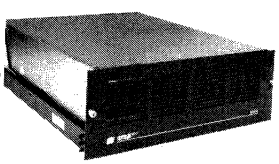
The Model 9016 is a 16-channel programmable filter instrument that allows you to amplify signals, and reject alias frequencies prior to recording or digitizing with unparalleled ease-of-use, versatility, and expandability. This multi-channel active filter features menu-driven set-up of each or every filter with five Command Function keys and a Help key. These keys provide convenient prompts that guide you through every step for the set-up you need.

Features

- Local or remote programming
- Rack mountable
- 3 ½ digit frequency resolution, from 0.1Hz to 102.4KHz (optional 204.8KHz bandwidth)
- Gain/phase matched channels
- Selectable single-ended or differential input
- Pre/Post filter gain
- Non-volatile memory stores up to 8 set-ups per channel.

New

64 Channel Computer Programmable Filter/AmplifierSystem



Specifications

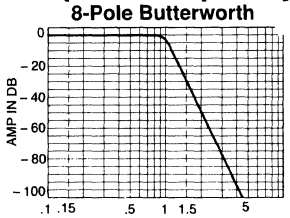
The Model 9064 is a multi-channel filter/amplifier system designed to provide cost effective signal conditioning under control of a remote computer. The system is comprised of a main frame chassis and a versatile selection of plug-in dual-or quad-module signal-conditioning channel cards. Simply, the 9064 mainframe was designed to hold up to 64 of our standard component level signal conditioning modules in a system configuration. As a result the 9064 can be populated with flexible and convenient programmable or lower cost fixed frequency conditioning modules.

Features

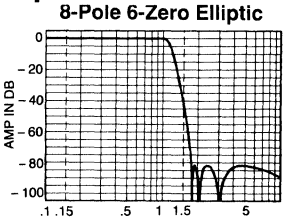
- 1Hz to 200KHz Filter Frequency Range
- 8 bit (256:1) or 10 bit (1024:1) Filter Tuning Position
- Programmable Amplifiers to 60dB
- Choice of Programmable FilterTypes
  - Low Pass - Bandpass
  - High Pass - Bandreject (Notch)
- Selectable Active or Bypass Modes
- Remote IEEE-488 or RS-232 Programmable
- Rack Mountable
- Common Input/Output Bus for Signal Monitoring and Calibration
- Isoltated Grounds: Chassis, Digital, Analog
- Cost Effective Fixed Frequency Modules also available
- Battery Backed RAM
- AC/DC Coupling

Lowpass Frequency Response Curves

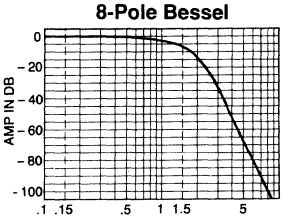
8-Pole Butterworth



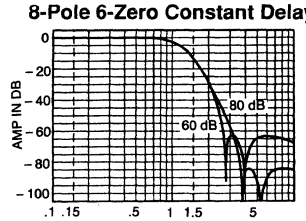
8-Pole 6-Zero Elliptic



8-Pole Bessel

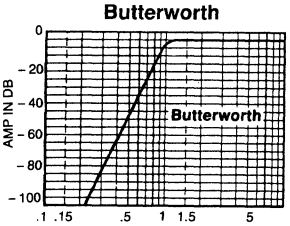


8-Pole 6-Zero Constant Delay

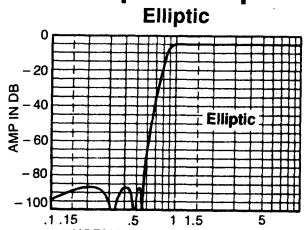


Highpass Butterworth & Elliptic Response Data

Butterworth



Elliptic



Other Frequency Devices Filter products include the following:

- Low Cost Frequency Modules
- Telecom Filters
- Anti-Alias Filters
- Programmable Amplifiers
- Differential Buffer Amplifiers
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(508) 374-0761 • FAX (508) 521-1839

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Oakland, CA 94606
FAX: (415) 452-3620

BRILL ELECTRONICS



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Santa Monica, CA 90404
Tel: (213) 452-8002

(415) 834-5888

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- Cablewave
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- Littelfuse
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- Tripp-lite
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- Waber

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- Coto
- Gordos
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- Midtex
- Omron
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- Sigma
- Struthers-Dunn
- Theta-J

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- Clarostat
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- RDI
- Siemen
- USD
- Vernitron-Beau
- Weidmuller

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- Simpson Electric
- Triplett

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- Agastat
- Amperite
- Industrial Timer
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- SSAC

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- Ersin
- Kester
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- Triad
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- Eimac
- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

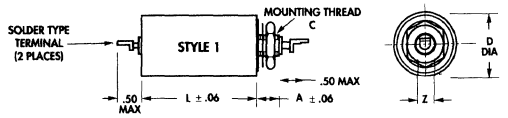
WIRE & CABLE
- Alpha
- Belden
- Cablewave
- Carol
- Iboco
- Madison
- Manhattan
- Quabbin

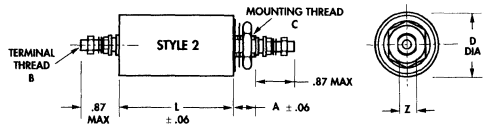
CURTIS INDUSTRIES, INC.

MALLORY

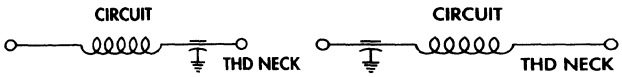
GENISCO ELECTRONICS CORPORATION
1657 PACIFIC RIM COURT, SAN DIEGO, CA 92173 USA
PHONE (619) 661-5100 FAX (619) 661-5120

FILTERS—High Performance Feed-Through RFI Filters—Per MIL-F-15733





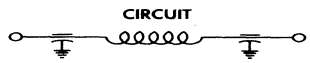
GF4000/GF4100 SERIES



Part Number	Current Amps	Voltage AC	Voltage DC	Terminal Dimensions L	D	A	Z	BThd	CThd	Insertion Loss At .15 MHz	Style
−1	1	30	100	2.00	.67	.34	.250	NA	5/16-24	40	1
−2	1	120	400	2.25	1.00	.34	.250	NA	5/16-24	40	1
−3	1	250	600	2.50	1.25	.50	.250	NA	7/16-20	40	1
−4	2	30	100	2.00	.87	.50	.250	NA	5/16-24	40	1
−5	2	120	400	2.25	1.25	.50	.370	NA	7/16-20	40	1
−6	2	250	600	2.50	1.25	.50	.370	NA	7/16-20	40	1
−7	5	30	100	2.37	1.50	.68	.250	NA	7/16-20	40	1
−8	5	120	400	2.50	1.50	.68	.370	NA	7/16-20	40	1
−9	5	250	600	2.75	1.50	.68	.370	NA	7/16-20	40	1
−10	10	30	100	3.50	1.75	.68	.658	NA	3/4-20	40	1
−11	10	120	400	4.00	1.75	.68	.658	NA	3/4-20	40	1
−12	10	250	600	4.25	1.75	.68	.658	NA	3/4-20	40	1
−13	15	30	100	3.50	1.75	.68	.658	8-32	3/4-20	35	1
−14	15	120	400	3.62	1.75	.68	.658	8-32	3/4-20	35	1
−15	15	250	600	3.93	1.75	.68	.658	8-32	3/4-20	35	1
−16	20	30	100	3.62	1.75	.68	.658	10-32	3/4-20	35	2
−17	20	120	400	3.75	1.75	.68	.658	10-32	3/4-20	35	2
−18	20	250	600	4.00	1.75	.68	.658	10-32	3/4-20	35	2
−19	30	30	100	3.75	1.75	.68	.658	10-32	3/4-20	35	2
−20	30	120	400	4.12	1.75	.68	.658	10-32	3/4-20	35	2
−21	20	250	600	4.37	1.75	.68	.658	10-32	3/4-20	35	2
−22	50	30	100	3.00	2.48	.75	1.055	1/4-28	1⅛-18	30	2
−23	50	120	400	4.50	2.48	.75	1.055	1/4-28	1⅛-18	30	2
−24	50	250	600	4.75	2.48	.75	1.055	1/4-28	1⅛-18	30	2
−25	75	30	100	3.50	2.48	.75	1.055	1/4-28	1⅛-18	25	2
−26	75	120	400	5.00	2.48	.75	1.055	1/4-28	1⅛-18	25	2
−27	75	250	600	5.25	2.48	.75	1.055	1/4-28	1⅛-18	25	2

Specifications subject to change without notice.

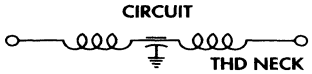
GF4200 SERIES



Part Number	Current Amps	Voltage AC	Voltage DC	Terminal Dimensions L	D	A	Z	BThd	CThd	Insertion Loss At .15 MHz	Style
−1	0.5	30	100	2.62	.67	.34	.250	NA	5/16-24	65	1
−2	0.5	120	400	2.75	.67	.34	.250	NA	5/16-24	60	1
−3	0.5	250	600	2.87	.87	.34	.250	NA	5/16-24	60	1
−4	1	30	100	2.75	.67	.34	.250	NA	5/16-24	60	1
−5	1	120	400	2.87	1.00	.50	.370	NA	7/16-20	60	1
−6	1	250	600	3.00	1.25	.50	.370	NA	7/16-20	60	1
−7	2	30	100	2.75	.87	.34	.250	NA	5/16-24	60	1
−8	2	120	400	2.37	1.25	.50	.370	NA	7/16-20	60	1
−9	2	250	600	2.87	1.25	.50	.370	NA	7/16-20	60	1
−10	5	30	100	2.75	1.50	.50	.370	NA	7/16-20	60	1
−11	5	120	400	3.00	1.50	.50	.370	NA	7/16-20	60	1
−12	5	250	600	3.75	1.50	.68	.658	NA	3/4-20	60	1
−13	10	30	100	3.00	1.50	.68	.658	NA	3/4-20	60	1
−14	10	120	400	3.50	1.50	.68	.658	NA	3/4-20	60	1
−15	10	250	600	3.75	1.75	.68	.658	NA	3/4-20	60	1
−16	15	30	100	3.12	1.75	.68	.658	8-32	3/4-20	60	2
−17	15	120	400	3.50	1.75	.68	.658	8-32	3/4-20	60	2
−18	15	250	600	3.75	1.75	.68	.658	8-32	3/4-20	60	2
−19	20	30	100	3.50	1.75	.68	.658	10-32	3/4-20	60	2
−20	20	120	400	3.75	1.75	.68	.658	10-32	3/4-20	60	2
−21	20	250	600	4.00	1.75	.68	.658	10-32	3/4-20	60	2
−22	30	30	100	3.75	1.75	.68	.658	10-32	3/4-20	60	2
−23	30	120	400	4.00	1.75	.68	.658	10-32	3/4-20	60	2
−24	30	250	600	4.25	1.75	.68	.658	10-32	3/4-20	60	2
−25	50	30	100	3.50	2.48	.75	1.055	1/4-28	1⅛-18	55	2
−26	50	120	400	5.00	2.48	.75	1.055	1/4-28	1⅛-18	55	2
−27	50	250	600	5.25	2.48	.75	1.055	1/4-28	1⅛-18	55	2

Specifications subject to change without notice.

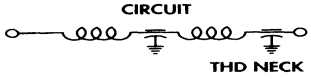
GF4300 SERIES



Part Number	Current Amps	Voltage AC	Voltage DC	Terminal Dimensions L	D	A	Z	BThd	CThd	Insertion Loss At .15 MHz	Style
−1	0.5	30	100	2.37	.67	.34	.250	NA	5/16-24	55	1
−2	0.5	120	400	2.50	.67	.34	.250	NA	5/16-24	55	1
−3	0.5	250	600	2.62	.87	.34	.250	NA	5/16-24	55	1
−4	1	30	100	2.62	.87	.34	.250	NA	5/16-24	55	1
−5	1	120	400	2.87	1.00	.34	.250	NA	5/16-24	55	1
−6	1	250	600	3.37	1.25	.50	.250	NA	7/16-20	55	1
−7	2	30	100	2.62	1.25	.50	.370	NA	5/16-20	55	1
−8	2	120	400	2.87	1.25	.50	.370	NA	7/16-20	55	1
−9	2	250	600	3.37	1.25	.50	.370	NA	7/16-20	55	1
−10	5	30	100	3.37	1.50	.50	.370	NA	7/16-20	55	1
−11	5	120	400	3.50	1.50	.50	.370	NA	7/16-20	55	1
−12	5	250	600	3.75	1.50	.50	.370	NA	7/16-20	55	1
−13	10	30	100	3.00	1.75	.68	.658	NA	3/4-20	45	2
−14	10	120	400	4.12	1.75	.68	.658	NA	3/4-20	45	2
−15	10	250	600	4.37	1.75	.68	.658	NA	3/4-20	45	2
−16	15	30	100	3.00	1.75	.68	.658	8-32	3/4-20	40	2
−17	15	120	400	3.37	1.75	.68	.658	8-32	3/4-20	40	2
−18	15	250	600	3.50	1.75	.68	.658	8-32	3/4-20	40	2
−19	20	30	100	3.12	1.75	.68	.658	10-32	3/4-20	35	2
−20	20	120	400	3.37	1.75	.68	.658	10-32	3/4-20	35	2
−21	20	250	600	3.50	1.75	.68	.658	10-32	3/4-20	35	2
−22	30	30	100	4.25	1.75	.68	.658	10-32	3/4-20	35	2
−23	30	120	400	4.37	1.75	.68	.658	10-32	3/4-20	35	2
−24	30	250	600	4.48	1.75	.68	.658	10-32	3/4-20	35	2
−25	50	30	100	4.50	2.48	.75	1.055	1/4-28	1⅛-18	35	2
−26	50	120	400	5.75	2.48	.75	1.055	1/4-28	1⅛-18	35	2
−27	50	250	600	6.00	2.48	.75	1.055	1/4-28	1⅛-18	35	2

Specifications subject to change without notice.

GF4400 SERIES



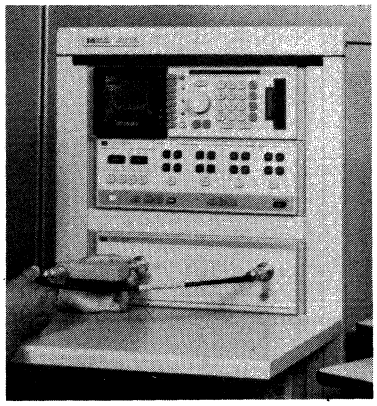
Part Number	Current Amps	Voltage AC	Voltage DC	Terminal Dimensions L	D	A	Z	BThd	CThd	Insertion Loss At .15 MHz	Style
−1	.05	30	100	3.00	.67	.34	.250	NA	5/16-24	70	1
−2	.05	120	400	3.12	.67	.34	.250	NA	5/16-24	65	1
−3	.05	250	600	3.25	.67	.34	.250	NA	5/16-24	65	1
−4	.5	30	100	3.25	.87	.34	.250	NA	5/16-24	70	1
−5	.5	120	400	3.12	1.00	.50	.370	NA	7/16-20	70	1
−6	.5	250	600	3.25	1.00	.50	.370	NA	7/16-20	70	1
−7	1	30	100	3.00	1.25	.50	.370	NA	7/16-20	70	1
−8	1	120	400	3.12	1.25	.50	.370	NA	7/16-20	60	1
−9	1	250	600	3.25	1.25	.50	.370	NA	7/16-20	60	1
−10	2	30	100	3.12	1.25	.50	.370	NA	7/16-20	60	1
−11	2	120	400	3.25	1.25	.50	.370	NA	7/16-20	60	1
−12	2	250	600	3.50	1.25	.50	.370	NA	7/16-20	60	1
−13	5	30	100	3.62	1.50	.68	.658	NA	3/4-20	70	1
−14	5	120	400	3.75	1.50	.68	.658	NA	3/4-20	60	1
−15	5	250	600	3.87	1.50	.68	.658	NA	3/4-20	60	1
−16	10	30	100	3.62	1.75	.68	.658	NA	3/4-20	60	1
−17	10	120	400	3.93	1.75	.68	.658	NA	3/4-20	55	1
−18	10	250	600	4.12	1.75	.68	.658	NA	3/4-20	55	1
−19	15	30	100	3.75	1.75	.68	.658	8-32	3/4-20	55	2
−20	15	120	400	4.00	1.75	.68	.658	8-32	3/4-20	55	2
−21	15	250	600	4.25	1.75	.68	.658	8-32	3/4-20	55	2
−22	20	30	100	4.00	1.75	.68	.658	10-32	3/4-20	60	2
−23	20	120	400	4.25	1.75	.68	.658	10-32	3/4-20	50	2
−24	20	250	600	4.50	1.75	.68	.658	10-32	3/4-20	50	2
−25	30	30	100	4.25	1.75	.68	.658	10-32	3/4-20	50	2
−26	30	120	400	4.50	1.75	.68	.658	10-32	3/4-20	50	2
−27	30	250	600	4.75	1.75	.68	.658	10-32	3/4-20	50	2
−28	50	30	100	4.50	2.48	.75	1.055	1/4-28	1⅛-18	55	2
−29	50	120	400	4.75	2.48	.75	1.055	1/4-28	1⅛-18	50	2
−30	50	250	600	5.25	2.48	.75	1.055	1/4-28	1⅛-18	50	2

Specifications subject to change without notice.

SEE OUR PAGES IN SECTION 2700 & 2460.

IF-RF-Microwave Filters

Custom Capabilities



Integrated Microwave™ is a leader in the design and manufacture of high performance micro-miniature filters, multiplexers and integrated subsystems in the DC to 26.5 GHz frequency range. IMC products are widely used in advanced military, space and communications applications.

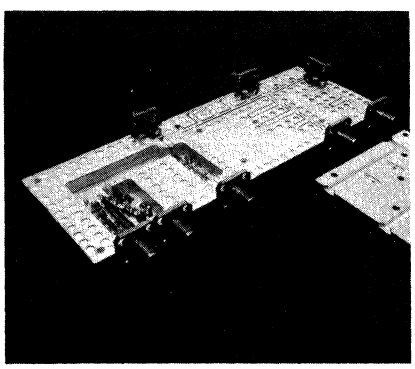
We have developed advanced systems and innovative manufacturing processes that allow IMC to offer efficient and timely delivery of custom designed components at "off the shelf" prices. Special services include: computer-aided synthesis, CAD, computer-aided engineering, CAM, computer-aided testing, computer-aided quotation and tracking.

Filters & Multiplexers

Functions:
1. Lowpass
2. Highpass
3. Bandpass
4. Band Reject (Notch)
5. Lowpass or Highpass plus band reject
6. All pass

Technologies:
1. Lumped Element
2. Tubular
3. Helical Resonator
4. Combine
5. Interdigital
6. Suspended Substrate
7. Waveguide
8. Varactor Tunable
9. Mechanically Tunable

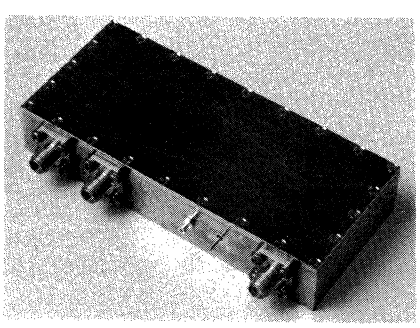
Responses:
1. Butterworth
2. Tchebycheff
3. Gaussian
4. Bessel
5. Linear Phase with equiripple degee phase error
6. Transitional filters
   a) Gaussian to 6 dB
   B) Gaussian to 12 dB
7. Elliptic
8. Pseudo Elliptic
9. Varactor Tunable, 20-600 MHz
10. Time domain designs (with optimized ringing and overshoot)
11. Terminated Diplexers
12. High power handling capabilities



Multiplexers can be designed utilizing any function, response and technology that IMC engineers determine will best meet the requirements of the customer specifications. In some instances IMC will use a combination of technologies to achieve the desired performance.

Integrated Subsystems & Components

1. Multiplexers .01 MHz to 26.5 GHz
2. Contiguous, Non-contiguous or Overlapping Passbands
3. Multiple Channel Devices:
   a) Diplexers
   b) Triplexers
   c) Quadraplexers
   d) Quintaplexers
   e) Additional Channels available upon request.
1. Switched Filter Banks
   a) Multiple channels
   b) .01 MHz to 26.5 GHz
   c) TTL/CMOS Compatible Drivers
2. Low Noise Filter-Amplifier Modules
   a) Low noise figure
   b) Low intermodulation distortion
   c) Medium power output
   d) Medium gain
3. Iso-Filters
4. Limiter/Detectors
5. Frequency Converters
6. Frequency Multipliers



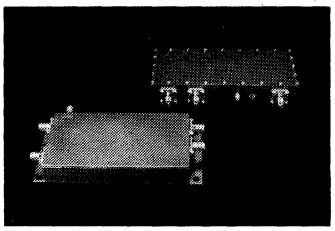
Domestic and international sales territories available.

INTEGRATED MICROWAVE™
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San Diego, CA 92121
TEL: (619) 259-2600
FAX: (619) 755-8679
FSCM: 60656

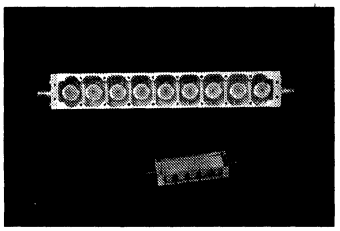
Quality by Design *Delivery on Time*

IF/RF/Microwave Filters

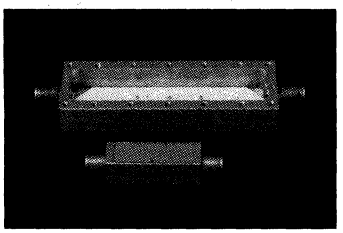
Filters and Components DC to 26.5 GHz



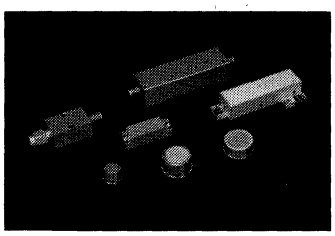
Multifunction Modules
- Switch/filters
- Filter/mixer
- Filter/multiplier



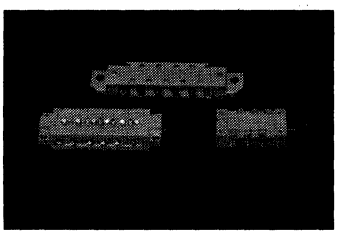
Miniature Helical
- 100MHz to 3000MHz
- 1% to 20% Bandwidths
- 2 to 12 sections



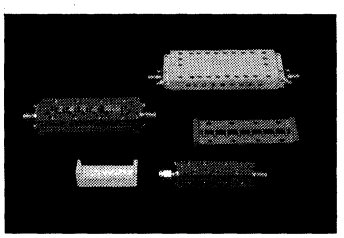
Bandstop
- 100MHz to 18GHz
- 1% to 50% Bandwidths
- 3 to 9 sections



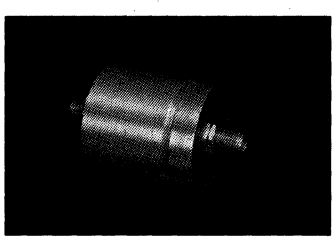
Lumped Constant
- DC to 18GHz
- 2% to over 100%
- 2 to 12 sections
- Bandpass/Highpass/Lowpass



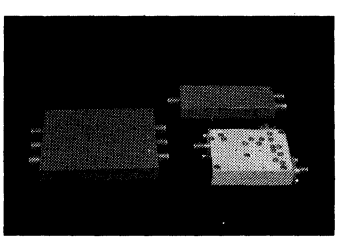
Interdigital and Miniature Interdigital
- 1.0GHz to 2.6GHz
- 2% to over 100% Bandwidths
- 3 to 20 sections



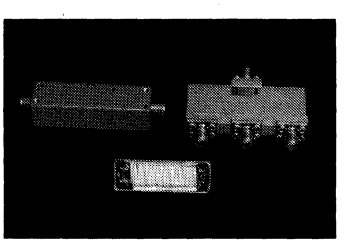
Combline and Miniature Combline
- 500MHz to 26.5GHz
- 2% to over 100% Bandwidths
- 3 to 20 sections



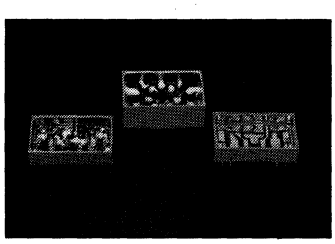
Cavity
- High Q, Narrow Band
- 20MHz to 12GHz
- 0.1% to 3.5% Bandwidths
- 2 to 12 sections



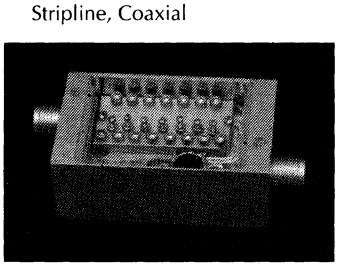
Diplexers-Multiplexers
- DC to 26.5GHz
- Contiguous/Non-contiguous
- Lumped Constant, Suspended Stripline, Coaxial



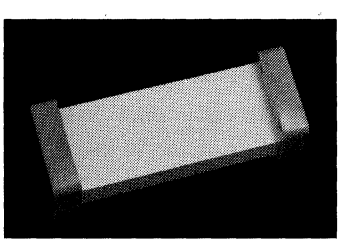
Passive Components
- Power dividers Ø matched
- Attenuators RF/microwave
- Delay lines



Miniature Tunable (Voltage)Bandpass
- 20 to 600MHz
- 3 sections
- Sub-octave tuning



Iso Filters
- 500MHz to 18GHz
- 1% to over 75% Bandwidths
- 3 to 20 sections
- Lumped Constant, Combline, Interdigital



Waveguide
- Rectangular
- Circular
- Waffle Iron
- 1 to 10 sections
- .001% to .09% Bandwidths

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Quality By Design • Delivered on Time

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Hearst Engineering Software



ICMASD...IC Alternate Source Directory

The all new 1991 version of the world famous Alternate Source Directory is now available in floppy disk form for your IBM XT & AT and 100% compatible personal computer with hard drive.

The **1991 ICMASD** contains the more than 180,000 listings that appear in the Alternate Source Directory Section contained in Volume Two of the printed version of the 1991 IC Master ...plus additional discontinued parts. The database includes complete vendor addresses and phone numbers.

You can personalize the **ICMASD** for your application. The program allows you to add comments, up to 20 digits long, to each listing. These comments can be part numbers, prices, or any information specific to your needs. You may also add, delete and/or discontinue devices!

For greater flexibility the base number search feature enables you to access parts by base number, i.e., the device number stripped of prefixes and suffixes. You don't need to know the manufactures codes to call up any of the alternates to these devices.

The **1991 ICMASD** is fast, convenient and very user friendly!

Complete program documentation is included. When ordering, be sure to specify if you want the **1991 ICMASD** on three, double-sided, double-density disks OR on one high-density disk.

For immediate delivery you can order the **1991 ICMASD** at $179.50* simply by charging your Visa or MasterCard credit card. To place your order or for more information, call or write:

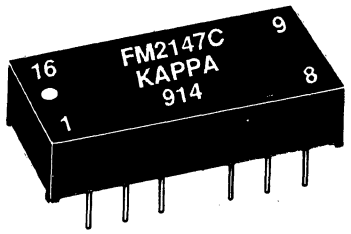
Marie Botta
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SERIES FM TWISTED-PAIR (16-PIN)

10 BASE-T FILTER MODULES FOR TWISTED-PAIR ETHERNET

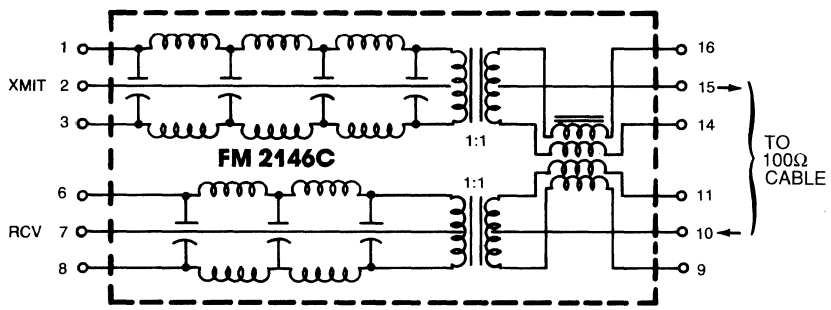


FILTER SPECIFICATIONS @ 25°C

Part No.		1.1 (db. max.) @ 10 MHz	Attenuation (db. min.)① 20 MHz	30 MHz	40 MHz	TPI Interface Impedance (Ω)
FM	XMT	0.75	7.0	32.0	35.0	100
2146	RCV	0.60	6.0	20.0	31.0	100
FM	XMT	3.50	7.0	24.0	24.0	400
2147	RCV	4.00	7.0	22.0	31.0	100

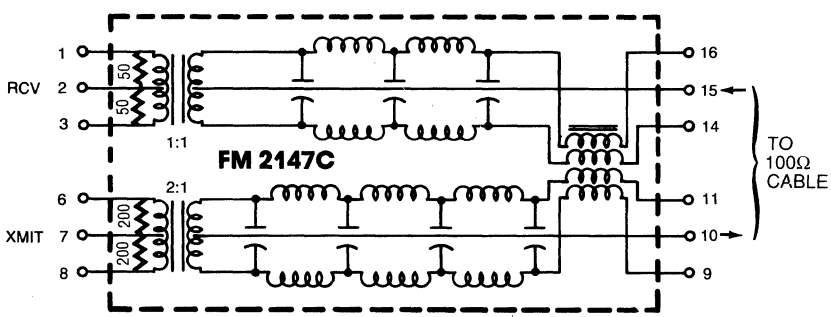
FEATURES

- IEEE 802.3 compatible
- −25 dB return loss, 0 to 10 MHz
- Standard Package includes:
  7-pole transmit filter
  5-pole receive filter
  Z-matched transformers
  Common-mode choke optional ⑤
- Lan Filters and Transformers are available in separate packages (consult factory)



RATINGS

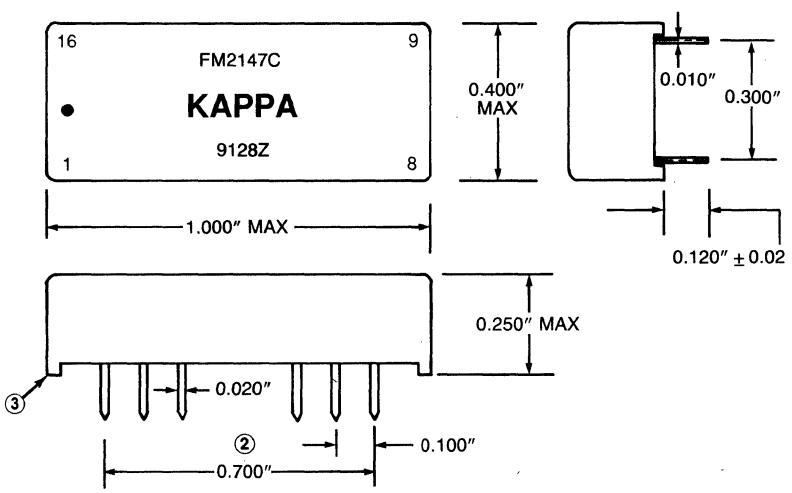
- Dielectric Strength: 2000 Vrms
- Insertion loss (1–10 MHz): 0.75dB max.
- Crosstalk (1–10 MHz): −30dB min.
- Group Delay, maximum variation (1–10 MHz): ±2.0 nS
- Amplitude slope (5–10 MHz): ±0.4 db



MECHANICAL SPECIFICATION

- Case Material: Molded epoxy or DAP
- Terminals: #24 AWG tinned-copper; or, flat DIP-type, Kovar (or equiv.) tin-plated
- Potting: 100% filled, two-component epoxy
- Marking: Includes manufacturer's name, part number, date code and facility code

MARKING AND DIMENSIONS④



NOTES:

① Attenuation is referenced to output at 10 MHz.

② Each terminal is located within ±0.010″ of its nominal multiple of 0.100″

③ Alternate standoff locations may be used.

④ Dimensional tolerances are ±0.010″ unless otherwise specified.

⑤ Adding suffix "C" to part number signifies inclusion of common-mode choke (see schematic above).

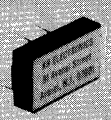
Revised 7/91, previous editions obsolete

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U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (908) 396-9400, Toll Free 800-223-0603 • FAX 908-388-4786

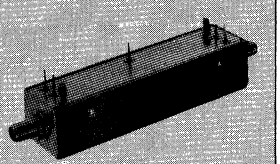
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CUSTOM & STANDARD FILTERS

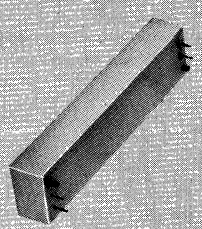
LOWPASS



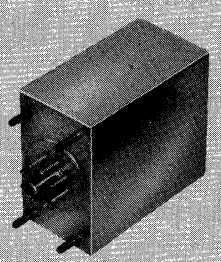
BANDPASS



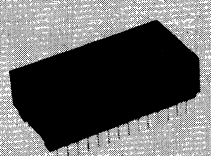
HIGH PASS



BAND REJECT

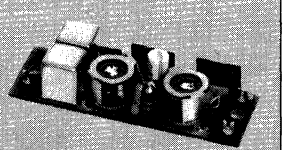


MATCHED PHASE & ATTENUATION



For use in sonar and other multi-channel systems

GROUP DELAY & ATTENUATION EQUALIZER NETWORKS



To correct sytem introduced delay and attenuation distortion. Computer designed from system error curve.

KR Electronics can quickly and accurately design networks to meet your requirements and provide an immediate quotation. Computers are extensively used by our engineers to find the most cost effective solutions which satisfy your system needs. Through the use of circuit analysis programs these networks are evaluated to assure compliance with your specifications. Graphical and tabular data can be generated and supplied to illustrate typical network response. This data can be used to predict system performance.

- Application Assistance
- Immediate Quotation
- Custom and Standard
- MIL-F-18327
- Prototype Service

Thorough analysis of the design before production is used to check all applicable network parameters.

- Attenuation
- Phase/Group Delay
- Impedance
- Transient Response
- Network Sensitivity
- Temperature Analysis

Computer controlled network analyzers assure accurate and repeatable measurements. Automated equipment 100% tests all products, verifying compliance to your specifications.

- 100% Electrical Inspection
- Graphical & Tabular Data
- Attenuation
- Phase/Group Delay
- VSWR/Return Loss
- Impedance

Some of KR's specialized design software include:

- Optimization and design of attenuation equalizers to correct for a prescribed frequency characteristic
- Design of group delay equalized filters yielding constant group delay and linear phase
- Optimization and design of group delay equalizers to correct for a prescribed frequency characteristic

- **Lowpass**
- **Bandpass**
- **Band Stop**
- **Highpass**
- **Notch**
- **Phase Matched**
- **Attenuation Matched**
- **Delay Lines**
- **Video**
- **Anti-Aliasing**
- **SIN(X)/X Corrected**
- **Cable Equalizers**
- **Attenuation Equalizers**
- **Group Delay Equalizers**
- **Linear Phase**
- **Low Transient Response**
- **Bessel**
- **Butterworth**
- **Chebyshev**
- **Elliptic/Cauer**
- **Gaussian**
- **Transitional**
- **Equi-Ripple Phase**

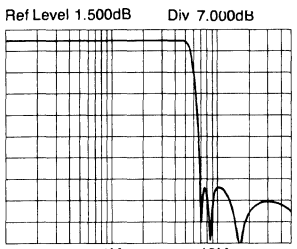
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VIDEO & ANTI-ALIASING FILTERS

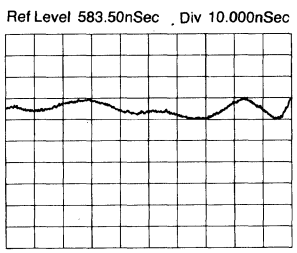


- Miniature
- Group Delay Equalized
- Flat Passband Response
- SIN(X)/X Compensation Available
- Custom Configurations

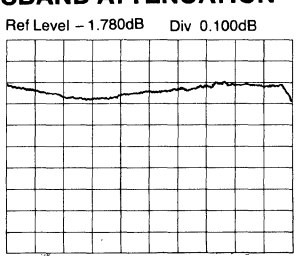
ATTENUATION vs. FREQUENCY



PASSBAND GROUP DELAY



PASSBAND ATTENUATION



Designed and manufactured to meet the stringent requirements of video analog and digital systems, KR Electronics' group delay equalized lowpass filters are optimized for performance and size.

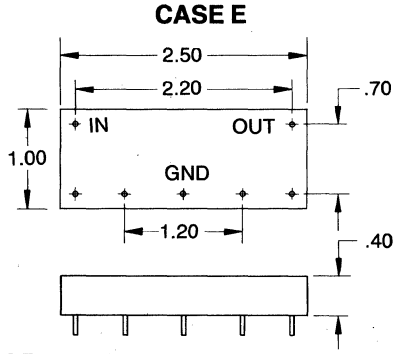
The three primary criteria for video applications are sharp transition, constant group delay and flat passband. The graphs at the left illustrate the typical response of a MDV8B500 filter. The filter makes a transition from the end of the passband to >45 dB at a shape factor of 1.4. To practically eliminate phase distortion, group delay equalizers are used to achieve constant group delay (< ± 10 nsec) over the entire passband. These filters also exhibit flat amplitude response (< ± .1 dB) up to the cutoff frequency. This performance is available in a miniature, low profile, PC board mountable package.

These filters are ideally suited for anti-aliasing in A/D and D/A applications. Various levels of attenuation are available for different resolutions. For filters used after D/A conversion, Sin(X)/X shaping of the passband is available.

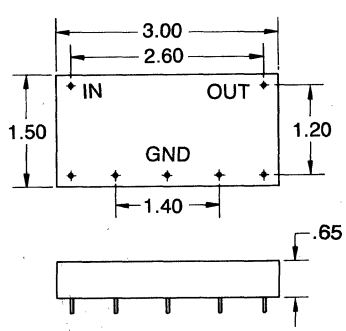
KR Electronics has a strong background in custom design and manufacture. This gives you the flexibility to specify the frequency, shape factor and package configuration that meet your particular requirement.

Model	MDV8B500	DV8B500	SV8B500	SV10B500
Insertion Loss (Ref 100 KHz)	2.2 dB	2.2 dB	2.2 dB	2.8 dB
Passband Ripple	< ± .1 dB	< ± .1 dB	< ± .1 dB	< ± .1 dB
End of Passband (Fc)	5 MHz	5 MHz	5 MHz	5 MHz
≈ 3 dB Frequency	5.56 MHz	5.56 MHz	—	—
≈ 12 dB Frequency	6.015 MHz	6.015 MHz	—	—
Start of Stopband (Fs)	7 MHz	7 MHz	7 MHz	7 MHz
Stopband Attenuation (As)	> 45 dB	> 45 dB	> 54 dB	> 66 dB
Approximate Group Delay	640 nsec	640 nsec	665 nsec	700 nsec
Group Delay Ripple (to Fc)	< ± 10 nsec	< ± 10 nsec	< ± 10 nsec	< ± 15 nsec
Impedance	75Ω	75Ω	75Ω	75Ω
SIN(X)/X Available	Yes	Yes	Yes	Yes
Case Style	E	F	G	G

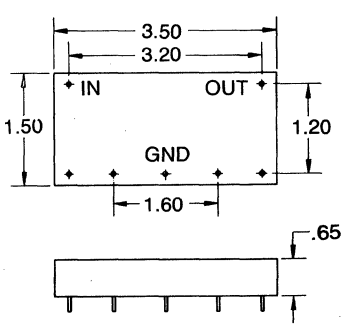
CASE E



CASE F



CASE G



FOR ALL CASES:

Input & Output Lead Diameter: .030"

Ground Lead Diameter: .040"

Case Material: Diallyl Phthalate

KROHN-HITE CORPORATION

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Tel: (508)580-1660; Fax: (508)583-8989

NEW *IEEE-488 PROGRAMMABLE FLEXI-FILTER FAMILY*

FLEXI-FILTER SALIENT FEATURES	CHANNELS MAX.	BATTERY OPERATION	OSCILLATOR MODE	MODEL	PRICE $
Frequency Range: 0.1Hz-200kHz (Option 002: 0.001Hz operation) Attentuation Slope: Selectable up to 78dB/octave Multiple Modes: LP, HP, BP, BR (or any combination*) and Amplifier Only Multiple Responses: Butterworth, Bessel, Chebyshev and RC Input and Output: Differential or Single ended Stopband Attenuation: >80dB Input Gain: 0dB to 40dB in 10dB steps Output Gain: -10dB to 40dB (in 0.1dB steps*) **Except for 3000 and 3002*	1	No	No	3000	1995
	2	No	No	3002	2995
	2	No	Yes	3010	2300
	4	No	Yes	3012	3300
	2	Yes	Yes	3020	2600
	4	Yes	Yes	3022	3600

IEEE-488 PROGRAMMABLE PLUG-IN FILTER CARD MAINFRAMES

CHARACTERISTICS	STORED SETTINGS	IEEE-488 PROGRAMMING	RACK MOUNTING KIT	MODEL	PRICE $
Holds up to 5 filter cards of any combination	85	Yes	RK-317	3905B	1900
Holds up to 16 filter cards of any combination	25	Yes	RK-817	3916B	2995

IEEE-488 PROGRAMMABLE PLUG-IN FILTER CARDS (Requires MainframeBlock Title)

FREQUENCY RANGE	FUNCTIONS					ATTEN. SLOPE dB/OCTAVE	NOISE AT 1kHz MAX GAIN (RTI)	MAXIMUM ATTEN. (dB)	OUTPUT Volts/Amps (rms)	BANDWIDTH	MODEL	PRICE $
	LP	HP	BP	BR	BYP							
1Hz-99kHz	•					115	10μV	80	7V/10mA	DC-99kHz	30-1	1295
0.1Hz-9.9kHz	•					115	10μV	80	7V/10mA	DC-9.9kHz	30-2	1295
0.01Hz-990kHz	•					115	10μV	80	7V/10mA	DC-990kHz	30-3	1345
1Hz-99kHz		•				115	10μV	80	7V/10mA	1Hz-500kHz	31-1	1295
0.1Hz-9.9kHz		•				115	10μV	80	7V/10mA	0.1Hz-500kHz	31-2	1295
0.01Hz-990kHz		•				115	10μV	80	7V/10mA	0.01Hz-100kHz	31-3	1345
1Hz-99kHz	•					53	100μV	80	7V/10mA	DC-99kHz	32-1	1000
0.1Hz-9.9kHz	•					53	100μV	80	7V/10mA	DC-9.9kHz	32-2	1100
0.01Hz-990kHz	•					53	100μV	80	7V/10mA	DC-990kHz	32-3	1150
1Hz-99kHz		•				53	100μV	80	7V/10mA	1Hz-500kHz	33-1	1000
0.1Hz-9.9kHz		•				53	100μV	80	7V/10mA	0.1Hz-500kHz	33-2	1100
0.01Hz-990kHz		•				53	100μV	80	7V/10mA	0.01Hz-100kHz	33-3	1150
1Hz-2MHz	•	•	•	•	•	24	100μV	80	4.6V/25mA	DC-10MHz	34	1575
170Hz -25.6MHz	•	*NEW*			•	24	500μV	80	2.1V/20mA	DC-25.6MHz	35	Consult Factory

TUNABLE ACTIVE FILTERS

FREQUENCY RANGE	FUNCTIONS				MAX. CHAN.	ATTEN. SLOPE dB/OCTAVE	NOISE (rms)	MAX. ATTEN. (dB)	OUTPUT VOLTS/AMPS	BANDWIDTH (3dB)	BATTERY KITS	RACK MOUNT KIT	MODEL	PRICE $
	BP	BR	HP	LP										
0.02Hz-20kHz	•	•	•	•	1	6,12,18,24	500μV	80	10V/2mA	DC-1MHz	BK375	RK-519	3750	1900
0.2Hz-20kHz	•				1	24	200μV	80	5V/1mA	N/A	BK370	RK-38	3700	1350
2Hz-200kHz	•	•	•	•	1	24	200μV	60	5V/10mA	0.2Hz-3MHz	N/A	RK-38	3550	1300
10Hz-1MHz	•				1	24	100μV	80	3V/10mA	N/A	N/A	RK-314	3100A	1150
10Hz-3MHz	•				1	24	100μV	80	3V/10mA	N/A	N/A	RK-314	3103A	1200
10Hz-3MHz	•				1	18	100μV	80	3V/10mA	N/A	N/A	RK-314	3103A-4	1200
20Hz-200kHz	•				1	24	200μV	60	5V/3.5mA	N/A	N/A	RK-38	3500	1200
20Hz-2MHz			•	•	1	24	100μV	80	3V/10mA	DC-10MHz	N/A	N/A	3200†	1050
20Hz-2MHz	•	•	•	•	2	24,48	100μV	80	3V/10mA	DC-10MHz	N/A	N/A	3202†	1750

†Rack Model (19" Front Panel): Add suffix 'R' to Model No. when ordering. ($50)

NARROW-BAND TRACKING FILTER

FREQUENCY RANGE	BANDWIDTHS	PEAK OUTPUT VOLTS/mA	MAX. ATTEN.	NOISE RFI (rms)	TUNING MODES	RACK MOUNTING KIT	MODEL	PRICE $
1Hz to 100kHz	0.001Hz, 0.01Hz, 0.1Hz, 1Hz, 10Hz, 100Hz, 1kHz, EXT	10V/5mA	40dB	100μV	Ref, Ref Track, Dial, Sig Track	RK-319	3800	2525

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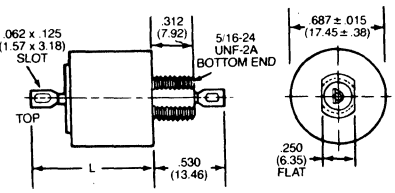
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EMI/RFI Suppression Filters

FOR ADDITIONAL INFORMATION SEE OUR DATA PAGES IN THE CONNECTOR SECTION, VOLUME C PAGES C•1468 - C•1471

Part Number	Rated DC Current	Working Voltage 85°C	Working Voltage 125°C	Elec. CKT	Length "L" ±.030 (.76)	Minimum Insertion Loss (dB) Per MIL-STD 220 75 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
L, Pi, T—.687 Dia.											
51-320-028	5 amp	250VDC	240VAC*	250VDC	L Top	.875 (22.23)	6	19	24	37	70	70
51-321-318	3 amp	250VDC	240VAC*	250VDC	Pi	1.170 (29.72)	6	31	55	70	70	70
51-321-610	1 amp	250VDC	240VAC*	250VDC	T	1.170 (29.72)	25	49	60	70	70	70

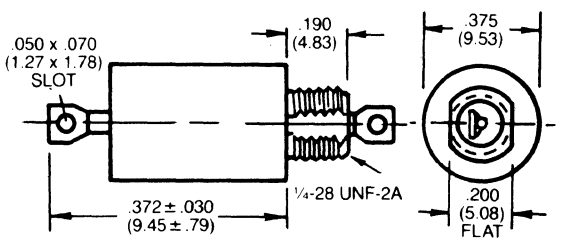
*0-60 Hz



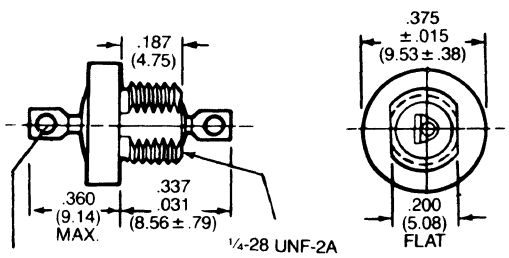
HERMETIC SEAL— FEED THROUGH CAPACITORS

Part Number	Rated DC Current	Working Voltage 85°C	Working Voltage 125°C	Capacitance And/Or Tolerance	Minimum Insertion Loss (dB) Per MIL-STD. 220 75KHz	150KHz	300KHz	1MHz	10MHz	1GHz
54-367-008	15 amp	100VDC	50VDC	1.4µF	20	28	33	44	60	70
54-367-006	15 amp	125VAC*	125VAC*	.25µF	9	14	19	30	50	70
51-359-001	15 amp	80VDC	50VDC	1.4µREF	18	28	33	44	60	70

54-367-008 54-367-006

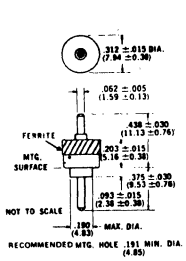


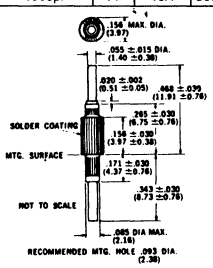
51-359-001



ECONOMICAL RESIN SEAL THREAD BUSHING

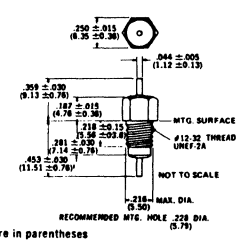
Ordering Number	Minimum Insertion Loss Per MIL-STD 200 10MHz	30MHz	100MHz	300MHz	1GHz	Capacitance and/or Tolerance	Elec. Ckt.	Rated DC Current	Working Voltage (VDC) 85°	125°
51-719-011	12	20	45	60	60	3000pF	Pi	10 amp	500	500
51-719-021	14	30	50	65	65	5500pF	Pi	10 amp	200	200
51-722-002	4	12	25	35	50	1000pF	L	25A	500	250
51-723-302	14	30	55	65	65	5500pF	Pi	10A	200	100
51-723-304	5	15	30	45	65	1300pF	Pi	10A	300	200





51-722-002 **51-723-302 51-723-304**

INCLUDES SOLDER MOUNTING WASHER

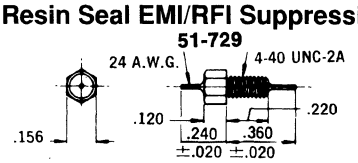


mm are in parentheses

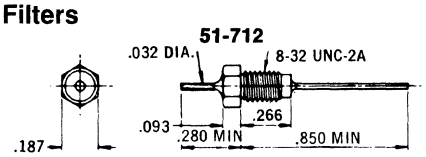
51-719-022
51-719-021
51-719-011
INCLUDES NUTS & LOCKWASHER

Resin Seal EMI/RFI Suppression Filters

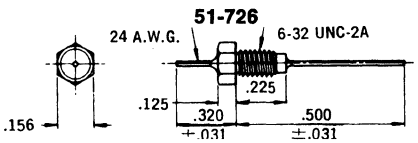
51-729



51-712



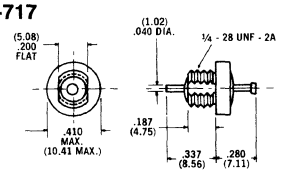
51-726



Part No.	Rated I_{DC} in Amps	Working Volts +85 °C	Working Volts +125 °C	DCR Max.	Capacitance Reference Only µF	Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz
51-712-001	10	200	100	.01	.0015	—	5	42	50	70
51-712-003	10	200	100	.01	.022	7	27	43	50	60
51-726-001	3	200	100	.01	.0015	—	5	42	50	70

Part No.	Rated I_{DC} in Amps	Working Volts +85 °C	Working Volts +125 °C	DCR Max.	Capacitance Reference Only µF	Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz
51-726-002	10	200	100	.01	.022	7	27	43	50	60
51-729-303	10	200	100	.01	.0015	—	5	42	60	70
51-729-304	10	200	100	.01	.022	7	27	43	50	55

51-717



100 VDC +85°C L SECTIONS 125 VAC +125°C

Part No.	Rated I_{DC}	Working Volts +85°C	Working Volts +125°C	DCR Max.	Capacitance Reference Only	Insertion Loss dB 30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
51-717-001	15 amps	100VDC	50VDC	.01	1.4 MFD	15	28	33	44	60	70
51-717-007	15 amps	125VAC*	125VAC*	.01	.015±20%	—	—	—	6	25	50

*0-400 Hz

All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control, Inc...**

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Military Filters

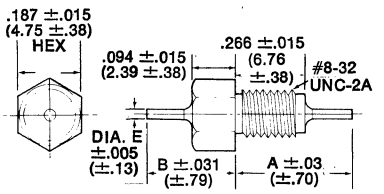
FOR ADDITIONAL INFORMATION SEE OUR DATA PAGES IN THE CONNECTOR SECTION, VOLUME C PAGES C•1468-C•1471

Shown below are a few of the most commonly used Military approved filters. These filters are approved to MIL-F-15733. Metuchen Capacitors stocks several hundred different MIL-F-15733 filters from MIL-F-15733/23 thru MIL-F-15733/70. Those shown below are IN STOCK continuously and offer a wide selection for your various applications. Both hermetic and non-hermetic (resin seal) are listed as well as different electrical configurations—L's and A's and Voltages from 50 VDC to 125 VAC.

IN STOCK

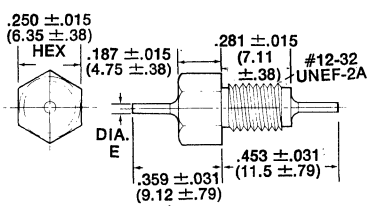
EMI/RFI Suppression Filters
RESIN SEAL

MIL P/N	Capacitance Ref-pf	Rtd. DC Voltage	Rtd. Current (A)	Electrical Circuit	Minimum Insertion Loss (dB) Per Mil-Std 220								A	B	C	E
					100 kHz	1 MHz	5 MHz	10 MHz	50 MHz	100 MHz	200 MHz	1 GHz				
MIL-F-15733/28-0001	1500	100	10	π	—	—	—	—	25	45	60	60	.890	.312	.266	.032
MIL-F-15733/28-0004	25,000	50	10	L-THD	—	10	—	28	—	41	44	60	.890	.312	.266	.040
MIL-F-15733/61-0008	5500	100	10	π	—	—	—	—	50	—	55	70	.500	.312	.266	.032
MIL-F-15733/61-0013	22,000	100	10	L-THD	—	10	22	30	—	50	—	70	.890	.280	.266	.032



IN STOCK

MIL P/N	Capacitance Ref-pF	Rated Voltage DC	Rated Current (A)	Electrical Circuit	Minimum Insertion Loss (dB) Per Mil-Std 220								E ±.005 (±.13)
					100 kHz	1 MHz	3 MHz	10 MHz	50 MHz	100 MHz	500 MHz	1-10 GHz	
MIL-F-15733/61-0002	1500	200	10	π	—	—	—	—	32	45	70	70	.032 (.81)



EMI/RFI Suppression Filters
HERMETIC SEAL

IN STOCK

MIL P/N	Rated Current	Working Volts +125°C	DCR Max. Ω	Reference Capacitance	Insertion Loss (dB) Per Mil-Std-220						Fig.
					30 kHz	150 kHz	300 kHz	1 MHz	10 MHz	1 GHz	
MIL-F-15733/49-0001	15 amps	100 VDC	.01	.68 μf	8	20	28	38	55	70	2
MIL-F-15733/49-0006	15 amps	50 VDC	.01	1.4 μf	15	28	33	44	60	70	1

FIG. 1

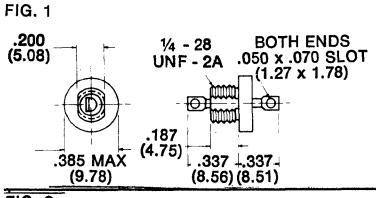
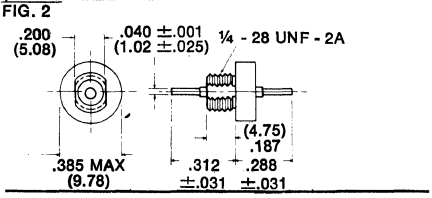
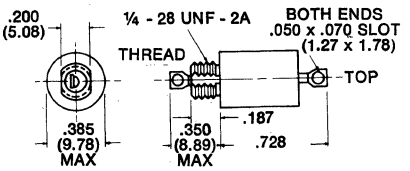


FIG. 2



IN STOCK

MIL P/N	Rated Current (Amps)	Filter Circuit	Working Volts 125°C		Max. Voltage Drop	Insertion Loss (dB) Per Mil-Std-220					
			AC	DC		75 kHz	150 kHz	300 kHz	1 MHz	10 MHz	1 GHz
MIL-F-15733/26-0001	1	L-1	125	150	.25	—	13	24	45	80	70
MIL-F-15733/26-0003	1	L-2	125	150	.25	—	13	24	45	80	70
MIL-F-15733/26-0004	3	L-1	125	150	.15	—	8	15	30	68	70
MIL-F-15733/26-0006	3	L-2	125	150	.15	—	8	15	30	68	70
MIL-F-15733/26-0007	5	L-1	125	150	.075	—	8	14	25	58	70
MIL-F-15733/26-0010	5	L-2	125	150	.075	—	8	14	25	58	70



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METUCHEN CAPACITORS INC.

ECONOMICAL PASS BAND FILTERS

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MasterCard VISA

FOR ADDITIONAL INFORMATION SEE OUR DATA PAGES IN THE CONNECTOR SECTION VOLUME C PAGES C•1468 - C•1471

Spectrum designs and manufactures a variety of pass band filters for featuring low loss and a virtually flat pass band and high performance in the reject band. These filters are excellent performers for data transmission networks.

SINGLE LINE PASS BAND FILTERS

SPECTRUM PART NUMBER	FIG	RATED DC CURRENT	WORKING VOLTAGE 125°C	PASS BAND	LOAD AND SOURCE IMPEDANCE	MINIMUM INSERTION LOSS (db) NO LOAD PER MIL-STD-220			
						20 MHz	50 MHz	100 MHz	1 GHz
52-706-301	1	30 ma	100 VDC	DC-10MHz<3db	50	12	30	48	70
52-706-306	1	30 ma	100 VDC	DC-1MHz<3db	50	70	70	70	70
52-706-309	1	50 ma	100 VDC	DC-2.5MHz<3db	50	50	70	70	70
52-706-310	1	30 ma	100 VDC	DC-33MHz<3db	75	—	—	8	70
52-706-304	2	30 ma	100 VDC	DC-30MHz<3db	50	—	10	30	60
52-713-301	3	30 ma	100 VDC	DC-100KHz<3db	600	70	70	70	70
52-713-302	1	10 ma	200 VDC	DC-1MHz<3db	600	—	—	43	70

*LINE TO LINE

52-706-301, 306, 309, & 310
52-713-302

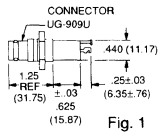


Fig. 1

52-706-304

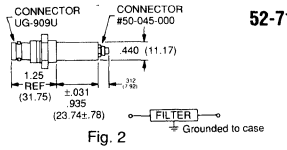


Fig. 2

52-713-301

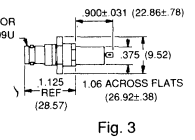


Fig. 3

UG909/U mating connector is UG-88

DUAL LINE PASS BAND FILTERS

*All mating connectors available from stock

SPECTRUM PART NUMBER	FIG	RATED DC CURRENT	WORKING VOLTAGE 125°C	PASS BAND	LOAD AND SOURCE IMPEDANCE	MINIMUM INSERTION LOSS (db) NO LOAD PER MIL-STD-220			
						20 MHz	50 MHz	100 MHz	1 GHz
52-792-001	1	150 ma	100 VDC	DC-8 KHz <3db	93	10	30	50	70
52-792-003	2	150 ma	100 VDC	60K-8M <3db	93	10	30	50	70
52-793-003	3	150 ma	100 VDC	DC-10MHz <3db	93	—	10	25	60

NOTE: PASS BAND MEASURED IN DESIGN IMPEDANCE ATTENUATION CHARACTERISTICS MEASURED PER MIL-STD-220

*LINE TO LINE

52-792-001

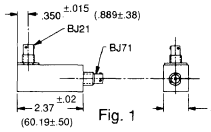


Fig. 1

52-792-003

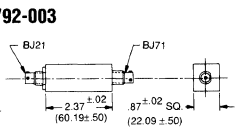


Fig. 2

52-793-003

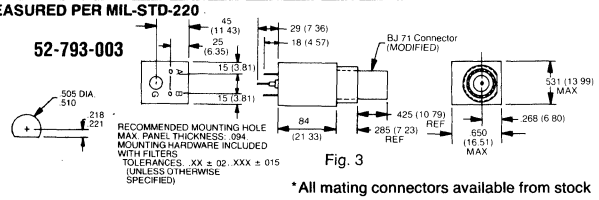


Fig. 3

POWER LINE FILTERS

*All mating connectors available from stock

SPECTRUM PART NUMBER	CURRENT RATING	VOLTAGE RATING	TEMPERATURE RANGE	DCR MAX. (ohms)	LEAKAGE CURRENT MAX	MINIMUM INSERTION LOSS (db)						
						50 KHz	150 KHz	300 KHz	1 Mhz	10 MHz	100 Mhz	1 GHz
52-378-001	3 amps	240 VAC 60 Hz Line to Line	−55°C to 85°C	.3	50 MA	40	70	80	80	80	70	60
52-378-002	5 amps	240 VAC 60 Hz Line to Line	−55°C to 85°C	.2	50 MA	24	60	0	80	80	70	70
52-387-010	10 amps	240 VAC 60 Hz Line to Line	−55°C to 85°C	.2	50 MA	24	60	70	80	80	70	70
52-409-001	14 amps	240 VAC 60 Hz Line to Line	−55°C to 85°C	.04	50 MA	14	30	45	80	80	70	60

52-378-001 & 002

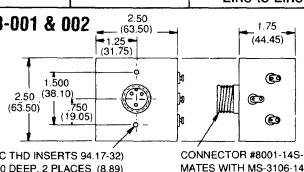


Fig. 1

52-387-010

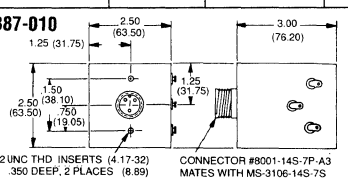


Fig. 2

52-409-001

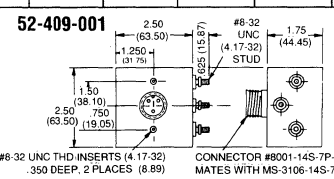


Fig. 3

BJ21 mating connector is PL20
BJ71 mating connector is PL75

HIGH PERFORMANCE POWER LINE FILTERS

*All mating connectors available from stock

SPECTRUM PART NUMBER	FIG	CURRENT RATING	VOLTAGE RATING	TEMPERATURE RATING	DCR MAX (ohms)	LEAKAGE CURRENT (MAX)	MODE	MINIMUM INSERTION LOSS (db) PER-MIL-STD-220							** GASKET SUPPLIED
								50K	150K	300K	1M	10M	100M	1G	
52-523-002	1	5A	120/240 VAC 60 Hz	−40°C to +65°C	.25	1 ma	COMM	—	55	60	80	80	70	60	572047-00532-03*
							DIFF	—	50	60	80	80	—	—	572016-00456-10**
52-600-001	2	5A	120/240 VAC 60 Hz	−40°C to +65°C	.20	1 ma	COMM	33	65	80	80	80	80	60	572047-00525-03*
							DIFF	37	65	80	80	80	—	—	
52-600-002	2	10A	120/240 VAC 60 Hz	−40°C to +65°C	.05	1 ma	COMM	—	50	70	80	80	70	60	572016-00457-10**
							DIFF	25	50	75	80	80	—	—	

52-523-002

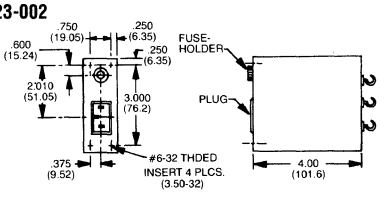


Fig. 1

52-600-001 & 002

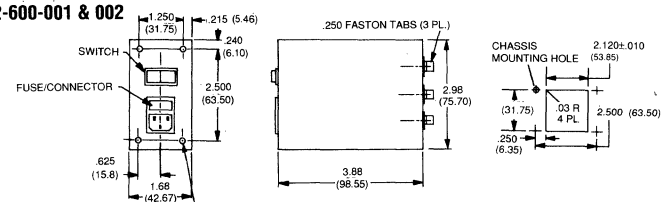


Fig. 2

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/908-679-3366/FAX 908-679-3222

RF/Microwave Filters In A Hurry For Customers In Trouble

FILTERS FOR DEFENSE & INDUSTRY
1 MHZ TO 26 GHZ

SINCE 1967

Need a *fast* quote or feasibility estimate? Need a one-of-a-kind filter - FAST? Need thousands? Phone or FAX us TODAY!

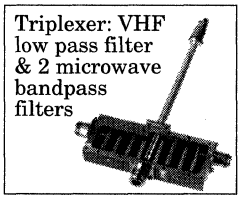
We're HYPER:
- Quotes within 48 hours - often during first contact if we find a "have done". Quote often includes a performance simulation from our sophisticated computer aided design-test system.
- Most one-of-a-kind deliveries are 30 days - faster "crash" deliveries are available.
- Short lead times for quantity orders.

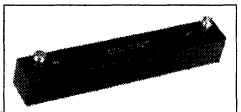
We speak all filter dialects:

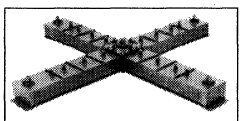
Types

High Pass	Tunable Notch
Low Pass	Tunable Bandpass
Bandpass	High Power
Bandreject	Filter Nets
Diplexers	

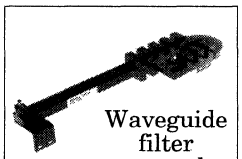

Notch Filters Tunable 30-900 MHz

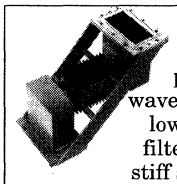

Triplexer: VHF low pass filter & 2 microwave bandpass filters

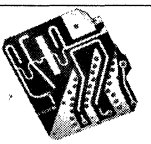

1000 Watt low pass filter 150 MHz

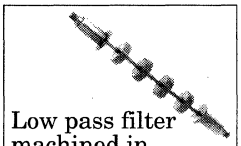

8016(4) Four-channel combiner

"We Make Your Non-Standard - FAST!"

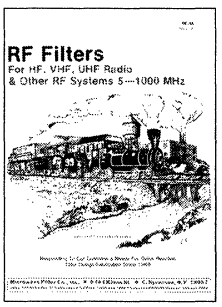

Waveguide filter network


High power waveguide low pass filter has stiff skirts


Stripline filter network


Low pass filter machined in one piece

Filters For All Applications In RF & Microwave: CATV, SMATV, In-House TV/LAN, Satellite, LPTV, FM/TV Broadcast, Mobile Radio, Microwave TV (ITFS/MMDS), RF/MW Communications, Radar, Navigation, Electronic Warfare, Medical/Physics Research

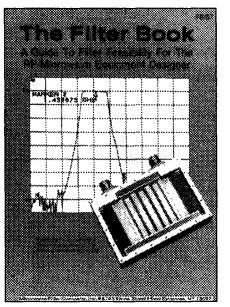


Have an Urgent requirement NOW?
Phone or FAX your FREE consultant:
Ask for an RF ENGINEER.

Ask For Them!

Catalog RF/88 - RF Filters For HF, VHF, UHF Radio & Other RF Systems.

Handbook FB/87 Guide to Specifying Microwave Filters



MICROWAVE FILTER COMPANY, INC.
6743 Kinne Street•East Syracuse, NY 13057

Toll Free(US/Can): 1-800-448-1666 **FAX: 315-463-1467**
Collect(NY/AK/HI): 315-437-3953 **Telex: 249-613**

RF/Microwave Filters In A Hurry For Customers In Trouble

Tunable Notch Filters 22 - 900 MHz

For suppression of interference to electronic systems:

•VHF/UHF Systems •Broadband LAN •Mobile Radio •Paging •CATV •FM •TV

The 6367 series comprises 6 separate tunable notch filters, each of which covers an approximately 2:1 frequency range with adjustable 3 dB bandwidth.

In CATV, LAN or other Broadband Data Systems, adjacent channel or FM carriers often interfere with reception of a desired channel or data frequency. The notches offer a convenient means of suppression.

Paging Transmitters often overload CATV and other off air reception systems. The exact frequency is often unknown to the offended party. These filters offer a convenient means of "search and suppress."

intermodulation in their front end, due to reception of a strong, unwanted carrier. These filters offer "front end" insurance against such intermodulation or desensitization.

Laboratory applications include suppressing discrete, unwanted carriers to increase the accuracy of spectrum noise measurements.

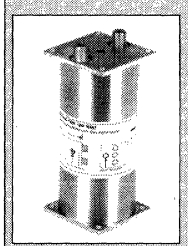
Standard models delivered in 3 days.

Need FASTER delivery? Need a SPECIAL notch filter?

Need any kind of filter 1 MHz - 26 GHz?
Then PHONE or FAX NOW!
Ask for an RF Filter Engineer.

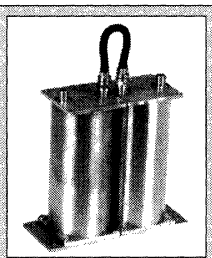
Tunable Notch Filter Type 6367

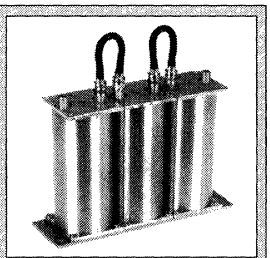
Standard Models 6367



Model #	Tunable (MHz)
6367-0	22 - 35
6367-1	30 - 50
6367-2	50 - 108
6367-3	108 - 216
6367-4	216 - 450
6367-5	450 - 900

Bandwidth Adjustment
1-5 MHz min.
Notch 20 dB approx. for Bandwidth=3 MHz
Standard:
75 ohm F conn.
50 ohm BNC



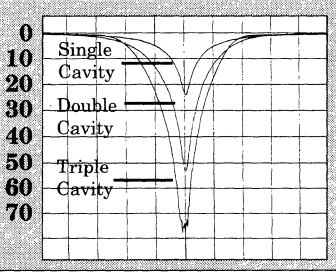


Special models available, including double and triple resonator types with 40 dB and 60 dB notches.

Other connectors available including SMA, TNC, N, C, UHF.

Standard Models $152.00 - 3 Days Delivery
Overnight delivery available.

"We Make Filters In A Hurry For Customers In Trouble!"



Response of single, double and triple cavity notches with same 3 dB bandwidth.

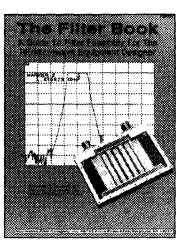
Details of 6367 series notch filters are given in FREE catalog RF/88, which also describes:

- •Low Pass/High Pass
- •High Power
- •Bandpass
- •Bandstop
- •Preselectors
- •Diplexers
- •Tunable Notch



RF/88: RF Filters
0 - 1000 MHz

Also, ask for FREE catalog The Filter Book - FB/87, a guide to specifying microwave filters.



FB/87 Guide To Specifying Microwave Filters.

Filters For All Electronic Needs: CATV, SMATV, In-House TV/LAN, Satellite, LPTV, FM/TV Broadcast, Mobile Radio, Microwave TV (ITFS/MMDS), RF/MW Communications, Radar, Navigation, Electronic Warfare, Medical/Physics Research

Microwave Filter Company, Inc.•6743 Kinne Street•East Syracuse, NY 13057

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RF/Microwave Filters In A Hurry For Customers In Trouble

Bandpass Filters For Any Job In Broadband Cable Systems

• CATV, SMATV, In-House TV, Broadband LAN, CARS Band Feeds

FAST DELIVERY - ONE WEEK OR LESS: OFTEN OVERNIGHT FOR EMERGENCIES!

We have a bandpass for *ANY* job. If not, we'll make it for you - *IN A HURRY*!

- Modulator Noise
- Agile Mod Clean-Up
- Off-Air Interference
- Processor Protection
- Sniffer Preselect
- Scrambler Behave
- CARS Band Noise
- Single Pay-TV Channel
- TVRO Block Preselect
- System Noise Test
- *Your Special Job!*

For *ANY* channel/frequency:

- Sub-Band(5- 40 MHz)
- Low-VHF(54- 88 MHz)
- FM Band(88- 108 MHz)
- Aeroband(108-118 MHz)
- Midband(120- 174 MHz)
- High-VHF(174- 216 MHz)
- Superband(216- 300 MHz)
- Hyperband(300- 550 MHz)
- UHF Band(470- 890 MHz)
- CARS Band(12.7-13.2 GHz)

You can have it NOW!

We Make Filters In A Hurry - For Customers In Trouble!

Have a BPF problem NOW? Phone or FAX - Today!

Don't forget to ask for your *FREE* copy of C/87 - the *BPF SUPERMARKET*:



Sharp 3303 for Channels in Sub, Lo, Mid, Hi and Super.



Types 4930 and 3278 for Hyper and UHF Channels.



3328 BPF for Leakage Receivers.



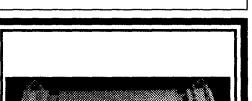
Pay -TV BPF is Pole Mounted.



Sharp BPF Selects FM Channel.



CARS Band Channel or Full Band BPF.

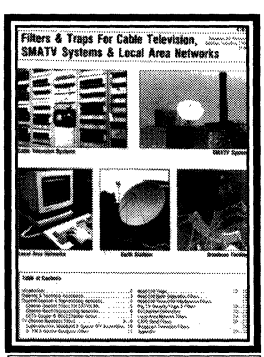


Brickwall LAN BPF Passes 246-299.75 MHz 50 dB: 244.5/301.25



TVRO Tunable BPF: Tunes 900-1450 MHz

Bandpass Filters:
- Channel BPF Standard Adjacent Cut-Off
- FM Channel Isolation Full FM Band
- Pole Mountable Pay-TV
- CARS Band Waveguide
- Carrier Isolation System Noise Test Leakage Sniffer
- Wideband: Low VHF Band Midband Hi VHF Band



Free Catalog C/87 Get It, *Now*!

Other Broadband Cable Filters In C/87:
- Filters For Channel Deletion/Reuse
- Suppressors For: Co-Channel, Radio Harmonics, Wideband Noise, Adjacent FM Channel
- Tunable Notch Filters 30-900 MHz
- Filters For Pay-TV Security
- Filters For Off-Air Interference

Filters For ANY Electronic Need: CATV, SMATV, In-House TV/LAN, Satellite, LPTV, FM/TV Broadcast , Mobile, Radio, Microwave TV (ITFS/MMDS), RF/MW Communications, Radar, Navigation, Electronic Warfare, Medical/Physics Research

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RF/Microwave Filters In A Hurry For Customers In Trouble

Channel Combiners For Wireless Cable (MMDS/ITFS) For US/Irish/Australian Systems (NTSC, PAL, SECAM)

Plus A Full Line Of Transmitter Site Accessories - Delivered FAST!

8000 series MMDS/ITFS channel and group combiners collect up to 16 non-adjacent channels to one transmission line. Typical loss of 0.6 dB across the channel is the *lowest* in industry.

9000 **directional** combiners are alternates or supplements to 8000 combiners. Use of 9000 is indicated when additional future channel identity is unknown: they are simply "patched" in the line with old channels.

Delivery of either type is 30 days *maximum* - sooner for your emergencies.

Group bandpass filters, interference notches, adapters, adjacent channel combining hybrids, MDS/MMDS diplexers and positive security systems make MFC a one-stop, fast source for all your MMDS/ITFS/MDS filter needs. We also have components for LMMDS (low power) systems.

Besides all that, we make the custom filters and accessories that only ***your*** system needs - and we do it *in a hurry*!

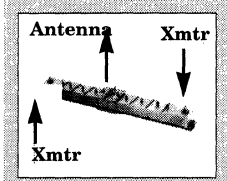
Need combiners or other operational filters *in a hurry*? Need assistance on systems planning - or becoming knowledgeable in *Wireless*?

Call Us *Now!*

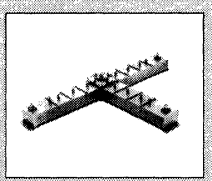
Ask For Bob Paul, Glyn Bostick or another Broadcast Products Engineer

Freq. band	Bandwidth	Type	Area
2500-2700 MHz	6 MHz	8016( )	US/CAN/SA
2300-2400 MHz	7 MHz	8017( )	Australia
2076-2111 MHz	7 MHz	8017( )	Australia
2500-2700 MHz	8 MHz	8018( )	Ireland

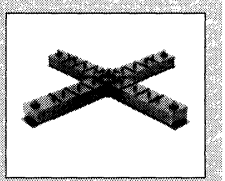
Type 8000 Channel Combiners



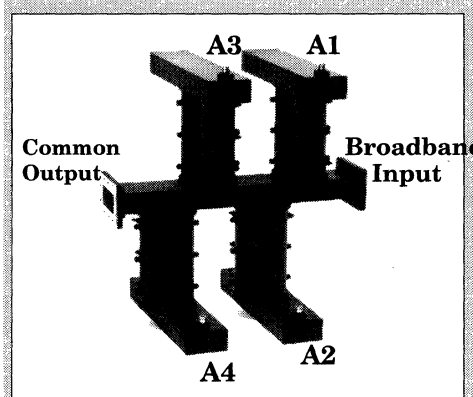
Two-Channel Combiner Can Retro-Fit To 4 Channels.



Three-Channel Combiner Can Retro-Fit To 4 Channels.



Four-Channel Combiner Can Mix Channels Of Non-Adjacent Groups.



Type 9000 Channel Combiners

Full filter line plus: Industry tutorial, channel frequencies, and resource list for legal, planning, construction and operation.



- Channel Combiners
- Channel Group Combiners
- Multichannel Systems
- MDS/MMDS Band Combiners
- Visual/Aural Combiners
- Waveguide/Coax Accessories
- Power Terminations
- Adjacent Hybrid Combiners
- TVRO Interference Filters
- CATV/SMATV/In-House TV Filters

FREE Handbook/Catalog Wireless/90, **Ask For It!**

Filters For:

CATV, SMATV, In-House TV/LAN, Satellite, LPTV, FM/TV Broadcast, Mobile Radio, Microwave TV (ITFS/MMDS), RF/MW Communications, Radar, Navigation, Electronic Warfare, Medical/Physics Research

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RF/Microwave Filters In A Hurry For Customers In Trouble

"Brickwall" TV Channel Deletion Filters
- For New Data/Program Insertion

Single or Multiple Channels
- For CATV, SMATV, Security, In-House TV and Broadband LAN Systems

The *originator* and still the only source for *any* channel 5-450 MHz - *Sub, Low, FM, Mid, Super, Hyper* (even *UHF* - on *Special* order).

Delivery : 1 Week - or *Faster!*

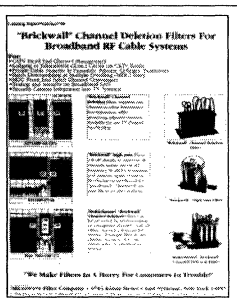
"We Make Filters In A Hurry - For Customers In Trouble!"

Plus custom *"Brickwall"*:
- *Low Pass Filters*
- *High Pass Filters*
- *Multiple, Contiguous Channels*
- *Multiple, Scattered Channels*

Options Available:
- *Weatherized Housings*
- *High AC/DC Current Passing*
- *Switch in/out of line*

Urgent Requirement *NOW*? Phone or FAX a Notcher Engineer - *TODAY*!

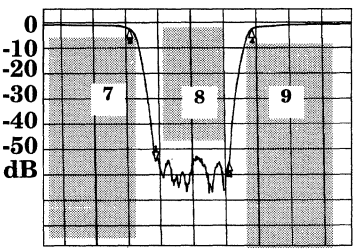
Get our Free Notcher Application Catalog/Handbook *SuperNotcher/91*



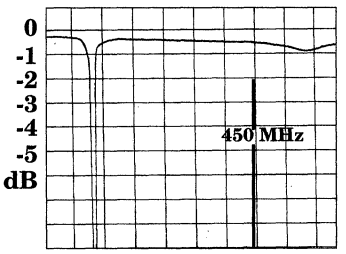
Catalog/ Handbook SuperNotcher/91

Applications:
- *Single Channel*
- *Multiple Channel*
- *Low Pass/High Pass*
- *Broadband Sweeps*

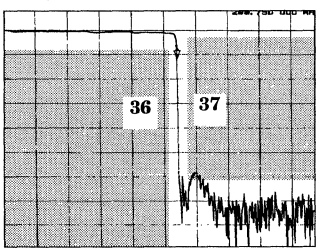
Networks:
Closed Circuit
Batch Descramble
Batch Rescramble
Batch Convert
- *Weatherized Cases*
- *AC/DC By-Passes*
- *In/Out Switching*
- *World Channel Data*



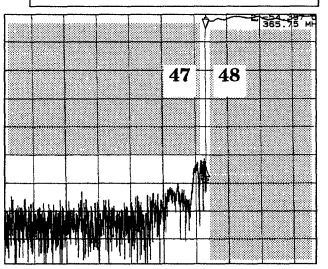
Single Channel 50 dB Notch, Leaves Adjacents In Service 3271ABH-8



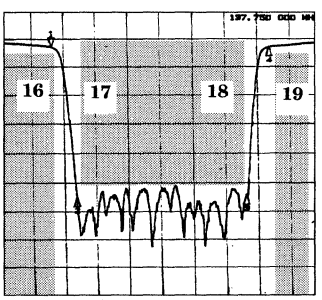
Low Off Notch Attenuation To At Least 450 MHz Type3271ABH-8



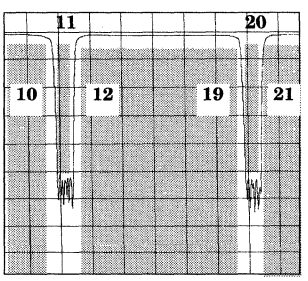
Brickwall LPF 6211LP-36/37 Passes Channel 36 Down, 50 dB Channel 37 Up



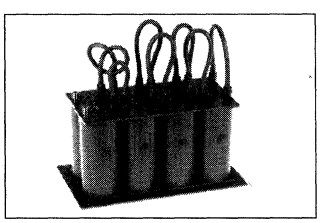
Brickwall HPF 6211HP-47/48 Passes Channel 48 Up, 50 dB Channel 47 Down



Contiguous Multichannel Type 7964-17/18

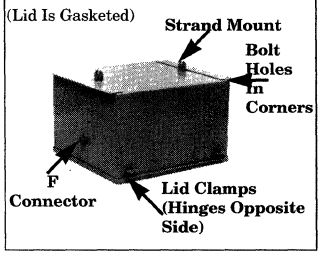


Scattered, Multichannel Type 6971-(2)(11,20)(450)



Single Channel Hyperband 3271ABY-FF

Weatherized Box (Example)



Filters for All Electronic Needs: CATV, SMATV, IN-HOUSE TV/LAN, SATELLITE, LPTV, FM/TV BROADCAST, MOBILE RADIO, MICROWAVE TV (ITFS/MMDS), RF/MW COMMUNICATIONS, RADAR, NAVIGATION, ELECTRONIC WARFARE, MEDICAL/PHYSICS RESEARCH

Microwave Filter Company, Inc. • 6743 Kinne Street • East Syracuse, New York 13057
Toll Free (USA/CAN): 1-800-448-1666 • Collect (NY/HI/AK): 315-437-3953 • FAX: 315-463-1467 • Telex: 249-613

RF/Microwave Filters In A Hurry For Customers In Trouble

Phase Out *"Unfilterable"* Off Air Interference To CATV/Broadcast/Mobile

Suppress Unwanted Receptions Too Close To Desired Signals For Filters:
Co-Channel • Ghosting • Harmonics • Wideband Noise • UHF-TV Sidebands • Adjacent FM

Choose the correct model 2903 "Phase Canceler", hook it up with a second antenna and cancel the unwanted reception at your radio receiver or CATV, SMATV or In-House TV System processor. No matter how close the bad signal is to the desired: *Even if at the **same** frequency!*

Standard Models available for bands 54-890 MHz. Special models feasible into microwave (for 4 GHz wideband interference, for example).

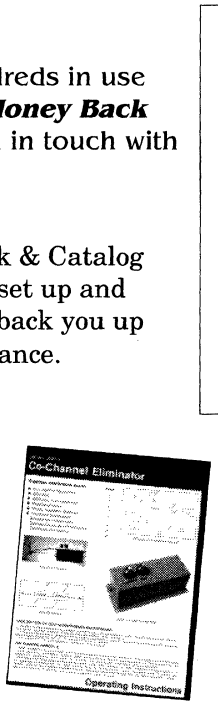
Standard models 1 week or less - overnight for your emergencies. Special models 30 days or sooner.

"We Make Filters In A Hurry For Customers In trouble!"

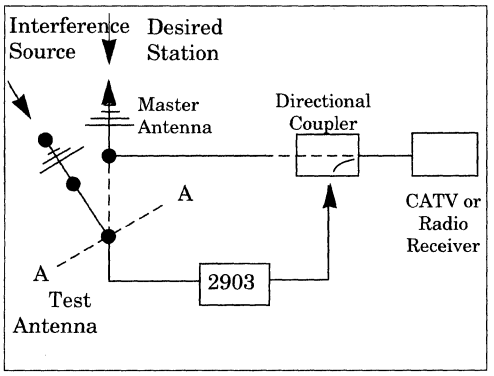
Does it really work? Hundreds in use since 1976 - sold with a ***Money Back Guarantee!*** We'll put you in touch with users with *your* problem.

Free Application Handbook & Catalog ***Phase Canceler/90*** gives set up and operating details - and we back you up with ***Free*** telephone assistance.

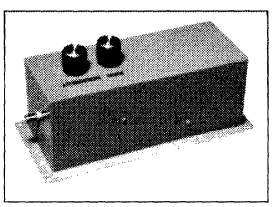
- Theory of Operation
- Detailed Set-Ups
- Detailed Operating Instructions
- Application to CATV
- Application to Co-Located Radio transmitter/receiver
- Application to TVRO Wideband Interference



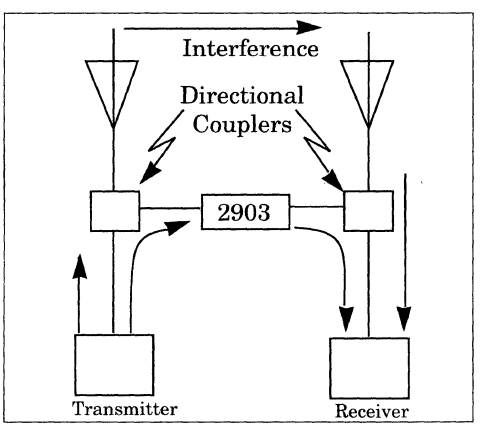
Phase Canceler/90
Get Your Copy Today!



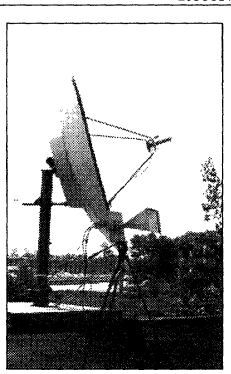
Phase Canceler applied to suppressing interference at CATV systems or radio receiving sites with distant interference source.



Model#	Operating Band (MHz)
2903-2/6	54-88
2903-FM	88-108
2903-A/I	120-174
2903-7/13	174-216
2903-UL	470-680
2903-UH	680-890



Phase canceler suppressing interference at duplex transmitter/ receiver systems: strong co-located transmitter signal is the problem.



Set up for suppressing wideband (digital) TI on 4 GHz TVRO.

Filters For All Electronic Needs: CATV, SMATV, In-House TV/LAN, Satellite, LPTV, FM/TV Broadcast, Mobile Radio, Microwave TV (ITFS/MMDS), RF/MW Communications, Radar, Navigation, Electronic Warfare, Medical/Physics Research

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RF/Microwave Filters In A Hurry For Customers In Trouble

TV Channel Combiners For Low Power TV (LPTV) Stations And Translators

For VHF, UHF Channels, 10 - 1,000 Watts-Per-Channel

"We Make Filters In A Hurry For Customers In Trouble!"

VHF 100 watt-per-channel combiners combine up to three non-adjacent channels in the low VHF band (Type 8604 for 2-6) or any four non-adjacent channels in the VHF high band (Type 8642 for 7-13).

A high-low band combiner (8606-124) allows mixing low and high band channels on a single tower cable.

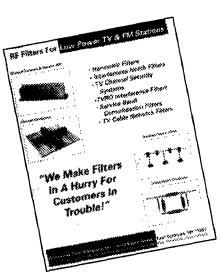
UHF 100 watt/channel combiners (Type 3854) and 1000 watt/channel combiners (Type 6464) combine up to four non-adjacent channels 14-69.

Custom units combining more than 4 UHF channels and units to combine the VHF and UHF bands onto one cable can be supplied.

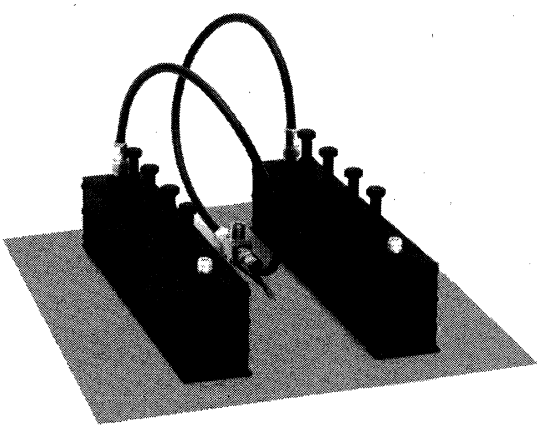
Catalog LPTV/90 gives details of these combiners, plus a full line of LPTV functional station filters.

Have A RUSH Requirement?
PHONE or FAX Us TODAY!

Ask For Your FREE Copy Of LPTV/90!

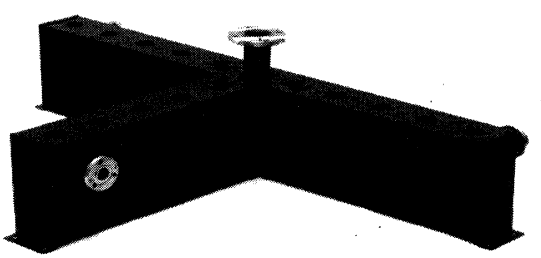


- Channel Combiners
- Channel Bandpass: Receive or Transmit
- Video/Audio Combiners
- Sideband Notch Filters
- Low VHF/High VHF Diplexer
- FM Harmonic Filters 500-50,000 watts
- Tunable RF Notches
- Mobile Interference Canceler
- TVRO Interference Filters



Example

Channel VHF Channel Combiner 8604-2/4 Combines Channels 2 and 4 at 100 Watts/Channel.



Example

Channel UHF Channel Combiner 6464(3)(32, 35, 38, 41) Combines 4, 1000 Watt Channels (32, 35, 38 and 41).

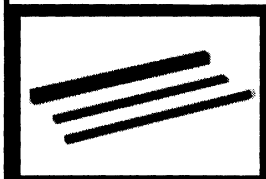
Filters For ALL Electronic Applications: CATV, SMATV, In-House TV/LAN, Satellite, LPTV, FM/TV Broadcast, Mobile Radio, Microwave TV (ITFS/MMDS), RF/MW Communications, Radar, Navigation, Electronic Warfare, Medical/Physics Research

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...And Microwave Absorbers Fast For Customers In Trouble

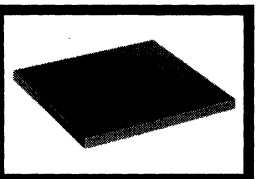
FERROSORB™ MICROWAVE ABSORBER

MATERIAL AND ELEMENTS FOR COAXIAL AND WAVEGUIDE CIRCUITS



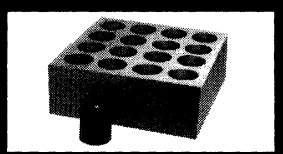
12" Bars:
Round
Square
Rectangular

Plates:
To 12" Square
To 1" Thick



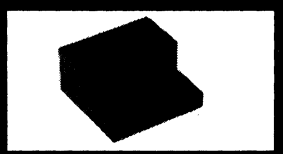
2-Part Castable Quarts:
FERROFLOW™ Cures
(Magnetic) Rigid



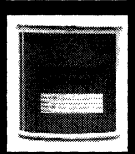


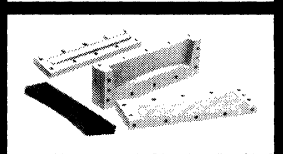
2-Part Castable Quarts:
CARBOFLOW™ Cures (Non-
Magnetic) Rigid

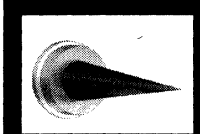


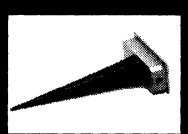


2-Part Castable Quarts:
FLEXFLOW™ Cures
(Magnetic) Flexible



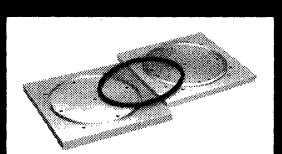




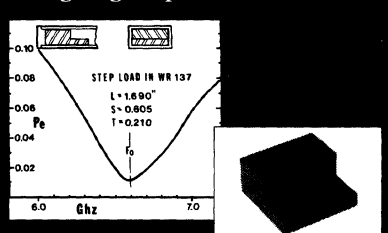


Waveguide Terminations:
Rectangular: Guide: WR42-284
Circular: Guide: 0.375-3.0" dia.

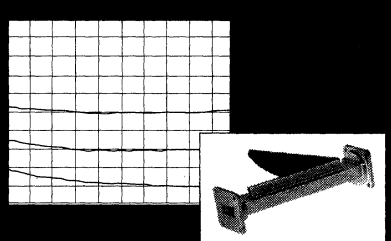
F/81 shows how to make molds
and to cast parts.



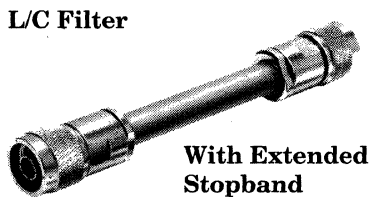
Designing Step Loads



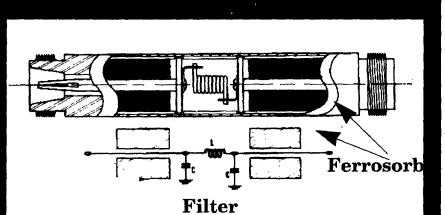
Ferrosorb Variable Attenuator



L/C Filter



With Extended
Stopband



FERROSORB™ is used to fabricate terminations, attenuators or spurious energy suppressors 1-26 GHz by casting or machining:

RIGID, machinable stock comes in plates, rods and square or rectangular bars.

FERROFLOW™ and CARBOFLOW™ are two part casting systems to produce rigid magnetic and non-magnetic parts. Two part system FLEXFLOW™ produces flexible parts such as gaskets for double duty: sealing against moisture and RF leakage.

FREE design handbook and catalog F/81 describes these materials in detail: physical properties to machine and cast them - including mold design.

Also described is a standard line of low VSWR terminating inserts for rectangular waveguide WR42 - WR284 and circular waveguide 0.375" - 3.00" diameter.

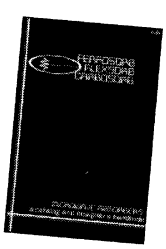
The design section shows how to design low VSWR coax/waveguide loads, including sliding elements for calibration, elements for variable coax and waveguide attenuators, coaxial amplitude compensators, waveguide absorptive harmonic filters and spurious energy absorbers for cavities, probes and filters.

Our ability to custom design-build-test new absorbers from your "Black Box" specs is illustrated with a variety of special parts from our 23 years of designing microwave components and equipment for defense and industry.

Need a SPECIAL product or RUSH standard? We quote specials 48 hrs. or sooner and standards during your first contact. Delivery is less than 1 week for standards and 30 days MAX for most SPECIALS.

PHONE or FAX NOW - ask for a MICROWAVE ABSORBER ENGINEER.

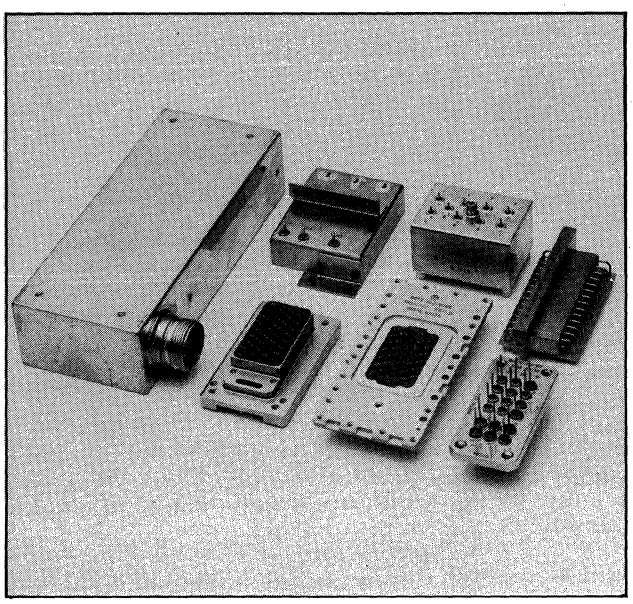
And Get Your Copy Of FREE DESIGN HANDBOOK and Catalog F/81!



MICROWAVE FILTER COMPANY, INC.•6743 KINNE STREET•EAST SYRACUSE, NY 13057
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CUSTOM DESIGNED FILTER NETWORKS AND ARRAYS

MURATA ERIE NORTH AMERICA

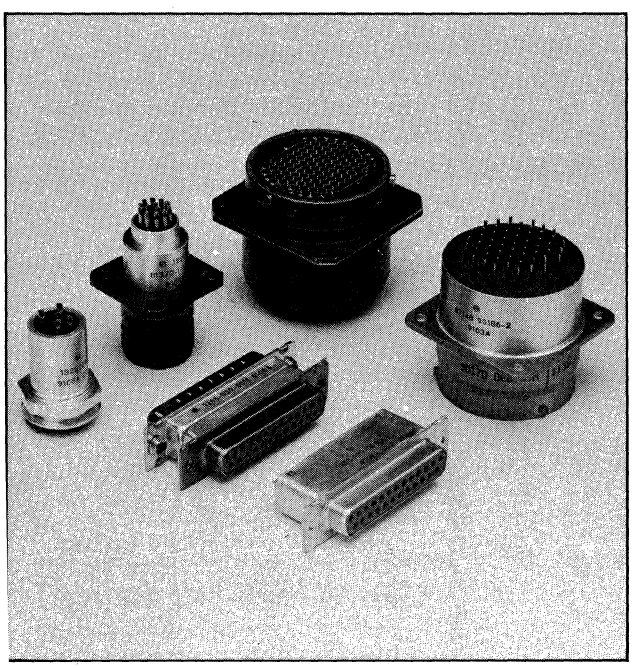


Murata Erie specializes in developing sophisticated circuit designs and creating high component density packaged networks and arrays. And Murata Erie does it all...in-house. Our engineering design teams analyze individual customer problems, design specific components or networks to solve the problem, build prototypes and test the complete system.

To support the high technological content of these custom networks, the engineering and test capabilities at the Murata Erie facility have become one of the most advanced in the industry today. The reliability of every component and network is assured by a comprehensive battery of tests performed under carefully controlled conditions. Then, in-line prototype techniques further validate component performance prior to volume production.

These technical support activities permit Murata Erie to respond to customer needs promptly and efficiently with positive performance engineered into the customer's system. If your requirements are unique, if you have a critical space, weight or environmental problem, Murata Erie can help solve your specific requirements for you with a custom designed filter network.

FILTERED CONNECTORS



Murata Erie does not usually manufacture the connector itself but procures a fully qualified connector and adds the filter elements to it. This "Piggy-Back" construction offers the best of two worlds, a connector manufactured by experts in their field and filters manufactured by Murata Erie who are also experts in their field, a tough combination to beat.

Murata Erie's mechanical and electrical engineering teams have developed this product line with two main goals in mind. First to offer you a package that is as electrically efficient as possible and secondly to environmentally protect this package by completely encapsulating it in a specially formulated epoxy, developed and tested over many years.

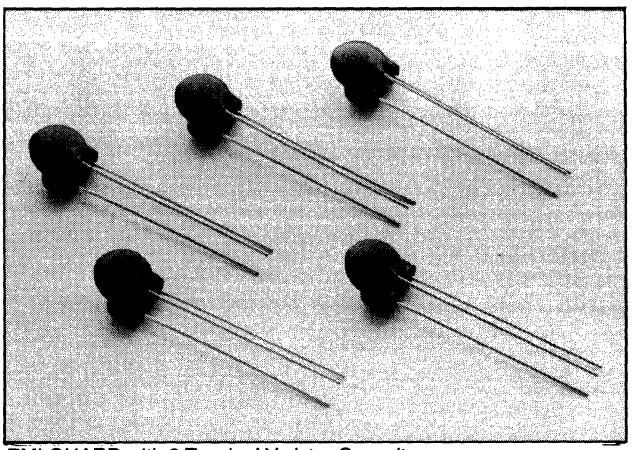
Murata Erie achieves its first goal of electrical efficiency by soldering every junction between all active components. This results in the absolute best grounding technique available to you. Just as one would not rely on a capacitor mounted on a P.C. Board by mechanical means to maintain its electrical integrity in a critical circuit, we, at Murata Erie, do not rely on mechanical grounding as others do to provide the various insertion loss characteristics required. The solder construction and complete encapsulation results in a filter connector that is more than capable of withstanding the many complex electrical and environmental requirements that have become commonplace in our sophisticated electrical society.

Filter connectors are available to meet the following MIL specifications: MIL-C-5015 MIL-C-83723 MIL-C-26482 MIL-C-38999

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

EMI/RFI SUPPRESSION FILTERS

MURATA ERIE NORTH AMERICA



EMI-GUARD with 3 Terminal Varistor-Capacitor

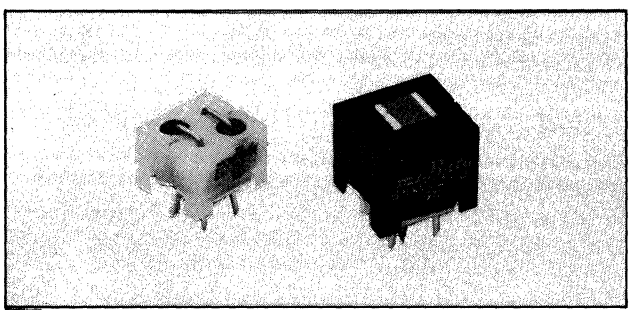
EMI-GUARD DSS710 D 223S 12-22

The DSS710 EMI-GUARD uses a new capacitor element which provides the varistor function. THis varistor-capacitor not only works as a bypass capacitor but also lets most high-voltage surges flow to ground.

The varistor-capacitor used in the DSS710 EMI-GUARD has a 3-terminal structure so that its high frequency functions are substantially better than those of conventional capacitors. Furthermore, it is combined with ferrite beads to form a T-type filter circuit that more effectively dampens noise.

The DSS710 EMI-GUARD efficiently removes quick-rising surges and high-frequency noise above 50 or 60 MHz which conventional capacitors and varistor-capacitors are incapable of removing.

Varistor capacitors are used even where EMI filters fail. They are self-healing and effective in circuits having 500-600V impulses.

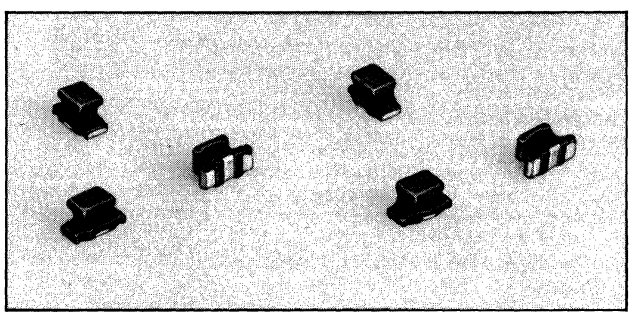


BNX [for DC power supply]

BLOCK TYPE EMIFIL®, BNP/BNX SERIES

Murata Erie's new block type EMIFIL BNP/BNX Series completely eliminates noise from extremely wide frequency bands. The BNX is perfect for use in DC power circuits, while the BNP is ideal for eliminating noise in logic signal circuits. Both are designed to perform superbly—the result of Murata Erie's wide expertise in the fields of through-type barrier layer capacitors, monolithic chip capacitors and bead inductors.

Each block contains a number of compact EMI-suppression filters. In addition, the input/output terminals and the grounding terminal are aligned in the same direction, thus permitting fast and easy assembly on any type of P.C. board.



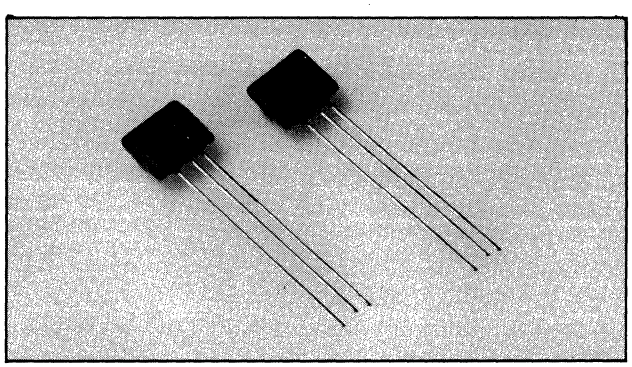
SURFACE MOUNT CHIP FILTERS, NFM52 SERIES

The NFM52R Series chip is an efficient signal line noise suppression filter for high-speed digital signal lines where base-band frequencies and noise band frequencies are very close.

Murata Erie has combined its superior ceramic technologies with a unique circuit configuration to realize outstanding noise suppression effect in these applications. The NFM52R Series assures noise reduction to meet the specifications of CISPR, FCC, etc.

APPLICATIONS

Noise suppression for compact digital instruments, laptop personal computers, HDTV, EDTV, portable VTR, etc.



SIGNAL LINE NOISE FILTER, NFV610 SERIES

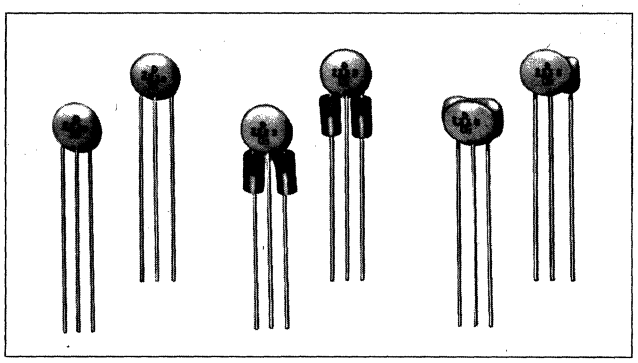
This new high performance noise suppression filter utilizes a unique circuit design and a total components concept to provide exception performance in high speed, high impedance digital signal lines. It uses considerably more components than previously available filters so that the high input and output impedances of digital IC's can be matched. This impedance matching greatly reduces the waveform distortions, created by reflections and ringing, that are apparent with convention filters.

The NFV610 Series of noise suppression filters meets all applicable specifications of the FCC, CISPR, etc.

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-303(

EMI/RFI suppression filters

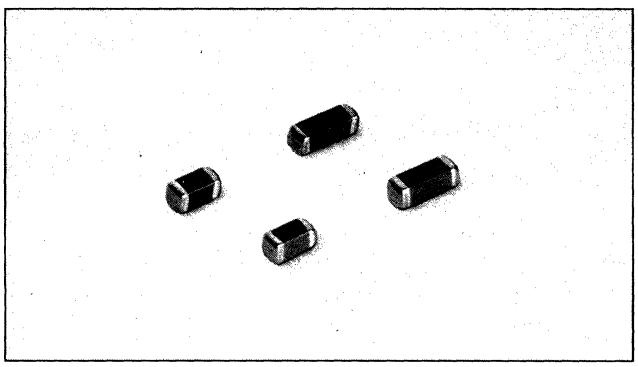
MURATA ERIE NORTH AMERICA



Disc-Type for PCB Mounting

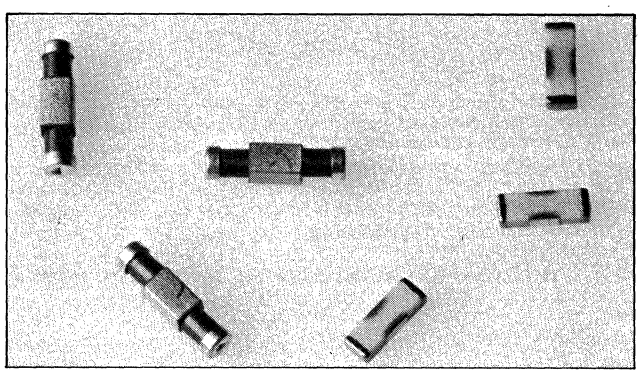
The three terminal takes advantages of lead inductance and is actually a T type filter when compared to a normal two leaded disk capacitor. The advantage is that the inherent resonance is shifted up in frequency while at the same time the attenuation above the resonant point is improved because of the inductive elements.

These parts are available with or without ferrite beads on the two outside leads which further improves the insertion loss. They are ideally suited to both DC powerline filtering and signal line filtering particularly at I/O ports.



Surface Mount Ferrite Chips

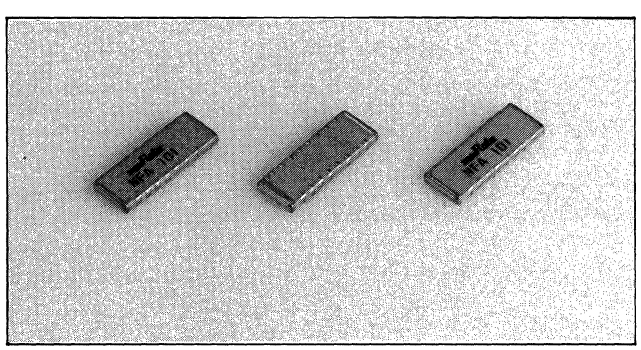
The BLM series of ferrites provides a large range of attenuation from 70 Ohms at 100 MHz to 600 Ohms at 100 MHz due to a unique internal construction. This coil like, multilayer ferrite bead is an inexpensive and effective way to attenuating noise on signal and DC powerlines without introducing any capacitance.



Surface Mount Filters

The first series of SMT filters is a three terminal chip cap, essentially a feedthru capacitor whereas the second is a three terminal T filter which has ferrites on each end of it and the third is a PI filter configuration.

The capacitive only filter, NFM41 series, is designed for low current 300mA signal line applications. The T series, NFM61R, is more suited to DC Powerline filtering because of the higher current rating of 2 amps and the T configuration which is more suited to low impedance circuits. The PI network is designed for high speed digital and video line filtering and has four specific cutoff frequencies of 10, 20, 50 and 100 MHz.



Surface Mount Filter Arrays

The NFA is similar to the NFM41 described above except that eight feedthru capacitors are built in one slab of ceramic and the BLA is a similar part except that it is ferrite. By utilizing these two components, the design engineer has the flexability of building the type of filtering circuit required by the application. These components are ideally suited to I/O filtering particularly when placed near an output connector.

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

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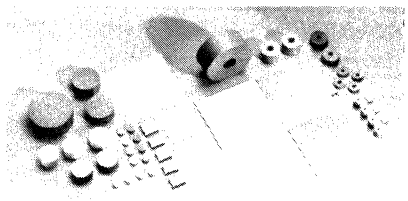
TECHNICAL CERAMICS

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99 Morris Ave., Springfield, NJ 07081 Phone: (201) 376-6070
CHICAGO OFFICE Telephone: (708) 824-1133, 1200 Business Center Dr., Suite 300, Mount Prospect, IL 60056
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MICROWAVE DIELECTRICS

☐ Resonators ☐ Substrates ☐ Metalized Substrates

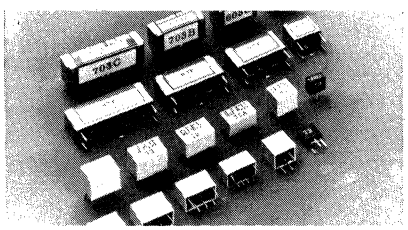
NTK offers the most complete line of high-Q Dielectrics for microwave applications available. Resonators and substrates are available in both standard and custom configurations.



455 KHZ FILTERS

☐ Miniature ☐ Surface Mount

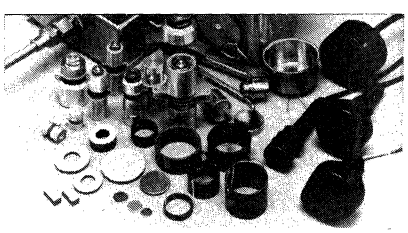
Featuring a complete line of filter characteristics, NTK's Ceramic Filters are temperature stable and cost effective.



PIEZOELECTRIC CERAMICS

☐ Lead Zirconate Titanate

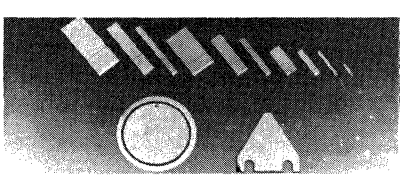
A complete family of PZT Ceramics including mil-std. compositions.

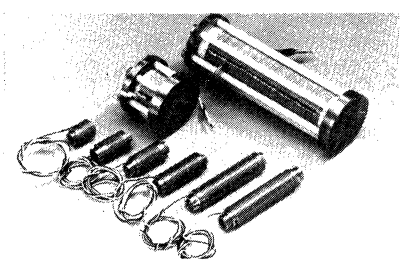


PIEZOELECTRIC ACTUATORS

☐ Bimorphs ☐ Piezo Stacks

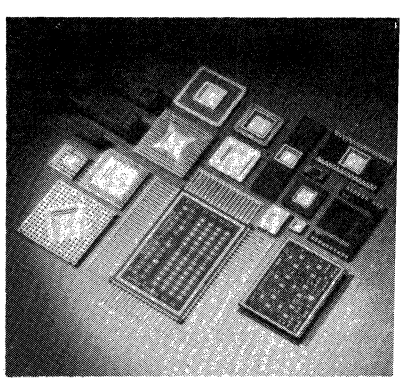
Electromechanical devices for a broad range of displacement and sensor applications.





IC PACKAGES

Making full use of the excellent electrical, heat-radiating, mechanical, and heat-resistant properties of alumina ceramics, NTK manufactures various types of IC Packages by application of its metalizing and vitrifying techniques.



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NTK

TECHNICAL CERAMICS

Since its founding in 1936, NTK Technical Ceramics has expanded its role in ceramics technology from industrial ceramics to piezoelectric and dielectric ceramics. From these new ceramics, NTK has developed a broad line of products for microwave, acoustic, electronic, and electromechanical applications. The company's substantial efforts in research and development in ceramics and related technologies has gained for NTK a position of leadership and reliability in state of the art modern technical ceramics.

PIEZOELECTRIC AUDIO TRANSDUCERS

☐ Diaphragms ☐ Buzzers ☐ Speakers
☐ Tweeter Elements

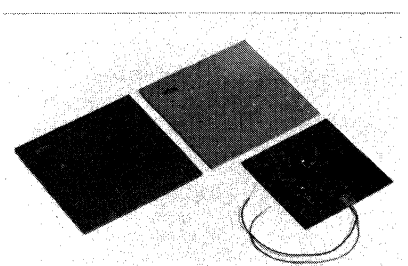
NTK offers a complete line of high efficiency sound transducers in both standard and custom designs with a wide range including single, low frequency devices to broadband voice and tweeter elements.



PIEZO RUBBER

☐ Sheet Form ☐ Wire

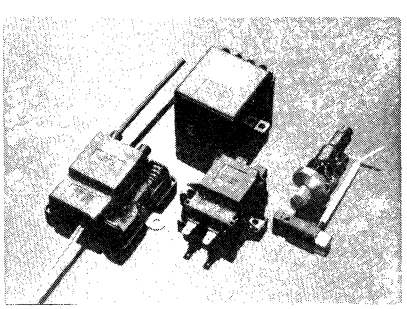
A unique, state of the art, flexible Piezoelectric material. Its durability and pressure stability make it an ideal material for advanced designs in acoustic applications.



GAS IGNITOR PRODUCTS

☐ Piezo Ignitors ☐ Electronic Ignitors

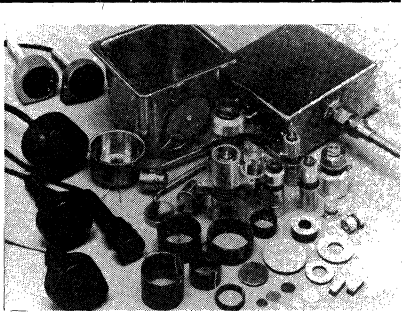
State of the art PZT materials and 20 years of experience in gas ignition applications has resulted in the most comprehensive high-rel line of components for ignition systems.



ULTRASONICS

☐ Transducers ☐ Meters ☐ Generators ☐ Cleaners

NTK's complete line of Ultrasonic Transducers and equipment include devices for air acoustics, fish finders, ultrasonic cleaners and power tools.

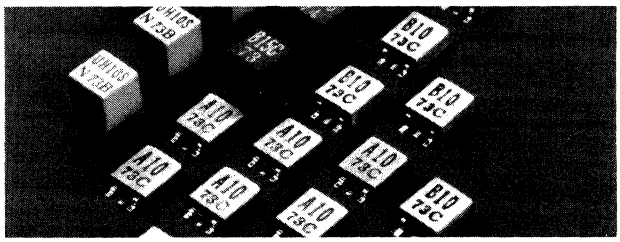


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TECHNICAL CERAMICS

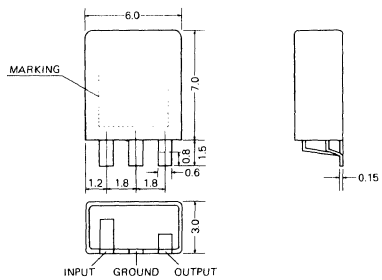
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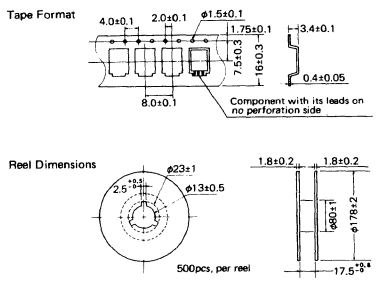
SURFACE MOUNT DEVICES 455KHZ CERAMIC FILTER MLF-B TYPE



These ceramic filters consist of three resonators. Ceramic filters are taped and reeled for automatic pick and place and I.R. reflowable. They are intended for use in circuit boards with SMD technology as an IF filter.

(Configuration/Dimensions)

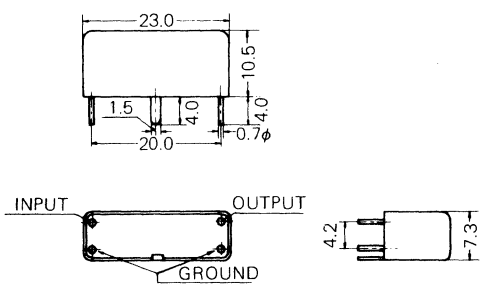




LF-E TYPE CERAMIC FILTERS

The LF-E type ceramic filter is composed of 11 resonators with ladder-type connection.
The filter features performance and size which are in between the LF-C type and the LF-D type.
This filter is recommended for use as an intermediate-frequency filter for sophisticated communications equipment.

(Configuration/Dimensions)



Characteristics / Model No.	Center Frequency (kHz)	Band Width (kHz) 3dB Min	6dB Min	60dB Max	Ripple (dB) Max	Stop Band Rejection 455kHz ± 100kHz (dB) Min	Spurious 0.1 ~ MHz (dB) Max	Insertion Loss (at 455kHz) (dB) Max	In/Out Impedance (KΩ)	Note
LF-E4	455 ± 0.75	—	± 2	± 6	3	50	40	10	2.0	S
E6	455 ± 1.0	—	± 3	± 8	3	55	45	8	1.5	T
E8	455 ± 1.0	—	± 4	±10	3	55	45	7	1.5	T
E12	455 ± 1.0	±4.5	± 6	±12	3	55	45	6	1.5	P
E15	455 ± 1.5	±5.5	± 7.5	±14	3	60	45	6	1.5	P
E18	455 ± 2.0	±6.5	± 9	±17	3	60	45	5	1.5	P
E20	455 ± 2.0	±7	±10	±19	3	60	45	5	1.5	T
E25	455 ± 2.0	±9	±12.5	±22	3	60	45	5	1.0	T

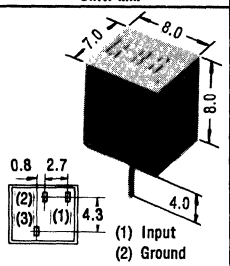
Note: P (Pager) T (Transceiver) S (SSB)

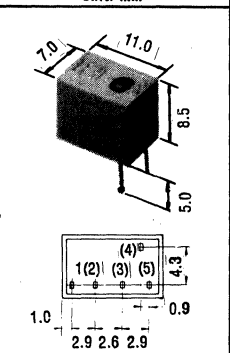
TECHNICAL CERAMICS

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NTK PIEZO CERAMIC FILTERS FOR COMMUNICATIONS

PLASTIC CASE FILTER

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−40dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-B4	455	4	15	25	9	2
	LF-B6	455	6	18	25	8	2
	LF-B8	455	8	21	25	7	2
	LF-B10	455	10	23	25	6	2
	LF-B12	455	12	26	25	6	2
	LF-B15	455	15	30	25	6	2
	LF-B20	455	20	40	25	5	2
	LF-B25	455	25	50	25	5	2
	LF-B4S	455	4	15	35	7	2
	LF-B6S	455	6	18	35	6	2
	LF-B8S	455	8	21	35	6	2

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−50dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-H4	455	4	15	40	8	2
	LF-H6	455	6	18	40	6	2
	LF-H8	455	8	21	40	6	2
	LF-H12	455	12	24	35	6	2
	LF-H15	455	15	30	35	6	1.5
	LF-H18	455	18	36	35	6	1.5
	LF-H4S	455	4	14	45	9	2
	LF-H6S	455	6	16	45	8	2
	LF-H8S	455	8	19	45	7	2
	LF-H12S	455	12	24	40	6	2
	LF-H15S	455	15	30	40	6	1.5
	LF-H18S	455	18	36	40	6	1.5
	LF-K9	400	9	@60dB 18	60	5	1.5
	LF-K12	400	12	@60dB 24	60	5	1.5
	LF-K14A	455	14	@70dB 25	50	6	1.5
	LF-K15	400	15	@60dB 30	60	5	1.5

LOW GROUP DELAY FILTERS

Dimension	Item Model	Center Freq.	−3dB BW (KHz)	−60dB BW (KHz)	Attn. (455 ±100) Min. (dB)	G.D. (μsec.) Max.	I.L. Max. (dB)	In. Out. Imp. (KΩ)
Same as CLF-D Type	CLF-G6	455	6	20	60	35	20	1.5
	CLF-G16	455	16	40	60	20	10	1.5
	CLF-G28	455	28	70	60	15	10	1.5
	CLF-G36	455	36	90	60	10	10	1.5

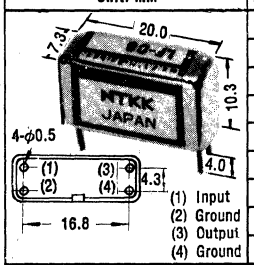
APPLICATIONS

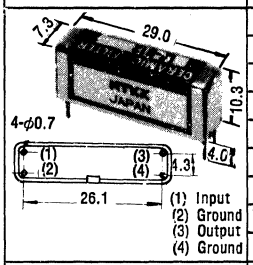
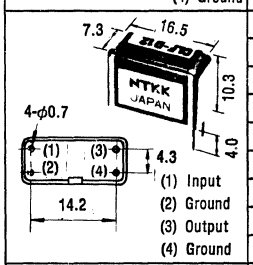
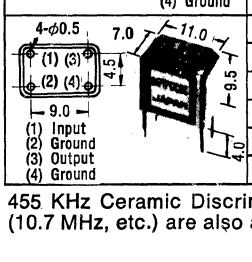
- Cordless Telephones
- Radios
- Transceivers

FEATURES

- Compact Size
- High Performance
- Low Insertion Loss

METAL CASE FILTER

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−50dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-C4	455	4	12	40	9	2
	LF-C6	455	6	16	45	7	1.5
	LF-C8	455	8	20	45	6	1.5
	LF-C12	455	12	24	45	6	1.5
	LF-C15	455	15	28	45	6	1.5
	LF-C18	455	18	30	45	5	1.5
	LF-C20	455	20	38	50	5	1.5
	LF-C25	455	25	44	50	5	1
	LF-C30	455	30	50	50	5	1

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−70dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-D4	455	4	10	70	12	2
	LF-D6	455	6	15	70	10	1.5
	LF-D8	455	8	18	70	9	1.5
	LF-D12	455	12	22	70	8	1.5
	LF-D15	455	15	28	70	7	1.5
	LF-D18	455	18	34	70	6	1.5
	LF-D20	455	20	36	70	6	1.5
	LF-D25	455	25	44	70	6	1
	LF-D30	455	30	50	70	6	1
	CLF-D2	455	2	8	60	10	2
	CLF-D4	455	4	10	70	9	2
	CLF-D6	455	6	15	70	7	1.5
	CLF-D8	455	8	18	70	7	1.5
	CLF-D10	455	10	20	70	6	1.5
	CLF-D12	455	12	22	70	6	1.5
	CLF-D15	455	15	28	70	6	1.5
	CLF-D18	455	18	34	70	5	1.5
	CLF-D20	455	20	36	70	5	1.5
	SLF-D4	455	4	10	70	9	2
	SLF-D6	455	6	15	70	7	1.5
	SLF-D8	455	8	18	70	7	1.5
	SLF-D10	455	10	20	70	6	1.5
	SLF-D12	455	12	22	70	6	1.5
	SLF-D15	455	28	28	70	6	1.5

455 KHz Ceramic Discriminators (P/N D455) and MHz Filters (10.7 MHz, etc.) are also available.

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PIEZOELECTRIC CERAMICS

■ **Properties of Piezoelectric Ceramics** ■

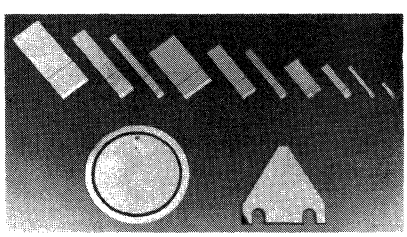
Material code	Electro-mechanical coupling coeff. K_p %	K_{31} %	K_{33} %	dielectric constant $\varepsilon_{33}^T/\varepsilon_0$	Piezoelectric constant d_{31} ×10⁻¹²m/V	d_{33} ×10⁻¹²m/V	g_{31} ×10⁻³v-m/N	g_{33} ×10⁻³v-m/N	Elastic modulus Y_{11}^E ×10¹⁰N/m²	Y_{33}^E ×10¹⁰N/m²	Mechanical Q	Density π g/cm²	Curie point Tc °C	Application
MT-107	63	34	71	1800	180	400	11.5	25	5.7	5.0	70	7.7	350	Piezoelectric elements, pick-up elements
MT-11	60	32	—	2000	180	—	10.7	—	6.3	—	80	7.5	270	Pick-up elements
MT-110	67	35	75	2400	210	450	10.0	21	5.7	5.8	75	7.8	250	Pick-up elements
MT-111H	63	34	73	3800	260	550	8.0	16	6.0	5.7	65	7.7	220	Pick-up elements
MT-114H	62	33	72	5800	310	650	6.2	13	5.9	5.5	45	7.8	110	Pick-up elements
MT-18	58	—	68	1400	104	300	8.4	24	8.1	6.3	1000	7.6	300	Ultrasonic oscillators

PIEZOELECTRIC ACTUATORS

Bimorphs

Standard dimensions and characteristics of parallel type bimorphs

No.	Model	ℓ (mm)	W (mm)	t (mm)	Capacitance (nF)	Displacement (at DC 60V) (μm)	Force (g)
1	EB-100-20MH$_2$	5	2	0.53	5.5	15	35
2	EB-200-20MH$_2$	15	2	0.53	11	120	12
7	EB-300-160MH$_2$	25	16	0.53	133	200	60
8	EB-400-40MH$_2$	35	4	0.53	44	500	10

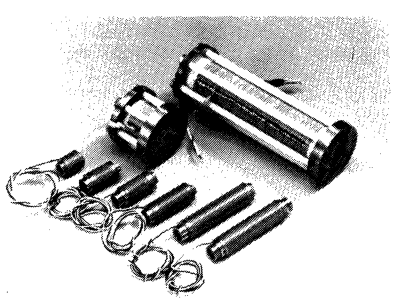


Note: The symbol ℓ indicated free length; the length of bimorph becomes ℓ + 5 since 5mm is clamped usually in the cantilever mounting.

Piezoelectric stacks

NTK standard Piezo-Stacks

Code / Item	T10505MM– 100P	F	G	A	B	K	M	N	FG1005PCC
Outer dia.	16∅ Max.								50∅
Length	72	32	45	38	74	74.5	75	39	150
Rated voltage (V)	400V.D.C.								1600
Displacement (μm)	34	7	15	9	34			9	90
Capacitance (nF)	300	75	150	100	300			100	1000



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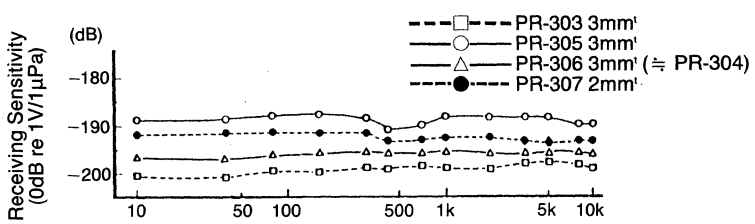
PIEZO-RUBBER

Piezoelectric flexible composites (**NTK** Piezo-Rubber) have been developed at **NTK-NGK.**
The features of **NTK** Piezo-Rubber are as follows.

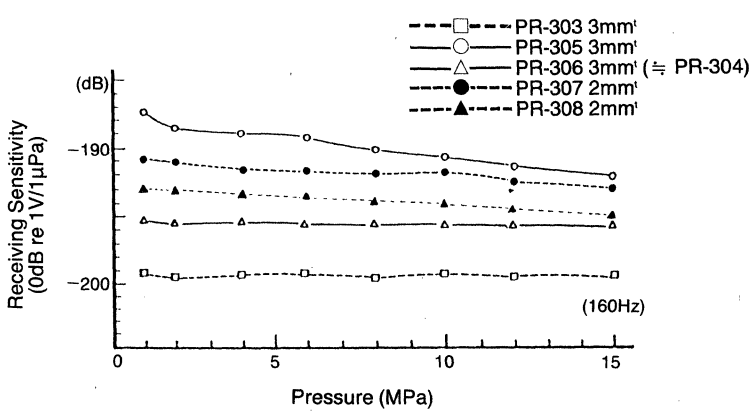
- **Flexible** not brittle.
- **Easily workable.** Can be cut easily with knife.
- **Large area sensor and laminated thick sensor**
  We can produce the Piezo-Rubber over a few hundred millimeter square and up to five millimeter thickness.
- **Large damping and flat frequency characteristics**
  Receiving waveform has high fidelity and it is used at frequency of 10 ~ 5MHz.
- **Acoustic impedance close to value of water**
  Acoustic impedance of Piezo-Rubber is about 8×10^6 Ns/m^3.

■ **Properties of Piezo-Rubbers** ■

	Piezo-Rubber (NTK)					
	PR-303	**PR-304**	**PR-305**	**PR-306**	**PR-307**	**PR-308**
ρ ($\times 10^3$kg/m^3)	5.3	5.3	5.5	5.3	5.9	6.2
c ($\times 10^3$m/s)	1.33	1.57	1.21	1.60	1.43	1.47
ρc ($\times 10^6$N = s/m^3)	7.0	8.3	6.7	8.5	8.4	9.1
ϵ_{33}/ϵ_0 [1KHz]	43	40	37	38	45	57
tanδ (%)	6	3	3	2	5	5
d_{33} ($\times 10^{-12}$C/N)	48	56	46	34	52	58
d_{31} ($\times 10^{-12}$C/N)	−15.5	−18.5	−2.5	−7.0	−4.0	−5.0
d_h ($\times 10^{-12}$C/N)	17	19	41	20	44	48
g_h ($\times 10^{-3}$V = m/N)	45	55	124	58	111	95
$d_h = g_h$ ($\times 10^{-15}$m^2/N)	765	1045	5084	1160	4884	4560



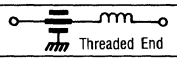
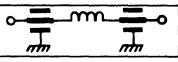
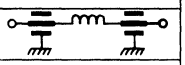
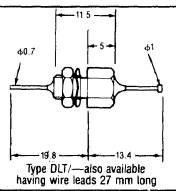
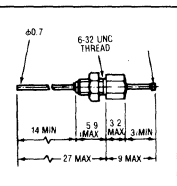
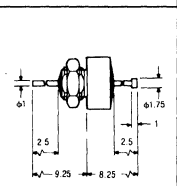
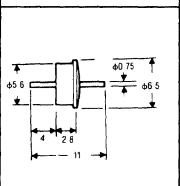
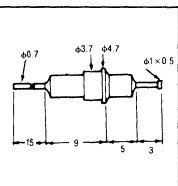
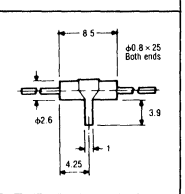
Frequency dependences of underwater receiving sensitivities of Piezo-Rubbers.



Pressure dependences of underwater receiving sensitivities of Piezo-Rubbers.

OXLEY EMI SUPPRESSION FILTERS

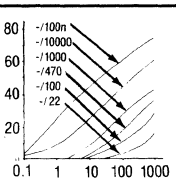
OXLEY SPECIALIZES IN THE DESIGN AND MANUFACTURE OF MILITARY FILTERS— STANDARD, CUSTOM, DISCRETE OR IN ARRAYS.

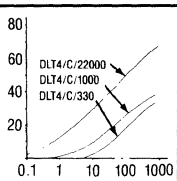
PRODUCT GUIDE	CHASSIS MOUNTING STYLES			SOLDER MOUNTING STYLES		PCB MOUNTING
Series	DLT/—/Ref 1	DLT4/L/—	DLT2/L/—	dBZ/—/Ref 1	SLT/P/—	SLT/P/—/PC2
Configuration		 Threaded End	 Threaded End			
Construction	Discoidal Monolithic Capacitor	L—C Filter Discoidal Capacitor	L—C Filter Discoidal Capacitor	Discoidal Monolithic Capacitor	Pi-Filter Tubular Capacitor	Pcb mounting Tubular pi-filter
Outline Dimensions (mm)	 Type DLT/—also available having wire leads 27 mm long					
Mounting Hole	4.6mm dia.	3.6mm dia.	6.0mm dia.	5.6mm dia.	3.7mm dia.	—
Capacitance	22pF to 0.1μF in 11 values	300pF to 22000pF in 6 values	1.2μF	22pF to 0.1μF in 11 values	680, 1500 5000pF	1500pF
Rated Voltage	100 Vd.c. (0.1μF:50 Vd.c.)	200 Vd.c.	50 Vd.c.	100 Vd.c. (0.1μF:50 Vd.c.)	200 Vd.c.	200 Vd.c.
Direct Current Rating	10A	10A	15A	10A	10A	10A
Climatic Category	40/100/21	55/125/21	55/125/21	40/100/21	40/85/04	40/85/21

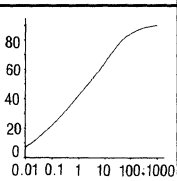
Typical insertion Loss (dB) (50Ω system) per MIL-STD-220A

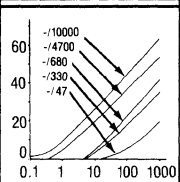
MHz	470	680	1000	10000pF	680	4700	10000pF	1.2μF	47	330pF	680	1500	5000pF	1500pF
0.01	—	—	—	—	—	—	—	9	—	—	—	—	—	—
0.10	—	—	—	1	—	—	1	28	—	—	—	—	—	—
1	—	—	—	8	—	3	8	47	—	—	—	1	4	1
10	3	4	9	27	4	21	28	58	—	2	4	12	25	22
100	20	22	27	44	24	38	48	85	5	16	35	50	70	40
1000	40	40	40	63	38	56	70	90	20	34	70	75	75	—

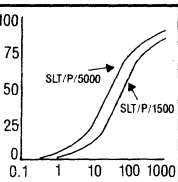
Insertion Loss (dB) vs. Frequency (MHz) db ↑ → MHz

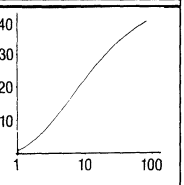








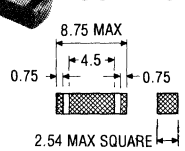




Military Approvals: Listed in QPL 15733, Approval in Progress MIL-F-28861, voltage conditioning (burn-in) is available



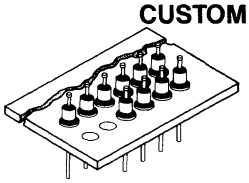
SURFACE MOUNTING PI-FILTER



TYPE SLT/P/1500/SM1

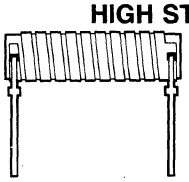
Designed for direct mounting to circuit boards, OXLEY surface mounting pi-section filters are leadless devices offering high insertion loss over a wide frequency range.

CUSTOM FILTER ARRAYS



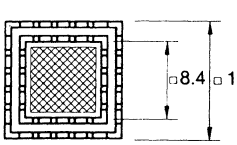
With multi-way feed-through arrays; each feed-through may be customer selected from a range of pi-filters, filter capacitors, unfiltered lead-throughs and grounding terminals.

HIGH STABILITY INDUCTORS



Featuring a precious metal alloy fired to a high purity alumina former, to provide high Q and long term stability.
Inductance range:
.045μH to 1.830μH

CERAMIC MICROWAVE PACKAGES



Oxley ceramic microwave packages have been specifically designed to meet requirements for high reliability and hermetic sealed of GaAs devices and ICs operating at X Band frequencies and beyond.

FOR OTHER OXLEY PRODUCTS SEE:
B•2440 MILITARY COMPONENTS Page **B**•1025
B•2460 INDICATOR LAMPS Page **B**•1179
B•3700 ELECTRO-OPTIC, THIN FILMS Page **B**•1335
C•2100 CONNECTORS, TEST POINTS Page **C**•1479

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OXLEY

PRECISION FILTERS

A growing selection of filters

Precise programmable filters are offered in a wide variety of types that you can mix and match within the 16 card capacity of the Precision 6000 mainframe. Filters come one, two, four or eight channels per card, depending on resolution and other performance features.

Custom systems at off-the-shelf prices

Not only can you mix various types of filters, you can also add a variety of preamps, post-amps, gain-ranging amps, and transducer amps (see Section 1100), as well as other signal conditioning devices such as frequency-band translators and switch matrices (see Section 2325).

Filter model selection guide (Filter cards plug into System 6000 mainframe.)

	6602B 6622	6604B 6624	6611A	6612A 6632	6614	6618	6694
Channels per system	32	64	16	32	64	128	64
Channels per card	2	4	1	2	4	8	4
Max cutoff freq (Hz)	204.7 k	25.575 k	2.048 M	204.7 k	32 k	12.8 k	25.594 k
Min cutoff freq (Hz)	0.1	0.1	20	0.1	1.0	1	0.25*
Bits in a range	10, 11†	10	10	10,11†	4	2	12
Filter types	HP1, LP1, TD6, HLP	HP1, LP1, TD6, HLP	HP1, LP1, TD6	HP8, LP8, TD8	HP1, LP1, TD6, HLP	HP1, LP1, TD6	NF1

* Limited use below 25 Hz. Specified performance at 25 Hz to maximum cutoff frequency.

† 11 bits on Models 6602B, 6612A, 6622, and 6632, ranges -A and -E.

Filter type selection guide

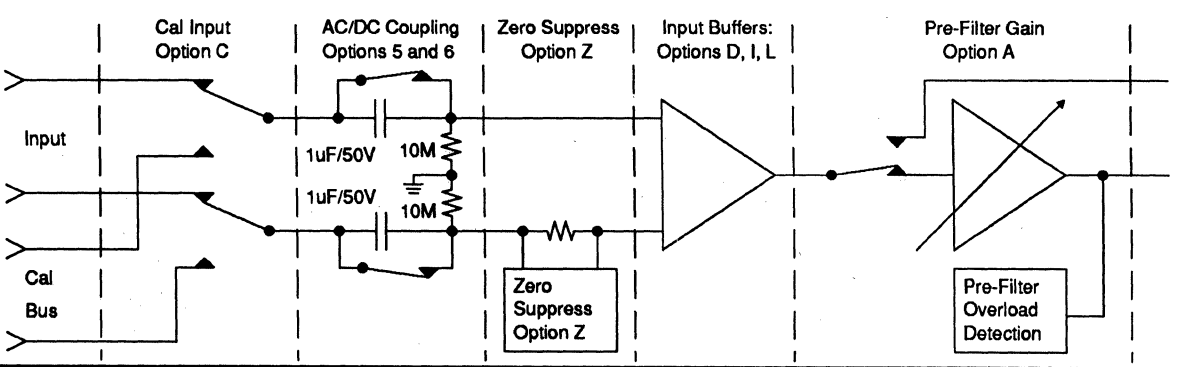
	HLP	HP1	HP8	LP1	LP8	TD6A	TD6B	TD8A	TD8B
Filter type	HP/LP	HP	HP	LP	LP	LP	LP	LP	LP
Function	*	Cauer	Cauer	Cauer	Cauer	†	‡	†	‡
Number of poles, zeros	6p,6z	6p,6z	8p,6z	6p,6z	8p,6z	6p,4z	6p,6z	8p,6z	8p,8z
Pass-band ripple (dB p-p)	0.1	0.1	0.044	0.1	0.044	–	0.2	–	0.2
Cutoff freq amplitude (dB)	–2.40	–3.01	–0.044	–3.01	–0.044	–9.61	–3.01	–10.06	–3.01
Stop-band frequency	0.383/2.61 Fc	0.508 Fc	0.637 Fc	1.971 Fc	1.569 Fc	3.535 Fc	4.893 Fc	–	3.335 Fc
Stop-band attn. (dB)	80	80.07	84.36	80.07	84.36	–	70.0	–	80.28
Attn. slope (dB/oct)	59.5	81.8	130	81.8	130	39.1	30.0	33.7	46.3

* Unity normalized natural frequencies; plug programmable for high-pass or low-pass.

† TD6A and TD8A: Bessel filter with zeros.

‡ TD6B: 6 pole Bessel w/4 stop-band zeros & 2 pass-band zeros; TD8B 8 pole Bessel w/ 6 stop band zeros & 2 pass band zeros.

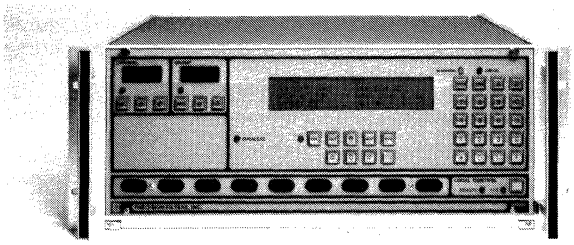
Filter Channel with Options



- See amplifier systems, transducer/amplifier systems, and auto-ranging amplifier systems in Section 1100.
- See other data acquisition systems in Section 2325.

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850
607-277-3550 Fax: 607-277-4466 Telex: 646846

PRECISION FILTERS, INC.



6602B & 6622 Dual filter/amps
80 dB/octave—204.7 kHz

Model number	Low range (Hz)			High range (Hz)		
	Min	Max	Step	Min	Max	Step
A	1.0	2047.0	1.0	2100	204,700	100
B	1.0	1023.0	1.0	1100	102,300	100
C	0.1	102.3	0.1	110	10,230	10
E	0.1	204.7	0.1	210	20,470	10
I				100	204,700	100
J				100	102,300	100

6604B & 6624 Quad filter/amps
80 dB/octave—25.575 kHz

Model number	Low range (Hz)			High range (Hz)		
	Min	Max	Step	Min	Max	Step
A	1.0	1023.0	1.0	1025	25,575	25
B	0.1	102.3	0.1	110	1,230	10
K	25	25,575	25			
L	10	10,230	10			
M	1.0	1,023	1.0			
N	0.1	102.3	0.1			

6614 Quad filter/amps
80 dB/octave—32 kHz

Range	Cutoff frequency (Hz)			Range	Cutoff frequency (Hz)		
	Min	Max	Step		Min	Max	Step
F04	1	16	1	F10	100	1600	100
F05	2	32	2	F11	200	3200	200
F06	5	80	5	F12	500	8000	500
F07	10	160	10	F13	1k	16k	1k
F08	20	320	20	F14	2k	32k	2k
F09	50	800	50				

6611A Single filter/amp
80 dB/octave—2.048 MHz

Model number	Frequency range (Hz)		Cutoff frequencies (Hz)		
			Step size		
	Min	Max	20	200	2k
A	20	2.048	20-20.48k	20.6-204.8k	206k-2.048M
B	20	1.024	20-10.24k	10.4k-102.4k	104k-1.024M

6618 Octal filter/amps
80 dB/octave–custom frequency

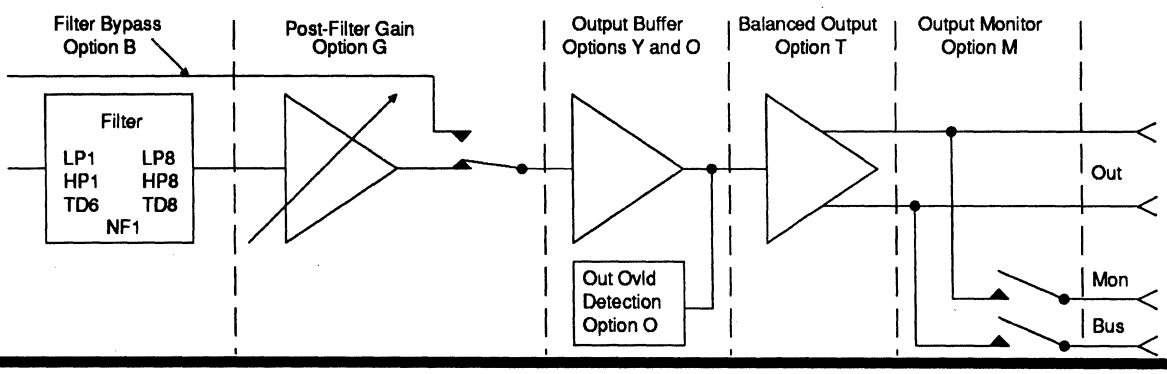
Model number	Description
6618-XXX-YYY	XXX = Frequency, YYY = Filter type
6618-FX?-YYY	FX? = Four custom cutoff frequencies, YYY = Filter type: HP1, LP1, TD6

6612A & 6632 Dual filter/amps
130 dB/octave—204.7 kHz

Model number	Low range (Hz)			High range (Hz)		
	Min	Max	Step	Min	Max	Step
A	1.0	2047.0	1.0	2100	204,700	100
B	1.0	1023.0	1.0	1100	102,300	100
C	0.1	102.3	0.1	110	10,230	10
E	0.1	204.7	0.1	210	20,470	10

6694 Quad notch filter/amps
Programmable notch filters

Model number	Cutoff frequencies (Hz)			Range
	Min	Max	Step	
6694-A	1025	25,594	6.25	High
	25	1023.75	0.25	Low
	0.25	24.75	0.25	Limited use



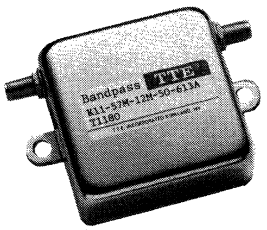
- See amplifier systems, transducer/amplifier systems, and auto-ranging amplifier systems in Section 1100.
- See other data acquisition systems in Section 2325.

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America's Filter Specialist for over 35 years

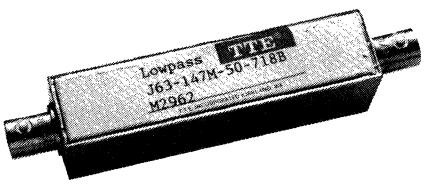
Passive ***Bandpass Filters***



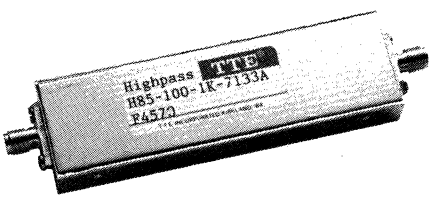
- Designs Include : Bessel, Butterworth, Chebyshev and Elliptical Function
- Number of poles : 2 to 6
- Frequency Range : 100Hz to 500MHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)

Passive ***Lowpass Filters***

- Designs Include : Bessel, Butterworth, Chebyshev and Elliptical Function
- Number of poles : 2 to 11
- Frequency Range : 10Hz to 500MHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)



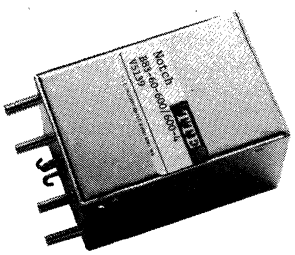
Passive ***Highpass Filters***



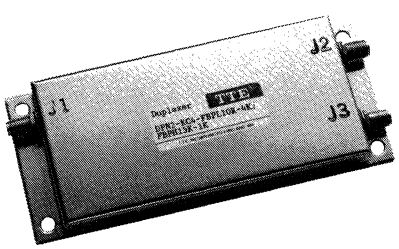
- Designs Include : Bessel, Butterworth, Chebyshev and Elliptical Function
- Number of poles : 2 to 11
- Frequency Range : 100Hz to 100MHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)

Passive ***Band Rejection Filters***

- Designs Include : Butterworth, Chebyshev and Elliptical Function
- Number of poles : 2 to 6
- Frequency Range : 1kHz to 10MHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)



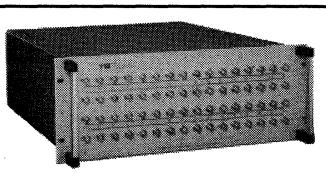
Passive ***Diplexers & Duplexers***



- Designs Include : Butterworth and Chebyshev
- Types : Contiguous or Noncontiguous Passbands
- Number of poles : 2 to 6
- Frequency Range : 10kHz to 30MHz
- Package Styles : SMA
- Shipment : 10 Working Days ARO (QTY 1-10)

Filter Systems

These bench top and rack mounting enclosures will accept from 1 to 36 filters. Any T T E active or passive filter may be specified.

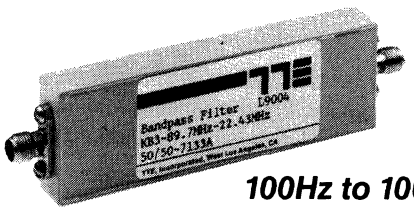


Need technical assistance? Call our engineering hot line (213) 445-2793.

T T E, Incorporated 2251 Barry Avenue West Los Angeles, CA 90064 FAX: (213) 445-2791 TEL.: (213) 478-8224

TTE *America's Filter Specialist for over 35 years*

3 pole Butterworth BPF



100Hz to 100MHz

Standard Features Include:

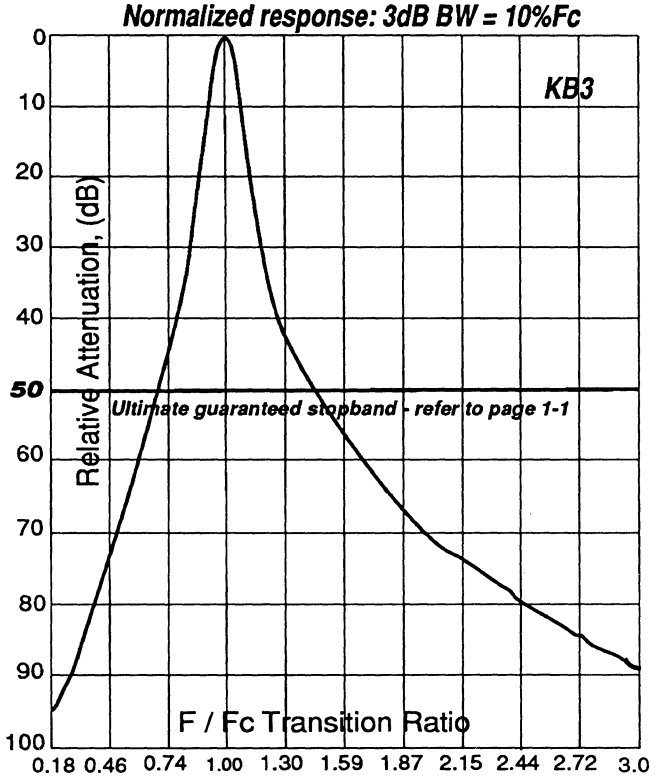
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

Series number	: KB3
F_c—Center Frequency Range	: 100Hz to 100MHz
% Bandwidth Range @ 3dB	: 6%F_c to 70%F_c
Bandwidth Ratio 50dB:3dB	: 10:1
Impedance Range	: 50Ω's to 50kΩ's
Insertion Loss at F_c	: <6dB
VSWR at F_c	: 1.5:1 typically
Typical PCB case dimensions	: 1.0″ x 3.3″ x 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized response: 3dB BW = 10%Fc



The listings on these pages represent only a few of our products. Please request the current 100 page Filter Catalog.

5 pole Butterworth BPF



1kHz to 10MHz

Standard Features Include:

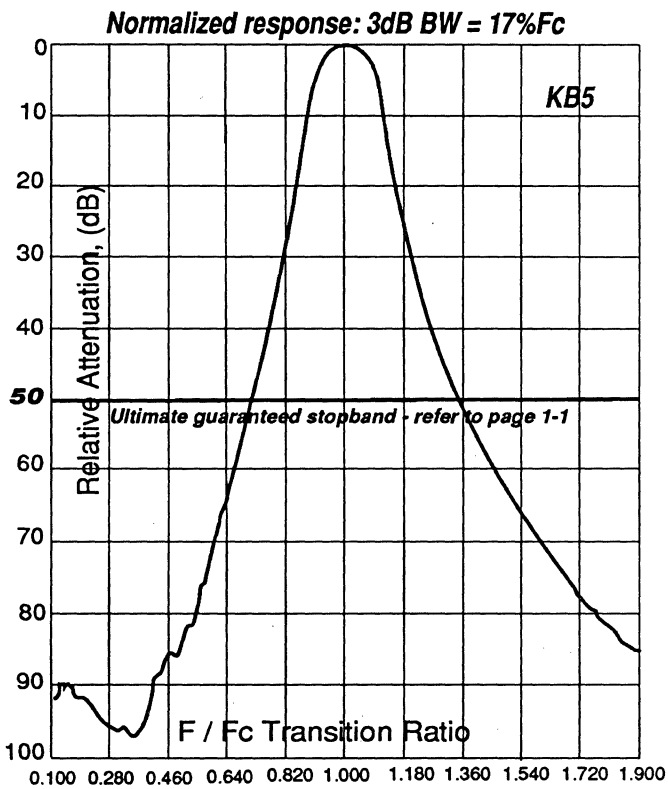
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

Series number	: KB5
F_c—Center Freq. Range	: 1kHz to 10MHz
% Bandwidth Range @ 3dB	: 15%F_c to 70%F_c
Bandwidth Ratio 50dB:3dB	: 5:1 (0.4dB ripple)
Impedance Range	: 50Ω's to 50kΩ's
Insertion Loss at F_c	: <6dB
VSWR at F_c	: 1.5:1 typically
Typical PCB case dimensions	: 1.42″ x 5.03″ x 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

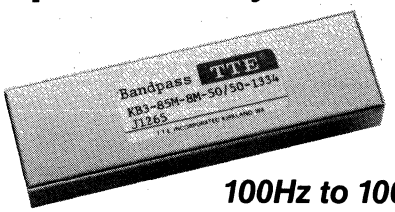
Normalized response: 3dB BW = 17%Fc



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TTE *America's Filter Specialist for over 35 years*

3 pole Chebyshev BPF



100Hz to 100MHz

Standard Features Include:

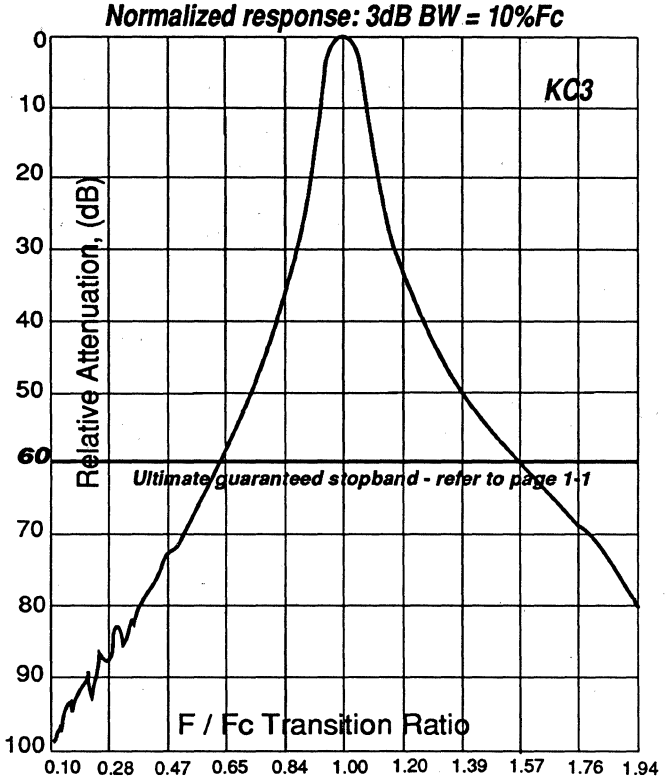
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

Series number	: KC3
F_c—Center Freq. Range	: 100Hz to 100MHz
% Bandwidth Range @ 3dB	: 6%F_c to 70%F_c
Bandwidth Ratio 50dB:3dB	: 10:1 (0.5dB ripple)
Impedance Range	: 50Ω's to 50kΩ's
Insertion Loss at F_c	: <6dB
VSWR at F_c	: 1.5:1 typically
Typical PCB case dimensions	: 1.0″ x 3.3″ x 0.5″H
Optional connectors	: BNC or SMA

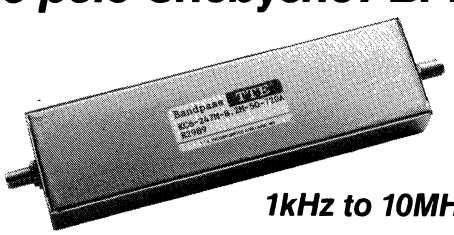
Need it now? 3 working day shipment is available. Call!

Normalized response: 3dB BW = 10%Fc



The listings on these pages represent only a few of our products. Please request the current 100 page Filter Catalog.

5 pole Chebyshev BPF



1kHz to 10MHz

Standard Features Include:

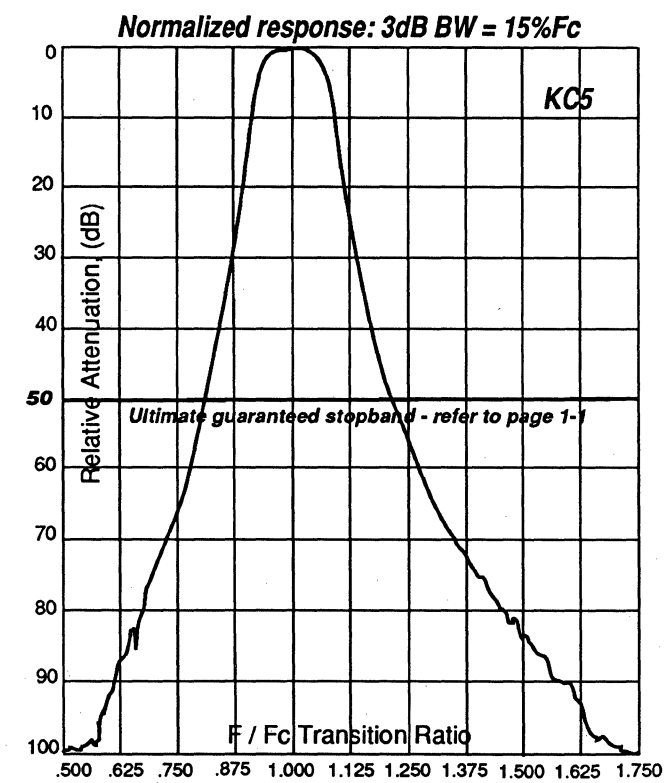
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

Series number	: KC5
F_c—Center Freq. Range	: 1kHz to 10MHz
% Bandwidth Range @ 3dB	: 15%F_c to 70%F_c
Bandwidth Ratio 50dB:3dB	: 4.3:1 (1dB ripple)
Impedance Range	: 50Ω's to 50kΩ's
Insertion Loss at F_c	: <6dB
VSWR at F_c	: 1.5:1 typically
Typical PCB case dimensions	: 1.42″ x 5.03″ x 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized response: 3dB BW = 15%Fc

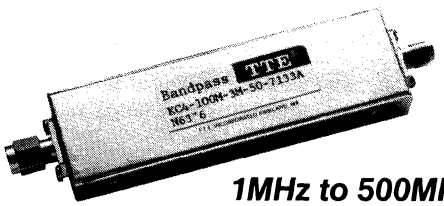


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4 pole Chebyshev BPF



1MHz to 500MHz

Standard Features Include:

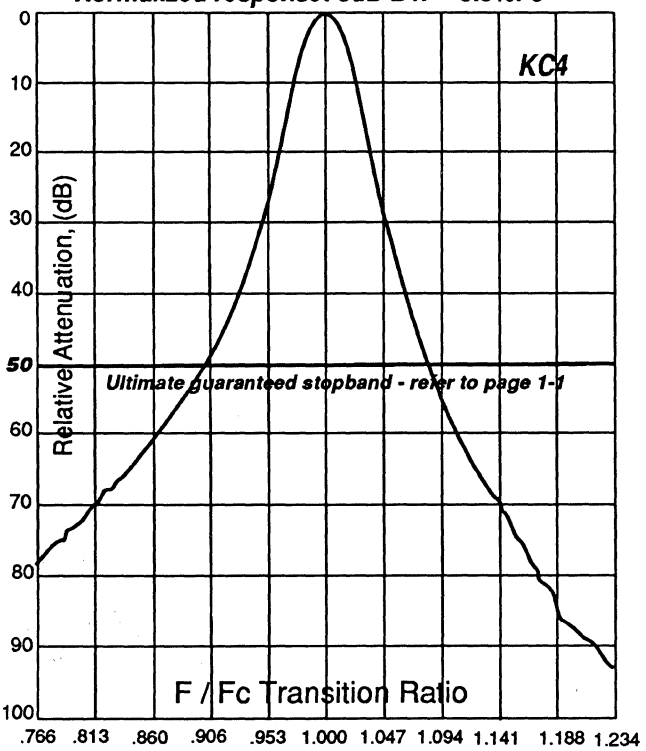
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

Series number	: KC4
F_c—Center Freq. Range	: 1MHz to 500MHz
% Bandwidth Range @ 3dB	: 3%F_c to 25%F_c
Bandwidth Ratio 50dB:3dB	: 6:1 (0.4dB ripple)
Impedance Range	: 50Ω's to 75kΩ's
Insertion Loss at F_c	: <12dB
VSWR at F_c	: 1.5:1 typically
Typical PCB case dimensions	: 1.0″ x 2.4″ x 0.5″H
Optional connectors	: BNC or SMA

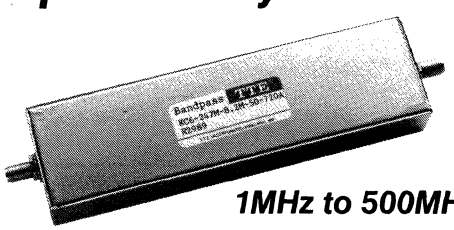
Need it now? 3 working day shipment is available. Call!

Normalized response: 3dB BW = 3.6%Fc



The listings on these pages represent only a few of our products. Please request the current 100 page Filter Catalog.

6 pole Chebyshev BPF



1MHz to 500MHz

Standard Features Include:

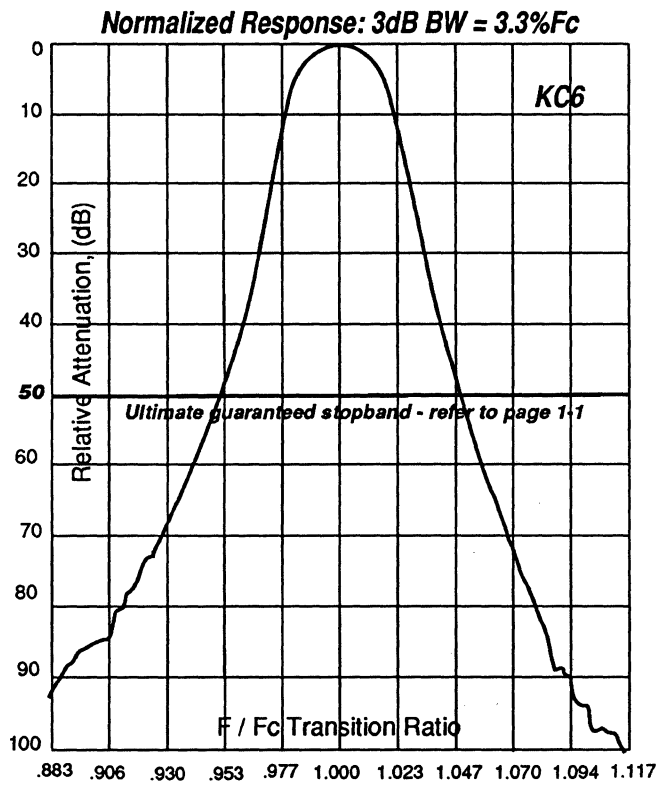
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

Series number	: KC6
F_c—Center Freq. Range	: 1MHz to 500MHz
% Bandwidth Range @ 3dB	: 3%F_c to 25%F_c
Bandwidth Ratio 50dB:3dB	: 4.5:1 (0.4dB ripple)
Impedance Range	: 50Ω's to 75kΩ's
Insertion Loss at F_c	: <12dB
VSWR at F_c	: 1.5:1 typically
Typical PCB case dimensions	: 1.42″ x 5.03″ x 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

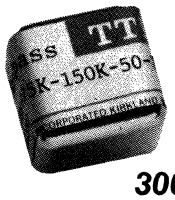
Normalized Response: 3dB BW = 3.3%Fc



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3 pole Butterworth BPF



300Hz to 20MHz

Standard Features Include:

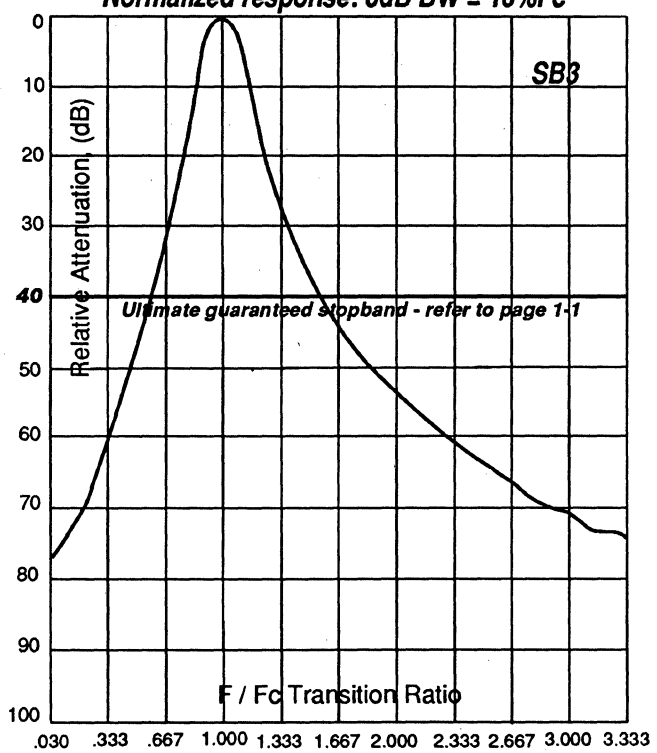
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **ϕ and Amplitude Matching is available**

General Specifications

Series number	: SB3
F_c—Center Freq. Range	: 300Hz to 20MHz
% Bandwidth Range @ 3dB	: 15%F_c to 60%F_c
Bandwidth Ratio 40dB:3dB	: 10:1
Impedance Range	: 50Ω's to 50kΩ's
Insertion Loss at F_c	: <6dB
VSWR at F_c	: 1.5:1 typically
Typical PCB case dimensions	: 0.75″ × 0.75″ × 0.5″H
Optional connectors	: BNC or SMA

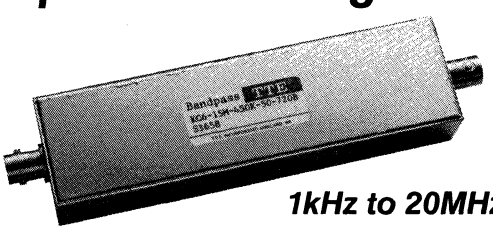
Need it now? 3 working day shipment is available. Call!

Normalized response: 3dB BW = 18%Fc



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7 pole T T E Design BPF



1kHz to 20MHz

Standard Features Include:

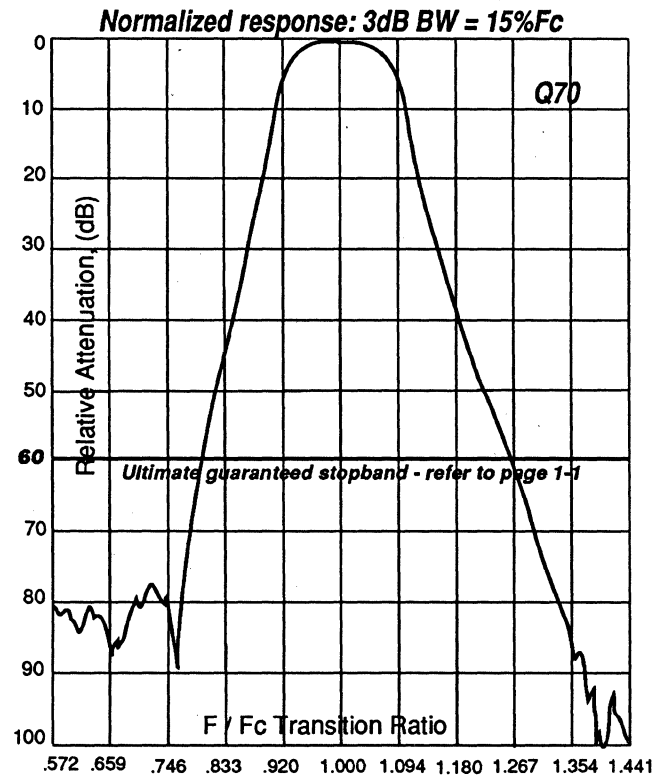
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **ϕ and Amplitude Matching is available**

General Specifications

Series number	: Q70
F_c—Center Freq. Range	: 1kHz to 20MHz
% Bandwidth Range @ 3dB	: 15%F_c to 70%F_c
Bandwidth Ratio 60dB:3dB	: 3.5:1
Impedance Range	: 50Ω's to 50kΩ's
Insertion Loss at F_c	: <6dB
VSWR at F_c	: 1.5:1 typically
Typical PCB case dimensions	: 1.42″ × 5.03″ × 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized response: 3dB BW = 15%Fc

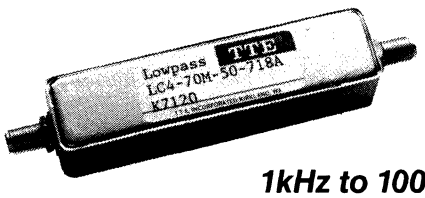


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11 pole Anti-Aliasing LPF



1kHz to 100MHz

Standard Features Include:

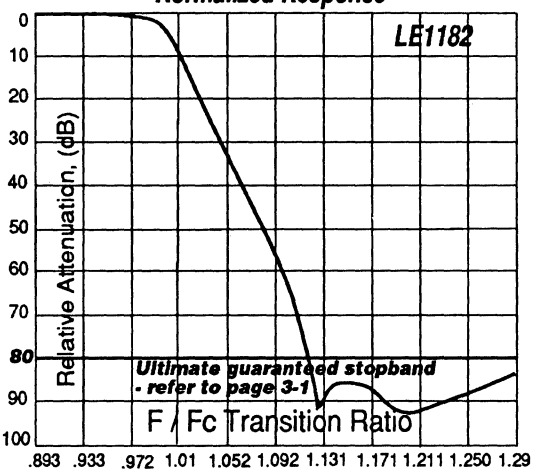
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

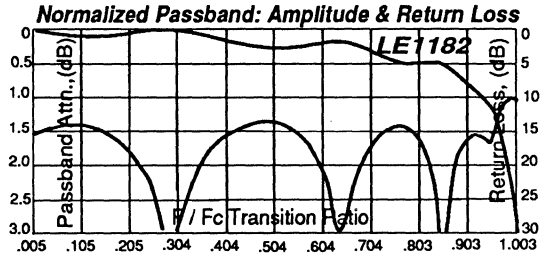
Series number	: LE1182
Design Type	: Elliptical Function
Frequency Range	: 1kHz to 100MHz
Cut-off Ratio 80dB:3dB	: 1.2:1 (0.5dB ripple)
Impedance Range	: 50Ω's to 39kΩ's
Dynamic Range	: >80dB
VSWR	: 1.5:1 typically
Typical PCB case dimensions	: 2.0″ x 3.0″ x 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized Response

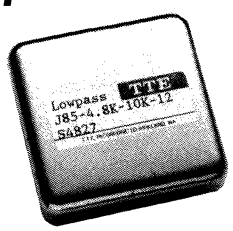


Normalized Passband: Amplitude & Return Loss



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9 pole T T E Design LPF



10Hz to 250MHz

Standard Features Include:

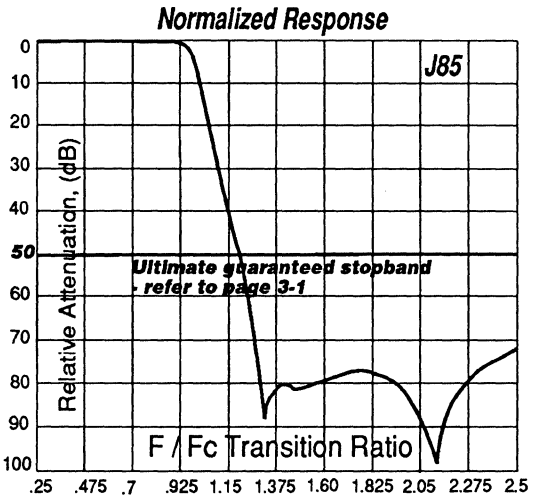
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

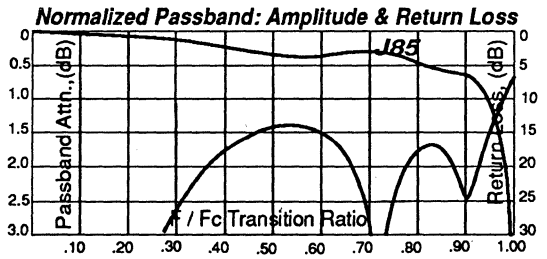
Series number	: J85
Design Type	: T T E
Frequency Range	: 10Hz to 250MHz
Cut-off Ratio 50dB:3dB	: 1.27:1 (0.5dB ripple)
Impedance Range	: 50Ω's to 39kΩ's
Dynamic Range	: >80dB
VSWR	: 1.5:1 typically
Typical PCB case dimensions	: 1.0″ x 3.0″ x 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized Response



Normalized Passband: Amplitude & Return Loss

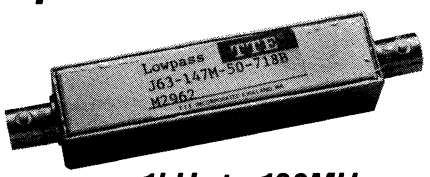


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6 pole Bessel LPF



1kHz to 100MHz

Standard Features Include:

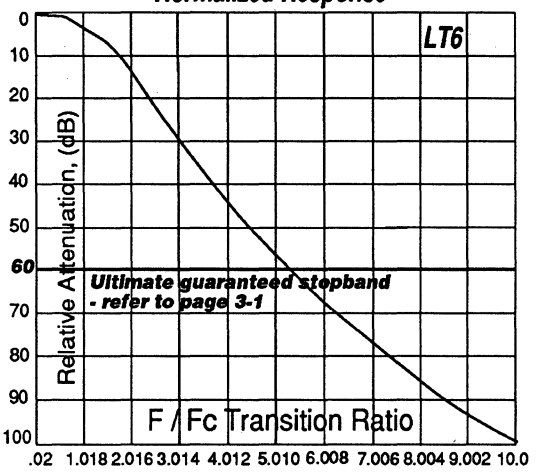
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

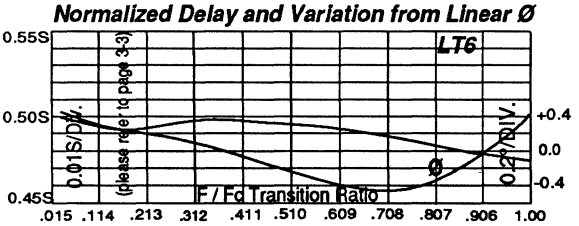
Series number	: LT6
Design Type	: Bessel
Frequency Range	: 1kHz to 100MHz
Cut-off Ratio 80dB:3dB	: 1.2:1 (0.5dB ripple)
Impedance Range	: 50Ω's to 39kΩ's
Dynamic Range	: >80dB
VSWR	: 1.5:1 typically
Typical PCB case dimensions	: 1.0″ × 2.4″ × 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized Response



Normalized Delay and Variation from Linear Ø



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9 pole Video LPF



10Hz to 20MHz

Standard Features Include:

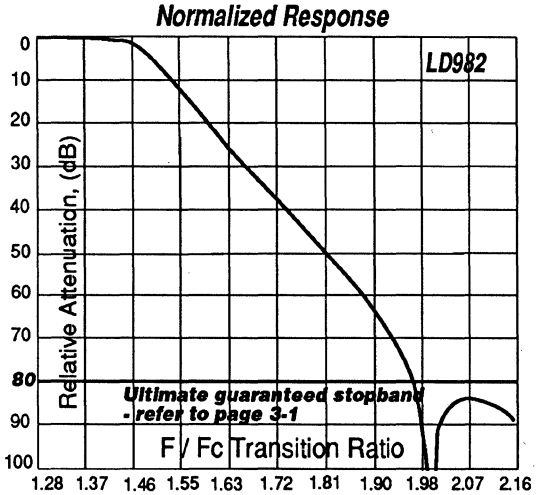
- **±3° deviation from linear Ø to F_c**
- **0.25dB MAX at F_c**
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**

General Specifications

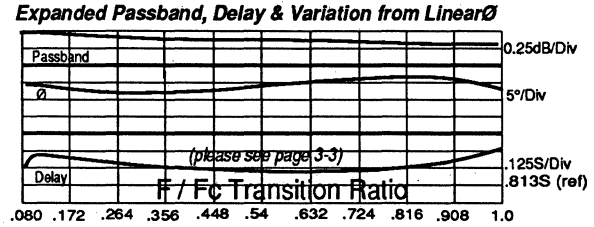
Series number	: LD982
Design Type	: Delay Equal. Elliptical Function
F_c—0.25dB Frequency Range	: 10kHz to 20MHz
80dB	: 2.0F_c
±3° deviation from linear ∅	: to F_c
VSWR	: 1.5:1 typically
Impedance	: 50Ω's or 75Ω's
Typical PCB case dimensions	: 1.93″ × 2.96″ × 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized Response



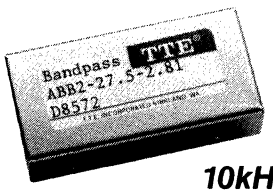
Expanded Passband, Delay & Variation from LinearØ



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TTE *America's Filter Specialist for over 35 years*

7 pole Anti-Aliasing LPF



10kHz to 20MHz

Standard Features Include:

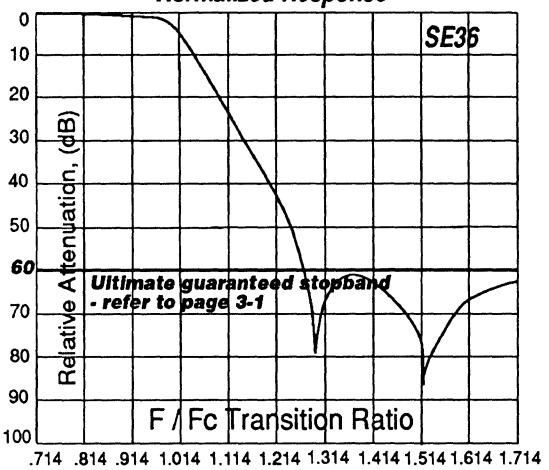
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

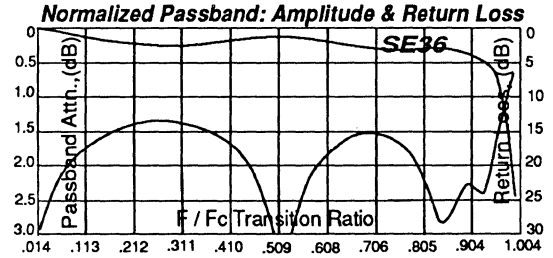
Series number	: SE36
Design Type	: Elliptical Function
Frequency Range	: 10kHz to 20MHz
Cut-off Ratio 60dB:3dB	: 1.35:1 (0.5dB ripple)
Impedance Range	: 50Ω's to 39kΩ's
Dynamic Range	: >80dB
VSWR	: 1.5:1 typically
Typical PCB case dimensions	: 0.6″ x 1.2″ x 0.4″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized Response

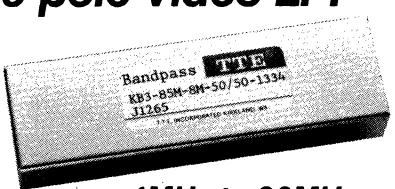


Normalized Passband: Amplitude & Return Loss



The listings on these pages represent only a few of our products. Please request the current 100 page Filter Catalog.

9 pole Video LPF



1MHz to 20MHz

Standard Features Include:

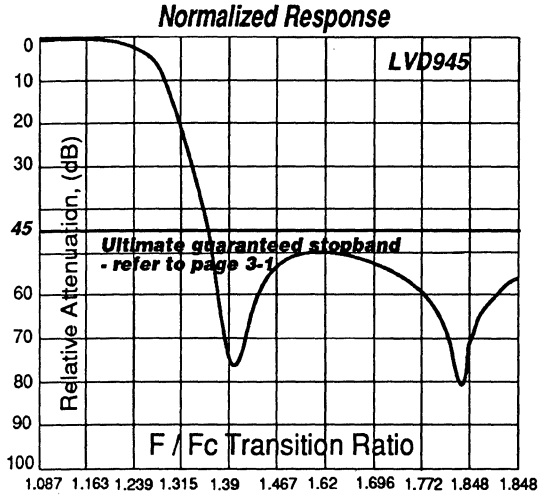
- **±1° deviation from linear Ø to F_c**
- **0.3dB MAX at F_c**
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**

General Specifications

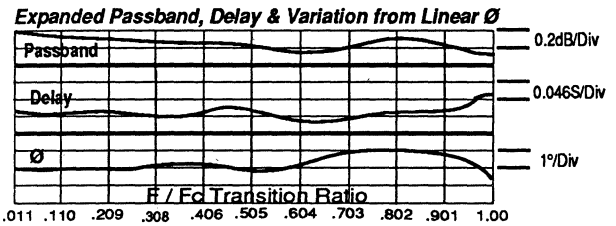
Series number	: LVD945
Design Type	: Delay Equal. Elliptical Function
F_c—0.3dB Frequency Range	: 1MHz to 20MHz
3dB Nom. at	: 1.25F_c
12dB Nom. at	: 1.31F_c
45dB Min. at	: 1.38F_c
±1° deviation from linear ∅	: to F_c
Typical PCB case dimensions	: 1.93″ x 2.96″ x 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized Response



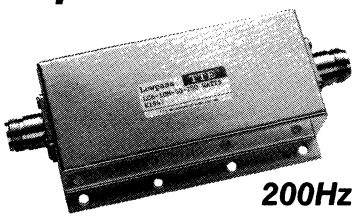
Expanded Passband, Delay & Variation from Linear Ø



T T E, Incorporated 2251 Barry Avenue West Los Angeles, CA 90064 FAX: (213) 445-2791 TEL.: (213) 478-8224

TTE America's Filter Specialist for over 35 years

11 pole T T E Design LPF



200Hz to 250MHz

Standard Features Include:

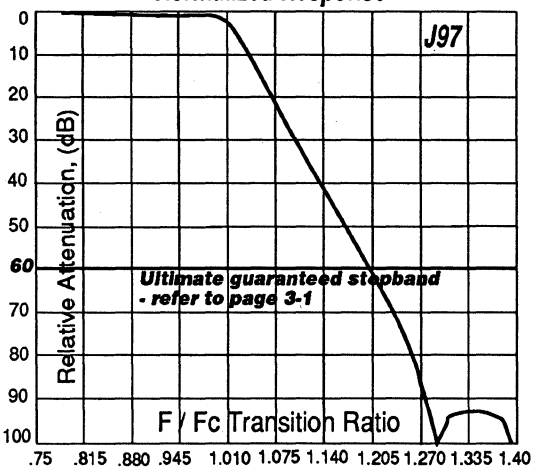
- **10 Day Shipment (1–10 units)**
- **No Minimum Order**
- **No Engineering Charges**
- **No Set-Up Charges (Std. Items)**
- **Ø and Amplitude Matching is available**

General Specifications

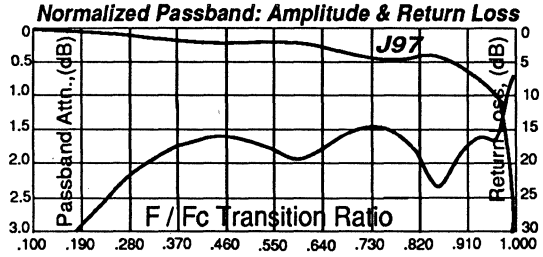
Series number	: J97
Design Type	: T T E
Frequency Range	: 200Hz to 250MHz
Cut-off Ratio 60dB:3dB	: 1.2:1 (0.5dB ripple)
Impedance Range	: 50Ω's to 39kΩ's
Dynamic Range	: >80dB
VSWR	: 1.5:1 typically
Typical PCB case dimensions	: 2.0″ x 3.0″ x 0.5″H
Optional connectors	: BNC or SMA

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Normalized Response

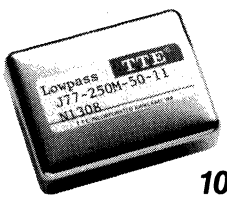


Normalized Passband: Amplitude & Return Loss



The listings on these pages represent only a few of our products. Please request the current 100 page Filter Catalog.

7 pole T T E Design LPF



10Hz to 250MHz

Standard Features Include:

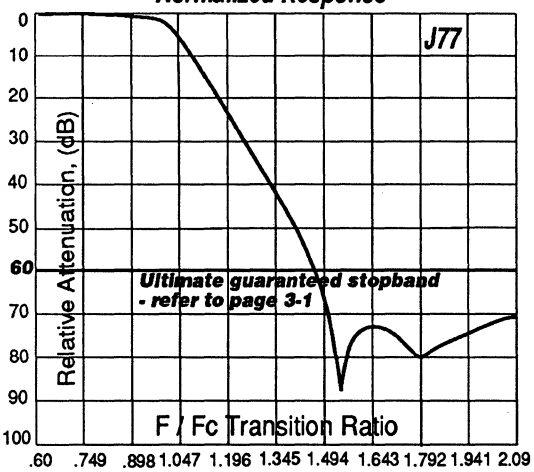
- ***10 Day Shipment (1–10 units)***
- ***No Minimum Order***
- ***No Engineering Charges***
- ***No Set-Up Charges (Std. Items)***
- **Ø and Amplitude Matching is available**

General Specifications

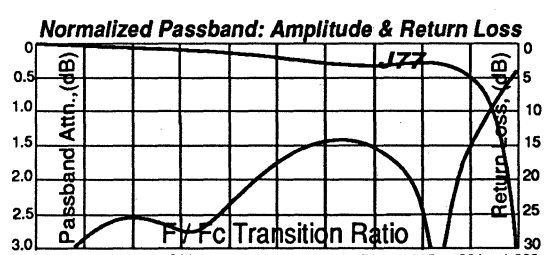
Series number	: J77
Design Type	: T T E
Frequency Range	: 10Hz to 250MHz
Cut-off Ratio 60dB:3dB	: 1.2:1 (0.5dB ripple)
Impedance Range	: 50Ω's to 39kΩ's
Dynamic Range	: >80dB
VSWR	: 1.5:1 typically
Typical PCB case dimensions	: 1.44″ x 1.88″ x 0.5″H
Optional connectors	: BNC or SMA

Need it now? 3 working day shipment is available. Call!

Normalized Response



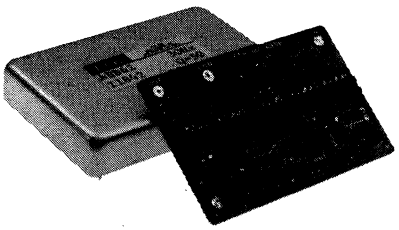
Normalized Passband: Amplitude & Return Loss



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TTE

America's Filter Specialist for over 35 years

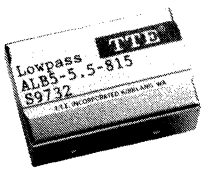


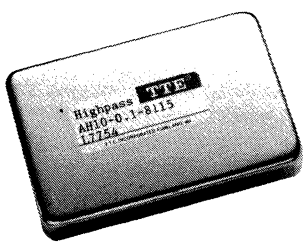
Active ***Bandpass Filters***

- Designs Include : Bessel, Butterworth, Chebyshev
- Number of poles : 1 to 3 pole pair
- Frequency Range : 1Hz to 200kHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)

Active ***Lowpass Filters***

- Designs Include : Bessel, Butterworth and Chebyshev
- Number of poles : 2 to 10
- Frequency Range : 0.1Hz to 1MHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)



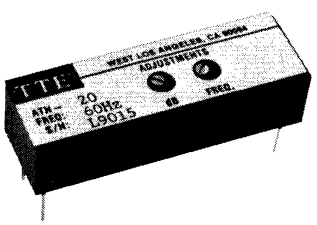


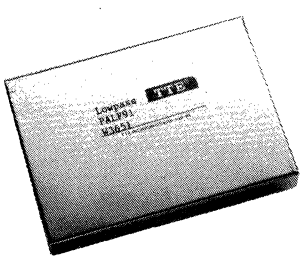
Active ***Highpass Filters***

- Designs Include : Bessel, Butterworth and Chebyshev
- Number of poles : 2 to 10
- Frequency Range : 0.1 Hz to 1 MHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)

Active ***Band Rejection Filters***

- Designs Include : Twin—T Notch
- Types : Fixed and Adjustable
- Frequency Range : 1Hz to 10kHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)



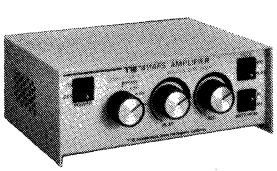


Active ***PROGRAMMABLE***

- Designs Include : Butterworth and Chebyshev
- Types : Lowpass and Highpass
- Number of poles : 5
- Frequency Range : 1Hz to 128kHz
- Package Styles : PCB
- Shipment : 10 Working Days ARO (QTY 1-10)

411AFS Amplifier & Anti-Aliasing Filter System

This filter system is used in laboratories that analyze speech and other audio and sub-audio utterances. ***Stock Delivery.***



Need technical assistance? Call our engineering hot line (213) 445-2793.

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eem SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

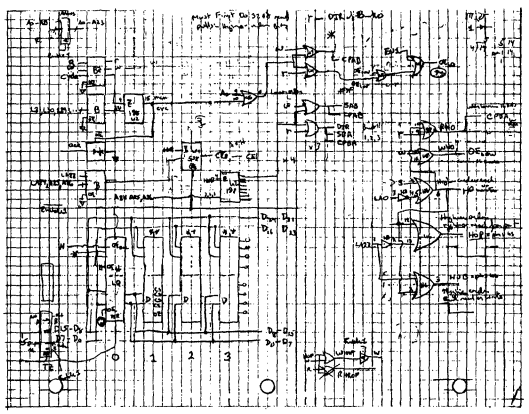
Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

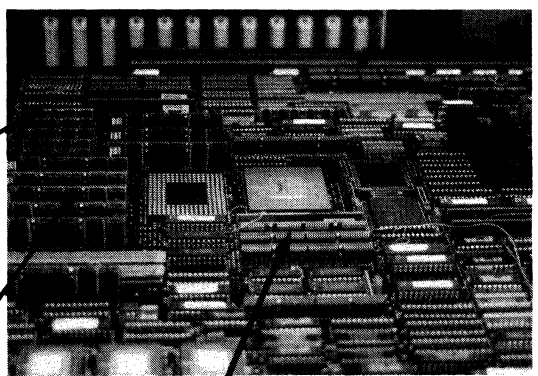
ADVANCED ELECTRONIC PACKAGING

CUSTOM MODULES

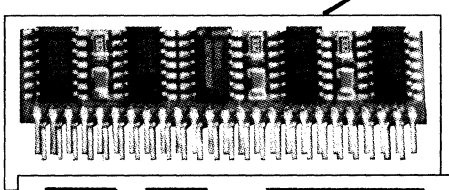
DEDICATED TO SPACE SAVING TECHNOLOGY . . .



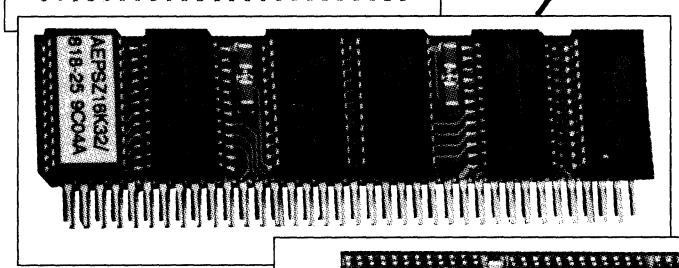
If your're trying to cram a pound of electronics into a small space — We Can Help!



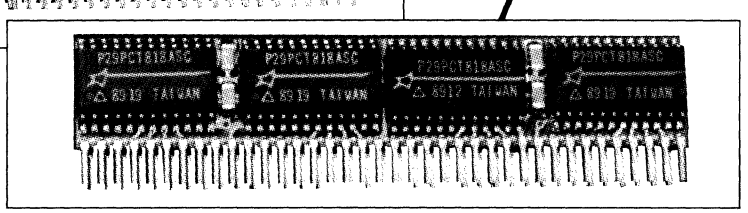
Our team of engineers can take your INITIAL CONCEPT, in whatever form, and work with you to produce a complete solution. The sooner you contact AEP, the sooner we'll be able to use our key ideas to aid you in fitting your design into the required space, as well as save you time. Engineers make design trade-offs due to board space limitations; by understanding the board space saving tools that are available, you will make better hardware decisions.

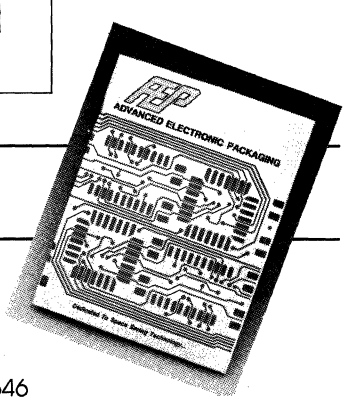


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WE SOLVE BOARD SPACE PROBLEMS FROM DESIGN TO FINISHED PRODUCT.





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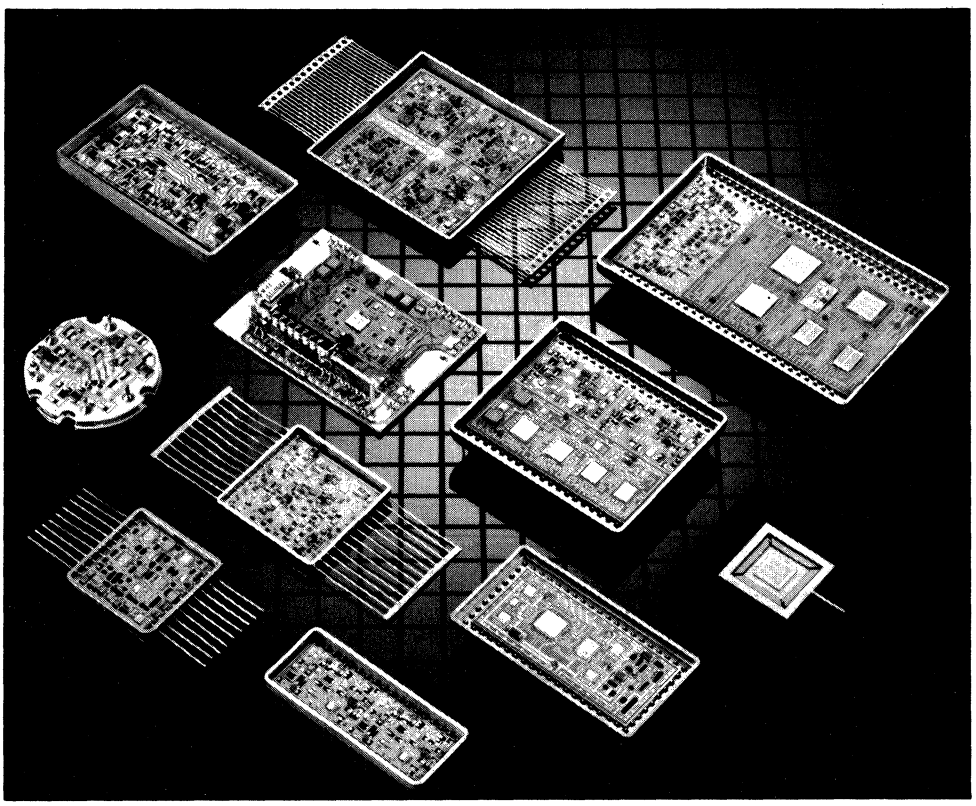
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We can package your microcircuits utilizing the latest techniques in Thick Film, Thin Film and Co-fired technologies in conjunction with Digital and Analog ASICS, chip capacitors, resistor networks and discrete components. These microcircuits range in frequency from DC to the 18 GHz domain.

Aeroflex utilizes this broad breadth of technical capability in supporting a complete line of **MIL-STD-1553** Standard Interface circuits including transceivers for 1553A/B, MACAIR, and H009, as well as Remote Terminals, Bus Controllers, Bus Monitors, and Monolithic Manchester Encoder/Decoders. We have received **DESC Standard Military Drawing (SMD)** approval for over twenty-six of these MIL-STD-1553 Products. Aeroflex is also a leader in the design and manufacture of Serial Interface Modules (SIM) for the **ARINC 629** Data Bus.

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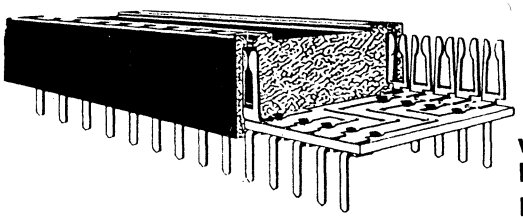
AEROFLEX MIL-STD-1553 SELECTION GUIDE

ARX PART NO.	ARX PART NO. "MONOLITHIC" VERSION	TRANSCEIVER—CURRENT DRIVE	TRANSCEIVER—VOLTAGE DRIVE	DUAL CHANNEL	SINGLE CHANNEL	±15 V, +5V REQUIRED	±12 V, +5V REQUIRED	+5V ONLY REQUIRED	1553A	1553B	MACAIR	H009 (F15 A/C)	VARIABLE OUTPUT	RECEIVER OUTPUTS LOW	RECEIVER OUTPUTS HIGH	BUS CONTROLLER	REMOTE TERMINAL	BUS MONITOR	ENCODER-DECODER	PROTOCOL DEVICE	DMA SUBSYSTEM DEVICE	DUAL PORTED SUBSYSTEM INTERFACE	ULTRA SMALL PACKAGE	PLUG-IN PACKAGE	FLAT PACKAGE	STANDARD MILITARY DRAWING (SMD)
TRANSCEIVERS																									
2401	3401*	●			●	●			●	●			●	●									●			
2402	3402*	●			●	●			●	●				●									●			5962-8604903,...04
2404	3404*		●		●	●	●		●	●	●				●								●	●		5962-8959202
2407	3407*		●		●	●	●		●	●					●								●	●		5962-8959201
2411	3411*	●		●		●			●	●				●									●	●		5962-8757904
2415	3415*	●			●	●			●	●					●								●			
2416	3416*	●		●		●			●	●					●								●	●		5962-8944701
2418*			●		●	●	●		●	●	●		●	●									●	●		
2419	3419*	●		●			●		●	●				●									●	●		5962-8982602
2420	3420*	●			●		●		●	●				●									●			5962-9082903
2424	3424*	●			●		●		●	●					●								●			5962-9082904
2425	3425*	●		●			●		●	●					●								●	●		
	3431*	●		●		●			●	●				●									●	●		
	3433*	●		●			●		●	●					●								●	●		
	3435*		●		●	●	●					●			●								●	●		
	3436*	●		●		●			●	●					●								●	●		5962-8944701
	3439*	●		●			●		●	●				●									●	●		
2453*	3453*	●		●				●	●	●				●									●	●		5962-8952202
2455*	3455*	●		●				●	●	●					●								●	●		
	3464*		●		●	●			●	●	●			●									●	●		
	3467*		●		●	●			●	●				●									●	●		
PROTOCOL DEVICES																									
2410					●			●	●	●	●					●	●	●	●				●			5962-9063603
2412					●			●	●	●	●					●	●	●	●				●			
	2439*			●				●	●	●	●								●				●			
	2441*							●		●						●	●	●		●	●		●			
MT32018‡					●			●	●	●	●								●				●			
MT32028‡					●			●	●	●	●								●				●			
MT32034‡				●				●		●							●			●	●		●	●	●	
MT32817‡				●				●		●							●		●	●	●		●	●	●	
TERMINALS																									
2427*		●		●		●				●						●	●	●					●			
2447*		●		●			●			●						●	●	●					●			
2452*		●		●		●				●							●				●		●	●		5962-8753502
2454*		●			●	●			●	●						●	●	●			●		●			
2457*		●		●				●		●						●	●	●				●	●			
2458*		●			●		●		●	●						●	●	●			●		●			
2462*		●		●			●			●							●				●		●	●		
	3491*	●		●		●				●						●	●	●			●		●			

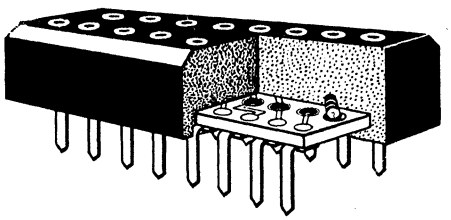
*RECOMMENDED FOR NEW DESIGNS ‡Aeroflex is a distributor for Micro Circuit Engineering–England

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Enhanced Sockets/Hybrid Sockets



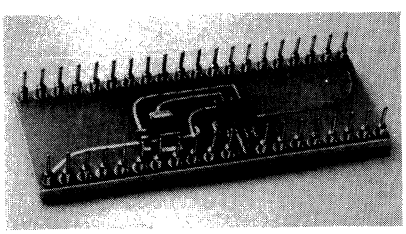
with bifurcated pins

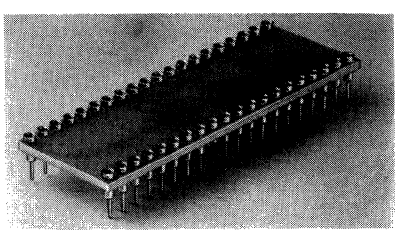


with collet pins

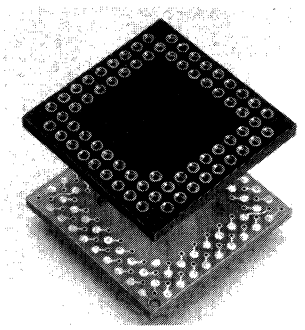
Circuit paths can be re-routed using the Aries Correct-A-Chip technology. The miniature printed circuit board inside the Correct-A-Chip provides circuit paths making the desired electrical connections and has high reliability collet contacts to accept devices and solder tail contacts for board insertion. Correct-A-Chip technology solves problems such as the need to use alternate IC's (availability, obsolescence or better performance, etc.) thus eliminating the need for new p.c. boards, jumper wires, cut traces or other alternatives. Full utilization of Correct-A-Chip technology may also incorporate both surface mount active and passive devices thus using available real estate to maximum advantage. The Correct-A-Chip is available with stamped pin or high reliability collet sockets.

CORRECT-A-CHIP Specials

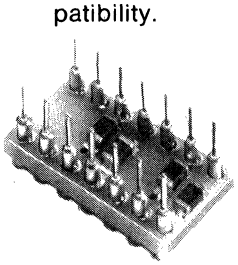


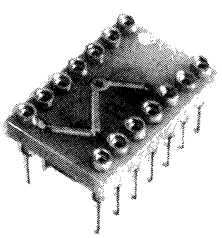


This special is a 40 pin collet socket, with a surface mount 7705 integrated circuit plus two surface mount resistors plus two capacitors all mounted on the socket. The effect of all this is that the socket becomes a hybrid, which is actually a reset monitor which constantly checks to make sure there is a minimum voltage to the microprocessor that will be plugged into the 40 pin socket. Although this was a special, designed for a specific application, it is quite possible that another customer may need to do the exact same thing. The Aries part number for this is 1107939.



Pin Grid Array Adaptors using the Correct-A-Chip technology are solving many problems of IC pin/out incompatibility.





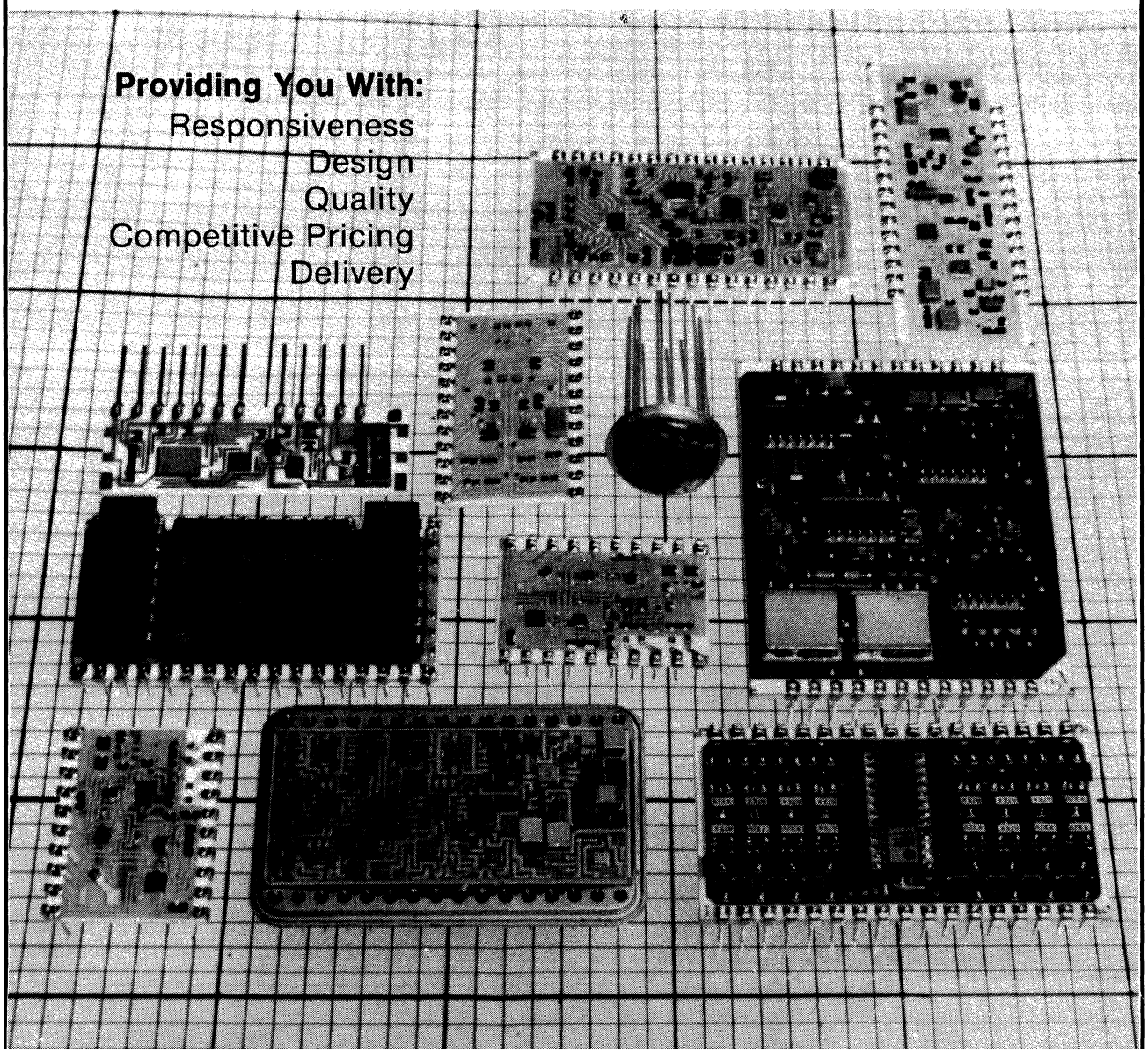
High-Voltage Transient Protection is incorporated into this special Aries Correct-A-Chip. DIP and SIP sockets easily lend themselves to this technology incorporating surface mount devices. In the sample shown transient suppressors have been surface mounted to protect 1488 or 89 IC from high voltage blow-out. The new Correct-A-Chip socket is retrofitable after a blow-out has occurred thus preventing future loss of 1488 or 89 IC's.

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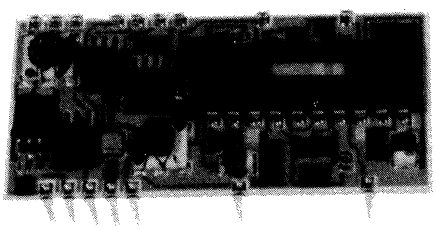
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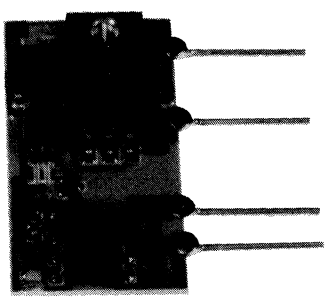
CUSTOM HYBRID CIRCUITS

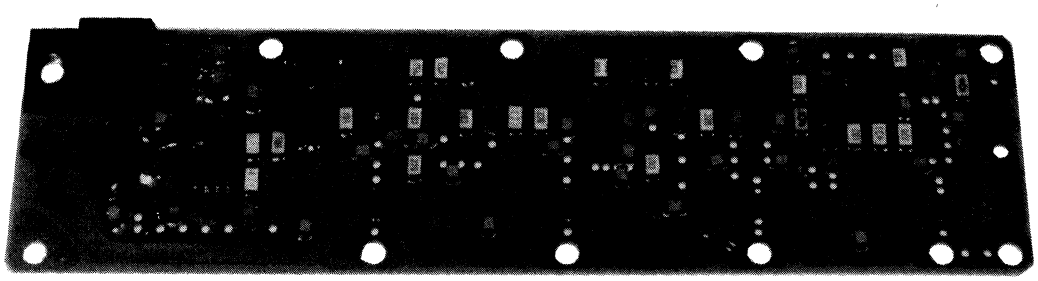
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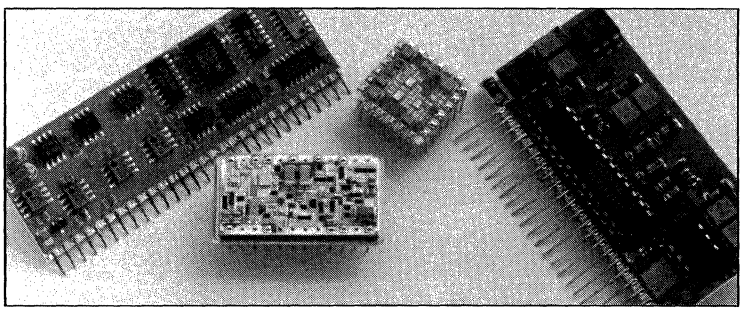
Hybrid construction offers some of the size reduction and performance efficiencies of ASIC's without large NRE, and without need for high volume production. Unlike ASIC's, hybrids do not require complex and costly micro-design work.

The reduced size of hybrids complements circuit performance because of shorter signal paths and lessened potential for stray capacitance and cumulative inductance. Low-profile, low-mass hybrids withstand higher G forces and vibration levels than conventional circuits.

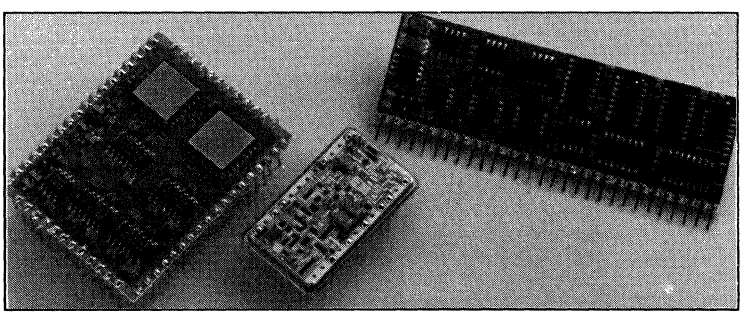
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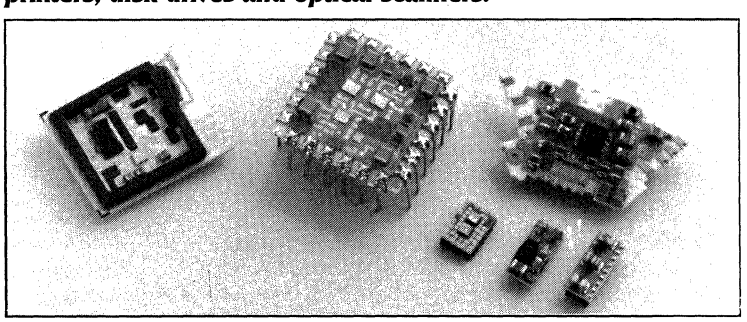
HEI hybrids can be made in multi-layer, double-sided and through-hole formats, with chip and wire-bonded IC's or surface-mounted devices.



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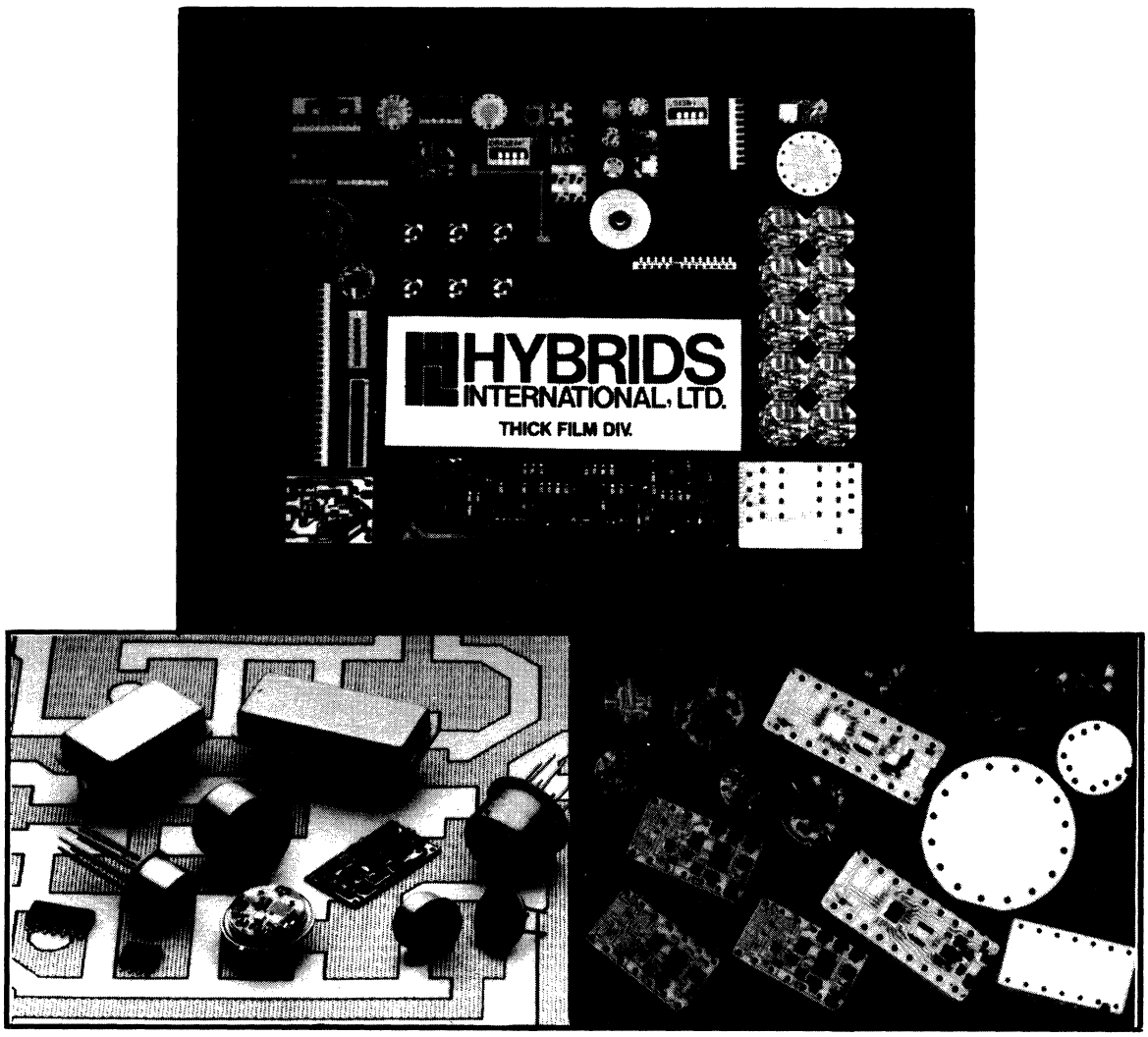
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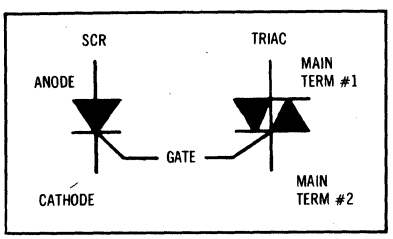
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

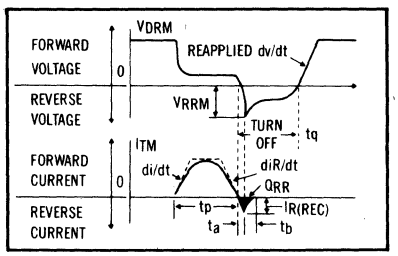


Fig. 1. Concurrent voltage and current waveforms

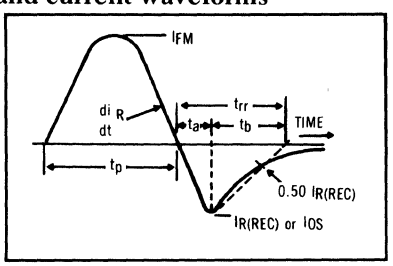


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature.*

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

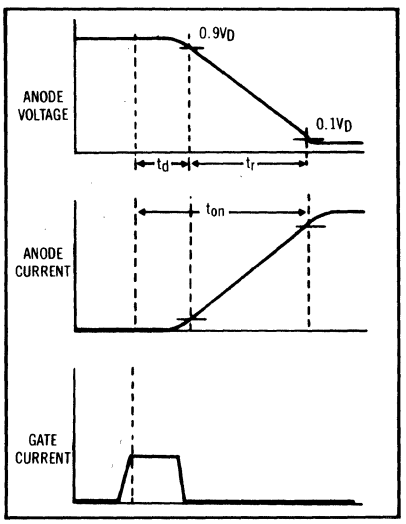


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage.*

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

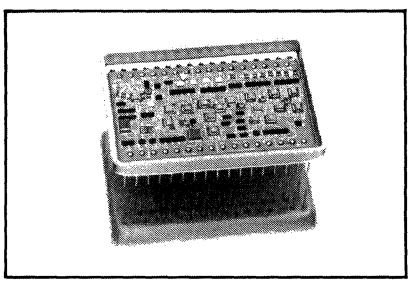
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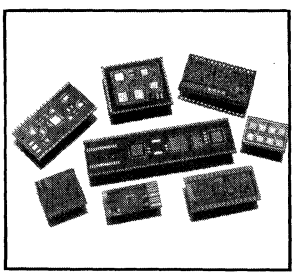
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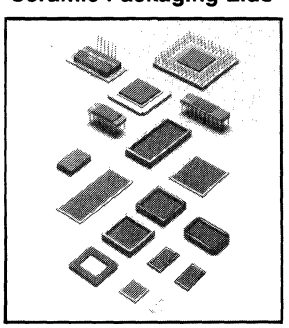
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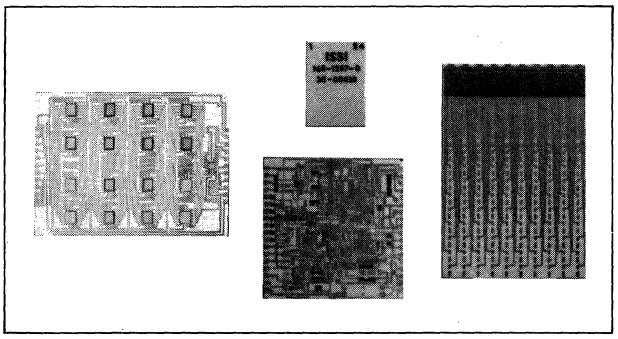
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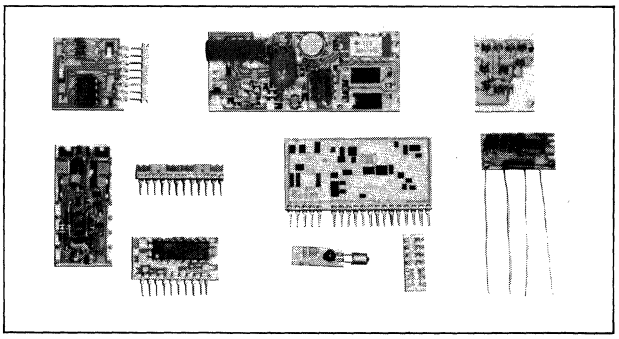
HYBRID THICK FILM TECHNOLOGY

FEATURES

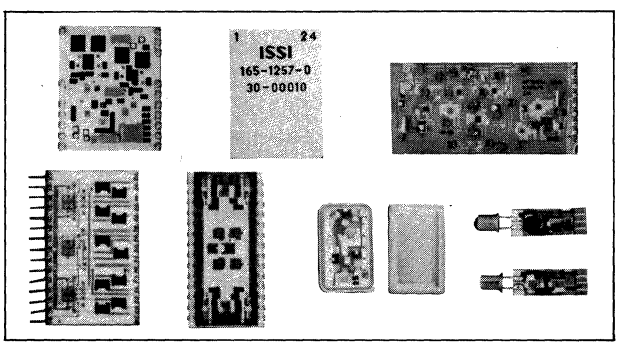
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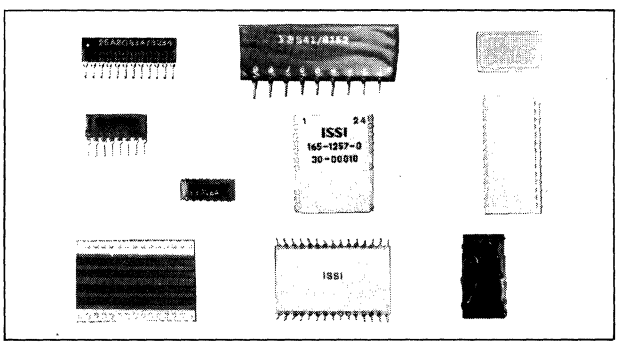
METALIZED SUBSTRATES — Simple or complex, single or multi-layer conductor patterns with Pd. Ag (Palladium Silver), Pt. Ag. (Platinum Silver), Au, (Gold), Pt. Au. (Platinum Gold) inks. Insulation with high temperature glass dielectric or low temperature glaze. Film Resistors from 1 ohm to 150 megohm, tolerances to ±0.1%, T.C.R. to 50 ppm, 1/10 w to 10 watt power dissipation, laser or abrasive trimming.



SOLDER REFLOW TECHNOLOGY — Compact networks with thick film resistors, IC packages, chip capacitors, inductors, discrete components, SOT package, diode bridge assembly, high and low temperature solder, standard or custom pinouts. Special devices with photo-transistors, LED's and functional sub-assemblies.



CHIP AND WIRE TECHNOLOGY — Microcircuit assembly of functional thin film integrated circuit or component chips into operational devices. All available IC & component chips assembled to a thick film circuit by solder or epoxy bonding. Chips wired into circuit with either gold or aluminum wire. (Thermocompression or thermosonic wire bonding). Special handling for static control. Components actively or passively trimmed to guarantee functional specifications.



CUSTOM PACKAGES — Single-in-line or Dual-in-line pinout packages, conformally coated, metal can, plastic or ceramic covered and sealed. Customer markings as well as manufacturer's identification for traceability. Leak tested, temperature cycling and burn-in before final test to insure reliability. Heat sink attached to either alumina or beryllium oxide to obtain maximum power dissipation.

TECHNICAL SERVICES

• Circuit design • layout (including conversion of existing circuitry to thick film technology) • material selection • rubylith production • screen fabrication • product tooling • product testing • and building to print. Testing includes functional electrical and mechanical parameters • burn-in • leak testing • and temperature cycling.

APPLICATIONS

• Memory • logic • linear circuits • A-D • D-A • timing • filters • isolation • pulse shaping • impedance matching • signal generation • switching • sequencing • and many other medium range energy dissipation functions or a combination thereof.

ISSI MILITARY SPECIFICATION CAPABILITIES

MIL-I-45208 Inspection System Requirements
MIL-STD-45662 Calibration System Requirements
MIL-STD-883 Test Methods & Procedures for Microelectronics
Certificate of Compliance furnished upon request.

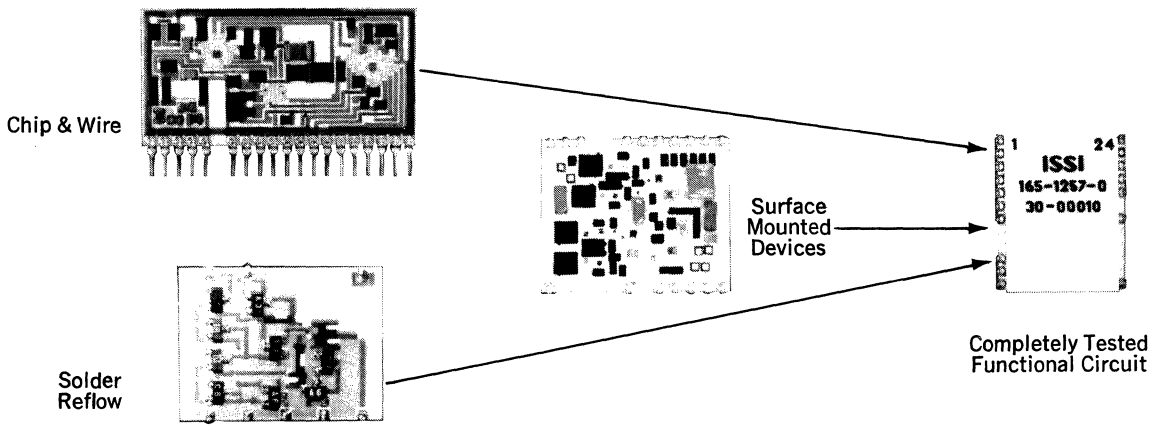
INTERNATIONAL SENSOR SYSTEMS, INC.

P.O. Box 345
Industrial Park
AURORA, NEBRASKA 68818

Telephone (402) 694-6111
FAX (402) 694-6180

HYBRID THICK FILM PRODUCTS AND SERVICES

Custom and Surface Mount Packages



CUSTOM PACKAGES

- Single In-line (SIP)
  - High Temp Solder
  - Low Temp Solder
- Hybrid
  - Flat Packs
- Dual In Line (DIP)
- Surface Mount
  - PCB Base
  - Ceramic Base
  - (See opposite page for details)
- Multi-layer Circuit
- Encapsulated
- X-tal Can Covers
- Ceramic Cover
  - High Temperature Sealant
  - Low Temperature Sealant
- Plastic Covers

CUSTOM COMPONENTS

- Custom Thick Film Metallized Substrates, Pd Ag, Pt Ag, Au, Pt Au, Dielectric, Glaze
- Networks, Specialized Resistor
  - Resistor-Capacitor
  - Resistor-Capacitor-Inductor
  - EMI/RFI Shielded
- Special Devices
- Amplifiers
- Oscillators
- Time Base Modules
- A-D, D-A Converters
- Fiber Optic
  - (Transceivers, Bar Code Readers)
- Solid State Relays
- Microwave
- Control Circuit
- Display Panels

TECHNICAL SERVICES

- Circuit Design
- Circuit Layout (Includes conversion to Thick Film)
- Material Selection
- Create Rubyliths
- Component Specification
- Tooling
- Product Testing
- Build to Print

TECHNICAL CAPABILITIES

- Solder Reflow
  - IC Packages, Discrete Components (Capacitors, Bridges, L E.D.'s etc.)
- Chip and Wire
  - All Component Chips
  - All Available Integrated Circuits
  - Thermo-Compression Bonding (Au Wire)
  - Thermo Sonic Bonding (Au Wire)
  - Ultrasonic Bonding (Al Wire)
- Special Static Handling
- Resistance & Capacitance Trimmed (Active and Passive)

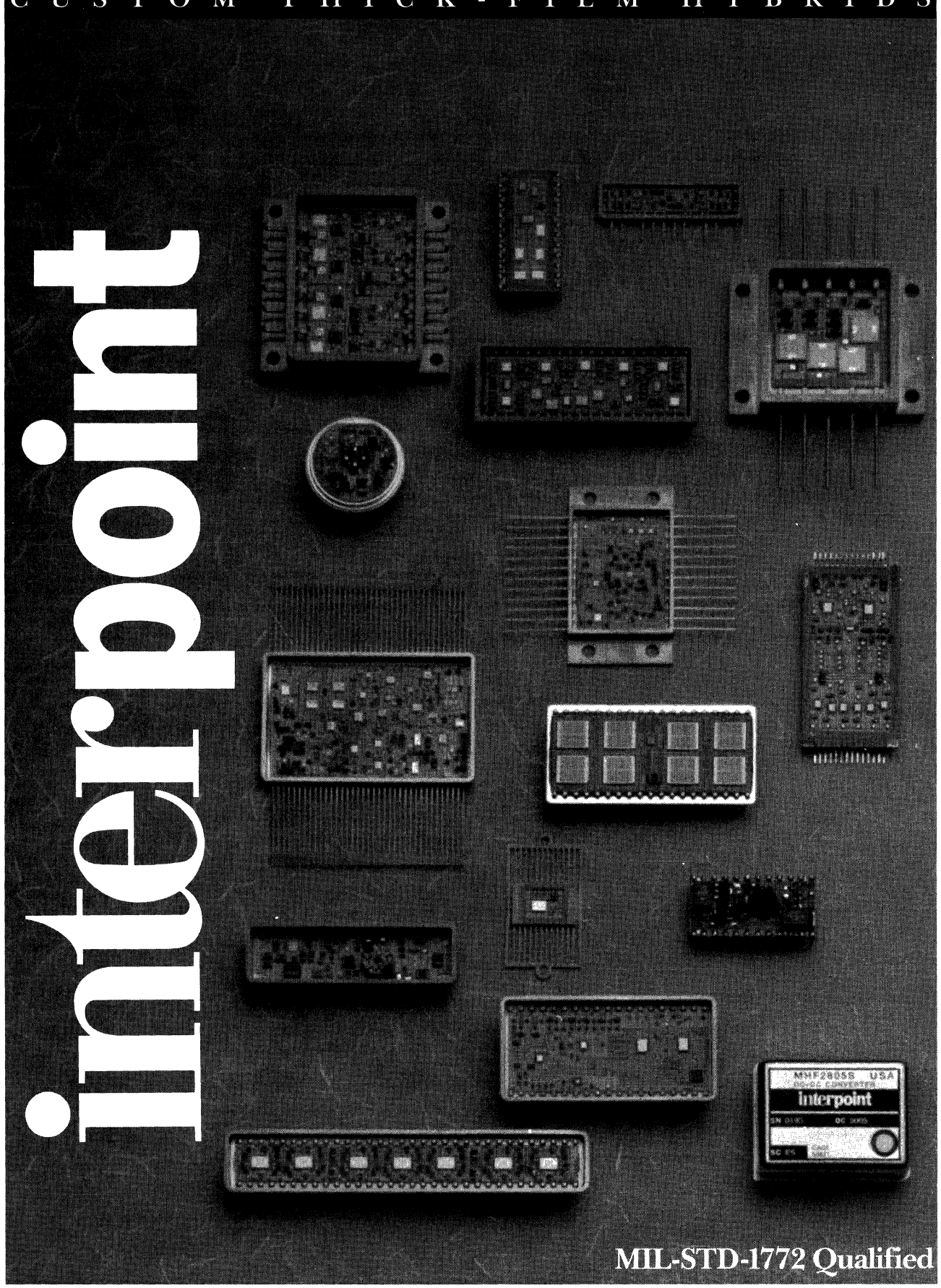
MILITARY SPECIFICATION CAPABILITIES

- MIL-I-45208 Inspection Systems Requirements
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- MIL-STD-883 Test Methods and Procedures for Microelectronics
- Certificate of Compliance furnished upon Request

PO BOX 345, INDUSTRIAL PARK
AURORA, NE 68818
TELEPHONE (402) 694-6111

CUSTOM THICK-FILM HYBRIDS

interpoint



MIL-STD-1772 Qualified

R E L I A B I L I T Y

20 Years of Hi-Rel Expertise

Interpoint Corporation is the premier world-wide supplier of thick-film hybrids for high reliability electronic applications. For over two decades it has proven itself by building custom microcircuits for the most demanding applications—commercial and military aircraft, computers, medical electronics, missile systems, satellite payloads.

Interpoint is a dedicated hybrid manufacturer—our entire corporate mission is design and production of superior microcircuits. Founded in 1969 as Integrated Circuits Incorporated, Interpoint was one of the first suppliers to offer full certification and qualification to the highest quality standards under MIL-STD-1772—and one of the first to implement Statistical Process Controls and Computer Integrated Manufacturing.

The Choice Is Yours

Interpoint offers the system designer more choices than any other microcircuit manufacturer.

- Choose domestic manufacturing in our MIL-STD-1772, 50,000 square foot Redmond Washington plant. Or pick cost effective off-shore production in our 40,000 square foot, military quality facility in Taiwan.
- Select test standards—up to full MIL-STD-883C test procedures are available in-house as well as custom screening to your own specifications.
- Choose package styles, from full hermetic welded cases to cost effective ceramic and plastic potted styles.
- Select the delivery system—large or small orders, inventory stock or just-in-time.



In programs that need the highest levels of reliability, Interpoint hybrids are the first choice. Interpoint hybrids are used on virtually every airliner in the West, the most advanced fighter aircraft, in medical electronics, computers, and industrial controls.

Short Lead Times

Interpoint has become one of the acknowledged industry leaders in applying systems management techniques to the hybrid process—from initial design and analysis through production and final test. This expertise means high reliability, fast turn-around, and precision engineering for each circuit.

Interpoint can produce a prototype of your circuit in as little as 8 to 12 weeks.

PROVEN RELIABILITY: WITH THE INDUSTRY'S WIDEST CHOICE OF DOMESTIC AND INTERNATIONAL MANUFACTURE.

A Single World-wide Quality Standard

Interpoint is the only thick-film hybrid supplier to provide both the highest standards of quality and a choice between domestic and international production.

Our US facility is fully qualified under MIL-STD-1772 and the company is listed in MIL-M-38510G's Qualified Manufacturer's List (QML).

We apply the same quality standards —the same source controls and process requirements—to our Interpoint manufacturing facility in Kaohsuing, Taiwan. This facility has been audited and approved for military program level production by some of the largest suppliers of Hi-Rel electronics.

Interpoint offers a complete in-house screening capability that includes full compliance with MIL-STD-883C method 5008. Screening includes electrical test over temperature; visual inspection; gross and fine leak tests; stabilization bake; temperature cycling, constant acceleration, and burn-in.

SPECIFICATIONS WORKED TO: INTERPOINT, REDMOND	
Overall Facilities	MIL-STD-1772
Inspection Systems	MIL-I-45208
Clean Room and Workstation Requirements	FED-STD-209
Configuration Control	MIL-STD-481, DOD-STD-480
Corrective Action, Nonconforming Material	MIL-STD-1520
ESD Control Program	DOD-STD-1686
Hybrid Microcircuit	**MIL-H-38534**
Calibration Program	MIL-C-45662
Test Methods and Procedures	MIL-STD-883

interpoint

MIL-STD-1772 Qualified

10301 Willows Road
P.O. Box 97005
Redmond, WA 98073-9705
TEL: (206) 882-3100
FAX: (206) 869-7402

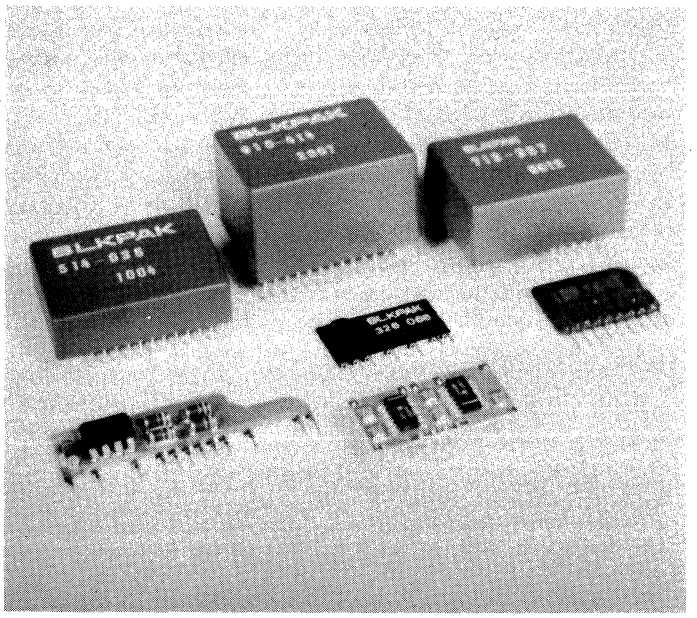
ISL PRODUCTS INTERNATIONAL LTD.

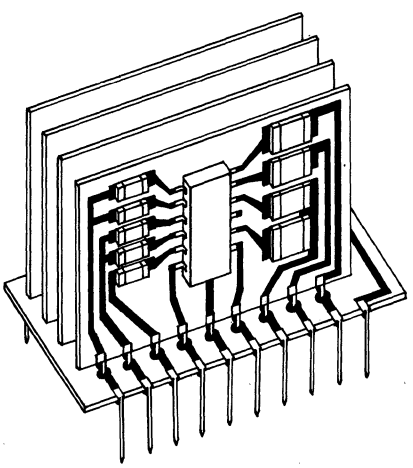
Dept. EM, 235 Robbins Lane, Suite 270, Syosset, NY 11791
(516) 937-3475/TWX 503242/ISL-INT
FAX (516) 937-3840

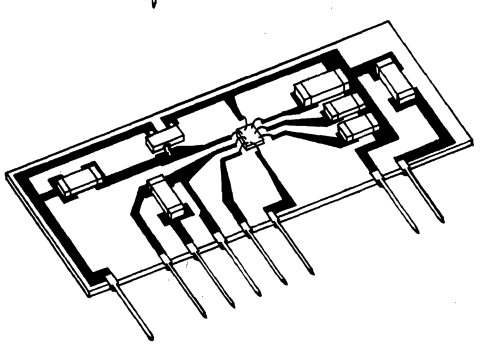
CAPACITORS / SILICON DIODES / LEDS / POTENTIOMETERS /
TRANSFORMERS / ADAPTORS AND POWER SUPPLIES / CUSTOM CABLE ASSEMBLIES

BLKPAK: A HYBRID IC REVOLUTION

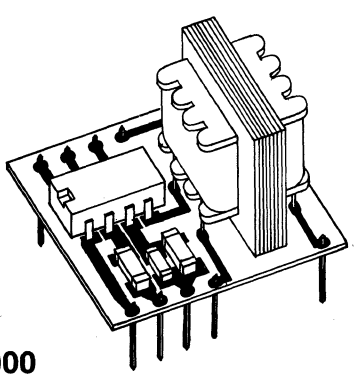
- Surface Mount Technology
- Die Attach (Epoxy, Solder)
- Ultrasonic Wire Bonding
- Epoxy Coating or Epoxy Potting
- Automated Hybrid Assembly
- CAD System In-House
- Experienced Design Engineering
- Temperature Cycle Burn-In
- 100% Quality Assurance







- Flexible Function Modularity
- Improved System Reliabiilty
- Circuit Miniaturization
- Ultra Low EMI/RFI Shield
- Solvent Washable
- Full-Custom or Semi-Custom Design
- Quick Prototyping
- High Volume Capacity
- Cost Effective

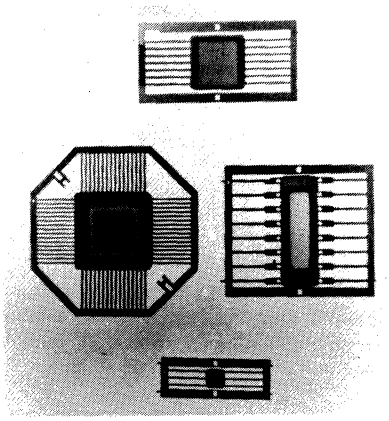


SEE OUR PAGES IN SECTIONS 2100, 4750, 5600 & 6000

HERMETIC PACKAGES FOR MICROCIRCUITS

MINI-SYSTEMS, INC.
Electronic Package Division
168 East Bacon St., P.O. Box 1597, Plainville, MA 02762
TEL (508) 695-2000 FAX (508) 695-8758 TWX 510-600-4340

GLASS FLATPACKS & CHIP CARRIERS

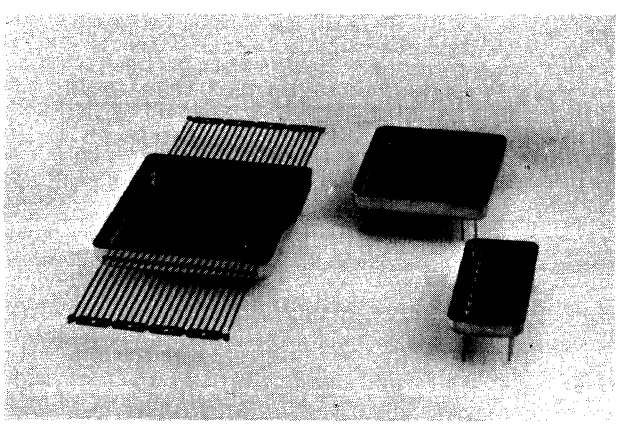


- Computer Aided Design
- Moderate tooling for custom packages
- Sealed by reflow soldering

Features

- Over 460 tooled variations
- Body sizes from 1/8″ square to 1″ square
- Lead counts up to 148
- Lead spacing .025, .030, .040, .050, .100
- Base materials ASTM F-15, Alumina, Metalized Alumina, Beryllia
- Custom lead forming (leaded chip carrier or gull wing)
- Gold, Nickel, Silver, and custom plating
- Matching combination lids available

METAL PLUG-INS & FLATPACKS



- Custom variations invited
- Used to enclose large, Hi-Rel hybrids
- Sealed by reflow soldering or seam welding

Features

- Unibody™ one piece case (ASTM-F-15 Alloy)
- Body sizes from .625 square to 1.97 × 2.97 available
- Lead spacings: .100 for Plug-ins .050, .100 for flatpacks
- Lead forming available
- Round or ribbon leads available
- Selective ground pins available
- Gold, Nickel, and selective plating
- Matching step lids available

WRITE OR CALL FOR OUR CATALOG

hybrid IC (HIC) DC/DC converter

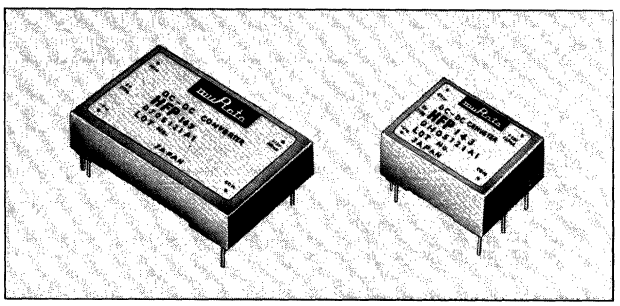
MURATA ERIE NORTH AMERICA

Miniature Power Supply for Computer Peripherals and Communications Systems.

Reliability is high because Murata Erie's ceramic capacitors are used in the filtering circuit. All components are mounted on alumina substrates, and resin potted.

These ultra-small converters were designed by raising converter frequency with a self-excited flyback converter as the circuit system.

Murata-Erie offers two output levels: 1.5W and 3.0W. Each has single output and dual output. Applications are built-in power supplies for communications systems and computer peripherals.



FEATURES:

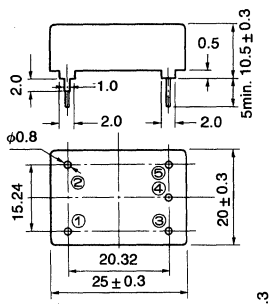
- Long life and high reliability (Electrolytic and tantalum electrolytic capacitors are not used).
- Perfect isolation between input and output signal. This guarantees protection against 500Vdc for up to one minute.
- Noise is prevented by built in LC filters for input-output, and the converter is shielded.
- Protective circuit prevents current overload.
- No external components are necessary.
- High efficiency has been achieved by a unique circuit. (3W-68% Type)
- Patent pending (Japan) for circuit design and package.

APPLICATIONS

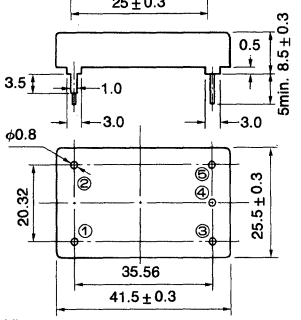
- PBX Equipment
- PC Data Aquisition Boards
- On-Board DC-DC Conversion

DIMENSIONS

1.5W Series



3.0W Series



(Unit: mm)

Pin. No. 1. +Vin
2. −Vin
3. +Vo
4. G (If the output is single, there is no pin.) — Output
5. −Vo (If the output is single, this pin is ground.)

Input

SPECIFICATIONS

Part Number	HFP143DH05121A1	HFP143DH05122A1	HFP1143DH05151A1	HFP143DH05000A1	HFP143DJ05121A1	HFP143DJ05122A1	HFP143DJ05151A1	HFP143DJ05152A1
Input Voltage Range	5V ± 10%				5V ± 10%			
Output Voltage	12V ± 5%	± 12V ± 5%	15V ± 5%	± 15V ± 5%	12V ± 5%	± 12V ± 5%	15V ± 5%	± 15V ± 5%
Output Current	0 to 120mA	Each 0 to 60mA	0 to 100mA	Each 0 to 50mA	0 to 250mA	Each 0 to 120mA	0 to 200mA	Each 0 to 100mA
Output Power	1.5W				3.0W			
Output Ripple Voltage	100mVpp MAX				100mVpp MAX			
Efficiency	65% Type				68% Type			
Input Characteristics	0.5% MAX				0.5% MAX			
Load Characteristics	1% MAX	5% MAX	1% MAX	5% MAX	1% MAX	5% MAX	1% MAX	5% MAX
Current Overload Protection	Current Overload Protection							
Operating Temperature Range	− 20°C to + 70°C (Refer to the Derating Curve)							
Storage Temperature Range	− 30°C to + 85°C							
Insulation pressure-proof	Between input and output AC500V for one minute							
Insulation resistance	Between input and output DC500V min 100MΩ							
Shield	Metal case, the quality of the material: SPCC							

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

hybrid IC (HIC) DC/DC converter

MURATA ERIE NORTH AMERICA

This DC/DC converter is suitable for battery powered radios such as pagers. With a 1.5V supply, outputs of 3V or 5V are available.

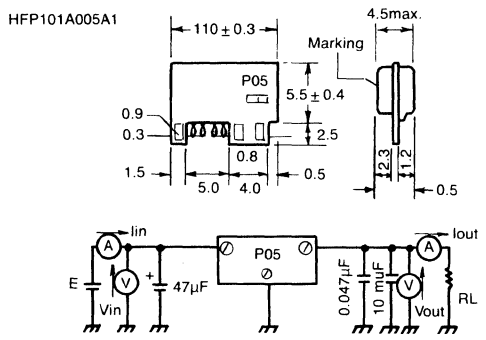
FEATURES:

- Miniature size, incorporating surface mount transformers and other SMD components.
- High efficiency due to unique circuit technology.
- Noise effects can be suppressed by adjusting the switching frequency or transformer shield.
- Temperature coefficient of output voltage is adjusted to the temperature characteristics of an LCD.

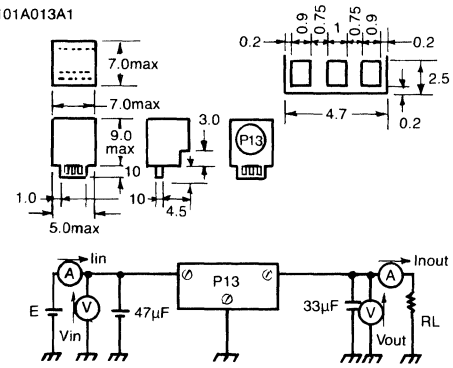
APPLICATIONS

- Pagers
- Notebook PC's (Battery Backup Circuit)

HFP101A005A1



HFP101A013A1



3V Output Series

Part Number		HFP101A005A1	HFP101A018A1	HFP101A019A1
Input Voltage Range	Vin (V)	0.9 to 1.7	1.0 to 1.7	0.9 to 1.7
Output Voltage	Vout (V)	1.8 to 2.8	2.80 to 3.05	2.95 to 3.35
Max. Load Current	Iout (mA)	10	1.0	0.1
No-load Input Current	Iin (μA)	—	300 max.	400 max.
Rise Time	T (msec)	30 max.	30 max.	5.0 max.
Output Ripple Voltage	Vrip (mVpp)	100 max.	20 max.	5 max.
Temperature coefficient	Tcoeff (mV/°C)	—	−4.0	−5.0
Efficiency*	η (%)	75	70	40
Oscillation Frequency**	Fd (KHz)	200 to 300	250 to 500	750 to 1300

5V Output Series

Part Number		HFP101A013A1	HFP101A014A1	HFP101A017A1
Input Voltage Range	Vin (V)	1.0 to 1.7	1.0 to 1.7	1.8 to 3.4
Output Voltage	Vout (V)	4.6 to 5.3	4.7 to 5.2	4.7 to 5.5
Max. Load Current	Iout (mA)	6.0	6.0	4.0
No-load Input Current	Iin (μA)	800 max.	500 max.	900 max.
Rise Time	T (msec)	30 max.	30 max.	30 max.
Output Ripple Voltage	Vrip (mVpp)	65 max.	65 max.	30 max.
Temperature Coefficient	Tcoeff (mV/°C)	−8.5	−8.5	−11
Efficiency*	η (%)	80	80	75
Oscillation Frequency**	Fd (KHz)	70 to 200	150 to 300	480 to 960

*Efficiency is a standard value at the rated input voltage and maximum load current.
**Oscillation frequency is the value at maximum load current.

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

hybrid IC active filter

MURATA ERIE NORTH AMERICA

PCM/Digital Audio

AFS814F20000A2

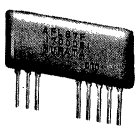


Part Number	Filter Order	Distortion Rate (%)	Noise Level (μV)	Dimension (mm)			Analog Filter	Digital Filter		De-emphasis	Aperture Compensation
				L	H	T		2Fs	4Fs		
AFL83F20000A1	3	0.003	30	22.0	14.0	5.5		○	○	○	
AFL75F20000D1	5	0.003	8	28.0	13.0	5.5			○		
AFL77F20000A1	7	0.003	8	33.0	15.0	5.5		○			
AFL87F20000E1	7	0.003	8	33.0	15.0	5.5	○				
AFS814F20000A2	7×2	0.003	8	53.0	15.0	5.5	○				
AFL89WB20000C5	9	0.003	8	37.0	16.0	5.0	○				
H8DN2175*	3	0.004	—	14.5	8.5	3.5		○	○	○	

*H8DN2175 RC Module is designed to be attached to an operational amplifier.

TV Surround Sound

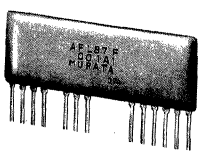
AFL87F17000E1



Part Number	Filter Order	Distortion Rate (%)	Noise Level (μV)	Dimension (mm)			Analog Filter	Digital Filter		De-emphasis	Aperture Compensation
				L	H	T		2Fs	4Fs		
AFL89F8000D1	9	0.003	8	38.0	17.0	5.0	○				
AFL85F8000E1	5	0.003	32Typ	23.0	15.0	5.5	○				

CD-i (Interactive)

AFL87F001A1



Part Number	Filter Order	Distortion Rate (%)	Noise Level (μV)	Dimension (mm)			Analog Filter	Digital Filter		De-emphasis	Aperture Compensation
				L	H	T		2Fs	4Fs		
AFL87F17000E1	7	0.003	8	33.0	15.0	5.5	○				
AFL87F001A1	7	0.004	60	44.5	18.0	5.5	○			○	

*Distortion rate is the typical value at 1KHz, 2Vms.
*Noise level is the typical value.
*Filter order ×2: Stereo.
*Custom-made types are available upon request.

Modem

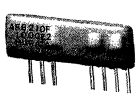
AFM922F001K1



Part Number	Function	Dimensions (mm)		
		L	H	T
AFL14F400C2	Transmit LPF (fc = 4KHz, Butterworth)	22.0	12.0	6.5
AFE36F1800E1	Link equalizer (1 link equalizer)	33.0	13.5	6.5
AFM94F400C12	Ringing tonal defecting circuit (fo = 400Hz)	48.0	15.0	6.5
AFR74F3280C1	Backword channel notch filter	27.5	12.0	6.5
AFM922F001K1	4800bps analog front end for modem application	76.5	17.0	8.0

Two Way Radio & Mobile Communications

AFB210F1000E2



Part Number	Function	Dimensions (mm)		
		L	H	T
AFB210F1000E2	Receiving unit BPF for US Cellular/UK-TACS	27.0	9.0	6.0
AFL14F20000S12	Data Filter for US Cellular	15.0	9.0	6.5
AFC98F003A1	Data/SAT Filter for US Cellular	27.5	10.0	7.0
AFL24F3120A14	Splatter Filter for Radio Tranceivers	16.5	11.5	5.0

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

REEVES-HOFFMAN

DIVISION DYNAMICS CORPORATION OF AMERICA

HERMETIC SEALS

Platforms—Kovar or CRS Material

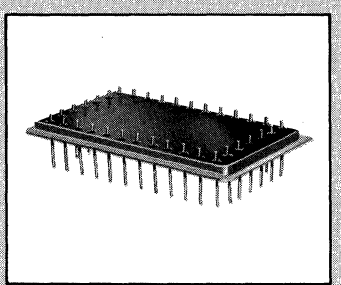
PACKAGE SIZE AND DESIGN

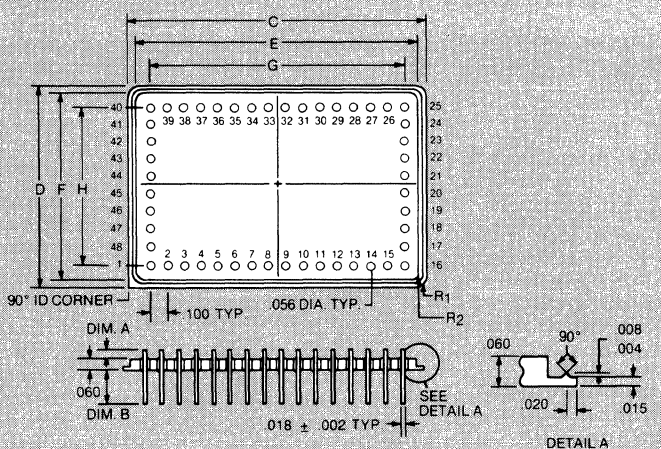
If you do not see a specific package which suits your requirements, please contact us. We are continually adding new sizes to meet customer demands.

PLATING

We have an in-house plating facility providing electrolytic gold and nickel, as well as electroless nickel. Quality controls are maintained to provide complete compliance with MIL-G-45204, QQN-290, and MIL-C-26074. Check with us for a plating recommendation to meet your requirements.

RESISTANCE WELD OR SOLDER SEAL





R-H PART NUMBER	NO. PINS[h]	PIN LOCATION	A[i]	B[i]	C	D	E	F	G	H	R_1	R_2	90°ID
04-20001-000	14	(7 + 7)G	.050	.250	.798	.497	.698	.397	.600	.300	.080	.030	YES
04-19538-000	14	(7 + 7)G	.050	.250	.870	.498	.770	.398	.600	.300	.080	.030	YES
04-19650-000	16	(8 + 8)G	.050	.250	.970	.498	.870	.398	.700	.300	.080	.030	YES
04-19759-000	22	(9 + 9)G/(2 + 2)H	.050	.250	1.070	.498	.970	.398	.800	.300	.080	.030	YES
04-19540-000	26	(8 + 8)G/(5 + 5)H	.050	.250	.970	.795	.870	.695	.700	.600	.080	.030	YES
04-19571-000	34	(12 + 12)G/(5 + 5)H	.050	.250	1.370	.795	1.270	.695	1.100	.600	.080	.030	YES
04-19529-000	32	(14 + 14)G/(2 + 2)H	.050	.250	1.560	.525	1.470	.435	1.300	.300	.080	.035	YES
04-19872-000	42	(14 + 14)G/(7 + 7)H	.050	.250	1.500	1.000	1.400	.900	1.300	.800	.085	.035	YES
04-19873-000	48	(16 + 16)G/(8 + 8)H	.050	.250	1.740	1.140	1.640	1.040	1.500	.900	.155	.105	NO
04-21291-000	24	(12 + 12)G	.050	.250	1.370	.495	1.270	.398	1.100	.600	.080	.035	YES
04-21585-000	24	(7 + 7)G/(5 + 5)H	.050	.250	.775	.775	.685	.685	.600	.600	.046	.035	NO
04-21186-000	32	(9 + 9)G/(7 + 7)H	.050	.250	1.000	1.000	.900	.900	.800	.800	.097	.046	NO
04-21181-000	44	(12 + 12)G/(10 + 10)H	.050	.250	1.270	1.270	1.185	1.185	1.100	1.100	.050	.050	YES
04-21640-000	26	(7 + 7)G/(6 + 6)H	.050	.250	.900	.900	.800	.800	.600	.700	.086	.039	YES

NOTES:

h. Packages available with any quantity of leads less than maximum listed.

i. Consult factory for other dimensions.

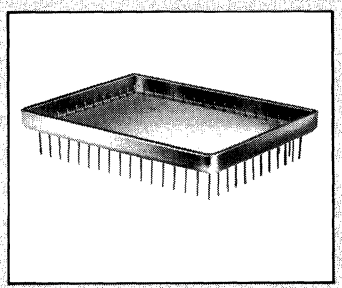
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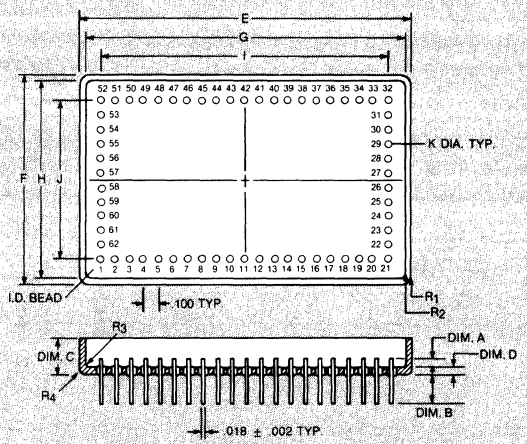
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HERMETIC SEALS

DRAWN TUB PLUG-INS
KOVAR OR CRS MATERIAL





R-H PART NUMBER	NO. PINS[a]	PIN LOCATION	A[b]	B[b]	C[b]	D	E	F	G	H	I	J	K	R_1	R_2	R_3	R_4
04-19526-000	18	(7 + 7)I / (2 + 2)J	.050	.250	.140	.040	.795	.470	.715	.390	.600	.300	.047	.060	.020	.010	.050
04-21124-000	18	(7 + 7)I / (2 + 2)J	.050	.250	.200	.040	.820	.490	.740	.410	.600	.300	.047	.060	.020	.010	.050
04-20517-000	20	(8 + 8)I / (2 + 2)J	.050	.250	.200	.040	.895	.495	.815	.415	.700	.300	.047	.060	.020	.010	.050
41-21081-000	10	(5 + 5)I	.050	.250	.200	.040	.625	.625	.545	.545	.400	.400	.047	.060	.020	.020	.050
04-19758-000	22	(9 + 9)I / (2 + 2)J	.050	.250	.200	.040	.998	.490	.918	.410	.800	.300	.047	.060	.020	.010	.050
04-20929-000	24	(7 + 7)I / (5 + 5)J	.050	.250	.200	.040	.750	.750	.670	.670	.600	.600	.047	.060	.020	.010	.050
04-19544-000	32	(9 + 9)I / (7 + 7)J	.050	.250	.200	.040	.995	.995	.915	.915	.800	.800	.047	.060	.020	.010	.050
04-19549-000	34	(12 + 12)I / (5 + 5)J	.050	.250	.385	.040	1.270	.770	1.190	.690	1.100	.600	.047	.060	.020	.020	.060
04-19550-000	46	(18 + 18)I / (5 + 5)J	.050	.250	.200	.040	1.895	.775	1.815	.695	1.700	.600	.047	.060	.020	.020	.050
04-19536-000	30	(10 + 10)I / (5 + 5)J	.050	.250	.170	.040	1.140	.936	1.060	.856	.900	.600	.047	.155	.115	.010	.050
04-19760-000	38	(12 + 12)I / (7 + 7)J	.050	.250	.185	.040	1.270	.970	1.190	.890	1.100	.800	.047	.060	.020	.020	.050
04-21235-000	42	(16 + 16)I / (5 + 5)J	.050	.250	.210	.040	1.695	.775	1.615	.695	1.500	.600	.047	.060	.020	.010	.050
04-19566-000	52	(19 + 19)I / (7 + 7)J	.050	.250	.220	.040	1.990	.990	1.910	.910	1.800	.800	.047	.080	.040	.020	.080
04-21076-000	52	(19 + 19)I / (7 + 7)J	.050	.250	.200	.040	1.990	.990	1.910	.910	1.800	.800	.056	.060	.020	.020	.080
04-19651-000	44	(12 + 12)I / (10 + 10)J	.050	.250	.200	.040	1.250	1.250	1.170	1.170	1.100	1.100	.047	.060	.020	.010	.050
04-20745-000	50	(18 + 18)I / (7 + 7)J	.050	.250	.230	.040	1.925	1.036	1.845	.956	1.700	.800	.047	.060	.020	.020	.060
04-19515-000	48	(16 + 16)I / (8 + 8)J	.050	.250	.260	.040	1.740	1.140	1.660	1.060	1.500	.900	.056	.060	.020	.010	.050
04-20833-000	64	(16 + 16 + 16 + 16)I	.050	.250	.225	.040/.045	1.760	1.245	1.680	1.162	note c	1.050	.050	.055	.020	.010	.050
04-19574-000	54	(17 + 17)I / (10 + 10)J	.050	.250	.170	.040	1.830	1.330	1.750	1.250	1.600	1.100	.056	.086	.046	.020	.050
04-21216-000	56	(15 + 15)I / (13 + 13)J	.050	.250	.200	.040	1.600	1.600	1.520	1.520	1.400	1.400	.047	.060	.020	.020	.060
04-19761-000	56	(20 + 20)I / (8 + 8)J	.050	.250	.385	.040	2.140	1.140	2.060	1.060	1.900	.900	.056	.060	.020	.010	.050
04-19537-000	62	(21 + 21)I / (10 + 10)J	.050	.250	.215	.050	2.300	1.400	2.200	1.300	2.000	1.100	.056	.090	.040	.010	.060
04-20850-000	62	(21 + 21)I / (10 + 10)J	.050	.250	.200	.040	2.300	1.400	2.220	1.320	2.000	1.100	.056	.060	.020	.010	.050
04-21587-000	50	(17 + 17)I / (8 + 8)J	.050	.250	.180	.040	1.930	1.140	1.850	1.060	1.600	.900	.056	.086	.046	.020	.060
04-21773-000	38	(14 + 14)I / (5 + 5)J	.050	.250	.240	.040	1.470	.770	1.390	.690	1.300	.600	.047	.060	.020	.015	.055
04-21801-000	78	note c	.050	.250	.210	.040	2.100	1.870	2.020	1.790	note c	note c	.056	.086	.046	.020	.060
04-21878-000	62	(23 + 23)I / (8 + 8)J	.050	.200	.160	.040	2.400	1.100	2.320	1.020	2.200	.900	.056	.060	.020	.020	.060
04-21879-000	132	note c	.050	.200	.200	.040	2.380	1.580	2.300	1.500	note c	note c	.042	.086	.046	.020	.060
04-21976-000	28	(9 + 9)I / (5 + 5)J	.050	.200	.160	.040	1.000	.750	.920	.670	.800	.600	.042	.055	.015	.020	.060

NOTES:

a. Packages available with any quantity of leads less than maximum listed.
b. Consult factory for other dimensions.
c. Special lead configuration—consult factory.

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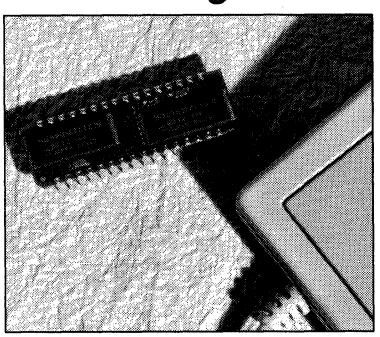
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4 Mbit CMOS SRAM Packaged in 32-PIN DIP



The BPS16288PL-12C SRAM provides a fast, easy upgrade to 4 Mbit memory in the same space as a standard 32-pin EIAJ package. Overall width is 15.5mm.

Memory is organized as 524,288 words X 8 bits. On-board ICs are TSOP, contributing to lower overall profile height, reduced cost, better process control, and the industry's highest quality control.

Access is a fast 85 nsec; maximum chip select time is 120 nsec. Operation is fully static, no clock or timing strobe is required. Power requirements are a low 80 µW operating, 40 µW standby. Other features include TTL-compatible I/O, tri-state output, and battery backup.

Low Cost, Low Power Single Chip Microcomputer



ROHMs 4-bit single chip application-specific microcomputers are ideal for high volume consumer pro-ducts. These fully supported parts offer very cost-effective design solutions.

CMOS Static RAMs

Organization	Part No.	Access (nS max)	Pins	Package
2Kx8	BR6116-09*	90	24	DIP
2Kx8	BR6116-12*	120	24	DIP
2Kx8	BR6116F-09*	90	24	SOP
2Kx8	BR6116F-12*	120	24	SOP
8Kx8	BR6264-10*	100	28	DIP
8Kx8	BR6264-12*	120	28	DIP
8Kx8	BR6264F-10*	100	28	SOP
8Kx8	BR6264-12*	120	28	SOP
32Kx8	BR62256-10*	100	28	DIP
32Kx8	BR62256-12*	120	28	DIP
32Kx8	BR62256F-10*	100	28	SOP
32Kx8	BR62256F-12*	120	28	SOP

*Low Power Available

Bi-Polar Linear ICs

Part Number	Function	Generic Equivalent	Pins	Package
BA4558	Dual Op Amp	4558	8	DIP
BA4558F	Dual Op Amp	4558	8	SOP
BA4560	Dual Op Amp	4560	8	DIP
BA4560F	Dual Op Amp	4560	8	SOP
BA14741	Quad Op Amp	4741	14	DIP
BA14741F	Quad Op Amp	4741	14	SOP
BA15532	Dual Op Amp	5532	8	DIP
BA15532F	Dual Op Amp	5532	8	SOP
BA15532N	Dual Op Amp	5532	8	SIP
BA15218	Dual Op Amp		8	DIP
BA15218F	Dual Op Amp		8	SOP
BA10324	Quad Op Amp	2902, 324	14	DIP
BA10324F	Quad Op Amp	2902, 324	14	SOP
BA10358	Dual Op Amp	2904, 358	8	DIP
BA10358F	Dual Op Amp	2904, 358	8	SOP
BA10393	Dual Comparator	2903, 393	8	DIP
BA10393F	Dual Comparator	2903, 393	8	SOP
BA10339	Quad Comparator	2901, 339	14	DIP
BA10339F	Quad Comparator	2901, 339	14	SOP

Series	ROM 8-bit	RAM 4-bit	Ports I	Ports O	Ports I/O	Instruction Set	Stack	EXE Time (µS)	VDD (V)	IDD (mA)	Package	Support System
BU2403L BU2404L	640	16	4	8	-	40	2	12.5	3.0	0.3	SOP18 DIP18	RDSBU2 EV2403C
BU2428L BU2429L	640	16	-	-	-	40	2	12.5	3.0	0.3	SOP16 DIP16	RDSBU2 EV2403C
BU2418L BU2419L BU2422L	1024	32	4	8	4	43	3	12.5	3.0	0.3	SOP22 DIP22 SDIP22	RDSBU2 EV2418
BU2430L BU2431L	1024	32	-	-	-	43	3	12.5	3.0	0.3	SOP20 DIP20	RDSBU2 EV2418
BU2421 BU2425	1024	64	4	1	4	38	3	1.5	5.0	0.5	SDIP32 QFP32	RDSBU2 EV2421
BU2424L	2048	64	4	1	4	38	3	12.5	3.0	0.3	QFP44	RDSBU2 EV2424

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SHARP

LH5492
4k × 9 CLOCKED FIFO

FUNCTIONAL DESCRIPTION

The LH5492 is a 4k x 9 bit dual-port memory with internal addressing to implement a First-In-First-Out Algorithm. One port is dedicated to write operations, and the other is dedicated to read operations. Two edge-sampled enable inputs are provided for each port. These read and write controls are designed to interface to continuously clocked synchronous systems, but the independent read and write clocks may be operated completely asynchronously relative to each other. Data flow is initiated on the rising edge of the appropriate clock signal, and gated only by the corresponding enable control inputs.

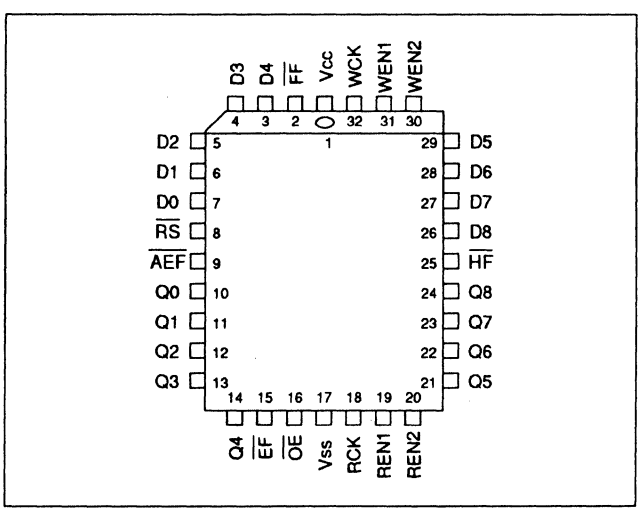
A broad range of status flags monitor the extent to which data has been written into the FIFO. These include Empty, Half, Almost Empty/Full (within eight of Empty or Full), and Full status flags. These flags may be tied directly enabling the inputs to prevent overrun of FIFO boundaries. Alternately, enabling read/write operations may be controlled entirely by external system logic, while the flags serve as system interrupts. This approach is particularly useful when the relation between read and write clocks is asynchronous.

A level-sensitive output-enable input provides high impedance output capability for interface to shared system buses. This output-enable function along with the multiple read and write enable inputs allows for simplified implementation of bidirectional FIFO interfaces, as well as interfaces between system buses of different word widths.

FEATURES

- Fast Cycle Times—25/35/50ns
  Frequency—40/28.5/20MHz
- Rising Edge-triggered Clock Inputs
- Multiple Read & Write Enable Inputs Sampled on Rising Edge
- Full CMOS Dual Port Memory Array
- Fully Asynchronous Read & Write Operations
- Empty, Half, Almost Empty/Almost Full, & Full Flags
- Output Enable for 3-state Output Capability
- Adaptable to Bidirectional Bus Interfaces
- Interface between Buses of different Word Widths
- Reset/Reread Capability
- TTL & CMOS Compatible I/O
- 32 Pin PLCC Package

PINOUT DIAGRAM



32-Pin PLCC (Top View)

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SHARP

LH5420
256 × 36 × 2 BIDIRECTIONAL FIFO

FUNCTIONAL DESCRIPTION

The LH5420 contains two FIFO buffers which operate in parallel but opposite directions for bidirectional data buffering. The two FIFO buffers are each organized as 256 words by 36 bits. The LH5420 is ideal for either wide unidirectional or bidirectional data applications, since component count and board area is reduced.

Each port has its own port-synchronous clock, but the two ports may operate asynchronously relative to each other. Data flow is initiated on a port by the rising edge of the appropriate clock and gated by the corresponding edge sampled enable and read/write control signals. Clock duty cycles can vary from 40% to 60% without sacrificing performance.

FIFO status flags monitor the extent to which the FIFO buffers have been filled. These include Empty, Almost Empty, Half Full, Almost Full, and Full flags for each FIFO. The Almost Empty and Almost Full flags are programmable over the entire FIFO depth, but are conveniently initialized to 8 locations from the respective boundaries at reset.

A synchronous request acknowledge handshake is provided on each port for FIFO data accesses. This request-acknowledge handshake resolves FIFO full and empty boundary conditions, when the two ports are operated asynchronously relative to each other.

Two mailbox registers provide a separate path for passing control or status words between ports. Each mailbox has a flag which is synchronized to the reading port's clock. This mailbox function can facilitate the synchronization of data transfers between asynchronous systems.

A Data Bypass mode allows Port-A to directly transfer data to or from Port-B at reset. In this mode the device acts as a registered transceiver under Port-A control. For instance, a master processor on Port-A can use the Data Bypass feature to pass initialization or configuration information directly to or from a peripheral device on Port-B during a system start-up.

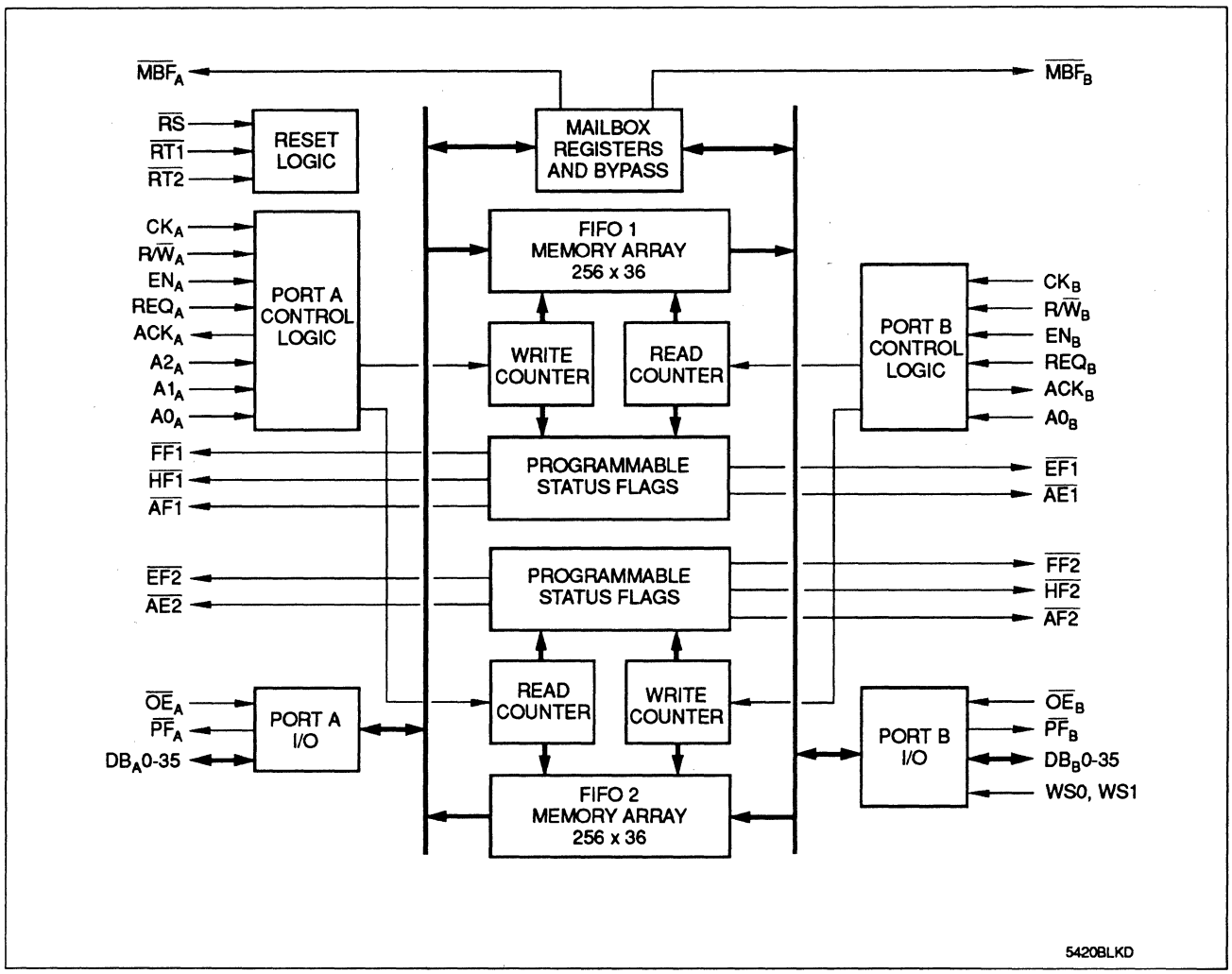
A word width select option is provided on Port B for 9 bit, 18 bit, or 36 bit data accesses. This allows word width matching between Port A and Port B with no additional logic; and ensures maximum utilization of bus bandwidths. A Byte Parity Check Flag on each port ensures data integrity. These flags initialize for odd data parity at reset, but may be reprogrammed for even or odd parity.

FEATURES

- Fast Cycle Times—25/30/35 ns
- Two 256 x 36 Bit FIFO Buffers
- Wide 36-bit Word Width
- Selectable 9/18/ 36-bit Word Width on Port-B
- Fully Asynchronous Port-to-Port Communications
- High Speed, Port-Synchronous Clocking Mechanism
  - Edge Triggered Clocks
  - R/W, Enable, & Address Pins Sampled on the Rising Clock Edge
  - Synchronous Request Acknowledge Handshake (Optional)
- Asynchronous Output Enables
- Dedicated FIFO Status Flags for Empty, Half-Full, & Full Flags
- Programmable Status Flags for Almost Empty & Almost Full
- Mailbox Registers with Synchronized Flags
- Data Bypass Function
- Data Retransmit Function
- Byte Parity Check
- TTL & CMOS Compatible I/O
- Area Efficient QFP, or PGA Packages

SHARP

LH5420
256 × 36 × 2 BIDIRECTIONAL FIFO



LH5420 Block Diagram

SHARP reserves the right to make changes in specifications at any time and without notice. SHARP does not assume any responsibility for the use of any circuitry described; no circuit patent licenses are implied.

MICROWAVE COMPONENTS

Manufacturer	Starting EEM Page No.	Terminations			RF Switches			Phase Shifters	Mixers	Oscillators	RF Relays	Detectors	Isolators	IF Amplifiers	Circulators	Frequency	
		Antenna	Coaxial	Feedthru	Diodes	Transfer	MIC									Multipliers	Synthesizers
Elcom Systems Inc.	A•1747	√	√	√					√								
Electro-Films Inc	A•1748						√	√	√	√		√	√	√	√		
General Microwave	A•1749				√§*			√*		√*							
Lorch/Vernitron	A•1751				√*	√*		√§*	√§*			√§*				√§*	
Mini-Circuits Labs	A•1752		√					√	√§			√§*		√§			
Murata Erie North America Inc.	A•1820									√			√				
NTK Technical Ceramics	A•1822									√							
Servo Corp. of America	A•1827															√*	√*
Trak Microwave Corp.	A•1829									√			√	√	√	√	√
Vernitron see Lorch above																	

* MIL Spec. § Surface Mount

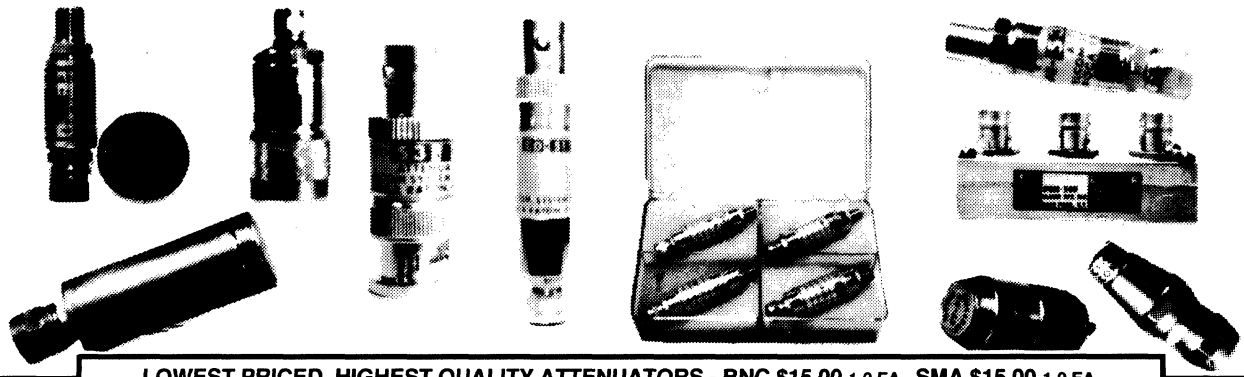
Manufacturer	Starting EEM Page No.	Attenuators					Couplers	Power Distributors		Filters			Capacitors		Cable Assemblies
		Fixed	Variable	Step	Coaxial	Programmable		Microwave	UHF/VHF	Waveguide	Coax	SAW	SLC	MLC	
Elcom Systems Inc.	A•1747	√			√		√		√						
Electro-Films	A•1748	√		√			√								
General Microwave	A•1749		√*		√*	√*	√*								
Kay Elemetrics Corp.	A•1750		√*	√*	√*	√*									
Lorch/Vernitron	A•1751		√*	√*	√*	√*	√§*			√*	√*				
Mini-Circuits Labs	A•1752	√	√		√		√§*				√				
Murata Erie North America Inc.	A•1820										√	√	√§	√§	
Quality Microwave Intrcnts	A•1824														√
Servo Corp. of America	A•1827						√*								

* MIL Spec. §Surface Mount

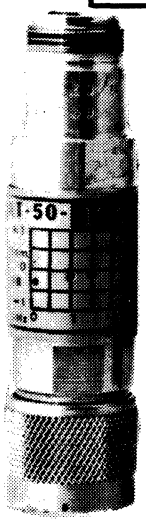
MICROWAVE SYSTEMS & SUBSYSTEMS

Manufacturer	Starting EEM Page No.	Amplifiers			Receivers	Generators	Modulators		Detectors
		Klystron	Microwave	Parametric			Microwave	Pulse	
Elcom Systems Inc.	A•1747								√
General Microwave	A•1749							√*	
Mini-Circuits.	A•1752		√				√*		
Noise Com, Inc	A•1821				√*	√*			
Servo Corp. of America	A•1827				√*	√*			

* MIL Spec.

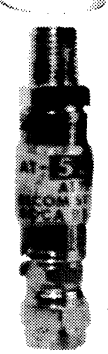


LOWEST PRICED, HIGHEST QUALITY ATTENUATORS - BNC $15.00 1-9 EA., SMA $15.00 1-9 EA. AND TERMINATIONS - BNC $5.60 10 EA., SMA $5.60 10 EA. MIL. HI-REL. NETWORKS



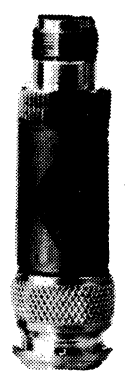
Model Number (2)	Impedance Ohms (Power W)	Frequency Range	UNIT PRICE (4) EFFECTIVE, 1-15-89 BNC	TNC	N	SMA	UHF	SMB	PC
Fixed Attenuators, 1 to 20 dB:									
AT-50 (3)	50 (.5W)	DC-1.5GHz	17.50	29.00	22.00	20.00	-	-	-
AT-51	50 (.5W)	DC-1.5GH	15.00	26.00	19.50	17.50	-	-	12.00
AT-52	50 (1W)	DC-1.5GHz	20.50	29.00	26.00	22.00	-	-	-
AT-53	50 (.25W)	DC-3.0GHz	20.50	26.00	-	15.00	-	18.00	-
AT-54	50 (.25W)	DC-4.2GHz	-	-	-	20.50	-	-	-
AT-55	50 (.25W)	DC-4.2GHz	-	-	-	19.20(10Pc.)	-	-	-
AT-75 or AT-90	75 or 93 (.5W)	DC-1.5GHz	17.50	26.00	45.50	19.50	-	-	-
Detector, Mixer, Zero Bias Schottky:									
CD-51 , 75	50 , 75	.01-4.2GHz	64.00	-	-	64.00	-	-	-
DM-51	50	.01-4.2GHz	-	-	-	64.00	-	-	-
Resistive Impedance Transformers, Minimum Loss Pads:									
RT-50/75	50 to 75	DC-1.5GHz	17.50	26.00	45.50	17.50	-	-	-
RT-50/93	50 to 93	DC-1.0GHz	17.50	26.00	45.50	17.50	-	-	-
Terminations:									
CT-50 (3)	50 (.5W)	DC-4.2GHz	11.50	15.00	15.00	17.50	-	-	-
CT-51	50 (.5W)	DC-4.2GHz	9.50	12.00	14.00	9.50	-	9.00	-
CT-52	50 (1W)	DC-2.5GHz	10.50	15.00	15.00	13.00	15.50	-	-
CT-53/M	50 (.5W)	DC-4.2GHz	5.60 (10Pc.)	-	-	5.60 (10Pc.)	-	-	-
CT-54	50 (2W)	DC-2.0GHz	14.00	15.00	15.00	17.50	-	-	-
CT-75	75 (.25W)	DC-2.5GHz	10.50	15.00	15.00	13.00	15.50	-	-
CT-93	93 (.25W)	DC-2.5GHz	13.00	15.00	-	15.00	15.50	-	-
Mismatched Terminations, 1.05:1 to 3:1, Open Circuit, Short Circuit:									
MT-51	50	DC-3.0GHz	45.50	45.50	45.50	45.50	-	-	-
MT-75	75	DC-1.0GHz	-	-	45.50	-	-	-	-
Feed thru Terminations, shunt resistor:									
FT-50	50	DC-1.0GHz	17.50	26.00	19.50	17.50	-	-	-
FT-75	75	DC-500MHz	17.50	26.00	45.50	17.50	-	-	-
FT-90	93	DC-150MHz	17.50	26.00	45.50	17.50	-	-	-
Directional Coupler, 30dB:									
DC-500	50	250-500MHz	60.00	-	84.00	84.00	-	-	-
Resistive Decoupler, series resistor or Capactive Coupler, series capacitor:									
RD or CC-1000	1000 (1000PF)	DC-1.5GHz	17.50	26.00	19.50	17.50	-	-	-
Adapters:									
CA-50 (N to SMA)	50	DC-4.2GHz	17.50	26.00	19.50	17.50	-	-	-
Inductive Decouplers, series inductor, Bias T:									
LD-R15	0.17uH	DC-500MHz	17.50	26.00	19.50	17.50	-	-	-
LD-6R8	6.8uH	DC-55MHz	17.50	26.00	19.50	17.50	-	-	-
BT-50	1.8uH	15-500MHz	84.00	84.00	94.00	84.00	-	-	-
Fixed Attenuator Sets, 3, 6, 10 and 20 dB, in plastic case:									
AT-50 -SET (3)	50	DC-1.5GHz	76.00	120.00	92.00	84.00	-	-	-
AT-51 -SET	50	DC-1.5GHz	64.00	108.00	82.00	74.00	-	-	-
Reactive Multicouplers, 2 and 4 ouput ports:									
TC-125-2	50	1.5-125MHz	84.00	-	94.00	84.00	-	-	-
TC-125-4	50	1.5-125MHz	94.00	-	104.00	94.00	-	-	-
Resistive Power Dividers, 3, 4 and 9 ports:									
RC-3-50	50	DC-2.0GHz	84.00	84.00	94.00	84.00	-	-	-
RC-4-50	50	DC-500MHz	84.00	84.00	94.00	84.00	-	-	-
RC-9-50	50	DC-500MHz	-	-	-	104.00	-	-	-
RC-3-75, 4-75	75	DC-500MHz	84.00	84.00	-	84.00	-	-	-
Double Balanced Mixers:									
DBM -1000	50	5-1000MHz	61.00	-	71.00	61.00	-	-	34.00
DBM -500PC	50	2-500MHz	-	-	-	-	-	-	34.00
RF Fuse, 1/8 Amp., and 1/16 Amp.:									
FL-50	50	DC-1.5GHz	17.50	26.00	45.50	17.50	-	-	-
FL-75	75	DC-1.5GHz	17.50	26.00	-	17.50	-	-	-

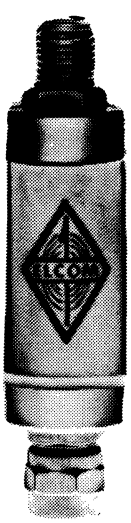




NOTE: 1) Critical parameters fully tested and guaranteed. Fabricated from Mil., Spec., High-Rel. resistors.Schottky diodes. Mil., Spec., plated parts, and connectors in nickel, silver, and gold. 2) See catalog for complete Model Number. Specify connector sexes. Specials available. 3) Calibration marked on label of unit. 4) Price subject to change without notice. Shipping $5.00 Domestic or $25 Foreign on Prepaid Orders. Minimum Order $50. Delivery in stock to 30 days ARO. © 1989A







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THIN-FILM MICROWAVE COMPONENTS

Metalized Plates

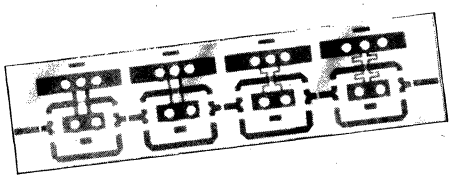
Electro-Films, Inc. offers a wide variety of metalized substrates suitable for Microwave Hybrid and Microwave Integrated Circuit applications. E.F.I.'s unique, economical fabrication process provides an exceptional range of dimensions, metalization and circuitry. Typical applications include: amplifiers, oscillators, UCO's, limiters, couplers, filters, attenuators, with frequency response thru 18 GHz and into the millimeter wave length range.

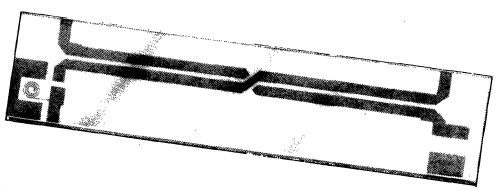
SUBSTRATE MATERIALS

- Alumina (as fired or polished) standard thicknesses of .010", .015", and .025", Dielectric Constant 9.8 typ. @ 25°C—10 GHz
- Quartz—BeO, Various thicknesses
- Sizes— Up to 4.1" x 3.3"

METALIZATION

- Sputtered in various combinations of NiCr, Cr, Ni, Au, Cu, TaN, TiW, Ti, Mo, Pd, TaW
- Electroplated — Cu, Ni, Au, up to 300 micro-inches
- Excellent adhesion (typically 7-10,000 lbs./in^2)
- One, Two or Six Surfaces
- Through Holes — metalized or non-metalized

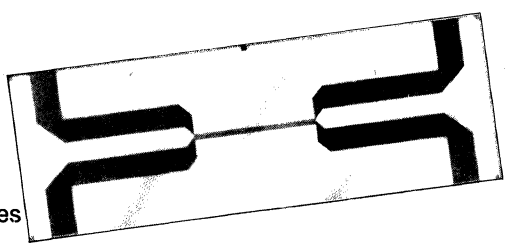




Patterned & Etched Substrates

Electro-Films, Inc. can handle the transition from a circuit requirement to a finished thin-film micro-component with in-house artwork and photo mask generation. E.F.I.'s processing techniques and quality control guarantee optimum quality in prototype or production quantities. E.F.I. is a thin-film specialist with unequalled productivity.

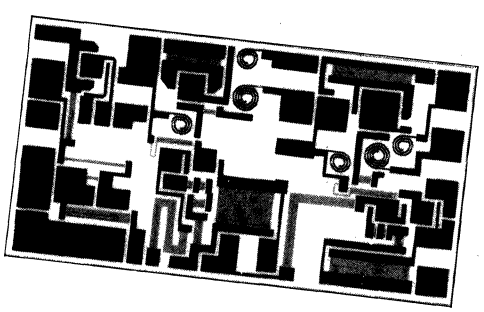
- Conductor only or resistor conductor patterns
- Resistive films — high stability NiCr or self passivating TaN
- In house laser machining for round or odd shaped substrates
- Metalized through holes
- Patterned edges
- Planar Inductors
- Lange couplers with fine line patterns, line and space tolerances as tight as ±.000050"
- Attenuator chips



Precision Chip Resistors

These precision Chip resistors are edge trimmed to tolerance providing excellent high frequency response. Edge trimming leaves a solid symmetrical block resistor void of any laser cuts eliminating the capacitive effects from a plunge or "L" cut trim.

- Resistance range 20ohm to 1 Kohm edge trimmed, 1 Kohm to 1 meg ohm non-edge trimmed
- Automatic laser trimming to ±.05% absolute
- Edge trim for high frequency applications
- Gold or solder coated terminations over a nickel barrier
- TCR ±50, 25 or 10 PPM °C — NiCr ±200, or100 PPM °C — TaN
- Single side or wrap around terminations
- Sizes — .020" x .040" to .100" x .100".



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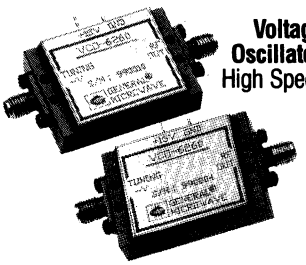
RF - MICROWAVE - MILLIMETER COMPONENTS FROM GENERAL MICROWAVE

DTO'S, VCO'S & DRO'S

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Digitally Tuned Oscillators 2-18 GHz. High Speed, Low Post-Tuning Drift, Wide Modulation Bandwidth

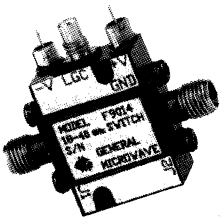


Voltage Controlled Oscillators 2-18 GHz. High Speed, Low Post-Tuning Drift, Superior Frequency Stability

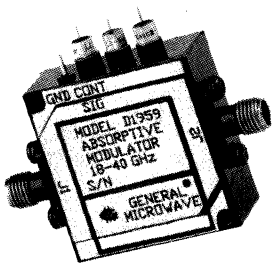


Dielectric Resonator Oscillators 5-18 GHz, Fixed and Mechanically Tuned Excellent Frequency Stability, Superior Phase Noise

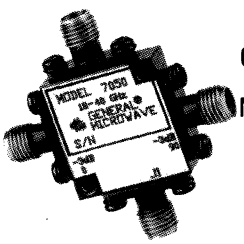
MILLIMETER WAVE COMPONENTS 18-40 GHz



Pin Diode Switches SPST/SPDT Series 90



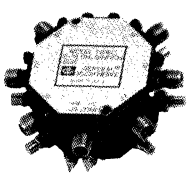
Pin Diode Attenuators Models 1959/D1959



3 dB Quadrature Coupler Model 7050

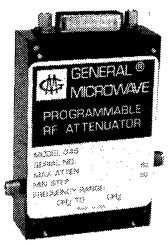
ANALOG/DIGITAL ATTENUATORS AND MODULATORS; PIN DIODE SWITCHES

DROP-IN AND CONNECTORIZED



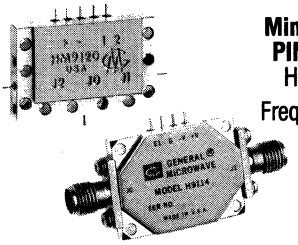
Pin Diode Switches SPST-SP7T

Frequency 0.2-40 GHz



Attenuators/ Modulators Analog/Digital Voltage/Current Controlled

Frequency 0.2-40 GHz



Miniaturized/Drop-In PIN Diode Switches Hermetically Sealed

Frequency 0.2-40 GHz

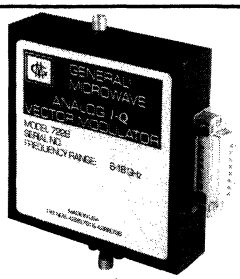
360° PHASE SHIFTERS

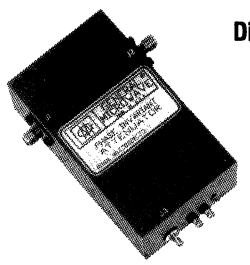
I-Q VECTOR MODULATORS

PHASE INVARIANT ATTENUATORS

Digital and Analog Phase Shifters For Frequency Translation and Phase Modulation. 0.5 to 18 GHz in 4 Bands.

Control Amplitude and Phase Simultaneously with I-Q Vector Modulators 0.5 to 18 GHz in 4 Bands.



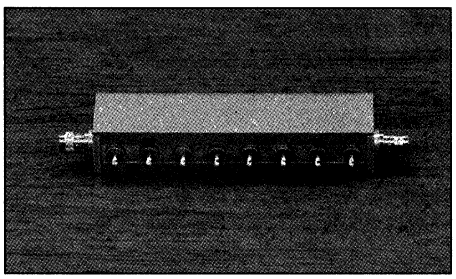


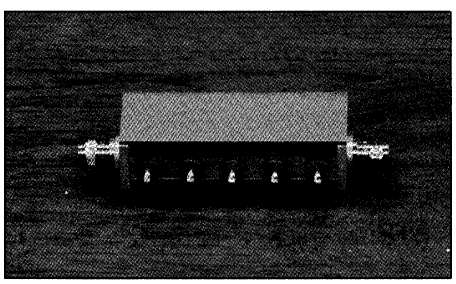
Digital & Analog with Near Zero Phase Change over Wide Attenuation Range Series 347 Digital Series D197 Analog

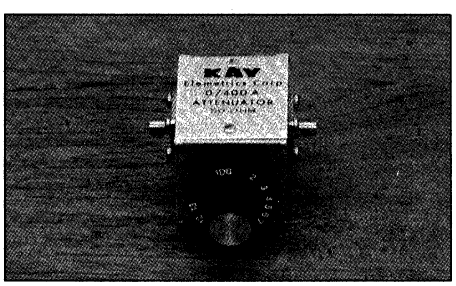
Frequency 2-18 GHz in 3 Bands.

GENERAL MICROWAVE

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Four reasons to buy Kay Attenuators.

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✓ **Dependability**
✓ **Price**
✓ **Delivery**

Kay Elemetrics Corp offers a complete line of Programmable, In-Line, Toggle Switch and Continuously Variable Attenuators. We can supply you with the right model to fit your specific application.

If you don't see an Attenuator that fits your requirements call us. Kay can design an Attenuator to fit your specific OEM needs. We have designed over 250 Attenuators in the past. Listed below are some typical Attenuator models.

Model#	Imped.	Freq. Range	Atten. Range	Steps
Programmable				
4440	50Ω	DC-1500MHz	0-130dB	10dB
4450	50Ω	DC-1500MHz	0-127dB	1dB
1/4450	50Ω	DC-1000MHz	0-16.5dB	.1dB
4457	75Ω	DC-1000MHz	0-127dB	1dB
1/4457	75Ω	DC-750MHz	0-16.5dB	.1dB
4460	50Ω	DC-1500MHz	0-31dB	1dB
4467	75Ω	DC-1000MHz	0-31dB	1dB
4480	50Ω	DC-1500MHz	0-63dB	1dB
4487	75Ω	DC-1000MHz	0-63dB	1dB
In-Line				
837	50Ω	DC-1500MHz	0-102.5dB	.5dB
838	50Ω	DC-1000MHz	0-41dB	1dB
839	50Ω	DC-2000MHz	0-101dB	1dB
1/839	50Ω	DC-1000MHz	0-22.1dB	.1dB
847	75Ω	DC-1000MHz	0-102.5dB	.5dB
849	75Ω	DC-1500MHz	0-101dB	1dB
1/849	75Ω	DC-500MHz	0-22.1dB	.1dB
860	50Ω	DC-1500MHz	0-132dB	1dB
870	75Ω	DC-1000MHz	0-132dB	1dB
Continuously Variable				
0/400	50Ω	DC-500MHz	1-13dB	—
0/410	75Ω	DC-400MHz	2-14dB	—

For more information ***call Kay's Product Specialist today at (201) 227-2000, ext. 104.***

KAY Kay Elemetrics Corp
12 Maple Avenue, P.O. Box 2025
Pine Brook, NJ 07058-2025
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FAX: (201) 227-7760

RF and IF SIGNAL PROCESSING COMPONENTS

Wideband RF Amplifiers
1.0 to 1000 MHz
Output: 10 mW to 10W
Gain: 10 dB to 60 dB
Low noise figure, low distortion

Digital Attenuators
DC to 600 MHz
TTL Control
One to seven bits
High video suppression, low insertion loss

Electronically Variable Attenuators
10 to 1500 MHz
High attenuation range
Low phase shift, low distortion

Electronically Variable Phase Shifters
10 to 1500 MHz
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Phase to 360°

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High directivity

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Helical resonator, interdigital,
Lumped constants.
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fundamental frequencies
and undesired
harmonic frequencies
Low conversion loss

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0.025 to 400 MHz
Four port devices
0° and 180° output

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Custom design

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I and Q Networks
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Unambiguous 360° phase resolution
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Phase Modulators
10 to 2000 MHz
BPSK, QPSK, 8 PSK
Good phase accuracy

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1.0 to 1000 MHz
zero to 360°
0 to +15 dBm input

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1.0 to 300 MHz
zero to 200°
Bandwidth 10%

Power Splitters
0.01 to 2000 MHz
Two-way to eight-way
Input power: 9W to 700W CW
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0.2 to 1000 MHz
Zero° and 90° output
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Designed entirely to customer's specifications. These units combine existing Lorch Electronics components and are integrated in our assembly to achieve better specifications, higher reliability, space savings and lower production cost.

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Mini-Circuits

how to use this guide

Over 1,000 RF/microwave signal-processing components are available from Mini-Circuits.

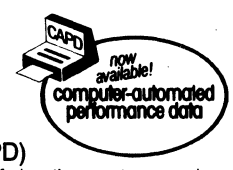
LOOKING FOR DATA ON A SPECIFIC MODEL? The model index contains a list of all models in alphabetical/numerical order with reference to specification and data pages.

SPECIFICATION PAGES. Each specification page is organized by series within the product line and by models within the series. Information given includes National Stock Numbers (NSN), equivalent MIL—part numbers, pin connection designations, case styles, and notes to the tables.

Full specifications for each model are given in table form. The various models within a series differentiate from each other by the frequency range they cover. Frequency range is defined in the tables by the lowest frequency f_L to the highest frequency f_U. For most models, the frequency range is further subdivided into three segments: L = low range, M = mid range, and U = upper range. Each range is defiined at the bottom of each table in terms of f_L and f_U.

CASE STYLES AND DIMENSIONS ARE EASY TO FIND . . . Each series has a particular case style. The specification page includes a photo and a reference number to the particular dimensions and outline drawing of the case, tolerances, bracket options, case material and finishes.

QUESTIONS AND ANSWERS... As the world's leading manufacturer of RF/microwave signal-processing components, we receive lots of phone calls with pertinent questions relating to RF/microwave signal-processing components, such as defining performance needs, estimating intercept points, and applying proper test procedures. We've gathered a number of such questions, with their answers, and encourage you to contact our Application Engineering staff when you need assistance.



Computer-Automated Performance Data (CAPD) is a Mini-Circuits innovation, offering the most comprehensive database for RF/microwave signal-processing components.

No more guesswork about RF/microwave signal-processing component performance in your systems design. Gain, directivity, input and output VSWR, conversion loss, isolation, and 1 dB compression point are given over a wide span of frequency data points; this allows a designer working within a narrow portion of the device's frequency range to pinpoint key parameters where it is most critical. The CAPD tables include typical values for each model, along with statistical process-control parameter "sigma" which is the measure of unit-to-unit variation. The more detailed and comprehensive the data available to the designer, the greater the probability of a sound and reliable design...the aim of Mini-Circuits' CAPD effort.

Call or write for your free copy of Mini-Circuits handbook on RF/microwave signal-processing components. Included is the most comprehensive compilation of data and design information, performance curves, "how-to-select" charts, and provocative Question and Answer sections.

ordering and delivery information

Refer to the rep listing in this handbook for Mini-Circuits' worldwide network of sales representatives and distributors ready to serve your needs, supply your orders, and answer your questions promptly andcourteously.

Federal supply code: 15542

how to order

Your local representative or distributor is the contact for both sales and service assistance for products listed in this catalog. These local offices have the latest price and delivery information on all models. They can also provide details on ordering procedures, service information and application engineering data. Your order may be sent directly to Mini-Circuits or to any of the local sales offices listed.
Prices listed in this catalog are domestic F.O.B. Brooklyn, New York. Mini-Circuits reserves the right to change specifications, models, prices, or designs without prior notice and without liability for such changes. Minimum order $50.00.

shipping instructions

Shipments can be made by either air or surface carriers. If specific shipping instructions do not accompany the order, Mini-Circuits will specify the carrier to be used. For air shipments, Mini-Circuits has arranged for substantial discounts with Federal Express.

terms

Net 30 days from date of invoice. If credit is not established with Mini-Circuits, shipments will be made C.O.D. (cash on delivery) or prepaid. We also accept American Express. If prepaying, please include freight.

warranty

Scientific Components Corporation, Mini-Circuits division, warrants each product manufactured by Mini-Circuits to meet all published specifications and to be free from defects in material and workmanship. The Company's liability under this warranty is limited to repair, adjustment and/or replacement of defective parts returned, freight paid by Buyer, to the factory within a period of one year from date of shipment from the factory unless a shorter period is specified. International customers may ship to the Company's nearest Distributor.
Damage by misuse or abnormal conditions of operation, or evidence of partial or complete disassembly voids this warranty. SINCE MINI-CIRCUITS HAS NO CONTROL OVER CONDITIONS OF USE, NO WARRANTY IS MADE OR IMPLIED AS TO SUITABILITY FOR CUSTOMER'S INTENDED USE, BEYOND SUCH PERFORMANCE SPECIFICATIONS AS ARE MADE A PART OF THE PURCHASE ORDER. Equipment shipped F.O.B. Mini-Circuits' plant shall become the property of the Buyer upon delivery to carrier. Damage in shipment should be handled by the Buyer directly with the carrier by immediately requesting carrier's inspection upon evidence of damage in shipment. A fee will be charged to the Buyer to cover the costs of inspection and test of units returned under this warranty and subsequently found to meet specifications or to be faulty for reasons which are not Mini-Circuits' responsibility. This warranty excludes all other warranties expressed or implied. Mini-Circuits shall not be liable for any special, indirect or consequential damages.

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*Performance curves and detailed data for mixers power splitters and amplifiers are contained in the RF/IF signal processing handbooks Vol. 1, Vol. 2 and Vol. 3. Write or call for your free, personal copies.

SP2 REV A

Quality Excellence

Quality Excellence is the foundation for the total operation of our business and the keystone of our goal of customer satisfaction. It is, therefore, our policy to:

- Consistently provide products and services that will exceed the quality expectations of our customers.
- Actively pursue ever-improving quality through process improvement programs that will enable each member to do their job right the first time, and with a continuing level of quality improvement.

Quality will continue to be a major, strategic thrust in Mini-Circuits. It lies at the heart of everything we do.

Through active planning in every function in the company, we will strive to provide products and services that consistently meet all quality, schedule, and cost objectives. Furthermore, we will dedicate ourselves to continually improving the quality of our products and services by focusing on our processes and procedures.

Our ability to develop and administer a disciplined system for achieving continuous quality improvement is at the heart of accomplishing all strategic business objectives and indeed will determine how successful we are in securing our future.

That success will depend on releasing the power of each inidividual to contribute in a positive, productive working environment through enthusiastic and conscientious efforts for quality excellence and customer satisfaction in everything we do.



HARVEY KAYLIE
President and Chief Executive Officer

Mini-Circuits guarantees quality

environmental specifications

Description

All MCL components are manufactured under exacting quality assurance and control standards. They will meet or exceed published specifications over the operating temperature range of −54° to +100°C, and after being subjected to any or all of the following physical or environmental tests of MIL-STD 202 which are applicable.

Test	Method
Altitude 150,000 feet Condition E	105
Humidity: 90% RH, 65°C (note 2)	106
Thermal shock −65°C to +125°C Condition B	107
Seal: less than 10^5 Atm cc/sec Conds. C & D	112
Drop: random, 45 minutes	203
Vibration: 2 to 2000 cps, 20g, 12 hrs. Condition D	204
Solder heat: 260°C, 10 sec Condition B	210
Solderability: 95% coverage	208
Terminal tensile strength: 4½ lbs., 10 sec Condition A	211
Terminal fatigue: 2 lbs., 3 cycles Condition C	211
Mechanical shock: 100g, 6 ms Condition I	213
Solvent resistance	215

note 1: These specifications do not apply to coaxial connector models.
note 2: Exceptions are non-hermetic case styles W38, X65, AA46, KK81, and as noted on specification sheet.

absolute maximum ratings

operating and storage temperature	−55°C to +100°C
pin temperature (10 secs)	+260°C

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Mini-Circuits

reliability and quality control

reliability and quality control

All Mini-Circuits' RF signal-processing components are subjected to rigid quality control procedures starting from raw material procurement through product production and final inspection; the objective—to supply our customers with the finest RF signal-processing components available. Here's a list of some of the procedures taken to insure high-quality performance and product reliability:

A. 100% testing of each unit in process.
B. 100% testing of each completed unit.
C. 100% inspection of every solder connection.
D. All transformers bonded to the header for protection against severe shock and vibration.
E. All resistors and capacitors bonded to the header for severe shock and vibration protection.
F. Resistor power dissipation derated more than 50%.
G. All components rated for greater than +125°C.
H. All transformer leads double wrapped.
I. Heavy coated wire insulation for HiPot/altitude.
J. Completely encapsulated for protection against mechanical shock/vibration and temperature shock.
K. Permanent case marking of model number.
L. Cupro-Nickel case for long-lasting finish especially under salt atmosphere conditions.

4.5 sigma unit-to-unit repeatability

Applying powerful statistical process control techniques, we guarantee "skinny" sigma on mixers and power splitters with the spec limit at least 4.5 sigma from the mean value (process capability Cpk of 1.5). This means production units shipped to you will very closely match the performance of samples we supplied for your evaluation and prototypes. Such product uniformity translates to substantial reductions in cost by trimming manufacturing throughput time, rework, specialized test equipment, troubleshooting, report paperwork, and inspection personnel. And more reliable performance of systems in the field under adverse conditions. Bottom line...a more competitive and profitable position.

mixers

ultra–rel mixers

All Mini-Circuits' Ultra-Rel mixers carry a five-year guarantee, a reliability breakthrough attributed mainly to H-P's unique Ultra-Rel diodes that easily meet and exceed MIL-STD-883 tests. Each diode must pass the following grueling tests:

LIFE	1,000 hrs. T_A +125°C 50 mA ac
THERMAL SHOCK	−65°C to +125°C, 200 cycles 5 min. dwell
MECHANICAL SHOCK	1.5Kg's, 0.5μsec pulse
VIBRATION	variable frequency 20 to 2,000 Hz
TEMPERATURE CYCLE	−65°C to +125°C 200 cycles, 10 min. dwell
AUTOCLAVE (pressure pot)	14.7 psi, T_A + 121°C, 96 hr.
85/85	85°C @ 85% humidity 168 hr., no bias
ACCELERATED HI-TEMPERATURE STORAGE	300°C, 325°C, 350°C storage until 50% failures

hi–rel mixers

Mini-Circuits hi-rel mixers are screened to:
(1) burn-in for 96 hours at 100°C with 8 ma at 1 KHz
(2) thermal shock per MIL-STD-202, Method 107
(3) Gross and fine leak tests according to MIL-STD-202, Test Method 112B, Conditions C and D.

tx mixers

For the most critical space, military or industrial applications in hostile environments, Mini-Circuits offers TX mixers. Stringent screening and stressing are applied to the TX mixers which employ TX hermetically-sealed diodes that have passed the following tests per MIL-STD-750: (1) high temperature storage for 340 hours at 150°C, Method 1032; (2) thermal shock, Method 1051, Test Condition C (−65°C to +150°C, 10 cycles); (3) constant acceleration, method 2006, Y1 orientation, 20,000 G's; (4) fine leak, Method 1071, Condition H; (5) gross leak, Method 1071, Condition C; (6) burn-in for 96 hours at 25°C, 75 mW/junction at 60 Hz, Method 1038, Condition B. They are then assembled into TX mixers which are then further exposed to these stress tests: (1) thermal shock, MIL-STD-202, Method 107; (2) burn-in for 96 hours at 100°C, with 8 ma at 1 KHz; (3) gross and fine leak, MIL-STD-202, Method 112B, Conditions A and C.

mil–mixers

Mini-Circuits' MIL mixers undergo further stresses per MIL-M-28837/1A as follows: 1) 12 hours of 20g (peak) 10-2000 Hz vibration over 4 hour intervals on each of three mutually perpendicular directions, 2) bake-in for 24 hours at 100°C, 3) burn-in for 48 hours at 100°C with 30 mA dc in each polarity, 4) thermal shock, MIL-STD-202, Method 107, Condition B, and 5) gross and fine leak, MIL-STD-202.

To order a Hi-Rel version of any Mini-Circuit mixer, add the suffix /Hi-Rel; for MIL versions, add suffix /MIL; for TX mixers, add suffix /TX.

power splitter/combiners

hi-rel power splitter/combiners

To assure high quality and long-term reliability, Mini-Circuits' Hi-Rel power splitter/combiners are subjected to:

1) bake-in for 96 hours at 100°C
2) thermal shock MIL-STD-202, Method 107, cond. A (100°C)
3) gross and fine leak tests, per MIL-STD-202, Test Method 112B, Condition C and D.

mil–power splitter/combiners

Mini-Circuits screens MIL-power splitter/combiners to MIL-P-23971 Group A and Group B electrical tests. In Group A, 100% of the lot quantity is tested. In Group B, tests are performed on units selected from Group A according to the sampling plan of MIL-STD-105 special inspection level S-3.

After each unit undergoes an environmental MIL-stress the units are electrically tested to ensure compliance with the applicable MIL specification and customer drawing. These tests generally include insertion loss, isolation, amplitude balance, VSWR, and phase balance.

MCL MIL components which undergo Group A and Group B of MIL-P-23971 are marked with the Mini-Circuits model number followed by /MIL.

When the military part number marking is required, the units must be on the QPL list or must be manufactured from a lot for which first article inspection has been performed. In this case, please contact the factory for pricing and contract requirements.

MIL power splitter/combiners are screened to MIL-P-23971 group A and group B electrical tests plus the following environmental stress tests: 1) thermal shock, MIL-STD-202, Method 107, test condition A, 2) terminal strength, MIL-STD-202, Method 211, test condition A, 3) resistance to solvents, MIL-STD-202, Method 215, 4) solderability, MIL-STD-202, Method 208, 5) vibration, MIL-STD-202, Method 204, test condition A, 6) shock, MIL-STD-202, Method 213, test condition G, 7) moisture resistance, MIL-STD-202, Method 106, and 8) salt spray, MIL-STD-202, Method 101, test condition B.

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case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
A01	.770 19.56	.800 20.32	.385 9.78	.400 10.16	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1, B3
A03	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									2.3	A1, B4
A04	.770 19.56	.800 20.32	.200 5.08	.210 5.33	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1, B3
A05	.770 19.56	.800 20.32	.240 6.10	.250 6.35	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1, B3
A06	.770 19.56	.800 20.32	.285 7.24	.310 7.88	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1, B3
A11	480 12.20	.500 1.270	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									1.9	A1, B4
B02	.480 12.20	.500 12.70	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								1.9	A1, B4
B13	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								2.3	A1, B4
C07	.770 19.56	.810 20.58	.380 9.66	.410 10.42	.030 .77	.200 5.08	.20 5.08	.14 3.56											11.0	A1
D08	1.000 25.40	1.025 26.04	.390 9.91	.430 10.93	.500 12.70	.525 13.34	.025 .64	.300 7.52	.200 5.08	.09 2.29	.13 3.31	.150 3.☆1	.20 5.08	.14 3.56					8.5	A1
D09	1.000 25.40	1.025 26.04	.240 6.10	.280 7.12	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.31	.150 3.81	.20 5.08	.14 3.56					7.5	A1
E10	1.580 40.13	1.620 41.15	.380 9.66	.410 10.42	.770 19.56	.810 20.58	.030 .77	.200 5.08	.10 2.54	.20 5.08	.14 3.56								23.0	A1
F14	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.25 6.35	1.500 38.10	.125 3.18	.39 9.91	1.00 25.40	.50 12.70	1.00 25.40								170.0	A10 C1, D2
F53	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.13 3.31	1.750 44.45	.125 3.18	.39 9.91	1.00 25.40	.50 12.70	1.00 25.40								170.0	A10 C1, D2
G15	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	.61 15.50	— —	.80 20.32	.80 20.32	.76 19.31	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				85.0	A10 B1, D1, D3
G144	1.25 31.75	1.25 31.75	— —	.63 16.01	.38 9.66	.61 15.50	— —	— —	— —	.76 19.31	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				85.0	A10, B6 D6
H16	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.00	A10, B1, D2, D3, D4
J17	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				75.0	A10, B1, D2, D3
K18	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.0	A10, B1 C1, D2, D3
L19	1.50 38.10	1.13 28.70	1.00 25.40	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	1.19 30.23	— —	.66 16.77	— —	— —	.150 3.81		37.0	A6, A11, B2 D6
L20	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.86 47.25	— —	.64 16.26	— —	— —	.150 3.81		74.0	A6, A11, B2 D5
M21	1.50 38.10	1.13 28,70	1.00 25.40	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	.75 19.05	1.19 30.23	.66 16.76	— —	— —	1.50 3.81		40.0	A6, A11, B2 C1, D6
M22	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.15 29.21	1.86 47.25	.64 16.26	— —	— —	.150 3.81		74.0	A6, A11, B2 C1, D5
M23	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.63 16.00	1.06 26.93	1.63 41.40	.69 17.53	— —	— —	.150 3.81		70.0	A6, A11 B2, C1, D6

tolerance ±.1 ±.03 ±.015 **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH
A1. Header material C.R.S.; Pin material; #52 alloy. Finish; electro tin, hot-oil flowed. Cover material; cupro-nickel.
A6. Case material; aluminum alloy. Finish; blue paint over iridite.
A10. Case material; aluminum alloy. Finish, grey paint.
A11. Case material; aluminum alloy. Finish, blue anodized.

B. MOUNTING
B1. Mounting bracket available on request. Add suffix B to part number.
B2. Mounting bracket available on request. For bracket mounted on connector end add suffix B to part number and $5.00 to unit cost. For bracket mounted on the rear, add suffix BR to part number and add $1.50 to unit cost.
B3. Insulated spacer available. Request P/N B14-045-01.
B4. Insulated spacer available. Request P/N B-14-047-01.
B6. Bracket version only.

C. MARKING
C1. For port markings 1, 2, and 3 see specification data sheet.

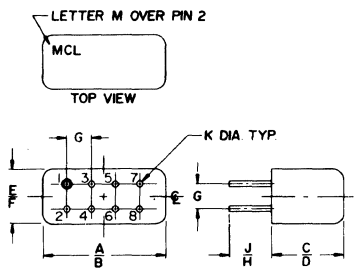
D. CONNECTORS
D1. Connectors: SMA Standard. BNC on request (no charge). Male SMA on request, consult factory.
D2. Connectors: please specify, unless otherwise noted; BNC is standard, TNC, SMA and Type N, consult factory. (ZAPD −4 units not available with BNC).
D3. For Bracket Version, Option B, this dimension, "C*", changes from 0.75 to 0.94 inches.
D4. FTB Models available:
*A15 female BNC/isolated female BNC.
*C15 male BNC/isolated female BNC.
FT Models available:
*A16 female BNC/female BNC 75 ohms.
*B16 female BNC/male BNC 75 ohms.
*C16 male BNC/female BNC 75 ohms.
D5. Connectors: BNC standard, TNC consult factory.
D6. Connectors: Female SMA only. Male SMA available on request, consult factory.

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156
SFB REV B

& outline drawings

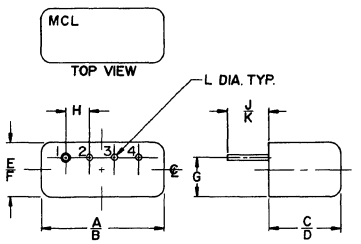
Mini-Circuits

A



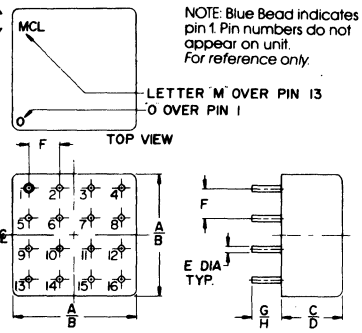
NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

B

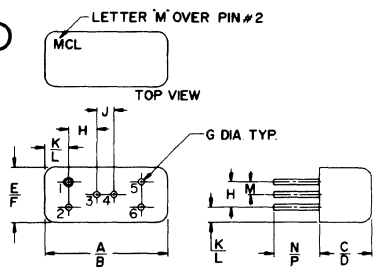


NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

C

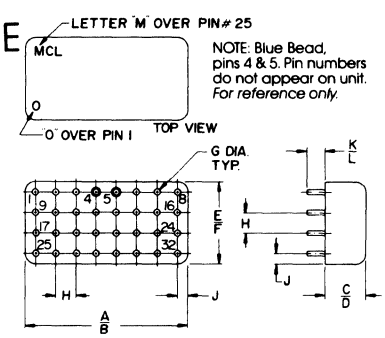


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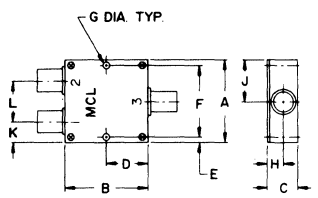


NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

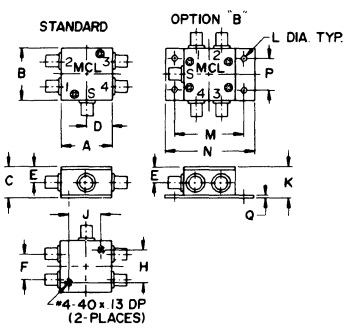
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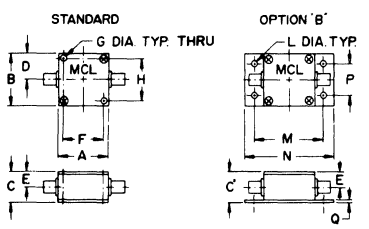
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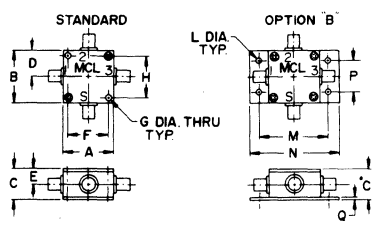
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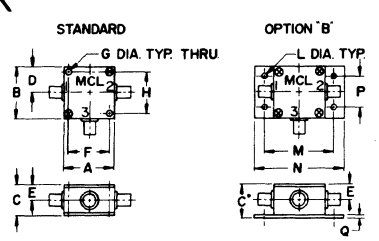
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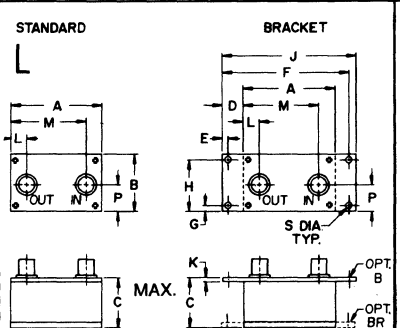
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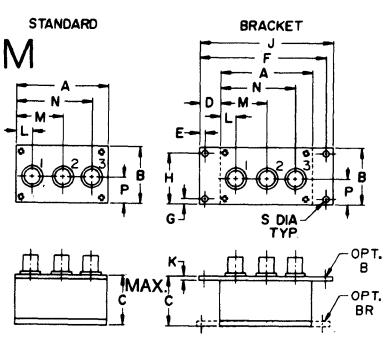
K



L



M



case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
N24	1.50 38.10	1.13 28.70	1.00 25.40	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.32 8.13	.75 19.05	1.18 29.97	.31 7.88	.56 14.23	.81 20.58	.150 3.81		45.0	A6, A11 B2, D6
N27	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.48 12.19	1.13 28.70	1.78 45.21	.36 9.14	.69 17.53	1.01 25.65	.150 3.81		92.0	A6, A11 B2, D7
P25	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.78 19.81	1.47 37.34	— —	.38 9.65	1.00 25.40	— —	.150 3.81		86.0	A6, A11 B2, D7
P26	1.50 38.10	1.13 28.70	1.00 25.40	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.50 12.70	1.00 25.40	— —	.31 7.88	.81 20.58	— —	.150 3.81		42.5	A6, A11 B2, D6
Q28	4.06 103.13	1.60 40.64	1.50 38.10	3.56 90.43	.24 6.10	.88 22.35	.36 9.15	.160 4.07	.4 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.8 20.32	.06 1.53				300.0	A10 D9
R29	4.06 103.13	1.60 40.64	1.50 38.10	3.56 90.43	.24 6.10	.88 22.35	.36 9.15	.160 4.07	.4 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.8 20.32	.06 1.53				300.0	A10, C2, D9
R30	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.24 6.10	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.55 13.97	.66 16.77	5.72 145.29	.81 20.58	.06 1.53				500.0	A5, C2, D9
R31	9.31 236.98	1.60 40.64	1.50 38.10	8.84 224.54	.24 6.10	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.54 13.72	.66 16.77	8.34 211.84	.81 20.58	.06 1.53				700.0	A5, C2, D9
R67	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.24 6.10	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	1.22 30.99	.66 16.77	5.72 145.29	.81 20.58	.06 1.53				500.0	A5, D9
S32	3.75 95.25	2.00 50.80	1.8 45.7	.19 4.83	3.375 85.73	.19 4.83	1.625 41.38	.156 3.97	.6 15.24	.4 10.16	.5 12.7	1.30 33.02	.09 2.29	.38 9.65	3.00 76.20	.30 7.62	2.60 66.04		220.0	A7, D16
T34	4.75 120.65	2.00 50.80	2.21 56.14	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.12 3.05	.38 9.65	4.00 101.60	.30 7.62	2.60 66.04	440.0	A7, A8, D16
T35	4.75 120.65	2.00 50.80	2.40 61.0	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.12 3.05	.38 9.65	4.00 101.60	1.50 38.10	5.00 127.00	700.0	A7, A8, D16
U36	7.00 177.80	3.25 82.55	2.13 54.10	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.97	.88 22.35	.73 18.54	.63 16.01	1.13 28.70	2.23 56.64	.125 3.18	.50 12.70	6.00 152.40			900.0	A7, A8, D6
U111	7.00 177.80	3.25 82.55	3.13 79.50	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.97	.88 22.35	.43 10.92	.63 16.01	1.00 25.40	2.63 66.80	.125 3.18	.50 12.70	6.00 152.40	2.23 56.64		1100.0	A8 D6
V37	.83 21.08	.83 21.08	.75 19.05	.37 9.40	.42 10.67	1.25 31.75	.100 2.54	1.150 29.21	.095 2.41	.735 18.67	.21 5.33	.106 2.69	.06 1.52						34.0	A10, C1, D17
W38	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.09 2.29	.37 9.40	.036 .91								.50	A3
X65	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.04 1.02	.12 3.05	.300 7.62	.35 8.89							.50	A3
Y39	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.36 9.15	1.000 25.40	1.000 25.40	.125 3.18	.125 3.18	.46 11.69	2.18 55.38	1.688 42.88	.07 1.78	.750 19.05	.50 12.70	.80 20.32	.45 11.43	.29 7.37	50.0	A4, B1, D6, D22
Z40	7.06 179.32	3.13 79.50	.88 22.35	.250 6.35	1.750 44.45	5.310 134.87	6.810 172.97		.312 7.92	2.875 73.03	.144 3.66	3.53 89.66	.44 11.18	.415 10.54	.89 22.61				800.0	A10, D11
AA46	.830 21.08	.580 14.73	.265 6.73	.13 3.30	.415 10.54	.340 8.64	.025 .64	.50 12.70											6.4	A2
BB48	.50 12.70	.39 9.91	.225 5.72	.025 .64	.07 1.79	.100 2.54	.250 6.35	.350 8.89	.06 1.53	.31 7.87									3.0	A1
CC51	2.00 50.80	2.00 50.80	.75 19.05	.938 23.83	.13 3.30	1.750 44.45	.125 3.18	.375 9.53	1.00 25.40	1.25 31.75									120.0	A10, D11

tolerance x±.1 xx±.03 xxx±.015 **oz. = grams x.0353**

*NOTES:

A. MATERIAL AND FINISH

A1. Header material C. R. S. Pin material; #52 alloy. Finish; electro tin, hot oil flowed. Cover material; cupro-nickel.

A2. Case material; C. R. S. Pin material; #52 alloy. Cover material; stainless steel. Finish; gold flash per MIL-G-45204.

A3. Case material; epoxy. Pin material; iron-nickel alloy. Finish, bright tin-plate

A4. Case material; aluminum alloy. Finish; iridite per MIL-C-5541.

A5. Case material; C. R. S. Finish; grey paint over hot-tip dip.

A6. Case material; aluminum alloy. Finish; blue paint over iridite.

A7. Case material; aluminum alloy. Finish; case black paint. Heat sink; black anodize. Baseplate iridite per MIL-C-5541.

A8. Case material; aluminum alloy. Finish; case iridite. Heat sink, black anodize

A10. Case material; aluminum alloy. Finish, grey paint.

A11. Case material; aluminum alloy. Finish, blue anodized.

B. MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number.

B2. Mounting bracket available on request. For bracket mounted on connector end add suffix B to part number and $5.00 to unit cost. For bracket mounted on the rear, add suffix BR to part number and add $1.50 to unit cost.

C. MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

C2. Consecutive marking, n = no. of way power-splitter.

D. CONNECTORS

D6. Connectors; Female SMA only. Male SMA available on request, consult factory.

D7. Connectors: BNC only.

D9. Connectors; BNC standard, TNC or Female SMA on request, consult factory.

D11. Connectors; Please specify; Type N or SMA.

D16. Connectors please specify, unless otherwise noted SMA is standard for model ZHL-2-12 for all other models BNC is standard. TNC, N, or SMA available on request, consult factory.

D17. Connectors; Female SMA only.

D22. Gain Control Terminal on Models ZFL-1000G and ZFL-1000GH only.

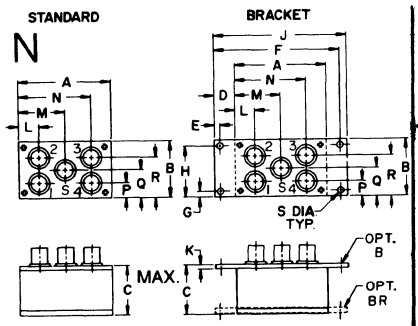
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF10 REV C

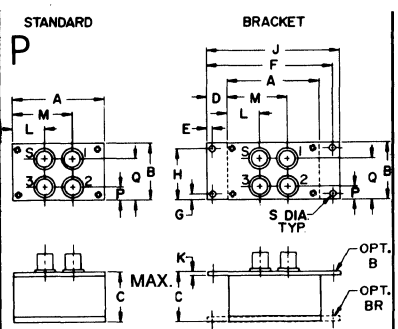
& outline drawings

Mini-Circuits

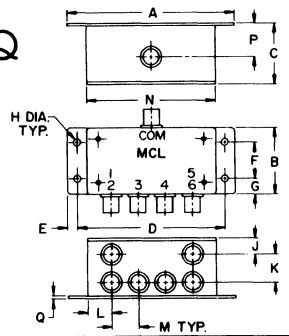
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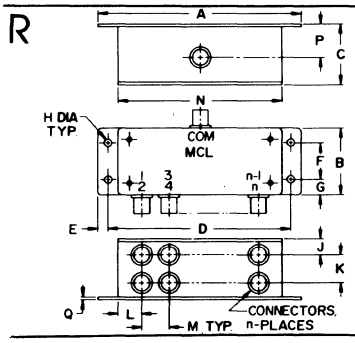
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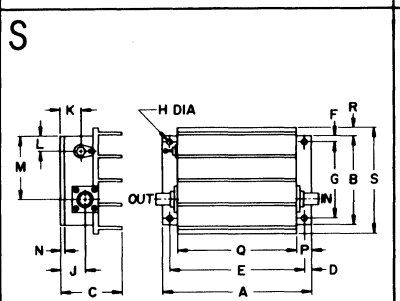
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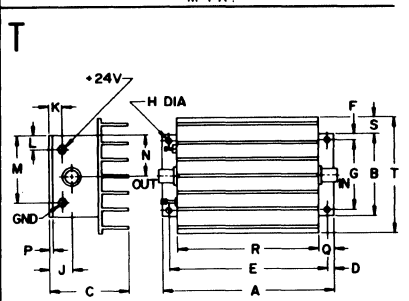
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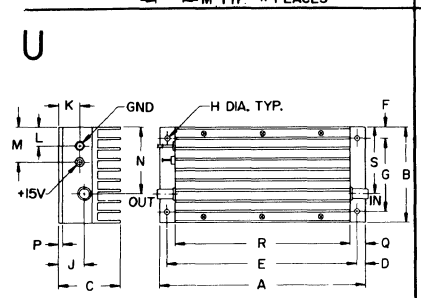
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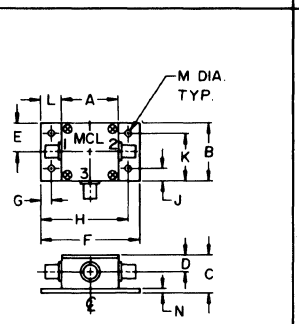
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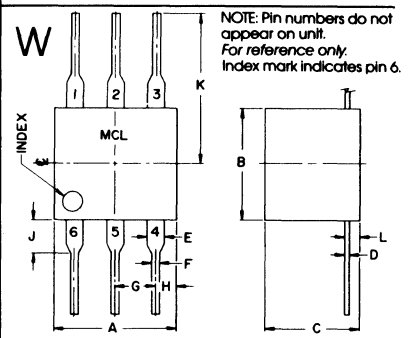
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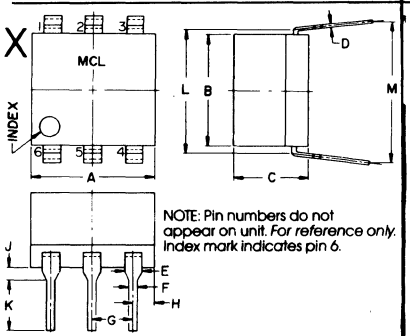
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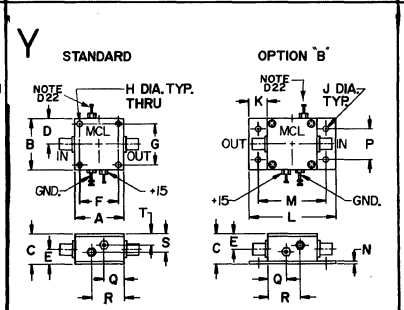
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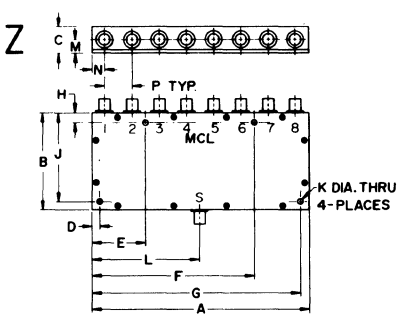
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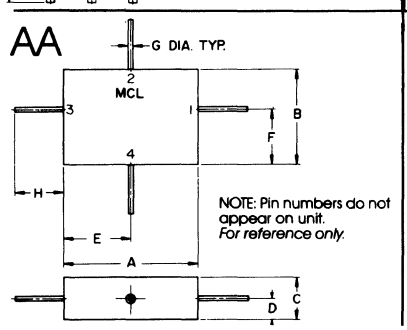
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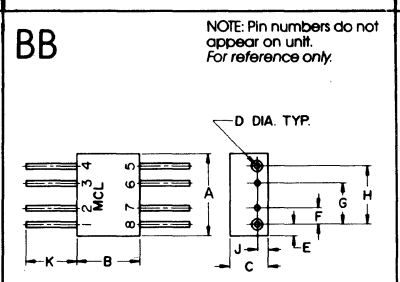
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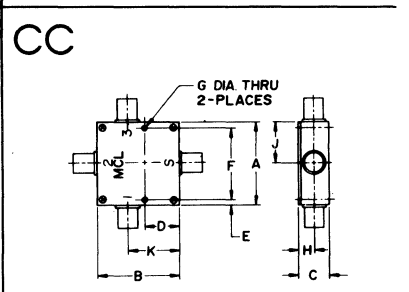
AA



BB



CC



case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
DD52	2.00 50.80	2.00 50.80	.75 19.05	.90 22.86	.156 3.96	1.688 42.88	.125 3.18	.392 9.96	1.00 25.40	.50 12.70	1.00 25.40	1.25 31.75							225.0	A10, D11
EE54	3.50 88.90	2.13 54.10	.88 22.35	.250 6.35	1.750 44.45	3.250 82.55	.250 6.35	1.813 46.05	.125 3.18	.44 11.18	.415 10.54	.89 22.61							250.00	A10, D11
FF55	1.40 35.56	.58 14.73	.73 18.54	2.59 65.79	— —														40.0	A9, D12
FF56	.98 24.89	.43 10.92	.47 11.94	1.70 43.18	— —														18.0	A9, D13
FF57	1.54 39.12	.72 18.29	.81 20.58	2.96 75.18	.82 20.83														90.0	A9, D14
FF58	1.40 35.56	.58 14.73	.61 15.50	2.59 65.79	.64 16.26														45.0	A9, D15
FF99	1.27 32.26	.72 18.29	.47 11.94	1.98 50.29															42.0	A9, D13
GG60	2.31 58.68	1.20 30.48	.60 15.24	.125 3.18	2.062 52.38	.30 7.62	.53 13.46	.63 16.00											75.0	A10, D10
HH68	9.31 236.47	1.60 40.64	3.57 90.68	8.84 224.54	.25 6.35	.88 22.35	.36 9.14	.160 4.06	.34 8.37	.69 17.53	.54 13.72	.66 16.76	8.34 211.84	.33 8.38	.06 1.52				1090.0	A5, D10
JJ77	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.14 3.55	.850 21.60	2.50 63.50	.10 2.54	.44 11.17	.75 19.05	.63 16.00	.54 13.71	.37 9.39	.43 10.92	.150 3.81	.73 18.54	50.0	A6, A11, D17
KK81	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.05 1.27	.035 .88	.036 .91	.26 6.60	.575 14.60						.50	A3
LL85	1.43 36.32	.58 14.73	.75 19.05																21.5	A9, D18
LL86	1.19 30.23	.58 14.73	.51 12.95																14.0	A9, D19
LL87	1.43 36.32	.82 20.83	.68 17.27																48.5	A9, D20
LL88	1.43 36.32	.61 15.49	.75 19.05																24.0	A9, D21
NN92	3.66 92.96	3.25 82.55	2.13 54.10	.25 6.35	3.16 80.26	.38 9.65	2.50 63.50	.156 3.96	.72 18.29	.64 16.26	.74 18.80	1.78 45.21	2.30 58.42	.125 3.18	.50 12.70	2.66 67.56			440.0	A7, A8, D6
PP94	.360 9.14	.250 6.35	.25 6.35	.016 .41	.020 .51	.04 1.02	.200 5.08												1.5	A12, C3
PP120	.50 12.70	.21 5.33	.150 3.81	.016 .41	.020 .51	.04 1.02	.3 7.62												1.5	A12, C3
QQ95	.500 12.70	.250 6.35	.25 6.35	.016 .41	.020 .51	.04 1.02	.300 7.62	.150 3.81	.150 3.81	.075 1.91									3.5	A12, C3
QQ96	.600 15.24	.250 6.35	.25 6.35	.016 .41	.020 .51	.04 1.02	.400 10.16	.200 5.08	.200 5.08	.100 2.54									4.0	A12, C3
RR93	4.06 103.13	1.60 40.64	2.125 53.98	3.56 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.4 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.8 20.32	.06 1.53	.33 8.38			350.0	A5, A10, D9

tolerance x ± .1 xx ± .03 xxx ± .015 **oz. = grams x.0353**

A. MATERIAL AND FINISH

A3. Case material, epoxy. Pin material; iron-nickel alloy. Finish; bright tin-plate per MIL-T-10727.

A5. Case material; C.R.S. Finish; grey paint over hot-tin dip.

A6. Case material; aluminum alloy. Finish; blue paint over iridite.

A7. Case material, aluminum alloy. Finish, case black paint. Heat sink, black anodize. Baseplate iridite per MIL-C-5541.

A8. Case material; aluminum alloy. Finish; case iridite. Heat sink, black anodize.

A9. Case material, brass. Finish; nickel plate.

A10. Case material; aluminum alloy Finish, grey paint.

A11. Case material; aluminum alloy. Finish, blue anodized.

A12. Header finish; gold plate per MIL-G-45204. Case material; cupro-nickel.

C. MARKING

C3. For Pin designations see specification data sheet.

D. CONNECTORS

D6. Connectors. Female SMA only. Male SMA available on request, consult factory.

D9. Connectors BNC standard. TNC or Female SMA on request, consult factory.

D10. Connectors. BNC standard. SMA on request, consult factory.

D11. Connectors; Please specify; Type N or SMA.

D12. Connectors; Male BNC, Female BNC standard. Other combinations with SMA available on request, consult factory.

D13. Connectors; Male SMA, Female SMA only.

D14.Connectors; Male N, Female N standard. Combinations with BNC, SMA, TNC available on request, consult factory.

D15. Connectors; Male TNC, Female TNC only.

D17. Connectors. Female SMA only.

D18. Connectors. Male BNC only.

D19. Connectors. Male SMA only.

D20. Connectors. Male Type N only.

D21. Connectors. Male TNC only.

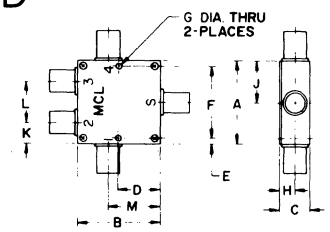
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF10 REV B

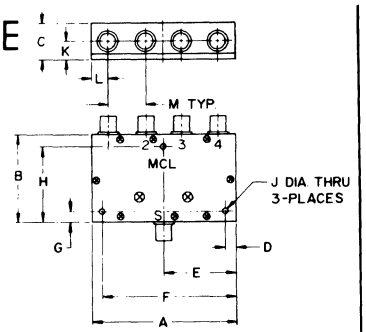
& outline drawings

Mini-Circuits

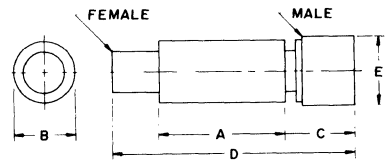
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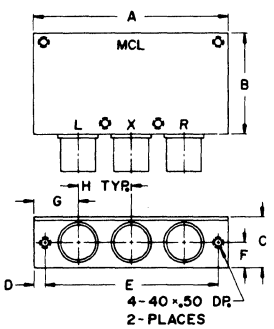
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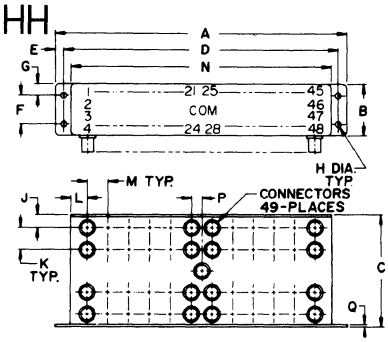
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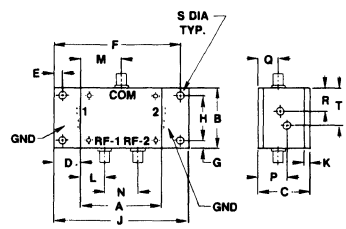
GG



HH

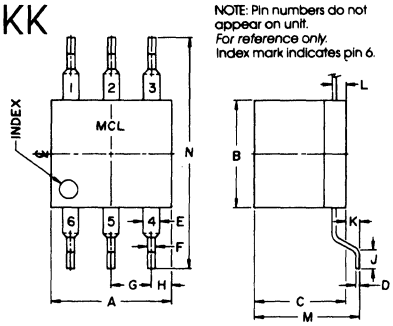


JJ

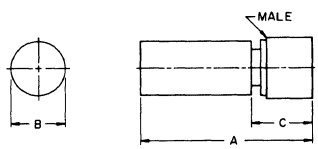


KK

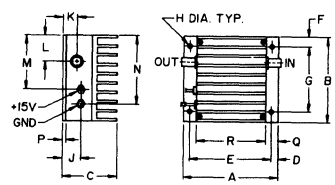
NOTE: Pin numbers do not appear on unit.
For reference only.
Index mark indicates pin 6.



LL

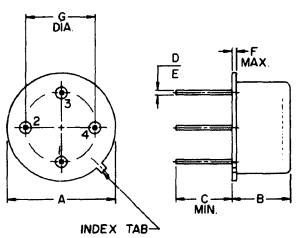


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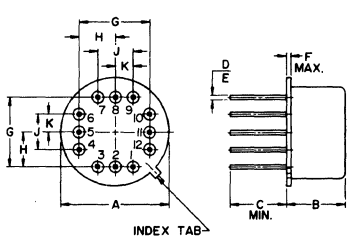
PP

NOTE: Pin numbers do not appear on unit.
For reference only.

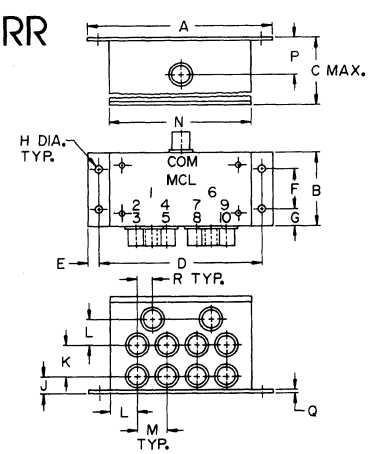


QQ

NOTE: Pin numbers do not appear on unit.
For reference only.



RR



case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
SS98	1.25 31.75	1.56 39.62	.75 19.05	.63 16.00	.39 9.91	1.56 39.62	1.000 25.40	— —	.125 3.18	.46 11.69	2.18 55.38	1.688 42.88	.07 1.78	.750 19.05	.50 12.70	.80 20.32	.45 11.43	.29 7.37	85.0	A8, B1, D6
TT100	.250 6.35	.310 7.87	.20 5.08	.100 2.54	.050 1.27	.035 .89	.040 1.02	.070 1.78	.270 6.86										.50	A14
TT146	.250 6.35	.310 7.87	.275 6.98	.100 2.54	.050 1.27	.055 1.40	.040 1.02	.070 1.78	.270 6.86										.50	A14
UU102	3.50 88.90	2.00 50.80	.50 12.70	.150 3.81	3.350 85.09	1.00 25.4	.125 3.18	1.75 44.45	.20 5.08	.55 13.97									120.0	A10, C2 D17
VV105	.085 2.16	.060 1.52	.020 .51	.006 .15	.020 .51	.46 11.68													.015	A13, C4
WW107	.018 .46	.10 2.54	.020 .51	.092 2.34	.085 2.16	.060 1.52	.006 .152	.020 .51	.025 .64										.015	A13, C4
XX112	.18 4.57	.06 1.52	.06 1.52	.40 10.16	.30 7.62	.050 1.27	.015 .38	.005 .13	.003 .08										.15	A15
YY101	.75 19.05	.38 9.66	.20 5.08	.010 1.91	.05 1.27	.050 1.27	.200 5.08	.075 1.91	.600 15.24	.45 11.43	.035 .89	.450 11.43	.100 2.54	.150 3.81					1.6	A13
YY109	.75 19.05	.38 9.66	.20 5.08	.010 1.91	.05 1.27	.050 1.27	.200 5.08	.075 1.91	.600 15.24	.72 18.29	.16 4.05	— —	— —	— —					1.6	A13
YY161	.75 19.05	.38 9.66	.250 6.36	.010 1.91	.05 1.27	.050 1.27	.200 5.08	.075 1.91	.600 15.24	.45 11.43	.035 .89	.450 11.43	.100 2.54	.150 3.81					1.6	A13
ZZ121	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	.61 15.50	— —	.800 20.32	.800 20.32	.76 19.31	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				85.0	A10, B1, D6
AAA118	1.50 38.10	.50 12.70	.935 23.75	.040 1.02	1.100 27.94	.185 4.70	.400 10.16	.153 3.89	.600 15.24	.300 7.62	.20 5.08	.14 3.56							.034	A1
BBB123	.145 3.69	.100 2.54	.04 1.02	.006 .152	.030 .762	.488 12.4													.015	A13, C5
CCC127	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.12 3.05	.80 20.32	.69 17.53	1.60 40.64	.60 15.24	1.200 30.48	.52 13.21	.82 20.83	.150 3.81	80.0	A6, A11, D17

tolerance x ± .1 xx ± .03 xxx ± .015 **oz. = grams x.0353**

A. MATERIAL AND FINISH

A1. Header material C. R. S. Pin material: #52 alloy Finish: electro tin, hot oil flowed. Cover material: cupro-nickel.

A6. Case material; aluminum alloy. Finish; blue paint over iridite.

A8. Case material; aluminum alloy. Finish; case iridite. Heat sink, black anodize.

A10. Case material; aluminum alloy Finish, grey paint.

A11. Case material; aluminum alloy. Finish, blue anodized.

A13. Case material; plastic. Lead finish, Tin plate.

A14. Case material; plastic. Leads: palladium platinum silver.

A15. Case material: kovar. Lead material: kovar. Finish: gold plate per MIL-G-45204.

B. MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number.

C. MARKING

C2. Consecutive marking n=no. of way power splitter.

C4. RF Input lead (1) identified by diagonally cut lead. Model dash number identified by color dot on case. See Specification Data Sheet.

C5. RF output is identified by index mark.

D. CONNECTORS

D6. Connectors. Female SMA only. Male SMA available on request, consult factory.

D17. Connectors. Female SMA only.

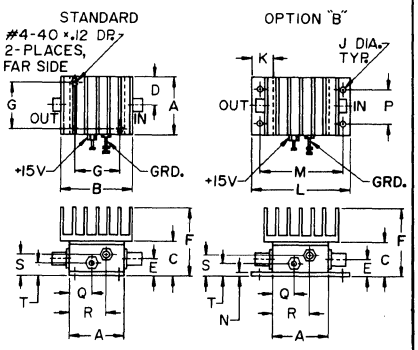
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FAX (718) 332-4661 TELEX 6852844 or 620156

SF14 REV E

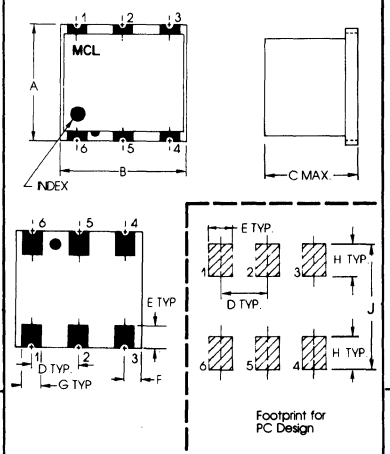
& outline drawings

Mini-Circuits

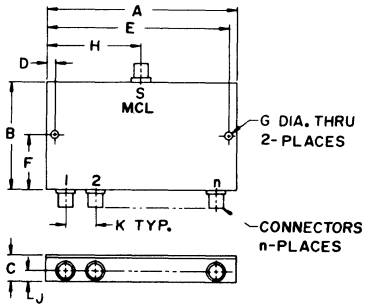
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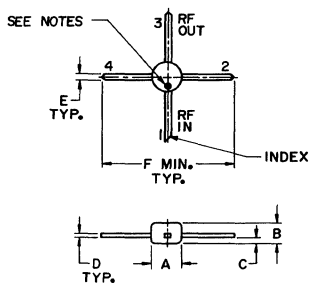
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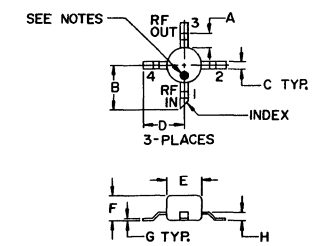
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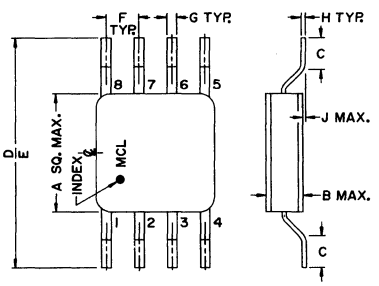
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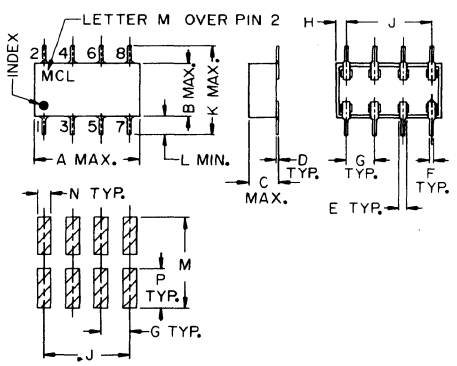
WW



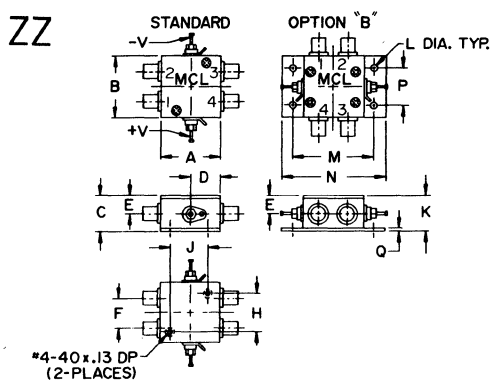
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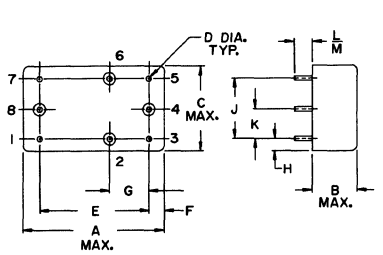
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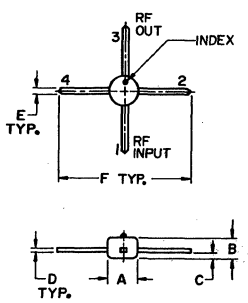
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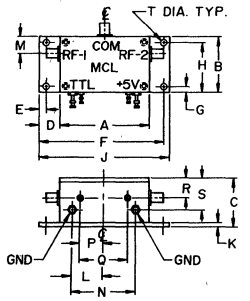
AAA



BBB



CCC



case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
DDD131	7.00 177.80	3.25 82.55	3.13 79.50	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.144 3.66	.88 22.35	.73 18.54	.63 16.01	1.13 28.70	2.23 56.64	.125 3.18	.50 12.70	6.00 152.40	2.23 56.64	8.35 212.09	1884.0	A7, D6
EEE132	.90 22.86	.90 22.86	.675 17.15	.245 6.22	.45 11.43	1.34 34.04	.09 2.29	1.152 29.26	.09 2.29	.712 18.08	.22 5.59	.106 2.69	.05 1.27						50.0	A4, D6
FFF122	.83 21.08	.83 21.08	.18 4.57	.10 2.54	.100 2.540	.600 15.24	.95 24.13	.017 .432	.15 3.81										.005	A15
GGG126	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.7	.138 3.51	1.238 31.45	3.25 82.55	.12 3.05	.80 20.32	.69 17.53	— —	.60 15.24	1.200 30.48	.52 13.21	.82 20.83	.150 3.81	80.0	A6, A11 D17
HHH141	2.00 50.80	2.00 50.80	.95 24.13	1.000 25.40	.100 2.54	1.800 45.72	.125 3.18	.62 15.75	1.00 25.4	1.35 34.29									200.0	A10, C1 D6
III145	.770 19.56	.810 20.58	.380 9.66	.410 10.42	.030 .77	.200 5.08	.20 5.08	.14 3.56											11.0	A1
JJJ142	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	.32 8.13	— —	.80 20.32	.80 20.32										70.0	A10, D17
KKK155	.32 8.13	.445 11.30	.090 2.29	.006 .152	.012 .31	.070 1.78	.050 1.270	.010 .254	.015 .380	.030 .762	.050 1.270	.050 1.270							.40	A13
LLL163	.360 9.14	.400 10.16	.350 8.89	.020 .51	.016 .41	.040 1.02	.020 5.08												2.9	A12. C3
MMM168	.045 1.14	.053 1.35	.110 2.79	.120 3.05	.035 .89	.005 .13	.089 2.26	.104 2.64	.070 1.78	.080 2.03	.018 .46	.022 .56	.030 .76	.033 .84	.015 .38	.018 .46	.024 .61	.006 .15	1.0	A13
NNN150	.50 12.70	.48 12.20	.255 6.48	.240 6.10	.23 5.85	.21 5.34	.06 1.53	.100 2.54	.09 2.29	.16 4.06	.020 .51	.09 2.29	.005 .13						1.9	A1
PPP83	.75 19.05	.38 9.65	.20 5.08	.010 .25	.05 1.27	.020 .51	.200 5.08	.075 1.91	.200 5.08	.14 3.56	.060 1.532								1.6	A13
QQQ130	.310 7.87	.310 7.87	.20 5.08	.10 2.54	.010 .25	.100 2.54	.050 1.27	.400 10.16	.40 10.16	.120 3.05	.060 1.52	.100 2.54							.55	A13
RRR137	.28 7.11	.14 3.56	.030 .76	.020 .51	.145 3.68	.110 2.80	.006 .15	.010 .25	.030 .76										.015	A13, C5

tolerance x ± .1 xx ± .03 xxx ± .015 **oz. = grams x.0353**

A. MATERIAL AND FINISH

A1. Header material C. R. S. Pin material: #52 alloy Finish: electro tin, hot oil flowed. Cover material: cupro-nickel.

A4. Case material; aluminum alloy. Finish; iridite per MIL-C-5541.

A6. Case material; aluminum alloy. Finish; blue paint over iridite.

A7. Case material; aluminum alloy. Finish; case black paint. Heat sink; black anodize. Baseplate iridite per MIL-C-5541.

A10. Case material; aluminum alloy Finish, grey paint.

A11. Case material; aluminum alloy. Finish, blue anodized.

A12. Header finish; gold plate per MIL-G-45204. Case material; cupro-nickel.

A13. Case material; plastic. Lead finish, Tin plate.

A15. Case material: kovar. Lead material: kovar. Finish: gold plate per MIL-G-45204.

C. MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

C3. For Pin designations see specification data sheet.

C5. RF output is identified by index mark.

D. CONNECTORS

D6. Connectors. Female SMA only. Male SMA available on request, consult factory.

D17. Connectors. Female SMA only.

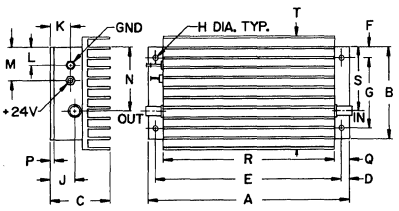
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3F14 REV C

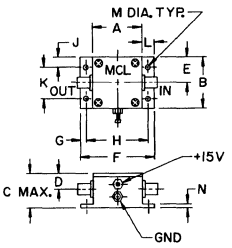
& outline drawings

Mini-Circuits

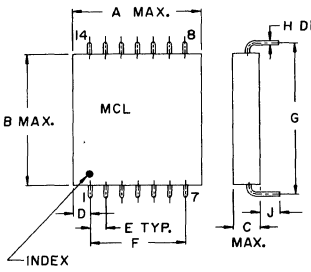
DDD



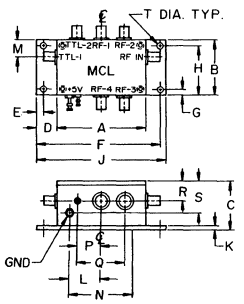
EEE



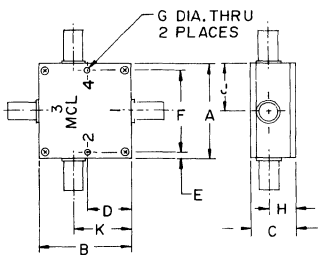
FFF



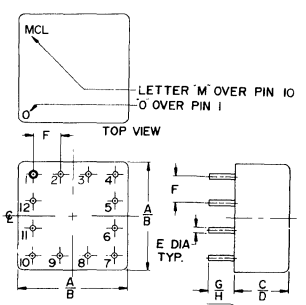
GGG



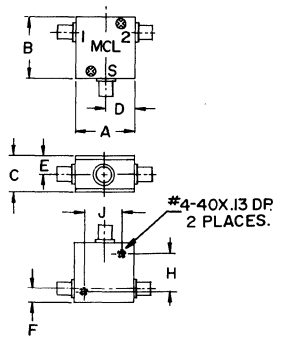
HHH



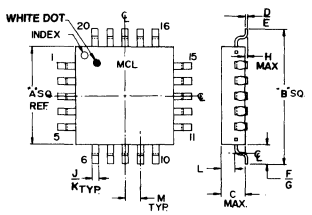
III



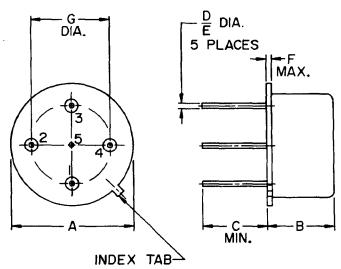
JJJ



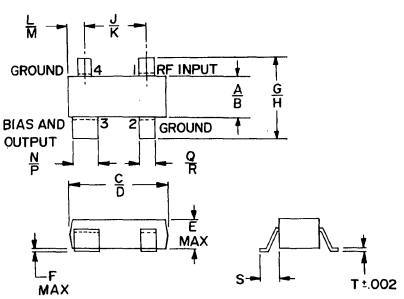
KKK



LLL

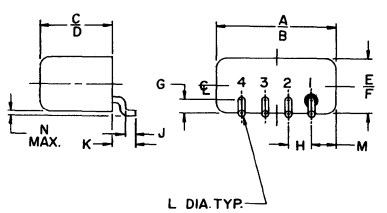


MMM

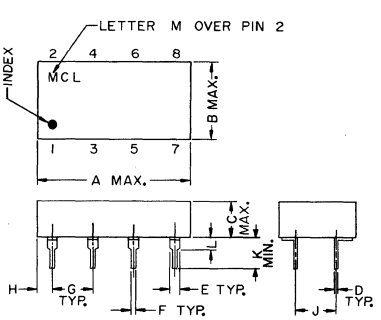


NNN

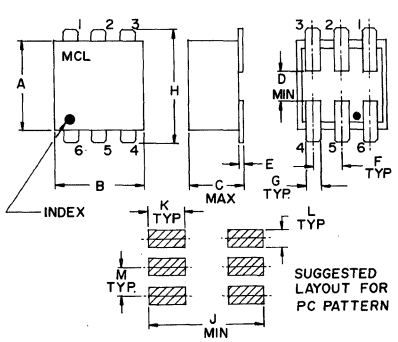
NOTE:
BLUE BEAD INDICATES PIN "1.
PIN NUMBERS DO NOT APPEAR
ON UNIT. FOR REFERENCE ONLY.



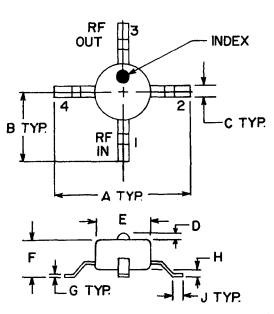
PPP



QQQ



RRR



active

Frequency Mixers

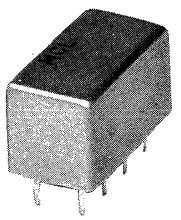
10 to 500 MHz

Load Insensitive

UNCL-X1 (+7 dBm LO, up to +1 dBm RF)
UNCL-X1MH (+13 dBm LO, up to 9 dBm RF)

case style selection

outline drawings see Table of Contents



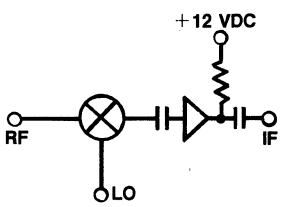
UNCL-X
UNCL-X1MH

	MODEL NO.	FREQUENCY MHz LO/RF f_L	FREQUENCY MHz IF f_U	CONVERSION GAIN, dB Mid Band $\bar{X}$	Mid Band σ	Mid Band Min.	Total Range Typ.	Total Range Min.	LO-RF ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INPUT POWER @ 1 dB Comp Typ.	DC POWER Volt	DC POWER Current (mA)	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
UNCL-X	UNCL-X1	1-500	10-500	1.57	.05	−1.0	0.5	−1.0	60	40	30	25	25	20	50	30	30	20	26	18	1	12	36	23.95	•	•
case A01	UNCL-X1MH	1-500	10-500	2.41	.015	0.5	2.0	0	60	40	35	25	30	20	50	30	25	18	18	14	7	12	60	27.95	•	•

L=low range (f_L to 10 f_L) M=mid range (10f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)

features

2-tone 3rd-order IM
insensitive to IF load
VSWR 1.2:1, IF/RF ports

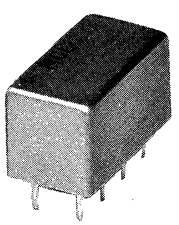


Low Noise (4.3 dB typ.)

UNCL-R1 (+7 dBm LO, up to −10 dBm RF)
UNCL-R1H (+17 dBm LO, up to +1 dBm RF)

case style selection

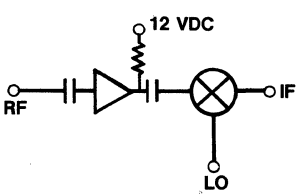
outline drawings see Table of Contents



UNCL-R1
UNCL-R1H

	MODEL NO.	FREQUENCY MHz LO/RF f_L	FREQUENCY MHz IF f_U	CONVERSION GAIN, dB Mid Band $\bar{X}$	Mid Band σ	Mid Band Min.	Total Range Typ.	Total Range Min.	LO-RF ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INPUT POWER @ 1 dB Comp Typ.	DC POWER Volt	DC POWER Current (mA)	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
UNCL-R	UNCL-R1	10-500	DC-500	5.53	.11	2	5	2	65	45	55	40	47	35	40	30	30	20	25	17	−10	12	35	23.95	•	•
case A01	UNCL-R1H	10-500	DC-500	6.32	.23	3	6	2	65	45	55	40	47	35	40	30	35	25	28	19	1	12	60	27.95	•	•

L=low range (f_L to 200 f_L) M=mid range (200 f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)



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SF16 REV C

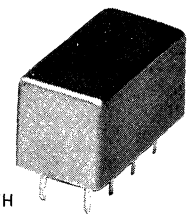
Mini-Circuits

Low LO drive

UNCL-L1 (−4 dBm LO, up to 1 dBm RF)
UNCL-L1H (+6 dBm LO, up to 14 dBm RF)

case style selection

outline drawings see Table of Contents



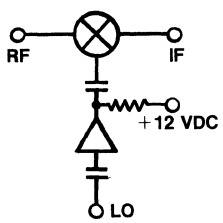
UNCL-L1
UNCL-L1H

	MODEL NO.	FREQUENCY MHz LO/RF f_L	IF f_U	CONVERSION LOSS, dB Mid Band $\bar{X}$	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	INPUT POWER @ 1 dB Comp Typ.	DC POWER Volt	Current (mA)	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
UNCL-L	UNCL-L1	10-500	DC-500	5.73	.08	8.0	6.5	8.5	45	30	35	20	25	17	32	20	23	15	18	12	+1	12	35	23.95	•	•
case A01	UNCL-L1H	10-500	DC-500	5.73	.07	8.0	6.5	8.5	45	25	36	20	24	17	32	18	25	15	18	10	14	12	60	27.95	•	•

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

NOTES:
1. For quality control procedures, environmental specifications, see Table of Contents.
2. Absolute Maximum Ratings, see Table of Contents.
3. Prices and specifications subject to change without notice.

$\bar{X}$ = Average of conversion loss at center of mid-band frequency ($f_L + f_U/4$).
σ = Standard deviation.



pin connections

	UNCL-X	UNCL-R	UNCL-L
LO	7	7	1
RF	8	1	7
IF	1	8	8
CASE GND	3, 5, 6	3, 5, 6	3, 5, 6
DC	4	4	4
NOT USED	2	2	2

FREQUENCY (MHz)	UNCL-X1MH CONVERSION GAIN (dB) (LO = +13 dBm)	UNCL-R1H CONVERSION GAIN (dB) (LO = +17 dBm)	UNCL-L1H CONVERSION GAIN (dB) (LO = +6 dBm)
1.00	2.00	8.60	6.86
2.00	2.30	8.00	6.55
5.00	2.40	6.90	6.40
10.00	2.30	6.00	6.30
25.00	2.20	6.00	6.00
50.00	2.30	6.10	6.10
100.00	2.20	6.30	6.00
250.00	2.20	5.80	6.10
500.00	2.10	5.00	6.10

SF18 REV C

In Stock...Immediate Delivery

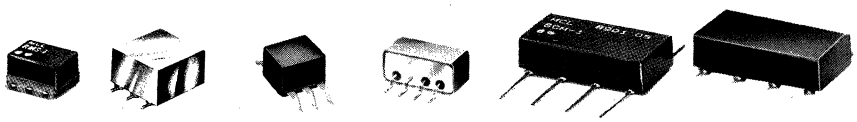
surface-mount

Frequency Mixers 500 Hz to 4.3 GHz

LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

case style selection

outline drawings Table of Contents



RMS LRMS ASK-KK81 TUF-SM SCM SCM-NL

		MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{X}$	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
▲□†RMS		RMS-1	.05-500	DC-500	5.94	.05	7.0	6.2	8.5	55	50	33	25	27	20	55	45	30	23	24	19	6.25	•	•
case TT-100		RMS-1W	2-750	DC-750	5.83	.21	7.5	6.0	8.5	70	45	45	28	38	22	60	45	40	25	30	20	6.75	•	•
		RMS-2	5-1000	DC-1000	6.67	.26	8.0	7.0	9.5	60	40	40	20	25	18	55	30	30	20	20	12	6.95	•	•
		RMS-2D	5-1000	DC-1000	6.81	.06	8.0	7.5	10.0	59	40	40	30	33	22	55	30	40	22	30	20	7.25	•	•
		RMS-2U	10-1000	10-750	6.79	.16	8.0	7.5	9.5	55	40	40	30	30	25	55	30	35	25	30	22	11.45	•	•
case TT-146	◇	RMS-1R	.05-500	DC-500	5.80	.16	7.0	6.2	8.5	55	50	33	25	27	20	55	45	30	23	24	19	14.45	•	•
	◇	RMS-2R	5-1000	DC-1000	6.60	.14	8.0	7.0	10.0	55	40	39	20	22	17	46	35	30	20	18	11	14.95	•	•
case TT-100		RMS-5	5-1500	DC-1000	5.92	.34	7.5	7.5	9.5	60	40	40	20	30	18	55	30	30	18	15	8	13.95	•	•
	◇	RMS-5R	10-1500	DC-1000	5.62	.12	8.0	7.8	9.9	50	40	34	20	22	18	50	27	30	15	14	7	16.95	•	•
□ † LRMS		LRMS-1	.05-500	DC-500	5.94	.05	7.0	6.2	8.5	55	50	33	25	27	20	55	45	30	23	24	19	6.25	•	•
case QQQ-130		LRMS-1W	2-750	DC-750	5.83	.21	7.5	6.0	8.5	70	45	45	28	38	22	60	45	40	25	30	20	6.75	•	•
NEW		LRMS-2	5-1000	DC-1000	6.67	.26	8.0	7.0	9.5	60	40	40	20	25	18	55	30	30	20	20	12	6.95	•	•
		LRMS-2D	5-1000	DC-1000	6.81	.06	8.0	7.5	10.0	59	40	40	30	33	22	55	30	40	22	30	20	7.25	•	•
		LRMS-2U	10-1000	10-750	6.79	.16	8.0	7.5	9.5	55	40	40	30	30	25	55	30	35	25	30	22	11.45	•	•
	◇	LRMS-1R	.05-500	DC-500	5.80	.16	7.0	6.3	8.5	55	50	33	25	27	20	55	45	30	23	24	19	14.45	•	•
	◇	LRMS-2R	5-1000	DC-1000	6.60	.14	8.0	7.0	10.0	55	40	39	20	22	17	46	35	30	20	18	11	14.95	•	•
		LRMS-5	5-1500	DC-1000	5.92	.34	7.5	7.5	9.5	60	40	40	20	30	18	55	30	30	18	15	8	13.95	•	•
	◇	LRMS-5R	10-1500	DC-1000	5.62	.12	8.0	7.8	9.9	50	40	34	20	22	18	50	27	30	15	14	7	16.95	•	•
□ ASK		ASK-1	1-600	DC-600	5.58	.06	7.0	6.0	8.5	50	30	35	25	30	20	45	35	30	20	25	15	6.95	•	•
case KK-81		ASK-2	1-1000	DC-1000	6.79	.10	8.0	8.0	9.8	60	40	35	18	26	16	50	30	25	17	15	10	8.25	•	•
□ TUF-SM		TUF-1SM	2-600	DC-600	5.85	.04	7.0	6.0	8.0	60	50	42	30	37	25	60	45	47	30	36	22	4.25	•	•
case NNN-150		TUF-2SM	50-1000	DC-1000	5.85	.07	7.5	6.6	9.0	58	40	47	30	42	25	50	35	44	20	29	18	5.20	•	•
NEW o▲□SCM		SCM-1	1-500	DC-500	5.72	.10	7.0	6.5	8.0	60	40	45	35	40	30	50	40	45	35	40	25	4.25	•	•
case YY-109		SCM-2	5-1000	DC-500	5.76	.03	7.5	7.0	9.8	50	40	40	25	35	20	55	30	40	25	30	18	5.45	•	•
		SCM-5	1250-1800	DC-500	5.82	.19	—	5.5	8.0	— —		28 (typ)		17 (min)	— —	— —		18 (typ)		8 (min)	— —	11.95	•	•
		SCM-2500	500-2500	DC-500	5.88	.08	6.9	6.4	10.0	35	22	35	22	35	22	18	12	18	12	18	12	11.95	•	•

L=low range (f_L to 10 f_L) M=mid range (10 f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)
m=mid band ($2f_L$ to $f_U/2$)

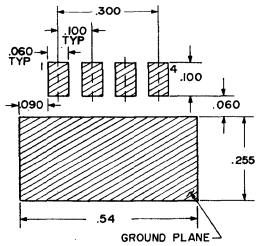
NOTES:
o Available in YY101, no leads.
▲ SCM (YY101 version, no leads) and all RMS units available on tape and reel. Please consult factory.
◇ hermetically sealed diodes
PAM-42 protected under patent 4,430,758.
† Phase Detection, Polarity Positive
□ NON-HERMETIC
$\bar{X}$ = Average of conversion loss at center of mid-band frequency ($f_L + f_U/4$).
σ = Standard deviation.
1. For quality control procedures, environmental specifications, and HI-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings: RF power 50 mW, peak IF current 40 mA, see Table of Contents.
3. Prices and specifications subject to change without notice.

pin connections see case style outline drawing

Series	RMS LRMS	SCM			TUF-SM
models	all models	-1	-2	-2500 -5	all models
LO	1	8	8	1	4
RF	4	1	1	8	1
IF	5	3,4	3	3	2
GND◆	2,3,6	2,5,6,7	2,5,6,7	2,4,5,6,7	3
CASE GND	—	4: NOT USED			

◆ Ground externally. All measurements made with GND pin(s) grounded externally.

Footprint for P.C. Design (TUF-SMD)



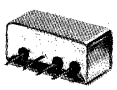
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

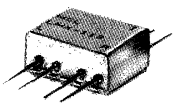
NEW A-LEFT REV E

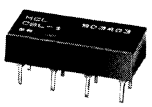
Plug-In

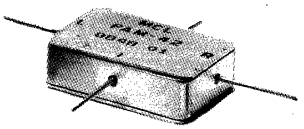
Mini-Circuits

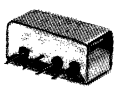

ASK


TFM


LMX


CBL


PAM


TUF

	MODEL NO.	FREQUENCY MHz LO/RF f_L–f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Typ.	Max.	LO–RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO–IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
*ASK	ASK-1	1-600	DC-600	5.58	.06	7.0	6.0	8.5	50	30	35	25	30	20	45	35	30	20	25	15	6.95	•	•
case W38	ASK-2	1-1000	DC-1000	6.79	.10	8.0	8.0	9.8	60	40	35	18	26	16	50	30	25	17	15	10	8.25	•	•
TFM	TFM-2	1-1000	DC-1000	5.74	.07	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	13.95	•	•
case B02	†TFM-2P	1-1000	DC-1000	5.74	.07	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	13.95	•	•
	TFM-3	0.04-400	DC-400	4.70	.06	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	21.45	•	•
	†TFM-4	5-1250	DC-1250	6.47	.05	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	23.45	•	•
	TFM-5	5-1500	DC-1000	6.33	.06	8.5	8.0	9.5	60	45	35	25	30	25	60	40	35	15	25	14	25.45	•	•
case B13	TFM-11	1-2000	5-600	7.16	.07	8.5	7.5	9.0	50	45	35	25	25	10	45	40	27	20	25	20	47.45	•	•
	TFM-12	800-1250	50-90	5.71	.14	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	47.45	•	•
	TFM-2400	750-2400	DC-400	6.65	.20	—	6.7	9.0	30	20	30	20	30	20	30	10	30	10	30	10	28.95	•	•
	TFM-4300	300-4300	DC-800	5.87	.13	—	8.0	10.5	30	20	—	—	30	17	15	7	—	—	10	7	38.95		
LMX	LMX-3	0.04-400	DC-400	4.84	.05	7.0	6.0	8.0	60	50	50	35	35	25	45	40	35	25	25	20	25.95	•	•
case BB48	LMX-113	5-1000	DC-1000	5.72	.05	7.0	7.0	8.0	50	40	40	25	35	25	45	35	35	30	30	20	16.95	•	•
	LMX-124	0.5-500	DC-500	5.18	.06	6.5	6.0	7.0	50	40	45	25	45	22	45	40	40	30	30	20	27.95	•	•
	LMX-149	10-1500	DC-1500	6.58	.09	7.5	6.0	9.0	55	40	45	35	30	20	50	40	40	25	20	12	29.95	•	•
	LMX-156	800-2500	DC-1500	7.09	.37	9.0	6.5	9.0	35	25	35	25	35	25	22	17	22	17	22	17	44.95	•	•
☐ CBL	CBL-1	1-500	DC-500	5.90	.05	7.0	6.5	8.0	60	45	45	35	40	25	45	35	40	25	30	20	3.99	•	•
case PPP83	CBL-1X	10-1000	5-500	5.94	.08	7.5	7.0	8.0	50	40	40	30	30	20	50	45	40	35	35	25	5.40	•	•
☐ PAM	PAM-42	2000-4200	DC-1300	8.13	.14	—	7.0	8.5	— — 25 (typ) 17 (min) — —						— — 12 (typ) 8 (min) — —						27.95	•	•
case AA46																							
☐ *TUF	TUF-1	2-600	DC-600	5.85	.04	7.0	6.0	8.0	60	50	42	30	37	25	60	45	47	30	36	22	4.25	•	•
case B02	TUF-2	50-1000	DC-1000	5.85	.07	7.5	6.6	9.0	58	40	47	30	42	25	50	35	44	20	29	18	5.20	•	•

NEW

L=low range (f_L to 10 f_L) M=mid range (10 f_L to f_U/2) U=upper range (f_U/2 to f_U)
m=mid band (2 f_L to f_U/2)

* Surface mounting available, see page 19.
ASK-Plug-In mounting available, see case X65.

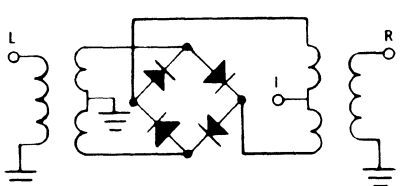
pin connections

see case style outline drawing

ASK	TFM	LMX	PAM	CBL	TUF
all models	all models ■	all models	all models	all models	all models
1	4	8	3	8	4
4	1	5	1	3,4	1
5	2	4	4	1	2
2,3,6	3	2,3,6,7	2	2,5,6,7	3
—	3	2,3,6,7	2		

■ TFM-2400, TFM-5, & TFM-4300 LO=1; RF=4

schematic



NSN GUIDE

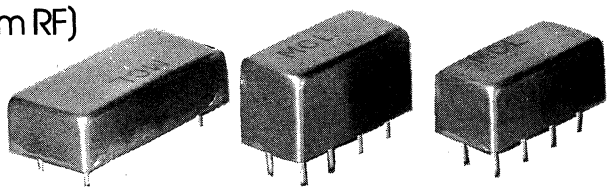
MCL NO.	NSN
TFM-2	5821-01-135-1852
TFM-3	5840-01-112-0031
TFM-12	5821-01-179-5686
TSM-1	5895-01-121-7958

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most widely-used
Frequency Mixers
LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

case style selection
outline drawings Table of Contents



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{X}$	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
GRA	GRA-1	.5-500	DC-500	5.96	.09	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	14.95	●	●
case D09	GRA-3	.025-200	DC-200	4.78	.07	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	18.45	●	●
	GRA-6	.003-100	DC-100	4.70	.14	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	28.95	●	●
	GRA-8	.0005-10	DC-10	6.03	.08	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	31.95	●	●
SRA	● SRA-1	.5-500	DC-500	5.11	.09	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	13.45	●	●
case A01	SRA-1TX	.5-500	DC-500	5.68	.04	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	59.95	●	
	SRA-1W	1-750	DC-750	5.80	.04	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	15.95	●	●
	SRA-1-1	.1-500	DC-500	4.81	.11	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	14.95	●	●
	SRA-2	1-1000	.5-500	5.66	.07	7.5	6.5	8.5	45	30	35	20	30	20	45	30	30	20	30	20	15.95	●	●
	SRA-2CM	5-1000	DC-1000	5.27	.04	7.0	6.5	8.5	60	50	35	30	30	25	50	45	30	25	25	20	14.95	●	●
	SRA-3	.025-200	DC-200	4.61	.06	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	15.95	●	●
	SRA-4	5-1250	:5-500	5.71	.08	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	17.95	●	●
	*SRA-5	5-1500	10-600	6.69	.07	8.0	7.5	8.5	50	45	35	30	30	20	45	40	30	25	25	15	24.95	●	●
	SRA-6	.003-100	DC-100	4.58	.05	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	24.95	●	●
	SRA-8	.0005-10	DC-10	5.69	.11	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	29.95	●	●
case A06	SRA-11	5-2000	10-600	6.72	.07	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	20.95	●	●
	SRA-12	800-1250	50-90	6.21	.13	—	6.0	7.5	32	25	35	25	35	25	30	20	30	20	30	20	29.95	●	●
	SRA-149	5-500	DC-500	5.61	.07	6.5	6.0	8.0	60	50	55	45	53	40	50	40	35	25	30	24	9.95	●	●
	SRA-2000	100-2000	DC-600	8.60	.15	9.5	7.0	9.5	—	—	37	20	—	—	—	—	—	—	30	20	21.95	●	●
	SRA-2400	750-2400	DC-400	5.95	.26	—	6.7	9.0	30	20	30	20	30	20	30	8	30	8	30	8	22.95	●	●
	**SRA-3500	500-3500	DC-1000	7.28	.31	—	7.5	9.5	30	17	30	17	30	17	20	8	20	8	20	8	28.95	●	●
□ SBL	SBL-1	1-500	DC-500	5.60	.09	7.0	6.5	8.0	60	45	45	35	40	25	45	35	40	25	30	20	4.75	●	●
case A06	SBL-1X	10-1000	5-500	5.88	.10	7.5	7.0	8.0	50	40	40	30	30	20	50	45	40	35	35	25	6.45	●	●
	SBL-1Z	10-1000	DC-500	6.27	.09	7.5	7.0	9.0	50	40	35	25	25	20	40	25	25	18	19	15	7.45	●	●
	SBL-1-1	0.1-400	DC-400	4.84	.04	7.0	6.0	8.0	50	45	45	30	35	25	45	30	40	25	30	20	7.45	●	●
	SBL-3	.025-200	DC-200	4.81	.05	7.5	6.0	8.5	55	50	45	30	35	25	45	35	40	30	30	20	7.45	●	●
	o SBL-11	5-2000	10-600	7.08	.11	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	19.95	●	●
SIMA	SIMA-5	2-1500	DC-1000	7.01	.08	8.0	7.0	9.0	65	44	44	23	31	22	54	38	30	18	25	11	24.95	●	●
case A06																							

L=low range (f_L to 10 f_L) M=mid range (10 f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)
m=mid band (2 f_L to $f_U/2$)

NOTES:
† Phase Detection, Polarity Positive
* SRA-5 case style is A06.
● HTRB tested, 3 year guarantee
** Conversion loss 10 dB max. at IF=1000 MHz.
o Pin connections same as the SRA-11
□ **NON-HERMETIC**
$\bar{X}$ = Average of conversion loss at center of mid-band frequency ($f_L + f_u/4$).
σ = Standard deviation.

1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings: RF power 50 mW, peak IF current 40 mA, see Table of Contents.
3. Prices and specifications subject to change without notice.

pin connections see case style outline drawing

Series	GRA	SRA						SBL			SIMA
models	all models	-1 -1TX -1-1 -3	-2 -4	-6 -8	-1W -2CM	-5 -11 -12 -2000 -2400† -3500†	-149***	-1 -1-1 -3	-1X	-1Z	-5
LO	1	8	8	8	8	8	8	8	8	1	8
RF	6	1	3,4*	1	1	1	2	1	3,4*	8	1
IF	4	3,4*	1	3,4*	3,4*	3	5,6*	3,4*	1	3	3
GND♦	2,3,5	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	1	2,5,6,7	2,5,6,7	2,5,6,7	4
CASE GND	—	2	2,5,6,7	—	2,5,6,7	2,5,6,7	3,4,7	—	2,5,6,7	2,5,6,7	2,5,6,7

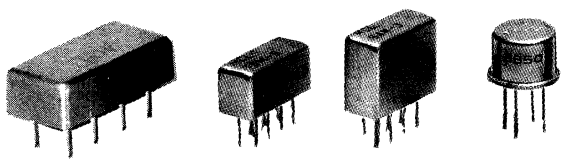
* Pins must be connected together externally
*** Blue bead is pin #4
♦ Ground externally. All measurements made with GND pin(s) grounded externally.

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NEW B LEFT REV S1C

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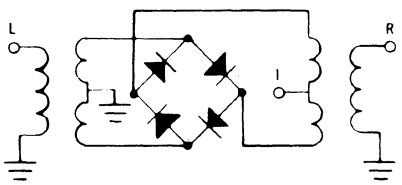


TAK TSM SAM ROSE

	MODEL NO.	FREQUENCY MHz LO/RF f_L–f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m X̄	σ	Max.	Total Range Typ.	Max.	LO–RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO–IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
TAK case A04	TAK-5	.01–250	DC–250	4.65	.02	7.0	6.5	8.5	60	50	50	35	40	35	55	45	45	30	35	25	20.95	•	•
	TAK-5R	.05–200	DC–200	4.70	.05	6.5	6.5	8.0	55	50	45	35	45	35	50	45	40	30	40	30	20.95	•	•
	TAK-6	.5–600	DC–600	5.58	.04	7.5	6.5	8.5	60	50	50	30	40	25	55	45	45	30	30	20	20.95	•	•
	TAK-6R	0.5–600	DC–600	5.40	.11	7.0	6.5	8.0	55	50	45	40	35	30	45	40	40	25	30	25	20.95	•	•
	TAK-7	2–1000	5–500	5.86	.08	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	20.95	•	•
TSM case A11	TSM-1	1–600	DC–600	5.71	.04	7.5	6.5	8.5	60	45	45	35	35	25	55	45	40	30	35	25	19.95	•	•
	TSM-2	1–1000	DC–1000	5.55	.08	7.5	7.0	10.0	55	45	40	20	35	18	50	40	40	20	25	18	20.95	•	•
	TSM-3	0.1–500	DC–500	4.75	.04	7.5	6.5	8.5	60	50	50	35	35	25	55	45	45	30	35	25	21.95	•	•
	†TSM-5	5–1500	DC–1000	6.16	.04	8.5	8.0	9.5	60	45	35	25	30	25	60	45	35	25	25	16	27.95	•	•
SAM case A03	SAM-1	1–600	DC–600	5.67	.05	7.0	6.5	8.5	55	45	45	30	35	20	50	40	40	25	30	20	16.95	•	•
	SAM-2	1–1000	DC–1000	5.68	.08	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	25	20.45	•	•
	SAM-3	0.1–500	DC–500	5.04	.07	7.0	6.5	8.5	60	50	50	35	35	30	50	40	45	30	30	20	19.95	•	•
	SAM-4	5–1250	0.5–1000	5.98	.18	8.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	23.95	•	•
	SAM-5	5–1500	0.5–1000	5.81	.08	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	29.95	•	•
ROSE case PP94	ROSE-1	1–600	DC–600	5.08	.03	6.5	6.0	7.5	40	30	35	25	30	20	55	40	40	20	25	18	11.95	•	•

L=low range (f_L to 10 f_L) M=mid range (10 f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)
m=mid band (2 f_L to $f_U/2$)

schematic



pin connections

see case style outline drawing

TAK				TSM	SAM			ROSE
−1 −3	−4 −5	−2	−6R	all models (△)	−1 −3	−4 −5	−2	−1
8	8	8	1	8	8	8	8	1
1	3,4*	1	8	1	1	3,4*	1	3
3,4*	1	3,4*	5,6*	3,4*	3,4*	1	3,4*	2
2,5,6,7	2,5,6,7	2,5,6,7	2,3,4,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	—
2	2,5,6,7	—	3,4,7	2	2	2,5,6,7	2,5,6,7	4

△ TSM-5, CASE GROUND 2,7; TSM-2 CASE GROUND 2, 5, 6, 7.
* Pins must be connected together externally.

MIL-M-28837/1, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1*
GRA-3	5895-01-169-1815	
GRA-8	5895-01-217-5627	
SAM-1	5895-01-117-2926	
SAM-1TX	5840-01-196-4765	
SAM-2	5985-01-165-6621	
SAM-3	5895-01-062-9973	
SAM-5	5895-01-036-9507	
SBL-1	9058-00-256-6818	
SBL-1X	5895-01-179-8084	
SRA-1	6625-00-008-8272	03
SRA-1-1	5962-01-113-5431	
SRA-1-TX	5895-01-163-9247	
SRA-1-1-TX	5895-01-151-6753	
SRA-11-TX	5895-01-163-9248	
SRA-1W		09
SRA-3	5895-01-021-5914	
SRA-4	5826-01-155-6545	
SRA-6	5895-01-124-0117	
SRA-8	5985-01-081-0977	
TFM-2-408	5821-01-076-2497	
TFM-2	5821-01-135-1852	
TFM-3	5840-01-112-0031	
TFM-12	5821-01-179-5686	
TSM-1	5895-01-121-7958	

*units are not QPL-listed

NEW B.RIGHT REV. S1B

In Stock...Immediate Delivery

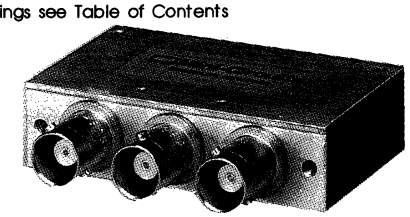
widest-variety of connector types

Frequency Mixers

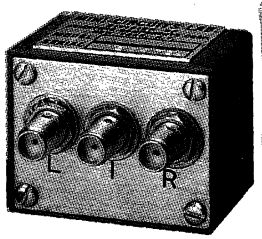
LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

case style selection

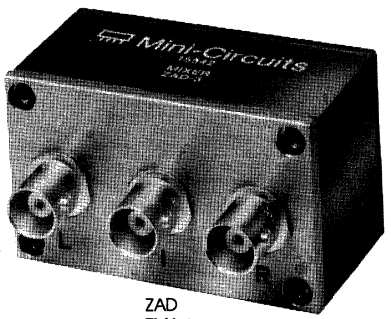
outline drawings see Table of Contents



ZP



ZLW△



ZAD
ZMA△

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{X}$	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
ZP case GG60	ZP10514	.2-500	DC-500	5.18	.026	7.0	6.5	8.5	55	45	50	35	35	30	50	40	36	30	30	20	62.95	•	
ZLW case M21 △	ZLW-1	.5-500	DC-500	5.81	.08	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	51.95	•	
	ZLW-1W	1-750	DC-750	5.74	.05	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	56.95	•	
	ZLW-1-1	.1-500	DC-500	4.82	.07	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	53.95	•	
	ZLW-2	1-1000	DC-1000	5.68	.08	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	20	56.95	•	
	ZLW-3	.025-200	DC-200	4.61	.06	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	53.95	•	
	ZLW-5	5-1500	10-600	5.81	.08	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	61.95	•	
	ZLW-6	.003-100	DC-100	4.58	.05	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	25	64.95	•	
	ZLW-8	.0005-10	DC-10	5.66	.08	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	69.95	•	
	ZLW-11	5-2000	10-600	6.85	.10	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	71.95	•	
	ZLW-12	800-1250	50-90	6.21	.13	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	71.95	•	
ZAD case M22	ZAD-1	.5-500	DC-500	5.24	.10	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	43.95	•	
	ZAD-1W	1-750	DC-750	5.56	.05	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	45.95	•	
	ZAD-1-1	.1-500	DC-500	4.83	.04	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	44.95	•	
	ZAD-2	1-1000	.5-500	5.66	.07	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	49.95		
	ZAD-3	.025-200	DC-200	4.61	.06	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	45.95	•	
	ZAD-4	5-1250	.5-500	5.71	.08	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	51.95	•	
	ZAD-6	.003-100	DC-100	4.65	.08	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	51.95	•	
	ZAD-8	.0005-10	DC-10	5.79	.05	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	54.95	•	
	ZAD-11	5-2000	10-600	7.12	.12	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	61.95	•	
	ZAD-12	800-1250	50-90	6.21	.13	7.5	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	61.95	•	

L=low range (f_L to 10 f_L) **M**=mid range (10f_L to f_U/2) **U**=upper range (f_U/2 to f_U)

m=mid band (2f_L to f_U/2)

single-balanced (1 to 3 GHz)

	MODEL NO.	LO/RF f_L-f_U	IF	Mid-Band m* $\bar{X}$	$\bar{V}$	Max.	Total Range Typ.	Max.	L* Typ.	Min.	M* Typ.	Min.	U* Typ.	Min.	L* Typ.	Min.	M* Typ.	Min.	U* Typ.	Min.	Qty. (1-9)
ZMA case M23 △	ZMA-2*	1-2.5GHz	DC-150	5.03	.15	8.5	8.0	9.0	25	20	22	17	20	15	50	35	40	30	35	25	74.95
	ZMA-3*	1.4-3.0GHz	DC-500	6.12	.14	8.0	7.0	9.0	25	20	28	18	23	15	50	35	50	30	50	30	79.95

*m = 500MHz *L = f_L to (f_L +500) *M = (f_L +500) to (f_U −500) *U = f_U to (f_U −500)

NOTES:

1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings: RF power 50 mW, peak IF current 40 mA.
3. For connector types and case mounting options, see case style outline drawing, see Table of Contents.
4. Prices and specifications subject to change without notice.

△ Available only with SMA connectors.

$\bar{X}$ = Average of conversion loss at center of mid-band frequency (f_L + f_U/4).

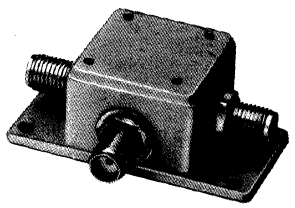
σ = Standard deviation.

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

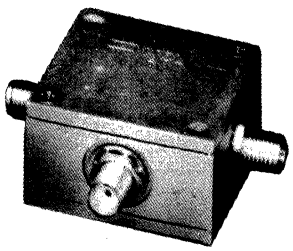
SF20 REV A

Mini-Circuits

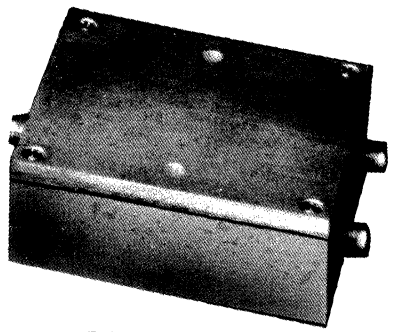
500 Hz to 4.2 GHz



ZEM



ZFM



ZAM

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{X}$	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
ZEM case V37	**ZEM-2B**	10-1000	DC-1000	5.74	.07	7.0	6.5	8.5	55	50	30	25	25	20	55	45	30	20	25	20	59.95	•	
	ZEM-4300	300-4300	DC-1000	6.65	.06	—	7.5	9.5	40	20	—	—	30	17	15	8	—	—	15	8	79.95	•	
ZFM case K18	**ZFM-1W**	10-750	DC-750	5.42	.14	7.0	6.2	8.0	50	45	45	30	35	25	45	40	40	25	27	20	51.95	•	
	ZFM-2	1-1000	DC-1000	5.72	.06	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	53.95	•	
	ZFM-3	0.04-400	DC-400	4.78	.03	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	61.95	•	
	†**ZFM-4**	5-1250	DC-1250	5.70	.34	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	61.95	•	
	ZFM-11	1-2000	5-600	7.03	.17	8.5	7.5	9.0	50	45	35	25	25	20	45	40	27	20	25	20	89.95	•	
	ZFM-12	800-1250	50-90	5.67	.12	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	79.95	•	
	△**ZFM-2000**	100-2000	DC-600	7.49	.20	9.5	7.0	9.5	—	—	37	20	—	—	—	—	—	—	30	20	71.95	•	
	△**ZFM-4212**	2000-4200	DC-1300	5.44	.088	—	7.0	8.5	—	—	25	17	—	—	—	—	18	10	—	—	54.95	•	
ZAM case F14	**ZAM-42**	1500-4200	DC-500	5.67	.11	—	7.0	8.5	25	14	25	14	25	14	18	10	18	10	18	10	54.95	•	

L=low range (f_L to 10 f_L) M=mid range (10 f_L to f_U/2) U=upper range (f_U/2 to f_U)

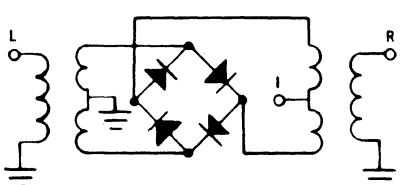
m=mid band (2 f_L to f_U/2)

†Phase detection, polarity positive

$\bar{X}$ = Average of conversion loss at center of mid-band frequency (f_L + f_U/4).

σ = Standard deviation.

schematic



NSN GUIDE

MCL NO.	NSN
ZAD-1B	5895-00-280-7750
ZAD-4B	5895-01-127-0376
ZAD-6B	5865-21-200-6364
ZEM-2B	5840-01-235-7834
ZFM-2	4935-01-230-3782
ZFM-3 (SMA)	5985-01-214-7362
ZFM-12-1	5825-01-127-3377
ZLW-1W	5840-00-607-7010
ZLW-2B	6920-01-037-1974
ZLW-5-1	4920-01-017-2753
ZMA-3	5865-01-064-0212

coaxial connections

see case style outline drawing

Series	ZP	ZLW	ZAD (ex-2, -4)	ZAD -2, -4	ZMA	ZEM		ZFM	ZAM
models	all models	all models	all models	all models	all models	-4300	-2B	all models	all models
L	L	1	1	1	1	2	1	1	2
R	R	3	3	2	2	1	2	2	1
I	X	2	2	3	3	3	3	3	3

SF21 REV C

In Stock . . . Immediate Delivery

broadband high dynamic range

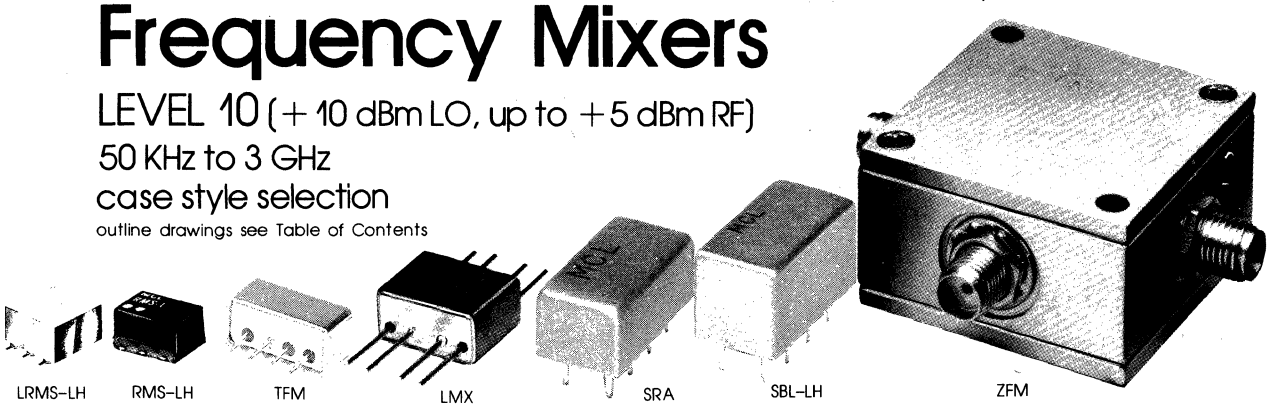
Frequency Mixers

LEVEL 10 (+10 dBm LO, up to +5 dBm RF)

50 KHz to 3 GHz

case style selection

outline drawings see Table of Contents



LRMS-LH RMS-LH TFM LMX SRA SBL-LH ZFM

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m X̄	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
o■RMS-LH	RMS-1LH	2-500	DC-500	5.36	.08	7.0	6.0	8.0	58	45	44	25	30	20	55	40	40	25	28	17	7.95	•	•
case TT100	RMS-2LH	5-1000	DC-1000	6.44	.10	8.0	7.0	9.5	58	40	39	20	22	16	52	30	30	17	18	11	8.95	•	•
	RMS-5LH	10-1500	DC-900	5.27	.09	8.0	7.6	9.8	58	35	38	20	25	18	56	30	38	14	17	6	14.95	•	•
■LRMS-LH	LRMS-1LH	2-500	DC-500	5.36	.08	7.0	6.0	8.0	58	45	44	25	30	20	55	40	40	25	28	17	7.95	•	•
case QQQ130	LRMS-2LH	5-1000	DC-1000	6.44	.10	8.0	7.0	9.5	58	40	39	20	22	16	52	30	30	17	18	11	8.95	•	•
	LRMS-5LH	10-1500	DC-900	5.27	.09	8.0	7.6	9.8	58	35	38	20	25	18	56	30	38	14	17	6	14.95	•	•
NEW TFM	TFM-15	10-3000	10-800	6.75	.08	8.0	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	49.95	•	
NEW case B13	TFM-150*	10-2000	DC-1000	6.19	.11	8.0	6.5	8.0	32	25	35	25	35	25	33	20	30	20	30	20	45.45	•	•
case B02	TFM-2LH	2-1000	DC-1000	5.70	.177	7.5	6.5	9.2	62	45	44	25	37	25	58	40	45	25	31	18	16.95	•	•
LMX	LMX-123	10-3000	10-1000	5.94	.08	8.0	7.5	8.5	35	25	35	20	30	15	35	25	30	25	30	20	69.95	•	
case BB48	LMX-148	10-1500	DC-1500	6.48	.08	7.0	6.0	10	45	40	35	30	25	20	40	35	35	25	20	12	29.95	•	•
NEW	LMX-1481	3-1100	DC-1100	6.7	.12	8.5	7.1	9.8	65	45	40	25	30	18	57	38	30	20	20	14	23.95	•	•
SRA	SRA-2CR	10-1000	5-500	5.68	.12	7.5	7.0	8.0	50	40	40	30	30	20	40	25	30	18	25	15	17.95	•	•
case A01	SRA-215	.05-1500	.05-500	5.20	.08	7.5	7.0	9.0	25	20	35	25	30	20	25	20	35	25	25	15	28.95	•	•
	SRA-220	.05-2000	.05-500	5.59	.11	8.0	7.0	9.0	25	20	40	30	30	20	25	20	40	30	25	15	31.95	•	•
NEW ZFM	ZFM-15	10-3000	10-800	6.13	.14	8.0	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	89.95	•	
case K18	ZFM-150*	10-2000	DC-1000	6.05	.12	8.0	6.5	8.0	32	25	35	25	35	20	33	20	30	20	25	20	69.95	•	
■SBL-LH	SBL-1LH	2-500	DC-500	5.8	.03	7.0	6.1	8.0	75	45	68	35	56	25	61	35	45	25	36	20	5.75	•	•
case A06	SBL-1-1LH	.2-400	DC-400	5.2	.06	7.0	5.9	9.0	67	45	64	30	51	25	62	30	52	25	34	20	8.45	•	•
	SBL-1XLH	10-1000	5-500	6.0	.12	7.5	6.0	8.5	50	40	40	25	30	20	70	45	55	40	45	30	7.45	•	•
	SBL-2LH	5-1000	DC-1000	5.9	.09	7.5	7.0	9.5	67	45	61	30	57	30	68	40	54	30	43	20	8.45	•	•
	SBL-3LH	.07-250	DC-250	4.9	.22	7.0	5.3	8.5	60	45	60	35	45	30	57	35	53	30	42	25	8.45	•	•
	SBL-11LH	5-2000	10-600	7.0	.11	8.5	7.5	9.5	60	45	45	30	30	20	50	35	30	20	25	16	20.95	•	•

L=low range (f_L to 10 f_L) M=mid range (10 f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)

m=mid band (2 f_L to $f_U/2$)

harmonic attenuation

RF CAL	MODEL TFM-15									
1	0	0	31	17	42	32	48	47	52	65	59
2	83	38	45	39	48	46	76	69	70	64	71
3	87	39	49	37	52	42	57	63	65	65	65
4	89	64	60	58	56	59	60	62	69	74	70
5	90	74	69	59	72	55	74	58	71	67	72
6	83	83	76	74	67	69	67	72	70	74	78
7	83	76	83	81	79	69	71	66	70	69	77
8	84	75	76	81	82	77	77	80	78	78	77
9	84	77	76	75	82	80	81	82	80	79	80
10	81	76	76	74	75	80	81	81	81	80	81
		1	2	3	4	5	6	7	8	9	10

Harmonic LO Order

Harmonics RF Order

MODEL: TFM-15

LO: +10 dBm 969.01 MHz.

RF: 0 dBm 999.01 MHz.

NSN GUIDE

MCL NO. NSN

ZFM-150 5895-01-217-6878

NOTES:

■ NON-HERMETIC

* Below 10 MHz IF, conversion loss increases up to 6 dB higher as frequency decreases to DC.

o Available on tape and reel. Please consult factory.

1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings, RF power 50 mW/level 10, 200 mW/level 13, except RMS-MH 150 mW. Peak IF current 40 mA, see Table of Contents.
3. For connector types and case mounting options, see case style outline drawings, see Table of Contents.
4. Prices and specifications subject to change without notice.

$\bar{X}$ = Average of conversion loss at center of mid-band frequency ($f_L + f_U/4$).

σ = Standard deviation.

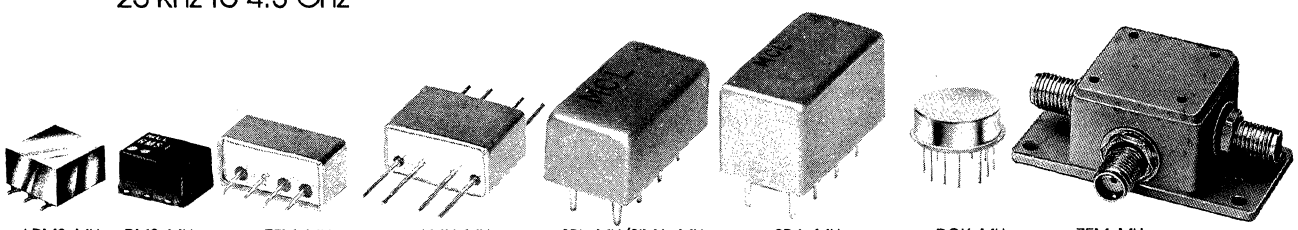
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF22 REV D

Mini-Circuits

LEVEL 13 (+13dBm LO, up to +9 dBm RF)

25 KHz to 4.3 GHz



LRMS-MH RMS-MH TFM-MH LMX-MH SBL-MH/SIMA-MH SRA-MH ROK-MH ZEM-MH

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m X̄	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
○■RMS-MH	**RMS-1MH**	2-500	DC-500	5.65	.08	7.0	6.0	8.0	58	45	44	25	30	20	55	40	36	25	28	17	8.95	●	●
case TT100	**RMS-2MH**	5-1000	DC-1000	6.72	.08	8.5	7.0	9.5	55	40	39	20	22	16	52	35	30	17	18	12	9.95	●	●
	RMS-5MH	10-1500	DC-900	5.67	.09	9.0	7.5	9.5	58	40	40	20	26	18	50	30	38	18	17	8	15.95	●	●
■LRMS-MH	**LRMS-1MH**	2-500	DC-500	5.65	.08	7.0	6.0	8.0	58	45	44	25	30	20	55	40	36	25	28	17	8.95	●	●
case QQQ130	**LRMS-2MH**	5-1000	DC-1000	6.72	.08	8.5	7.0	9.5	55	40	39	20	22	16	52	35	30	17	18	12	9.95	●	●
NEW	**LRMS-5MH**	10-1500	DC-900	5.67	.09	9.0	7.5	9.5	58	40	40	20	26	18	50	30	38	18	17	8	15.95	●	●
SIMA-MH	**SIMA-5MH**	2-1500	DC-1000	7.11	.11	8.6	7.0	9.0	70	44	44	23	31	22	57	38	30	20	25	15	28.95	●	●
case A06																							
TFM-MH	**TFM-1MH**	2-500	DC-500	5.80	.05	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	24.95	●	●
case B02	**TFM-3MH**	1-250	DC-250	4.79	.23	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	24.95	●	●
case B13	**TFM-12MH**	0.5-2000	0.2-600	6.99	.16	8.0	7.2	9.5	60	45	35	30	30	25	55	40	30	25	25	20	48.95	●	●
NEW	**TFM-42MH**	10-4200	10-1000	7.46	.12	8.5	7.5	11	35	25	40	25	35	25	35	20	35	25	27	20	69.95	●	
LMX-MH	**LMX-123MH**	10-2500	10-500	6.80	.074	8.5	7.8	9.6	42	22	35	20	28	20	33	20	36	20	36	15	70.95	●	●
case BB48	**LMX-125MH**	0.5-500	DC-500	5.80	.07	7.0	7.0	9.0	45	40	45	40	40	30	45	40	40	35	35	25	62.95	●	●
■SBL-MH	**SBL-1MH**	1-500	DC-500	5.73	.08	7.5	6.5	8.5	50	35	45	30	35	25	45	30	40	25	30	20	10.45	●	●
case A06	**SBL-1ZMH**	2-1100	DC-500	6.63	.10	8.0	7.0	9.0	50	40	40	30	30	20	40	30	25	20	25	15	12.45	●	●
SRA-MH	**SRA-1MH**	.5-500	DC-500	5.65	.04	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	14.95	●	●
case A01	**SRA-3MH**	.025-200	DC-200	4.77	.07	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	16.95	●	●
case A06	**SRA-2010MH**	10-2000	DC-600	7.50	.20	8.5	7.8	9.8	50	45	45	30	40	30	45	45	35	30	35	25	38.95	●	●
ROK-MH	**ROK-186MH**	5-2500	10-1000	6.57	.11	8.5	7.0	9.5	33	25	35	25	25	20	33	20	31	25	27	20	47.95	●	●
case QQ96																							
ZEM-MH	**ZEM-4300MH**	300-4300	DC-1000	6.42	.15	—	7.0	8.5	40	20	—	—	40	20	14	7	—	—	12	7	89.95	●	
case V37																							

L=low range (f_L to 10 f_L) M=mid range (10 f_L to f_U/2) U=upper range (f_U/2 to f_U)

m=mid band (2 f_L to f_U/2)

pin connections

see case style outline drawing

Series	RMS-LH RMS-MH LRMS-LH LRMS-MH	TFM	LMX/MH	SRA	ZFM	TFM-MH/LH		SBL-LH/-MH					SRA-MH		ROK-MH	SIMA-MH	ZEM-MH
Models	all models	all models	all models	all models except -2CR**	all models	-2LH -1MH -3MH -12MH	-42MH	-1LH -1-1LH -3LH -1MH	-2LH	-1XLH	-11MH	-1ZMH	-1MH -3MH	-2010MH	all models	-5MH	-4300MH
LO	1	1	8	8	1	4	1	8	8	8	8	1	8	8	5	8	2
RF	4	4	5	1	2	1	4	1	1	3,4*	1	8	1	1	11	1	1
IF	5	2	4	3	3	2	2	3,4*	3,4*	1	3	3	3,4*	3	2	3	3
GND♦	2,3,6	3	1,2,3,6,7	2,5,6,7	—	3	3	2,5,6,7	7	—	—	2,5,6,7	2,5,6,7	2,5,6,7	GND:	4	—
CASE GND	—	3	1,2,3,6,7	2,5,6,7	—	3	3	—	2,5,6	2,5,6,7	2,5,6,7	2,5,6,7	2	2,5,6,7	8,1,3,4,6,	2,5,6,7	—
														4 open	7,9,10,12		

*pins must be connected together externally **model SRA-2CR LO is pin 1, RF is pin 8

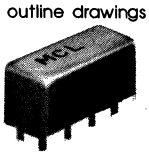
♦Ground externally. All measurements made with GND pin(s) grounded externally.

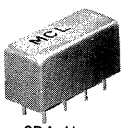
SF23 REV B

In Stock . . . Immediate Delivery

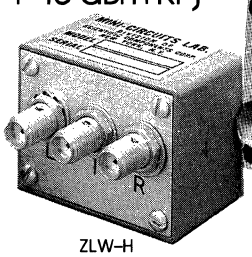
very high dynamic range
Frequency Mixers
LEVEL 17 (+17 dBm LO, up to +10 dBm RF)

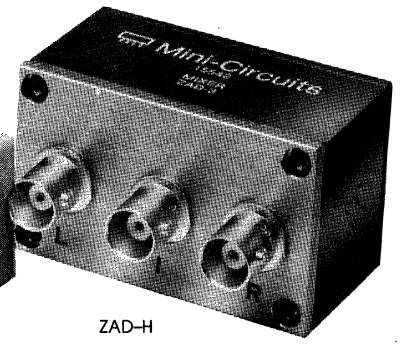
case style selection
outline drawings see Table of Contents


SIMA-H


SRA-H


GRA-H


ZLW-H



ZAD-H

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m $\bar{X}$	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
SRA-H case A01	●SRA-1H	.5-500	DC-500	6.01	.08	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	20.95	●	●
	●SRA-1WH	1-750	DC-750	5.85	.11	7.5	6.5	8.5	50	40	45	25	35	25	45	35	40	30	30	20	24.95	●	●
	●SRA-2H	2-1000	DC-1000	6.34	.14	7.5	8.5	10	50	40	35	25	35	25	45	30	30	20	25	20	38.95	●	●
	●SRA-3H	.05-200	DC-200	5.18	.05	7.0	5.5	7.5	50	45	40	30	35	25	45	35	40	30	30	20	22.95	●	●
	SRA-6H	.01-50	DC-50	4.97	.06	6.0	5.5	7.0	50	45	45	30	35	25	50	40	47	35	32	25	38.95	●	●
	SRA-11H	10-3000	10-1000	6.83	.09	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	47.95	●	●
	SRA-173H	5-1200	DC-1200	5.38	.05	7.0	7.0	8.5	40	35	35	25	35	20	40	35	35	20	30	20	31.95	●	●
SIMA-H case A06	SIMA-5H	2-1500	DC-1000	6.94	.07	8.5	7.0	8.5	65	35	44	23	40	22	54	25	30	23	25	13	32.95	●	●
GRA-H case D08	GRA-1H	.5-500	DC-500	5.87	.09	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	21.95	●	●
	GRA-3H	.05-200	DC-200	4.85	.07	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	24.95	●	●
	GRA-6H	.01-50	DC-50	5.04	.05	6.0	5.5	7.0	50	45	45	30	35	25	50	40	47	35	32	25	34.95	●	●
ZLW-H case M21	●ZLW-1H	.5-500	DC-500	6.13	.08	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	56.95	●	
	●ZLW-1WH	1-750	DC-750	6.07	.13	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	59.95	●	
	●ZLW-2H	2-1000	DC-1000	6.34	.14	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	64.95	●	
	●ZLW-3H	.05-200	DC-200	5.18	.05	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	58.95	●	
	ZLW-11H	10-3000	10-1000	6.83	.09	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	99.95	●	
ZAD-H case M22	●ZAD-1H	.5-500	DC-500	6.16	.08	7.5	6.5	8.5	50	45	45	30	35	25	45	35	40	30	30	20	48.95	●	
	●ZAD-1WH	1-750	DC-750	6.16	.09	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	52.95	●	
	●ZAD-2H	2-1000	DC-1000	6.22	.15	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	59.95	●	
	●ZAD-3H	.05-200	DC-200	4.89	.09	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	50.95	●	
	ZAD-11H	10-3000	10-1000	6.83	.09	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	89.95	●	

L=low range (f_L to 10 f_L) M=mid range (10 f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)

m=mid band (2 f_L to $f_U/2$)

NOTES:
- HTRB tested
1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings: RF power 200 mW, peak IF current 40 mA, see Table of Contents.
3. For connector types and case mounting options, see case style outline drawings, see Table of Contents.
4. Prices and specifications subject to change without notice.

$\bar{X}$ = Average of conversion loss at center of mid-band frequency ($f_L + f_U/4$).

σ = Standard deviation.

pin and coaxial connections
see case style outline drawing

Series	SRA					GRA-H	ZLW-H	ZAD-H	SIMA-H
Models	-1H -3H -6H▲	-1WH -2H	-11H	-173H Configuration 1	-173H Configuration 2	all models	all models	all models	-5H
LO	8	8	8	3,4*	8	1	1	1	8
RF	1	1	1	1	1	6	3	3	1
IF	3,4*	3,4*	3	8	3,4*	4	2	2	3
GND◆	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,3,5	—	—	4
CASE GND	2	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	—	—	—	2,5,6,7

*pins must be connected together externally.

◆Ground externally. All measurements made with GND pin(s) grounded externally.

▲Pin 2 is not case grounded.

MIL-M-28837/1, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1*
GRA-3H	5895-01-171-0974	
SRA-1H	6625-00-594-0223	08
SRA-1WH	5840-00-576-0716	
SRA-2H	5895-01-063-1078	
SRA-3H	5895-01-117-4537	
SRA-11H	5895-01-192-0173	
SRA-11H-TX	5895-01-137-9278	
ZAD-1WH	5895-01-045-4647	
ZAD-3H	5895-01-149-0771	
ZLW-1H	5985-01-080-7637	
ZLW-1H-B	5962-045-7500	

*units are not QPL-listed

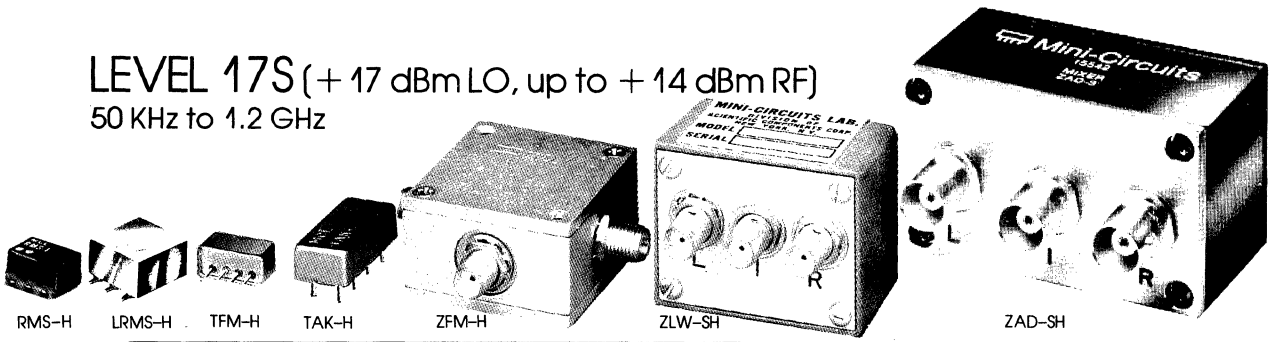
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156
SF24 REV B

very low distortion

Mini-Circuits

LEVEL 17S (+17 dBm LO, up to +14 dBm RF)

50 KHz to 1.2 GHz



	MODEL NO.	FREQUENCY MHz LO/RF f_L–f_U	IF	CONVERSION LOSS dB Mid-Band m X̄	σ	Max.	Total Range Typ.	Max.	LO–RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO–IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
o □ RMS-H	RMS-1H	2-500	DC-500	6.25	.034	7.0	6.4	8.5	55	44	44	25	33	20	50	34	45	25	37	22	10.95	•	•
case TT-100	RMS-1WH	5-750	DC-750	7.00	.11	8.5	7.8	8.8	55	40	43	22	28	20	52	30	38	22	29	20	11.95	•	•
NEW	RMS-2H	5-1000	DC-900	6.98	.054	8.5	7.8	9.3	55	40	39	22	33	20	52	30	45	22	30	17	11.95	•	•
NEW	RMS-2UH	10-1000	10-750	7.10	.083	8.5	8.5	9.6	50	40	38	30	30	23	50	30	40	25	34	22	14.45	•	•
	RMS-5H	10-1500	DC-900	6.36	.05	8.0	7.5	9.8	65	40	36	20	22	15	50	30	30	18	17	7	17.95	•	•
□ LRMS-H	LRMS-1H	2-500	DC-500	6.25	.034	7.0	6.4	8.5	55	44	44	25	33	20	50	34	45	25	37	22	10.95	•	•
case QQQ-130	LRMS-1WH	5-750	DC-750	7.00	.11	8.5	7.8	8.8	55	40	43	22	28	20	52	30	38	22	29	20	11.95	•	•
NEW	LRMS-2H	5-1000	DC-900	6.98	.054	8.5	7.8	9.3	55	40	39	22	33	20	52	30	45	22	30	17	11.95	•	•
	LRMS-2UH	10-1000	10-750	7.10	.083	8.5	8.5	9.6	50	40	38	30	30	23	50	30	40	25	34	22	14.45	•	•
	LRMS-5H	10-1500	DC-900	6.36	.05	8.0	7.5	9.8	65	40	36	20	22	15	50	30	30	18	17	7	17.95	•	•
TFM-H	TFM-1H	2-500	DC-500	6.14	.11	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	25.95	•	•
case B02	TFM-2H	5-1000	DC-1000	6.12	.12	7.0	7.0	10	50	45	40	30	30	20	45	40	35	25	25	17	36.95	•	•
	TFM-3H	.1-250	DC-250	4.58	.11	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	25.95	•	•
case 3	TFM-4H	5-1200	DC-1200	5.24	.05	8.0	7.0	9.0	50	40	35	25	30	20	50	40	35	20	30	20	39.45	•	•
TAK-H	TAK-1H	2-500	DC-500	5.93	.08	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	21.45	•	•
case A05	TAK-1WH	5-750	DC-750	5.71	.08	7.5	7.0	9.0	50	40	40	30	30	25	45	35	35	25	30	20	25.95	•	•
	TAK-3H	.05-300	DC-300	4.82	.09	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	23.45	•	•
ZFM-H	ZFM-1H	2-500	DC-500	6.14	.11	7.5	7.0	8.5	50	45	40	30	30	25	45	35	35	25	25	20	64.95	•	
case K18	ZFM-2H	5-1000	DC-1000	6.12	.12	7.0	7.0	10	50	40	40	30	30	20	45	40	35	25	25	17	74.95	•	
	ZFM-3H	.05-300	DC-300	5.18	.11	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	64.95	•	
	ZFM-4H	5-1200	DC-1200	4.97	.11	8.0	7.0	9.0	50	40	35	25	30	20	50	40	35	20	30	20	73.95	•	
ZLW-SH	ZLW-1SH	2-500	DC-500	5.93	.08	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	62.95	•	
case M21	ZLW-1WSH	5-750	DC-750	5.83	.07	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	66.95	•	
	ZLW-3SH	.05-300	DC-300	4.65	.09	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	64.95	•	
ZAD-SH	ZAD-1SH	2-500	DC-500	5.98	.08	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	54.95	•	
case M22	ZAD-1WSH	5-750	DC-750	5.64	.08	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	56.95	•	
	ZAD-3SH	.05-300	DC-300	5.08	.09	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	55.95	•	

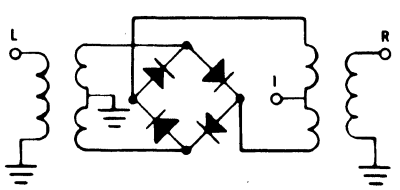
L=low range (f_L to 10 f_L) M=mid range (10 f_L to f_U/2) U=upper range (f_U/2 to f_U)

m=mid band (2f_L to f_U/2)

Two-Tone 3rd order IM below IF

each tone (0dBm, 200 and 202 MHz), LO (+17dBm, 180 MHz). All models 60dB typ. 55 dB min. except 55 dB typ. 45 dB min. for TFM-3H, TAK-3H, ZFM-3H, ZLW-3SH, ZAD-3SH

schematic



NOTES:

□ NON-HERMETIC

o Available on tape and reel. Please consult factory.

$\bar{X}$ = Average of conversion loss at center of mid-band frequency (f_L + f_U/4).

σ = Standard deviation.

pin and coaxial connections

see case style outline drawing

Series	TFM-H	TAK-H		ZFM-H	ZLW-SH	ZAD-SH	RMS-H LRMS-H
Models	all models	−1H −3H	−1WH	all models	all models	all models	all models
LO	4	8	8	1	1	1	1
RF	1	1	1	2	3	3	4
IF	2	3,4*	3,4*	3	2	2	5
GND♦	3	2,5,6,7	2,5,6,7	—	—	—	2,3,6
CASE GND	3	2	2,5,6,7	—	—	—	—

*pins must be connected externally ♦Ground externally. All measurements made with GND pin(s) grounded externally.

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
TAK-1H	5895-01-167-9721	
TAK-1WH	5895-01-189-9481	
TFM-1H	5895-01-129-0110	
TFM-2H	5985-01-235-1274	

SF25 REV B

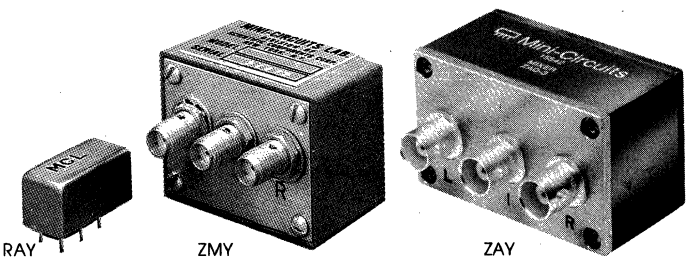
In Stock...Immediate Delivery

ultra-low distortion

Frequency Mixers

LEVEL 23 (+23 dBm LO, up to +15 dBm RF)

10 KHz to 2.5 GHz



case style selection

outline drawings see Table of Contents

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m $\bar{X}$	σ	Max.	CONVERSION LOSS dB Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
RAY	•RAY-1	5-500	DC-500	6.57	.09	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	40.95	•	•
case A01	•RAY-2	10-1000	DC-1000	6.89	.22	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	64.45	•	•
	•RAY-3	.07-200	DC-200	5.53	.08	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	40.95	•	•
	RAY-6	0.03-50	DC-50	5.36	.00	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	52.45	•	•
	RAY-6U	0.01-100	DC-100	5.09	.00	7.0	6.0	8.0	60	50	50	40	40	30	50	45	40	30	35	25	46.95	•	•
	RAY-11	100-2500	DC-500	6.23	.21	9.0	7.0	9.0	35	25	32	25	32	25	14	10	20	10	20	10	74.95	•	•
ZMY	•ZMY-1	5-500	DC-500	6.62	.10	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	67.95	•	
case M21	•ZMY-2	10-1000	DC-1000	6.89	.22	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	84.95	•	
	•ZMY-3	.07-200	DC-200	5.53	.08	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	69.95	•	
ZAY	•ZAY-1	5-500	DC-500	6.57	.09	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	64.95	•	
case M22	•ZAY-2	10-1000	DC-1000	6.89	.22	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	84.95	•	
	•ZAY-3	.07-200	DC-200	5.53	.08	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	64.95	•	

L=low range (f_L to 10 f_L) M=mid range (10 f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)

m=mid band ($2f_L$ to $f_U/2$)

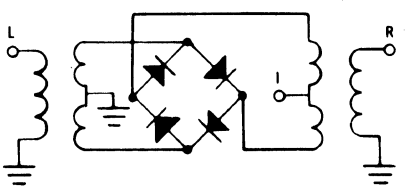
NOTES:

- HTRB tested
1. For quality control procedures, environmental specifications, and Hi-Rel, MIL and TX description see Table of Contents.
2. Absolute Maximum Ratings; RF power 350 mW for level 23, 23S and 500 mW for level 27. Peak IF current 40 mA.
3. For connector types and case mounting options, see case style outline drawing, see Table of Contents.
4. Prices and specifications subject to change without notice.

$\bar{X}$ = Average of conversion loss at center of mid-band frequency ($f_L + f_U/4$).

σ = Standard deviation.

schematic



pin and coaxial connectors

see case style outline drawing

Series	RAY				ZMY	ZAY	SAY	ZFY	VAY
Models	-1 -3	-2	-6 -6U**	-11	all models	all models	all models	all models	all models
LO	8	8	8	1	1	1	8	1	8
RF	1	1	1	8	3	3	1	2	1
IF	3,4*	3,4*	3,4*	3	2	2	3	3	3
GND♦	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	—	—	2,5,6,7	—	2,5,6,7
CASE GND	2	2,5,6,7	—	2,5,6,7	—	—	2,5,6,7	—	2,5,6,7
NOT USED	—	—	—	—	—	—	4	—	4

*pins must be connected externally

**Pin 2: case gnd. Pin 5,6,7: gnd.

♦Ground externally. All measurements made with GND pin(s) grounded externally.

MIL-M-28837/1*, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1*
RAY-1	5825-01-105-6188	
RAY-2	5895-01-111-7368	
RAY-3	5895-01-064-5082	
ZMY-2	4935-01-080-7636	
SAY-11	5895-01-199-3893	
VAY-1	5985-01-232-5890	
ZMY-1B	5840-01-213-3888	

*units are not QPL listed

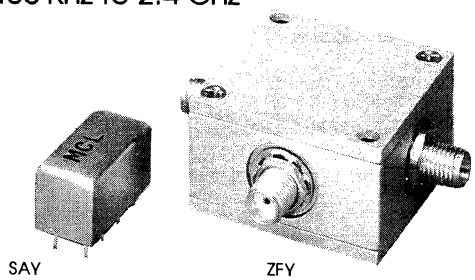
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF28 REV C

Mini-Circuits

Level 23S (+23dBm LO, up to +20dBm RF)

100 KHz to 2.4 GHz



SAY ZFY

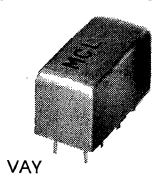
	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m $\bar{X}$	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
SAY case A01	SAY-1	0.1-500	.01-500	4.85	.00	6.0	5.3	7.5	40	20	46	35	40	30	37	23	46	35	40	30	62.95	•	•
	SAY-2	0.1-1000	.01-500	5.40	.24	7.5	7.5	9.5	40	20	40	30	30	25	37	23	40	25	25	20	67.95	•	•
	SAY-11	10-2400	5-1000	7.40	0.9	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	72.95	•	•
ZFY case K18	ZFY-1	0.1-500	.01-500	4.85	.00	6.0	5.3	7.5	40	20	46	35	40	30	37	23	46	35	40	30	74.95	•	
	ZFY-2	0.1-1000	.01-500	5.40	.24	7.5	7.5	9.5	40	20	40	30	30	25	37	23	40	25	25	20	79.95	•	
	ZFY-11	10-2400	5-1000	7.40	.09	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	84.95	•	

L=low range (f_L to 10 f_L) M=mid range (10 f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)

m=mid band (2 f_L to $f_u/2$)

Level 27 (+27dBm LO, up to +24dBm RF)

0.5 MHz to 500 MHz



VAY

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m $\bar{X}$	σ	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
VAY case A01	VAY-1	0.5-500	.02-500	5.79	.15	7.5	7.5	8.5	47	40	46	35	35	25	47	40	46	35	35	25	84.95	•	

L=low range (f_L to 10 f_L) M=mid range (10 f_L to $f_U/2$) U=upper range ($f_U/2$ to f_U)

m=mid band (2 f_L to $f_u/2$)

SF26 REV C

In Stock...Immediate Delivery

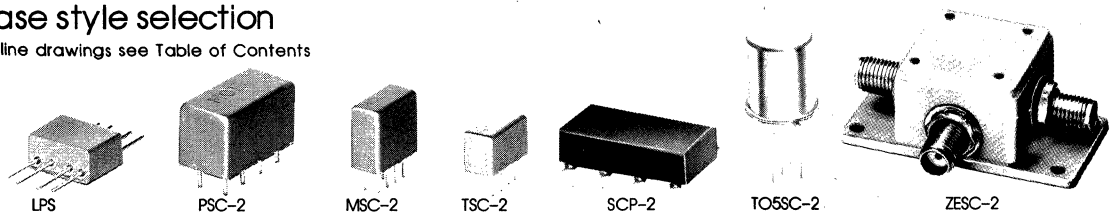
Power Splitter/Combiners

2 WAY–0°

DC to 10 GHz

case style selection

outline drawings see Table of Contents



LPS PSC–2 MSC–2 TSC–2 SCP–2 TO5SC–2 ZESC–2

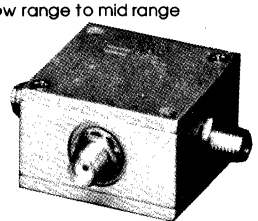
	MODEL NO.	FREQ. RANGE MHz f_L–f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
LPS case BB48	LPS-109	10–500	35	25	30	25	30	25	0.3	0.5	0.4	0.6	0.5	1.1	2.0	3.0	4.0	0.15	0.2	0.3	17.95	•	•
PSC–2 case A01	PSC-2-1	0.1–400	20	15	25	20	25	20	0.2	0.6	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	10.95	•	•
	■ PSC-2-1V-75	40–450	—	—	31	27	—	—	—	—	0.5	1.0	—	—	—	4.0	—	—	0.3	—	14.45	•	•
	PSC-2-1W	1–650	25	20	35	20	25	20	0.3	0.6	0.5	0.9	0.7	1.0	2.0	3.0	4.0	0.15	0.2	0.3	16.95	•	•
NEW	♦ PSC-2-2	0.004–60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	0.15	0.25	0.3	23.95	•	•
	♦ ■ PSC-2-2-75	0.008–60	35	20	40	25	30	22	0.1	0.4	0.15	0.4	0.3	0.8	1.0	1.0	1.0	0.15	0.15	0.15	23.95	•	•
	PSC-2-4	10–1000	30	25	25	20	25	20	0.6	1.0	0.6	1.2	0.7	1.2	2.0	8.0	20.0	0.15	0.2	0.4	23.95	•	•
	PSC-2-5	10–1400	28	18	22	17	24	17	0.3	0.6	0.6	1.0	0.9	1.6	2.0	3.0	4.0	0.15	0.2	0.4	29.95	•	•
	PSC-2-45	700–900	—	—	20	17	—	—	—	—	0.2	0.4	—	—	—	3.0	—	—	0.2	—	22.95	•	•
	■ PSC-2375	55–85	—	—	35	25	—	—	—	—	0.3	0.5	—	—	—	1.0	—	—	0.1	—	23.95	•	•
	■ PSC-2-1-75	0.25–300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	0.15	0.2	0.3	13.45	•	•
	■ PSC-2-4-752	10–850	31	20	32	23	23	15	0.3	0.5	0.4	0.6	0.5	1.0	2.0	5.0	10.0	0.1	0.2	0.5	23.95	•	•
MSC–2 case A03	MSC-2-1	0.1–450	20	15	30	20	30	20	0.3	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	18.95	•	•
	MSC-2-1W	2–650	22	18	30	20	22	18	0.3	0.5	0.5	0.8	0.8	1.2	1.0	2.0	4.0	0.3	0.2	0.3	20.95	•	•
	MSC-2-5	5–1500	18	16	20	16	20	14	0.6	0.8	0.6	0.8	0.6	1.1	2.0	3.0	5.0	0.2	0.3	0.4	24.95	•	•
	MSC-2-11	5–2000	18	16	20	16	18	11	0.6	0.8	0.6	0.8	1.2	1.8	2.0	3.0	5.0	0.2	0.3	0.5	29.95	•	•
TSC–2 case B02	TSC-2-1	1–400	30	25	30	25	30	20	0.25	0.5	0.4	0.75	0.8	1.0	2.0	3.0	4.0	0.15	0.2	0.6	15.95	•	•
SCP–2	SCP-2-1	0.1–400	25	15	30	20	25	20	0.3	1.2	0.2	0.6	0.4	1.1	2.0	2.0	3.0	0.15	0.2	0.3	10.45	•	•
NEW case YY101	SCP-2-1A	1–550	25	20	25	20	25	20	0.3	0.6	0.3	0.6	0.7	1.3	2.0	2.0	3.0	0.15	0.2	0.4	10.45	•	•
NEW TO5SC–2 case LLL163	TO5SC-2-1	1–500	30	20	28	20	26	20	0.2	0.5	0.3	0.7	0.7	1.5	2.0	1.0	2.5	0.25	0.25	0.4	24.95	•	•

NEW L=low range (f_L to 10 f_L) M=mid range (10 f_L to f_U/2) U=upper range (f_U/2 to f_U)

♦ 1 dB compression derates approximately 13 dB from low range to mid range

2 WAY–0° RESISTIVE

DC to 4.2 GHz



ZFRSC

	MODEL NO.	FREQ. RANGE MHz f_L–f_U	ISOLATION dB *L Typ.	M Typ.	U Typ.	INSERTION LOSS, dB Above 6dB *L Typ.	*L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees *L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB *L Max.	M Max.	U Max.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
ZFRSC case K18	† ZFRSC-42	DC–4200	6.2	6.5	7.0	0.1	0.2	0.1	0.5	0.4	1.4	1	3	5	0.1	0.2	0.5	59.95	•	
	■ ZFRSC-2075	DC–2000	6.2	6.6	7.0	0.1	0.2	0.3	0.6	0.5	1.4	1	2	5	0.1	0.2	0.5	59.95	•	
	▲ ZFRSC-2050	DC–2000	6.2	6.6	7.0	0.1	0.2	0.3	0.6	0.5	1.4	1	2	5	0.1	0.2	0.5	59.95	•	

*L=DC–100MHz M=mid range (100MHz to f_U/2) U=upper range (f_U/2 to f_U)

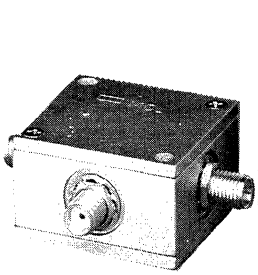
Above models are resistive power dividers to enable frequency coverage from dc to the highest rated frequency. Since resistive power dividers do not provide a high degree of isolation (basically isolation equals the insertion loss between parts), an amplifier such as Mini-Circuits' ZFL series is recommended when high isolation is required. Matched power rating 0.75W, internal load dissipation 0.375W.

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

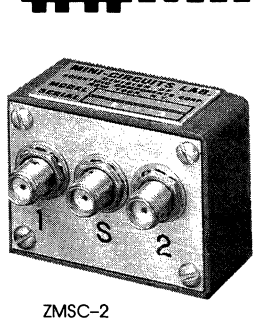
SF28 REV B

50 ohms and 75 ohms

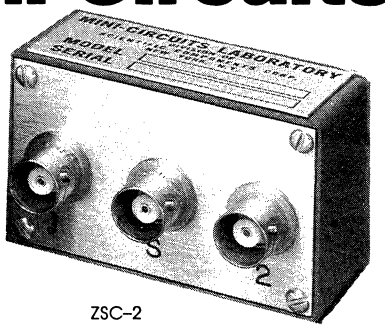
Mini-Circuits



ZFSC-2 ZAPD



ZMSC-2



ZSC-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
ZESC-2																							
case V37	**ZESC-2-11**	10-2000	19	10	18	13	20	11	0.5	0.9	0.5	1.0	0.6	1.2	1	3	6	0.2	0.3	0.5	71.95	•	
ZFSC-2	**ZFSC-2-1**	5-500	30	25	28	20	25	20	0.2	0.5	0.3	0.6	0.6	0.8	2.0	4.0	4.0	.15	.15	0.3	44.95	•	
case K18 ■	**ZFSC-2-1-75**	0.25-300	20	15	30	25	20	20	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	45.95	•	
	ZFSC-2-1W	1-750	30	20	28	20	25	20	0.2	0.5	0.4	0.8	0.8	1.0	2.0	4.0	4.0	.15	.15	0.3	48.95	•	
	ZFSC-2-2	10-1000	30	20	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	51.95	•	
	ZFSC-2-4	0.2-1000	20	15	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	55.95	•	
	ZFSC-2-5	10-1500	25	15	30	20	25	18	0.25	0.6	0.5	1.0	0.8	1.5	5.0	8.0	10.0	.15	0.2	0.5	59.95	•	
	◆△ **ZFSC-2-6**	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	49.95	•	
	◆■ **ZFSC-2-6-75**	0.004-60	30	20	35	20	25	20	0.5	0.8	0.4	0.8	0.7	1.0	1.0	2.0	3.0	.15	0.2	0.3	51.95	•	
	ZFSC-2-11	10-2000	14	10	16	14	20	15	1.2	1.5	1.2	1.5	1.0	2.2	1	2	4	0.2	0.3	0.5	64.95	•	
	‡ **ZFSC-2-2500**	10-2500	16	11	17	14	17	14	0.5	0.8	0.6	1.4	0.8	1.5	1	4	8	0.2	0.3	0.4	74.95	•	
		GHz	**L1**		**U1**				**L1**		**U1**				**L1**		**U1**	**L1**		**U1**			
case	**ZFSC-2-9G**	3.5-9.0	18	12	20	12			0.5	1.5	0.6	1.2			7		10	0.3		0.5	59.95	•	
JJJ-142	**ZFSC-2-10G**	2.0-10.0	15	9	20	12			0.5	1.5	0.6	1.6			7		12	0.6		0.5	69.95	•	
		GHz																					
ZAPD	**ZAPD-1**	0.5-1.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	1	—	—	0.2	—	54.95	•	
case F14	**ZAPD-2**	1.0-2.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	2	—	—	0.2	—	54.95	•	
	ZAPD-4	2.0-4.2	25	19	25	19	25	19	0.4	0.8	0.4	0.8	0.4	0.8	—	6	—	—	0.4	—	59.95	•	
case F53	**ZAPD-21**	0.5-2.0	25	18	—	—	25	18	0.25	0.8	—	—	0.25	1.0	—	3	—	—	0.2	—	59.95	•	
		MHz																					
ZMSC-2	**ZMSC-2-1**	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	49.95	•	
case M21	**ZMSC-2-1W**	1-650	25	20	35	20	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	54.95	•	
	◆△ **ZMSC-2-2**	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	59.95	•	
ZSC-2	**ZSC-2-1**	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	47.95	•	
case M22	**ZSC-2-1W**	1-650	25	20	35	25	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	49.95	•	
	◆△ **ZSC-2-2**	0.002-60	25	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	52.95	•	
	◆△■▲ **ZSC-2-2-75**	0.002-60	25	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	53.95	•	
	ZSC-2-4	10-1000	25	20	35	20	25	20	0.2	0.5	0.5	0.8	0.7	1.3	2.0	4.0	6.0	.15	0.2	0.3	52.95	•	
	▲■ **ZSC-2375**	55-85	35	25	35	25	35	25	0.3	0.5	0.3	0.5	0.3	0.5	—	1.0	—	—	0.1	—	52.95	•	
	▲■ **ZSC-2-1-75**	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	49.95	•	

L=low range (f_L to 10 f_L) **M**=mid range (10 f_L to f_U/2) **U**=upper range (f_U/2 to f_U)

L1=F_L — 6GHZ **U1**=6GHZ — F_U

NOTES:

- ■ Denotes 75 ohm models, 75 ohm BNC connections are standard
- † Available only with SMA connector
- △ Isolation specified to 0.004 MHz.
- ▲ Available only with BNC connectors.
- ◆ 1 dB compression derates approximately 13 dB from low range to mid range
1. For Quality Control procedures, see Table of Contents.
2. For environmental specifications, see Table of Contents.
3. Absolute Maximum Ratings. Matched power rating ZAPD 10W, all other models 1W, internal load dissipation 0.125W.
- ‡ Available only with SMA connectors.
4. For connector types and case mounting options, see case style outline drawing.
5. Prices and specifications subject to change without notice.

pin and coaxial connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Case Ground
LPS	1	4	5	2,3,6,7,8
PSC-2	1	5	6	2,3,4,7,8
MSC-2	1	5	6	2.3.4.7.8
SCP-2-1	1	5	6	2,3,4,7,8
TSC-2	1	2	4	3
ZFSC-2	3	1	2	—
ZAPD	3	1	2	—
ZMSC-2	2	1	3	—
ZSC-2	2	1	3	—
ZESC-2	3	1	2	—

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN	MIL-P-23971/15*
MSC-2-1	6625-01-124-8595	02
PSC-2-1	5820-00-548-0739	01
PSC-2-1W	5895-01-190-7701	
PSC-2-2	5825-01-044-8944	
PSC-2-4	6625-01-230-0492	
ZAPD-2 (SMA)	5985-01-229-7431	
ZAPD-4	6625-01-173-1887	
ZFSC-2-1	6625-01-139-3499	
ZFSC-2-1W (SMA)	6625-01-200-5094	
ZFSC-2-2A	6625-02-079-7021	
ZFSC-2-4A	5825-01-226-7956	
ZMSC-2-1W	5895-01-127-0232	
ZSC-2-1-BNC	5895-01-036-6254	
ZSC-2-1B	5820-00-270-3055	
ZSC-2-1-B-TNC	5820-01-109-3706	
ZSC-2-1-75B	5821-01-136-8182	
ZSC-2-2-75B	5915-01-012-8162	

* units are not QPL listed

SF29 REV A

In Stock...Immediate Delivery

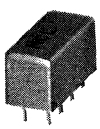
Power Splitter/Combiners

2 WAY–90°

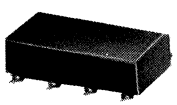
0.42 MHz to 4.2 GHz

case style selection

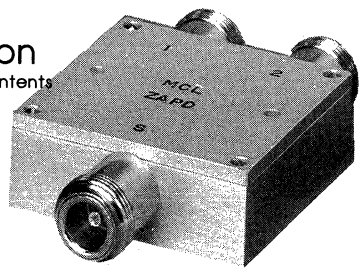
outline drawings see Table of Contents



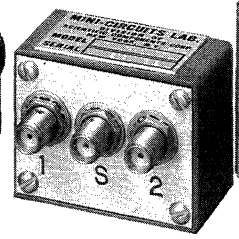
PSCQ–2



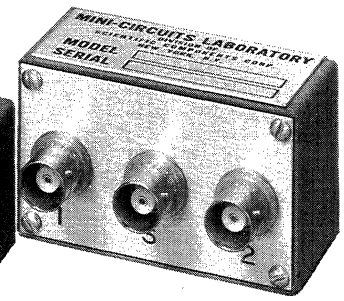
SCPQ



ZAPDQ



ZMSCQ–2



ZSCQ–2

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB Typ.	ISOLATION dB Min.	INSERTION LOSS, dB Avg. of Coupled Outputs less 3 dB Typ.	INSERTION LOSS, dB Avg. of Coupled Outputs less 3 dB Max.	PHASE UNBALANCE Degrees Max.	AMPLITUDE UNBALANCE dB Max.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
PSCQ–2 case A01	**PSCQ-2-0.455**	0.42–0.51	30	25	0.1	0.5	3.0	1.2	25.95		
	PSCQ-2-1.25	1.13–1.38	29	25	0.4	0.7	3.0	1.2	14.95	•	•
	PSCQ-2-1.5	1.4–1.7	29	25	0.4	0.7	3.0	1.2	14.95	•	•
	PSCQ-2-3.4	3.0–3.8	30	25	0.4	0.7	3.8	1.2	19.95	•	•
	PSCQ-2-4.0	3.5–4.5	36	25	0.4	0.7	3.0	1.5	14.95	•	•
	PSCQ-2-6.4	5.8–7.0	30	25	0.4	0.7	3.0	1.2	14.95	•	•
	PSCQ-2-7.5	7.0–8.0	35	25	0.4	0.7	3.0	1.2	14.95	•	•
	PSCQ-2-10.5	9.0–11.0	25	20	0.4	0.7	3.0	1.2	14.95	•	•
	PSCQ-2-13	12–14	29	25	0.4	0.7	3.0	1.2	14.95	•	•
	PSCQ-2-14	12–16	30	25	0.3	0.6	3.0	1.8	19.95	•	•
	PSCQ-2-17.5	16–19	28	25	0.6	0.7	3.0	1.6	14.95	•	•
	PSCQ-2-21.4	20–23	30	25	0.4	0.7	3.0	1.2	14.95	•	•
	PSCQ-2-26	14–30	25	20	0.4	0.7	3.0	1.5	23.95	•	•
	PSCQ-2-40	23–40	21	18	0.3	0.7	3.0	1.5	19.95	•	•
	PSCQ-2-50	25–50	30	20	0.3	0.7	3.0	1.5	23.95	•	•
	PSCQ-2-70	40–70	30	20	0.3	0.7	3.0	1.5	23.95	•	•
	PSCQ-2-70N	66–74	22	19	0.2	0.5	0.8	0.25	23.95	•	•
	PSCQ-2-90	55–90	30	20	0.3	0.7	3.0	1.2	23.95	•	•
	PSCQ-2-120	80–120	25	18	0.3	0.7	3.0	1.5	23.95	•	•
	PSCQ-2-160	100–160	24	19	0.3	0.7	3.0	1.5	23.95	•	•
	PSCQ-2-180	120–180	23	15	0.3	0.7	4.0	1.2	23.95	•	•
	PSCQ-2-250	150–250	30	22	0.4	0.8	4.0	1.5	23.95	•	•
	PSCQ-2-300	220–300	27	20	0.3	0.7	3.0	1.3	23.95	•	•
	PSCQ-2-400	250–400	23	16	0.5	0.9	4.0	1.5	23.95	•	•
NEW	**PSCQ-2-450**	350–450	23	16	0.5	0.9	5.0	1.5	23.95	•	•
NEW	**PSCQ-2-550**	450–550	19	15	0.4	0.7	5.0	1.5	23.95	•	•
SCPQ case YY101	**SCPQ-21.4**	20–23	32	25	0.15	0.5	2.5	1.0	13.95	•	•
	SCPQ-90	55–90	26	20	0.2	0.7	3.0	1.2	13.95	•	•
NEW	**SCPQ-180**	120–180	20	16	0.3	0.7	3.0	1.2	13.95	•	•
NEW	**SCPQ-400**	250–400	20	16	0.3	0.7	3.0	1.2	14.95	•	•
ZAPDQ case F14	**ZAPDQ-2**	1000–2000	22	16	0.4	1.4	6.0	0.8	79.95	•	
	ZAPDQ-4	2000–4200	22	16	0.4	0.9	8.0	1.0	79.95	•	
ZMSCQ–2 case M21	**ZMSCQ-2-21.4**	20–23	30	25	0.4	0.7	3.0	1.2	61.95	•	
	ZMSCQ-2-50	25–50	30	20	0.3	0.7	3.0	1.5	61.95	•	
NEW	**ZMSCQ-2-90**	55–90	30	20	0.3	0.7	3.0	1.2	61.95	•	
	ZMSCQ-2-120	80–120	25	18	0.3	0.7	3.0	1.5	61.95	•	
	ZMSCQ-2-180	120–180	23	15	0.3	0.7	4.0	1.2	61.95	•	
ZSCQ–2 case M22	**ZSCQ-2-50**	25–50	30	20	0.3	0.7	3.0	1.5	54.95	•	
	ZSCQ-2-90	55–90	30	20	0.3	0.7	3.0	1.2	54.95	•	
	ZSCQ-2-180	120–180	23	15	0.3	0.7	4.0	1.2	54.95	•	

Models available at frequencies other than shown in chart above. Please consult factory.

NOTES:

1. For quality control procedures and reliability, see Table of Contents.
2. For environmental specifications see section 1.
3. Absolute Maximum Ratings,
   Matched power rating ZAPDQ (10W),
   all other models (1W),
   Internal load dissipation (0.125W), see section 1.
4. For connector types and case mounting options, see case style outline drawings.
5. Prices and specifications subject to change without notice.

NSN GUIDE

MCL NO.	
PSCQ-2-180	5945-01-186-4456
PSCQ-2-90	6625-01-160-0151

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Case Ground	Terminate 50 ohms
PSCQ–2	1	2	5	3,4,7,8	6
PSCJ–2	1	5	6	2,3,4,7,8	—
SCPQ	1	2	5	3,4,7,8	6
ZAPDQ	3	1	2	—	—
ZMSCQ–2	2	1	3	—	—
ZSCQ–2	2	1	3	—	—
ZFSCJ–2	3	1	2	—	—
ZMSCJ–2	2	1	3	—	—
ZSCJ–2	2	1	3	—	—
ZAPDJ–2	3	1	2	—	—

Mini-Circuits
P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

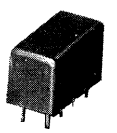
SF30 REV C

50 ohms and 75 ohms

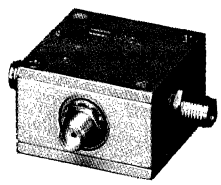
Mini-Circuits

2 WAY–180°

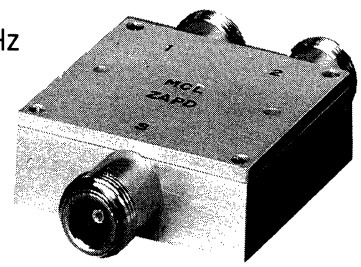
10 kHz to 2000 MHz



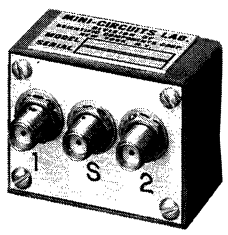
PSCJ-2



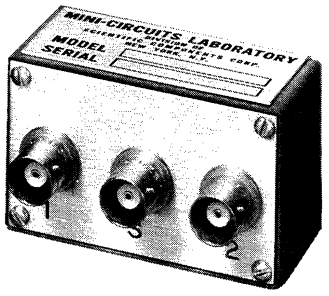
ZFSCJ-2



ZAPDJ-2



ZMSCJ-2



ZSCJ-2

	MODEL NO.	FREQ. RANGE MHz f_L–f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
PSCJ-2	**PSCJ-2-1**	1–200	35	30	35	25	30	23	.75	1.0	0.5	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	23.95	•	•
case A01	◆**PSCJ-2-2**	0.01–20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	34.95	•	•
	■**PSCJ-2-1-75**	1–200	35	30	31	25	26	20	0.6	1.2	0.8	1.2	1.2	1.6	2.0	4.0	6.0	.15	0..2	0.5	23.95	•	•
ZFSCJ-2	**ZFSCJ-2-1**	1–500	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	59.95	•	
case K18	*◆**ZFSCJ-2-2**	0.01–20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	57.95	•	
	ZFSCJ-2-3	5–300	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	49.95	•	
	*ZFSCJ-2-4	50–1000	30	20	—	—	25	18	1.2	1.9	—	—	1.6	2.4	6.0	—	7.0	0.6	—	0.6	69.95	•	
ZMSCJ-2	**ZMSCJ-2-1**	1–200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	57.95	•	
case M21	◆**ZMSCJ-2-2**	0.01–20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	67.95	•	
ZSCJ-2	**ZSCJ-2-1**	1–200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	51.95	•	
case M22	◆**ZSCJ-2-2**	0.01–20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	59.95	•	
ZAPDJ-2																							
case F14	**ZAPDJ-2**	1000–2000	—	—	22	18	—	—	1.3	1.8	1.3	1.8	1.3	1.8	6	6	6	0.8	0.8	0.8	71.95	•	

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

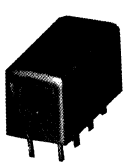
◆ 1 dB compression derates approximately 13 dB from low range to mid range

■ Denotes 75 ohm models.

* Available only with SMA connectors.

2 WAY–0°/180°

5 to 200 MHz



PMT

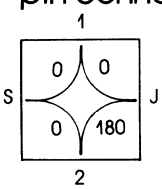
	MODEL NO.	FREQ. RANGE MHz f_L–f_U	ISOLATION[1] dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB[2] Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE[3] dB L Max.	M Max.	U Max.	PRICE Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
PMT	**PMT-1**	5–200	22	20	24	20	24	18	0.8	1.0	0.9	1.1	1.0	1.5	2	4	8	0.1	0.2	0.5	23.95	•	•
case A01	■**PMT-1-75**	5–200	22	18	22	18	22	18	1.0	1.3	1.0	1.4	1.0	1.5	2	4	8	0.1	0.2	0.5	23.95	•	•

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

1. S–J ports, typical isolation is 40 dB.
2. For in-phase ports, typ. insertion loss is 0.2 dB.
3. Input S or J ports, output ports 1 and 2.

pin connections



S PORT	1
J PORT	4
1 PORT	2
2 PORT	3
case ground	5,6,7,8

SF35 REV B

In Stock...Immediate Delivery

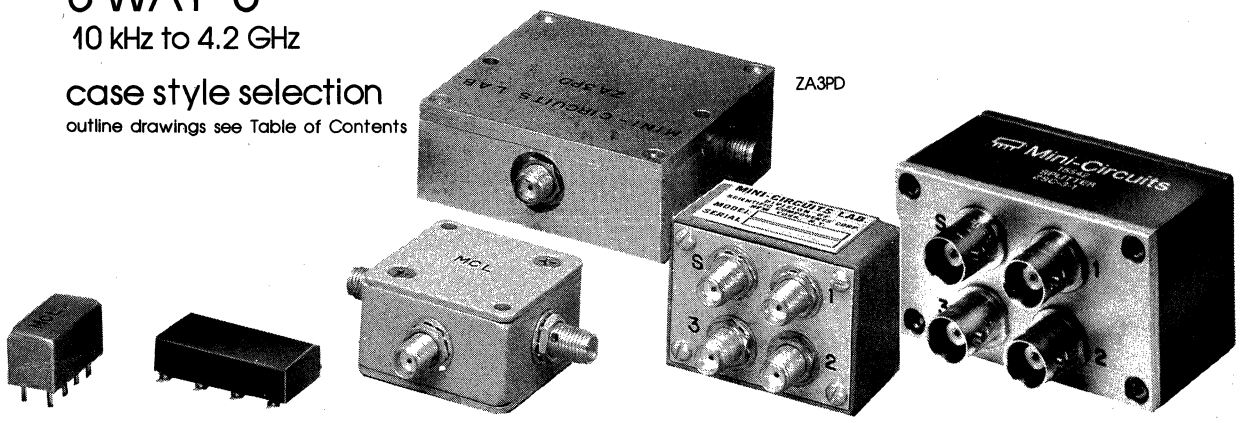
Power Splitter/Combiners

3 WAY–0°

10 kHz to 4.2 GHz

case style selection

outline drawings see Table of Contents



PSC–3 SCP–3 ZFSC–3 ZMSC–3 ZSC–3

	MODEL NO.	FREQ. RANGE MHz f_L–f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 4.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
PSC–3 case 1	• PSC–3–1	1–200	45	30	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	23.95	•	•
	PSC–3–1A	1–300	38	30	33	23	29	22	0.2	0.5	0.2	0.7	0.6	1.5	1.0	3.0	5.0	0.2	0.3	0.6	26.95	•	•
	PSC–3–1W	5–500	25	20	31	15	25	15	0.4	0.8	0.4	1.4	0.8	1.4	6.0	14.	20.	0.1	0.3	0.6	35.95	•	•
	*♦PSC–3–2	0.01–30	35	30	40	25	30	25	.25	.45	0.15	0.45	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	35.95	•	•
	■ PSC–3–1–75	1–200	35	23	35	25	35	25	0.6	1.0	0.3	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	23.95	•	•
	■ PSC–3–1–75–2	10–300	28	20	25	20	28	20	0.2	0.4	0.3	0.5	0.4	0.7	2.0	3.0	4.0	.15	0.2	0.3	27.95	•	•
	PSC–3–13	1–200	45	35	45	30	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	4.0	0.1	0.2	0.2	29.95	•	•
	PSC–3–13–39	0.5–50	47	33	46	35	40	33	.15	0.4	.15	0.4	.15	0.4	1.0	1.0	2.0	0.1	0.1	0.1	29.95	•	•
SCP case YY101	SCP–3–1	1–300	30	25	25	20	20	15	0.3	0.6	0.4	0.8	0.7	1.5	1.0	2.0	4.0	0.1	0.15	0.5	16.95	•	•
ZFSC–3 case J17	ZFSC–3–1	1–500	30	20	30	20	25	18	0.4	.75	0.5	0.9	0.8	1.2	2.0	3.0	4.0	0.2	0.3	0.4	51.95	•	
	ZFSC–3–1W	2–750	30	20	30	20	25	18	0.4	.75	0.5	1.0	1.0	1.6	3.0	5.0	7.0	0.2	0.3	0.5	53.95	•	
	ZFSC–3–13	1–200	45	30	48	35	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	5.0	0.1	0.2	0.2	51.95	•	
	ZFSC–3–4	1–1000	35	20	20	18	20	17	0.2	0.5	0.7	1.4	1.0	2.0	3.0	6.0	10.	0.2	0.4	0.9	59.95	•	
		GHz																					
ZA3PD case CC51	ZA3PD–1	0.5–1.0	20	14	20	14	20	14	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.4	0.4	0.4	89.95	•	
	ZA3PD–1.5	0.75–1.5	20	14	20	14	20	14	0.3	0.7	0.3	0.7	0.3	0.7	—	—	—	0.4	0.4	0.4	89.95	•	
	ZA3PD–2	1–2	20	15	20	15	20	15	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.3	0.3	0.3	89.95	•	
	ZA3PD–4	2–4.2	18	14	18	14	18	14	0.7	1.0	0.7	1.0	0.7	1.0	—	—	—	0.9	0.9	0.9	89.95	•	
		MHz																					
ZMSC–3 case P26	ZMSC–3–1	1–200	45	35	40	25	40	25	0.3	0.5	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	57.95	•	
	*♦ZMSC–3–2	0.01–30	35	30	40	25	30	25	.25	.45	0.15	0.45	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	67.95	•	
ZSC–3 case P25	ZSC–3–1	1–200	45	30	40	25	40	25	0.3	0.5	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	51.95	•	
	*♦ZSC–3–2	0.01–30	35	30	40	25	30	25	.25	.45	0.15	0.45	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	61.95	•	
	■ ZSC–3–1–75	1–200	35	30	35	25	35	25	0.6	1.0	0.4	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	52.95	•	
	♦■ ZSC–3–2–75	0.02–20	35	30	35	25	30	20	0.2	0.5	.25	0.6	.45	.75	2.0	3.0	4.0	0.2	0.3	0.4	62.95	•	

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

♦ 1 dB compression derates approximately 13 dB from low range to mid range
* 25 dB, −55°C to 0° over 0.01–0.1 MHz.

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Case Ground
PSC–3 except PSC–3–1W, PSC–3–1–75–2	6	1	2	5	—	3,4,7,8
PSC–3–1W						
PSC–3–1–75–2	1	5	7	8	—	2,3,4,6
PSC–4	4	7	8	1	2	3,5,6
PSC–4A	2	8	12	5	9	3,4,6,7,10 11,13,14,15,16
SCP	6	1	2	5		3,4,7,8

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN	MIL-P-23971/15*
PSC–3–1	5820–01–015–6027	
ZFSC–3–1	6625–01–235–6873	
ZSC–3–1B	5820–01–008–9566	
ZSC–3–2B	5825–01–120–9320	
PSC–4–1	5821–01–065–0106	–10
PSC–4–2	5825–01–044–8945	
PSC–4–3	5825–01–105–6189	–11
ZFSC–4–1A	5825–01–227–6681	
ZSC–4–1B	5820–00–270–3056	
ZSC–4–2B	5820–01–120–5238	
ZSC–4–3B	6920–01–038–8553	

*units are not QPL listed

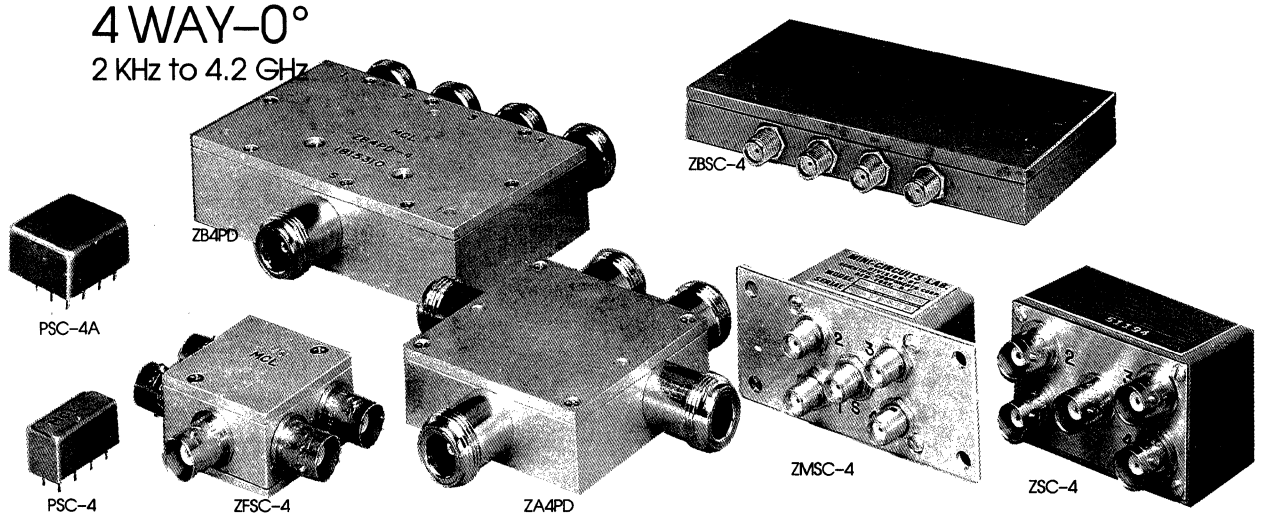
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

50 ohms and 75 ohms

4 WAY–0°

2 KHz to 4.2 GHz

Mini-Circuits



	MODEL NO.	FREQ. RANGE MHz f_L–f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 6dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
PSC–4	PSC–4–1	0.1–200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	35.95	•	•
case A01	PSC–4–1W	1–500	29	20	27	18	25	18	0.4	0.8	0.5	1.0	0.8	1.5	1.0	3.0	5.0	0.2	0.3	0.5	38.95	•	•
	■PSC–4–1–75	1–200	30	20	25	20	25	20	0.4	0.7	0.5	0.9	0.7	1.2	4.0	6.0	10.0	.15	.20	0.3	32.95	•	•
	PSC–4–3	0.25–250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	8.0	.15	.20	.25	31.95	•	•
	PSC–4–5	1–800	29	20	24	18	25	17	0.4	0.8	0.6	1.5	1.3	2.5	1.0	4.0	5.0	0.2	0.5	0.6	45.45	•	•
	♦PSC–4–6	0.01–40	35	18	32	25	25	18	0.4	0.8	0.3	0.5	0.5	1.0	2.0	2.0	2.0	.10	.15	.20	36.95	•	•
PSC–4A	PSC–4A–4	10–1000	25	20	21	15	18	15	0.5	0.8	0.8	1.8	1.5	2.5	4.0	16.0	20.0	0.2	0.5	0.7	64.95	•	•
case C07	■PSC–4A–475	10–800	30	20	33	20	25	18	0.4	0.7	0.6	0.9	1.2	1.6	—	—	—	0.2	0.4	0.8	64.95	•	•
ZBSC–4																							
case UU102	ZBSC–413	10–800	26	20	18	15	18	15	0.6	1.0	1.0	1.5	1.6	2.0	4.0	8.0	8.0	0.2	0.4	0.6	99.95	•	
ZFSC–4	ZFSC–4–1	1–1000	25	20	23	18	20	15	0.4	1.2	0.6	1.5	1.6	2.5	4.0	8.0	8.0	0.2	0.4	0.7	89.95	•	
case G15	ZFSC–4–1W	10–500	23	20	23	20	23	20	0.6	1.5	0.6	1.5	0.6	1.5	4.0	8.0	8.0	0.2	0.3	0.4	84.95	•	
	ZFSC–4–3	10–300	32	28	38	30	38	30	0.5	0.8	0.6	0.9	0.9	1.2	4.0	6.0	8.0	0.1	0.1	0.2	78.95	•	
	■ZFSC–4375	50–90	34	30	34	30	34	30	0.3	0.8	0.3	0.8	0.3	0.8	4.0	6.0	8.0	0.15	0.15	0.15	89.95	•	
	*▲■ZFSC–4–2–75–1	200–800	25	20	—	—	25	20	0.8	1.6	—	—	1.0	1.6	4.0	16.0	20.0	0.2	—	0.4	84.95	•	
	■ZFSC–4–175	10–1000	35	25	38	20	22	18	0.5	0.8	0.6	1.2	0.9	2.0	—	—	—	0.2	0.3	0.6	89.95	•	
ZMSC–4	ZMSC–4–1	0.1–200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	1.0	2.0	3.0	.15	.20	.25	66.95	•	
case N24	♦ZMSC–4–2	0.002–20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	76.95	•	
	ZMSC–4–3	0.25–250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	64.95	•	
ZSC–4	ZSC–4–1	0.1–200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	59.95	•	
case N27	■ZSC–4–1–75	1–200	30	20	25	20	25	20	0.4	0.7	0.5	0.8	0.7	1.2	0.4	6.0	10.0	.15	.20	0.3	59.95	•	
	♦ZSC–4–2	0.002–20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	74.95	•	
	ZSC–4–3	0.25–250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	56.95	•	
	■ZSC–4–3–75	0.25–250	28	20	30	20	27	20	0.4	0.8	0.3	0.7	0.5	1.0	1.0	2.0	3.0	.15	.20	.25	56.95	•	
		GHz																					
ZA4PD	ZA4PD–2	1–2	25	16	25	16	25	16	0.3	1.0	0.3	1.0	0.3	1.0	—	6.0	—	0.7	0.7	0.7	89.95	•	
case DD52	ZA4PD–4	2–4.2	25	16	25	16	25	16	0.5	1.0	0.3	1.0	0.3	1.0	—	16.0	—	0.8	0.8	0.8	89.95	•	
ZB4PD	ZB4PD–42	1.7–4.2	23	16	23	16	23	16	0.5	1.4	0.5	1.4	0.5	1.4		8.0		0.8	0.8	0.8	99.95	•	
case EE54	ZB4PD–4	3.7–4.2	24	15	24	15	24	15	0.6	1.1	0.6	1.1	0.6	1.1	—	8.0	—	0.8	0.8	0.8	94.95	•	

L=low range (f_L to 10 f_L) M=mid range (10 f_L to f_U/2)

*L=low range (f_L to f_L/2) U=upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

• Model PSC–3–1 manufactured under license protected by patent 3,428,920.

▲ On Model ZFSC–4–2–75–1, up to 15V and 15mA DC may be passed from input to all outputs.

♦ 1 dB compression derates approximately 13 dB from low range to mid range

1. For quality control procedures, see Table of Contents.
2. For environment specifications, see Table of Contents.
3. Absolute Maximum Ratings:
   Matched power rating ZA3PD, ZA4PD, ZB4PD (10W).
   PSC–4–5 & PSC–4–1W (0.5W).
   All other models (1W) internal load dissipation.
   All 3–way models (0.375W). All 4–way models (0.25W).
4. For connector types and case mounting options; see case style outline drawing.
5. Prices and specifications subject to change without notice.
6. All 3–way power dividers with exception of ZA3PD are licensed under U.S. Patent 3,428,920; reissued as RE 27,299.

SF33 REV A

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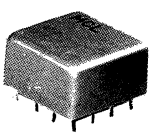
Power Splitter/Combiners

5 WAY-0°

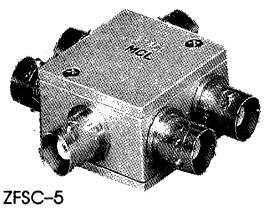
1 MHz to 300 MHz

case style selection

outline drawings see Table of Contents



PSC-5



ZFSC-5

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.0dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
PSC-5	PSC-5-1	1-300	25	20	23	18	20	17	0.2	0.5	0.6	1.0	1.5	2.0	2.0	4.0	8.0	0.2	0.3	0.6	64.45	•	•
case C07 ■	PSC-5-1-75	1-300	35	20	30	18	25	17	0.4	0.6	0.6	0.9	0.9	1.3	2.0	4.0	8.0	0.2	0.3	0.6	64.45	•	•
ZFSC-5																							
case G15	ZFSC-5-1	1-300	25	20	23	18	20	17	0.2	0.5	0.6	1.0	1.5	2.0	2.0	4.0	8.0	0.2	0.3	0.6	99.95	•	

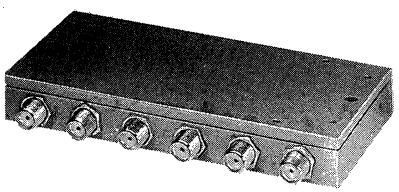
L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

6 WAY-0°

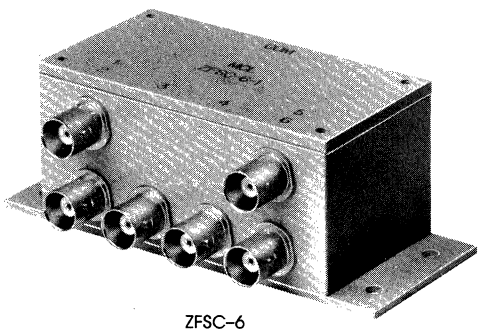
1 MHz to 500 MHz



PSC-6



ZBSC-6



ZFSC-6

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
PSC-6	PSC-6-1	1-175	30	24	26	18	26	18	0.5	0.8	0.7	1.0	1.0	1.5	4.0	6.0	12.0	0.2	0.4	0.8	74.95	•	•
case C07 ■	PSC-6-1-75	1-300	35	25	30	23	25	18	0.4	0.9	0.6	1.1	0.6	1.3	2.0	4.0	8.0	0.2	0.3	0.6	78.95	•	•
ZBSC-6	ZBSC-611	10-200	28	22	26	20	23	20	0.5	0.8	0.7	1.0	0.9	1.2	4.0	5.0	6.0	0.2	0.3	0.5	114.95	•	
case UU102	ZBSC-615	1-500	30	25	26	18	24	18	0.5	0.8	0.7	1.2	1.0	2.2	4.0	5.0	20	0.2	0.4	1.2	119.95	•	
ZFSC-6	ZFSC-6-1	1-175	27	22	26	20	26	20	0.75	1.0	0.75	1.2	0.8	1.2	2.0	6.0	12.0	0.2	0.4	0.6	99.95	•	
case Q28 ■	ZFSC-6-1-75	1-200	30	25	30	22	20	18	0.75	1.0	0.75	1.0	0.9	1.2	2.0	6.0	12.0	0.2	0.4	0.6	102.95	•	
	ZFSC-6-110	1-500	35	25	26	20	25	20	0.5	0.8	0.6	1.1	1.0	1.7	2.0	6.0	12.0	0.3	0.3	0.8	109.95	•	

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Case Ground	Not Used
PSC-5	1	4	8	12	16	15	—	2,5,7,11,13,14	3,6,9,10
PSC-6	1	3	4	8	12	16	15	2,5,7,11,13,14	6,9,10

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

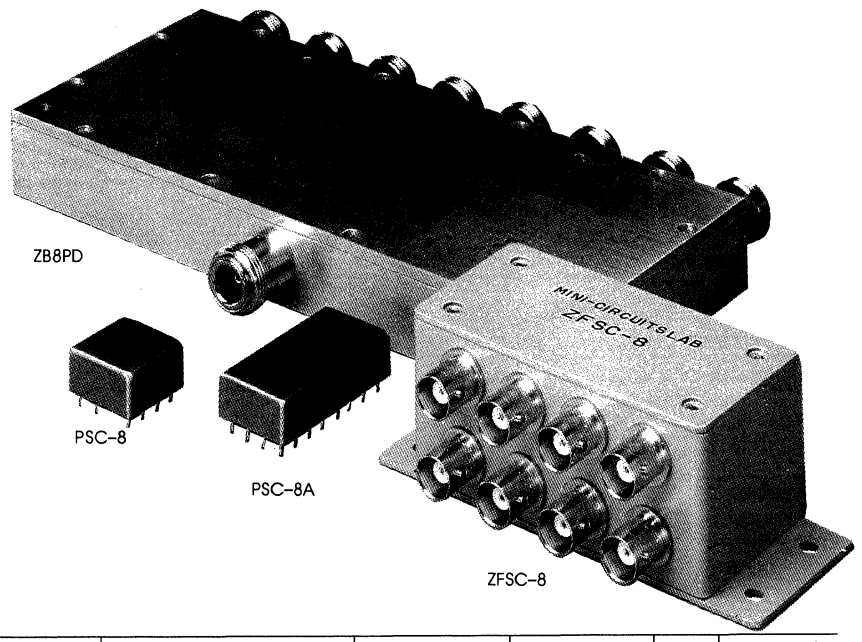
SF34 REV A

50 ohms and 75 ohms

8 WAY–0°

10 KHz to 4.2 GHz

Mini-Circuits



	MODEL NO.	FREQ. RANGE MHz f_L–f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 9dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
PSC–8	PSC–8–1	0.5–175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.3	0.5	74.95	•	•
case C07	■PSC–8–1–75	0.5–175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.2	0.3	78.95	•	•
	PSC–8–6	0.01–10	40	20	40	25	28	23	0.3	0.7	0.5	1.0	0.6	1.1	1.0	2.5	4.0	0.1	0.2	0.3	93.95	•	•
PSC–8A	PSC–8A–4	5–500	25	20	23	18	20	15	0.7	1.2	1.0	1.8	1.4	2.5	3.0	8.0	16.0	0.2	0.3	0.5	103.95	•	•
case E10	■PSC–8A4–75	1–300	26	20	30	25	30	23	0.8	1.2	0.7	1.1	0.9	1.3	1.0	3.0	8.0	0.2	0.2	0.4	93.95	•	•
ZFSC–8	ZFSC–8–1	0.5–175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.2	0.3	99.95	•	
case R29	■ZFSC–8–1–75	0.5–175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.3	0.5	102.95	•	
	■ZFSC–82–75	10–900	35	17	23	17	20	15	0.6	0.9	0.9	1.6	1.6	2.7	2.0	4.0	10.0	0.2	0.5	1.2	139.95		
	■ZFSC–84–75	1–300	26	20	30	25	30	23	0.8	1.5	0.7	1.1	0.9	1.5	1.0	3.0	8.0	0.2	0.2	0.4	119.95	•	
	■ZFSC–8375	50–90	30	25	30	25	25	25	1.0	1.0	1.0	1.3	1.3	1.3	2.0	2.0	2.0	0.2	0.2	0.2	119.95	•	
	ZFSC–8–4	5–700	35	20	25	17	20	17	0.8	1.2	1.2	1.8	1.8	2.5	2.0	5.0	15.0	0.2	0.4	0.7	128.95	•	
	ZFSC–8–43	10–1000	23	20	25	20	26	20	1.0	1.6	1.4	1.8	2.1	2.9	5.0	10.0	20.0	0.2	0.4	0.7	138.95	•	
	ZFSC–8–6	0.01–10	35	20	40	25	35	25	0.3	0.7	0.2	0.6	0.3	0.7	1.0	2.0	3.0	0.1	0.2	0.3	109.95	•	
		GHz																					
ZB8PD	ZB8PD–2	1–2	24	17	24	17	24	17	0.8	1.3	0.8	1.3	0.8	1.3	—	—	18	0.8	0.8	0.8	138.95	•	
case Z40	ZB8PD–4	2–4.2	23	16	23	16	23	16	0.8	1.8	0.8	1.8	0.8	1.8	10	10	10	0.9	0.9	0.9	138.95	•	

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, ZB8PD (10W), all other models (1W). internal load dissipation, 0.62 watts, 0.5 watts for 5 and 6 way.
2. Refer to Table of Contents for quality control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.
5. ZFSC–8–6, PSC–8–6: below 0.1 MHz power handling decrease as to typically 15 dBm at 0.01 MHz, 23 dBm at 0.025 MHz, & 29 dBm at 0.05 MHz.

NSN GUIDE

MCL NO.	NSN
ZFSC–6–1	5820–01–225–6965
ZFSC–8–1	5820–01–136–7244

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8	Port 9	Port 10	Port 11	Port 12	Case Ground	Do Not Use
PSC–8	2	1	5	9	13	16	12	8	4	—	—	—	—	3,6,7,14,15	10–11
*PSC–8A	29	7	16	31	24	9	2	26	17	—	—	—	—	All other pins	—
PSC–10–1	29	7	16	31	24	9	2	26	17	4	5	—	—	All other pins	15
**PSC–12–1	5	7	8	1	2	31	32	25	26	22	30	19	27	All other pins	11,14,21

*Pins 4, 5 and 15 must be grounded externally for PSC-8A-4. Pin 15 must be grounded externally for PSC-8A4-75.

**Pin 4 must be grounded externally.

SF35 REV B

In Stock...Immediate Delivery

Power Splitter/Combiners

10 WAY-0°

0.5 to 150 MHz

case style selection

outline drawings see Table of Contents



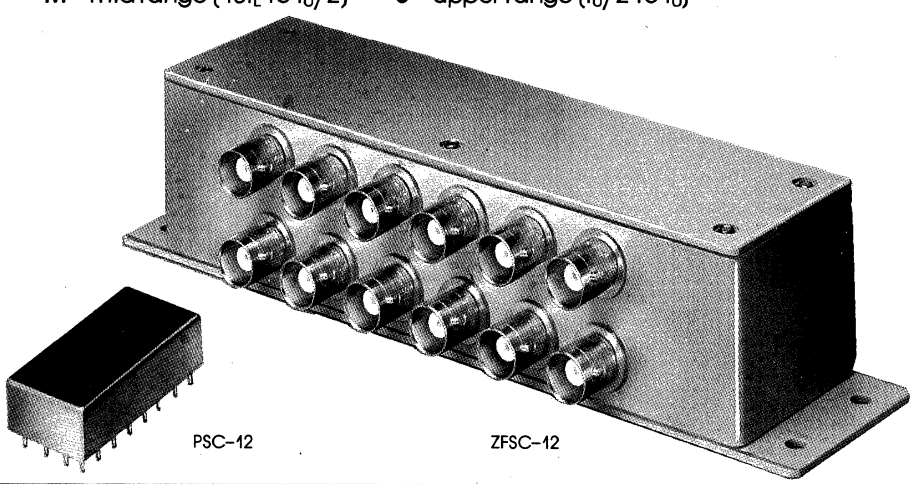
PSC-10 ZFSC-10

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 10dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
PSC-10 case E10	PSC-10-1	1-150	36	23	27	23	23	18	0.3	0.6	0.4	0.8	1.0	1.3	1	4	10	0.1	0.2	0.3	85.95	•	•
ZFSC-10 case RR93	ZFSC-10-1	0.5-100	28	20	30	24	27	20	0.5	0.8	0.4	1.0	0.8	1.5	2	6	10	0.2	0.3	0.4	119.95	•	

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

12 WAY-0°

1 MHz to 500 MHz



PSC-12 ZFSC-12

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 10.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
PSC-12 case E10	PSC-12-1	1-200	35	30	27	20	21	18	0.5	0.8	0.8	1.2	1.0	1.4	1	4	6	0.2	0.4	0.7	88.95	•	•
ZFSC-12 case R67	ZFSC-12-1	1-200	30	25	35	20	28	20	0.8	1.2	1.1	1.4	1.3	1.6	4.0	8.0	16.0	0.1	0.2	0.3	174.95	•	
	ZFSC-12-11	10-300	28	20	33	25	28	20	1.1	1.3	1.1	1.5	1.5	1.8	2.0	4.0	6.0	0.2	0.3	0.4	174.95	•	
	■ZFSC-12-1-75	10-200	35	27	—	—	27	20	0.5	0.8	—	—	0.8	1.3	—	—	—	0.25	—	0.4	179.95	•	
	■ZFSC-12-175	10-500	23	20	24	20	22	18	0.9	1.2	1.0	1.3	1.2	1.6	—	—	—	0.4	0.5	0.8	197.95	•	

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

pin connections

see case style outline drawings and table on previous page

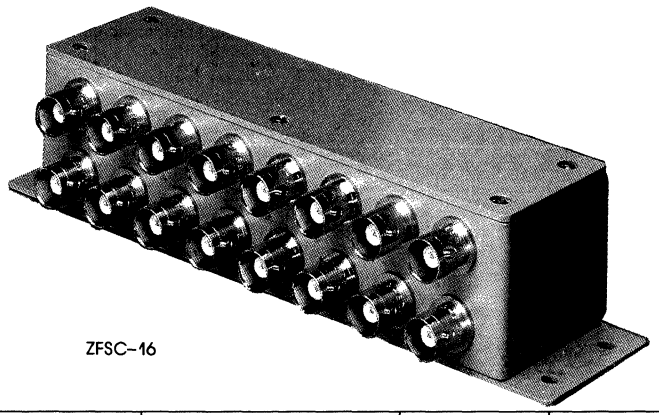
Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF58 REV A

50 ohms and 75 ohms

16 WAY–0°

10 KHz to 200 MHz



ZFSC–16

	MODEL NO.	FREQ. RANGE MHz f_L–f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 12dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
ZFSC–16	ZFSC–16–1	0.5–125	30	24	25	18	20	15	1.0	1.2	1.1	1.3	1.2	1.4	1.0	3.0	5.0	0.1	0.2	0.5	172.95	●	
case R30	■ZFSC–16–1–75	1–150	30	25	30	25	25	20	0.8	1.1	0.7	1.1	1.0	1.3	1.0	3.0	5.0	0.1	0.2	0.4	182.95	●	
	ZFSC–16–3	1–30	45	35●	45	40●	41	40●	0.5	0.9	0.5	0.9	0.5	0.9	1.0	2.0	3.0	0.1	0.1	0.1	172.95	●	
	◆■ZFSC–16–675	0.01–25	25	20	40	25	25	20	0.8	1.1	0.4	0.8	1.0	1.6	1.0	3.0	5.0	0.1	0.2	0.4	189.95	●	
	ZFSC–16–12	0.1–200	33	20	27	20	26	20	0.6	1.5	0.7	1.0	0.9	1.2	2.0	6.0	9.0	0.4	0.2	0.4	189.95	●	

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

NSN GUIDE

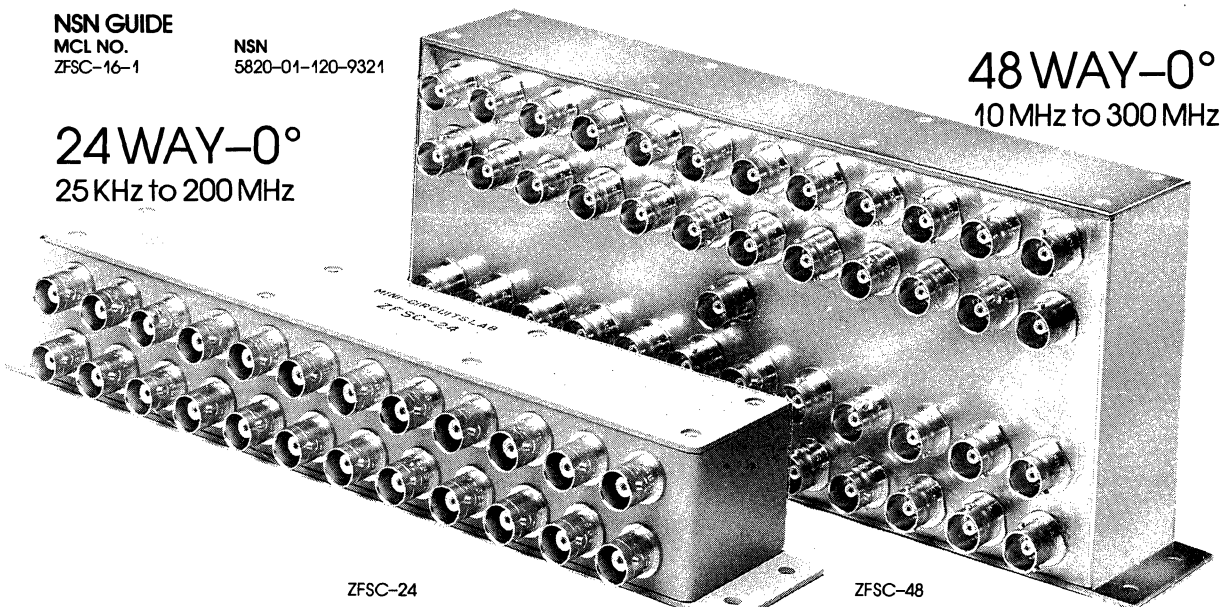
MCL NO.	NSN
ZFSC–16–1	5820–01–120–9321

24 WAY–0°

25 KHz to 200 MHz

48 WAY–0°

10 MHz to 300 MHz



ZFSC–24 ZFSC–48

	MODEL NO.	FREQ. RANGE MHz f_L–f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB 24 WAY (above 13.8dB) 48 WAY (above 16.8dB) L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE $ Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
ZFSC–24	ZFSC–24–1	0.2–100	25	20	25	20	25	20	1.0	2.0	1.0	2.0	1.0	2.0	0.2	0.4	0.5	264.95	●	
case R31	ZFSC–24–11	1–200	33	25	22	20	20	17	0.9	1.7	1.0	1.8	1.3	2.2	0.2	0.8	0.8	274.95	●	
	◆ZFSC–24–6	0.025–50	30	25	39	28	30	22	0.4	1.0	0.4	1.0	0.6	1.5	0.2	0.3	0.7	274.95	●	
ZFSC–48	ZFSC–48–1	10–300	30	25	28	20	23	20	1.0	1.5	1.8	2.2	2.0	2.5	0.6	0.7	0.9	590.00	●	
case HH68	■ZFSC–48–1–75	10–300	30	25	28	20	23	20	1.2	2.0	2.1	2.5	2.3	3.0	0.6	0.7	1.0	590.00	●	

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

NOTES:

◆ 1 dB compression derates approximately 13 dB from low range to mid range

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

● Adjacent ports 28dB

1. Matched power rating, 1 watt internal load dissipation, 0.87 watts.
2. Refer to Table of Contents for quality control procedures. environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

SF37 REV A

In Stock...Immediate Delivery

broadband, linear

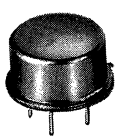
Low-Noise Amplifiers

up to 50mW (+17dBm) output

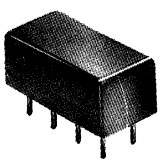
0.1 to 1000 MHz

case style selection

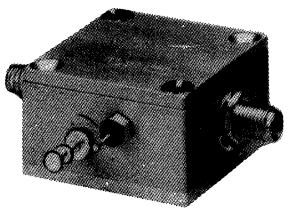
outline drawings see Table of Contents



AMP



MAN



ZFL

	MODEL NO.	FREQUENCY MHz		GAIN, dB			MAX. POWER, dBm			DYNAMIC RANGE		VSWR		DC POWER		PRICE $	DISTRIBUTOR	
					Flatness Max.		Output (1 dB Comp.)		Input (no damage)	NF	Intercept Pt., dBm 3rd Order			Volt.	Current		FACTORY	LOCAL
		f_L	f_U	Min.	m	Total Range	L_W	U		dB Typ.	Typ.	In	Out	V.	mA	Qty. (1-9)		
AMP	AMP-11-2	5-1000		14	±1.0	±1.0	−3.5	−3.5	+13	3.0	+13	2:1	2:1	15	12	44.95	•	
case PP120	AMP-15	5-1000		13	±0.6	±1.2	+8.0	+8.0	+13	2.8	+22	2:1	2:1	15	29	40.95	•	
	AMP-75	5-500		19	±0.4	±1.0	+12.0	+12.0	+13	2.4	+28	2:1	2:1	15	29	43.95	•	
NEW	AMP-76	5-500		26	±0.7	±1.0	+13.5	+13.5	+ 6	3.1	+28	2:1	2:1	15	68	78.95	•	
	AMP-77	5-500		15	±0.4	±1.0	+17.0	+16.0	+13	3.3	+32	2:1	2:1	15	56	45.95	•	
MAN	MAN-1LN	0.5-500		28	±0.5	±1.0	+8	+8	+15	2.8	+18	1.8:1	1.8:1	12	60	19.95	•	•
case A05	MAN-1HLN△	10-500		10	±0.5	±0.8	+15	+16	+15	3.7	+30	1.8:1	1.8:1	12	70	19.95	•	•
ZFL	ZFL-500HLN	10-500		19	—	±0.4	+16		+15	3.8	+30	1.5:1	1.5:1	15	110	99.95	•	
	▲ ZFL-500LN	0.1-500		24	—	±0.3	+5		+5	2.9	+14	1.5:1	1.6:1	15	60	79.95	•	
case Y39	ZFL-1000LN	0.1-1000		20	—	±0.5	+3		+5	2.9	+14	1.5:1	2:1	15	60	89.95	•	

L_W = Low Range (f_L to $f_{U/2}$) m = mid Range (2 f_L to $f_{U/2}$) U = Upper Range ($f_{U/2}$ to f_U)

NOTES:

▲ VSWR 1.6 maximum from 01. to 0.2 MHz.
Also available with BNC connectors. $5.00 additional

△ case A06

1. For quality control procedures, environmental specifications, see Table of Contents.
2. Absolute Maximum Ratings, see Table of Contents.
3. Prices and specifications subject to change without notice.
4. Maximum Operating Temperature for AMP series: −54°C-+85°C.
5. Maximum DC Voltage: 17V for AMP series, 12.5V for MAN series.

PIN CONFIGURATION

SERIES	MAN	AMP
RF IN	1	2
RF OUT	8	4
DC	5	1
CASE GND	2,3,4,6	3
NOT USED	7	—

features

- ideal for printed-circuit designs (MAN & AMP series)
- smooth response over entire band, no external resonances
- low impedance, less susceptible to EMI
- easy to use, 50 ohm input/output
- all models are cascadable

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

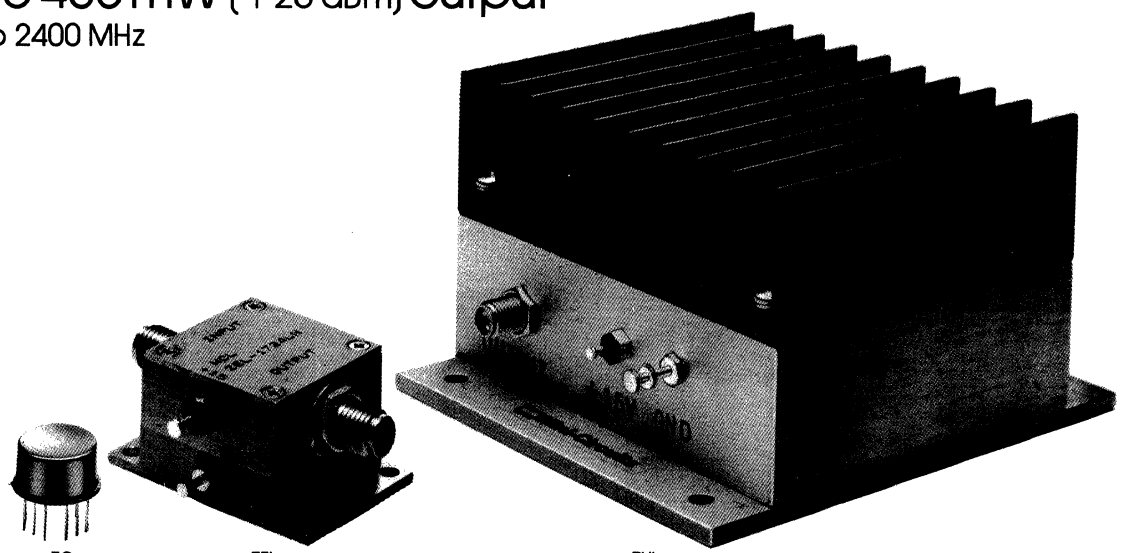
SF41 REV A

broadband, linear

Mini-Circuits

up to 400 mW (+26 dBm) output

800 to 2400 MHz



TO ZEL ZHL

	MODEL NO.	FREQ. MHz f_L f_U	NF, dB Max.	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output 1 dB (Comp.)	MAXIMUM POWER, dBm Input no (damage)	INTERCEPT PT., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt. V	DC POWER Current mA	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
TO case QQ 96	**TO-0812LN**	800–1200	1.6	20	±1.0	+ 8	+13	+18	2.5:1	2.5:1	15	70	199.00	•	
	TO-1217LN	1200–1700	1.6	20	±1.0	+10	+13	+25	2.5:1	2.5:1	15	70	199.00	•	
	TO-1724LN	1700–2400	1.6	20	±1.0	+10	+13	+22	2.5:1	2.5:1	15	70	199.00	•	
ZEL case EEE 132	**ZEL-0812LN**	800–1200	1.5	20	±1.0	+ 8	+13	+18	2.5:1	2.5:1	15	70	274.95	•	
	ZEL-1217LN	1200–1700	1.5	20	±1.0	+10	+13	+25	2.5:1	2.5:1	15	70	274.95	•	
	ZEL-1724LN	1700–2400	1.5	20	±1.0	+10	+13	+22	2.5:1	2.5:1	15	70	274.95	•	
ZHL case NN 92 NEW	**ZHL-0812HLN**	800–1200	1.5	30	±1.0	+26	+10	+36	2.4:1	2.4:1	15△	725	349.95	•	
	ZHL-1217HLN	1200–1700	1.5	30	±1.0	+26	+10	+36	2.4:1	2.4:1	15△	725	349.95	•	
	ZHL-1724HLN	1700–2400	1.5	30	±1.0	+26	+10	+36	2.4:1	2.4:1	15△	725	349.95	•	

NOTES:

△ Max. Supply Voltage +29 VDC.

ZEL & TO

NF Max. at room temperature, increases to 2 dB typ. at +85°C.

ZHL Units

NF Max. at room temperature, increases to 2.3 dB max. at +65°C.

1. With no load output, derate max. input power (no damage) by 10 dB.
2. SMA connectors only, ZEL, ZHL units.
3. Operating temperature: −54°C to 85°C. (ZHL to 65°C).
4. TO- units pin configuration: DC, Pin 2; RF-IN, Pin 5; RF-OUT, Pin 11; GROUND, Pins 1,3,4,6,7,8,9,10,12.

features

- very low noise
- high dynamic range (ZHL-HLN series)
- ideal for printed-circuit designs (TO series)
- smooth response over entire band, no external resonance
- easy to use, 50 ohms input/output
- all models are cascadable

SF42 REV A

In Stock . . . Immediate Delivery

broadband "plug-in"

Monolithic Amplifiers

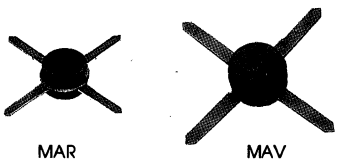
50 ohms

up to 40 mW (+16 dBm) output

dc to 2 GHz

case style selection

outline drawings Table of Contents



MAR MAV

	MODEL NO.	Color Dot	*FREQ. MHz f_L	f_U	GAIN, dB Typical (at MHz) 100	500	1000	2000	(Note) 4 MIN	MAXIMUM POWER, dBm Output 1dB Comp.	Input no damage	DYNAMIC RANGE Intercept Pt. dBm NF dB Typ.	3rd Order Typ.	VSWR In	Out	MAXIMUM RATING (25°C) I(mA)	P(mW)	DC POWER at Pin 3 Current (mA)	Volt. Typ.	PRICE $ Qty. (25)	DISTRIBUTOR FACTORY	LOCAL
MAR case VV105	MAR-1	Brown	DC	1000	18.5	17.5	15.5	—	13.0	0	+10	5.0	+15	1.5:1	1.5:1	40	100	17	5	0.99†	●	●
	MAR-2	Red	DC	2000	13	12.8	12.5	11	8.5	+ 3	+15	6.5	+18	1.3:1	1.6:1	60	325	25	5	1.35	●	●
	MAR-3	Orange	DC	2000	13	12.8	12.5	10.5	8.0	▲+ 8	+15	6.0	+23	1.6:1	1.6:1	70	400	35	5	1.45	●	●
	MAR-4	Yellow	DC	1000	8.2	8.2	8.0	—	7.0	+11	+15	7.0	+27	1.9:1	2:1	85	500	50	5	1.55	●	●
	MAR-6	White	DC	2000	20	19	16	11	9	0	+15	2.8	+15	2:1	1.8:1	50	200	16	3.5	1.29	●	●
	MAR-7	Violet	DC	2000	13.5	13.1	12.5	10.5	8.5	+ 4	+15	5.0	+20	2:1	1.5:1	60	275	22	4	1.75	●	●
□	MAR-8	Blue	DC	1000	33	28	23	—	19	+10	+15	3.5	+27	□	□	65	500	36	7.5	1.70	●	●

MAR-1SM thru MAR-8SM: surface mount, see case WW107 for outline drawing.

NOTES:

† quantity 100

▲ +4 dBm (1-2 GHz)

□ MAR-8 input and output impedances are not 50 ohms, see S parameter data. Conditionally stable for source/load VSWR < 3:1.

* Lower frequencies determined by input and output capacitors.

1. Operating temperature −20°C to +85°C
   Storage temperature −55°C to +100°C
2. With no load output, derate maximum input power (no damage) by 10dB.
3. Price and specifications subject to change without notice.
4. Minimum gain at highest frequency point and over full temperature range.
5. Surface mount models are available in tape & reel.

designers amplifier kit, DAK-2

5 of each model, total 35 amplifiers only $59.95

DAK-2SM, surface mount, only $61.95

designers capacitor kit, KCAP-1

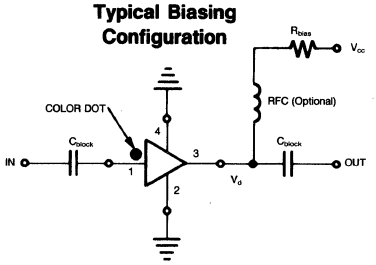
50 pieces of each capacitor value only $89.95 or 12¢ each, minimum 50 per value

Also, for your design convenience, Mini-Circuits offers chip coupling capacitors at 12 cents each.†

[mils]		Characteristic	
80 × 50	5%	NPO	10, 22, 47, 68, 100, 220, 470, 680,
80 × 50	10%	X7R	1000 pf, 2200, 4700, 6800, 10,000 pf
120 × 60	10%	X7R	.022, .047, .068, .1μf

† Minimum Order 50 per Value

Typical Biasing Configuration



	MODEL NO.	FREQ. MHz f_L	f_U	GAIN, dB Typical (at MHz) 100	500	1000	1500	MIN.*	MAXIMUM POWER, dBm Output 1 dB Comp.	Input no damage	DYNAMIC RANGE Intercept Pt., dBm NF dB Typ.	3rd Order Typ.	VSWR In	Out	MAXIMUM RATING (25°C) I (mA)	P (mW)	DC POWER at Pin 3 Current (mA)	Volt. Typ.	PRICE $ Qty. (25)	DISTRIBUTOR FACTORY	LOCAL
MAV case BBB-123	MAV-1	DC	1000	19	17.5	15	—	12.5	+1	+20	5.0	+17	1.4:1	1.4:1	40	200	17	5.0	1.10	●	●
	MAV-2	DC	1500	12.5	12.0	11.0	10	7.5	+4	+20	7.0	+18	1.6:1	1.6:1	60	325	25	5.0	1.40	●	●
	MAV-3	DC	1500	12.5	12.4	11.3	10	7.5	+8**	+20	6.0	+23	1.6:1	1.6:1	70	400	35	5.0	1.50	●	●
	MAV-4	DC	1000	8.5	8.5	8.0	—	7.0	+11	+20	7.0	+28	1.8:1	1.8:1	85	500	50	5.25	1.60	●	●
	MAV-11	10	1000	13	12.2	11.5	—	9.0	+16	+15	3.8	+30	2.5:1	2.2:1	80	550	60	5.6	2.10	●	●

MAV-1SM thru MAV-11SM: surface mount, see case RRR-137 for outline drawing.

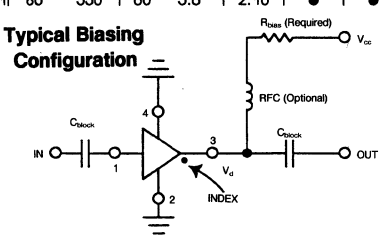
NOTES:

*Minimum gain over temperature and frequency range

**Decreases to 7 dBm at 1.5 GHz

1. Operating temperature: −20° to +85°C
2. Storage: −55° to 100°C

Typical Biasing Configuration



Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

323 REV E.

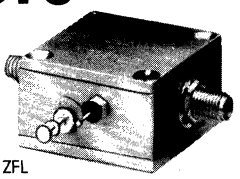
broadband, linear

Mini-Circuits

Variable Gain Amplifiers

up to 20mW (+13 dBm) output

10 to 1200 MHz



ZFL

	MODEL NO.	FREQ. MHz f_L	FREQ. MHz f_U	GAIN, dB Min.	GAIN, dB Flatness Max.	GAIN, dB Control range	MAXIMUM POWER, dBm Output 1 dB (Comp.)	MAXIMUM POWER, dBm Input no (damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept Pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt. V	DC POWER Current mA	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
ZFL case Y39	* ZFL-1000GH	10	1200	24	±1.5	30+	+13	+10	15	+25	2.2:1	2:1	15	170	219.00	•	
	* ZFL-1000G	10	1000	17	±1.5	30+	+3	+10	12	+13	2:1	2:1	15	100	199.00	•	

NOTES:

+ Response time (10 to 90%) 25 μsec.

* ZFL-1000GH and ZFL-1000G ALL SPECS at 0 volts control voltage.

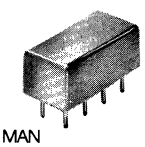
1. Operating temperature is −55°C to +71°C.
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.

broadband, linear

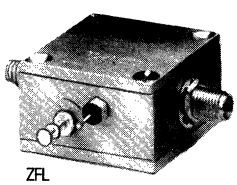
High Isolation Amplifiers

up to 500mW (+27 dBm) output

2 to 2000 MHz



MAN



ZFL

	MODEL NO.	FREQUENCY MHz f_L	FREQ. MHz f_U	GAIN, dB Min.	GAIN, dB Flatness m	GAIN, dB Flatness Max. Total Range	MAX. POWER dBm Output 1 dB Comp. L_W	MAX. POWER dBm Output 1 dB Comp. U	MAX. POWER dBm Input no (damage)	DYNAMIC RANGE NF dB Typ.	DYNAMIC RANGE Intercept Pt., dBm 3rd Order Typ.	VSWR In	VSWR Out	ACTIVE DIRECTIVITY• dB L_W Typ.	ACTIVE DIRECTIVITY• dB L_W Min.	ACTIVE DIRECTIVITY• dB U Typ.	ACTIVE DIRECTIVITY• dB U Min.	DC POWER Voltage V.	DC POWER Current mA	PRICE $ Qty. (1-9)
MAN-AD case A05	MAN-1AD	5	500	16	±0.5	±1.0	+7.0	+6.0	+15	7.2	+20	1.6:1	1.7:1	35	25	30	20	12	85	26.45
	MAN-11AD	2	2000	8	±0.5	±1.5	−2.0	−3.5	+10	6.5	+14	3.0:1	2.0:1	21	14	16	12	15	22	31.95
NEW	MAN-2AD	2	1000	9	±0.4	±0.7	−2.0	−2.0	+10	6.5	+14	2.0:1	2.0:1	24	19	19	14	15	22	23.95
ZFL-AD case Y39	ZFL-11AD	2	2000	8	±0.5	±1.3	−2.0	−3.5	+10	6.5	+14	2.5:1	2.0:1	21	14	16	12	15	22	91.95
	ZFL-2AD	2	1000	10	±0.4	±0.5	−2.0	−2.0	+10	6.5	+14	2.0:1	2.0:1	24	19	19	14	15	22	83.95
case SS98	ZFL-1HAD△	10	500	10	—	±1.0	+20	+20	+17	7.5	+30	1.3:1	1.35:1	30	20	25	18	15	115	210.00
ZHL-HLD case T34	ZHL-1HLD	225	400	23	—	±1.0	+27	+27	+10	2.5	+40	2.0:1	2.0:1	34	28	34	28	24	525	395.00

NEW

L_W = Low Range (f_L to $f_{U/2}$) m = mid Range (2 f_L to $f_{U/2}$) U = Upper Range ($f_{U/2}$ to f_U)

•Active Directivity (dB) = Isolation (dB) − Gain (dB)

△ Input VSWR of ZFL-1HAD in 10-20 MHz band increases to 1.45 at −55°C

PIN CONFIGURATION

SERIES	MAN
RF IN	1
RF OUT	8
DC	5
CASE GND	2,3,4,6
NOT USED	7

NOTES:

1. For quality control procedures, environmental specifications, see Table of Contents.
2. Absolute Maximum Ratings, see Table of Contents.
3. Prices and specifications subject to change without notice.
4. Maximum Operating Temperature: −54°C-+85°C.
5. Maximum DC Voltage: 16V except for MAN-1AD (12.5V), ZHL-1HLD(28V), ZHL-1HAD(17V).
6. Model ZHL-1HLD is available in SMA connector only.

SF44 REV A

In Stock . . . Immediate Delivery

broadband, linear

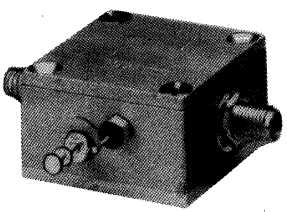
Low Power Amplifiers

up to 10mW (+10 dBm) output

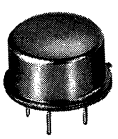
50 KHz to 3000 MHz

case style selection

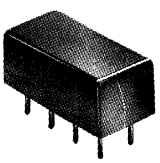
outline drawings see Table of Contents



ZFL



AMP



MAN

	MODEL NO.	FREQ. MHz f_L	FREQ. MHz f_U	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1 dB Comp.)	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept Pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt. V	DC POWER Current mA	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
ZFL case Y39	ZFL-500▲	0.05	500	20	±1.0	+9	+5	5.3	+18	1.9:1	1.9:1	15	60	69.95	•	
	ZFL-750	0.2	750	18	±0.5	+9	+5	6.0	+18	1.5:1	2:1	15	90	74.95	•	
	■ ZFL-1000	0.1	1000	17	±0.6	+9	+5	6.0	+18	1.5:1	2:1	15	105	79.95	•	

NOTES:

▲ ZFL-500 available with BNC also, $5.00 additional.

■ ZFL-1000 output VSWR 2.8:1 maximum over 750-1000 MHz; 1 dB compression +7 dBm 500-1000 MHz

1. Operating temperature is −55°C to +71°C.
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.

	MODEL NO.	FREQUENCY MHz f_L	FREQUENCY MHz f_U	GAIN, dB Min.	GAIN, dB Flatness Max. m	GAIN, dB Flatness Max. Total Range	MAX. POWER, dBm Output (1 dB Comp.) L_W	MAX. POWER, dBm Output (1 dB Comp.) U	MAX. POWER, dBm Input (no damage)	DYNAMIC RANGE NF dB Typ.	DYNAMIC RANGE Intercept Pt., dBm 3rd Order Typ.	VSWR In	VSWR Out	DC POWER Voltage V.	DC POWER Current mA	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
NEW AMP case PP120	AMP-3G	30	3000	8.0	±0.75	±0.75	+9.5	+9.5	+13	3.5△	+20	2.6:1	2.5:1	15	55	89.95	•	
	AMP-74	5	500	27	±1.0	±1.0	+7.0	+7.0	+13	5.0	+20	2:1	2:1	15	44	44.95	•	
MAN case A05	MAN-1	0.5	500	28	±0.5	±1.0	+8	+8	+15	4.5	+18	1.8:1	1.8:1	12	60	15.95	•	•
	MAN-2	0.5	1000	18	±0.5	±1.5	+9	+7	+15	6.0	+19	1.8:1	1.8:1	12	85	19.95	•	•

L_W = Low Range (f_L to $f_{U/2}$) m = mid Range ($2f_L$ to $f_{U/2}$) U = Upper Range ($f_{U/2}$ to f_U)

NOTES:

△ NF increases with decreasing frequency, 5 dB Typ. at 300 MHz and 10 dB Typ. at 30 MHz.

1. For quality control procedures, environmental specifications, see Table of Contents.
2. Absolute Maximum Ratings, see Table of Contents.
3. Prices and specifications subject to change without notice.
4. Maximum Operating Temperature: −54°C-+85°C.
5. Maximum DC Voltage: 17V for AMP series, 12.5V for MAN series.

PIN CONFIGURATION

SERIES	MAN	AMP
RF IN	1	2
RF OUT	8	4
DC	5	1
CASE GND	2,3,4,6	3
NOT USED	7	—

features

- ideal for printed-circuit designs (MAN & AMP series)
- smooth response over entire band, no external resonances
- low impedance, less susceptible to EMI
- easy to use, 50 ohm input/output
- all models are cascadable

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF45 REV A

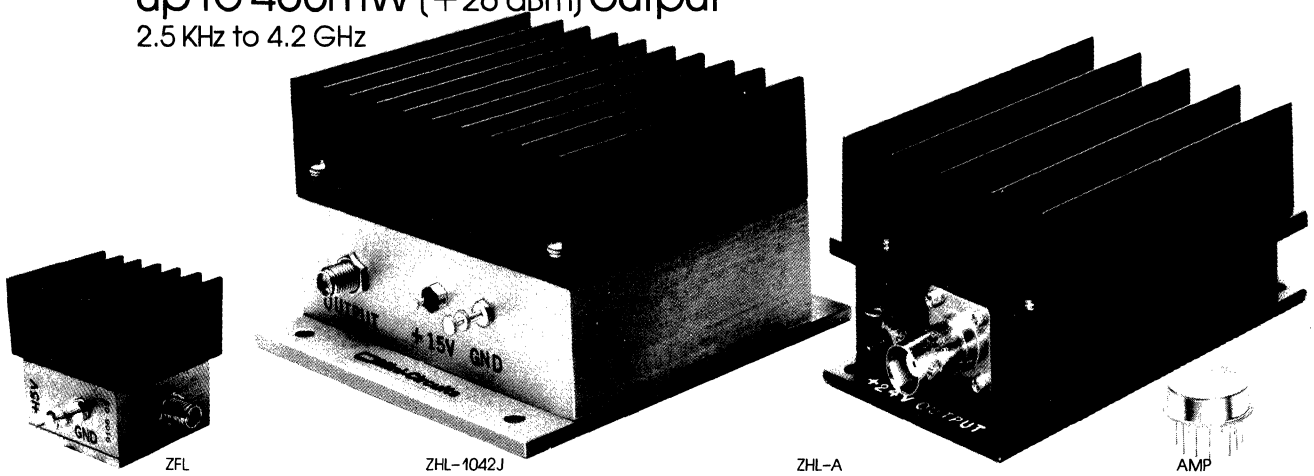
broadband, linear

Mini-Circuits

Medium Power Amplifiers

up to 400mW (+26 dBm) output

2.5 KHz to 4.2 GHz



ZFL ZHL-1042J ZHL-A AMP

	MODEL NO.	FREQ. MHz f_L f_U	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1 dB Comp.)	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept Pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt. V	DC POWER Current mA	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
ZFL case SS98	**ZFL-2000▲**	10-2000	20	±1.5	+16●	+5	7.0	+25	2:1	2:1	15	100	219.00	●	
	ZFL-1000H	10-1000	28	±1.0	+20	+5	5	+33	2:1	2:1	15	150	219.00	●	
	ZFL-1000VH	10-1000	20	±1	+26	+15	4.5	+38	1.8:1	2.0:1	15	320	229.00	●	
ZHL-1042J case NN92	**ZHL-1042J**	10-4200	25	±1.5	+20	+10	4.5	+30	2.5:1	2.5:1	15	300	495.00	●	
ZHL-A□ case S32	**ZHL-6A**	.0025-500	21	±1.0	+23	+10	7.5	+34	1.8:1	2:1	24	350	199.00	●	

	MODEL NO.	FREQUENCY MHz f_L f_U	GAIN, dB Min.	GAIN, dB Flatness Max. m	GAIN, dB Flatness Max. Total Range	MAX. POWER, dBm Output (1 dB Comp.) L_W	MAX. POWER, dBm Output (1 dB Comp.) U	MAX. POWER, dBm Input (no damage)	DYNAMIC RANGE NF dB Typ.	DYNAMIC RANGE Intercept Pt., dBm 3rd Order Typ.	VSWR In	VSWR Out	DC POWER Voltage V.	DC POWER Current mA	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
NEW AMP case QQ96	**AMP-2000**	10-2000	20	±0.6	±1.5	+15.0	+16.0	+ 5	5.0	+25	2:1	2:1	15	100	139.95	●	

L_W = Low Range (f_L to $f_{U/2}$) m = mid Range (2 f_L to $f_{U/2}$) U = Upper Range ($f_{U/2}$ to f_U)

NOTES:

▲ case style Y39.
● +15dBm below 1000 MHz.
□ NF SPEC above 10 MHz. Output VSWR above 400 MHz is 2.2:1 max. Available only with BNC connectors.
1. Operating temperature is −55°C to +71°C; (ZFL-2000 is −55°C to +100°C, ZHL Series −20°C to +65°C). When model ZFL-1000H and ZFL-2000 are mounted to chassis using a thermoconductive paste, their operating temperature range will be increased.
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.

PIN CONFIGURATION

SERIES	AMP-2000
RF IN	5
RF OUT	11
DC	2
CASE GND	1,3,4,6,7,8,9,10,12

SF46 REV A

In Stock . . . Immediate Delivery

broadband, linear

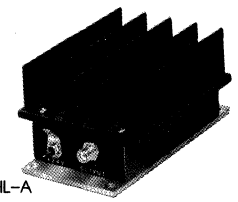
High Power Amplifiers

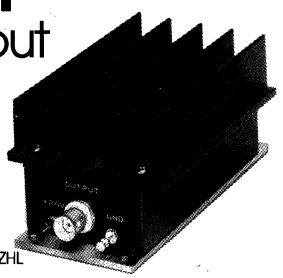
up to 10 Watts (+40 dBm) output

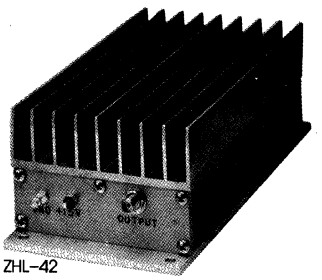
50 KHz to 4.2 GHz

case style selection

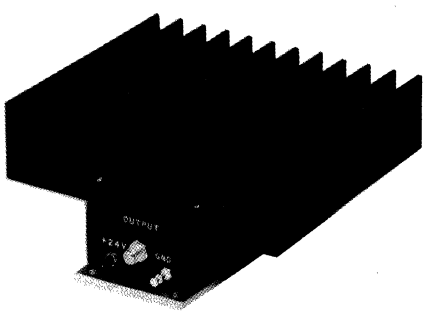
outline drawings see Table of Contents

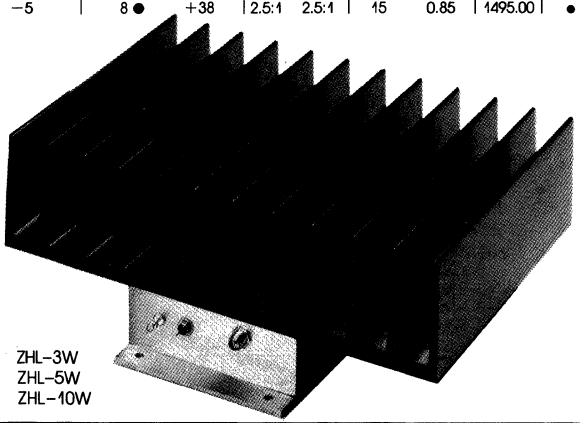

ZHL-A


ZHL


ZHL-42

	MODEL NO.	FREQUENCY MHz f_L f_U	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output 1 dB (Comp.)	MAXIMUM POWER, dBm Input no (damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept Pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt. V	DC POWER Current A	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
ZHL-A case S 32	ZHL-1A	2-500	16	±1.0	+28	+20	11	+38	2:1	2:1	24	0.6	199.00	•	
	ZHL-3A	0.4-150	24	±1.0	+29.5	+10	11	+38	2:1	2:1	24	0.6	199.00	•	
	ZHL-32A	0.05-130	25	±1.0	+29	+10	10	+38	2:1	2:1	24	0.6	199.00	•	
ZHL case T 34	ZHL-2	10-1000	16	±1.0	+29	+20	9	+38	2:1	2:1	24	0.6	349.00	•	
	ZHL-2-8	10-1000	27	±1.0	+29	+5	10	+38	2:1	2:1	24	0.6	525.00	•	
	ZHL-2-12	10-1200	24	±1.0	+29▲	+10	10	+38	2:1	2:1	24	0.75	625.00	•	
ZHL-42 case U 36	ZHL-42	700-4200	30	±1.0	+28	+5	10	+38	2.5:1	2.5:1	15	0.8	895.00	•	
	ZHL-4240	700-4200	40	±1.5	+28	−5	4	+38	2.5:1	2.5:1	15	0.7	1395.00	•	
	ZHL-42W	10-4200	30	±1.5	+28 ■	+5	8 ●	+38	2.5:1	2.5:1	15	0.75	1095.00	•	
	ZHL-4240W	10-4200	40	±1.5	+28 ■	−5	8 ●	+38	2.5:1	2.5:1	15	0.85	1495.00	•	




ZHL-3W
ZHL-5W
ZHL-10W

	MODEL NO.	FREQ. MHz f_L f_U	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output 1 dB (Comp.)	MAXIMUM POWER, dBm Input no (damage)	DYNAMIC NF, dB Typ.	DYNAMIC Intercept Pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt. V	DC POWER Current A	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
ZHL-2W case T 35	ZHL-1-2W	5-500	29	±1.0	+33	+10	12	+44	2:1	2:1	24	0.9	525.00	•	
	ZHL-7-2W	600-800	28	±1.0	+33	+10	12	+43	2:1	2:1	24	0.9	590.00	•	
ZHL-3W case DDD-131	ZHL-1000-3W	500-1000	38	±1.0*	+35**	0	9	+45	2:1	2.5:1	24	2	695.00	•	
ZHL-5W case DDD-131	ZHL-5W-1	1-500	40	±1.5	+37	0	8	+49	2:1	2.5:1	24	3.3	995.00	•	
ZHL-10W case DDD-131	ZHL-900-10W	480-900	19	±1.0	+38	+25	10	+50	2:1	2:1	24	5.5	1995.00	•	

NOTES:

■ +27 dBm, 10 MHz to 700 MHz

● Below 100 MHz, increases to 15 dB at 10 MHz

▲ +28.5 dB maximum output 1000-1200 MHz. Available only with SMA.

* 1.5 dB over temperature range −20°C to +65°C

** 1 dB compression point typ. 37 dBm

1. Operating temperature −20°C to +65°C.
   Storage temperature −55°C to +100°C.
2. With no load on output, derate maximum input power (no damage) by 10dB.
3. Price and specifications subject to change without notice.

NSN GUIDE

MCL NO.	NSN
ZHL-1A	6130-01-088-2322
ZHL-3A	5895-01-194-1718

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF47 REV A

high rejection of 1st and 3rd harmonics

Mini-Circuits

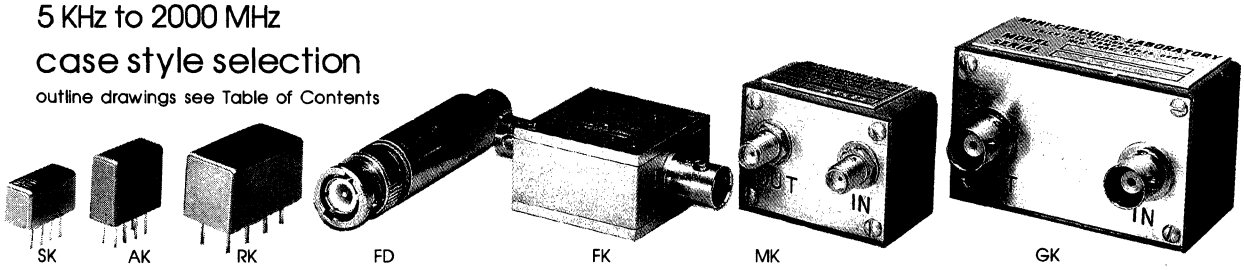
Frequency Doublers

input power 0 to +20dBm

5 KHz to 2000 MHz

case style selection

outline drawings see Table of Contents



SK AK RK FD FK MK GK

	MODEL NO.	FREQUENCY MHz Input	Output	RF INPUT PWR. dBm Min.	Max.	CONVERSION LOSS dB Input freq.	Typ.	Max.	*HARMONIC OUTPUT, dB F1 Typ.	Min.	F3 Typ.	Min.	F4 Typ.	Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
SK case B02	SK-2	1-500	2-1000	1	10	1-100	13.0	15.0	40	30	50	40	16	12	26.45	•	•
						100-300	13.5	15.5	25	20	40	30	16	12		•	•
						300-500	14.0	17.5	20	15	30	25	16	12		•	•
AK case A03	AK-2	1-500	2-1000	1	10	1-100	13.0	15.0	40	30	50	40	16	12	20.95	•	•
						100-300	13.5	15.5	25	20	40	30	16	12			
						300-500	14.0	17.5	20	15	30	25	16	12			
RK case A01	RK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	17.95	•	•
						100-300	13.5	15.5	25	20	40	30	16	12			
						300-500	14.0	16.5	20	15	30	25	16	12			
	RK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	15.95	•	•
						50-150	11.5	15.0	35	20	40	20	16	12			
	RK-5	10-800	20-1600	10	20	10-100	13.0	15.0	20	12	25	20	15	12	49.95	•	•
						100-400	12.5	16.0	20	12	30	20	15	12			
						400-800	13.0	16.0	20	12	25	18	15	10			
	RK-6	0.005-25	0.01-50	0	10	0.005-1	11.0	13.0	40	30	45	30	16	12	25.95	•	•
						1-25	11.5	15.0	35	20	40	20	16	12			
FD case FF55	FD-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	40.95	•	
						100-300	13.5	15.5	25	20	40	30	16	12			
						300-500	14.0	16.5	20	15	30	25	16	12			
FK case H16	FK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0									
						600-1000	14.0	17.0	20	15	25	20	—	—	69.95	•	
MK case L19	MK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	52.95	•	
						100-300	13.5	15.5	25	20	40	30	16	12			
						300-500	14.0	16.5	20	15	30	25	16	12			
	MK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	47.95	•	
						50-150	11.5	15.0	35	20	40	20	16	12			
	MK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0							76.95	•	
						600-1000	14.0	17.0	20	15	25	20	—	—			
GK case L20	GK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	45.95	•	
						100-300	13.5	15.5	25	20	40	30	16	12			
						300-500	14.0	16.5	20	15	30	25	16	12			
	GK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	43.95	•	
						50-150	11.5	15.0	35	20	40	20	16	12			
	GK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0									
						600-1000	14.0	17.0	20	15	25	20	—	—	67.95	•	

*Harmonic Output below power of F2.
**ABOVE 700 MHz min. Input power +13dBm

NOTES:

1. Maximum RF input power, 200mW.
2. Refer to Table of Contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. Prices and specifications subject to change without notice.

NSN GUIDE

MCL NO.	NSN
AK-2	5895-01-131-4569
RK-3	5895-01-143-3726
RK-3-TX	5895-01-160-8656
FK-5	5895-01-204-9746

pin connections

see case style outline drawing

Series	SK	RK			AK
Models	all models	-2 -5	-3	-6	all models
IN	*1,2	*1,3,4	*1,3,4	*1,3,4	*1,3,4
OUT	4	8	8	8	8
GND♦	3	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND	3	2,5,6,7	2	—	2,5,6,7

*pins must be connected together externally
♦Ground externally. All measurements made with GND pin(s) grounded externally.

applications

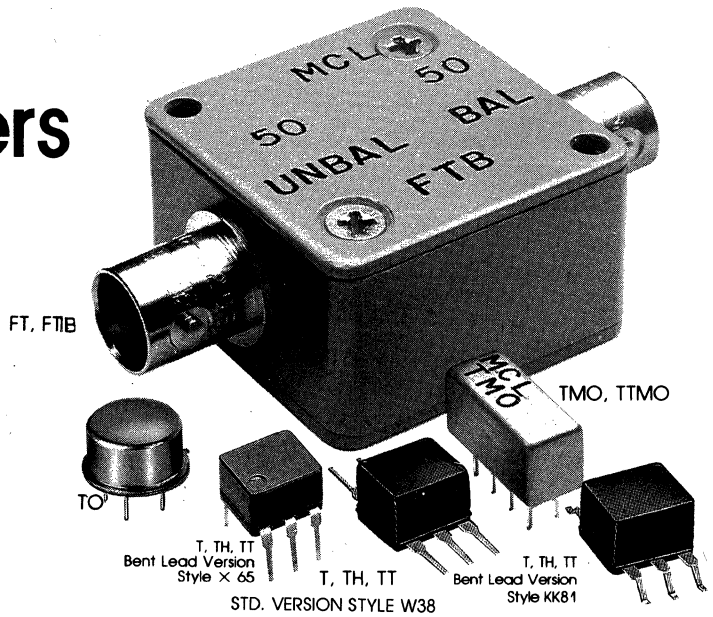
- Wideband frequency multiplier chains
- Low spurious frequency multiplier chains
- FM, PM modulation chains
- Double frequency range of signal generators

SF67 REV B

In Stock . . . Immediate Delivery

wideband
RF Transformers

3 KHz to 800 MHz



case style selection

outline drawings see Table of Contents

T, TH, TT: Case W38, X65, KK81*
TMO: Case A11 except
(†TMO, TTMO: Case A03)
FT, FTB: Case H16
TO: Case PP94

*KK81 leads bent for Surface Mounting

For PC applications, select from the low-cost; plastic-case T series (small enough to be inserted into a standard 1/3 DIP socket), or the hermetically-sealed RFI shielded TMO metal-case series (requiring less PC are a than a flatpack or TO-5 can), or the plastic-case T-H series designed to handle up to 100 mA in the primary winding without appreciable saturation or change in RF characteristics.

Transformer core saturation is influenced by (1) dc current through the winding, (2) RF input power, and (3) frequency of operation. These three variables interact to affect the point at which saturation occurs, see Figs. (1) and (2). These curves show the point where distortion occurs, by visual observation.

Now comparing the T-H series to the conventional T-series in Figs. (1) and (2), note that saturation effects are negligible with the T16-1H; so for wide dynamic range applications, specify the T-H series.

These transformers may be operated as low as 12.5 ohms at the primary with essentially the same impedance matching ratio and only a slight change in frequency response. All Mini-Circuits' transformers are specified as step-up.

For each RF transformer model, the minimum and maximum frequency is given for the insertion loss at the 3 dB, 2 dB and 1 dB points, as shown in Fig. (3) and listed in the data chart. For example, the T1-1 insertion loss is 1 dB from 2 to 50 MHz and 3 dB from 0.15 to 400 MHz.

Coaxial connector models are available from 10 KHz to 500 MHz and are offered with 50 ohm and 75 ohm impedances; 75 ohm connectors are used at 75 ohm ports. The FT1.5-1, with unbalanced input and output, is especially useful for 50 ohm to 75 ohm matching applications. The FTB series with unbalanced output and balanced input (connector ground insulated from the case) helps eliminate ground loop problems, especially when long cable runs are involved.

performance saturation curves T, TH series

(RF power & DC current at which signal saturation begins)

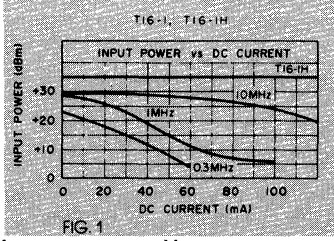


FIG. 1

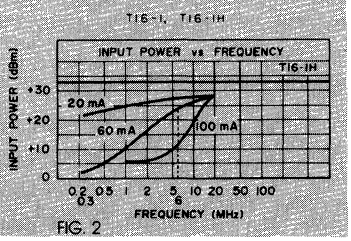


FIG. 2

frequency response curve

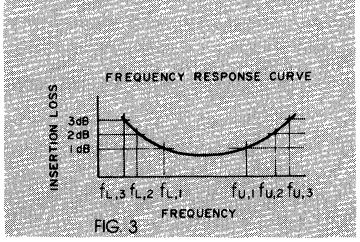


FIG. 3

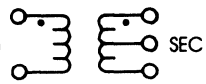
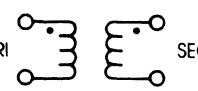
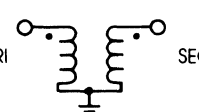
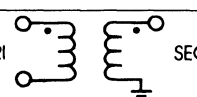
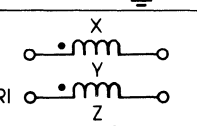
pin connections see case style outline drawings.

CONFIGURATION CODE	*A		*B		C,E			D		F
CONFIGURATION	DC Isolated Center-Tap Secondary		DC Isolated Center-Tap Primary, Secondary		DC Isolated			Unbalanced Primary, Secondary		Windings Open■
Series	T, TH	TMO	TT	TTMO	T, TH	TO	TMO●	T	TMO	T
Primary DOT	4	1	4	1	4	1	1	6	1	X1 Y2 Z3
Primary	6	5	6	5	6	2	5	3◇	6◇◇	X6 Y5 Z4
Primary CT	—	—	5	3	—	—	—	—	—	
Secondary DOT	3	2	3	2	3	4	2	1	2	
Secondary	1	6	1	6	1	3	6	3◇	6◇◇	
Secondary CT	2	4	2	4	—	—	—	—	—	
Case Gnd.	—	7,8	—	7,8	—	—	7,8	—	7,8	

◇pin 3 must be grounded
◇◇pin 6 must be grounded

● For the TMO1-02 Primary: Pin 3 Primary Dot: Pin 1, Secondary: Pin 4. Secondary Dot: Pin 2. Pins 5, 6, 7, 8 not used.
■ For the T2-613-1 Primary: X2, Y6, Z4. Primary Dot: X1, Y5, Z3.

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SF52 REV A

case style number see opposite page		MODEL NO.	Ω RATIO	FREQUENCY MHz	INSERTION LOSS 3db MHz	INSERTION LOSS 2db MHz	INSERTION LOSS 1db MHz	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
A* 	T	T1-1T	1	.05-200	.05-200	.08-150	.2-80	4.45	●	●
		T1-6T	1	.003-300	.003-300	.01-150	.02-50	6.95	●	●
		T2-1T	2	.07-200	.07-200	.1-100	.5-50	4.95	●	●
		T2.5-6T	2.5	.01-100	.01-100	.02-50	.50-20	4.95	●	●
		T3-1T	3	.05-250	.05-200	.1-200	.5-70	4.95	●	●
		T4-1	4	.2-350	.2-350	.35-300	2-100	3.25	●	●
		T4-6T	4	.02-250	.02-250	.05-150	0.1-100	4.45	●	●
		T5-1T	5	.3-300	.3-300	.6-200	5-100	4.95	●	●
		T8-1T	8	.03-140	.03-140	.10-90	1-60	7.95	●	●
		T13-1T	13	.3-120	.3-120	.7-80	5-20	4.95	●	●
		T16-6T	16	.03-75	.03-75	.06-30	.1-20	5.65	●	●
	TH	T4-1H	4	10-350	10-350	15-300	25-200	5.95	●	●
	TMO	TMO1-1T	1	.05-200	.05-200	.08-150	.2-80	7.95	●	●
		TMO2-1T	2	.07-200	.07-200	.1-100	.5-50	8.45	●	●
		†TMO2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	8.45	●	●
		†TMO3-1T	3	.05-250	.05-250	.1-200	.5-70	7.95	●	●
		TMO4-1	4	.2-350	.2-350	.35-300	2-100	6.25	●	●
		TMO5-1T	5	.3-300	.3-300	.6-200	5-100	8.45	●	●
		TMO13-1T	13	.3-120	.3-120	.7-80	5-20	8.45	●	●
B* 	TT	TT1-6	1	.004-500	.004-500	.02-200	.1-50	6.95	●	●
		TT1.5-1	1.5	.075-500	.075-500	.2-100	1-50	5.95	●	●
		TT2.5-6	2.5	.01-50	.01-50	.025-25	.05-10	6.45	●	●
		TT4-1	3	.05-200	.05-200	.2-50	1-30	5.95	●	●
		TT4-1A	4	0.1-300	0.1-300	0.2-250	0.3-180	6.95	●	●
		TT16-1	16	0.1-45	0.1-45	0.14-35	1-20	9.95	●	●
		TT25-1	25	.02-30	.02-30	.05-20	.1-10	9.95	●	●
	TTMO	TTMO25-1	25	.02-30	.02-30	.05-20	.1-10	11.95	●	●
		TTMO1-1	1	.005-100	.005-100	.01-75	.05-40	11.45	●	●
		TTMO4-1A	4	0.1-300	0.1-300	0.2-250	0.3-180	13.95	●	●
C 	T	T1-1	1	.15-400	.15-400	.35-200	2-50	3.25	●	●
		T1.18-3	1.18	0.01-250	0.01-250	0.02-200	0.03-50	5.65	●	●
		T1-6	1	.01-150	.01-150	.02-100	.05-50	5.65	●	●
		T1.5-1	1.5	.1-300	1-300	.2-150	.5-80	4.45	●	●
		T1.5-6	1.5	.02-100	.02-100	.05-50	0.1-25	5.65	●	●
		T2.5-6	2.5	.01-100	.01-100	.02-50	.05-20	4.45	●	●
		T4-6	4	.02-200	.02-200	.05-150	.1-100	4.45	●	●
		T9-1	9	.15-200	.15-200	.3-150	2-40	3.95	●	●
		T16-1	16	.3-120	.3-120	.7-80	5-20	4.45	●	●
		T36-1	36	.03-20	.03-20	.05-10	.1-5	6.95	●	●
	TO	TO-75	1	10-500	—	10-500	40-250	6.95	●	●
	▲TH	T1-1H	1	8-300	8-300	10-200	25-100	5.95	●	●
		T9-1H	9	2-90	2-90	3-75	6-50	6.45	●	●
		T16-1H	16	7-85	7-85	10-65	15-40	6.45	●	●
	TMO	●TMO1-02	1	1-800	1-800	2-500	—	9.45	●	●
		TMO1-1	1	.15-400	.15-400	.35-200	2-50	6.25	●	●
		TMO1.5-1	1.5	.1-300	.1-300	.2-150	.5-8	8.45	●	●
		†TMO2.5-6	2.5	.01-100	.01-100	.02-50	.05-20	7.95	●	●
		†TMO4-6	4	.02-200	.02-200	.05-150	.1-100	7.95	●	●
		TMO6-1	6	.3-200	.3-200	.5-150	5-50	7.95	●	●
		TMO9-1	9	.15-200	.15-200	.3-150	2-40	7.95	●	●
		TMO16-1	16	.3-120	.3-120	.7-80	5-20	7.95	●	●
D 	T	T2-1	2	.050-600	.050-600	.1-400	.5-200	3.95	●	●
		T3-1	3	.5-800	.5-800	2-400	—	4.45	●	●
		T4-2	4	.2-600	.2-600	.5-500	2-250	3.95	●	●
		T8-1	8	.15-250	.15-250	.25-200	2-100	3.95	●	●
		T14-1	14	.2-150	.2-150	.5-100	2-50	4.95	●	●
	TMO	TMO2-1	2	.050-600	.050-600	.1-400	.5-200	7.95	●	●
		TMO3-1	3	.5-800	.5-800	2-400	—	8.45	●	●
		TMO4-2	4	.2-600	.2-600	.5-500	2-250	7.95	●	●
		TMO8-1	8	.15-250	.15-250	.25-200	2-100	7.95	●	●
		TMO14-1	14	.2-150	.2-150	.5-100	2-50	8.45	●	●
	FT	FT1.22-1	1.22	.005-100	.005-100	.01-50	.05-25	35.95	●	●
		FT1.5-1	1.5	.1-400	.1-400	5-200	1-100	35.95	●	●
E 	FTB	FTB1-1	1	.2-500	.2-500	.5-300	1-100	36.95	●	●
		FTB1-6	1	.01-125	.01-125	.05-50	.1-25	36.95	●	●
		■FTB1-1-75	1	.5-500	.5-500	5-300	10-100	36.95	●	●
F 	T	T-622	1:1:1	0.1-200	0.1-200	0.5-100	5-80	3.25	●	●
		T-626	1:1:1	0.01-10	0.01-10	0.2-5	.04-2	3.95	●	●
		T2-613-1	1:1:2	0.07-200	0.07-200	0.1-100	0.5-50	1.95	●	●

* FOR A AND B CONFIGURATIONS

Maximum Amplitude Unbalance
0.1 dB over 1 dB frequency range
0.5 dB over entire frequency range

Maximum Phase Unbalance
1.0° over 1 dB frequency range
5.0° over entire frequency range

NSN GUIDE

MCL NO.	NSN
FTB1-1-75	5950-01-132-8034
FTB1-6	5950-01-225-8773
T1-1	5950-10-128-3745
T1-1T	5950-01-153-0668
T2-1	5950-01-106-1218
T3-1T	5950-01-153-0298
T4-1	5950-01-024-7626
T9-1	5950-01-105-8153
T16-1	5950-01-094-7439
TMO1-1	5950-01-178-2612
TMO2-1	5950-01-183-6414
TMO2.5-6	5950-01-215-4038
TMO2.5-6T	5950-01-215-8697
TMO3-1T	5950-01-168-7512
TMO4-1	5950-01-067-1012
TMO4-2	5950-01-091-3553
TMO4-6	5950-01-132-8102
TMO5-1T	5930-01-183-0779
TMO9-1	5950-01-141-0174
TMO16-1	5950-01-138-4593

NOTES:
▲ Insertion loss referenced to mid-band loss.
■ Denotes 75 ohm models, For coax connectors, 75 ohm BNC is standard.
1. For quality control procedures and environmental specifications, absolute maximum ratings see section 1. Except for T, TT, and TH series, Temperature range is −20°C to +85°C.
2. Absolute maximum ratings; RF power 250 mW, DC current 30 mA.
3. For connector types and case mounting options, see case style outline drawing.
4. Prices and specifications subject to change without notice.

SF53 REV A

GaAs <5 nsec

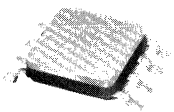
Switches

SPDT, reflective or absorptive

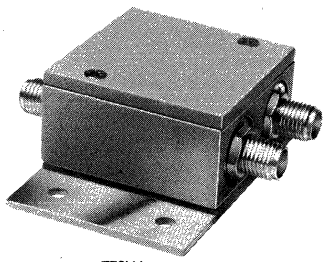
dc to 4.6 GHz

pin connections

see case style outline drawings



KSW/KSWHA



ZFSW

	MODEL NO.	FREQ. GHz	ABSORP.	REFLECT.	INSERTION LOSS, dB FREQUENCY BAND A Typ.	A Max.	B Typ.	B Max.	C Typ.	C Max.	1dB COMPRESSION, dBm FREQUENCY BAND A Typ.	B Typ.	C Typ.	IN-OUT ISOLATION dB A Typ.	A Min.	B Typ.	B Min.	C Typ.	C Min.	PRICE Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
KSW	KSW-2-46	DC-4.6		•	0.9	1.1	1.0	1.3	1.3	1.7	+10	+17	+27	60	50	45	40	30	23	36.95	•	•
case XX112	KSWA-2-46	DC-4.6	•		0.8	1.1	0.9	1.3	1.5	2.6	+10	+17	+27	60	45	50	40	30	25	58.95	•	•
ZFSW	ZFSW-2-46	DC-4.6		•	0.9	1.1	1.0	1.3	1.3	1.7	+10	+17	+27	60	50	45	40	30	23	79.95	•	
case G144	ZFSWA-2-46	DC-4.6	•		0.8	1.1	0.9	1.3	1.5	2.6	+10	+17	+27	60	45	50	40	30	25	89.95	•	

A=DC to 200MHz B=200MHz to 1000MHz C=1000MHz to 4600MHz

NOTES:

1. To ensure proper performance, connect case to pc board. Ground and interconnect top and bottom of pc board. Ground very close to case position.
2. Control voltage −8V on
   Logic 0V off
3. All specifications, except compression, apply for control voltage −8V to −5V (2.5 mA typ.).
4. Control voltage −10V max.
5. Switching speed: Rise time 2 nanosec typ., Fall time 2 nanosec typ.
6. VSWR 1.3 to 1 typical over most of frequency range.
7. Maximum RF input for no damage +27 dBm below 500 MHz, +30 dBm above 500MHz.

MTBF: 15 million hours at 55°C
KSW-2-46 = 7 million hours at 100°C.
KSWA-2-46 = 11 million hours at 100°C.

8. Prices and specifications subject to change without notice.

FUNCTION	KSW KSWA PIN	ZFSW ZFSWA PORT
Control 2	1	1
RF-IN	2	S
Control 1	3	4
Ground	4	—
RF Out 1	5	3
Ground	6	—
Ground	7	—
RF Out 2	8	2

Control 1	Control 2	RF Out 1	RF out 2
−8V	0V	ON	OFF△
0V	−8V	OFF△	ON

△ For KSW-2-46, OFF state of RF output is low impedance. For KSWA-2-46, OFF state of RF output is 50 ohms to ground

SPST, absorptive

	MODEL NO.	FREQ. GHz	ABSORPT.	INSERTION LOSS, dB FREQUENCY BAND A Typ.	A Max.	B Typ.	B Max.	1dB COMPRESSION, dBm FREQUENCY BAND A Typ.	B Typ.	IN-OUT *ISOLATION dB A Typ.	A Min.	B Typ.	B Min.	PRICE Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
NEW																
KSWHA	KSWHA-1-20	DC-2.0	•	0.8	1.2	1.3	1.7	+19	+26	75	60	65	58	34.95	•	•
case XX-112																

A=DC to 200MHz B=200MHz to 2000MHz

ADDITIONAL SPECIFICATIONS

		A	B	UNITS
3rd ORDER INTERCEPT	TYP.	+35	+46	dBm
VSWR "ON" IN & OUT,	MAX.	1.25:1	1.50:1	
VSWR "OFF" IN,	MAX.	1.25:1	1.25:1	
OUT,	MAX.	1.40:1	1.50:1	
RF POWER (NO DAMAGE),	MAX.	1000 @	2000 @	mW
WITH CONSTANT 0/−8V CONTROL (SEE NOTE 5) AS MODULATOR (SEE NOTE 6)		100 @	500 @	mW
		TYP.	MAX.	UNITS
RISE/FALL TIME (10%-90%)		3	5	ns
SWITCHING TIME, 50% OF CONTROL TO:				
90% RF (TURN ON)		7	10	ns
10% RF (TURN OFF)		3	10	ns
VIDEO LEAKAGE, 0/−5V CONTROL		30	50	mV p-p

OPERATING TEMPERATURE: −55 to 100 Deg. C.
STORAGE TEMPERATURE: −55 to 150 Deg. C.

FUNCTION	PIN
RF-IN	1
RF-OUT	5
CONTROL 1	2
CONTROL 2	3
CASE GND	4,6,7,8

features

- high-isolation absorptive switch, 75 dB at 200 MHz, 65 dB at 2 GHz.
- very fast switching, 3 ns typical.
- hermetically sealed glass-metal package.
- compatible with surface mount soldering techniques.

NOTES:

@ BELOW 20 MHz: 200 mW MAX, 30 mW AS MODULATOR.
# BELOW 500 MHz: 200 MHz LIMITS APPLY.

1. To ensure proper performance, connect case to upper PC board ground, and interconnect top and bottom PC board grounds very close to case location.
2. Control logic: ON −V, OFF 0; ON 0, OFF −V
3. All specifications, except compression and intercept, apply for control voltage −8V to −5V Control current is 200 μA max. in this voltage range.
4. Maximum control current for no damage 500 μA. (Occurs at −9 to −12V typ.)
5. Above 20 deg. C derate power linearly to zero at 150 deg. C.
6. In modulator service, unrestricted switching is permitted with rf applied.
7. MTBF: 15 million hours at 55 deg. C, 11 million hours at 100 deg. C.

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF51 REV D

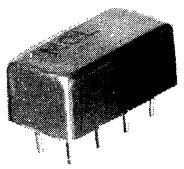
pin diode

Switches

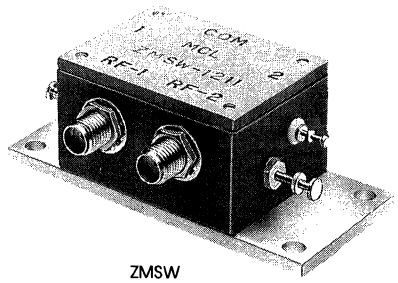
SPST/SPDT

10 to 2500 MHz

Mini-Circuits



PSW



ZMSW

	MODEL NO.	TYPE	FREQUENCY MHz f_L-f_U	INSERTION LOSS dB low-band lw Typ.	lw Max.	upper band U Typ.	U Max.	IN-OUT ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
PSW case A06	**PSW-1111**	SPST	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	32.95	•	•
	PSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	32.95	•	•
ZMSW case JJ77	**ZMSW-1111**	SPST	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	69.95	•	
	ZMSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	69.95	•	

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

lw=low band (f_L to f_U/2)

NOTES:

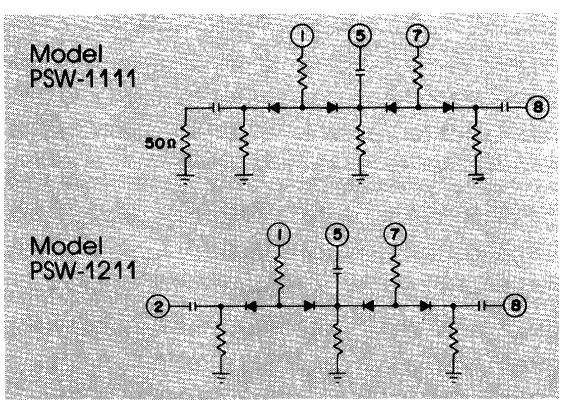
1. Refer to Table of Contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
2. For PSW and ZMSW models
   a) VSWR 1.5 max. ("on" state)
   b) Switching time 4μ sec. max., 2μ sec. rise time.
   c) Maximum RF input +20 dBm
   d) Control voltage +5V (5mA max.) on condition
      0V off condition
3. 1 dB compression for all pin diode switches from 10 to 100 MHz increase from 6 to 19 dBm. Above 100 MHz, 19 dBm min.
4. Prices and specifications subject to change without notice.

CAPD **PSW-1211**

computer-automated performance data

typical production unit / for data of other models consult factory

RF (MHz)	INSERTION LOSS, dB com RF-1	com RF-2	ISOLATION, dB com RF-1	com RF-2
10	-1.29	-1.38	-49.04	-49.44
110	- .93	- .97	-49.74	-49.78
210	- .91	- .90	-48.87	-44.32
310	- .92	- .84	-44.55	-45.60
410	- .83	- .71	-42.88	-44.53
610	-1.09	- .96	-39.47	-39.28
810	-1.13	-1.12	-37.53	-36.80
1010	-1.12	-1.09	-35.83	-34.95
1310	-1.14	-1.10	-33.28	-32.77
1510	-1.16	-1.12	-32.93	-32.41
1810	-1.30	-1.26	-31.80	-31.32
2010	-1.40	-1.32	-30.31	-29.93
2110	-1.45	-1.34	-28.33	-28.99
2310	-1.44	-1.31	-28.08	-28.09
2510	-1.59	-1.45	-27.89	-28.11



pin and coaxial connections

see case style outline drawings

Series	PSW		ZMSW	
Models	1111	1211	1111	1211
RF COMMON	5	5	com	com
RF-1 port	8	2	—	RF-1
RF-2 port	—	8	RF-2	RF-2
CONTROL RF-1	7	1	—	1
CONTROL RF-2	—	7	2	2
CONTROL 50 ohm TERMINATION	1	—	1	—
GND	2,4	4	—	—
CASE GND	3,6	3,6	—	—

SF55 REV A

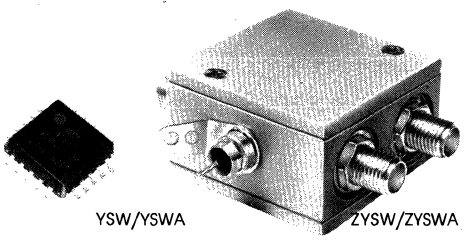
In Stock...Immediate Delivery

GaAs <5 nsec

Switches

SPDT, reflective or absortive with TTL driver

dc to 5 GHz



YSW/YSWA ZYSW/ZYSWA

	MODEL NO.	FREQ. GHz	REFLECT.	ABSORT.	INSERTION LOSS, dB FREQUENCY BAND A Typ.	A Max.	B Typ.	B Max.	C Typ.	C Max.	1dB COMPRESSION, dBm FREQUENCY BAND A Typ.	A Min.	B Typ.	B Min.	C Typ.	C Min	IN-OUT *ISOLATION dB A Typ.	A Min.	B Typ.	B Min.	C Typ.	C Min.	PRICE Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
YSW	YSW-2-50DR	DC-5	•		0.9	1.5	1.3	1.7	1.4	2.1	20	15	20	19	24	22	50	41	40	32	28	22	19.95	•	•
case KKK-155	YSWA-2-50DR	DC-5		•	1.1	1.5	1.4	1.9	1.9	2.7	18	13	20	17	22.5	20	42	38	31	27	20	19	23.95	•	•
NEW ZYSW	ZYSW-2-50DR	DC-5	•		0.9	1.5	1.3	1.7	1.4	2.1	20	15	20	19	24	22	50	41	40	32	28	22	59.95	•	
case ZZ-121	ZYSWA-2-50DR	DC-5		•	1.1	1.5	1.4	1.9	1.9	2.7	18	13	20	17	22.5	20	42	38	31	27	20	19	69.95	•	

A=DC to 500MHz B=500MHz to 2000MHz C=2000MHz to 5000MHz

*Typical isolation at 5 MHz, is 80 dB and decreases 5 dB/octave from 5-1000 MHz.

ADDITIONAL SPECIFICATIONS

	MIN.	TYP.	MAX.	UNITS
VSWR (ON)	—	1.4	2.0	
@ VIDEO BREAK THROUGH TO RF	—	30	—	mV P-P
RISE/FALL TIME (10% TO 90%)	—	1.5	3.0	nsec
SWITCHING TIME (FROM 50% TTL TO 90% RF)	—	3.0	5.0	nsec
POSITIVE SUPPLY VOLTAGE (PIN-19)	4.5	5.0	5.5	V
NEGATIVE SUPPLY VOLTAGE (PIN-7)	4.5	5.0	5.5	V
+5 V POWER SUPPLY CURRENT		12	20	mA
−5 V POWER SUPPLY CURRENT		12	20	mA
TTL LOGIC				
TTL INPUT HIGH	△RF-OUT #1 OFF, RF-OUT #2 ON			
TTL INPUT LOW	△RF-OUT #2 OFF, RF-OUT #1 ON			
TTL SPECS				
TTL VOLTAGE	0	—	5.5	V
TTL TOGGLE RATE	0	80	—	MHz
TTL INPUT				
HIGH, THRESHOLD	2.0	—	—	V
HIGH, CURRENT	—	2	5	mA
LOW, THRESHOLD	—	—	0.8	V
LOW, CURRENT	—	—	0.2	mA

ADDITIONAL SPECIFICATIONS

	MIN.	TYP.	MAX.	UNITS
TEMPERATURE				
OPERATING	−55	-	85	°C
STORAGE	−62	—	100	°C
MAX. RF INPUT (No Damage)*				
DC-2 GHz	—	—	+22	dB
2-5 GHz	—	—	+26	dBm

*For YSWA-2-50DR: +20dBM at "OFF" port, +24 dBM total

PIN CONFIGURATION

FUNCTION	YSW PIN	ZYSW PORT
RF-IN	4	3
RF-OUT 1	12	2
RF-OUT 2	14	1
TTL-IN	2	4
+15V	19	+5 VDC
−15V	7	−5 VDC
No Connection	9, 17	—
GND	1,3,5,6,8,10,11 13,15,16,18,20	GND

△ For YSW-2-50DR,ZYSW-2-50DR OFF state of RF output is low impedance.
@ Video break thru is defined as leakage of TTL switching signal to RF output ports.

YSW-2-50DR

FREQUENCY (MHz)	INSERTION LOSS (dB) S-1	INSERTION LOSS (dB) S-2	ISOLATION (dB) S-1	ISOLATION (dB) S-2
1.40	0.93	0.93	82.99	84.10
2.06	0.92	0.92	83.26	83.56
4.45	0.92	0.93	80.71	81.43
9.62	0.93	0.93	76.14	76.34
21.21	0.93	0.93	68.98	69.49
45.85	0.94	0.94	63.63	63.82
103.18	0.93	0.94	57.57	57.74
201.48	0.94	0.95	52.81	52.99
501.83	1.04	1.03	46.01	46.30
1000.00	1.08	1.09	40.48	40.75
1500.00	1.22	1.23	36.78	37.23
2000.00	1.36	1.39	34.27	34.49
2500.00	1.26	1.29	32.55	32.81
3000.00	1.22	1.25	31.02	31.39
3500.00	1.26	1.29	29.96	30.30
4000.00	1.29	1.32	29.18	29.80
4500.00	1.35	1.35	28.28	28.99
5000.00	1.52	1.50	28.59	29.23
5500.00	1.48	1.47	27.44	28.15
6000.00	1.89	1.87	27.25	28.16

features

- excellent repeatability, specification limits 4.5 σ typical from mean.
- high isolation, 80 dB typical at 5 MHz.
- low video break thru, 30 mV P-P typical.
- very fast switching, 3 nsec typical.
- low DC power consumption, 120 mW typical.
- YSW/A-2-50DR available in tape & reel.

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF52 REV C

pin diode

Mini-Circuits

Switches, with TTL Drivers

SPDT/SP4T

10 to 3000 MHz



TOSW ZSDR-230 ZSDR-425

case style selection

outline drawings see Table of Contents

	MODEL NO.	TYPE	FREQUENCY MHz f_L-f_U	INSERTION LOSS dB low-band lw Typ.	lw Max.	upper band U Typ.	U Max.	IN-OUT ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
TOSW	**TOSW-230**	SPDT	10-3000	1.3	1.9	1.8	2.7	60	40	40	28	35	22	49.95	•	•
case QQ96	**TOSW-425**	SP4T	10-2500	1.1	1.7	1.5	2.5	60	40	40	30	35	22	69.95	•	•
ZSDR																
case CCC-127	**ZSDR-230**	SPDT	10-3000	1.3	1.9	1.8	2.7	60	40	40	28	35	22	89.95	•	
case GGG-126	**ZSDR-425**	SP4T	10-2500	1.1	1.7	1.5	2.5	60	40	40	30	35	22	109.95	•	

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

lw=low band (f_L to f_U/2)

NOTES:

1. Refer to Table of Contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing
2. VSWR ("on" state): typ. 1.3, 1.6 max.
3. Switching time (μ sec): all switches, typ. 2.0, 4.0 max.
4. Max. RF input for all switches: 20 dBm for low range, 28 dBm for mid range, & 30 dBm for upper range.
5. Supply voltage for all switches, +5V (10 mA max.)
6. 1 dB compression point for all switches: from 10-100 MHz increase from 6 to 19 dBm. Above 100 MHz, 19 dBm min.
7. TTL input high threshold 2 volts min.
   TTL input low threshold 0.8 volts max.
8. Prices and specifications subject to change without notice.

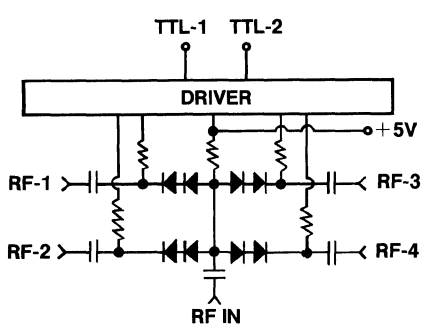
pin connections

see case style outline drawings

Series	TOSW	
Models	425	230
RF IN	8	8
RF-1	4	5
RF-2	6	11
RF-3	10	—
RF-4	12	—
TTL-1	2	3*
TTL-2	3	—
+5 VDC	1	1
CASE GND	5,7,9,11	2,4,6,7, 9,10,12

*TTL: pin 3

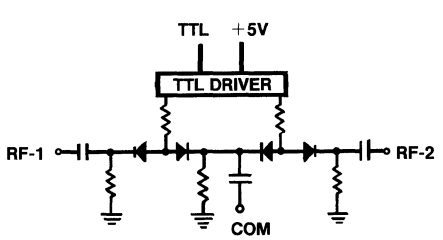
MODEL TOSW-425 & ZSDR-425



TTL LOGIC FOR ZSDR-425 & TOSW-425

	TTL-1	TTL-2
RF-1	1	0
RF-2	1	1
RF-3	0	1
RF-4	0	0

MODEL TOSW-230 & ZSDR-230



TTL LOGIC FOR ZSDR-230 & TOSW-230

TTL 1:	RF-1/OFF	RF-2/ON
TTL 0:	RF-1/ON	RF-2/OFF

SF56 REV A

In Stock . . . Immediate Delivery

low current, low voltage

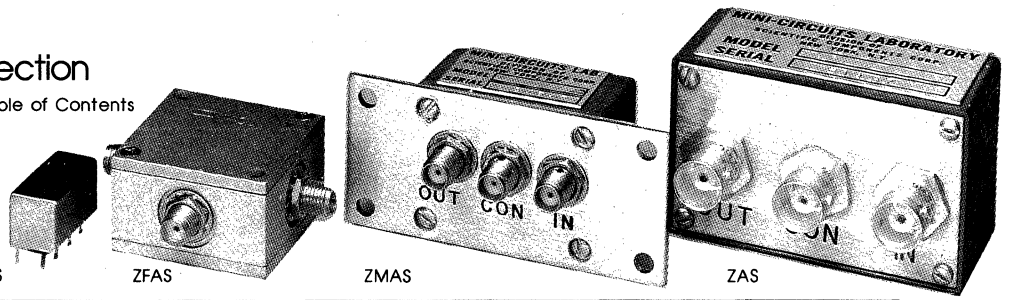
Electronic Attenuators/Switches

1.4 to 60 dB

1 MHz to 2.5 GHz

case style selection

outline drawings see Table of Contents



PAS ZFAS ZMAS ZAS

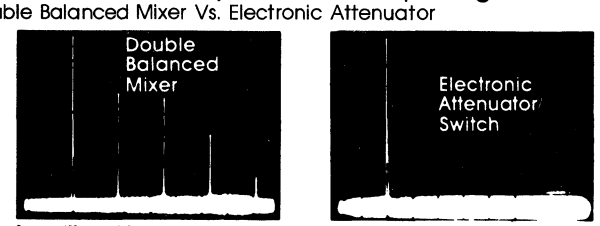
	MODEL NO.	FREQUENCY MHz IN f_L–f_U	FREQUENCY MHz CON	INSERTION LOSS dB Mid-Band m Typ.	INSERTION LOSS dB Mid-Band m Max.	INSERTION LOSS dB Total Range Typ.	INSERTION LOSS dB Total Range Max.	IN-OUT ISOLATION dB L Typ.	IN-OUT ISOLATION dB L Min.	IN-OUT ISOLATION dB M Typ.	IN-OUT ISOLATION dB M Min.	IN-OUT ISOLATION dB U Typ.	IN-OUT ISOLATION dB U Min.	IN-CON ISOLATION dB L Typ.	IN-CON ISOLATION dB L Min.	IN-CON ISOLATION dB M Typ.	IN-CON ISOLATION dB M Min.	IN-CON ISOLATION dB U Typ.	IN-CON ISOLATION dB U Min.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
PAS case A01	PAS-1	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	45	35	35	25	35	25	25	15	20	10	33.95	•	•
	PAS-2	10-1000	DC-0.05	4.0	6.0	6.5	8.5	50	40	40	30	35	25	30	20	17	10	17	10	47.95	•	•
	PAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	10	15	10	34.95	•	•
ZFAS case K18	ZFAS-15	10-2500	DC-200	3.5	4.5	3.5	7.0	20	18	35	25	30	20	19	15	28	20	20	15	99.95	•	
ZMAS case M21	ZMAS-1	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	66.95	•	
	ZMAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	10	15	10	67.95	•	
ZAS case M22	ZAS-1	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	59.95	•	
	ZAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	10	15	10	59.95	•	

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

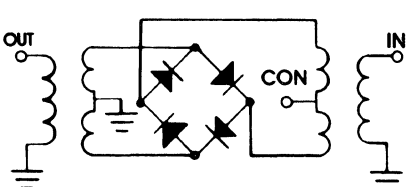
m=mid band (2f_L to f_U/2)

typical harmonic spectrum comparing attenuators

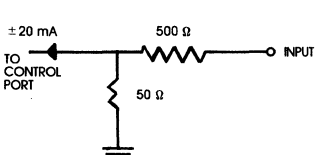
Double Balanced Mixer Vs. Electronic Attenuator



schematic



suggested control port biasing configuration



pin and coaxial connections

see case style outline drawings

Series	PAS		ZFAS	ZMAS	ZAS
Models	−1		all models	all models	all models
	−3	−2			
OUT	8	8	1	1	1
IN	1	1	2	3	3
CONTROL	*3,4	*3,4	3	2	2
GND◆	2,5,6,7	2,5,6,7	—	—	—
CASE GND	2	2,5,6,7	—	—	—

*pins 3 and 4 must be connected together externally

◆Ground externally. All measurements made with GND pin(s) grounded externally.

NSN GUIDE

MCL NO.	NSN
PAS-2	5895-01-102-0100
PAS-3	5895-01-067-3035
ZMAS-1	5895-01-140-4291

NOTES:

1. Maximum RF input power, 1 watt no damage, 100 mW operating except ZFAS-15, 1 mW. Maximum control current 20 mA.
2. Refer to Table of Contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. Prices and specifications subject to change without notice.

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF57 REV A

pin diode

Mini-Circuits

Electronic Step Attenuators

with TTL Control Inputs

0.5 to 20 dB steps, up to 35 dB attenuation
10 MHz to 1 GHz
Also available in SMA connector package



TOAT

	MODEL NO.	FREQUENCY MHz f_L	FREQUENCY MHz f_U	PRIMARY ATTN. STEPS (dB) @ TTL CONTROL PORT #1	#2	#3	MAX. ATTEN. (dB)	THRU LOSS (dB) MAX.	STEP ACCURACY (± dB) FOR STEP #1	#2	#3	VSWR L	M	U	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
TOAT	TOAT-R512	10	1000	0.5	1	2	3.5	4.0	0.2	0.25	0.25	1.6	1.4	1.5	59.95	•	•
case GQ96	TOAT-124	10	1000	1	2	4	7	4.0	0.25	0.25	0.3	1.6	1.4	1.5	59.95	•	•
	TOAT-3610	10	1000	3	6	10	19	4.0	0.3	0.4	0.4	1.6	1.4	1.5	59.95	•	•
	TOAT-51020	10	1000	5	10	20	35	4.0	0.4	0.4	0.5	1.6	1.4	1.5	59.95	•	•

L=10–100 MHz M=100–500 MHz U=500–1000 MHz

ADDITIONAL SPECIFICATIONS

DC VOLTAGE: +5V
DC CURRENT: 10 mA MAX.
RISE TIME (10% TO 90%): 6 μ SEC. MAX
DELAY TIME (50% TTL TO 90% RF): 6 μ SEC. MAX.
TTL INPUT HIGH THRESHOLD: 2V MIN.
TTL INPUT LOW THRESHOLD: 0.8V MAX.
TTL TOGGLE RATE: 100 KHz TYP.
1 dB COMPRESSION: 0 dBm
MAX. RATINGS:
INPUT POWER: 15 dBm
DC VOLTAGE: 5.5V MAX.
TTL PORT: 5.5V MAX.
OPERATING TEMPERATURE: −55° TO 100°C
STORAGE TEMPERATURE: −55° TO 125°C
LOGIC FUNCTION:
TTL HIGH ACTIVATES ASSOCIATED IN-LINE ATTENUATION
TTL LOW BYPASSES THIS ATTENUATION

NOTES:

1. STEP ACCURACY IS SPECIFIED FOR BASIC STEPS. FOR COMBINATION OF STEPS, ACCURACY IS ADDITIVE.
2. THRU LOSS IS MINIMUM ACHIEVABLE INSERTION LOSS WITH ALL ATTENUATION ELEMENTS BYPASSED (TTL CONTROL STATE 000).
3. PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
4. ALSO AVAILABLE IN SMA CONNECTOR PACKAGE. PLEASE CONSULT FACTORY FOR DETAILS.

pin connections

PIN	FUNCTION
1	TTL CONTROL #3
2	TTL CONTROL #1
3	TTL CONTROL #2
4	RF IN
11	RF OUT
12	+5V DC
5,6,7,8,9,10	CASE GROUND

features

- wide frequency band, 10-1000 MHz
- excellent step accuracy, 0.2 dB typ.
- excellent VSWR, 1.3 typ.
- low DC current, 6 mA typ.
- operates over −55° to 100°C
- small case, 0.6" dia., TO-8

TOAT-51020

STEP ATTENUATION AT TTL CONTROL STATE

FREQUENCY (MHz)	000 (dB)	100 (dB)	010 (dB)	001 (dB)	110 (dB)	101 (dB)	011 (dB)	111 (dB)
0.3	0.01	5.1	8.0	18.0	12.8	22.9	25.9	30.7
0.9	−0.02	5.0	9.7	19.8	14.7	24.9	29.2	34.3
2.9	0.00	4.8	9.7	19.9	14.5	24.7	29.4	34.3
9.0	0.00	4.9	9.9	20.0	14.8	24.9	29.9	34.9
19.0	0.00	4.9	9.9	20.0	14.9	25.0	30.0	34.9
58.0	0.00	4.9	10.0	20.0	14.9	25.0	29.9	34.9
124.0	0.00	4.9	9.9	20.0	14.9	25.0	29.9	34.9
384.0	0.00	4.9	9.9	19.9	14.8	24.8	29.7	34.7
603.0	0.00	4.9	9.9	19.8	14.8	24.8	29.7	34.7
846.0	0.00	5.0	9.9	19.8	14.9	24.8	29.8	34.8
1060.0	0.00	5.1	10.0	19.7	15.0	24.9	29.7	34.8
1242.0	0.00	5.1	9.9	19.6	15.0	24.9	29.5	34.7
1592.0	0.00	5.2	9.8	19.2	14.9	24.7	28.6	33.7
1995.0	0.00	5.3	9.6	18.9	15.0	24.6	28.1	33.4
2284.0	0.00	5.5	9.5	18.8	15.0	24.6	27.5	33.1
2500.0	0.00	5.6	9.4	18.5	15.0	24.2	27.2	32.6

THRU LOSS

FREQUENCY (MHz)	UNIT-1 (dB)
0.3	14.1
0.9	9.8
2.9	5.0
9.0	3.0
19.0	2.7
58.0	2.0
124.0	2.5
384.0	2.7
603.0	2.8
846.0	3.1
1060.0	3.1
1242.0	3.2
1592.0	3.0
1995.0	3.8
2284.0	4.1
2500.0	4.2

SF56 REV D

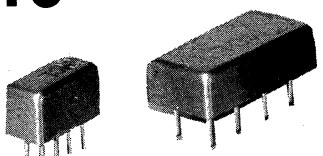
In Stock...Immediate Delivery

rugged, one-piece design

Fixed Attenuators

1 to 40 dB

DC to 1500 MHz



MAT AT

case style selection

outline drawings see Table of Contents

	MODEL NO.	FREQUENCY RANGE, MHz	ATTENUATION dB Nom.	FLATNESS, MAX. L	M	U	VSWR max. L	M	U	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
MAT	MAT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	4.45	•	•
case A11	MAT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	4.45	•	•
	MAT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	4.45	•	•
	MAT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	4.45	•	•
	MAT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	4.45	•	•
	MAT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	4.45	•	•
	MAT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	4.45	•	•
	MAT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	4.45	•	•
	MAT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	4.45	•	•
	MAT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	4.45	•	•
	MAT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	4.45	•	•
	MAT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	4.45	•	•
	MAT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	4.45	•	•
NEW	MAT-25	DC-1500	25±0.5	0.4	0.8	1.3	1.3	1.6	1.8	4.45	•	•
	MAT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	4.45	•	•
	MAT-40	DC-500	40±0.6	1.0	—	—	1.5	—	—	4.45	•	•
AT	AT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	3.65	•	•
case A04	AT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	3.65	•	•
	AT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	3.65	•	•
	■ AT-3-75	DC-500	3±0.2	0.9	—	—	2.0	—	—	3.65	•	•
	AT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	3.65	•	•
	AT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	3.65	•	•
	AT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	3.65	•	•
	■ AT-6-75	DC-500	6±0.3	1.0	—	—	2.0	—	—	3.65	•	•
	AT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	3.65	•	•
	AT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	3.65	•	•
	AT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	3.65	•	•
	AT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	3.65	•	•
	■ AT-10-75	DC-500	10±0.4	1.0	—	—	2.0	—	—	3.65	•	•
	AT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	3.65	•	•
	AT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	3.65	•	•
	■ AT-15-75	DC-500	15±0.4	0.8	1.2	—	1.5	2.0		3.65	•	•
	AT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	3.65	•	•
	■ AT-20-75	DC-500	20±0.5	1.1	—	—	2.0	—	—	3.65	•	•
	AT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	3.65	•	•
	AT-40	DC-500	40±0.6	1.0	—	—	1.5	—	—	3.65	•	•

L = DC-500 MHz M = DC-1000 MHz U = DC-1500 MHz

designers kits available

KIT NO.	MODEL TYPE	No. of Units in Kit	DESCRIPTION	PRICE $ per kit
KAT-1	AT	16	4 of each 3, 6, 10, 20 dB	39.95
KAT-2	AT	15	1 of each 1 to 40 dB	
KMAT-1	MAT	14	2 of each 3, 6, 9, 10, 12,15,20 dB	39.95
KMAT-2	MAT	16	1 of each 1 to 40 dB	

NSN GUIDE

MCL NO.	NSN
SAT-6	5985-01-237-5343
SAT-30	5985-01-190-6838

NOTES:

■ Denotes 75 ohm models, connectors available in 75 ohm BNC only.

1. For quality control procedures, environmental specifications, and Hi-Rel description see Table of Contents.
2. Absolute maximum ratings see section 1. In addition, maximum RF power
   1 watt for AT, CAT, NAT, TAT;
   ½ watt for MAT, SAT;
   ¼ watt for Terminations
3. Models are available with male/female coax connectors. For other configurations and inter-series versions consult factory. See case style outline drawings.

pin connections

see case style outline drawings

SERIES	In	Out	Ground
MAT	1	8	2,3,4,5,6,7
AT	1	8	2,3,4,5,6,7

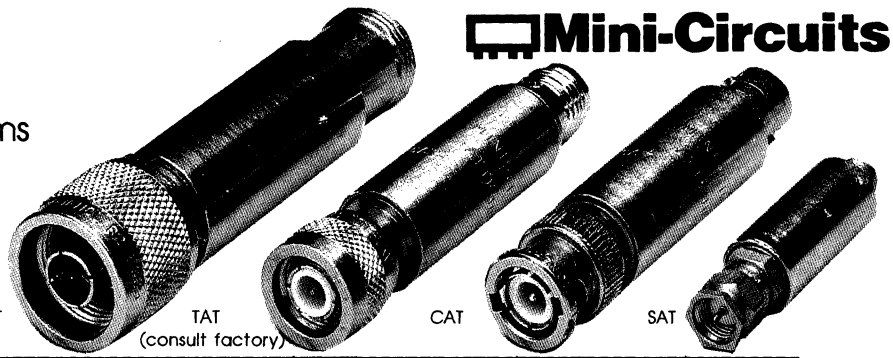
4. Prices and specifications subject to change without notice.

Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF58 REV A

Mini-Circuits

50 ohms and 75 ohms



NAT TAT (consult factory) CAT SAT

	MODEL NO.	FREQUENCY RANGE, MHz	ATTENUATION dB Nom.	Flatness, max. L	M	U	VSWR max. L	M	U	PRICE Qty. (1-9) NAT	CAT	DISTRIBUTOR FACTORY	LOCAL
	_AT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	23.95	16.95	•	•
	_AT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	23.95	16.95	•	•
	_AT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	23.95	16.95	•	•
*NAT ■	CAT-3-75	DC-500	3±0.2	0.9	—	—	2.0	—	—	—	16.95	•	•
case FF57	_AT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	23.95	16.95	•	•
	_AT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	23.95	16.95	•	•
	_AT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	23.95	16.95	•	•
■	CAT-6-75	DC-500	6±0.3	1.0	—	—	2.0	—	—	—	16.95	•	•
	_AT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	23.95	16.95	•	•
	_AT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	23.95	16.95	•	•
	_AT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	23.95	16.95	•	•
	_AT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	23.95	16.95	•	•
*CAT ■	CAT-10-75	DC-500	10±0.4	1.0	—	—	2.0	—	—	—	16.95		
case FF55	_AT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	23.95	16.95	•	•
	_AT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	23.95	16.95	•	•
■	CAT-15-75	DC-1000	15±0.4	0.8	1.2	—	1.5	2.0	—	—	16.95	•	•
	_AT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	23.95	16.95	•	•
■	CAT-20-75	DC-500	20±0.5	1.1	—	—	2.0	—	—	—	16.95	•	•
	_AT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	23.95	16.95	•	•
	_AT-40	DC-500	40±0.6	1.0	—	—	1.5	—	—	23.95	16.95	•	•

*Add prefix letter N or C to _AT where applicable

SAT	SAT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	20.95		•	•
case FF56	SAT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	20.95		•	•
	SAT-3	DC-1500	3±.02	0.3	0.6	1.0	1.3	1.5	1.7	20.95		•	•
	SAT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	20.95		•	•
	SAT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	20.95		•	•
	SAT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	20.95		•	•
	SAT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	20.95		•	•
	SAT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	20.95		•	•
	SAT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	20.95		•	•
	SAT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	20.95		•	•
	SAT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	20.95		•	•
	SAT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	20.95		•	•
	SAT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	20.95		•	•
	SAT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	20.95		•	•
	SAT-40	DC-500	40±0.6	1.0	—	—	1.5	—	—	20.95		•	•

L = DC-500 MHz M = DC-1000 MHz U = DC-1500 MHz

Terminations

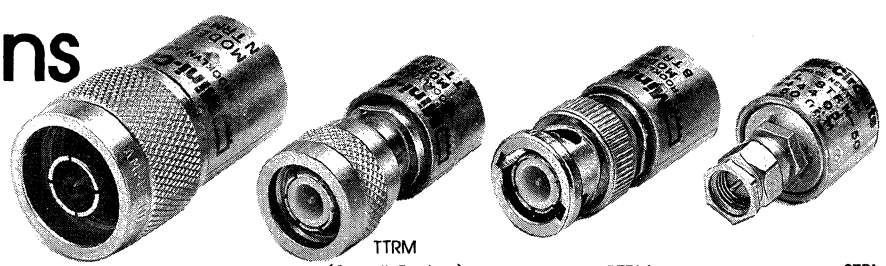
DC to 2000 MHz

50 ohms

case style selection

outline drawings see Table of Contents

For Notes see opposite page



NTRM TTRM (Consult Factory) BTRM STRM

	MODEL NO.	IMPEDANCE OHMS	FREQUENCY RANGE MHz	RETURN LOSS, dB, MIN. DC-500	DC-1000	DC-2000	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
case LL85	BTRM-50	50	DC-2000	35	30	21	8.25	•	•
	BTRM-75	75	DC-1000	30	20	—	9.95	•	•
case LL86	STRM-50	50	DC-2000	40	35	26	9.45	•	•
case LL87	NTRM-50	50	DC-2000	35	30	21	9.45	•	•

SF59 REV A

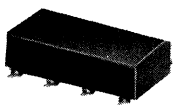
In Stock . . . Immediate Delivery

Filters, low pass

dc–1.2 GHz

case style selection

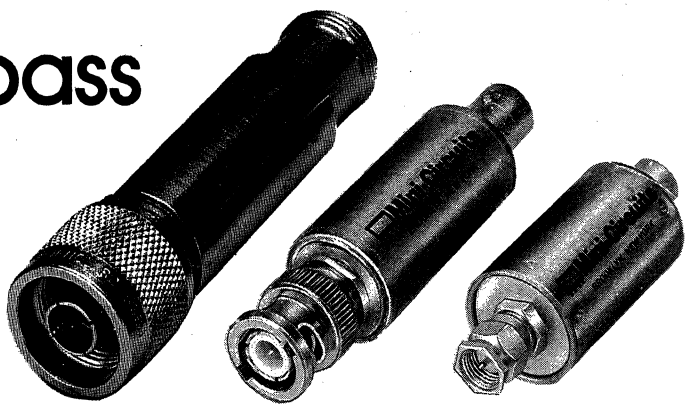
outline drawings see Table of Contents



SCLF



PLP



NLP BLP SLP

	MODEL NO.	PASSBAND, MHz (loss <1dB) Min.	fco, MHz (loss 3db) Nom.	STOP BAND, MHz (loss>20dB) Max.	(loss>40dB) Max.	Min.	VSWR, Passband Typ.	Stopband Typ.	PRICE $ Note 4 Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
	PLP-5	DC-5	6	8	10	200	1.7	18	11.45	●	●
	PLP-10.7	DC-11	14	19	24	200	1.7	18	11.45	●	●
PLP	PLP-21.4	DC-22	24.5	32	41	200	1.7	18	11.45	●	●
case A01	PLP-30	DC-32	35	47	61	200	1.7	18	11.45	●	●
	PLP-50	DC-48	55	70	90	200	1.7	18	11.45	●	●
	PLP-70	DC-60	67	90	117	300	1.7	18	11.45	●	●
	PLP-90	DC-81	90	121	157	400	1.7	18	11.45	●	●
	PLP-100	DC-98	108	146	189	400	1.7	18	11.45	●	●
	PLP-150	DC-140	155	210	300	600	1.7	18	11.45	●	●
	PLP-200	DC-190	210	290	390	800	1.7	18	11.45	●	●
	PLP-250	DC-225	250	320	400	1200	1.7	18	11.45	●	●
	PLP-300	DC-270	297	410	550	1200	1.7	18	11.45	●	●
	PLP-450	DC-400	440	580	750	1800	1.7	18	11.45	●	●
	PLP-550	DC-520	570	750	920	2000	1.7	18	11.45	●	●
	PLP-600	DC-580	640	840	1120	2000	1.7	18	11.45	●	●
	PLP-750	DC-700	770	1000	1300	2000	1.7	18	11.45	●	●
	PLP-800	DC-720	800	1080	1400	2000	1.7	18	11.45	●	●
	PLP-850	DC-780	850	1100	1400	2000	1.7	18	11.45	●	●
	PLP-1000	DC-900	990	1340	1750	2000	1.7	18	11.45	●	●
	PLP-1200	DC-1000	1200	1620	2100	2500	1.7	18	11.45	●	●
	_LP-5	DC-5	6	8	10	200	1.7	18	32.95	●	●
	_LP-10.7	DC-11	14	19	24	200	1.7	18	32.95	●	●
*BLP	_LP-21.4	DC-22	24.5	32	41	200	1.7	18	32.95	●	●
case FF55	_LP-30	DC-32	35	47	61	200	1.7	18	32.95	●	●
	_LP-50	DC-48	55	70	90	200	1.7	18	32.95	●	●
*NLP	_LP-70	DC-60	67	90	117	300	1.7	18	32.95	●	●
case FF57	_LP-90	DC-81	90	121	157	400	1.7	18	32.95	●	●
	_LP-100	DC-98	108	146	189	400	1.7	18	32.95	●	●
	_LP-150	DC-140	155	210	300	600	1.7	18	32.95	●	●
	_LP-200	DC-190	210	290	390	800	1.7	18	32.95	●	●
*SLP	_LP-300	DC-270	297	410	550	1200	1.7	18	32.95	●	●
case FF99	_LP-450	DC-400	440	580	750	1800	1.7	18	32.95	●	●
	_LP-550	DC-520	570	750	920	2000	1.7	18	32.95	●	●
	_LP-600	DC-580	640	840	1120	2000	1.7	18	32.95	●	●
	_LP-750	DC-700	770	1000	1300	2000	1.7	18	32.95	●	●
	_LP-800	DC-720	800	1080	1400	2000	1.7	18	32.95	●	●
	_LP-850	DC-780	850	1100	1400	2000	1.7	18	32.95	●	●
	_LP-1000	DC-900	990	1340	1750	2000	1.7	18	32.95	●	●
	_LP-1200	DC-1000	1200	1620	2100	2500	1.7	18	32.95	●	●

*Add prefix letter B, N, or S to _LP where applicable (see note 4)

surface mount

	MODEL NO.	PASSBAND, MHz (loss <1dB) Min.	fco, MHz (loss 3db) Nom.	STOP BAND, MHz (loss>20dB) Max.	(loss>40dB)▲ Max.	Min.	VSWR, Passband To 0.8 f_{co} Typ.	Passband To f_{co} Typ.	Stopband Typ.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
NEW!	SCLF-21.4	DC-22	24.5	32	41	200	1.3	1.7	18	11.45	●	●
SCLF	SCLF-30	DC-30	35	47	61	200	1.3	1.7	18	11.45	●	●
case YY161	SCLF-45	DC-45	55	70	90	200	1.3	1.7	18	11.45	●	●
	SCLF-135	DC-135	155	210	300	600	1.5	1.7	18	11.45	●	●
	SCLF-190	DC-190	210	290	390	800	1.5	1.7	18	11.45	●	●
	SCLF-380	DC-380	440	580	750	1800	1.5	1.7	18	11.45	●	●
	SCLF-420	DC-420	570	750	920	2000	1.5	1.7	18	11.45	●	●

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SF59 REV B

Filters, high pass

Mini-Circuits

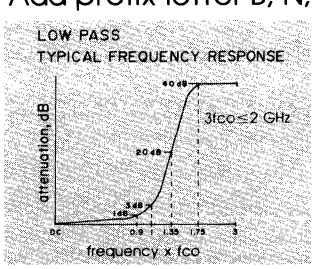
41 MHz–2.2 GHz

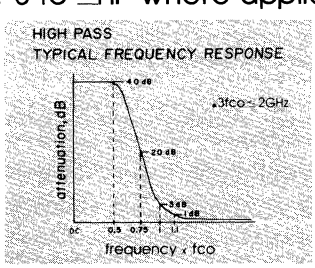


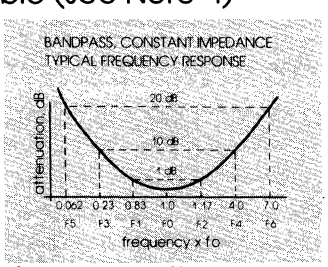
	MODEL NO.	PASSBAND, MHz (loss <1dB) Min.	Min.	fco, MHz (loss 3db) Nom.	STOP BAND, MHz (loss>20dB) Min.	(loss>40db) Min.	VSWR, Passband Typ.	Stopband Typ.	PRICE $ (Note 4) Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
PHP	**PHP-50**	41	200	37	26	20	1.5	17	14.95	•	•
case A01	**PHP-100**	90	400	82	55	40	1.5	17	14.95	•	•
	PHP-150	133	600	120	95	70	1.8	17	14.95	•	•
	PHP-175	160	800	140	105	70	1.5	17	14.95	•	•
	PHP-200	185	800	164	116	90	1.6	17	14.95	•	•
	PHP-250	225	1200	205	150	100	1.3	17	14.95	•	•
	PHP-300	290●	●1200	245	190	145	1.7	17	14.95	•	•
	PHP-400	395	1600	360	290	210	1.7	17	14.95	•	•
	PHP-500	500	1600	454	365	280	1.9	17	14.95	•	•
	PHP-600	600	1600	545	440	350	2.0	17	14.95	•	•
	PHP-700	700	1800	640	520	400	1.6	17	14.95	•	•
	PHP-800	780	2000	710	570	445	2.1	17	14.95	•	•
	PHP-900	910	2100	820	660	520	1.8	17	14.95	•	•
	PHP-1000	1000	2200	900	720	550	1.9	17	14.95	•	•
*BHP	**_HP-50**	41	200	37	26	20	1.5	17	36.95	•	•
case FF55	**_HP-100**	90	400	82	55	40	1.5	17	36.95	•	•
*NHP	**_HP-150**	133	600	120	95	70	1.8	17	36.95	•	•
	_HP-175	160	800	140	105	70	1.5	17	36.95	•	•
case FF57	**_HP-200**	185	800	164	116	90	1.6	17	36.95	•	•
	_HP-250	225	1200	205	150	100	1.3	17	36.95	•	•
*SHP	**_HP-300**	290●	●1200	245	190	145	1.7	17	36.95	•	•
case FF99	**_HP-400**	395	1600	360	290	210	1.7	17	36.95	•	•
	_HP-500	500	1600	454	365	280	1.9	17	36.95	•	•
	_HP-600	600	1600	545	440	350	2.0	17	36.95	•	•
	_HP-700	700	1800	640	520	400	1.6	17	36.95	•	•
	_HP-800	780	2000	710	570	445	2.1	17	36.95	•	•
	_HP-900	910	2100	820	660	520	1.8	17	36.95	•	•
	_HP-1000	1000	2200	900	720	550	1.9	17	36.95	•	•

• insertion loss 1.5 db max.

*Add prefix letter B, N, or S to _HP where applicable (see Note 4)







NOTES:

▲ 35 dB for SCLF-380 and SCLF-420

1. For quality control procedures, environmental specifications, and Hi-Rel description see Table of Contents.
2. Absolute maximum ratings see section 1. In addition, maximum RF power 1/2 watt.
3. Models are available with male/female coax connectors. For other configurations and inter-series versions consult factory. See case style outline drawings.
4. For N prefix add $3, S prefix add $2 to price shown.
5. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

SERIES	In	Out	Ground
PLP	1	8	2,3,4,5,6,7
PHP	1	8	2,3,4,5,6,7
PIF	1	6	2,3,4,5,7,8
SCLF	1	8	2,3,4,5,6

SF60 REV B

In Stock...Immediate Delivery

Filters, bandpass

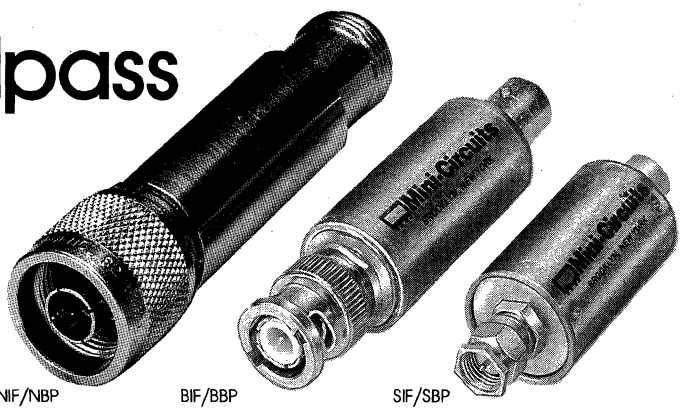
8.9 MHz to 82.0 MHz

case style selection

outline drawings see Table of Contents



PIF/PBP



NIF/NBP BIF/BBP SIF/SBP

constant impedance

MODEL NO.	CENTER FREQ. MHz	PASS BAND MHz (loss < 1 db)		STOP BAND, MHz (loss > 10 dB)		STOP BAND, MHz (loss > 20 dB)		VSWR, 1.3:1, Typ. TOTAL BAND, MHz	PRICE $ (Note 4)	DISTRIBUTOR	
		Max.	Min.	Min.	Max.	Min.	Max.			FACTORY	LOCAL
	F0	F1	F2	F3	F4	F5	F6		Qty. (1-9)		
*PIF _IF-21.4 case A01	21.4	18	25	4.9	85	1.3	150	DC-220	14.95	•	•
*BIF _IF-30	30	25	35	7	120	1.9	210	DC-330	14.95	•	•
case FF55 _IF-40	42	35	49	10	168	2.6	300	DC-400	14.95	•	•
*NIF _IF-50	50	41	58	11.5	200	3.1	350	DC-440	14.95	•	•
case FF57 _IF-60	60	50	70	14	240	3.8	400	DC-500	14.95	•	•
*SIF _IF-70 case FF99	70	58	82	16	280	4.4	490	DC-550	14.95	•	•

*Add prefix letter P, S, B or N to _IP where applicable (see note 4)

elliptic response

MODEL NO.	CENTER FREQ. (MHz)	PASSBAND I.L. 1.5 dB MAX. (MHz)	3 dB BANDWIDTH TYPICAL (MHz)	STOP BAND I.L. > 20 dB (MHz)		STOP BAND I.L. > 35 dB (MHz)		PASS BAND VSWR MAX.	STOP BAND VSWR TYPICAL	PRICE $ (Note 5)	DISTRIBUTOR	
											FACTORY	LOCAL
	f_0	f1-f2	f3-f4	f5	f6	f7	f8-f9			Qty. (1-9)		
NEW *PBP _BP-10.7 case A01	10.7	9.5-11.5	8.9-12.7	7.5	15	0.6	50-1000	1.7	16.0	18.95	•	•
_BP-21.4	21.4	19.2-23.6	17.9-25.3	15.5	29	3.0	80-1000	1.7	16.0	18.95	•	•
NEW *BBP _BP-30 case FF55	30.0	27.0-33.0	25-35	22	40	3.2	99-1000	1.7	16.0	18.95	•	•
NEW *NBP _BP-60 case FF57	60.0	55.0-67.0	49.8-70.5	44	79	4.6	190-1000	1.7	16.0	18.95	•	•
NEW *SBP _BP-70 case FF99	70.0	63.0-77.0	58.0-82.0	51	94	6.0	193-1000	1.7	16.0	18.95	•	•

*Add prefix letter P, S, B or N to _BP where applicable (see note 5)

pin connections

see case style outline drawing

SERIES	In	Out	Ground
PIF	1	6	2,3,4,5,7,8
PBP	1	8	2,3,4,5,6,7

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SF61 REV B

flat time delay

Filters, low pass

DC–1.87 GHz

Mini-Circuits

case style selection

outline drawings see Table of Contents


PBLP


NBLP BBLP SBLP

	MODEL NO.	PASSBAND, MHz (loss=1.2dB) Min.	fco, MHz (loss=3dB) Nom.	GROUP DELAY VARIATION, ns DC–fco X̄	DC–2fco X̄	DC–2.67fco X̄	VSWR DC-0.2fco X̄	DC-0.6fco X̄	STOPBAND, MHZ Loss–10dB Max.	Loss–20dB Max.	PRICE $ (See Note 6) Qty. (1–9)	DISTRIBUTOR FACTORY	LOCAL
NEW *PBLP	_BLP-39	DC–23	39	0.7	4.0	5.0	1.3	2.3	78	117	19.95	•	•
case A01	_BLP-117	DC–65	117	0.35	1.4	1.9	1.3	2.4	234	312	19.95	•	•
NEW *BBLP	_BLP-156	DC–94	156	0.3	1.1	1.5	1.3	2.3	312	416	19.95	•	•
case FF55	_BLP-200	DC–120	200	0.4	1.3	1.6	1.1	1.9	400	534	19.95	•	•
NEW *NBLP	_BLP-300	DC–180	300	0.2	0.6	0.8	1.25	2.2	600	801	19.95	•	•
case FF57													
NEW *SBLP	_BLP-467	DC–280	467	0.15	0.4	0.55	1.25	2.2	934	1246	19.95	•	•
case FF99	▲_BLP-933	DC–560	933	0.09	0.2	0.28	1.3	2.2	1866	2490	38.95	•	•
	▲_BLP-1870	DC–850	1870	0.05	0.1	0.15	1.45	2.9	3740	5000	38.95	•	•

*Add prefix letter P, B, N, or S to _SLP where applicable (see note 6)

SR62 REV B

In Stock . . . Immediate Delivery

very broadband

Directional Couplers

6 to 30 dB

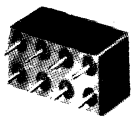
5 KHz to 2000 MHz

case style selection

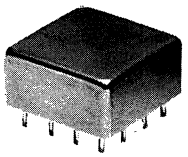
outline drawings see Table of Contents



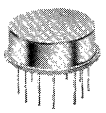
TDC



PDC



PDC-20A-5



TODC

	MODEL NO.	FREQ. MHz f_L–f_U	COUPLING dB Nom.	Flatness	MAINLINE LOSS* dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	DIRECTIVITY dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	VSWR Typ.	POWER INPUT, W L Max.	POWER INPUT, W MU Max.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
TDC	TDC-6-1	10-400	6.3±0.4	±0.4	2.0	2.4	2.0	2.4	2.0	2.5	36	30	30	25	20	15	1.5	1	2	23.95	●	●
case B02	TDC-10-1	1-400	10.0±0.5	±0.5	1.2	1.5	1.0	1.3	1.2	1.5	35	25	30	20	20	15	1.5	1	2	17.95	●	●
	TDC-10-2	5-1000	11±0.5	±0.6	1.4	1.8	1.5	1.8	1.6	2.0	50	35	25	20	20	15	1.5	0.5	0.5	25.95	●	●
PDC	PDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	13.45	●	●
◇◇	PDC-10-1BD	1-400	11.5±0.5	±0.5	0.6	0.9	0.8	1.1	0.9	1.3	55	35	35	20	22	15	1.2	2.0	4	11.45	●	●
case A01 △	PDC-10-2	250-1000	10.5±0.5	±0.6	1.4	1.6	—	—	1.6	2.0	30	25	30	20	25	15	1.5	—	5	34.45	●	●
	PDC-10-5	1-2000	10.5±0.5	±1.0	1.2	1.9	1.3	1.9	2.0	2.5	38	25	30	18	22	18	1.3	0.5	0.5	40.95	●	●
	PDC-10-6	0.005-20	11±0.5	±0.5	0.4	1.2	0.4	0.8	0.4	1.0	40	30	40	30	35	25	1.3	1.5	3	23.95	●	●
	▲ PDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.7	1.6	2	40	30	25	20	25	17	1.2	1	2	32.95	●	●
	PDC-10-22	5-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.6	1.9	35	30	25	20	25	20	1.25	1	2	23.95	●	●
	PDC-10-54	10-1500	10.5±0.5	±0.7	1.2	1.8	1.3	1.9	1.6	2.3	35	25	28	23	28	23	1.3	0.5	0.5	35.95	●	●
	PDC-15-6	0.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	23.95	●	●
	PDC-15-21	1-500	14.7±0.5	±0.6	0.7	1.1	0.7	1.1	0.8	1.2	35	30	35	30	30	23	1.4	1	2	23.95	●	●
	† PDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	23.95	●	●
◇◇	PDC-20-1BD	0.5-200	19.2±0.5	±0.5	0.3	0.5	0.3	0.5	0.4	0.6	40	30	35	20	18	22	1.1	3	5	16.95	●	●
	PDC-20-1W	10-700	19.2±0.5	±0.5	0.25	0.5	0.4	0.7	0.7	1.1	34	30	27	23	23	20	1.4	1	2	23.95	●	●
	PDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	15.95	●	●
◇◇	PDC-20-3BD	0.2-250	19.5±0.5	±0.5	0.3	0.6	0.25	0.5	0.35	0.6	47	40	40	25	30	20	1.1	1.5	4	17.95	●	●
case III145	PDC-20A-5	0.1-2000	20.0±0.5	±1.0	0.6	1.5	0.6	1.5	1.9	2.9	34	20	25	15	20	10	1.5	0.5	2	44.95	●	●
case A01	■ PDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2.0	2	4	14.95	●	●
	■ PDC-10-6-75	0.2-100	10.0±0.5	±0.2	1.2	1.6	0.9	1.2	0.9	1.3	50	30	40	25	37	25	1.5	1	2	23.95	●	●
	■ PDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	25.95	●	●
	■ PDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	20	2.0	2	4	14.95	●	●
	■ PDC-20-6-75	0.05-40	20.4±0.3	±0.25	0.1	0.25	0.1	0.2	0.1	0.3	45	35	35	20	25	18	1.2	1.5	3	23.95	●	●
TODC	TODC-10-1	10-400	11.5±0.5	±0.5	1.2	1.5	1.0	1.3	1.2	1.5	35	25	30	20	25	20	1.5	0.5	1	17.95	●	●
case QQ96																						

L=low range (f_L to 10 f_L) M=mid range (10 f_L to f_U/2) U=upper range (f_U/2 to f_U)

pin and coaxial connection

see case style outline drawing

Series	In	Out	Cpl_{in}	NOTE 6 Cpl_{out}	Case Ground	Not Used
TODC	5	8	2	—	all others	11
PDC	1	4	3	6	2,5,7,8	6
TDC	1	2	4	—	3	—
ZEDC	1	2	3	—	—	—
ZMDC	3	2	1	—	—	—
ZDC	3	2	1	—	—	—
ZFDC (except 20-4, -5)	1	2	3	—	—	—
ZFDC-20-4, -5	3	1	2	—	—	—
PDC-20A-5	9	5	12	—	1,2,3,4,6, 7,8,10,11	—

NOTES:

△ L = f_L − 2f_L, M=0

* Includes theoretical power loss at coupled port.

■ Denotes 75 ohm models, available only with 75 ohm BNC

◇ bi directional, L = 30 to 100 MHz

◇◇ bi directional

† Models PDC-20-1, ZDC-20-1, ZMDC-20-1: L=25-50 MHz, M=50-300 MHz, U=300-400 MHz

● Model ZFDC-20-5: above 1000 MHz, coupling flatness ±1.0dB

▲ Models PDC-10-21, ZFDC-10-21; Upper range coupling ±0.75dB

1. For quality control procedures, see Table of Contents.
2. For environmental specifications, see Table of Contents.
3. For connector types and case mounting options, see case style outline drawing.
4. Prices and specifications subject to change without notice.
5. All models are licensed under U.S. Patent 3,426,298.
6. Bidirectional for Model PDC-20-3BD, PDC-20-1BD.

MIL-C-15370/18, NSN GUIDE

MCL NO.	NSN	MIL-C-15370/18*
PDC-10-1	5985-01-178-4406	002
PDC-10-2		008
PDC-10-21	5985-01-130-0177	003
PDC-10-22	5985-01-190-7738	
PDC-15-6	5985-01-147-0160	009

MCL NO.	NSN	MIL-C-15370/18*
PDC-20-3	5985-01-076-8477	001
TDC-10-1	5985-01-226-3428	
ZDC-10-1-BNC	5985-01-125-3467	
ZDC-20-1	5985-01-178-4405	
ZDC-20-3-BNC	5985-01-096-5007	

MCL NO.	NSN	MIL-C-15370/18*
ZFDC-10-1	5985-01-179-5122	
ZFDC-10-2	5985-01-208-5694	
ZFDC-20-3	5985--01-146-0478	
ZFDC-20-5	5985-01-097-2192	
ZMDC-20-3	5985-01-193-8515	

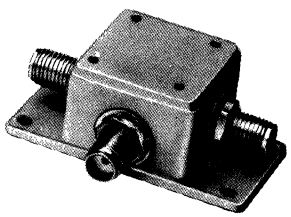
*units are not QPL listed.

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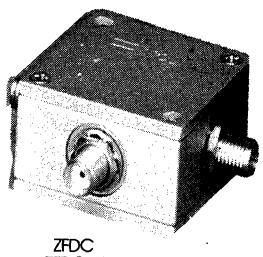
SF62 REV C

50 ohms and 75 ohms

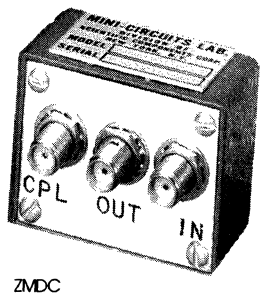
Mini-Circuits



ZEDC



ZFDC
ZFDC-H



ZMDC



ZDC

	MODEL NO.	FREQ. MHz f_L-f_U	COUPLING dB Nom.	Flatness	MAINLINE LOSS* dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	DIRECTIVITY dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	VSWR Typ.	POWER INPUT, W L Max.	M,U Max.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
ZEDC case V37	ZEDC-10-2B	1-1000	11±0.5	±0.75	1.3	1.5	1.5	1.8	1.5	1.8	35	30	30	20	18	13	1.3	1.5	3	64.95	•	
	ZEDC-15-2B	1-1000	15±0.5	±0.5	0.5	1.0	0.8	1.2	1.0	1.4	35	30	30	25	25	15	1.15	1.5	3	64.95	•	
ZFDC case K18	ZFDC-10-1	1-500	10.5±0.25	±0.6	1.0	1.3	0.8	1.1	1.0	1.3	32	25	33	25	22	15	1.2	1.5	3	44.95	•	
	ZFDC-10-2	10-1000	10.75±0.5	±0.5	1.5	2.0	1.2	1.6	1.5	2.0	35	28	30	25	27	20	1.5	1.5	3	51.95	•	
	ZFDC-10-5	1-2000	10.8±0.5	±1.0	1.2	1.9	1.2	1.8	1.8	2.5	38	25	30	18	22	18	1.3	0.5	0.5	84.95	•	
	ZFDC-10-6	0.005-20	11±0.5	±0.5	0.4	1.2	0.4	0.8	0.4	1.0	40	30	40	30	35	25	1.3	1.5	3	52.95	•	
	▲ ZFDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.7	1.6	2.0	40	30	25	20	25	20	1.2	1	2	54.95	•	
	■ ZFDC-10-1-75	1-400	10.5±0.5	±0.5	1.0	1.4	1.1	1.5	1.1	1.6	46	30	44	28	34	20	1.3	2	4	45.95	•	
	■ ZFDC-10-21-75	10-750	11±0.5	±0.75	1.5	1.8	1.5	1.9	1.7	2.1	36	30	30	20	26	20	1.4	1	2	54.95	•	
	ZFDC-10-22	1-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.4	1.9	35	30	25	20	25	20	1.25	1	2	49.95	•	
	ZFDC-15-5	1-2000	15.5±0.5	±1.0	1.0	1.8	1.2	1.8	1.3	2.3	30	20	25	20	18	11	1.3	0.5	2	71.95	•	
	ZFDC-15-6	0.03-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	49.95	•	
	■ ZFDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	49.95	•	
	ZFDC-20-3	0.2-250	19.5±0.5	±0.25	0.35	0.6	0.25	0.5	0.35	0.6	36	25	33	25	25	20	1.2	1.5	4	44.95	•	
	■ ZFDC-20-3-75	10-250	19.3±0.5	±0.3	0.25	0.4	0.3	0.5	0.4	0.6	29	25	29	25	28	24	1.2	1	2	49.95	•	
	ZFDC-20-4	1-1000	19.5±0.5	±0.5	1.2	1.5	0.6	0.8	1.2	1.5	36	28	27	20	23	18	1.1	.5	2	64.95	•	
	● ZFDC-20-5	0.1-2000	19.5±0.5	±0.5	0.3	1	0.7	1.4	1.5	2.3	30	20	27	20	22	10	1.2	.5	2	84.95	•	
	■ ZFDC-3375	0.2-200	30.5±0.5	±0.6	0.5	0.8	0.6	0.9	0.7	1.0	30	25	25	20	19	15	1.6	.5	2	45.95	•	
ZFDC-H case J17	◇ ZFDC-20-1H	30-400	20.5±0.5	±0.4	0.15	0.4	0.15	0.4	0.3	0.4	30	25	30	25	30	23	1.2	25	25	58.95	•	
ZMDC case M21	ZMDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	49.95	•	
	△ ZMDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	59.95	•	
	ZMDC-15-6	.01-35	15±0.5	±0.5	0.4	0.6	0.2	0.4	0.4	0.6	38	30	35	25	28	20	1.15	2	4	59.95	•	
	† ZMDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	59.95	•	
	ZMDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.5	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	49.95	•	
	ZMDC-30-1	0.1-250	30±0.5	±0.5	0.4	0.6	0.5	0.8	0.55	0.85	23	18	20	15	17	10	1.5	1.0	3	51.95	•	
ZDC case M22	ZDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	44.95	•	
	△ ZDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	25	—	—	20	15	1.5	—	4	51.95	•	
	ZDC-15-2	0.5-250	15±0.5	±0.5	0.8	1.2	0.7	1.0	0.9	1.2	32	28	32	28	32	28	1.4	1.5	3	51.95	•	
	ZDC-15-6	.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	51.95	•	
	† ZDC-20-1	25-400	20±0.5	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	51.95	•	
	ZDC-20-3	0.2-250	19±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	44.95	•	
	■ ZDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	44.95	•	
	■ ZDC-15-6-75	.02-35	14.5±0.5	±0.6	0.3	0.6	0.2	0.4	0.4	0.6	35	30	35	25	28	20	1.5	2	4	52.95	•	
	■ ZDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	20	2	2	4	45.95	•	
	■ ZDC-2375	50-100	10.5±0.3	±0.2	—	—	—	—	1.1	1.3	—	—	—	—	35	30	1.3	—	4	52.95	•	
	■ ZDC-20-3-75-1	55-90	18.6±0.5	±0.3	0.4	0.6	0.4	0.6	0.4	0.6	35	30	35	30	35	30	1.2	—	4	52.95	•	

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

PDC-10-1 typical production unit / for data of other models consult factory

FREQUENCY (MHz)	MAINLINE LOSS (dB)	COUPLING (dB)	DIRECTIVITY (dB)	VSWR IN	VSWR OUT	VSWR CPL
.50	.73	11.17	37.21	1.11	1.13	1.09
26.789	.62	11.50	36.92	1.10	1.13	1.06
53.078	.66	11.49	36.96	1.09	1.13	1.08
105.656	.72	11.52	36.48	1.06	1.14	1.09
158.234	.74	11.52	35.07	1.04	1.14	1.12
210.812	.81	11.60	32.60	1.02	1.15	1.12
263.39	.84	11.59	30.32	1.01	1.15	1.12
315.968	.92	11.56	27.36	1.01	1.15	1.13
368.546	.95	11.50	24.22	1.01	1.15	1.15
421.124	1.02	11.49	21.84	1.01	1.14	1.17
500.00	1.12	11.43	18.71	1.01	1.12	1.22

In Stock . . . Immediate Delivery

SF63 REV A

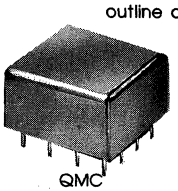
wideband, 360° in 90° steps

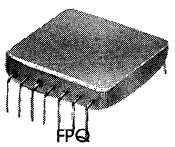
Phase Modulators

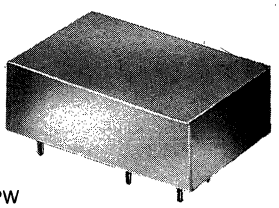
QPSK

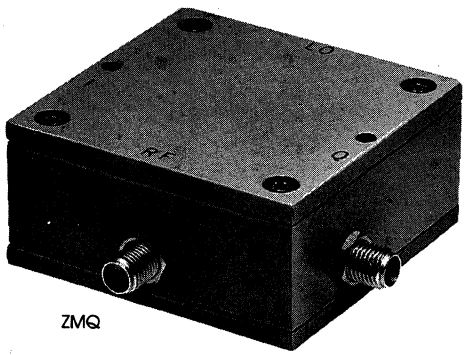
case style selection

outline drawings see Table of Contents


QMC


FPQ


PMQPW
PMQ


ZMQ

MODEL NO.	FREQ. (MHz)	INSERTION LOSS dB TYP.	INSERTION LOSS dB MAX.	AMPLITUDE UNBAL., dB TYP.	AMPLITUDE UNBAL., dB MAX.	PHASE UNBAL., DEG (±) TYP.	PHASE UNBAL., DEG (±) MAX.	1 dB COMPRESSION dBm TYP	VSWR TYP. IN	VSWR TYP. OUT	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	DISTRIBUTOR LOCAL
QMC QMC-100	50-100	5.6	7.5	0.2	0.8	3	6	4	1.5:1	1.9:1	128.95	●	
case C07 QMC-170	90-170	5.6	7.5	0.3	0.8	3	6	4	1.3:1	1.5:1	128.95	●	
PMQ PMQ-94	47-94	5.5	7.0	0.4	1.2	3	5	4	1.7:1	1.7:1	119.95	●	
case AAA118 PMQ-330	200-330	5.8	8.0	0.4	1.5	3	6	4	1.5:1	1.5:1	119.95	●	
PMQ-440	240-440	5.9	8.0	0.5	1.8	3	7	4	1.5:1	1.5:1	119.95	●	
PMQ-850	800-900	6.8	9.0	0.4	1.0	3	7	4	1.5:1	1.5:1	119.95	●	
FPQ FPQ-76	60-90	5.4	7.0	0.1	0.9	2	5	4	1.5:1	1.7:1	149.95	●	
case FFF122 FPQ-331	205-331	6.0	8.0	0.6	1.5	3	6	4	1.4:1	1.7:1	149.95	●	
FPQ-440	240-440	6.2	8.0	0.5	1.5	4	6	4	1.4:1	1.7:1	149.95	●	
FPQ-475	421-475	6.8	8.0	0.8	1.5	3	6	4	1.7:1	1.7:1	149.95	●	
*PMQPW PMQPW-150	30-150	6	10.5	0.4	0.9	3	8	4	2:1	2:1	172.95	●	
case AAA118 PMQPW-250	50-250	6.5	10.5	0.5	1.2	3	8	4	1.7:1	1.4:1	172.95	●	
ZMQ ZMQ-850	800-900	6.8	9.0	0.4	1.0	3	7	4	1.5:1	1.5:1	169.95	●	
case HHH141													

NOTES:
1. All data taken @ control current ±20 mA
2. Control ports drive with 50 ohms source.

* Protected under Patent No. 4,673,898

features

- octave & multi-octave bandwidth
- good phase & amplitude balance
- hermetically sealed metallic enclosure with bent leads or plug-in version.
- capable of meeting MIL-M-28837 requirements

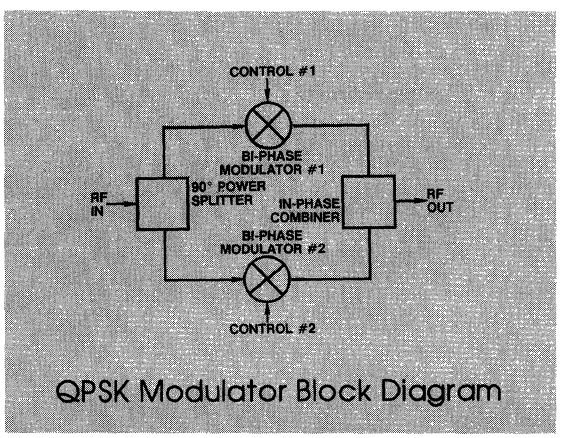
PHASE SHIFT VS. CONTROL CURRENT

CONT.-1 (mA)	CONT.-2 (mA)	PHASE SHIFT (Deg.)
+20	+20	0 (REF)
+20	−20	90
−20	−20	180
−20	+20	270

pin configuration

Series	QMC	PMQ & PMQPW	FPQ	ZMQ
RF IN	13	8	1	3
RF OUT	1	4	8	1
CONTROL-1	5	2	5	4
CONTROL-2	8	6	10	2
GND◆	9,12,16	—	—	
CASE GND	3,4,6,7,10 11,14,15	1,3,5,7	2,3,4,6,7,9 11,12,13,14	
NOT USED	2	—	—	

◆ Ground externally. All measurements made with GND pin(s) grounded externally.



QPSK Modulator Block Diagram

maximum ratings:

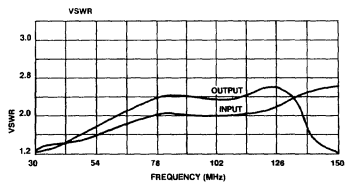
Input Power	100 mW
Control Current	+40 mA
Temperature	−55°C to 100°C

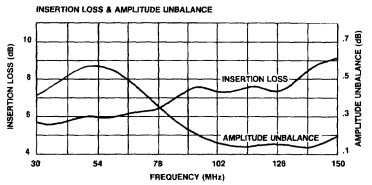
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FAX (718) 332-4661 TELEX 6852844 or 620156

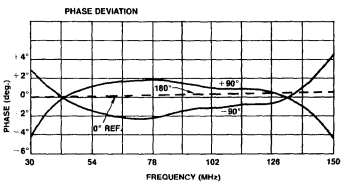
SF64 REV A

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PMQPW-150

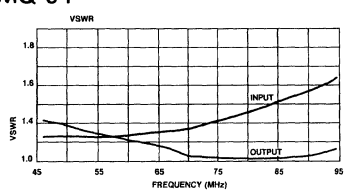


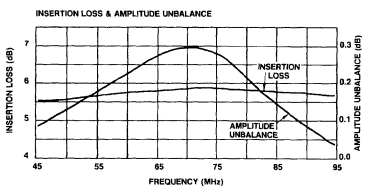


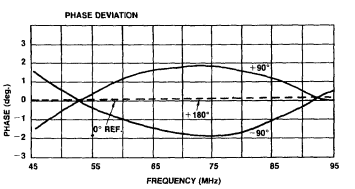


FREQUENCY (MHz)	VSWR In	VSWR Out	Insertion Loss (dB)	Unbalance (dB)	0°	90°	180°	−90°
30	1.30	1.26	5.6	.4	0	86.2	180.02	−93.2
54	1.60	1.75	5.9	.55	0	91.5	180.03	−88.5
90	2.05	2.40	7.4	.23	0	91.6	180.16	−88.4
126	2.25	2.60	7.3	.14	0	90.8	180.30	−89.5
150	2.60	1.25	8.9	.18	0	86.2	180.35	−94.40

PMQ-94

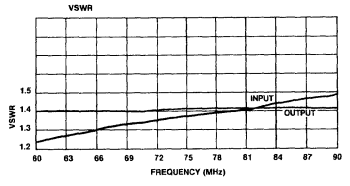


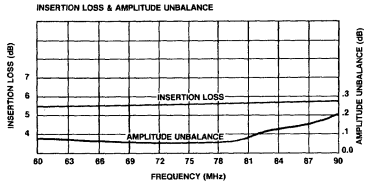


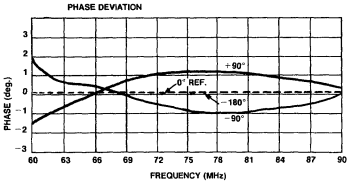


FREQUENCY (MHz)	VSWR In	VSWR Out	Insertion Loss (dB)	Unbalance (dB)	0°	90°	180°	−90°
47.05	1.27	1.43	5.53	.09	0.00	87.80	180.01	−92.43
55.75	1.28	1.32	5.69	.18	−.03	90.97	180.03	−89.30
70.00	1.36	1.14	5.83	.29	−0.00	93.51	180.09	−86.80
85.75	1.66	1.11	5.74	.14	−.01	92.18	180.12	−88.15
94.00	1.86	1.16	5.71	.04	.01	89.56	180.15	−90.82

FPQ-76

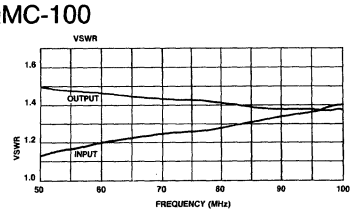


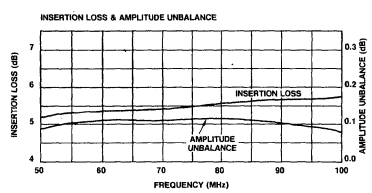


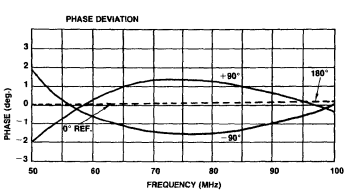


FREQUENCY (MHz)	VSWR In	VSWR Out	Insertion Loss (dB)	Unbalance (dB)	0°	90°	180°	−90°
60	1.26	1.40	5.40	.08	0	88.65	180.10	−91.7
66	1.32	1.41	5.40	.07	0	90.0	180.13	−90.4
75	1.38	1.41	5.50	.06	0	91.2	180.14	−89.2
84	1.45	1.41	5.58	.13	0	90.9	180.18	−89.5
90	1.49	1.41	5.64	.20	0	90.3	180.20	−90.1

QMC-100







FREQUENCY (MHz)	VSWR In	VSWR Out	Insertion Loss (dB)	Unbalance (dB)	0°	90°	180°	−90°
50.00	1.15	1.50	5.24	.06	−.02	86.06	180.20	−93.90
60.00	1.20	1.47	5.36	.13	−.02	90.71	180.27	−89.30
75.00	1.26	1.44	5.50	.17	−.04	92.46	180.30	−87.48
90.00	1.34	1.40	5.66	.11	−.03	91.36	180.37	−88.49
100.00	1.40	1.38	5.74	.07	−.04	89.80	180.40	−89.97

SF65 REV A

In Stock...Immediate Delivery

highest figure of merit

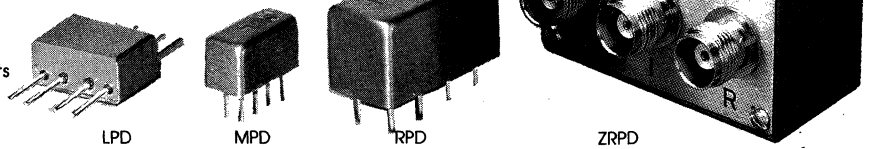
Phase Detectors

1000mV DC output, +7dBm RF

LEVEL 10 (+10 dBm LO, up to +5 dBm RF)

case style selection

outline drawings see Table of Contents



LPD case BB48 | MPD case A11 | RPD case A01 | ZRPD

description

These new high efficiency phase detectors are the only units in the world offering a figure-of-merit greater than 125.

The figure-of-merit M or efficiency of a phase detector can be defined as the ratio of maximum DC output voltage (in mV) divided by the RF power (in dBm). The maximum DC output from these units is 1000 mV with +7 dBm applied to the LO and RF ports, and DC offset is typically 400 microvolts. Thus, its figure-of-merit M is 143, which indicates a highly efficient phase detector. For comparison, a double-balanced mixer used as a phase detector offers 350 mV DC output with the same LO and RF inputs for a figure-of-merit M of 50.

Both the RPD and MPD are packaged in a hermetically-sealed EMI-shielded metal case. The miniature RPD measures 0.4 × 0.8 × 0.4 in. and the micromin MPD only 0.2 × 0.5× 0.25 in.

So when your system requires a high output phase detector, specify the new RPD or MPD series.

NOTES:

1. Maximum RF input power, 50 mW, peak IF current, 20mA.
2. Refer to section 1 for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.

cost (1-9)

RPD-1	$18.45	MPD-1	$21.45	LPD-1	$26.45	MPD-21 NEW	$26.95
RPD-2	$20.95	MPD-2	$24.95	ZRPD-1	$57.95		

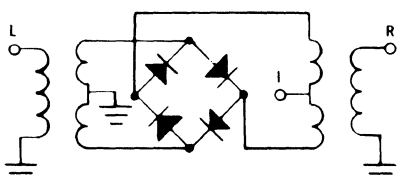
specifications

	LPD-1 MPD-1 RPD-1 **ZRPD-1	RPD-2	MPD-2	MPD-21
FREQUENCY RANGE (MHz):				
L and R ports	1–100	5–150	10–200	50–400
Output port	DC–50	DC–50	DC–50	DC–50
SCALE FACTOR (mV/degree)	8	8	8	7
IMPEDANCE (ohms)				
L and R port	50	50	50	50
I port	500	500	500	500
L and R SIGNAL LEVELS	+7dBm	+7dBm	+7dBm	+7dBm LW* U*
ISOLATION, L–R, min.	40 dB	40 dB	40 dB	40 30
MAX. DC OUTPUT (mV)				
Typ.	1000	1000	1000	800
Min.	750	750	750	600
OUTPUT POLARITY (L and R in-phase)	neg	neg	neg	
DC OUTPUT OFFSET (mV)				
Typ.	0.2	0.3	0.3	0.5
Max.	1	1	1	1
FIGURE-OF-MERIT, M	143 typ.	143 typ.	143 typ.	120 typ.

**See case M22 for outline drawing.

*LW = 50–200 MHz. U = 200–400 MHz.

schematic



pin connections

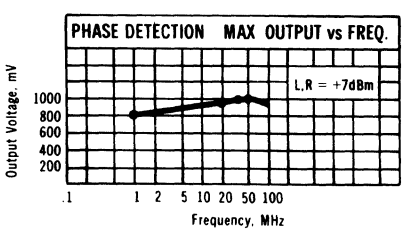
see case style outline drawing

Series		RPD	MPD	LPD
REF.	L	8	8	8
RF in:	R	1	1	5
DC out:	I	*3,4	*3,4	4
GND♦		2,5,6,7	2,5,6,7	1,2,3,6,7
CASE GND.		2	2	1,2,3,6,7

♦Ground externally. All measurements made with GND pin(s) grounded externally.

*pins must be externally connected together.

Model RPD-1



Mini-Circuits P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500
FAX (718) 332-4661 TELEX 6852844 or 620156

SF68 REV A

broadband, minimal phase change

Mini-Circuits

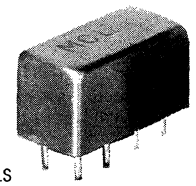
Limiters

50 ohms

+3 to +10 dbm input

case style selection

outline drawings see Table of Contents



PLS

	MODEL NO.	FREQUENCY MHz F_L F_U	INPUT dbm Min.	Max.	*OUTPUT dBm Typ.	CONTROL CURRENT (mA) Typ.	LIMITING Input range, Δ Output/Δ 1db Input dBm	amp, dB	phase, deg.	PRICE $ Qty. (1-9)	DISTRIBUTOR FACTORY	LOCAL
PLS case A01	PLS-1	0.1-150	6	20	−4.0	3	6 to 10 10 to 16 16 to 20	0.1 0.15 0.15	0.8 0.8 0.7	22.95	•	•
	PLS-2	100-900	3	15	−5.0	5	3 to 8 8 to 12 12 to 15	0.2 0.4 0.4	2.0 2.0 2.0	22.95	•	•
	PLS-6	0.003-1	6	20	3.0	5	6 to 10 10 to 16 16 to 20	0.2 0.1 0.2	1.0 1.0 1.5	35.95	•	•

*Typical output level at typical control current. Level may be changed by varying current.

pin connections

see case style outline drawing

Series	PLS		
Model	−1	−2	−6
INPUT	1	1	1
OUTPUT	8	8	8
CONTROL	*3,4	*3,4	*3,4
GND◆	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND.	2	2,5,6,7	—

*Pins must be externally connected together.
◆Ground externally. All measurements made with GND pin(s) grounded externally.

NOTES:
1. Maximum RF input power, 100mW. Maximum control current, 10 mA.
2. Refer to Table of Contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.

NSN GUIDE

MCL NO.	NSN
PLS-1	5895-01-105-7820

PLS-1 LIMITING

CAPD

computer-automated performance data

typical production unit / for data of other models consult factory

MHz	Output (20 dBm IN)	Output (16 dBm IN)	Output (10 dBm IN)	Output (6 dBm IN)	Delta, Out (20 to 16 dBm IN)	Delta, Out (16 to 10 dBm IN)	Delta, Out (10 to 6 dBm IN)
.100	−1.36	−1.47	−1.77	−2.15	.11	.30	.38
7.990	− .77	−1.02	−1.28	−1.68	.25	.26	.37
15.880	− .81	− .97	−1.35	−1.65	.16	.38	.30
23.769	− .79	− .95	−1.35	−1.64	.16	.40	.29
31.658	− .77	− .94	−1.38	−1.54	.17	.44	.16
39.547	− .71	− .93	−1.34	−1.47	.22	.41	.13
47.437	− .86	−1.08	−1.41	−1.46	.22	.33	.05
55.327	− .88	−1.03	−1.40	−1.73	.15	.37	.33
63.217	− .86	−1.05	−1.48	−1.63	.19	.43	.15
71.105	−1.02	−1.01	−1.42	−1.78	−.01	.41	.36
78.995	−1.05	−1.05	−1.37	−1.57	0.00	.32	.20
86.884	− .95	−1.08	−1.49	−1.78	.13	.41	.29
94.775	− .98	−1.12	−1.40	−1.73	.14	.28	.33
102.661	−1.06	−1.15	−1.50	−1.59	.09	.35	.09
110.551	−1.14	−1.29	−1.58	−2.32	.15	.29	.74
118.440	−1.09	−1.19	−1.58	−1.98	.10	.39	.40
126.330	−1.03	−1.21	−1.53	−1.65	.18	.32	.12
134.221	−1.10	−1.31	−1.59	−2.28	.21	.28	.69
142.111	−1.19	−1.44	−1.70	−1.98	.25	.26	.28
150.000	−1.16	−1.47	−1.72	−2.07	.31	.25	.35

REMARK: Control Current: 5.6 mA

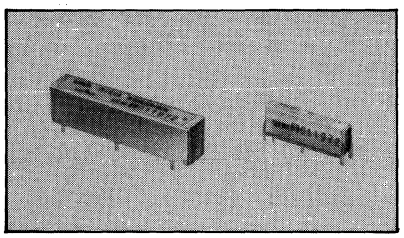
SF51 REV A

In Stock...Immediate Delivery

dielectric resonator-based products

MURATA ERIE NORTH AMERICA

DUPLEXERS

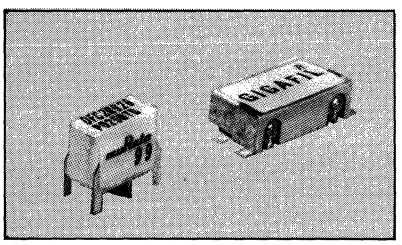


Murata Erie offers a complete selection of dielectric resonator-based Duplexers. Three versions are included—standard, separated pair and separated.

FEATURES

- Low insertion loss thru the use of dielectric resonators.
- Small and light
- Excellent temperature stability thru temperature compensated dielectric constant (0 ± 5ppm/°C max.)
- Excellent mechanical stability
- High power ratings

FILTERS

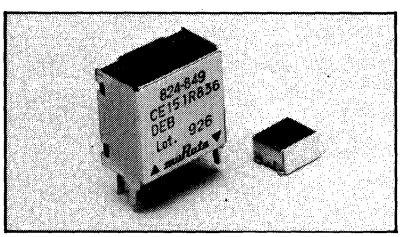


Murata Erie offers a wide selection of dielectric resonator-based filters (Gigafils®) specifically designed for telecommunications application.

FEATURES

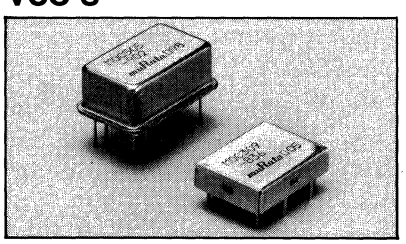
- Extremely low insertion loss
- Surface mount units available
- Small size and light weight
- Excellent temperature and mechanical stability
- Low VS WR

ISOLATORS



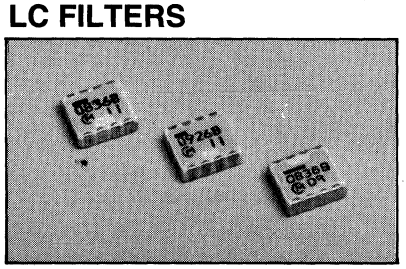
Murata Erie microwave isolators feature small size for surface mounting combined with excellent electrical performance. Typical isolation is 12 dB within insertion loss of 0.9 dB. Power ratings 2.5 to 10W depending on model.

VCO'S



Compact VCO's designed for mobile communications applications are included in the Murata Erie line of dielectric resonator-based products. These devices are designed for local oscillator use in the high MHz ranges and offer excellent mechanical and frequency stability invert compact packages.

LC FILTERS



A new line of diminutive surface mount LC Filters designed for applications from 750 MHz to 1.16Hz is now available form Murata Erie. They measure just 5.7 mm × 5 mm × 2 mm including integral metal shielding. They require no adjustments and are supplied on tape and reel for auto-placement.

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

EW and ATE designers...

Digitally controlled noise sources with variable bandwidth & frequency to 18 GHz



- ***Streamline the design of high-power noise jammers***
- ***Improve performance of ATE systems***
- ***Speed up testing of communications channels***
- ***Improve intermodulation testing and spurious testing of frequency converters***

Noise Com's NCS-4100 Series noise sources have the unique ability to deliver white noise output that is variable over bandwidth and frequency in increments of 500 kHz from 500 MHz to 18 GHz. Bandwidth and optionally center frequency are varied by TTL digital control.

The power spectral density of an NCS-4100 increases with a given output power by 1 dB for each 20 percent reduction in bandwidth. The bandwidth can be up to 20 percent of the center frequency. Output is at least +10 dBm with flatness of ±0.5 dB over bandwidths up to 10% of the center frequency, and ±1.0 dB up to 20% of center frequency.

The NCS-4100 is available in MIL-E-5400-grade subsystem form or as a programmable bench instrument. Options include custom electrical specifications, IEEE-488 bus control, attenuators, switched outputs, and customer-specified modifications.

Noise Com's versatile NCS-4100 Series noise sources can make a big improvement in the performance of your system. To find out more, call **Gary Simonyan** at (201) 261-8797.

Specifications

Center frequencies	500 MHz to 18 GHz (user specified)
Bandwidth (3 dB)	0 (CW) to 20% of center frequency
Bandwidth increments	16 user-specified increments from 500 kHz (up to 256 increments available as option)
Output power	+10 dBm
Flatness	±0.5 dB to 10% bandwidth ±1.0 dB to 20% bandwidth
Harmonic suppression	−20 dBc (optionally −60 dBc)
Control	Digital TTL control of bandwidth (optionally center frequency)
Response time	Less than 200 ns

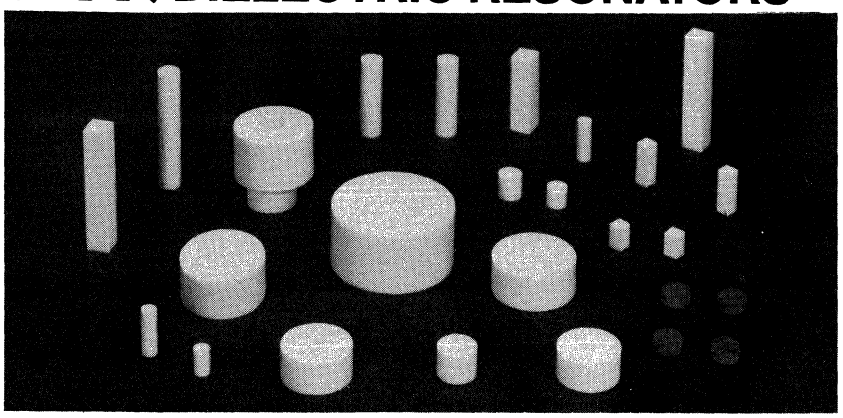
NOISE/COM

E. 64 Midland Avenue, Paramus, New Jersey 07652
(201) 261-8797 • FAX: (201) 261-8339 • TWX: 910-380-8198

NTK TECHNICAL CERAMICS

NGK SPARK PLUGS (U.S.A.), INC.
99 Morris Ave., Springfield, NJ 07081 Phone: (201) 376-6070
CHICAGO OFFICE Telephone: (708) 824-1133, 1200 Business Center Dr., Suite 300, Mount Prospect, IL 60056
CALIFORNIA OFFICE Telephone: (408) 727-5180, 3255-2 Scott Blvd., Suite 101, Santa Clara, CA 95054

NTK DIELECTRIC RESONATORS

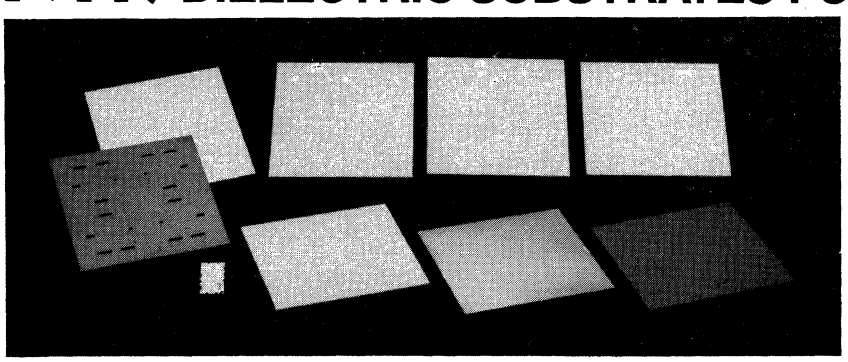


FEATURES
- High Q
- Broad range of dielectric constant
- Optional T.C.'s
- Optional T.C. tolerances

APPLICATIONS
- DRO
- Filter

Characteristics / Notation	A	F	K	O
Relative dielectric constant K	12.6	34	93	6.2
Temp. coeff. of freq. π f (ppm/°C)	+10	0 ~ +10	+4	−45
Q (= 1/tan δ) (Measurement frequency)	18000 (13GHz)	8000 (8GHz)	2100 (2.3GHz)	1000 (7GHz)
Volume resistivity (Ω•cm) (25°C)	1.1×10^{14}	1.1×10^{13}	7.6×10^{14}	5×10^{15}
Linear expansion coeff. (ppm/°C) (30 ~ 400°C)	7.6	9.5 ~ 11	10.2	3.0
Density (g/cm^3)	3.93	4.5	5.6	2.56
Bending strength (kg/cm^2)	3900	1500	1500	1700
Thermal conductivity (cal/cm-sec.°C)	0.06	0.0044	0.0039	0.0060
Water absorption (%)	<0.01	<0.01	<0.01	<0.01

NTK DIELECTRIC SUBSTRATES FOR MICROWAVE USE



FEATURES
- Surface finish to .2 microns
- Available with plating
- High Q
- Excellent uniformity
- Wide range of available thickness

APPLICATIONS
- Microwave substrates
- Precision capacitors
- Stripline filters

Shape		Material	Dielectric constant K	Temperature coefficient of capacitance (ppm/°C)	Q (= 1/tan δ) Measured frequency	Linear expansion coefficient (ppm/°C)
A ± 0.2 (m/m)	T ± 0.02 (m/m)					
20 ~ 60	0.2 ~ 2.5	A	12.6	0 ± 30	18000 (13GHz)	7.6
		F	35.8		8000 (8GHz)	9.5
		K	93		1500 (2.7GHz)	10.0

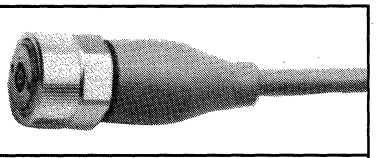
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

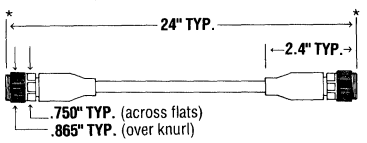
Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
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Military Qualified Products List **B**•1002
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Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

QMI. When quality and performance really count!

TS7878 TEST PORT EXTENSION CABLES (DC-6GHZ)



TS7878 STS



*MECHANICAL AND ELECTRICAL REFERENCE PLANE

APPLICATIONS

Replaces OEM assemblies that are used to extend the test ports on the following Hewlett-Packard S-Parameter Test Sets: HP8503A, HP85046A, HP85047A, HP8745A, and HP8748A. Used with the following Hewlett-Packard Network Analyzers: HP8505A, HP8507S, HP8753A, AND HP8754A. Also used with the Hewlett-Packard HP85044A T/R Test Set.

How to Order:
Standard configurations may be ordered by specifying the QMI model number. For other lengths and connectors, as well as additional application information, contact QMI or your local QMI representative.

MODEL NUMBER

TS7878-STS
Two 61cm (24-inch) assemblies with 7mm connectors. Phase matched to a laboratory standard to within ±2° at 2.0 GHz. Equivalent to HP Catalog No. HP11857D (Cable Part NO. 8120-4779).

TS7878-24
One 61cm (24-inch) assembly with 7mm connectors. Other characteristics as above.
Used with the following HP equipment:

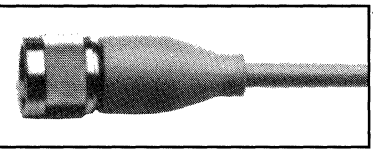
S-Parameter Test Sets	Network Analyzers	T/R Test Sets
HP8503A	HP8505A	HP85044A
HP85046A	HP8507A	
HP85047A	HP8753A	
HP8745A	HP8754A	
HP8748A		

MECHANICAL AND ELECTRICAL PERFORMANCE CHARACTERISTICS

Connectors 7MM	Outer Conductor	Gold Plated Beryllium Copper	Cable Electrical	Nominal Capacitance	29.4 pf/ft.
	Center Contact	Gold Plated Beryllium Copper		Propagation Velocity	70.7%
	Mating Dimensions	I.A.W. IEEE STD 287		Attenuation (nom.)	.37 db/ft. at 6 GHz
	Cable Attachment System	Tri-system, including solder-clamp, epoxy potting & strain relief	Assembly Electrical	Frequency Range	DC to 6 GHz
				Impedance (nom.)	50 ohms
	Maximum Voltage Rating	1000 volts RMS		VSWR (max.)	1.10:1, 0 to 3 GHz 1.16:1, 3 to 6 GHz
Cable Mechanical	Dielectric Material	Solid PTFE			
	Outer Jacket	.240 diameter gray PVC		Isolation (min.)	110 dB between two parallel touching cables
	Bend Radius	1.5" min. (static) 3.0" min. (dynamic)		Phase Stability[1]	0.3°/GHz typical
				VSWR Stability	1.01:1.0 typical
				Insertion Loss Stability	0.01 dB typical

[1] Tested by bending the cable ten times at angles from +90° through straight to −90° back to straight using a three-inch radius.

TS1818 ANALYZER CABLE ASSEMBLIES (DC TO 6GHz)



APPLICATIONS

Replaces OEM assemblies used to connect the HP8753B or other Network Analyzers to S-Parameter Test Sets, the HP8754A to the HP85044A/A Transmission/Reflection Test Set, and the HP11850C/D Power Splitter to the HP85044A/B Transmission/Reflection Test Set. The TS1818 series is also appropriate for similar applications.

MODEL NUMBER

TS1818-07
190 mm (7.5 inch) with precision Type N male connectors. Used as the interconnects between the HP8753B or other Network Analyzers and the S-Parameter Test Set.

TS1818-24
(Combine three TS1818-24s and one TS1818-34 for an equivalent HP11851B RF Cable Set).
610 mm (24 inch) with precision Type N male connectors. Used as the interconnects between the HP85044A/B Transmission/Reflection Test Set and the HP11850C/D Power Splitter.
Also used to connect the HP8754A Network Analyzer to the HP85044A/B Transmission/Reflection Test Set.

TS1818-34
(Combine one TS1818-34s and three TS1818-24's for an equivalent HP11851B RF Cable Set).
860 mm (34 inch) with precision Type N male connectors. Used as the interconnects between the HP85044A/B Transmission/Reflection Test Set and the HP11850C/D Power Splitter.
Also used to connect the HP8754A Network Analyzer to the HP85044A/B Transmission/Reflection Test Set.

How to Order:
Standard configurations may be ordered by specifying the QMI model number. For other lengths and connectors, as well as additional application information, contact QMI or your local QMI representative.

MECHANICAL AND ELECTRICAL PERFORMANCE CHARACTERISTICS

Connectors	Shell Assembly Finish	Passivated stainless steel	Cable Electrical	Nominal Capacitance	29.4 pf/ft.
	Center Contact	Gold plated Beryllium Copper		Propagation Velocity	70.7%
	Mating Dimensions	I.A.W. MIL-STD-348[1]		Attenuation (nom.)	.37 db/ft @ 6 GHz
	Cable Attachment System	Tri-system, including solder-clamp, epoxy potting & strain relief	Assembly Electrical	Frequency Range	DC to 6 GHz
				Impedance (nom.)	50 ohms
	Maximum Voltage Rating	1000 volts RMS		VSWR (max.)	1.13:1.0, 0 to 3 GHz, 1.17:1.0, 3 to 6 GHz
Cable Mechanical	Dielectric Material	Solid PTFE			
	Outer Jacket	.240 diameter gray PVC		Isolation (min.)	80 db, two parallel touching cables
	Bend Radius	1.5" min. (static) 3.0" min. (dynamic)		Phase Stability[2]	0.3°/GHz typical
				VSWR Stability[2]	1.01:1.0 typical
				Insertion Loss Stability	0.01 db typical

[1] Connector Interface Requirement for MIL-C-39012. [2] Tested by bending the cable ten times at angles from +90° through straight to −90° back to straight using a three-inch radius.

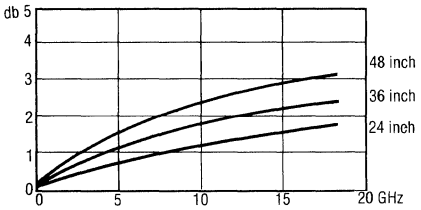
301 Ballardvale Street, Wilmington, MA 01887
Tel. 508/988-9090 FAX 508/988-9393
Quality Microwave Interconnects Inc.

Extension test port laboratory, and production test cable assemblies.

7MM "KU" SERIES 18 GHz CABLE ASSEMBLIES

ASSEMBLY ELECTRICAL SPECIFICATIONS:

- Maximum insertion loss.



- VSWR (max, to 18.0 GHz): 1.25:1.
- Phase stability with flexure (ten, 180° reverse bends):
  ± 0.3° @ 2.0 GHz.
  ± 1.1° @ 10.0 GHz.
  ± 2.0° @ 18.0 GHz.
- Relative shielding: >100 db.
- Velocity of propagation: 70.7%.
- Power handling: 110 watts (sea level).
- Delay: 1.44 ns/ft.
- Impedance: 50 ohms nominal.
- Operating temperature range: -13°C to +33°C.

HOW TO ORDER:

Available lengths are 24, 36, and 48 inches. Replace "XX" in the model number below with the length in inches.

Model Number
KU7878-XX

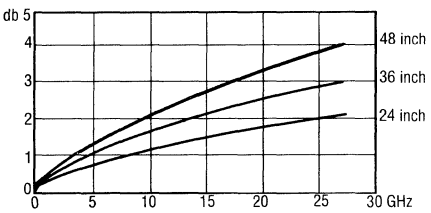
Connector Configuration
7MM connectors both ends.

Delivery
All items stock to 4 weeks.

SMA "KU" SERIES 18 GHz, & "K" SERIES 26.5 GHz CABLE ASSEMBLIES

ASSEMBLY ELECTRICAL SPECIFICATIONS:

- Maximum insertion loss, K3636 configuration (KU3636 to 18.0 GHz only.)



- VSWR (max, all connector configuration):

"KU" series	"K" series
1.30:1	1.35:1

- Phase stability with flexure (ten, 180° reverse bends):
  ± 0.3° @ 2.0 GHz.
  ± 1.1° @ 10.0 GHz.
  ± 2.0° @ 18.0 GHz.
  ± 3.0° @ 26.5 GHz. (K series only)
- Relative shielding: >100 db.
- Velocity of propagation: 70.7%.
- Power handling: 110 watts (sea level).
- Delay: 1.44 ns/ft.
- Impedance: 50 ohms nominal.
- Operating temperature range: -13°C to +33°C.

HOW TO ORDER:

Available lengths are 24, 36, and 48 inches. Replace "XX" in the model number below with the length in inches.

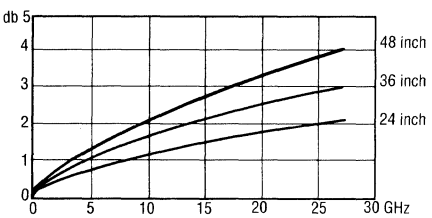
Model Number 18 GHz	Model Number 26.5 GHz	Connector Configuration
KU3636-XX	K3636-XX	SMA plugs both ends.
KU3638-XX	K3638-XX	SMA plug/SMA jack.
KU3838-XX	K3838-XX	SMA jacks both ends.

Delivery
All items stock to 4 weeks.

3.5MM "K" SERIES 26.5 GHz CABLE ASSEMBLIES

ASSEMBLY ELECTRICAL SPECIFICATIONS:

- Maximum insertion loss, K7272 configuration.



- VSWR (max, to 26.5 GHz):
  plug to plug: 1.35:1.
  plug to jack: 1.35:1.
  jack to jack: 1:35:1.
- Phase stability with flexure (ten, 180° reverse bends):
  ± 0.3° @ 2.0 GHz.
  ± 1.1° @ 10.0 GHz.
  ± 2.0° @ 18.0 GHz.
  ± 3.0° @ 26.5 GHz.
- Relative shielding: >100 db.
- Velocity of propagation: 70.7%.
- Power handling: 110 watts (sea level).
- Delay: 1.44 ns/ft.
- Impedance: 50 ohms nominal.
- Operating temperature range: -13°C to +33°C.

HOW TO ORDER:

Available lengths are 24, 36, and 48 inches. Replace "XX" in the model number below with the length in inches.

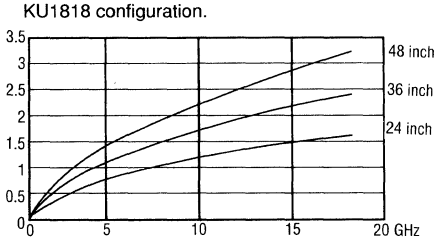
Model Number	Connector Configuration
K7272-XX	3.5MM plugs both ends.
K7274-XX	3.5MM plug/3.5MM jack.
K7474-XX	3.5MM jacks both ends.

Delivery
All items stock to 4 weeks.

TYPE N "KU" SERIES 18 GHz CABLE ASSEMBLIES

ASSEMBLY ELECTRICAL SPECIFICATIONS:

- Maximum insertion loss, KU1818 configuration.



- VSWR (max, to 18.0 GHz):
  plug to plug: 1.25:1.
  plug to jack: 1.30:1.
  jack to jack: 1.35:1.
- Phase stability with flexure (ten, 180° reverse bends):
  ± 0.3° @ 2.0 GHz.
  ± 1.1° @ 10.0 GHz.
  ± 2.0° @ 18.0 GHz.
- Relative shielding: >100 db.
- Velocity of propagation: 70.7%.
- Power handling: 110 watts (sea level).
- Delay: 1.44 ns/ft.
- Impedance: 50 ohms nominal.
- Operating temperature range: -13°C to +33°C.

HOW TO ORDER:

Available lengths are 24, 36, and 48 inches. Replace "XX" in the model number below with the length in inches.

Model Number	Connector Configuration
KU1818-XX	TYPE N plugs both ends.
KU1820-XX	TYPE N plug/TYPE N jack.
KU2020-XX	TYPE N jacks both ends.

Delivery
All items stock to 4 weeks.

ALSO AVAILABLE
Custom Built Semi-Rigid Cable Assemblies

301 Ballardvale Street, Wilmington, MA 01887
Tel. 508/988-9090 FAX 508/988-9393

Quality Microwave Interconnects Inc.

QMI. When quality and performance really count!

QMI. When quality and performance really count!

7000 SERIES FLEXIBLE MICROWAVE CABLE ASSEMBLIES

HOW TO ORDER:

Designate the desired assembly by choosing from the available cables above and connectors from the matrix to the far right. Insert the codes at the appropriate location as noted in the example. **Connector codes should be listed in increasing numerical sequence.**
Contact QMI for cables and connectors not shown.

1-XXXX-XXX-7XXX

- Length in whole inches
- QMI Cable Code
- 2nd Connector Code
- 1st Connector Code

ABBREVIATIONS

FEP Fluorinated ethylene propylene
PE Polyethylene
PFA Perfluoroalkoxy
PTFE Polyetrafluoroethylene
PUR Polyurethane
PVC Polyvinylchloride

CONNECTOR CODES

Configuration	Series						
	BNC	TNC N	TYPE	SMA	SSMA	SMB	SMC
Plug	24	30	18	36	54	42	48
Right Angle Plug	25	31	19	37	55	43	49
Jack	26	32	20	38	56	44	50
Panel Jack	27	33	21	39	57	45	51
Bulkhead Jack	28	34	22	40	58	46	52
Max. Operating Frequency	4.0	11.0	11.0	12.4	limited by cable	4.0	10.0

All cable assemblies are labeled and 100% inspected to QMI's rigorous quality standards. Each item is tested for continuity, dielectric withstanding voltage and insulation resistance. The product is individually unit packaged and tagged for maximum protection and ease of identification.

M17/# or other #	QMI Cable Code	Operating Freq. (GHz)	Power @ Max. Freq. (Watts)	Maximum Attenuation (db/100 FT)							Max. Dielectric Material	Handling Jacket Material
				100 MHz	400 MHz	1 GHz	3 GHz	5 GHz	10 GHz	12.4 GHz		
/28-RG58	115	1.0	33.0	6.5	17.0	28.0					PE	PVC
/60-RG142	132	8.0	180.0	5.5	11.7	19.0	35.0	48.0			PTFE	FEP
/75-RG214	163	11.0	30.0	2.6	6.8	12.0	25.0	35.0	56.0		PE	PVC
/84-RG223	174	12.4	10.5	6.5	12.0	21.0	40.0	55.0	84.0	92.0	PE	PVC
/93-RG178	140	3.0	44.0	16.0	33.0	52.0	94.0				PTFE	FEP
/113-RG316	187	3.0	77.0	11.0	21.0	38.0	58.0				PTFE	FEP
/128-RG400	190	12.4	144.0	4.5	10.5	17.0	38.0	50.0	78.0	90.0	PTFE	FEP
/138-00001 (RG188A)	149	3.0	78.0	10.0	20.0	32.0	55.0				PTFE	PFA
Double braided RG316	401	3.0	77.0	10.6	20.0	30.0	55.0				PTFE	FEP
SF142B	402	26.5	90.0	4.3	8.8	14.6	27.2	36.8	56.6	65.0	PTFE	FEP
SF214	404	13.7	48.0	2.3	4.6	8.4	16.6	23.3	37.7	44.0	PE	PVC
QMI custom cable	513	8.0	14.5	5.3	11.1						PE	PUR
QMI custom cable	514	12.0	3.8	9.1	18.7						PE	PUR

M17/# or other #	Nom. O.D. (inches)	# of braids	Relative Shielding (db)[1]	Minimum Bend Radius (inches)	Withstanding Voltage (RMS)[2]	Operating Temp. Range (°C)	Cable/Connector Compatibility Guide						
							BNC	TNC	N	SMA	SSMA	SMB	SMC
/28-RG58	0.195	1	40	1.0	5,000	-40 to +85	X	X	X	X			
/60-RG142	0.195	2	60	1.0	5,000	-55 to +200	X	X	X	X			
/75-RG214	0.425	2	60	2.0	10,000	-40 to +85	X	X	X				
/84-RG223	0.212	2	60	1.0	5,000	-40 to +85	X	X	X	X			
/93-RG178	0.071	1	40	0.4	5,000	-55 to +200	X	X		X	X	X	X
/113-RG316	0.098	1	40	0.5	2,000	-55 to +200	X	X		X	X	X	X
/128-RG400	0.195	2	40	1.1	5,000	-55 to +200	X	X	X	X			
/138-00001 (RG188A)	0.098	1	40	0.5	2,000	-55 to +200	X	X		X	X	X	X
Double braided RG316	0.115	2	60	0.5	2,000	-55 to +200	X	X		X	X	X	X
SF142B	0.195	2+	90	1.0	5,000	-55 to +200	X	X	X	X			
SF214	0.425	2+	90	2.1	10,000	-55 to +80	X	X	X				
QMI custom cable	0.212	2+	100	1.1	5,000	-65 to +80	X	X	X	X			
QMI custom cable	0.119	2+	100	0.6	4,500	-65 to +80	X	X		X	X	X	X

[1] Measured at 3 GHz, one foot sample. [2] Typically limited to a lower value by connectors.

QMI CABLE ASSEMBLY ACCESSORY

21 GHz, SMA Male-Female Right Angle Adaptor or Connector Saver

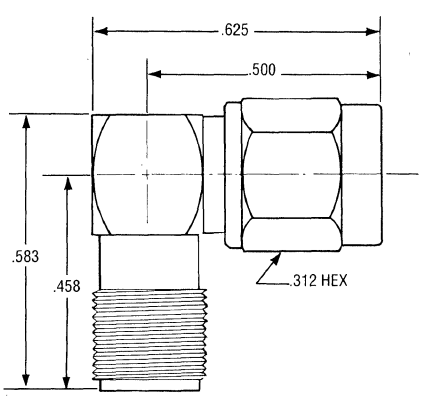
For use with ANY cable assembly terminated with SMA male plugs.

FEATURES

- DC to 21 GHz operation
- Excellent VSWR and loss
- One piece right angle contact
- Passivated stainless steel materials

HOW TO ORDER:

Specify QMI's 21 GHz right angle adaptor part number 9-3738-1



MECHANICAL ADVANTAGES:

- Single piece, formed right angle contact constructed of gold plated beryllium copper (no access cap required).
- Body machined from passivated stainless steel. Nickel brazed for strength, corrosion resistance and environmental integrity.
- Interface IAW MIL-STD-348.
- Precision machined and free coupling mechanism for easier finger tightening prior to wrench torquing.
- Contact retention: 6 lbs minimum.

ELECTRICAL ADVANTAGES:

- DC to 21 GHz operation.
- VSWR:
  1.15:1.0 maximum (DC to 9.0 GHz)
  1.20:1.0 maximum (9.0 to 18.0 GHz)
  1.25:1.0 maximum (18.0 to 21.0 GHz)
- Insertion loss: .05 x $\sqrt{f(GHz)}$.
- RF leakage: -100 db minimum.
- Impedance: 50 ohms nominal.

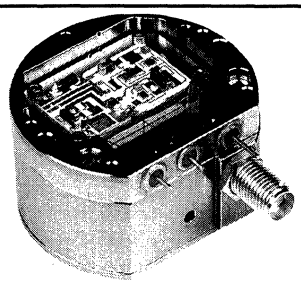
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RF SOLUTIONS From SERVO CORPORATION OF AMERICA

Transmitters • Receivers • Filters • Amplifiers • Multicouplers Multipliers • Attenuators • Converters • Switches • Frequency Sources

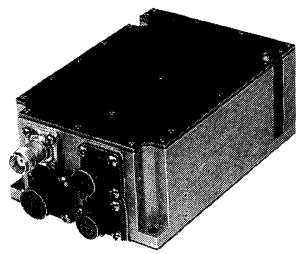
QUALIFIED SUPPLIER CERTIFIED TO MIL-Q-9858A AND MIL-STD-2000 TASK G

S-Band Transmitter



A 2.2 to 2.4 GHz transmitter available for use in Hi-G applications to 30,000 G's. Phase modulation to a modulation index of 5 with rates from 10 KHz to 5 MHz. Power output in excess of +23 dBm. Optional configuration available to provide bi-phase modulation with a 10 MHz bit rate. Small size resulting from in house hybrid micro-circuitry development.

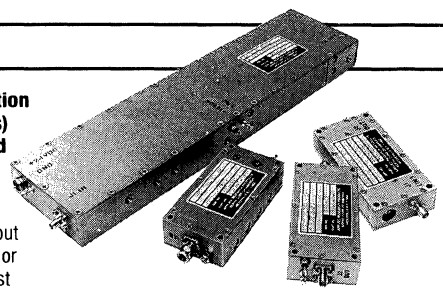
Flight Termination Receiver



FM solid-state UHF band remotely operated receiver, receives an unmodulated RF signal under normal conditions. In the command state, two or three frequency modulated tones are decoded to provide monitor, arm and terminate commands. Optional configuration provides demodulated signal as an output.

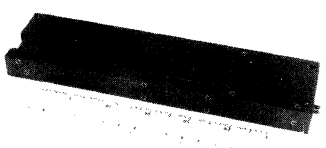
RF Multipliers

Frequency generation through multiplication or phase-lock techniques (A thru J bands) for shipboard, airborne and ground based units.



If your system requires low additive phase noise, wide bandwidth (10%), high power output (10 watts) and multiplications from X2 to X144 or greater, Servo has the design to meet your most stringent requirements.

- Custom Sizes
- Multiple Outputs
- Various Primary Power Sources
- Multiple Selectable Outputs
- Custom Multiplier Chains
- BITE
- Crystal Controlled Sources

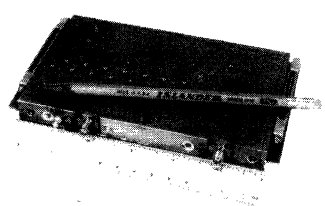


Our Phase-Lock loops, comprised of I.C. components, together with RF devices, yield outputs of up to 10 watts at microwave frequencies. Our multipliers are available as passive devices or in combination with amplifiers having multiplication factors from 2 to 2000. In combination with varactor multiplier devices output in Ku-band can be obtained.

In addition, we can supply crystal oscillators or internal drivers to provide a self-contained source.

ELECTRICAL CHARACTERISTICS C-BAND PASSIVE BROADBAND HIGH POWER MULTIPLIERS:

- Input Power: +40 dBm
  Output Power: +32.6 dBm ±0.5 dB
- Spurious Response: -70 dBc inband
- Bandwidth: 5.9 to 6.4 GHz

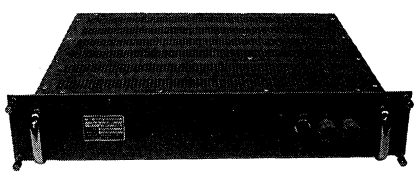


Frequency sources with multiplication up to 29 and multiples thereof are available deriving signals in the L, S and C-bands.

ELECTRICAL CHARACTERISTICS (TYPICAL):

- Input Frequency: 100 MHz ±10 MHz
- Output Frequency
  Type 1: 6400 MHz (X64)
  Type 2: 5800 MHz (X58)
- RF Power
  Input Power: +5 dBm ±3 dBm
  Output Power: +5 dBm ±2 dBm over temperature
- Discrete Spurious Outputs: Harmonics below -60 dBc, others at a maximum of -60 dBc
- Temperature: -54°C to +85°C

Multicouplers



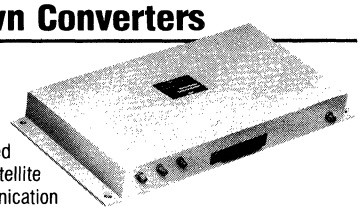
Model HFM-(TX)-1424-8 Multicoupler is one in a series of broadband active multicouplers available. Operating over the Telemetry band, this multicoupler derives 8 outputs which track in amplitude and phase.

PERFORMANCE SPECIFICATIONS:

- Isolation between Outputs: To be specified (30 dB to 70 dB)
- Overall Gain: Nominal 0 dB
- Connectors: To be specified

Model	No. of Outputs	Frequency Range
HFM-2(TX)0532 8/40	6 to 32	500 KHz-32 MHz
HFM-2(TX)232 8/40	6 to 32	2 MHz-32 MHz
HFM-2(TX)140 12/40	6 to 32	10 MHz-400 MHz
HFM-2(TX)2410 8/40	6 to 32	20 MHz-1100 MHz
HFM-2(TX)1415 6/50	6 to 32	1400 MHz-1600 MHz
HFM-2(TX)2223 8/50	6 to 32	2200 MHz-2300 MHz
HFM-2(TX)1423 8/50	6 to 32	1400 MHZ-2300 MHz

Down Converters



Designed as a Satellite Communication System Converter, this unit is an IF-Hopping down converter for the frequency range of 50 to 1000 MHz. The unit provides I and Q outputs with selectable video low pass filtering.

servo
SERVO CORPORATION OF AMERICA

ELECTRONIC SYSTEMS
Department EM
111 New South Road
Hicksville, NY 11802
(516) 938-9700 • FAX: (516) 938-9644

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

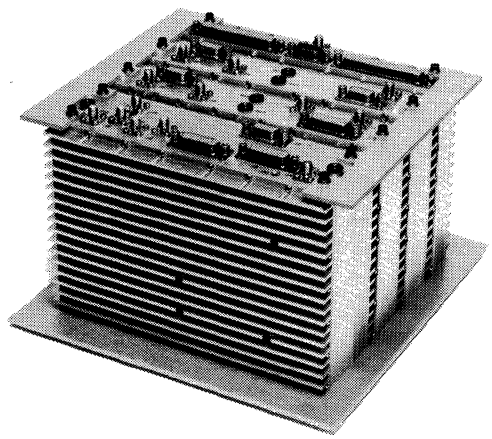
W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

TRAK MICROWAVE

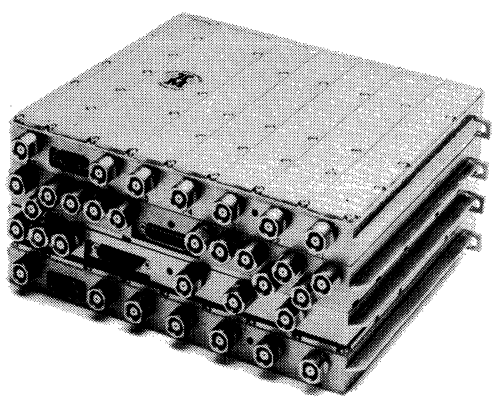
CUSTOM MILITARIZED SYNTHESIZERS



INDIRECT

Indirect Synthesizers utilize phase lock loops and provide moderate switching speed (greater than 25 microseconds)

Octave/Multi-Octave Coverage
Step Sizes: 1 Hz — 25 MHz
Speed: 25 microsec — Millisec
Size: as small as 20 cubic inches
Typical phase noise: 115 dBc/Hz, 100 KHz from carrier
Typical Spurious: −60 dBc
Power consumption: as low as 4 W



DIRECT

Direct Synthesizers use simple arithmetic operation and provide very fast switching speeds (less than 500 nanoseconds) for frequency agility.

Octave Bandwidths from .5–18 GHz
Step Sizes: 1 MHz–50 MHz
Speed: 200 nanoseconds anywhere in the band
Size: as small as 150 cubic inches
Typical phase noise: 125 dBc/Hz, 100 KHz from carrier
Typical Spurious: −60 dBc
Power consumption: as low as 25 W



Call or write today for our catalog of high quality mil-spec microwave components and subsystems.

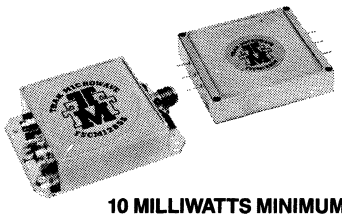
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TRAK MICROWAVE

OSCILLATORS & IF AMPLIFIERS

60 MHZ—18 GHZ MINIATURE CRYSTAL CONTROLLED OSCILLATORS AND OSCILLATOR/MULTIPLIERS



ELECTRICAL PARAMETERS (general)
Frequency set accuracy at room temperature: ±0.001%
Frequency stability: ±0.003%
Aging rate: ±0.0005% per year
Power variation with temperature: ±2 dB

Power supply: +15 VDC (other voltages optional)
Load VSWR: 1.5:1 maximum
Temperature Range: -55 to +85°C. (to +125°C with degradation)
Contact factory for other frequencies and/or power levels. (A 1 watt output series is available.)

10 MILLIWATTS MINIMUM OUTPUT

FREQUENCY RANGE	CURRENT mA, nom. at +15 VOLTS	P.C. BOARD MOUNT MODEL NUMBER	MICROSTRIP MODEL NUMBER	BASE PLATE MOUNT MODEL NUMBER	HARMONICS OF CRYSTAL OSCILLATOR UP TO 2nd HARMONIC OF OUTPUT FREQUENCY
60 - 120 MHz	25	5040 - 1056	5140 - 1057	5040 - 1057	> 30 dBc
121 - 240 MHz	35	5041 - 1056	5141 - 1057	5041 - 1057	> 30 dBc
241 - 360 MHz	35	5042 - 1056	5142 - 1057	5042 - 1057	> 30 dBc
361 - 720 MHz	50	5043 - 1056	5143 - 1057	5043 - 1057	> 30 dBc
721 - 1200 MHz	50	5044 - 1056	5144 - 1057	5044 - 1057	> 30 dBc
1.2 - 1.7 GHz	60	-	-	5044 - 1110	> 40 dBc
1.7 - 2.0 GHz	65	-	-	5044 - 1111	> 40 dBc
2.0 - 2.3 GHz	65	-	-	5044 - 1310	> 40 dBc
2.3 - 2.5 GHz	75	-	-	5044 - 1313	> 40 dBc
2.5 - 4.0 GHz	100	-	-	5044 - 1311	> 40 dBc
4.0 - 6.0 GHz	110	-	-	5044 - 1611	> 40 dBc
6.0 - 8.0 GHz	110	-	-	5044 - 1615	> 40 dBc
8.0 - 10.0 GHz	120	-	-	5045 - 1911	> 40 dBc
10.0 - 12.0 GHz	140	-	-	5045 - 1913	> 40 dBc
12.0 - 18.0 GHz	150	-	-	5045 - 1240	> 40 dBc

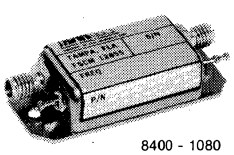
100 MILLIWATTS MINIMUM OUTPUT

FREQUENCY RANGE	CURRENT mA, nom. at +15 VOLTS	P.C. BOARD MOUNT MODEL NUMBER	MICROSTRIP MODEL NUMBER	BASE PLATE MOUNT MODEL NUMBER	HARMONICS OF CRYSTAL OSCILLATOR UP TO 2nd HARMONIC OF OUTPUT FREQUENCY
60 - 120 MHz	40	5040 - 1086	5140 - 1087	5040 - 1087	> 20 dBc
121 - 240 MHz	50	5041 - 1086	5141 - 1087	5041 - 1087	> 20 dBc
241 - 360 MHz	50	5042 - 1086	5142 - 1087	5042 - 1087	> 20 dBc
361 - 720 MHz	70	5043 - 1086	5143 - 1087	5043 - 1087	> 20 dBc
721 - 1200 MHz	70	5044 - 1086	-	5044 - 1087	> 20 dBc
1.2 - 1.7 GHz	80	-	-	5044 - 1120	> 40 dBc
1.7 - 2.0 GHz	90	-	-	5044 - 1121	> 40 dBc
2.0 - 2.3 GHz	90	-	-	5044 - 1320	> 40 dBc
2.3 - 2.5 GHz	100	-	-	5044 - 1321	> 40 dBc

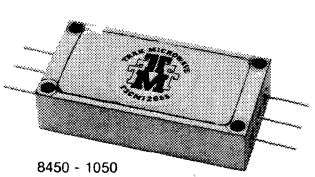
AVAILABLE OPTIONS:
- Gating
- Heater Control
- Frequency Trim
- One watt versions are available

NOTE: Size may vary with options. Contact Factory.

WIDE DYNAMIC RANGE LOW NOISE IF AMPLIFIER SERIES



8400 - 1080

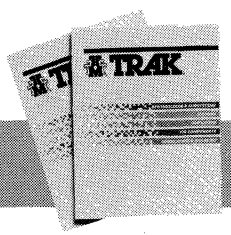


8450 - 1050

	Model 8450 - 1050	Model 8400 - 1080
Frequency Range	Customer Specified 20 - 300 MHz	Customer Specified 20 - 150 MHz
3dB Bandwidth	10% of center frequency, nominal	10 MHz, nominal
Size	1.50 × .75 × .35 inches, nominal	1.28 × .71 × .05 inches, nominal
Weight	0.4 ounces, nominal	1 ounce, nominal
Connections	.020 diameter pins	SMA female

The following specifications apply to *both* models.

Bandpass Ripple	1 dB, typical
Skirt Selectivity	12 dB/octave, typical
Gain	70 ± 3 dB
Noise Figure	3 dB maximum
Input Impedance	50 ohms, nominal
1 dB Compression Point	0 dBm minimum
3rd Order Intercept Point	+10 dBm, nominal
Input Dynamic Range (with AGC)	80 dB minimum
AGC Range	60 dB minimum
AGC Voltage	0 to +5 volts
Temperature Range	-54°C to +85°C



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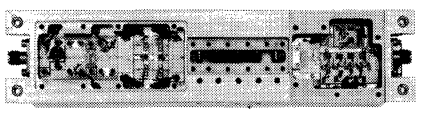
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TRAK MICROWAVE

FREQUENCY MULTIPLIERS

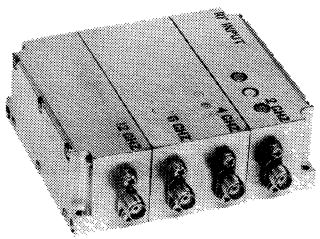
X7 MULTIPLIER/AMPLIFIER



Electrical Specifications

Multiplication Factor:	X7
Output Frequency:	9.275 GHz to 9.520 GHz
RF Power Input:	−1 dBm to +5 dBm
Power Output:	+26.5 dBm to +28.5 dBm
Input VSWR:	1.3:1
Output VSWR:	1.5:1
Harmonic Rejection:	−30 dBc
Spurious Rejection:	+15 VDC @ 700 mA, nominal
Power Supply:	−15 VDC @ 25 mA, nominal
Operating Temperature Range:	−20 to +65°C
RF Connectors:	SMA female

MULTI-OUTPUT MULTIPLIER/AMPLIFIER



This multi-output multiplier has outputs of 2, 4, 6, and 12 GHz. The assembly includes a TTL switch for selecting two of the outputs while the other two outputs are continuously "on." It is totally stable over temperature.

Electrical Specifications

Multiplication Factor:	Port 2 X2 Port 3 X4 Port 4 X6 Port 5 X12
Input Frequency:	1.0 GHz
RF Power Input:	+10 dBm ± 2 dB
Output Power:	+10 dBm, nominal
Input VSWR:	2:1 maximum
Load VSWR:	3:1 maximum
Harmonics:	−60 dBc
Power Supply:	+12 VDC @ 275 mA, nominal

MULTIPLIER/AMPLIFIERS

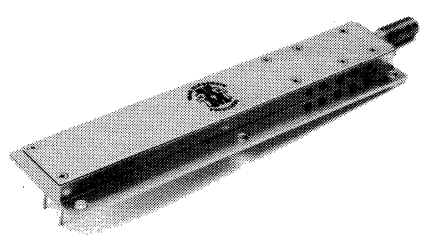


This series of multipliers provides signals in the 2.5 to 4.0 GHz range from inputs in the 500 to 700 MHz range.

Electrical Specifications

Multiplication Factor:	X5, X6, typical
Input Power:	−6 dBm to +7 dBm
Output Power:	+13 dBm, nominal
Bandwidth:	6% typical
Harmonics and Spurs:	−65 dBc, maximum
Input VSWR:	2.0:1 maximum
Operating Temperature:	−54 to +85°C
DC Power:	+15 VDC @ 140 mA, maximum
Connectors:	SMA female

X40 MULTIPLIER/AMPLIFIER



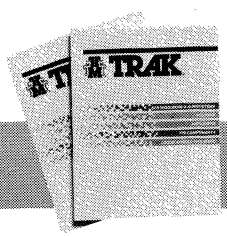
This high order frequency multiplier/amplifier is custom designed with regards to multiplication factor, bandwidth, and power output levels.

Electrical Specifications

Multiplication Factor:	X40
Input Frequency Range:	VHF
Output Bandwidth:	±1.5%, typical
RF Power Input:	+15 dBm ±2 dB
Power Output:	+9 dBm ±1.5 dB
Power Variation with Temperature:	±1.5 dB
VSWR:	1.5:1 maximum
Harmonics:	−40 dBc maximum
Sub-harmonics	−40 dBc maximum
Spurious	−40 dBc maximum
Power Supply:	+15 VDC @ 150 mA, nominal

Environmental Conditions

Operating Temperature Range:	−30° to +90°C



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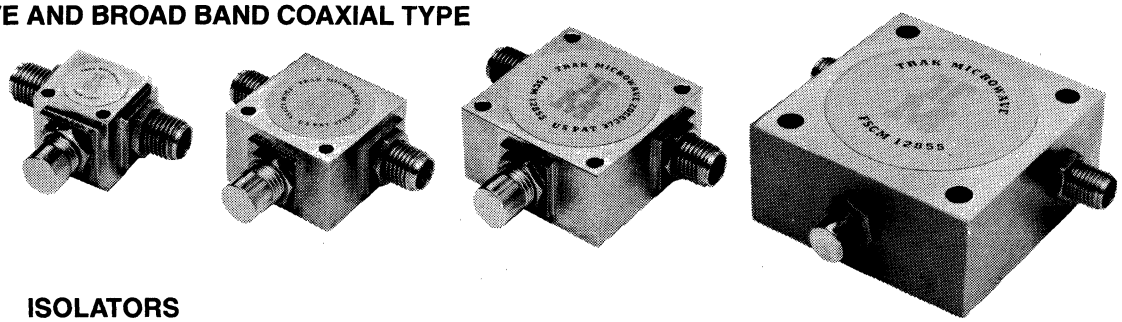
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TRAK MICROWAVE

CIRCULATORS & ISOLATORS

OCTAVE AND BROAD BAND COAXIAL TYPE

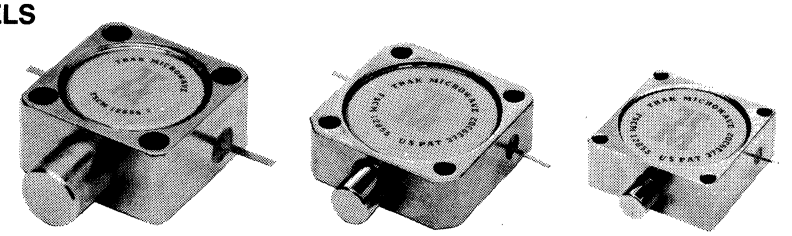


ISOLATORS

FREQUENCY RANGE (GHz)	MODEL NUMBER	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (INCHES NOMINAL) L W H
1.0 - 2.0	60A1101*	15	0.6	1.40	0 to +50	0.1	1.0	+50	1.60 × 1.60 × 0.75
2.0 - 4.0	60A3001*	18	0.5	1.30	-10 to +70	0.1	1.0	+70	1.00 × 1.00 × 0.50
2.0 - 6.0	60A3401*	12	1.0	1.65	-10 to +60	0.1	1.0	+60	1.00 × 1.00 × 0.50
2.6 - 5.2	60A3011*	18	0.5	1.30	-25 to +80	0.1	1.0	+80	1.00 × 1.00 × 0.50
3.0 - 6.0	60A6301*	18	0.5	1.40	-45 to +85	0.1	1.0	+85	0.75 × 0.75 × 0.50
4.0 - 8.0	60A6001*	18	0.5	1.30	-45 to +95	0.1	3.0	+95	0.75 × 0.75 × 0.50
5.0 - 10.0	60A6071*	18	0.5	1.30	-55 to +95	0.1	2.0	+95	0.75 × 0.75 × 0.50
6.0 - 12.0	60A9201*	16	0.7	1.35	-55 to +95	0.1	1.0	+95	0.75 × 0.75 × 0.50
6.0 - 18.0	60A2601*	12	1.0	1.67	-40 to +80[2]	0.1	3.0	+80	0.50 × 0.50 × .375
6.5 - 18.0	60A2701*	14	1.0	1.50	-54 to +95	0.1	3.0	+95	0.50 × 0.50 × .375
7.0 - 18.0	60A2171	13	0.75	1.58	-40 to +65	0.5	3.0	+65	0.50 × 0.50 × .375
7.5 - 18.0	60A2301*	14	0.9	1.50	-54 to +95	0.5	3.0	+85	0.50 × 0.50 × 0.50
8.0 - 12.4	20B9201*	20	0.5	1.30	-55 to +95	0.1	3.0	+95	0.50 × 0.50 × 0.50
8.0 - 16.0	60A2001*	17	0.5	1.35	-40 to +95	0.5	3.0	+95	0.50 × 0.50 × 0.50
8.0 - 16.0	60A2501	17	0.5	1.35	-40 to +95	0.1	3.0	+95	0.50 × 0.50 × .375
8.0 - 18.0	60A2051*	14	0.6	1.50	-54 to +95	0.5	3.0	+95	0.50 × 0.50 × 0.50
8.0 - 20.0	60A2401*	12	1.0	1.67	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × .375
12.0 - 18.0	20B2201*	18	0.5	1.30	-55 to +110	0.5	3.0	+110	0.50 × 0.50 × 0.50
18.0 - 22.0	20A8021*	18	0.7	1.30	-54 to +95	0.5	1.0	+95	0.50 × 0.50 × .375
18.0 - 26.5	60A8101*	14	1.0	1.50	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × .375

*These units are normally available from stock or from our distributors.
NOTES:
(1) Circulators are also available.
(2) The insertion loss for Model 60A2601 is 1.5 dB maximum from -54°C to +95°C. Other specifications are unchanged over this temperature range.

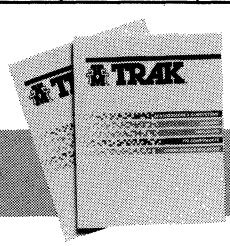
DROP-IN BROAD BAND MODELS



ISOLATORS

FREQUENCY RANGE (GHz)	MODEL NUMBER	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (INCHES NOMINAL) L W H
2.0 - 4.0	69A3101*	16	0.6	1.40	-10 to +70	0.1	1.0	+70	.875 × .875 × .345
2.5 - 5.0	69A3181	16	0.6	1.40	-10 to +85	0.1	1.0	+70	.875 × .875 × .345
2.6 - 5.2	69A3111*	16	0.6	1.40	-25 to +85	0.1	1.0	+85	.875 × .875 × .345
		16	0.7	1.40	-54 to +95	0.1	1.0	+95	.875 × .875 × .345
3.0 - 6.0	69A6201*	16	0.6	1.40	-25 to +85	0.1	1.0	+85	.875 × .875 × .345
4.0 - 8.0	69A6001*	16	0.6	1.40	-40 to +85	0.1	1.0	+85	0.75 × 0.75 × 0.25
4.7 - 10.0	69A6051	12	1.0	1.50	-40 to +85	0.1	1.0	+85	0.75 × 0.75 × 0.25
5.0 - 10.0	69A6101*	16	0.6	1.40	-30 to +70	0.1	1.0	+70	0.75 × 0.75 × 0.25
6.0 - 18.0	69A2601*[2]	10	1.2	2.0	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × 0.20
7.5 - 18.0	69A2041*	12	1.0	1.65	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × 0.25
8.0 - 12.0	69A9201*	17	0.6	1.40	-40 to +85	0.1	1.0	+85	0.50 × 0.50 × 0.25
8.0 - 16.0	69A9301*	14	0.8	1.50	-40 to +85	0.1	1.0	+85	0.50 × 0.50 × 0.25
8.0 - 18.0	69A2031*	13	1.0	1.60	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × 0.25
12.0 - 18.0	69A2201*	17	0.7	1.50	-55 to +100	0.1	1.0	+95	0.50 × 0.50 × 0.25

*These units are normally available from stock or from our distributors.
NOTES: (1) Circulators are also available. (2) For Model 69A2601 only, the insertion loss is 1.5 dB maximum from -54°C to +95°C.



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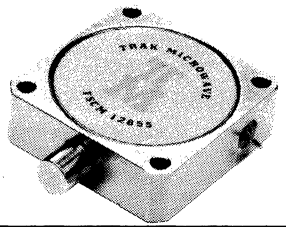
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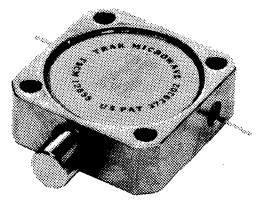
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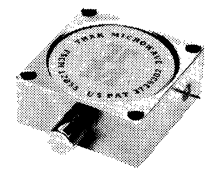
TRAK MICROWAVE

CIRCULATORS & ISOLATORS

DROP-IN TYPE







ISOLATORS

FREQUENCY RANGE (GHz)	MODEL NUMBER	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (INCHES NOMINAL) L W H
0.5 - 0.7	29*0401	3	20	0.7	1.25	-54 to +95	0.1	1.0	+95	1.00 × 1.00 × 0.30
0.7 - 1.0	29*0501	5	20	0.6	1.25	-54 to +95	0.1	1.0	+95	1.00 × 1.00 × 0.30
1.0 - 1.3	29*1401	10	20	0.5	1.25	-54 to +95	0.1	1.0	+95	1.00 × 1.00 × 0.30
1.3 - 1.65	29*1501	10	20	0.5	1.25	-54 to +95	0.1	1.0	+95	1.00 × 1.00 × 0.30
1.65 - 2.0	29*1601	5	20	0.5	1.25	-54 to +95	0.1	1.0	+95	0.75 × 0.75 × 0.25
2.0 - 2.5	29*3401	5	20	0.5	1.25	-54 to +95	0.1	1.0	+95	0.75 × 0.75 × 0.25
2.5 - 3.7	29*3501	10	20	0.6	1.25	-54 to +95	0.1	1.0	+95	0.75 × 0.75 × 0.25
2.5 - 3.7	29*3601	5	18	0.6	1.30	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
3.7 - 4.6	29*6401	5	18	0.6	1.30	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
4.6 - 6.2	29*6501	10	18	0.6	1.30	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
6.2 - 8.0	29*6601	10	18	0.6	1.35	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
8.0 -10.0	29*9401	10	18	0.6	1.35	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
10.0 - 12.0	29*9501	10	18	0.6	1.35	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
12.0 - 15.0	29*2401	10	17	0.6	1.45	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25
15.0 - 18.0	29*2501	10	17	0.6	1.45	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × 0.25

*Specify center frequency when ordering. Model designation will be completed by TRAK.

NOTES:
(1) Circulators are also available.
(2) If your lower frequency limit is below the lower limit stated for a particular model, select the preceding model. If your upper frequency limit will exceed 12 GHz, select the next higher frequency model.

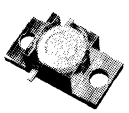
μicrOpuck® CIRCULATORS & ISOLATORS

The Micropuck® family of circulators and isolators was designed to maximize the use of isolators and circulators in stripline and microstrip applications. They are easy-to-mount devices with magnetic shielding which prevents detuning or changes in performance when operating in magnetic fields or in close proximity to ferrous metals. The round design and tab lead configuration allow installation at a reduced cost, replacing milling operations with a simple drilled hole.

The Micropuck® isolator is also available in a flange mount similar to the mounting used on some power transistors. This construction has input and output tabs located 180° from each other as opposed to the 120° separation of the round version. This provides an alternative choice for system designers who prefer the screw-down mounting and can allow the extra space it requires.

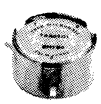
Specifications for these microminiature ferrite devices are as good as you'll find anywhere. Look at the data and call our ferrite sales group or local representative.

FLANGE MOUNT MICROPUCK® ISOLATORS



MODEL NUMBER	FREQUENCY RANGE (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER WATTS	AVERAGE POWER WATTS	HEAT SINK TEMP °C.	SIZE (INCHES NOMINAL) L W H
F9*6101	4.0 - 8.0	10	20	0.5	1.25	-54 to +95	50	.7	95	.62 × .375 × .21
F9*9001	8.0 - 12.0	10	20	0.4	1.25	-54 to +95	50	.5	95	.50 × .25 × .18
F9*2001	12.0 - 18.0	10	17	0.5	1.35	-54 to +95	50	.5	95	.50 × .25 × .18
F9A6141	3.7 - 4.3	FULL BAND	15	0.6	1.45	-30 to +70	50	.7	70	.62 × .375 × .21
F9A9101**	8.0 - 12.0	FULL BAND	16	0.7	1.45	-54 to +95	50	.7	95	.62 × .375 × .21
F9A2201**	12.0 - 18.0	FULL BAND	17	0.7	1.50	-55 to +100	50	.5	95	.50 × .25 × .18

MICROPUCK® CIRCULATORS



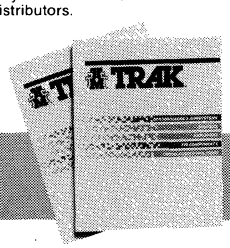
MODEL NUMBER	FREQUENCY RANGE (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER WATTS	AVG. POWER WATTS	HEAT SINK TEMP.	SIZE DIA. INCH	SIZE HEIGHT INCH
79*6101	4.0 - 8.0	10	18	.5	1.30	-54 to +95	50	25	50	.375	.200
79*9001	8.0 - 12.0	10	18	.4	1.30	-54 to +95	50	20	50	.250	.156
79*2001	12.0 - 18.0	10	17	.5	1.35	-54 to +95	50	20	50	.250	.156
79A9101**	8.0 - 12.0	FULL BAND	16	.7	1.45	-54 to +95	50	20	50	.375	.200

MICROPUCK® ISOLATORS

89*6101	4.0 - 8.0	10	20	.5	1.25	-54 to +95	50	.7	95	.375	.200
89*9001	8.0 - 12.0	10	20	.4	1.25	-54 to +95	50	.5	95	.250	.156
89*2001	12.0 - 18.0	10	17	.5	1.35	-54 to +95	50	.5	95	.250	.156
89A2201**	12.0 - 18.0	FULL BAND	17	.7	1.50	-54 to +100	50	.5	95	.250	.156
89A9101**	8.0 - 12.0	FULL BAND	16	.7	1.45	-54 to +95	50	.7	95	.375	.200

*Specify center frequency when ordering. Model designation will be completed by TRAK. **These units are normally available from stock or from our distributors.

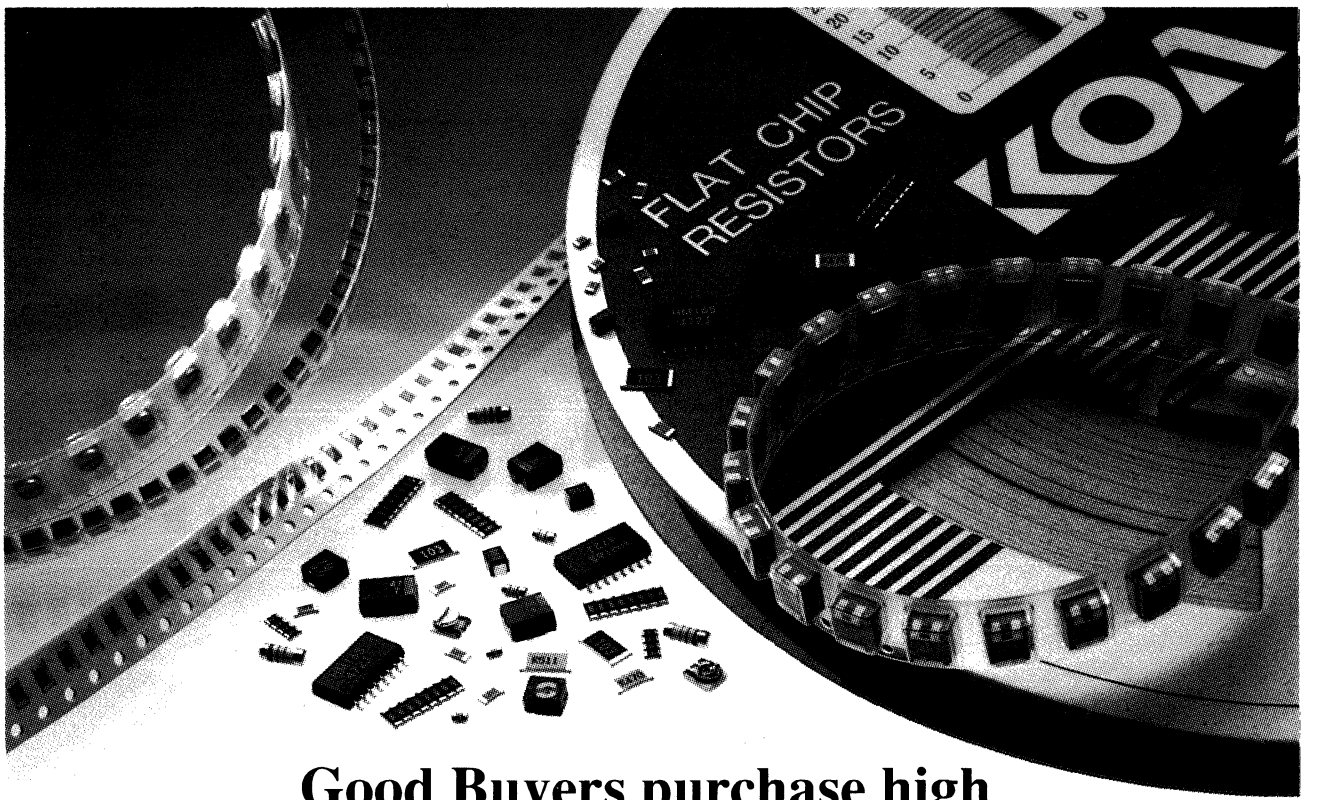
NOTES: (1) Upper frequency limit cannot exceed 18 GHz. (2) If your lower frequency limit is below the lower limit stated for a particular model, select the preceding model. If your upper frequency limit will exceed 12 GHz, select the next higher frequency model.



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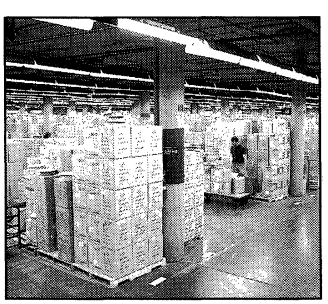
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RESISTORS

Manufacturer	Starting EEM Page No.	Bulk Ceramic	Ceramic Core	Cermet	Carbon Comp.	Film: Metallized & Non-metallized	Film: Carbon	Wirewound	Power: >2W R <5W	Power: 5W to 15W	Power: >15W	Foil	Fuse	Chip	Networks	Precision	Varistors	Features
Aalpha Precision	A•1837							√*	√*							√*		
Robert G. Allen Inc.	A•1839	√					√							√*	√*			Flame Retardant
Amitron	A•1843								√§*					√§*	√§	√§*		
Angstrom/Vishay Elec. Comps.	A•1844		√§*			√§*											√§*	Noninductive, Flame retardant
Beckman Industrial Corp.	A•1847	√*		√*		√*			√*					√*	√*	√*		Noninductive, Flame retardant
Bourns Inc.	A•1848														√§*			
Cableform	A•1850	√*					√*		√*	√*	√*							High voltage (> 1000V), Noninductive
Caddock Electronics	A•1852		√			√			√	√	√			√	√	√		High voltage (> 1000V), Noninductive, Flame retardant
Carborundum Co.	A•1880	√*									√*							High voltage * (> 1000V), Noninductive *
Colber Corp.	A•1882	√§*						√§*	√§*	√§*	√§*		√§*					Flame retardant §*
CTS Corp./ Resistor Network Division	A•1884		√§	√§					√§						√§			
Dale Electronics, Inc.	A•1886	√§	√§	√§		√§	√§	√§	√§	√§	√§		√§	√§	√§	√§		High voltage (> 1000V), Noninductive, Flame retardant
Electro-Films Inc.	A•1910								√§*	√§*	√§*			√§•	√§*	√§*		Noninductive §*
Elliott/Jordan/Vishay Elec. Comps.	A•1914							√	√							√		
General Resistance	A•1913							√*							√	√*		Noninductive *
Hymeg Corp.	A•1916		√	√		√		√	√	√					√	√		High voltage (> 1000V), Noninductive
Imperial Astronics	A•1919							√	√	√	√					√		
International Mfg. Svcs.	A•1922								√§	√§				√§*	√§	§		High voltage (>1000V), Noninductive, Flame retardant
ISKRA Electronics	A•1923																√	
Isotek Corporation	A•1925								√	√	√	√§				√§		Noninductive §
Julie Research Labs	A•1929							√*	√*	√*					√*	√*		
KOA Speer Electronics	A•1930		√§	√§	√§	√§	√§		√	√	√		√§	√§		√§		
KRL/Bantry Components Inc.	A•1935		√§*					√§*	√§*	√§*	√§*		√§			√§*		Noninductive §*, Flame Retardant §*

* Mil. Spec. § Surface Mount

RESISTORS (cont'd)

Manufacturer	Starting EEM Page No.	Bulk Ceramic	Ceramic Core	Cermet	Carbon Comp.	Film		Power				Foil	Fuse	Chip	Networks	Precision	Varistors	Features
						Metallized & Non-metallized	Carbon	Wirewound	>2W R <5W	5W to 15W	>15W							
Maida Development Co.	A•1942																√	
Memcor-Truohm	A•1946							√*	√*	√*	√*							Noninductive, Flame retardant
Micro-Ohm Corp.	A•1947					√*	√*	√*	√*	√*	√*		√*			√*		Noninductive *, Flame retardant *
Mills Resistor Co.	A•1949							√*	√*	√*	√*				√	√		
Milwaukee Resistor Corp.	A•1950		√					√		√	√							Noninductive, Flame retardant
Mini -Systems Inc.	A•1955	√*	√*			√*				√*	√*			√*	√*			
Murata Erie/KSA	A•1957														√		√	
Ohmite Mfg. Co.	A•1958		√*					√*	√*	√*	√*							
Ohmtek/Vishay Elec. Comps.	A•1965			√§*		√§*						√§*		√§*	√§*	√§*		Noninductive §*
Pacific Resistors Co.	A•1968							√*	√*	√*			√*		√*	√*		
Philips Components Discrete Prods. Div.	A•1972	√§				√§*	√§*	√						√§			√	
Piconics Inc.	A•1975					√§*			√§*	√§*	√§*			√§*	√§*	√§*		
Precision Resistive Prods.	A•1976															√		
Precision Resistor Co.	A•1978							√*	√*							√*		High voltage (> 1000V)
RCD Components Inc.	A•1982	√	√§*	√§*		√§*	√§*	√§*	√§*	√*	√*	√*	√§	√§*	√§*	√§*		High voltage §* (> 1000V), Noninductive §*, Flame retardant §*
Resistors Inc.	A•1983	√	√§*					√§*	√*	√*	√*							High voltage (> 1000V) §*, Noninductive §*, Flame retardant §*
Rohm Electronics	A•1984					√			*					√§	√§	√§	√§	Flame retardant §
State of the Art Inc.	A•1986	√§*												√§*	√§*	√§*		High voltage (> 1000V)
Ultronix/Vishay Elec. Comps	A•1992		√			√		√§*	√*	√*	√*			√§*	√*	√*		
Victoreen Inc.	A•1996		√			√			√	√	√							High voltage (>1000V), Noninductive
Vishay Electronic Comps.	A•2001					√*			√*	√*	√*	√§*		√§*	√	√*		
World Products Inc.	A•2010																√	

* Mil. Spec. § Surface Mount

PRECISION WIREWOUND RESISTORS

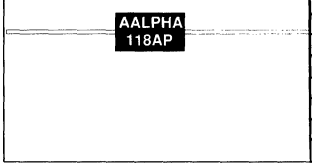
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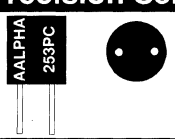
RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS					
AALPHA	MIL				LENGTH ±.010	DIAMETER ±.010	LENGTH MM	DIAMETER MM	LEADS AWG	LEADS Inch
112AP	-	.06	50K	75	.210	.100	5.3	2.5	24	.020
118AP	-	.08	250K	100	.260	.125	6.6	3.2	24	.020
122AP	-	.10	500K	100	.375	.125	9.5	3.2	24	.020
124AP	-	.10	500K	100	.312	.156	7.9	4.0	24	.020
128AP	-	.125	600K	150	.250	.187	6.3	4.7	22	.025
130AP	-	.15	1.2 MEG	150	.295	.187	7.5	4.7	22	.025
134AP	-	.175	1.3 MEG	200	.375	.187	9.5	4.7	22	.025
142AP	-	.175	750K	150	.260	.260	6.5	6.5	20	.032
144AP	-	.2	1 MEG	200	.450	.187	11.4	4.7	22	.025
148AP	-	.25	1.2 MEG	250	.465	.210	11.8	5.3	22	.025

AXIAL PRECISION Miniature Series



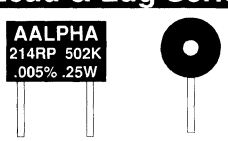
RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS					
AALPHA	MIL				LENGTH ±.010	DIAMETER ±.010	LENGTH MM	DIAMETER MM	LEADS AWG	LEADS Inch
152AP	RB56	.20	2 MEG	200	.375	.250	9.5	6.3	20	.032
154AP	RB56	.20	2 MEG	200	.375	.250	9.5	6.3	22	.025
156AP	-	.25	2.5 MEG	300	.500	.250	12.7	6.3	22	.025
160AP	RBR55	.25	2.5 MEG	300	.500	.250	12.7	6.3	20	.032
164AP	RBR54	.35	4.5 MEG	400	.750	.250	19.1	6.3	20	.032
168AP	RBR53	.50	8 MEG	400	.750	.375	19.1	9.5	20	.032
172AP	-	.50	4 MEG	300	.500	.375	12.7	9.5	20	.032
176AP	-	.50	8 MEG	400	.500	.500	12.7	12.7	20	.032
178AP	-	.50	8 MEG	400	.885	.375	22.4	9.5	20	.032
180AP	-	.60	9 MEG	400	.625	.500	15.9	12.7	20	.032
184AP	RBR52	.75	10 MEG	600	1.000	.375	25.4	9.5	20	.032
188AP	RBR57	1.00	18 MEG	800	1.000	.500	25.4	12.7	20	.032
192AP	RB58	1.50	30 MEG	900	1.500	.500	38.1	12.7	20	.032
196AP	-	2.00	30 MEG	900	2.000	.500	50.8	12.7	20	.032

PRINTED CIRCUT Precision Series



RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS					
AALPHA	MIL				LENGTH ±.025	DIAMETER ±.025	LEAD SPACING		LEADS AWG	LEADS Inch
231PC	-	.25	500K	300	.312	.250	.150	-	22	.025
253PC	RB71	.25	500K	300	.312	.250	.200	-	22	.025
325PC	-	.25	500K	300	.375	.250	.150	-	22	.025
525PC	-	.50	600K	300	.500	.250	.150	-	22	.025
550PC	-	.70	1 MEG	400	.500	.500	.300	-	22	.025
575PC	RB70	.70	800K	300	.500	.375	.200	-	20	.032

RADIAL PRECISION Lead & Lug Series



RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS				
AALPHA	MIL				LENGTH ±.025	DIAMETER ±.025	SPACING ±.015	TERMINAL TYPE	MOUNTING HOLE
200RP	-	.125	500K	100	.250	.250	.200	AWG 22	NONE
214RP	-	.25	1 MEG	150	.425	.250	.277	AWG 22	#2 SCREW
250RP	-	.25	1 MEG	150	.500	.250	.400	AWG 22	NONE
275RP	-	.50	4 MEG	400	.500	.500	.400	AWG 20	#6 SCREW
285RP	-	.50	1 MEG	300	.750	.375	.600	AWG 20	#6 SCREW
324RP	RB08	.50	4 MEG	400	.500	.500	.325	LUG	#6 SCREW
350RP	-	1.00	8 MEG	800	1.00	.500	.850	AWG 20	#6 SCREW
372RP	RB18	2.00	10 MEG	1000	1.250	.750	1.000	LUG	#6 SCREW

FAST RISE SERIES



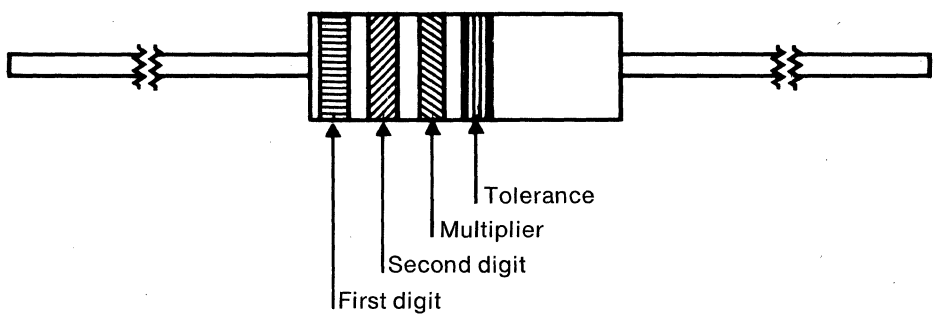
RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS					
AALPHA	MIL				LENGTH ±.010	DIAMETER ±.010	LENGTH MM	DIAMETER MM	LEADS AWG	LEADS Inch
F134AP	-	.175	500K	200	.375	.187	9.5	4.7	22	.025
F160AP	RBR55	.25	1.0 MEG	300	.500	.250	12.7	6.3	20	.032
F164AP	RBR54	.35	1.25 MEG	400	.750	.250	19.1	6.3	20	.032
F168AP	RBR53	.50	5 MEG	400	.750	.375	19.1	9.5	20	.032
F188AP	RBR57	1.00	10 MEG	800	1.000	.500	25.4	12.7	20	.032

AALPHA PRECISION

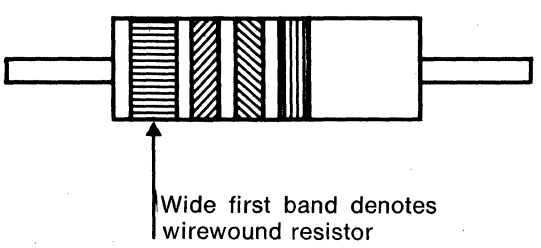
18300 OXNARD ST.
TARZANA, CA 91356

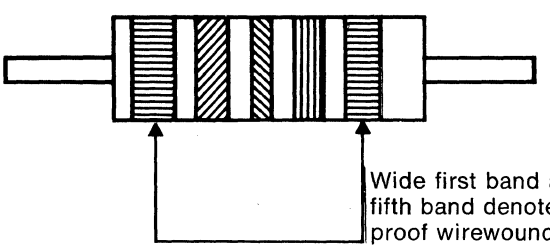
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

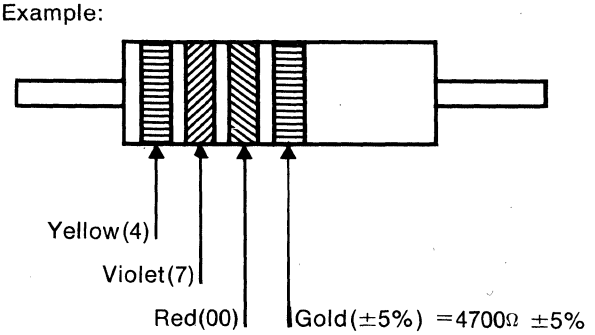




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



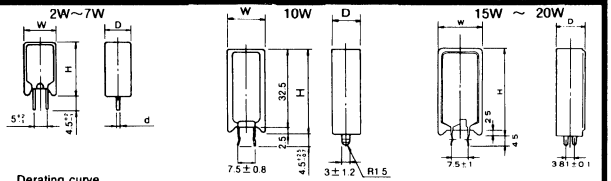
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CERAMIC INSULATED RESISTORS (STANDARD)

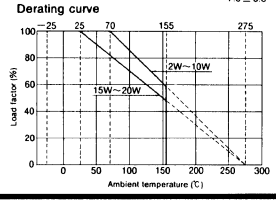
- **MNS**
- **MNR**
- **MNG**

Terminals and leads in the same direction; space-saving types

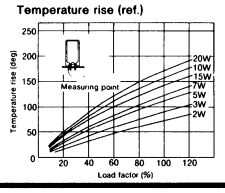


Rated power (W)	Dimensions (mm) W	D	H	d	Resistance range MNS Standard	MNS UL	MNR Standard	MNR UL	MNG Standard	Weight (g)
2	11±1	7±1	20.5±1.5	0.8±0.1	0.15 ~ 200	0.15 ~ 200	100 ~ 13K	100 ~ 13K	0.082 ~ 33	3.7
3	12±1	8±1	25.0±1.5	0.8±0.1	0.27 ~ 360	0.27 ~ 360	100 ~ 22K	100 ~ 22K	0.18 ~ 68	5.3
5	13±1	9±1	25.5±1.5	0.8±0.1	0.3 ~ 510	0.3 ~ 5.10	100 ~ 27K	100 ~ 27K	0.22 ~ 91	6.4
7	13±1	9±1	38.5±1.5	1.0±0.1	0.51 ~ 1.5K	—	200 ~ 56K	—	—	10.2
10	16±1	12±1	35.0±1.5	—	1.0 ~ 1K	—	—	—	—	15.5
15	20±1.2	13±1	38.0±1.5	—	1.0 ~ 2.0K	—	—	—	—	30.0
20	20±1.2	13±1	45.0±1.5	—	1.0 ~ 3.0K	—	—	—	—	41.0

Derating curve



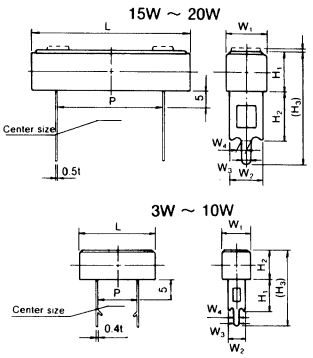
Temperature rise (ref.)



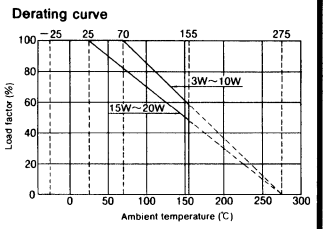
- **MPS**
- **MPR**
- **MQS**
- **MQR**

PCB direct-mounting types

Types using lower heat conductive terminal (approx. 50% of MPS, MPR)



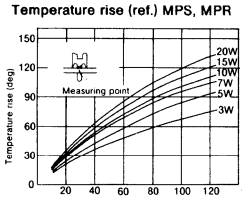
Derating curve



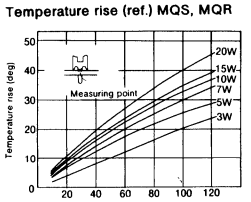
Rated power (W)	Dimensions (mm) L	P	W_1	W_2	W_3	W_4	H_1	H_2	(H_3)
3	24 ±1.2	12.5±1	9 ±1	5±0.2	1.4±0.1	1.6±0.1	9 ±1	10+2 −1	23.5
5	27 ±1.5	15 ±1	9.5±1	5±0.2	1.4±0.1	1.6±0.1	99.5±1	10+2 −1	24
7	35 ±1.5	22.5±1	9.5±1	5±0.2	1.4±0.1	1.6±0.1	9.5±1	10+2 −1	24
10	48 ±1.5	35 ±1	9.5±1	5±0.2	1.4±0.1	1.6±0.1	9.5±1	10+2 −1	24
15	48 ±1.5	32.5±1	12.5±1.2	10±0.5	2.7±0.1	3 ±0.1	12.5±1.2	15±1.5	34.5
20	63.5±2	50 ±1.5	12.5±1.2	10±0.5	2.7±0.1	3 ±0.1	12.5±1.2	15±1.5	34.5

Rated power (W)	Resistance range MPS Standard	MPS UL	MPR Standard	MPR UL	MQS Standard	MQR Standard	Weight (g)
3	0.22 ~ 390		100 ~ 39K	100 ~ 22K	0.22 ~ 390	100 ~ 22K	5.5
5	0.47 ~ 680	0.47 ~ 680	100 ~ 11K	100 ~ 27K	0.47 ~ 680	100 ~ 27K	6.5
7	0.68 ~ 1000	0.68 ~ 1000	200 ~ 100K	100 ~ 56K	0.68 ~ 1000	200 ~ 56K	8.3
10	1.0 ~ 1500	1.0 ~ 1000	200 ~ 150K	200 ~ 75K	1.0 ~ 1500	200 ~ 75K	11.0
15	1.0 ~ 2000	1.0 ~ 2000	510 ~ 200K	510 ~ 110K	1.0 ~ 2000	510 ~ 110K	17.8
20	1.0 ~ 3000	1.0 ~ 3000	510 ~ 240K	510 ~ 180K	1.0 ~ 3000	510 ~ 180K	22.8

Temperature rise (ref.) MPS, MPR

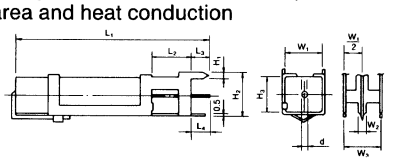


Temperature rise (ref.) MQS, MQR

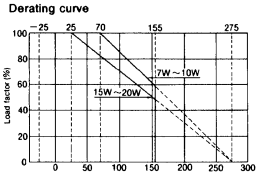


- **MVS**
- **MVR**

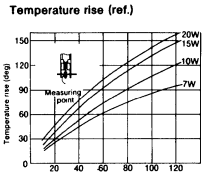
Designed for minimal PCB occupation area and heat conduction



Derating curve



Temperature rise (ref.)



Rated power (W)	Dimensions (mm) L_1	L_2	L_3	L_4	H_1	H_2	H_2	W_1	W_2	W_3	d±0.1	Resistance range MVS	MVR	Weight
7	49 ±1.5	10±1	4.0±0.2	5.0±0.5	1.5±0.1	11±1	9pm1	9.5±1	1.5±0.1	10±1	0.8	0.51 ~ 1500	200 ~ 56K	10.0
10	67 ±1.5	10±1	4.0±0.2	5.0±0.5	1.5±0.1	11±1	9±1	9.5±1	1.5±0.1	10±1	0.8	1 ~ 2000	200 ~ 75K	13.3
15	62.5±1.5	10±1	4.5±0.2	6.5±1	2.5±0.15	14±1	12.5±1.2	12.5±1.2	2.5±0.15	13±1	1.0	1 ~ 2000	510 ~ 110K	22.1
20	78 ±2	10±1	4.5±0.2	6.5±1	2.5±0.15	14±1	12.5±1.2	12.5±1.2	2.5±0.15	13±1	1.0	1 ~ 3000	510 ~ 180K	26.4

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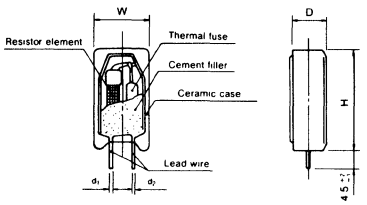
RESISTORS

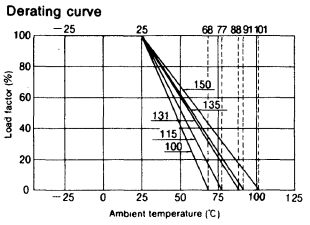
THERMAL FUSE INCORPORATED CEMENT RESISTORS

- **MEG**
- **MES**
- **MER**

Since thermal fuses are incorporated, cement resistors respond quickly to overloading as well as external overheating.

These resistors also provide outstanding features against surges. Therefore they are suitable for the prevention of inrush current for switching regulators.





Type	Dimensions (mm)					Temperature range of each element		
	W	D	H	d_1	d_2	MEG	MES	MER
02	11±1	7±1	20.5±1.5	0.8±0.1	0.6±0.1	4.7~20	0.15~200	100~13K
03	12±1	8±1	25.0±1.5	0.8±0.1	0.6±0.1	4.7~20	0.27~360	100~22K
05	13±1	9±1	25.5±1.5	0.8±0.1	0.6±0.1	4.7~91	0.3~510	100~27K
07	13±1	9±1	38.5±1.5	1.0±0.1	1.0±0.1	—	0.51~1500	—

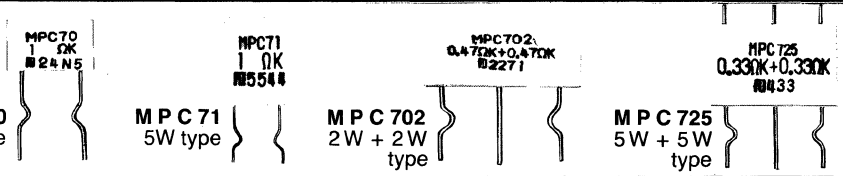
Type	Resistance range	Tolerance	Type of thermal fuse		Continuous Rated power
			Nominal operating temp	Operating temp	
02	0.15Ω~13kΩ	J:±5% K:±10%	100	95±	0.7W
			115	110±4	1.0W
			131	126±4	1.4W
			135	130±4	1.5W
			150	145±4	1.9W
03	0.27Ω~22kΩ		100	95 pm	0.75W
			115	110 pm4	1.05W
			131	126±4	1.45W
			135	130±4	1.55W
			150	145±4	2.0W
05	0.3Ω~27kΩ		100	95±	0.8W
			115	110±4	1.1W
			131	126±4	1.5W
			135	130±4	1.6W
			150	145±4	2.1W
07	0.51Ω~1.5kΩ		101	99±	1.3W
			113	109±	1.6W
			121	119±4	1.9W
			133	129±4	2.2W
			147	139±4	2.7W

MPC Series Metal Plate Cement Resistors

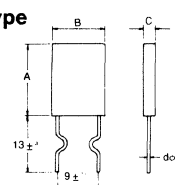
- **MPG**

Compact type with any safety design on nonflammability and insulation.

Low resistance and strong at surge current

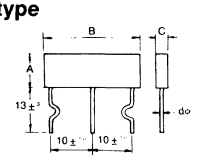


Single type



Model	Rated power (W)	Resistance range (Ω)	Tolerance	A (mm)	B (mm)	C (mm)	dφ (mm)	Remarks
MPC 70	1	0.1~1.0	K	8±1.0	13±1.0	4±0.5	0.6	
MPC 78	2	0.1~0.47	K	8±1.0	13±1.0	4±0.5	0.6	Low distortion factor products for acoustic products
MPC 76	2	0.01, 0.05	K	8±1.0	13±1.0	4±0.5	0.6	
MPC 71	5	0.1~1.0	K	18±1.0	14±1.0	5±0.5	0.6	
MPC 75	3	0.01, 0.05	K	18±1.0	14±1.0	5±0.5	0.8	
MPC 74	5	0.1~1.0	K	18±1.0	14±1.0	5±0.5	0.8	Low distortion factor products for acoustic products
MPC722	10	2.2, 3.3	J	18±1.0	26±1.0	5±0.5	0.8	

Double type

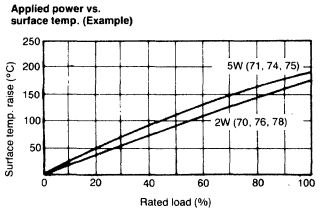


Model	Rated power (W)	Resistance range (Ω)	Tolerance	A (mm)	B (mm)	C (mm)	dφ (mm)	Remarks
MPC702	2+2	0.22+0.22~0.47+0.47	K	10±1.0	26.5±1.0	5±0.5	0.6	
MPC722	5+5	0.1+0.1~0.47+0.47	K	17±1.0	26±1.0	5±0.5	0.8	Resistor have ideling terminal
MPC725	5+5	0.22+0.22~0.47+0.47	K	17±1.0	26±1.0	5±0.5	0.8	

- The terminals are of straight type and kink-forming type.

Item	Specification	Remarks
Temp. coeff. of resistance	±350ppm/°C>	
Short-time overload	±2%>	10× rated power for 5 sec.
Withstanding voltage	±2%>	500V for 1 min.
Insulation resistance	10MΩ>	500V megger.
Damp. load life	±5%>	40°C 95% RH, for 1000hr.
Load life	±5%>	70°C for 1000hr.
Unflammability	PASS	According to UL 492-2•7•8

Applied power vs. surface temp. (Example)

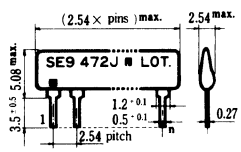
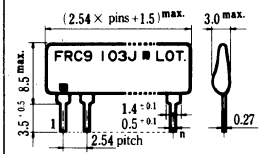
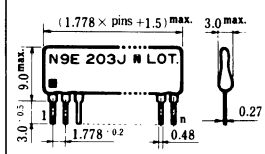
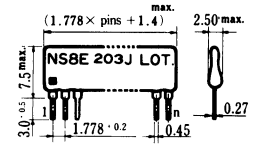


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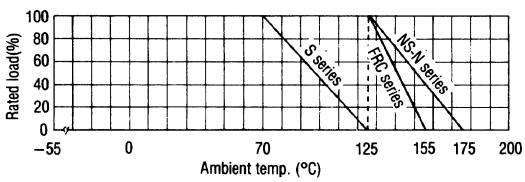
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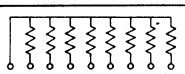
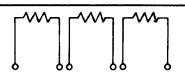
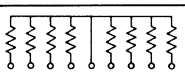
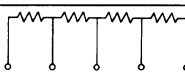
Thick Film Resistor Networks

SIP type hybrid thick film resistor networks

	Standard products (Low profile)	For burn-in: High power	For burn-in: Shrink type (1.778mm pitch)	
	S series	F R series	N series	N S series
Appearance / Dimensions				
Example	S E 9 472 J Type Circuit Elements Value Tolerance	FRC 9 103 J Type Elements Value Tolerance	N E 9 203 J Type Circuit Elements Value Tolerance	NS E 8 203 J Type Circuit Elements Value Tolerance
Rated power	0.125W/element	0.250W/element	0.250W/element	0.250W/element
Max. working voltage	100V	200V	200V	200V
Resistance range	22Ω ~ 1 MΩ	22Ω ~ 1 MΩ	22Ω ~ 470kΩ	22Ω ~ 470kΩ
Resistance tolerance	G(±2%)J(±5%)K(±10%)	G(±2%)J(±5%)K(±10%)	G(±2%)J(±5%)K(±10%)	G(±2%)J(±5%)K(±10%)
Temp. coeff. of resistance	±200ppm/°C	±250ppm/°C	±250ppm/°C	±250ppm/°C
Operating temp. range	−55 ~ +125°C	−55 ~ +155°C	−55 ~ +175°C	−55 ~ +175°C

Derating curve

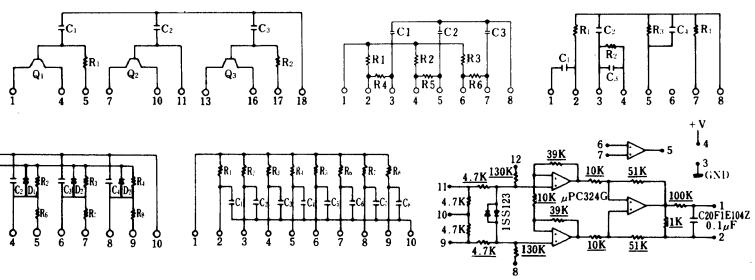


Series	Standard circuit	Standard elements	Series	Standard circuit	Standard elements
S E F R C N N S	 1 PIN E circuit (Edge common type)	3 ~ 12 4 ~ 14 4 ~ 21 4 ~ 13	S I	 1 PIN 1 circuit (Individual type)	2 ~ 7
S S	 1 PIN S circuit (I Symmetrical type)	4 ~ 12	S D	 1 PIN D circuit (Divider type)	3 ~ 12

Custom H.I.C. & Resistor Networks

Our H.I.C. and resistor networks, using alumina or organic substrate and being finished with surface mount, can respond to various custom requests such as circuits, relative ratio, double-sided print, crossover print, etc.

Circuit example



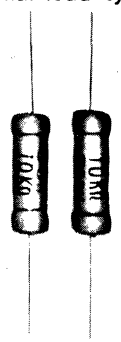
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7267 Coldwater Canyon, North Hollywood, California 91605
(818) 765-8300 in LA • (714) 549-4316 in Santa Ana/Orange County
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FAX: (818) 765-2387

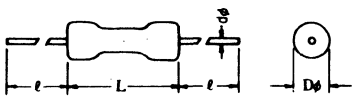
The Resistorsource!

Flame-Proof Metal Oxide Film Resistors — Standard Size

Axial-lead type			DIMENSIONS					
Model	Rated power (W)	Resistance range(Ω)	Tolerance	L (mm)	Dϕ (mm)	ℓ (mm)	dϕ (mm)	Remark
RNU 1/2 RSU 1/2	1/2	0.1~9.1 10~20 K	J	9±1	3.5±1	30±3	0.65±0.1	dϕ =0.8 for miniaturized resistors
RNU 1 RSU 1	1	0.1~9.1 10~100 K	J	12^{+1}_{-2}	4±1	38±3	0.8±0.1	
RNU 2 RSU 2	2	0.1~9.1 10~100 K	J	16^{+1}_{-2}	6±1	38±3	0.8±0.1	
RNU 3 RSU 3	3	0.1~9.1 10~150 K	J	26^{+1}_{-2}	8.5±1	38±3	0.8±0.1	

Axial lead type



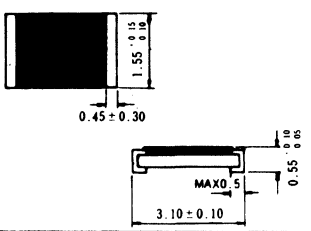


See the spec. for taping

Thick Film Chip RESISTORS (FCR-125)

■ DIMENSIONS

Item	Specifications	Remarks
Rated power	0.125W	Ambient temp.: 70ºC
Max. working voltage	200V	
Resistance range	100Ω~10MΩ	As a standard, E-24 step
Tolerance of resistance	±2, 5, 10, 20%	



RESISTOR PRODUCTS

Carbon Comp
1/8w, 1/4w, 1/2w

Carbon Film
1/8w, 1/4w, 1/2w, 1w, 2w

Metal Film
1/8w, 1/4w, 1/2w, 1w, 2w

Metal Oxide
1/4w, 1/2w, 1w, 2w, 3w, 5w

Metal Plate
2w, 5w

Precision Wirewound
Tol. to .005%
Temp. Coefficient to 1PPM

Wirewounds
1w to 1000 watts

Chip Resistors
1/8w, 1/4w, 1/2w, 1w, 2w

Variable Resistors
UL, CSA Approved

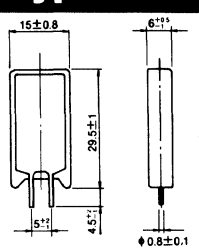
Networks
Sips
Dips
Custom Type
Hybrid Circuits
Flameproof

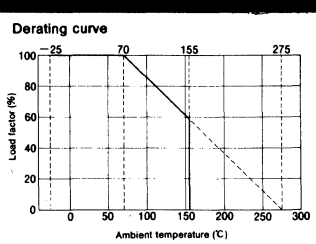
MNM Space-saving thin type

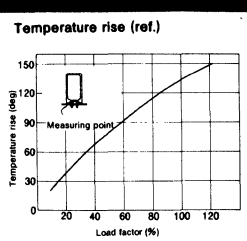
Rated power, resistance range, and tolerance

Type	Rated power	Nominal resistance
05	5W	1Ω ~ 20MΩ

* The wire-wound type is used for 1Ω~43Ω, and the film type is for 47Ω or more.





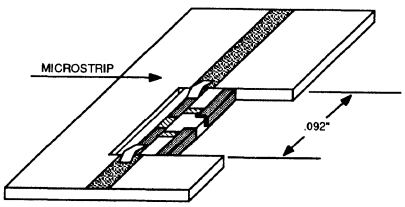


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FAX: (818) 765-2387

AMITRON
American Micro-Tronix Inc.
85 Flagship Drive
North Andover, Massachusetts 01845
(508) 686-1882
Fax # (508) 686-0622

THICK FILM MICROWAVE COMPONENTS
CHIP ATTENUATORS



01 — STANDARD FEATURES INCLUDE:

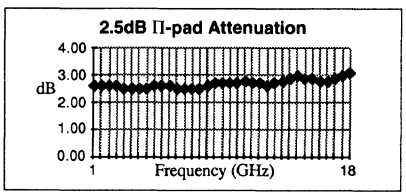
- Chip construction designed for MIC assembly
- Ground plane metalization suitable for soldering or epoxying
- Wire or ribbon bondable gold top conductor lines
- Size: Length .092"
  Width <.045"
  Thickness .010"

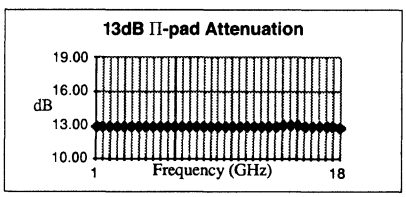
ORDERING INSTRUCTIONS FOR Π-PADS:

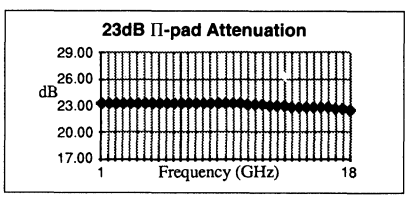
Amitron Part Number = AMP-XX.XdB-01
AMP = Amitron Π-pad
XX.X = Desired Attenuation
01 = Standard Features

ATTENUATOR PERFORMANCE

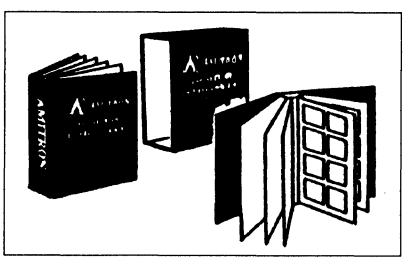
AMITRON has manufactured Π-pads up to 45 dB.
High power balanced attenuators, 4 watts average handling power capability available.





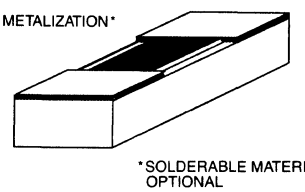


CHIP RESISTOR KITS



AMITRON Engineering Chip Resistor Kits provide a variety of resistor values allowing engineers the flexibility to more readily develop new designs or modify existing circuits. Standard Kits include resistors with 30 different values ranging from 1 ohm to 820K ohms, 20 resistors per value packaged in separate containers. Resistor sizes = .020" width × .040" length × .015" thick with gold metalization pads for aluminum gold wire bonding.

STANDARD KIT RESISTOR STYLE



RESISTOR SPECIFICATIONS:

Resistance Values (ohms): Tolerance ±5%

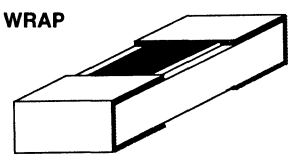
1	10	100	1.0K	10K	100K
1.8	18	180	1.8K	18K	180K
3.3	33	330	3.3K	33K	330K
4.7	47	470	4.7K	47K	470K
8.2	82	820	8.2K	82K	820K

Temperature Coefficient of Resistance (TCR) ±200 PPM from −55°C to +125°C.
Power Rating 50 milliwatts (without heat sinking).

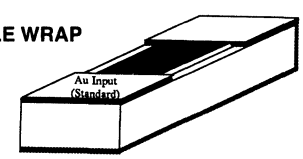
OPTIONS:

- Additional Values to megohm range at $50 per package of 20 after purchase of initial kit
- Solder Tinning
- Dual Wrap or Single Wrap Chip Resistor Styles:

DUAL WRAP



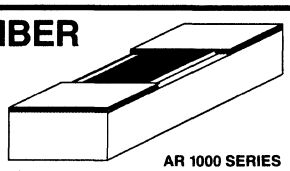
SINGLE WRAP

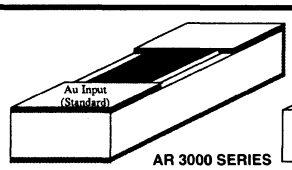


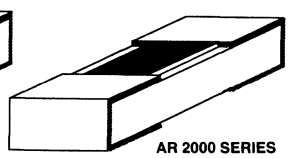
CHIP RESISTOR PART NUMBER GUIDE

AR XXXX / X / 000-0 / XX / X

- **CHIP DESIGN:**
  X XXX
  - Chip Size (see charts)
  - Resistor Metalization:
    1 = standard resistor
    2 = dual wrap resistor
    3 = single wrap resistor
- **TERMINATION METALIZATION**
  Q = Palladium/Silver
  R = Platinum/Gold
  S = Platinum/Palladium/Gold
  T = Gold
  QN = Nickel Barrier
- **RESISTANCE SPECIFICATIONS:** First three (3) digits represent significant figures, digit after the dash (–) specifies the number of zeros. If fractional values of an Ω are required, the letter "D" shall be substituted for one of the significant digits and succeeding digits of the group shall represent significant figures.
- **OPTIONS:**
  O = No options
  T = SN62 solder tinning
  M = Back Metalization
  UP = Unpassivated
  R = Pt/Au Input metalization
- **TOLERANCE (+/−):**
  D5 = .5%
  01 = 1%
  02 = 2%
  05 = 5%
  10 = 10%







NO WRAP

AMITRON Series	Width	Length	Thickness
AR1001	.020	.040	.010
AR1002	.025	.050	.010
AR1003	.050	.050	.010
AR1004	.025	.100	.010
AR1005	.050	.075	.010
AR1006	.100	.050	.010
AR1007	.020	.020	.010
AR1008	.100	.100	.020
AR1009	.050	.050	.020
AR1010	.120	.240	.030

SINGLE WRAP

AMITRON Series	Width	Length	Thickness
AR3001	.020	.030	.015
AR3002	.020	.040	.015
AR3003	.025	.045	.010
AR3004	.025	.045	.015
AR3005	.055	.065	.015
AR3006	.055	.065	.025
AR3007	.025	.045	.025
AR3008	.020	.040	.010
AR3009	.050	.065	.025
AR3010	.102	.110	.010
AR3011	.050	.050	.020
AR3012	.020	.040	.025
AR3013	.055	.065	.010
AR3014	.025	.045	.025

DUAL WRAP

AMITRON Series	Width	Length	Thickness
AR2001	.020	.030	.015
AR2002	.020	.040	.015
AR2003	.030	.050	.015
AR2004	.050	.050	.015
AR2005	.050	.075	.015
AR2006	.050	.100	.015
AR2007	.050	.150	.015
AR2008	.100	.100	.015
AR2009	.050	.030	.015
AR2010	.015	.040	.010

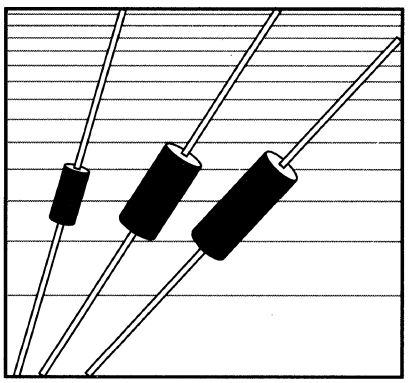
The above configurations are only a sample of resistor sizes available. Please call for additional part numbers to meet your design requirements. As with the above standard chips (AR1000, 2000, 3000), AMITRON will supply special configurations, such as the AR4000 series (partial wraps), upon request.

A COMPANY OF VISHAY ANGSTROHM

Precision Metal Film Resistors

■ ***Established Reliability*** ■ ***Hermetically-sealed***
■ ***MIL-R-55182, Style RNR/RNN*** ■ ***Characteristics C and E***

For the ultimate in reliability, stability and uniformity of construction, ANGSTROHM hermetically-sealed metal film resistors are unquestionably first-choice. ANGSTROHM has accumulated over 1.234 billion unit failure rate hours to MIL-R-55182 on the RNR/RNN style, characteristics C and E, without a single failure. The true glass-to-metal hermetically-sealed enclosure seals the resistor element in an inert gas atmosphere and protects it from virtually all adverse environmental influences. The glass enclosure will withstand in excess of 3000 p.s.i. external pressure without leakage. The reliability and stability of ANGSTROHM hermetically-sealed resistors have been established by their use in nearly every military, missile, aerospace, and oceanography program having the most demanding applications and the most hostile environments.



Features

- Qualified to MIL-R-55182 Characteristics C and E
- Performance far exceeds the requirements of MIL-R-55182
- Excellent long term stability
- Highest reliability
- Hermetic glass enclosure is impervious to harmful environments
- Inert gas filled
- Very low noise
- Excellent high frequency performance

General Specifications

- **Resistance Range**: 10.0Ω to 7.5M (see Table below) Standard values should be selected from the Standard Resistance Value Table in the ANGSTROHM Precision Metal Film catalog.
- **Tolerance**: ±0.1% (B), ±0.5% (D), ±1.0% (F)
- **Temperature Characteristics**: ±25ppm/°C (Characteristic E), ±50ppm/°C (Characteristic C)
- **Power Ratings**: 1/10, 1/8, 1/4, and 1/2 watt @125°C 1/8, 1/4, 1/2, and 3/4 watt @ 70°C
- **Power Derating**: For ambient temperatures above 125°C, see Power Derating Curve.
- **Life Failure Rate**: M, P, R, S
- **Voltage Rating**: Applied voltage shall not exceed $\sqrt{\text{Power Rating x Resistance Value}}$ or the Maximum Voltage Rating (per Table) whichever is lesser.

Style Selection/Electrical Specifications

Military Style	ANGSTROHM Type	Military Power Rating		Maximum Working Voltage	Temperature[1] Characteristic (ppm/°C)	Resistance Tolerance (%)	Qualified[2] Resistance Range		Life Failure Rate
		125°C	70°C				Min.	Max.	
RNR55 RNN55	HT/HS/HN55 HN55	1/10	1/8	200	C = ±50 E = ±25	B = ±0.1 D = ±0.5 F = ±1.0	10.0Ω	1.21M	M, P, R, S
RNR57 RNN57	HS/HN57 HN57	1/8	1/4	250	C = ±50 E = ±25	F = ±1.0	49.9Ω	200K	M, P, R, S
RNR60 RNN60	HT/HS/HN60 HN60	1/8	1/4	250	C = ±50 E = ±25	B = ±0.1 D = ±0.5 F = ±1.0	10.0Ω	2.49M	M, P, R, S
RNR65 RNN65	HT/HS/HN65 HN65	1/4	1/2	300	C = ±50 E = ±25	B = ±0.1 D = ±0.5 F = ±1.0	24.9Ω	4.99M	M, P, R, S
RNR70 RNN70	HS/HN70 HN70	1/2	3/4	350	C = ±50 E = ±25	B = ±0.1 D = ±0.5 F = ±1.0	24.9Ω	7.5M	M, P, R, S

1. Temperature Characteristics C and E designate hermetically-sealed enclosure.
2. Standard resistance values should be selected from the Standard Resistance Values Table found in the ANGSTROHM Precision Metal Film Catalog. Other values available on special order.

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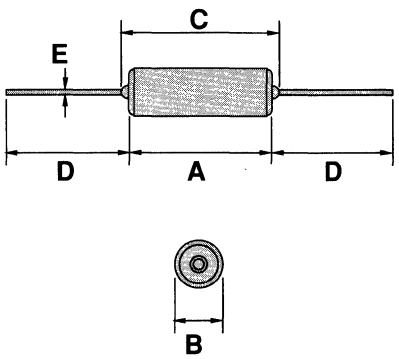
Precision Metal Film Resistors

Dimensions (Per MIL-R-55182)

Military Style (RNR/RNN)	A Body Length	B Body Diameter	C Clean Lead to Clean Lead (Max.)	D Lead Length (±0.125/3.18)	E Lead Diameter (±0.002/.05)	Approx. Weight (Grams)
55	$0.250^{+0.031}_{-0.045}$ / $6.35^{+0.79}_{-1.17}$	0.109 ± 0.031 / 2.77 ± 0.79	0.379 / 9.63	1.500 / 38.10	0.025 / 0.64	0.314
57	0.281 ± 0.062 / 7.14 ± 1.57	0.155 ± 0.015 / 3.94 ± 0.38	0.467 / 11.86	1.25 / 31.75	0.020 / 0.51	0.317
60	0.375 ± 0.062 / 9.53 ± 1.57	$0.125^{+0.040}_{-0.031}$ / $3.18^{+1.02}_{-0.79}$	0.561 / 14.25	1.500 / 38.10	0.025 / 0.64	0.485
65	$0.625^{+0.031}_{-0.094}$ / $15.88^{+0.79}_{-2.39}$	$0.188^{+0.062}_{-0.031}$ / $4.78^{+1.57}_{-0.79}$	0.780 / 19.81	1.500 / 38.10	0.025 / 0.64	0.950
70	$0.750^{+0.125}_{-0.062}$ / $19.05^{+3.18}_{-1.57}$	$0.250^{+0.078}_{-0.031}$ / $6.35^{+1.96}_{-0.79}$	0.939 / 23.85	1.500 / 38.10	0.032 / 0.81	1.300

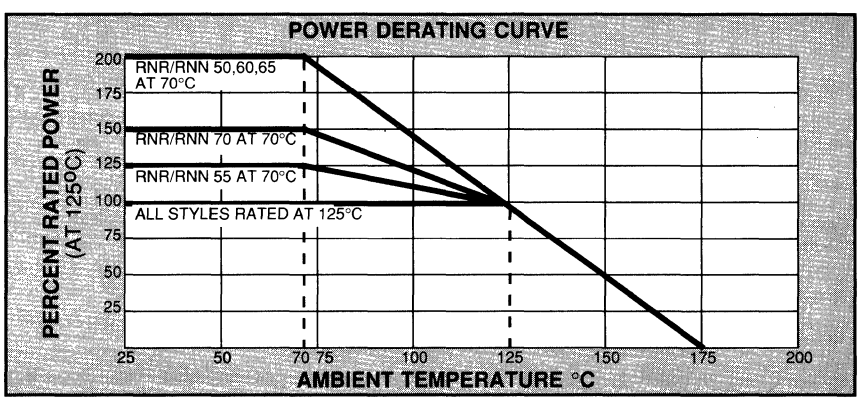
1. Dimensions shown are maximum allowable per MIL-R-55182. For dimensions, refer to "H" series, Commercial Metal Film Resistors, in the ANGSTROHM Precision Metal Film Catalog.

OUTLINE DRAWING (HN, HS, HT)

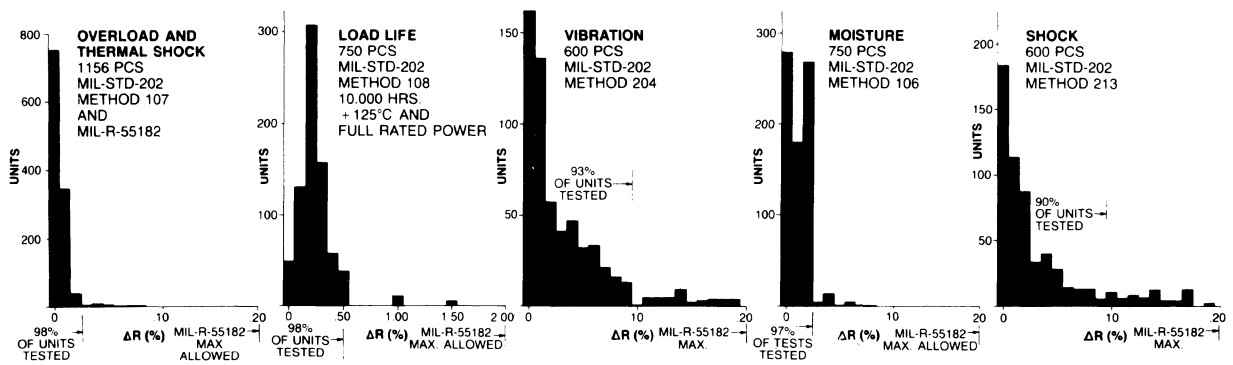


Power Rating

Resistors shall have a power rating based on continuous full load operation at 125°C. For temperatures above 125°C, the load shall be derated per the Power Derating Curve for all styles. For power rating at temperatures below 125°C (down to 70°C) the load may be increased per the Power Derating Curve for the particular style selected. In no case should the voltage exceed the maximum voltage rating per the Style and Electrical Specifications table for types HN, HS and HT, in the ANGSTROHM Precision Metal Film Resistors Catalog.



Typical Performance Characteristics To MIL-R-55182 (MIL-STD-202)





610 East Tenth Street
Oakland, CA 94606
FAX: (415) 452-3620

BRILL ELECTRONICS



1220 Olympic Boulevard
Santa Monica, CA 90404
Tel: (213) 452-8002

(415) 834-5888

ANTENNAS
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- Cablewave Hardware
- Decibel Products

AUDIO PRODUCTS
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- Bogen
- Quam
- Shure
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BATTERIES
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- Eveready
- Kodak

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- BUD
- Calif. Chassis

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- E.F. Johnson
- Mallory
- Sprague

CIRCUIT BREAKERS
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- Potter Brumfield
- Waber Electric

CONNECTORS
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- Amphenol
- Cablewave
- E.F. Johnson
- Kulka
- Manhattan
- Paladin
- Panduit
- Pomona
- Superior
- Switchcraft

COUNTERS
- Hecon
- Kessler-Ellis
- Redington
- Stemco

FIBER OPTICS
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- Amphenol
- Belden Cable
- Madison

FILTERS
- Curtis
- J.W. Miller
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- Stancor

FUSES
- Bussmann
- Littelfuse
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- Mag-Lite
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OUTLET STRIPS
- Waber

POT'S & CONTROLS
- Bourns
- Clarostat
- Ohmite

POWER SUPPLIES & TRANSFORMERS
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- Microtran
- Sola
- Stancor
- Superior
- Triad
- Tripp-lite
- UTC
- Waber

RELAYS
- Aleph International
- Allied Controls
- American Zettler
- Aromat
- C.P. Clare
- Crydom
- Coto
- Gordos
- Guardian
- ITT
- Line Electric
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- Sigma
- Struthers-Dunn
- Theta-J

RESISTORS & NETWORKS
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- Mallory
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SEMICONDUCTORS
- Semi Inc.
- Semitronics

SWITCHES
- Arrow Hart
- AMP
- C & K
- Cherry Electric
- G.C.
- McGill
- Omron
- Oslo
- Otto
- Switchcraft
- Unimax

TERMINAL BLOCKS
- AMP
- Buchanan
- Curtis
- Electrovert
- Magnum
- RDI
- Siemen
- USD
- Vernitron-Beau
- Weidmuller

TEST EQUIPMENT
- Fluke
- Simpson Electric
- Triplett

TIMERS
- Agastat
- Amperite
- Industrial Timer
- Magnecraft
- Master Electronics
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- Blazer
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TRANSFORMERS
- Dormeyer
- Jeffersons
- Microtran
- Sola
- Stancor
- Thordarson
- Triad
- U.T.C.

TUBES
- Eimac
- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

WIRE & CABLE
- Alpha
- Belden
- Cablewave
- Carol
- Iboco
- Madison
- Manhattan
- Quabbin

BOURNS



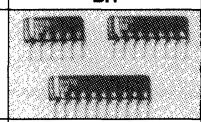
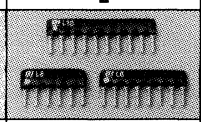
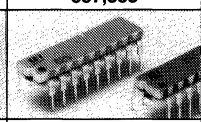
OHMITE

Beckman Industrial™

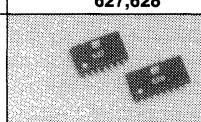
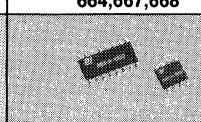
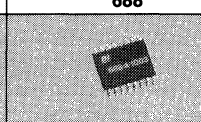
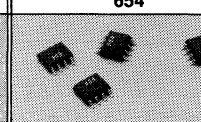
Affiliate of Emerson Electric Co.

RESNET® Resistor Networks & Thick Film Chip Resistors

SIPs & DIPs

Model		BH	L	694,698,699	887,888	898,899
						
Element		Cost Effective Thick Film	Cost Effective Thick Film	Precision Thin Film	Cost Effective Thick Film	Cost Effective Thick Film
Type		Conformal SIP	Conformal SIP	Molded DIP	Ceramic DIP	Ceramic DIP
# of Pins		4 to 14	4 to 14	8,14,16	18,20	14,16
Resistance Range, Ohms		22 to 1 Meg	22 to 1 Meg	100 to 100K	22 to 2.2 Meg	22 to 1 Meg
Resistance Tolerance		±2%	±2%	±1% to ±0.1%	±2%	±2%
TCR, ppm/°C		±100	±100	±50	±100	±100
TCR Tracking, ppm/°C		±50	±50	±5	±50	±50
Power Rating, Watts, (Per Resistor)	Bussed	0.250 at 70°C	0.125 at 70°C	0.05 at 70°C	0.125 at 70°C	0.125 at 70°C
	Isolated	0.400 at 70°C	0.200 at 70°C	0.10 at 70°C	0.250 at 70°C	0.250 at 70°C

Surface Mount

Model		627,628	664,667,668	688	654
					
Element		Cost Effective Thick Film	Precision Thin Film	Precision Thin Film	Thin Film RF Attenuator
Type		.220" SMD	.150" SMD	.300" SMD	50 Ω Π Attenuator
# of Pins		14,16	14,16	16	8
Resistance Range, Ohms		22 to 1 Meg	1K-100K	50K, 100K	3dB to 16dB Attenuation
Resistance Tolerance		±2%	±1% to ±0.1%	±1% to ±0.1%	±0.2dB to 1 GHz
TCR, ppm/°C		±100	±25	±25	±25
TCR, Tracking, ppm/°C		±50	±5	±5	N/A
Power Rating, Watts, (Per Resistor)	Bussed	0.16 at 70°C	0.10 at 70°C	0.10 at 70°C	0.4 Max. Package Power
	Isolated	0.32 at 70°C	0.10 at 70°C	0.10 at 70°C	

Chip Resistors

Model	BCR1/16	BCR1/10	BCR1/8	BCR1/4	BCR1/2
Industry Style, Inches(mm)	0603(1608)	0805(2012)	1206(3216)	1210(3225)	2010(5125)
Standard Resistance Tolerance	±0.5% (D Tolerance), ±1% (F Tolerance), ±2% (G Tolerance), ±5% (J Tolerance)				
Standard Resistance Range, Ohms	10 Ohm to 1 Megohm (Plus "Zero Ohm" Jumper Chip) • J Tol.-E24 • G Tol.-E48 • F&D Tol.-E96				
Power Rating, Watts	0.063 at 70°C	0.100 at 70°C	0.125 at 70°C	0.250 at 70°C	0.500 at 70°C
High Power Rating, Watts	—	0.125 at 70°C	0.250 at 70°C	—	—
TCR, ppm/°C	±50ppm/°C (D Tolerance), ±100ppm/°C (F Tolerance), ±200ppm/°C (G&J Tolerances)				
Packaging Options (Quantity/Reel)					
Paper Tape	5,000 pcs./reel		5,000 pcs./reel (Standard)	N/A	N/A
Embossed Tape	N/A	N/A	4,000 pcs./reel (Optional)	4,000 pcs./reel	

Custom Networks - Special resistance values, resistor combinations and package arrangements are available if an "off-the-shelf" resistor package doesn't meet your needs. For additional information and complete product specifications contact the factory or your local Beckman Industrial Representative.

Telephone: (714) 447-2345 / FAX: (714) 447-2500

BOURNS NETWORKS, INC. • 1400 NORTH 1000 WEST STREET • LOGAN, UT 84321
(801) 750-7333 • FAX (801) 750-7253 • TWX -910- 971-4034

General Specifications

The following specifications apply to all Bourns standard networks (Series 4100, 4200, 4300, 4400, 4600 and 4800).

Environmental Specifications

Tests per MIL-R-83401...ΔR Maximum
Short Time Overload (STOL)...±0.25%
Load Life...±1.00%
Thermal Shock...±0.25%*
Power Conditioning...±0.50%*
Mechanical Shock...±0.25%
Moisture Resistance...±0.50%
Resistance to Solder Heat...±0.25%
Terminal Strength...±0.25%
Vibration...±0.25%
Low Temperature Storage...±0.25%
High Temperature Exposure...±0.50%
Low Temperature Operation...±0.25%
Operating Temperature
...−55 to +125°C
Storage Temperature...−65 to +150°C

*Thermal Shock and Power Conditioning Combined...±0.7% maximum

Mechanical Specifications

Flammability...Conforms to UL94V-0
Leadframe...Copper (Olin 194)
Tin/lead Finish
Body Material
Molded Product...Epoxy/Novolac
Conformal Product...Epoxy/Anhydride
Lead Solderability and Solvent Resistance
...Meet requirements of MIL-R-83401

Electrical Specifications

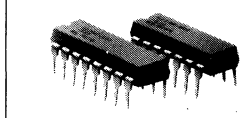
Standard Resistance Range
...10 ohms to 10 megohms
Resistance Tolerance
(Bussed and Isolated Circuits)
±2.0%...50 ohms to 5 megohms*
±1 ohm...10 ohms to 49 ohms
Dual Terminator
±2.0%...100 ohms to 5 megohms*
±2 ohms...10 ohms to 99 ohms
Maximum Operating Voltage
Through-Hole Components...100V
SMD Components...50V
Temperature Coefficient (TCR)
±100PPM/°C 50 ohms to 2.2 megohms
±250PPM/°C Below 50 ohms and above 2.2 megohms
TCR Tracking...50PPM/°C maximum
Equal value resistors
Insulation Resistance (@100V)
...10,000 megohms minimum
Dielectric Withstanding Voltage
200VRMS...1Ma maximum
leakage current
*Above 5 megohms = ±5.0%

STANDARD RESISTANCE VALUES
(003, 104 Circuits)

Resistance			
Ohms		Code	
R_1	R_2	R_1	R_2
160	240	161	241
180	390	181	391
220	270	221	271
220	330	221	331
330	390	331	391
330	470	331	471
3000	6200	302	622

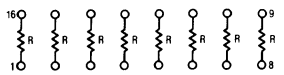
Molded DIP

(4100 Series)

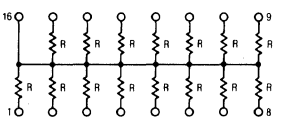


The Molded DIP product is suitable for automatic insertion and is in the standard JEDEC MS-001, .300 row spacing package. This product is available with 8, 14, 16, 18 or 20 pins.

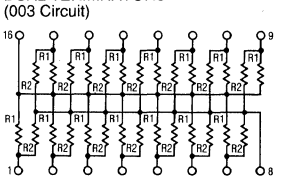
ISOLATED RESISTORS
(001 Circuit)



BUSSED RESISTORS
(002 Circuit)



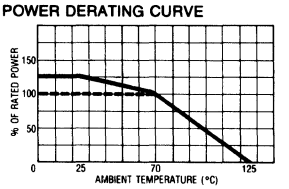
DUAL TERMINATORS
(003 Circuit)



POWER RATINGS @ 70°C
Resistor
001 Circuit...250W
002 Circuit...125W
003 Circuit...125W

Package
4108R...1.69W
4114R...2.00W
4116R...2.25W
4118R...2.50W
4120R...2.80W

POWER DERATING CURVE

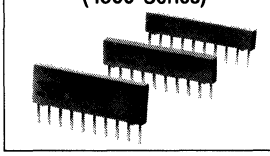


Bourns Resistor Networks power ratings are specified at +70°C, derated to zero at +125°C.

+25°C power ratings are 1.25 X the rated power specified at @ +70°C.

Molded SIP

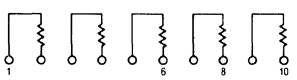
(4300 Series)



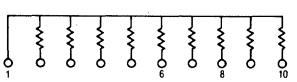
The Molded SIP product is suitable for automatic insertion and is available in low profile (.195" high), medium profile (.250" high) and high profile (.350" high) styles.

PIN COUNTS AVAILABLE
Low Profile...6-8-9-10-11
Medium Profile...4-6-8-10
High Profile...4-6-8-10

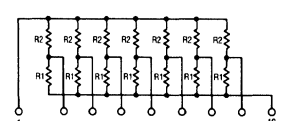
ISOLATED RESISTORS
(102 Circuit)



BUSSED RESISTORS
(101 Circuit)



DUAL TERMINATOR
(104 Circuit)



MAXIMUM PACKAGE POWER
(Watts @ 70°C)

Pins	Low Profile	Medium Profile	High Profile
4	—	.600	.800
6	.750	.900	1.200
8	1.000	1.200	1.600
9	1.125	—	—
10	1.250	1.500	2.000
11	1.375	—	—

MAXIMUM RESISTOR POWER
(Watts @ 70°C)

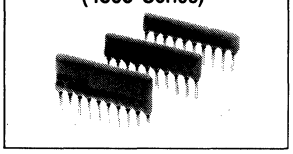
Profile	Isolated 102 Circuit	Bussed 101 Circuit	Dual Terminator 104 Circuit
Low	.300	.200	.200
Medium	.400	.250	.250
High	.500	.300	.300

Pins	A - Maximum Inches	(mm)
4	.384	(9.76)
6	.584	(14.84)
8	.784	(19.92)
9	.884	(22.46)
10	.984	(25.00)
11	1.084	(27.54)

Profile	B - Maximum Inches	(mm)
Low	.195	(4.96)
Medium	.250	(6.35)
High	.350	(8.89)

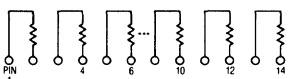
Conformal SIP

(4600 Series)

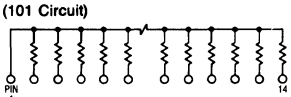


The Conformal SIP product is a lower cost alternative to the molded product and is suitable for use where manual insertion is employed. This product is available in all pin counts from 4 through 14 pins, in low profile (.200" high), medium profile (.250" high) and high profile (.350" high) packages.

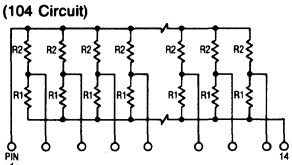
ISOLATED RESISTORS
(102 Circuit)



BUSSED RESISTORS
(101 Circuit)



DUAL TERMINATOR
(104 Circuit)



MAXIMUM PACKAGE POWER
(Watts @ 70°C)

Pins	Low Profile	Medium Profile	High Profile
4	.500	.600	.800
5	.625	.750	1.000
6	.750	.900	1.200
7	.875	1.050	1.400
8	1.000	1.200	1.600
9	1.125	1.350	1.800
10	1.250	1.500	2.000
11	1.375	1.650	2.200
12	1.500	1.800	2.400
13	1.625	1.950	2.600
14	1.750	2.100	2.800

MAXIMUM RESISTOR POWER
(Watts @ 70°C)

Profile	Isolated 102 Circuit	Bussed 101 Circuit	Dual Terminator 104 Circuit
Low	.300	.200	.200
Medium	.400	.250	.250
High	.500	.300	.300

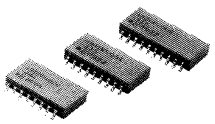
Pin Count	A - Maximum Inches	(mm)
4	.398	(10.11)
5	.498	(12.65)
6	.598	(15.19)
7	.698	(17.73)
8	.798	(20.27)
9	.898	(22.81)
10	.998	(23.35)
11	1.098	(27.89)
12	1.198	(30.43)
13	1.298	(32.97)
14	1.398	(35.51)

Profile	B - Maximum Inches	(mm)
Low	.200	(5.08)
Medium	.250	(6.35)
High	.350	(8.89)

BOURNS NETWORKS, INC. • 1400 NORTH 1000 WEST STREET • LOGAN, UT 84321
(801) 750-7333 • FAX (801) 750-7253 • TWX -910- 971-4034

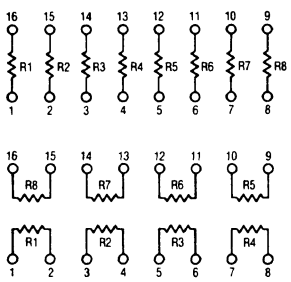
Medium Body SMD

(4800 Series)

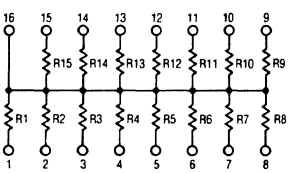


The SOM package is a surface-mount device (SMD) available in 14, 16, 18 and 20 pin versions. The Model 48XXP is designed per the EIA SOGN-0002 standard with gull wing leads, the most popular package style in the industry.

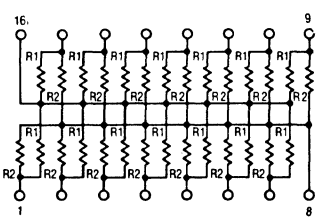
ISOLATED RESISTORS
(001 and 004 Circuits)



BUSSED RESISTORS
(002 Circuit)



DUAL TERMINATOR
(003 Circuit)



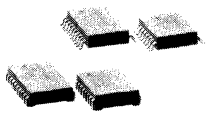
POWER RATINGS @ 70°C

Resistor
- 001 Circuit ..... .160W
- 002 Circuit ..... .080W
- 003 Circuit ..... .080W
- 004 Circuit ..... .160W

Package
- 4814 ..... 1.12W
- 4816 ..... 1.28W
- 4818 ..... 1.44W
- 4820 ..... 1.60W

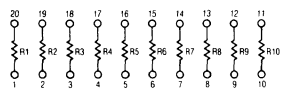
Wide Body SMD

(4400 Series)

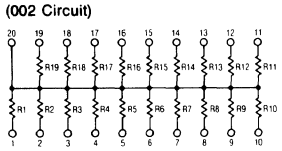


The SOL package is a surface-mount device (SMD) available in 16 and 20 pin configurations. These devices are available in the standard JEDEC MS-013 SOL (.300 wide) package with gull wing leads (Model 44XXP) and are also available with J-Hook leads (Model 44XXJ) for use where mounting area is restricted. The J-Lead version of the SOL package mounts on the same land pattern as the EIA SOM (.220 wide) medium body package.

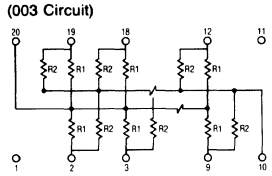
ISOLATED RESISTORS
(001 Circuit)



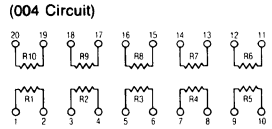
BUSSED RESISTORS
(002 Circuit)



DUAL TERMINATOR
(003 Circuit)



ISOLATED RESISTORS
(004 Circuit)



POWER RATINGS @ 70°C

Resistor
- 001 Circuit ..... .160W
- 002 Circuit ..... .160W
- 003 Circuit ..... .115W
- 004 Circuit ..... .160W

Package
- 4416 ..... 1.6W
- 4420 ..... 2.0W

Military Qualified Networks

GENERAL SPECIFICATIONS

These specifications are applicable to all Military Qualified Networks.

	Characteristic K	Characteristic M
Electrical Specifications		
Temperature Coefficient of Resistance (TCR)	±100ppm	±300ppm
Maximum Ambient Temperature @ Rated Power	70°C	70°C
Maximum Ambient Temperature @ Zero Power	125°C	125°C
Resistance Tolerance	F = ±1% G = ±2%	F = ±1% G = ±2% J = ±5%

	K	M
Environmental Specifications		
Thermal Shock ΔR Plus Power Conditioning ΔR	±0.7%	±0.7%
Low Temperature Operation ΔR	±0.25%	±0.5%
Short Time Overload ΔR	±0.25%	±0.5%
Terminal Strength ΔR	±0.25%	±0.25%
Resistance to Soldering Heat - ΔR	±0.25%	±0.25%
Moisture Resistance ΔR	±0.5%	±0.5%
Shock ΔR	±0.25%	±0.25%
Vibration - High Frequency ΔR	±0.25%	±0.25%
Life ΔR	±0.5%	±2.0%
High Temperature Exposure ΔR	±0.5%	±1.0%
Low Temperature Storage ΔR	±0.25%	±0.5%
Insulation Resistance	10,000 MegΩ	10,000 MegΩ

Mechanical Specifications
- Flammability ..... Conforms to UL94V-0
- Lead Frame Material ..... Copper (OLIN 194) tin/lead finish
- Body Material ..... Epoxy resin/Novolac

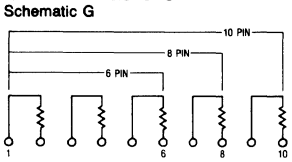
MILITARY SIP NETWORKS (M3XXX Series)

MILITARY QUALIFIED MOLDED SIPs

Low Profile (M83401-07, 08, 09)
High Profile (M83401-04, 05, 06)

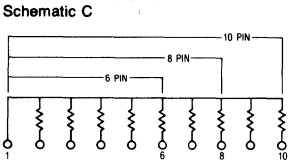
These SIP Resistor Networks are qualified in accordance with MIL-R-83401 and are available in bussed and isolated electrical configurations in pin counts of 6, 8 and 10 pins, with both low and high profile packages available.

ISOLATED RESISTORS
Schematic G



These models incorporate 3, 4 or 5 isolated thick-film resistors of equal value, each connected between two pins.

BUSSED RESISTORS
Schematic C



These models incorporate 5, 7 or 9 thick-film resistors of equal value, each connected between a common bus (pin 1) and a separate pin.

MILITARY DIP NETWORKS (M1XXR Series)

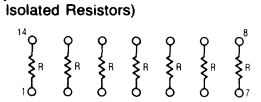
MILITARY QUALIFIED MOLDED DIPs

14-Pin (M83401-01)
16-Pin (M83401-02)

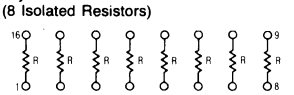
These Molded DIP Resistor Networks are qualified in accordance with MIL-R-83401 and are available in bussed and isolated electrical configurations in 14 and 16 pin packages.

ISOLATED RESISTORS
Schematic A

Style 01 - 14-Pin
(7 Isolated Resistors)



Style 02 - 16 Pin
(8 Isolated Resistors)



Specifications are subject to change without notice.

Cableform - Beman

Zion Cross Roads, Troy VA 22974 TEL: 804/589-8224 FAX: 804/589-3803

Carbon Film Resistors

HIGH VOLTAGE RESISTORS

Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	ID	FD	Ohms Min.	Ohms Max.	Available in Fig. No.'s
CFA	2,500	.5	3/4	1/4			10K	1G	2
CFB	5,000	1	1 1/2	1/4			20K	2G	2
CFC	3,500	1	1	5/16			10K	10G	1,2,4
CFD	10,000	2	1 3/4	5/16			10K	25G	1,2,4
CFE	15,000	3	3	5/16	NA	NA	20K	25G	1,2,4
CFF	30,000	5	5 1/2	5/16			40K	25G	1,2,4
CFG	15,000	4	2 1/2	9/16			20K	25G	1,2
CFH	25,000	6	4	9/16			40K	25G	1,2
CFJ	40,000	10	6 1/2	9/16			70K	25G	1,2
NFA	2,500	.5	3/4	1/4			10K	1G	3
NFB	5,000	1	1 1/2	1/4			20K	2G	3
NFC	3,500	1	1	5/16	NA	NA	10K	10G	3
NFD	10,000	2	1 3/4	5/16			10K	25G	3
NFE	15,000	3	3	5/16			20K	25G	3
*CJA	25 KV	10	4 1/2	3/4	1/2	—	50K	100G	5
*CJB	35 KV	20	6 1/2	1 1/8	3/4	13/16	100K	100G	5,6
*CJC	65 KV	30	10 1/2	1 1/8	3/4	13/16	200K	100G	5,6
*CJD	90 KV	60	14 1/2	1 1/2	1 1/8	19/64	400K	100G	5,6
*CJE	40 KV	35	6 1/2	2	1 9/16	19/64	300K	100G	5,6
*CJF	125 KV	100	18 1/2	2	1 9/16	19/64	700K	100G	5,6

*Sleeving available on request. Standard Tolerances are 15%, 10% 5% and 3%.

PRECISION TOLERANCE RESISTORS

Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	Resistance Value (Max.) ±2%	±1%	Available in Fig. No.'s
MP-1	5KV	1	1 1/2	1/4	2G	1G	2
MP-2	10KV	2	2	5/16	20G	5G	1,2,4
MP-4	20KV	4	3 1/2	5/16	50G	10G	1,2,4
MP-6	30KV	6	6	5/16	50G	10G	1,2,4
MP-8	30KV	8	5	9/16	50G	10G	1,2
MP-10	60KV	10	11	5/16	50G	10G	1,2,4
MP-12	50KV	12	8	9/16	50G	10G	1,2
MP-20	80KV	20	13	9/16	50G	10G	1,2
SP-1	5KV	1	1 1/2	1/4	100G	25G	2
SP-2	10KV	2	2	5/16	100G	25G	1,2,4
SP-4	20KV	4	3 1/2	5/16	100G	25G	1,2,4
SP-6	30KV	6	6	5/16	100G	25G	1,2,4
SP-8	30KV	8	5	9/16	100G	25G	1,2
SP-10	60KV	10	11	5/16	100G	25G	1,2,4
SP-12	50KV	12	8	9/16	100G	25G	1,2
SP-20	80KV	20	13	9/16	100G	25G	1,2

NOTE: Megohm equal 10^6, Gigohm equals 10^9, Teraohm equals 10^{12}.

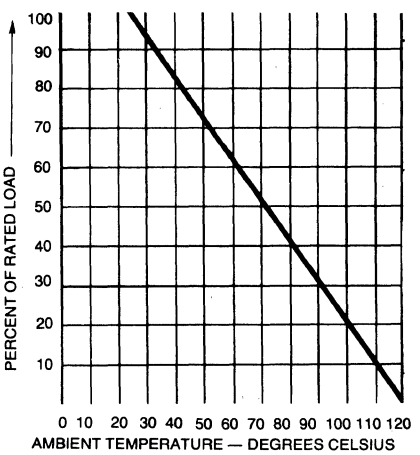
TEST DATA

Voltage and Temperature Characteristics

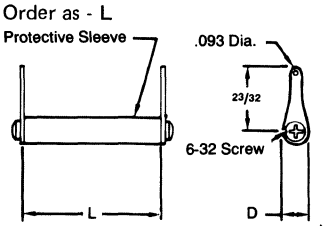
Type	Voltage Coeficient Neg. PPM/V Avg.	Temperature Coefficient Neg. PPM/°C Avg.
CFA	20-50	1100-4000
CFB	10-25	1100-4000
CFC	15-40	1100-5000
CFD	7-20	1000-4800
CFE	4-10	950-4400
CFF	2-6	900-4200
CFG	3-7.5	900-4200
CFH	1.5-4.5	875-4100
CFJ	1-2.5	850-4000
All SF Types	Less than 15% of Value at Max. Voltage	2000-5000
CJA	1.25-3.5	850-4900
CJB	.6-1.7	775-4500
CJC	.35-.9	725-4300
CJD	.2-.5	700-4000
CJE	.35-1	730-4200
CJF	.1-.25	675-3800
All SJ Types	Less than 15% of Value at Max. Voltage	2000-5000

NF Types have same characteristics as CF Types. HF Types are approximately 30% lower in V.C. and 10% lower in T.C. as compared to the CF Types.

Power Derating

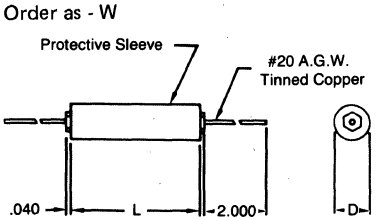


Order as - L



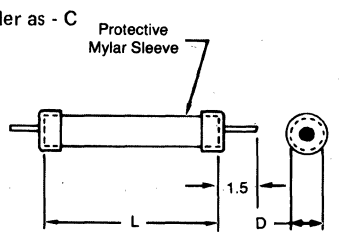
RADIAL LUG
FIG. 1

Order as - W



THREADED AXIAL WIRE LEAD
FIG. 2

Order as - C



CAPPED AXIAL WIRE LEAD
FIG. 3

Cableform - Beman

Zion Cross Roads, Troy VA 22974 TEL: 804/589-8224 FAX: 804/589-3803

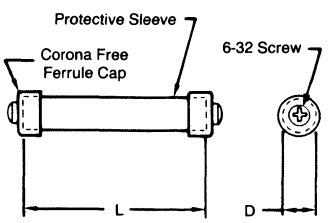
Hi-Voltage • Hi-Frequency • Hi-Megohm • Precision Pairs

HIGH FREQUENCY RESISTORS

Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	ID	FD	Ohms Min.	Ohms Max.	Available in Fig. No.'s
SFA	400	.5	¾	¼			20	20M	2
SFB	800	1	1½	¼			25	40M	2
SFC	500	1	1	5/16			20	25M	1,2,4
SFD	1,000	2	1¾	5/16			25	50M	1,2,4
SFE	2,000	3	3	5/16	NA	NA	35	100M	1,2,4
SFF	3,700	5	5½	5/16			60	100M	1,2,4
SFG	1,500	4	2½	9/16			20	50M	1,2
SFH	2,800	6	4	9/16			25	75M	1,2
SFJ	4,500	10	6½	9/16			40	100M	1,2
*SJA	3,000	10	4½	¾	½	—	20	50M	5
*SJB	4,000	20	6½	1 1/8	¾	13/16	20	50M	5,6
*SJC	7,000	30	10½	1 1/8	¾	13/16	30	100M	5,6
*SJD	10,000	60	14½	1½	1 1/8	19/64	35	100M	5,6
*SJE	4,500	35	6½	2	1 9/16	19/64	20	35M	5,6
*SJF	12,500	100	18½	2	1 9/16	19/64	30	100M	5,6

*Sleeving available on request.

Order as - F

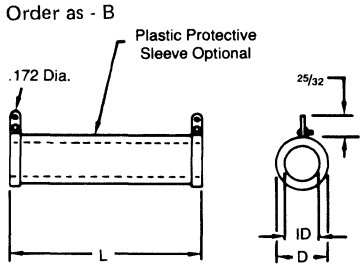


FERRULE CAP
FIG. 4

HIGH MEGOHM RESISTORS

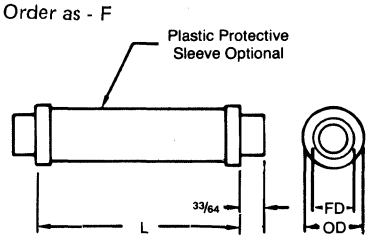
Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	Ohms Min.	Ohms Max.	Available in Fig. No.'s
HFA	2,500	.5	¾	¼	1M	1T	2
HFB	5,000	1	1½	¼	1M	5T	2
HFC	3,500	1	1	5/16	1M	25T	1,2,4
HFD	10,000	2	1¾	5/16	1M	50T	1,2,4
HFE	15,000	3	3	5/16	1M	100T	1,2,4
HFF	30,000	5	5½	5/16	1M	100T	1,2,4
HFG	15,000	4	2½	9/16	1M	100T	1,2
HFH	25,000	6	4	9/16	1M	100T	1,2
HFJ	40,000	10	6½	9/16	1M	100T	1,2

Order as - B



RADIAL BAND
FIG. 5

Order as - F



FERRULED ENDS
FIG. 6

- Standard Tolerances are 20%, 15%, 10% and 5% for the SF and SJ Series and 10%, 5% and 3% for the HF Series.
- Resistors of greater than 10G, are provided with special coating to minimize effects of handling and humidity, no change in diameter.
- All Dimensional Tolerances ± 1/64 or 1% whichever is greater.
- If units are to be operated near maximum limits, at elevated ambient, or in a coolant, order resistors without sleeving.
- Special values or configurations are available upon request.
- Special coatings available upon request.

Sample Order Writing Data: Type - Termination - Sleeve - Tolerance - Value
Note: Sleeve Required Specify 2, No Sleeve Specify 1.

Part Number — CFD-L-1-10-100K

Description — High voltage resistor, with radial lugs, no protective sleeve, 10% tolerance, 100K OHMIC value

For additional performance information and design assistance call Cableform Inc. Zion Cross Roads, Troy, VA 22974 TEL: 804/589-8224 FAX: 804/589-3803

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

High Performance Film Resistors

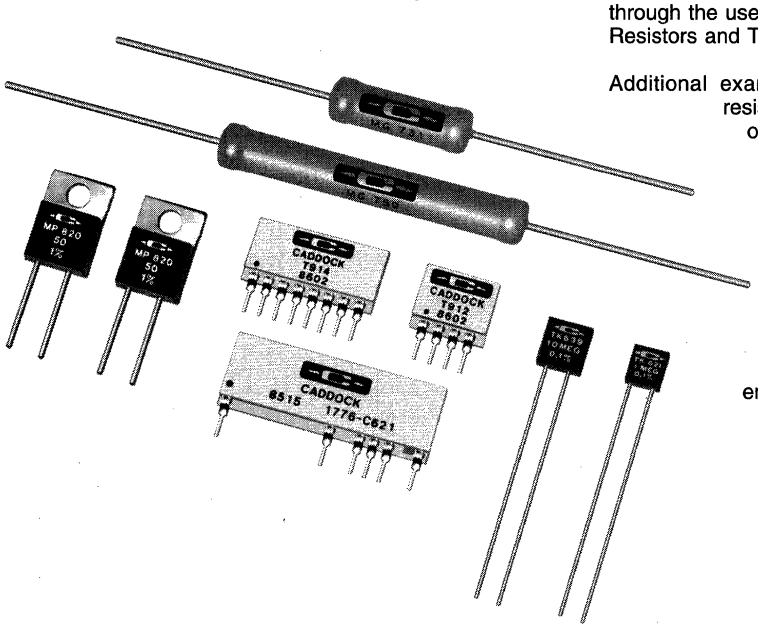
The Caddock Electronics General Catalog describes over 200 in-production models of precision discrete resistors and resistor networks that utilize Caddock's high stability, extended life Micronox® and Tetrinox® resistance films. With over 25 years of experience and an exceptional record of in-circuit performance and reliability, Caddock Electronics continues to lead the industry in the development, production and on-time delivery of high performance film resistors

Caddock's Advanced Resistor Technology Provides Many Exceptional Performance Advantages:

Caddock's advanced resistor technology began in 1962 with the introduction of Micronox® harsh environment, high power and high voltage resistors. The Caddock technology was further extended in 1975 with the development of the Tetrinox® resistance system that made possible the introduction of low TC, ultra-stable resistors and resistor networks.

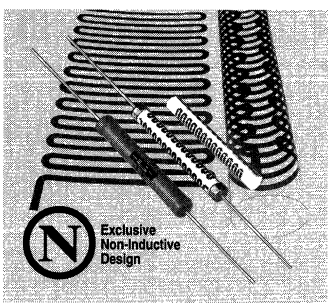
These technological advances have provided the electronics industry with a selection of precision resistor types that provide many high performance advantages.

- **Precision** - Tolerances as close as 0.01%.
- **Long-Term Stability** - Better than 0.005% per 1,000 hours of operation under full load operating conditions.
- **Higher Power Ratings** - Up to five times higher than other resistor technologies.
- **High Operating Temperatures** - Up to +275°C.
- **Ultra-Low Temperature Coefficients** - Standard to less than 10 ppm/°C and custom values as low as 2 ppm/°C.
- **Non-Inductive Design** - Available in resistance values from as low as 0.1 ohm to as high as 10,000 Megohms.



Caddock's Exclusive Non-Inductive Performance is Available in Both High-Power and High-Voltage Micronox® Film Resistors.

For wide-band, high frequency applications, the advantages of Caddock's Exclusive Non-Inductive Design are available in most models of Micronox® resistors. This special sepentine pattern provides for neighboring lines to carry currents in opposite directions thereby achieving maximum cancellation of flux fields over the entire length of the resistor.



The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

The High-Performance Capabilities of Caddock Film Resistors Can Provide Improved Accuracy and Stability to Precision Circuitry:

Because of the special advantages of Caddock's resistance film technology, Caddock High Performance Film Resistors are often specified in the precision circuits that ultimately establish the overall accuracy and stability of the equipment.

Examples of such applications include many types of precision high-voltage supplies and voltage references that have achieved improved accuracy and extended-life stability through the use of Caddock Type MG Precision High-Voltage Resistors and Type T912 Precision Resistor Networks.

Additional examples of the application of this advanced resistor technology include the industry-wide use of Caddock Type 1776 and Type 1787 Precision Decade Divider Resistors in the signal input circuits of laboratory and bench-type digital voltage and current measuring instruments.

An introduction and index to these Caddock resistor technologies is provided on the next page. Additional information and technical assistance is also available directly from our application engineering team.

We welcome your call.

SALES OFFICE
CORPORATE HEADQUARTERS
1717 CHICAGO AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE: (714) 788-1700
FAX: (714) 369-1151

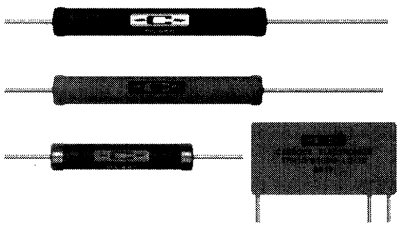
CADDOCK
ELECTRONICS, INCORPORATED

APPLICATIONS ENGINEERING
APPLIED SCIENCES DIVISION
17271 NORTH UMPQUA HWY.
ROSEBURG, OREGON 97470
PHONE: (503) 496-0700
FAX: (503) 496-0408

Index to Caddock High Performance Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Precision High Voltage Resistors and High Voltage Divider Networks



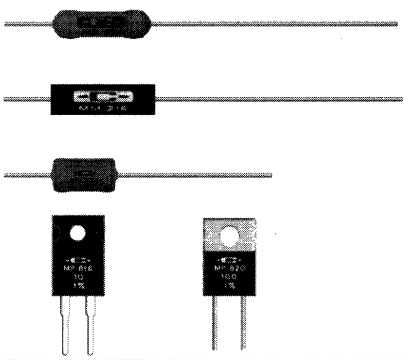
Type TG Low TC Precision High Voltage Resistors
Temperature Coefficient of 25 ppm/°C from -55°C to +125°C — Page C4

Type MG Precision High Voltage Resistors with Extended Resistance Range
Resistance Values to 10,000 Megohms, TC of 80 ppm/°C — Pages C5 and C6

Type MX Lab Grade Precision High Voltage Resistors ***NEW PRODUCT***
High Voltage Resistors for Laboratory and Industrial Applications — Page C7

Type THV Precision High Voltage Divider Networks ***NEW MODELS***
Ratio Temperature Coefficients to 10 ppm/°C from -55°C to +125°C,
Ratio Tolerances to 0.25% at 10 KVDC, 15 KVDC or 20 KVDC — Page C8

Power Film and Precision Film Resistors



Type MS and MR Power Film Resistors
Operating Temperature to +275°C, Power Ratings to 15 Watts,
Non-Inductive Design — Pages C9 and C10

Type MM and ML Precision Film Resistors
High Temperature Resistors for Geophysical, Aerospace
and Industrial Requirements — Page C11

Type MV Low Resistance Power Film Resistors ***NEW RESISTANCE RANGE***
Values from 0.1 ohm to 50 ohms, Power Ratings to 10 Watts,
Operating Temperature to +275°C and Non-Inductive Design — Page C12

Type MP Kool Pak™ Power Film Resistors ***NEW 0.1Ω TO 10KΩ***
Non-Inductive 16 Watt Power Resistor in an all molded TO-220 Power
Package utilizing a high thermal conductivity molding compound — Page C13

Type MP Kool-Tab™ Power Film Resistors ***NEW 0.1Ω TO 10KΩ***
Non-Inductive 20 Watt Power Resistor in the TO-220 Power Package
with Metal Mounting Tab — Page C14

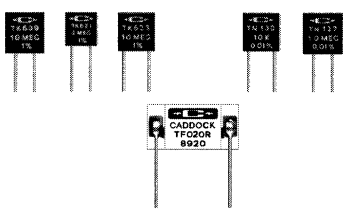
Power Radial-Lead and Extended Resistance Range Radial-Lead Resistors



Type MK 132 and MK 120 Precision Film Resistors ***NEW RESISTANCE RANGE***
3/4 and 1/2 Watt Ratings at +125°C, 1 ohm to 5 Megohms — Pages C15 and C16

Type MK 632 and MK 620 Extended Resistance Range Film Resistors
Resistance Range from 2.1 Megohms to 100 Megohms — Pages C15 and C16

Low Temperature Coefficient Precision and Ultra-Precision Film Resistors

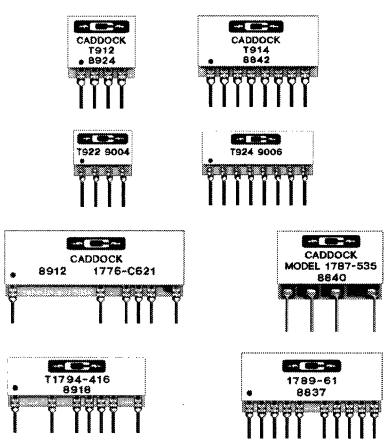


Type TK Low TC Precision Radial-Lead Film Resistors
Resistance Range from 1 Kohm to 10 Megohms, Tolerances to 0.05%,
T.C. of 5, 10 or 20 ppm/°C from -55°C to +125°C — Pages C17 and C18

Type TN Lab Grade Low TC Precision Film Resistors ***NEW PRODUCT***
Tolerances to 0.01%, Resistance Range from 1 Kohm to 1 Megohm,
Temperature Coefficient of 5, 10 or 20 ppm/°C from 0°C to +70°C — Page C19

Type TF Low TC Ultra-Precision Film Resistors
Resistance Range from 1 Kohm to 125 Megohms,
Temperature Coefficients to 5 ppm/°C, Tolerances to 0.01% — Page C20

Precision and Ultra-Precision Standard Resistor Networks and Custom Resistor Networks



Type T912 and T914 Precision Resistor Networks
Two Resistor and Four Resistor Networks with Precise Ratio Performance,
Ratio Tolerances to 0.01%, Ratio TC to 2 ppm/°C — Page C21

Type T922 and T924 Low Profile Precision Resistor Networks ***NEW PRODUCT***
Two Resistor and Four Resistor Networks with Precise Ratio Performance,
Ratio Tolerances to 0.01%, Ratio TC to 5 ppm/°C — Page C22

Type 1776 Precision Decade Resistor Voltage Dividers ***NEW MODELS***
39 Models of Input Voltage Dividers for Digital Multimeters and other
Range-Switching Circuits, Ratio Tol. to 0.02%, Ratio TC to 5ppm/°C — Pages C23 and C24

Type 1787 Precision Current Shunt Resistor Networks
3 and 4-step Current Shunt Resistor Networks for
Current Sensing in Multi-Range Instrumentation — Pages C25 and C26

Type T1794 Custom Low TC Precision SIP Resistor Networks
Ratio TC to 5 ppm/°C, Ratio Tolerances to 0.025%,
Resistance Range from 500 ohms to 50 Megohms — Page C27

Type 1789 Custom Low Resistance Value Precision SIP Resistor Networks
Ratio TC to 15 ppm/°C, Ratio Tolerances to 0.05%,
Resistance Range from 0.5 ohm to 10,000 ohms — Page C28

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Caddock process control, quality control and test programs

The outstanding levels of performance and reliability that Caddock resistors provide are maintained through intensive programs for manufacturing and process control, quality assurance testing and reliability verification:

Manufacturing Control

Our manufacturing controls include processes for power conditioning, over-voltage conditioning and maximum temperature conditioning. We also perform many in-process tests to verify the performance levels and consistency of all our resistor types, and to screen out defects which do not meet our high standards.

Quality Control

The Caddock Quality Control System covers every step in the manufacturing process from the examination of incoming raw materials to the final testing and packaging of each resistor product.

To meet the most stringent Q.C. requirements, Caddock's Quality Control Procedures have been approved as being in conformance to MIL-I-45208 in surveys by military and space systems customers.

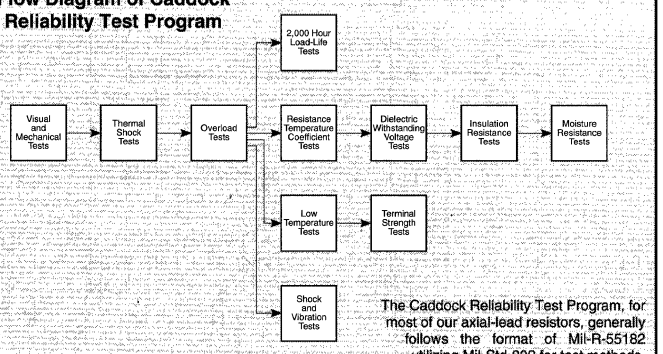
Reliability Verification

In addition to tests for tolerance, stability and temperature characteristics that are a part of our normal manufacturing procedures, we also perform semi-annual reliability tests to confirm compliance to our exacting product specifications.

The flow diagram of the Caddock Reliability Test Program for axial-lead resistors illustrates the sequence of the tests in this program.

Data from the Caddock Reliability Test Program is available to assist designers in qualifying Caddock resistor products for use on high reliability programs.

Flow Diagram of Caddock Reliability Test Program



The Caddock Reliability Test Program, for most of our axial-lead resistors, generally follows the format of Mil-R-55182 utilizing Mil-Std-202 for test methods.

Customer Required Quality Assurance Testing

For our customers whose program requirements for performance, quality and reliability verification include added testing, our specially developed in-house testing capabilities and data acquisition systems give us the ability to perform customer required testing for the most demanding program requirements.

Design Assistance and Assistance in Developing the Resistor Product Specifications

By providing design assistance and technical support at the initiation of a new design and a new Specification Control Drawing (SCD), we have often been able to achieve improvements in both the resistor product performance and cost while fully achieving the program's quality objectives.

For assistance in design and specification development and assistance in the application of our quality assurance testing capabilities to your specific circuit performance and program needs, call or write our applications engineers at our main offices in Riverside, California.

Patent Notification:

Certain Caddock Electronics resistor technologies presented in this catalog are covered by one or more of the following Patents:

United States	3,636,493	Australia	444,860	France	2,040,498	United Kingdom	1,314,581
United States	3,649,944	Australia	474,644	France	2,210,808	United Kingdom	1,314,582
United States	3,722,084	Australia	475,305	France	2,254,866	United Kingdom	1,409,127
United States	3,722,085					United Kingdom	1,482,164
United States	3,858,147	Canada	916,790	Italy	899,834		
United States	3,880,609	Canada	968,429	Italy	989,763	West Germany	2,021,374
United States	3,881,162	Canada	1,021,419			West Germany	2,327,750
United States	3,921,119			Japan	763,586	West Germany	2,459,283
United States	4,075,968	European	0181766	Japan	839,506		
United States	4,132,971			Japan	1,038,412		
United States	4,670,734			Japan	1,062,089		
United States	4,766,410						

Other Patents are pending

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Type TG Low TC Precision High Voltage Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

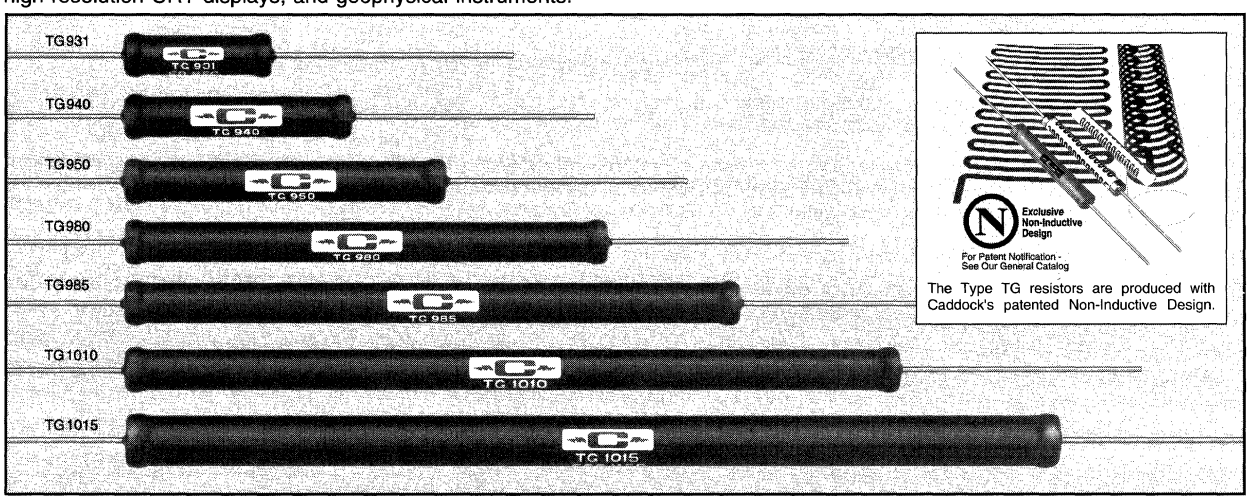
TC of 25 ppm/°C from -55°C to +125°C, Resistance Range from 1 Megohm to 1,000 Megohms

To meet the precision temperature stability requirements of high accuracy, high voltage systems, Caddock introduces the Type TG Low TC Precision High Voltage Resistors. These resistors utilize our proven Tetrinox® resistance system to achieve the unique combination of low temperature coefficient with high stability performance at high operating voltages.

The Type TG Low TC Precision High Voltage Resistors are designed to meet the demanding stability requirements of TWT power supplies, electron microscopes, X-ray systems, high resolution CRT displays, and geophysical instruments.

The performance features of the Type TG Low TC Precision High Voltage Resistors are:

- Temperature Coefficient: 25 ppm/°C from -55°C to +125°C.
- Load Life Stability of 0.25% per 1,000 hours at +125°C.
- Resistance Tolerance from ±1.0% to ±0.1%.
- Resistance Range from 1 Megohm to 1,000 Megohms.
- Maximum Continuous Operating Temperature of +225°C.
- The low temperature coefficient minimizes the self-drift due to power dissipation warm-up.



Model No.	Wattage	Max. Continuous Oper. Volt.	Dielect. Strength	TC ppm/°C	Resistance Min.	Resistance Max.	Dimensions in inches and (millimeters) A	B	C
TG931	1.0	4,000	750	25	1 Meg	50 Meg	1.000 ±.060 (25.40 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG940	1.5	6,000	750	25	1.5 Meg	100 Meg	1.500 ±.060 (38.10 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG950	2.0	10,000	1,000	25	2 Meg	200 Meg	2.125 ±.060 (53.98 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG980	3.0	15,000	1,000	25	3 Meg	300 Meg	3.125 ±.060 (79.38 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG985	4.0	20,000	1,000	25	4 Meg	400 Meg	4.000 ±.120 (101.60 ±3.05)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG1010	5.0	25,000	1,000	25	5 Meg	500 Meg	5.000 ±.120 (127.00 ±3.05)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG1015	6.0	30,000	1,000	25	6 Meg	1,000 Meg	6.000 ±.120 (152.40 ±3.05)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)

Extended Maximum Continuous Operating Voltage Rating

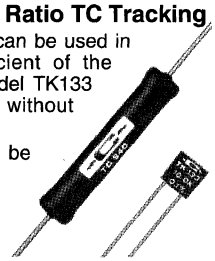
Maximum continuous operating voltages up to 60% higher than the values listed in the table can be achieved through special factory conditioning, provided the power ratings are not exceeded. To specify maximum continuous operating voltages above the values listed in the table, add a "-15" to the model number (Example: TG950-15). Note that the standard overload and overvoltage ratings do not apply to the "-15" resistors.

Combine Type TG and Type TK Resistors for Low Ratio TC Tracking

The Type TG Low TC Precision High Voltage Resistors can be used in combination with the low Absolute Temperature Coefficient of the Type TK Low TC Precision Radial-Lead Film Resistors (Model TK133 with TC of 5 ppm/°C) to achieve 30 ppm/°C Ratio TC without special matching.

With special matching, a **Ratio TC of 10 ppm/°C** can be achieved.

The low temperature coefficient for both the Type TG and Type TK resistors will also minimize ratio drift due to power dissipation warm-up.



Specifications:

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Temperature Coefficient: 25 ppm/°C referenced to 25°C, ΔR taken at -55°C and +125°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR 0.20% max.

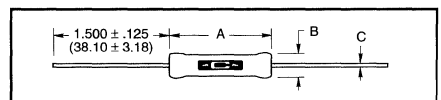
Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR 0.20% max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.20% max.

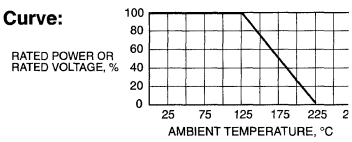
Load Life: 1,000 hours at rated power, ΔR 0.25%.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal.



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MG Precision High Voltage Resistors

Now with Extended Resistance Range to 10,000 Megohms and Additional Models

Temperature Coefficient as tight as 80 ppm/°C. Combined with Excellent Long-Term Stability, and Precision Tolerances.

Caddock's Micronox® resistance films are the source of the Type MG Precision High Voltage Resistors' outstanding combination of performance features:

- Single-resistor values as high as 10,000 Megohms.
- Maximum continuous operating voltages as high as 48,000 volts ("-15" Ratings).
- Overvoltage capabilities of 150% of standard working voltages for all models and values.
- Resistance Tolerances from ±1.0% to ±0.1%.
- Temperature Coefficient, for standard resistance range, of 80 ppm/°C in combination with resistance tolerances as tight as ±0.1%.
- Typical extended life stability of 0.02% per 1,000 hours for standard resistance range as demonstrated by reliability testing.

This exceptional performance has been proven through many years of use in equipment that demands the highest reliability and stability, including TWT amplifiers, X-ray systems, geophysical instruments and medical electronics.

Preconditioning for Power and Voltage Ratings

All power ratings and maximum operating voltage ratings are for continuous duty. These ratings are based on pre-stress voltage levels applied during the manufacturing process to provide for stable resistor performance even under momentary overload conditions.

Maximum operating voltages 60% higher than the values listed in the table may be specified by adding "-15" to the model number (Example: MG750-15), provided power ratings are not exceeded. Note that overload and overvoltage ratings do not apply to the "-15" resistors.

Non-Inductive Performance

Most models are manufactured with Caddock's patented Exclusive Non-Inductive Design which uses a serpentine resistive pattern that provides for neighboring lines to carry current in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

Model No.	Wattage	Max. Continuous Oper. Volt.	Dielect. Strength	Resistance			Dimensions in inches and (millimeters)		
				Min.	Standard Max.	Extended Max.	A	B	C
MG650	.5	600	750	200 Ω	5 Meg	N/A	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MG655	.5	600	750	200 Ω	8 Meg	N/A	.313 ±.030 (7.95 ±.76)	.109 ±.015 (2.77 ±.38)	.025 ±.002 (.64 ±.05)
MG660	.6	1,000	750	400 Ω	10 Meg	N/A	.500 ±.030 (12.70 ±.76)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MG680	.8	2,000	750	600 Ω	20 Meg	N/A	.750 ±.030 (19.05 ±.76)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MG710	1.0	4,000	750	800 Ω	50 Meg	N/A	1.000 ±.040 (25.40 ±1.02)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MG712	.6	1,000	750	800 Ω	20 Meg	N/A	.400 ±.060 (10.16 ±.152)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG714	1.0	1,000	750	200 Ω	20 Meg	N/A	.562 ±.060 (14.27 ±1.52)	.150 ±.030 (3.81 ±.76)	.032 ±.002 (.81 ±.05)
MG715	1.0	2,000	750	400 Ω	50 Meg	N/A	.750 ±.060 (19.05 ±1.52)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG716	1.5	4,000	750	600 Ω	75 Meg	N/A	1.000 ±.060 (25.40 ±1.52)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG717	1.5	2,000	750	600 Ω	75 Meg	225 Meg	.710 ±.050 (18.03 ±1.27)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG720	2.0	6,000	750	1 K	150 Meg	N/A	1.500 ±.080 (38.10 ±2.03)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG721	2.0	4,000	750	200 Ω	100 Meg	300 Meg	1.000 ±.050 (25.40 ±1.27)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG725	2.5	10,000	750	1.5 K	200 Meg	N/A	2.000 ±.080 (50.80 ±2.03)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG730	3.0	6,000	1,000	500 Ω	250 Meg	750 Meg	1.500 ±.080 (38.10 ±2.03)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG731	2.6	4,000	1,000	200 Ω	150 Meg	750 Meg	1.000 ±.060 (25.40 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG735	3.6	10,000	1,000	750 Ω	300 Meg	1,000 Meg	2.000 ±.080 (50.80 ±2.03)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG740	3.6	6,000	1,000	300 Ω	300 Meg	1,500 Meg	1.500 ±.060 (38.10 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG745	5.0	15,000	1,000	1 K	500 Meg	1,500 Meg	3.000 ±.100 (76.20 ±2.54)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG750	5.0	10,000	1,000	400 Ω	500 Meg	2,500 Meg	2.125 ±.060 (53.98 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG780	7.5	15,000	1,000	600 Ω	750 Meg	3,750 Meg	3.125 ±.060 (79.38 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG785	8.0	20,000	1,000	800 Ω	1,000 Meg	5,000 Meg	4.000 ±.120 (101.60 ±3.05)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG810	10.0	25,000	1,000	1 K	1,250 Meg	6,250 Meg	5.000 ±.120 (127.00 ±3.05)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG815	15.0	30,000	1,000	1 K	2,000 Meg	10,000 Meg	6.000 ±.120 (152.40 ±3.05)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)

Models with low inductance construction are in shaded areas.
Models with Caddock's patented Exclusive Non-Inductive Design are in non-shaded areas.

Specifications:

Resistance Tolerance:

Resistance Range	Tolerance
Standard	±1%, ±0.5%, ±0.25%, ±0.1%
St'd with "-15" rating	±1%
Extended Range	±1%

Temperature Coefficient:

Resistance Range	TC Specifications
Standard and St'd with "-15" rating	±80 ppm/°C from -15°C to +105°C, referenced to +25°C.
Extended Range	±80 ppm/°C from +25°C to +105°C, -200 ppm/°C to +50 ppm/°C from -15°C to +25°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.

Resistance Range	Overload/Overvoltage, ΔR
Standard	0.5% max.
St'd with "-15" rating	N/A
Extended Range	0.8% max.

Thermal Shock: Mil-Std-202, Method 107, Cond. C, ΔR 0.25% max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.4% max.

Load Life: 1,000 hours at rated power.

Resistance Range	Load Life, ΔR
Standard	0.5% max.
St'd with "-15" rating	0.8% max.
Extended Range	0.8% max.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal.

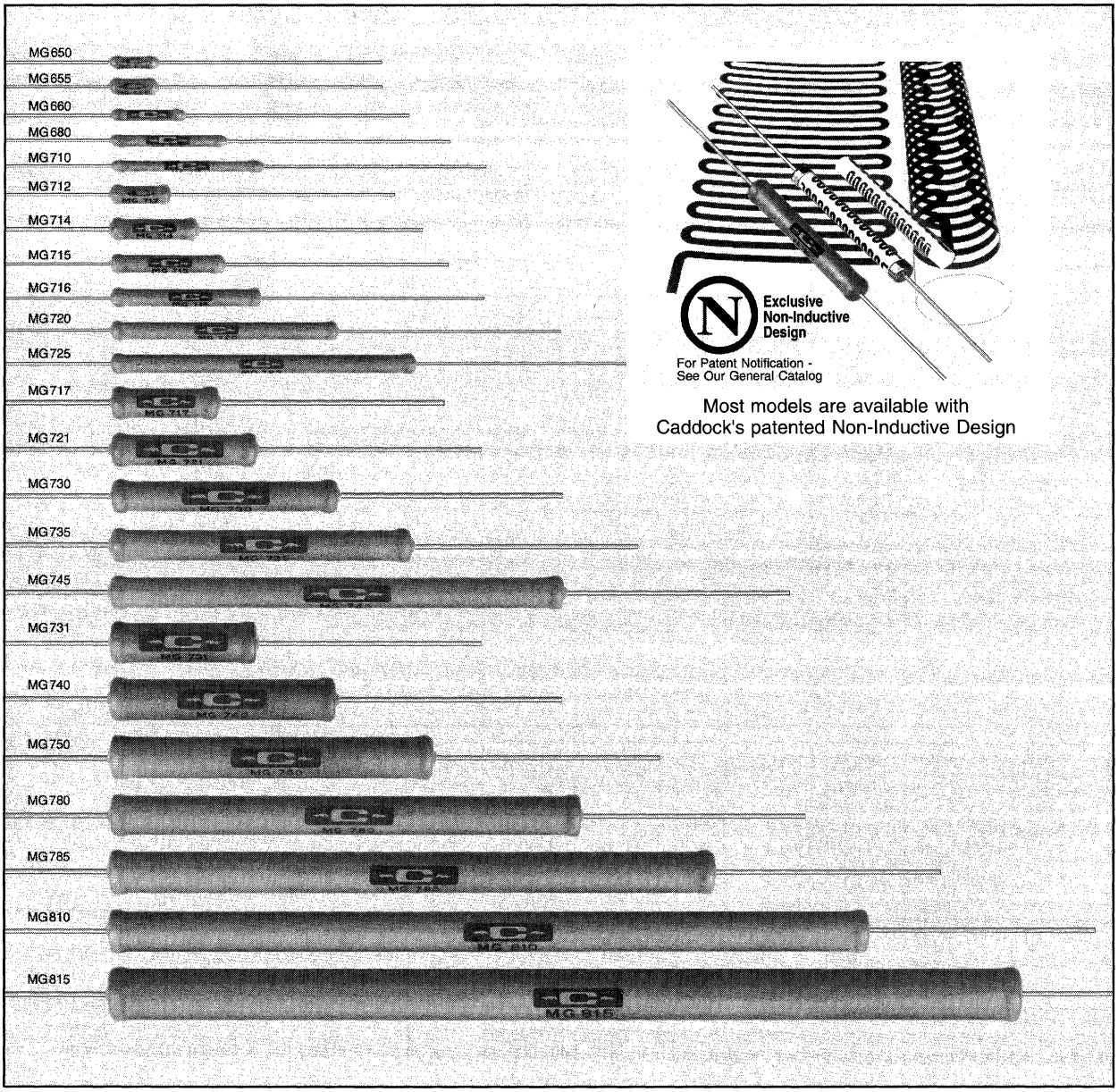
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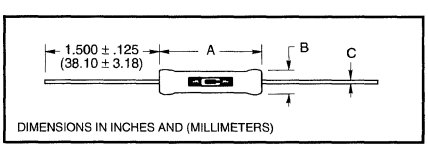
Type MG Precision High Voltage Resistors

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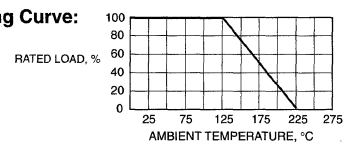
For Patent Notification - See Our General Catalog

Most models are available with Caddock's patented Non-Inductive Design



DIMENSIONS IN INCHES AND (MILLIMETERS)

Derating Curve:



Design Assistance in Developing High Voltage Resistor Sets with Low TC Tracking.

For immediate engineering assistance in developing Low Ratio TC matched high voltage resistor sets, call or write our Applications Engineering and we will be pleased to offer the best solution from our high voltage resistor product capabilities.

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

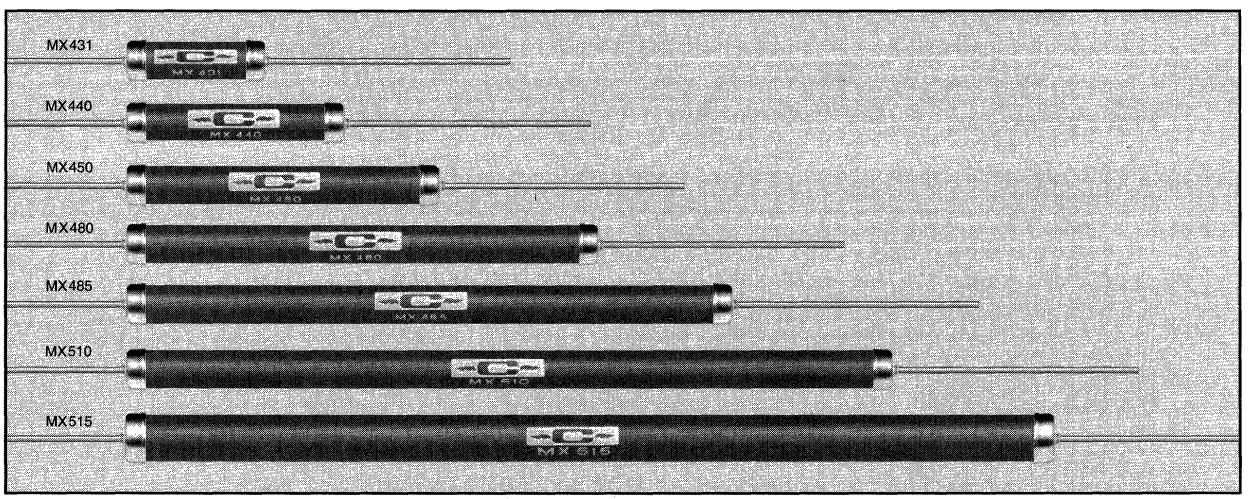
Type MX Lab Grade Precision High Voltage Resistors

High Voltage Resistors for Laboratory and Industrial Applications

The Type MX Lab Grade Precision High Voltage Resistors were specifically developed for use in high performance laboratory and industrial high voltage systems. These resistors combine the proven performance of Caddock's Micronox® resistance system with new cost efficient design elements. These resistors are intended for the design of high voltage systems where the system is not exposed to full military or space grade operating conditions. For full military or space grade operating conditions, we recommend Caddock's **Type TG Low TC Precision High Voltage Resistors** or **Type MG Precision High Voltage Resistors.**

The performance features of the Type MX Lab Grade Precision High Voltage Resistors are:

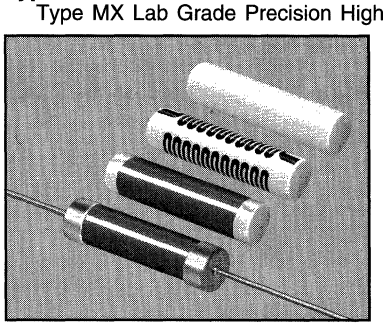
- Seven Models with Voltage Ratings from 7.5 KV to 48 KV.
- Temperature Coefficient: 80 ppm/°C from 0°C to +70°C.
- Load Life Stability of 0.50% per 1,000 hours.
- Resistance Tolerance from ±0.1% to ±10%.
- Non-Inductive Design.
- Resistance Range from 1 Megohm to 2,000 Megohms.



Model No.	Watt-age	Max. Continuous Oper. Volt.	TC ppm/°C	Resistance		Dimensions in inches and (millimeters)		
				Min.	Max.	A	B	C
MX431	2.5	7,500	80	1 Meg	150 Meg	.940 ±.040 (23.88 ±1.02)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX440	3.5	11,000	80	1.5 Meg	300 Meg	1.450 ±.040 (36.83 ±1.02)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX450	5.0	16,000	80	2 Meg	500 Meg	2.080 ±.040 (52.83 ±1.02)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX480	7.5	24,000	80	3 Meg	750 Meg	3.080 ±.050 (78.23 ±1.27)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX485	10.0	32,000	80	4 Meg	1,000 Meg	3.940 ±.050 (100.08 ±1.27)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX510	12.5	40,000	80	5 Meg	1,250 Meg	4.940 ±.080 (125.48 ±2.03)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX515	15.0	48,000	80	6 Meg	2,000 Meg	5.940 ±.080 (150.88 ±2.03)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)

Type MX Resistors Utilize Caddock's Patented Coating Design

Type MX Lab Grade Precision High Voltage Resistors combine Caddock's Exclusive Non-Inductive serpentine pattern with a patented, high thru-put screen printed silicone coating. The alignment of the gap in the coating pattern with the gap in the serpentine resistor pattern provides a complete encapsulation of the resistor element. The cap and lead assemblies are pressed onto the resistor core, finishing the resistor and providing rugged terminal attachment.



Specifications:

Resistance Tolerance: ±1%, ±2%, ±5% or ±10% (tolerance to ±0.5%, ±0.25% or ±0.1% on special order).

Temperature Coefficient: 80 ppm/°C referenced to 25°C, ΔR taken at 0°C and +70°C.

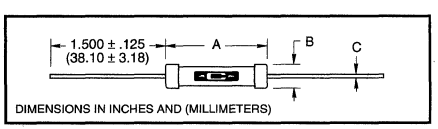
Thermal Shock: Mil-Std-202, Method 107, Cond. A, ΔR, 0.20% max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR, 0.40% max.

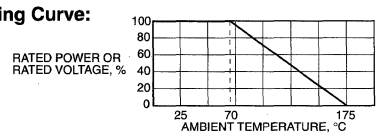
Load Life: 1,000 hours at rated power at 70°C, ΔR, 0.50% max.

Lead Material: Tinned copper clad steel.

Encapsulation: Screen printed silicone coating over resistor element.



Derating Curve:



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Type THV Precision High Voltage Divider Networks

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

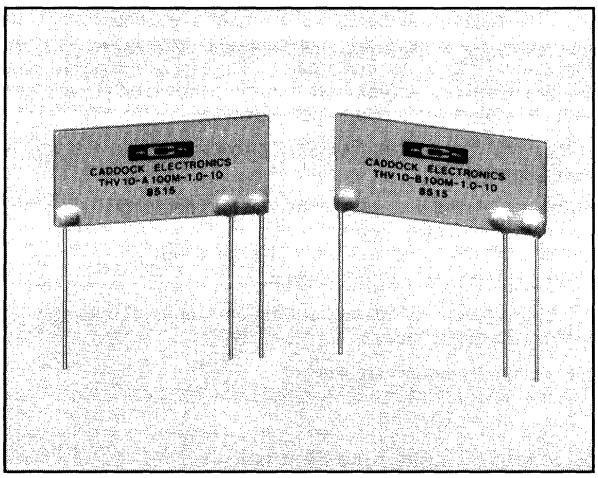
Ratio TC to 10 ppm/°C, Ratio Tolerance to ±0.25%, Voltage Ratings of 10 KV, 15 KV or 20 KVDC

The Type THV Precision High Voltage Divider Networks introduce Caddock's advanced high voltage resistor technology which doubles the allowable working voltage over the length of the high voltage section. This technology combines Caddock's Tetrinox® resistance films with a patented laser-generated V-Notch Geometry which optimizes the voltage gradient over the length of the resistance pattern.

Type THV networks provide tighter ratio temperature coefficients and tighter ratio tolerances than have previously been available in standard high voltage divider products.

- Ratio Temperature Coefficients of 10 ppm/°C or 25 ppm/°C from -55°C to +125°C.
- Ratio Tolerances of ±0.25%, ±0.5%, ±1.0% or ±2.0% at Rated Voltage.
- Voltage Rating of 10 KVDC, 15 KVDC or 20 KVDC at +125°C.
- Standard Voltage Division Ratios of 1,000:1 or 100:1, with custom ratios available.

These specifications can provide important improvements in performance in many types of advanced electronic systems, including TWT power supplies, radar systems, X-ray systems, analytical equipment and high resolution CRT displays.



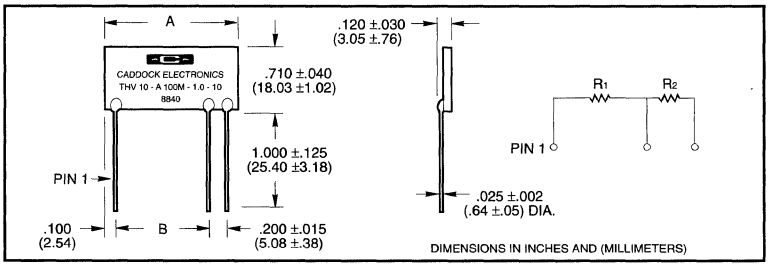
For complete information on price and delivery of both evaluation and production quantities, contact our Sales Office.

Standard Type THV Precision High Voltage Divider Networks

Model No.	Voltage Rating	Ratio Code Letter	Voltage Division	Resistance			Dimensions inches (mm)	
				R_1	R_2	Total	A	B
THV10	10 KVDC	A	1,000:1	99.9 Meg	100 K	100 Meg	1.500 ±.030 (38.10 ±.76)	1.100 ±.015 (27.94 ±.38)
		B	100:1	99 Meg	1 Meg	100 Meg		
THV15	15 KVDC	A	1,000:1	149.85 Meg	150 K	150 Meg	2.050 ±.030 (52.07 ±.76)	1.650 ±.015 (41.91 ±.38)
		B	100:1	148.5 Meg	1.5 Meg	150 Meg		
THV20	20 KVDC	A	1,000:1	199.8 Meg	200 K	200 Meg	2.600 ±.030 (66.04 ±.76)	2.200 ±.015 (55.88 ±.38)
		B	100:1	198 Meg	2 Meg	200 Meg		

Ordering Information: THV10 - A 100M - 1.0 - 10

- Model Number: THV10
- Ratio Code Letter: A
- Total Resistance Value of the Divider: 100M
- Ratio Temperature Coefficient from -55°C to +125°C: -25 = 25 ppm/°C, -10 = 10 ppm/°C
- Standard Ratio Tolerance at Rated Voltage: -2.0 = 2.0%, -0.5 = 0.5%, -1.0 = 1.0%, -0.25 = 0.25%



Specifications:

Ratio Tolerance: See ordering information.

Absolute Tolerance: ±1.0% for all resistors.

Ratio Temperature Coefficient: See ordering information.

Absolute Temperature Coefficient: 30 ppm/°C. Referenced to 25°C, ΔR taken at -55°C and +125°C.

Voltage Rating: Rated voltage applied to R_1 and R_2 in series.

Load Life: Ratio change with rated voltage applied for 1,000 hours at +125°C, 0.4% max.

Overvoltage: 1.5 times rated voltage for 5 seconds, ratio change 0.5% max.

Thermal Shock: Mil-Std-202, Method 107, Cond. C, ratio change 0.25% max.

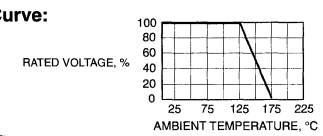
Moisture Resistance: Mil-Std-202, Method 106, ratio change 0.5% max.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal with Dielectric Withstanding Voltage of 750 volts.

Insulation Resistance: 10,000 Megohms, min.

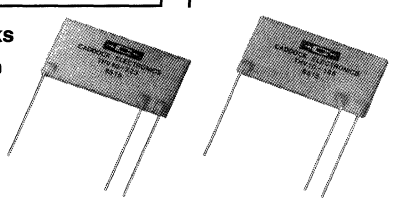
Derating Curve:



Custom Type THV Precision High Voltage Divider Networks

Custom Type THV Precision High Voltage Divider Networks can be produced with a broad range of resistance values, voltage ratios, voltage ratings, ratio tolerances and ratio temperature coefficients.

Contact our Applications Engineering about your custom high voltage divider requirement.



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MS and MR Power Film Resistors

Power Film Resistor Family with Wide Resistance Range and +275°C Maximum Temperature

With power ratings to 15 watts and voltage ratings as high as 6,000 volts in an axial-lead resistor with values to 30 Megohms, the Type MS Power Film Resistors deliver the performance capabilities that can simplify circuit design and reduce equipment cost and complexity.

Type MS Power Film Resistors provide all these features in a single resistor:

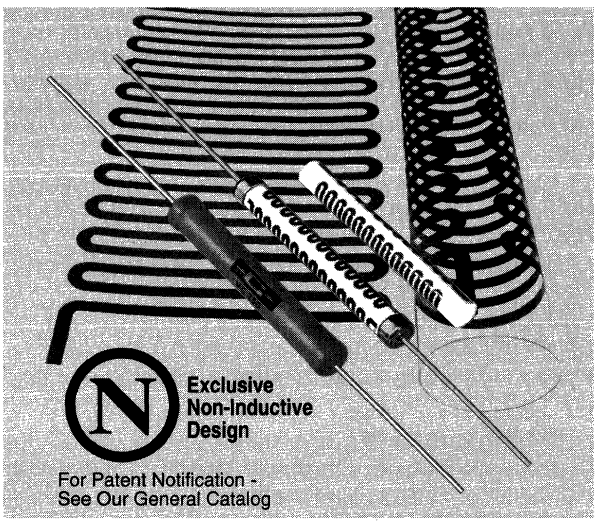
- Full power and voltage ratings, without derating:
  - for non-inductive performance.
  - for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability.
  Tests demonstrate typical stability of 0.05% per 1,000 hours over extended life.

Micronox® Resistance Films

Type MS performance begins with Caddock's Micronox® resistance films. Produced exclusively by Caddock Electronics, these proven complex oxide films have been used reliably for over 25 years in Caddock's precision power resistor products.

Micronox® resistance films are fired directly onto a ceramic core at temperatures above 1400°F. These resistance films have demonstrated outstanding stability when exposed to a high ambient temperature, thermal shock and high power densities.

This unique approach to precision power resistors opens new design possibilities by providing a wider resistance range, precise temperature characteristics, and higher temperature and power handling capability.



There's no derating of performance with Caddock's Exclusive Non-Inductive Design.

Most models are manufactured with Caddock's patented Exclusive Non-Inductive Design which uses a serpentine resistive pattern that provides for neighboring lines to carry current in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

Carefully Controlled Manufacturing and Test Procedures Assure Compliance with Strict Quality Control Requirements.

Manufacturing Control

Type MS Resistors are produced under intensive manufacturing controls with processes which include power conditioning, overvoltage conditioning and maximum temperature conditioning.

Quality Control

From the certification and testing of all materials to the supervision of manufacturing processes, all Caddock Type MS and MR Power Film Resistors are produced under procedures that have been approved for conformance to the requirements of Mil-I-45208 in many recent surveys.

Reliability Verification

Type MS resistors are included in the Caddock Reliability Testing Program. Conformance to specification parameters including Extended Life, Shock, Vibration and Humidity are verified on a periodic basis. Data from Type MS resistors can be compared by similarity to other Caddock resistor types, since Type ML, MM, MS, MP, MG and MK represent an identical combination of materials - aluminum oxide substrate, Micronox® resistance film and silicone insulating coating.

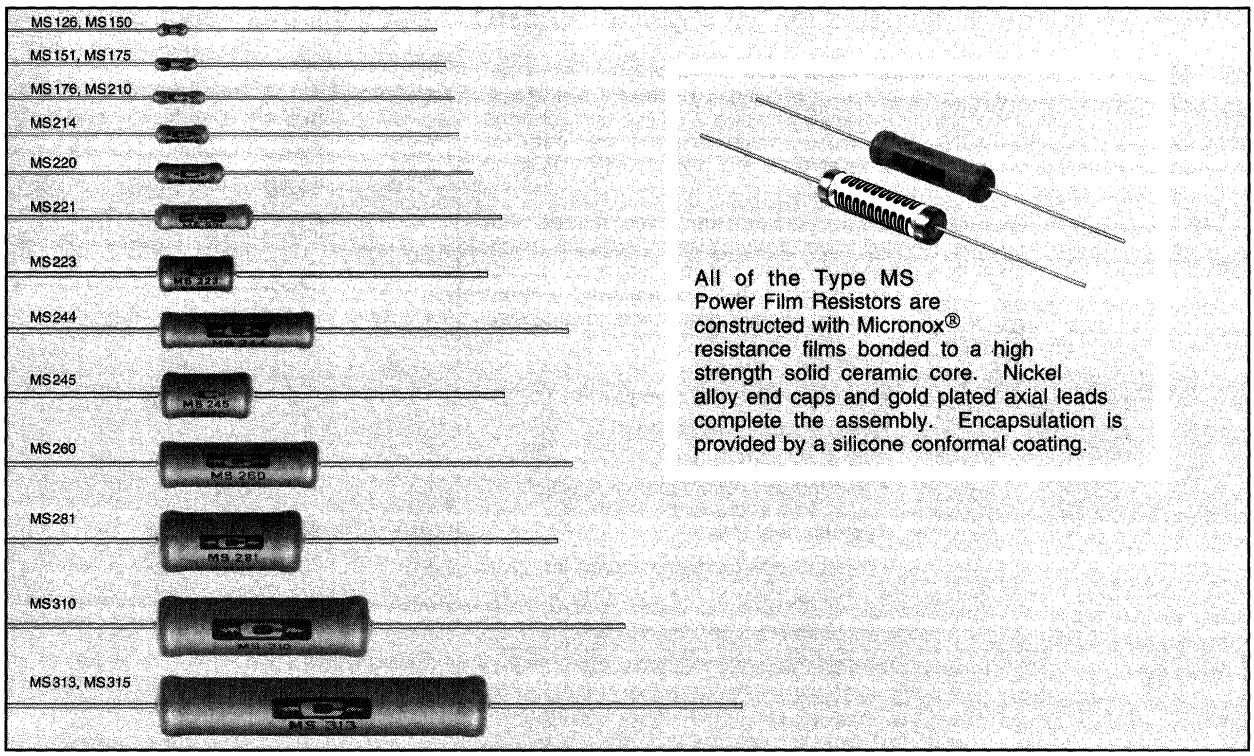
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Type MS and MR Power Film Resistors

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HIGH PERFORMANCE FILM RESISTORS



All of the Type MS Power Film Resistors are constructed with Micronox® resistance films bonded to a high strength solid ceramic core. Nickel alloy end caps and gold plated axial leads complete the assembly. Encapsulation is provided by a silicone conformal coating.

Model No.	Watt-age	Max. Voltage	Dielect. Strength	TC ppm/°C	Resistance Min.	Resistance Max.	Dimensions in inches and (millimeters) A	B	C	Leadwire
MR129	.25	200	500	150	50 Ω	500 K	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)	Nickel
MR154	.40	300	750	150	50 Ω	1 Meg	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Nickel
MR178	.60	500	750	150	50 Ω	3 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Nickel
MS126	.25	200	500	50	20 Ω	1 Meg	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)	Gold Plated
MS150	.50	—	500	50	20 Ω	2 K	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)	Gold Plated
MS151	.50	300	750	50	20 Ω	2 Meg	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Gold Plated
MS175	.75	—	750	50	20 Ω	2 K	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Gold Plated
MS176	.75	500	750	50	45 Ω	5 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Gold Plated
MS210	1.0	—	750	50	45 Ω	3 K	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Gold Plated
MS214	1.0	500	750	50	45 Ω	5 Meg	.313 ±.030 (7.95 ±.76)	.109 ±.025 (2.77 ±.64)	.025 ±.002 (.64 ±.05)	Gold Plated
MS220	2.0	1,000	800	50	20 Ω	10 Meg	.400 ±.060 (10.16 ±1.52)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)	Gold Plated
MS221	3.0	1,000	800	50	45 Ω	10 Meg	.575 ±.050 (14.61 ±1.27)	.165 ±.030 (4.19 ±.76)	.032 ±.002 (.81 ±.05)	Gold Plated
MS223	3.0	800	1,000	50	20 Ω	4 Meg	.480 ±.060 (12.19 ±1.52)	.230 ±.030 (5.84 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS244	4.0	2,000	1,000	50	45 Ω	15 Meg	.950 ±.060 (24.13 ±1.52)	.230 ±.030 (5.84 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS245	4.0	800	1,000	50	20 Ω	6 Meg	.570 ±.060 (14.48 ±1.52)	.300 ±.030 (7.62 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS260	6.0	2,000	1,000	50	45 Ω	15 Meg	.970 ±.060 (24.64 ±1.52)	.300 ±.030 (7.62 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS281	8.0	2,000	1,000	50	45 Ω	8 Meg	.910 ±.060 (23.11 ±1.52)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS310	10.0	4,500	1,000	50	45 Ω	20 Meg	1.250 ±.070 (31.75 ±1.78)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS313	12.5	6,000	1,000	50	50 Ω	30 Meg	2.000 ±.080 (50.80 ±2.03)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS315	15.0	—	1,000	50	50 Ω	1 Meg	2.000 ±.080 (50.80 ±2.03)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated

Models with low inductance construction are in shaded areas.
Models with Caddock's patented Exclusive Non-Inductive Design are in non-shaded areas.

Specifications:

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Temperature Coefficient: See Table for TC value. TC referenced to 25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

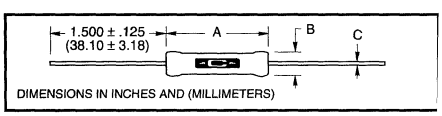
Thermal Shock: Mil-Std-202, Method 107, Cond. C, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

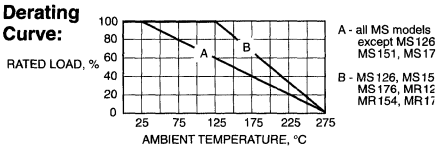
Load Life: 1,000 hours at rated power, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

Maximum Operating Temperature: +275°C.

Encapsulation: Silicone Conformal.



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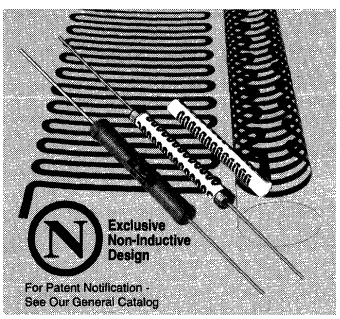
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MM and ML Precision Film Resistors

High Temperature Resistors for Geophysical, Aerospace and Industrial Requirements

Type MM and ML resistors have a proven performance history in industrial, computer, military and space applications. Utilizing our proven Micronox® resistance films, these resistors are available with power ratings up to 3 watts and resistance values to 15 Megohms. These resistors are ideal for applications requiring tolerances as close as 0.1% and extended life stability of 0.1% per 1,000 hours.

Most models of Type MM and ML resistors are manufactured with Caddock's patented Exclusive Non-Inductive Design that provides for neighboring lines to carry current in opposite directions. This efficient non-inductive construction is accomplished without derating of any performance advantages.

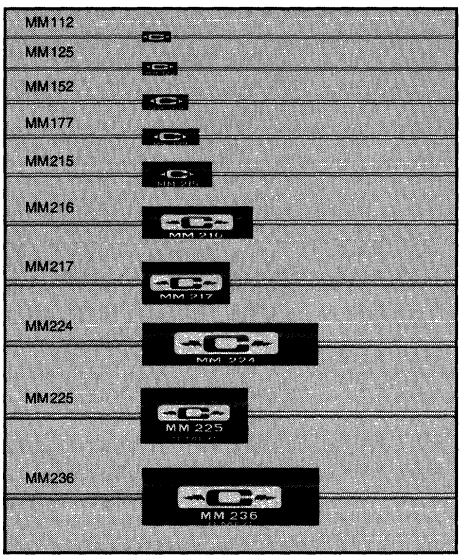


Type MM features:

- Max. Operating Temperature to +275°C.
- High Power Rating at +125°C.
- TC of 50 ppm/°C from -15°C to +105°C.
- Non-Inductive Performance Available.

Type ML features:

- Non-Inductive performance at a low cost.
- TC of 50 ppm/°C from -15°C to +105°C.



Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Strength	Resistance		Dimensions in inches and (millimeters)		
					Min.	Max.	A	B	C
MM112	.12	200	275°C	400	45 Ω	500 K	.160 ±.010 (4.06 ±.26)	.065 ±.010 (1.65 ±.26)	.016 ±.002 (.41 ±.05)
MM125	.25	200	275°C	500	30 Ω	1 Meg	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
MM152	.4	300	275°C	750	30 Ω	2 Meg	.250 ±.020 (6.35 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
MM177	.6	500	275°C	750	45 Ω	5 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
MM215	1.0	800	275°C	1,000	45 Ω	10 Meg	.400 ±.020 (10.16 ±.51)	.150 ±.010 (3.81 ±.26)	.025 ±.002 (.64 ±.05)
MM216	1.5	1,000	275°C	1,000	45 Ω	10 Meg	.625 ±.030 (15.88 ±.76)	.190 ±.020 (4.83 ±.51)	.032 ±.002 (.81 ±.05)
MM217	1.5	800	275°C	1,500	30 Ω	4 Meg	.500 ±.030 (12.70 ±.76)	.250 ±.020 (6.35 ±.51)	.040 ±.002 (1.02 ±.05)
MM224	2.0	2,000	275°C	1,500	45 Ω	15 Meg	1.000 ±.030 (25.40 ±.76)	.250 ±.020 (6.35 ±.51)	.040 ±.002 (1.02 ±.05)
MM225	2.0	800	275°C	2,000	30 Ω	6 Meg	.600 ±.030 (15.24 ±.76)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)
MM236	3.0	2,000	275°C	2,000	45 Ω	15 Meg	1.000 ±.030 (25.40 ±.76)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)
ML104	.08	200	175°C	400	50 Ω	300 K	.160 ±.010 (4.06 ±.26)	.065 ±.010 (1.65 ±.26)	.016 ±.002 (.41 ±.05)
ML114	.15	200	175°C	500	50 Ω	500 K	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
ML124	.25	300	175°C	750	50 Ω	600 K	.250 ±.020 (6.35 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
ML131	.4	500	175°C	750	50 Ω	1 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
ML181	.6	600	175°C	750	50 Ω	5 Meg	.400 ±.020 (10.16 ±.51)	.150 ±.010 (3.81 ±.26)	.025 ±.002 (.64 ±.05)
ML212	1.0	1,000	175°C	1,000	45 Ω	10 Meg	.625 ±.030 (15.88 ±.76)	.190 ±.020 (4.83 ±.51)	.032 ±.002 (.81 ±.05)
ML213	1.0	800	175°C	1,500	30 Ω	4 Meg	.500 ±.030 (12.70 ±.76)	.250 ±.020 (6.35 ±.51)	.040 ±.002 (1.02 ±.05)
ML218	1.25	2,000	175°C	1,500	45 Ω	15 Meg	1.000 ±.030 (25.40 ±.76)	.250 ±.020 (6.35 ±.51)	.040 ±.002 (1.02 ±.05)
ML219	1.25	800	175°C	2,000	30 Ω	6 Meg	.600 ±.030 (15.24 ±.76)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)
ML226	2.0	2,000	175°C	2,000	45 Ω	15 Meg	1.000 ±.030 (25.40 ±.76)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)

Models with low inductance construction are in shaded areas.
Models with Caddock's patented Exclusive Non-Inductive Design are in non-shaded areas.

Specifications:

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Temperature Coefficient: 50 ppm/°C referenced to 25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

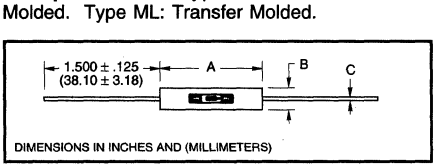
Thermal Shock: Mil-Std-202, Method 107, Cond. F, ΔR 0.2% max. or 0.5 ohm max., whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

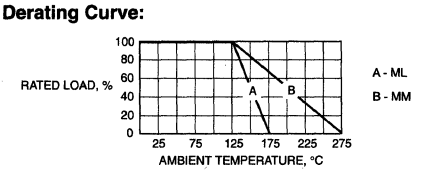
Loadlife: 1,000 hours at rated power, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

Lead Material: Gold Plated.

Encapsulation: Type MM: Black Transfer Molded. Type ML: Transfer Molded.



Derating Curve:



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Type MV Low Resistance Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

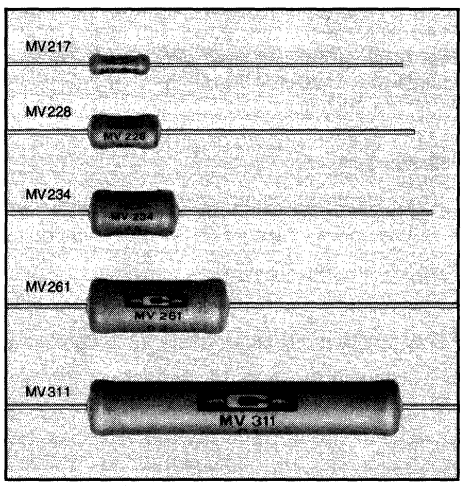
Values from 0.1 Ohm to 50 Ohms with Exclusive Non-Inductive Design

Type MV Low Resistance Power Film Resistors combine Caddock's Exclusive Non-Inductive Design with many high performance capabilities of Micronox® resistance films to achieve these special advantages:

- Low Resistance - from 0.1 ohm to 50 ohms.
- Maximum Operating Temperature up to +275°C.
- Five Sizes and Power Ratings.
- Full Power Ratings without derating for Non-Inductive Performance.

The interdigitated terminations in the Type MV resistors provide a multiple-path distribution of the current into parallel resistance sections, which provides low resistance values and non-inductive performance. This Exclusive Non-Inductive Design provides significant performance improvements in high speed or inductance sensitive electronic circuits, including high performance power amplifiers, high-speed data transmission systems, high frequency video amplifiers, current switching circuits and current sensing circuits.

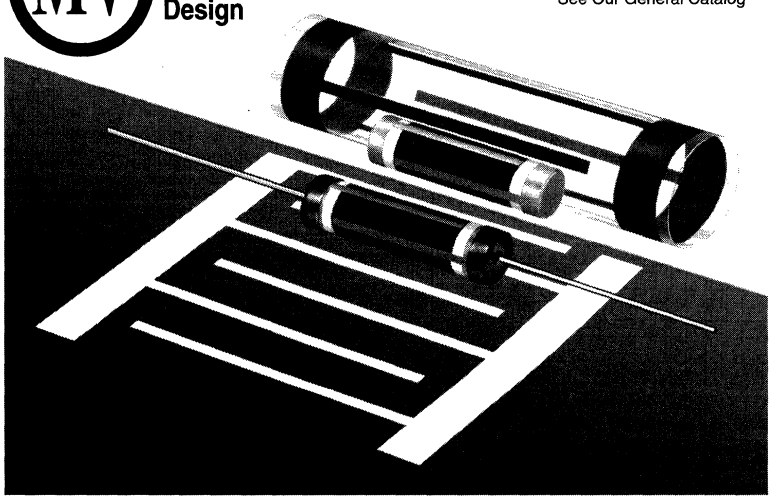
For complete price and delivery information on the Type MV resistors, call or write our Sales Office.



Model No.	Watt-age	Oper. Temp. (Max.)	Dielect. Strength	Resistance		Dimensions in inches and (millimeters)			Leadwire
				Min.	Max.	A	B	C	
MV217	1.5	275°C	800	0.2 Ω	50 Ω	.400 ±.060 (10.16 ±1.52)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)	Gold Plated
MV228	2.0	275°C	1,000	0.1 Ω	50 Ω	.480 ±.060 (12.19 ±1.52)	.230 ±.030 (5.84 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MV234	3.0	275°C	1,000	0.1 Ω	50 Ω	.570 ±.060 (14.48 ±1.52)	.300 ±.030 (7.62 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MV261	6.0	275°C	1,000	0.1 Ω	50 Ω	.910 ±.060 (23.11 ±1.52)	.350 ±.030 (8.89 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MV311	10.0	275°C	1,000	0.1 Ω	50 Ω	2.000 ±.080 (50.80 ±2.03)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated

MV **Exclusive Non-Inductive Design**

For Patent Notification - See Our General Catalog



Specifications:

Resistance Tolerance: ±1% (2%, 5% and 10% are also available).

Temperature Coefficient: 5 ohms and above ±100 ppm/°C, referenced to 25°C, ΔR taken at -15°C and +105°C.
Below 5 ohms ±(200 ppm + 0.00002 ohm)/°C, referenced to 25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, min.

Momentary Overload: 5 times rated power for 5 seconds, ΔR ±(1 percent + 0.001 ohm) max.

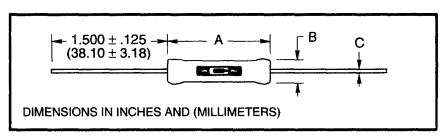
Thermal Shock: Mil-Std-202, Method 107, Cond. C, ΔR ±(1 percent + 0.001 ohm) max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR ±(1 percent + 0.001 ohm) max.

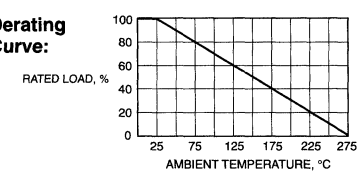
Load Life: 1,000 hours at rated power, ΔR ±(1 percent + 0.001 ohm) max.

Encapsulation: Silicone Conformal.

Measurement Note: For these specifications, resistance measurement shall be made at a point 0.3 inch (7.62 mm) from the resistor body.



Derating Curve:



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

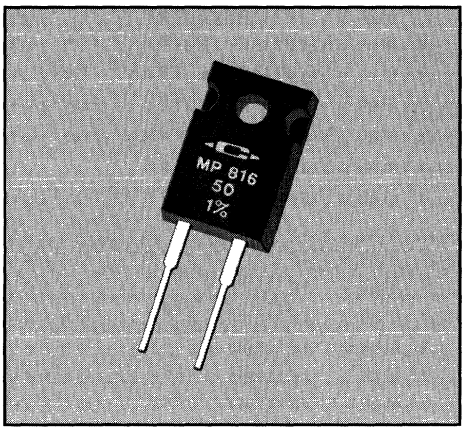
MP 816 Kool-Pak™ Power Film Resistors

Cost Effective All Molded TO-220 Power Package with 16 Watt Rating - 0.1 ohm to 10Kohm

Model MP816 Kool-Pak™ Power Film Resistor utilizes our proven Micronox® resistance film system in an all molded TO-220 Power Package to provide a cost efficient 16 watt heat sink mountable resistor. The non-inductive design makes this resistor ideal in high frequency communications and power switching circuits.

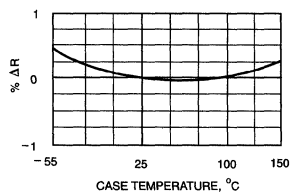
The special performance features of the Type MP Kool-Pak™ Power Film Resistor include:

- Cost Effective all molded TO-220 package configuration.
- 16 Watt power rating at 25°C case temperature.
- **Non-Inductive Design.**
- Single screw mounting simplifies resistor attachment to the heat sink.
- Low profile provides an easier fit in tight places.
- Resistance values to 0.1 ohm for current sense applications .
- Resistor element is electrically isolated by the molded package



Model No.	Power Rating	Dielect. Strength V_{RMS} AC	Max. Voltage	Resistance		Terminals
				Min.	Max.	
MP816	16 Watts*	1,500	300	0.1 Ω	10 K	Tinned Copper

MP 816 TYPICAL R-T CURVE
(10 Ω and above)



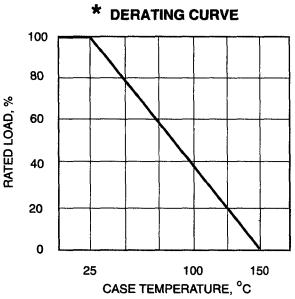
Temperature Coefficient:
TC referenced to 25°C, ΔR taken at +150°C

5.0 ohms and above, 0 to +50 ppm/°C
0.50 ohm to 4.99 ohms, 0 to +100 ppm/°C
0.10 ohm to 0.49 ohm, 0 to +200 ppm/°C

Cost Effective Non-Inductive Design

The MP816 Kool-Pak™ Power Film Resistor is constructed with our Micronox® resistance film fired onto a flat substrate. The terminal attachment and resistance element geometry are configured to provide outstanding non-inductive performance. The resistor body is then completely surrounded by a high thermal conductivity molding compound to finish this cost effective power resistor package.

*** DERATING CURVE**



The case temperature is to be used for purposes of establishing the maximum applied power. See Derating Curve. The case temperature measurement is made with the thermocouple contacting the bottom insulated mounting surface of the package (center of bottom surface), the device mounted on a heat sink, themal grease applied at a mounting torque of 6 to 8 in-lbs. Without a heat sink, when in free air at 25°C, the MP816 is rated for 2.25 watts.

Derating for case temperature above 25°C is 0.128 W/°C.

Mounting Note: The MP816 must be mounted using a screw and compression washer mounting technique. This will provide sufficient pressure on the package over time and through large temperature variations to maintain the maximum power disslpation capability. Maximum torque to be applied to mounting screw is 8 in-lbs.

Patents Pending

Specifications:

Resistance Tolerance: ±1% (0.5%, 2%, 5% and 10% are also available).

Insulation Resistance: 10,000 Megohms, min.

Terminal Strength: Mil-Std-202, Method 211, Cond. A (Pull Test) 5 lbs., ΔR ±(0.2 percent + 0.001 ohm) max.

Thermal Shock: Mil-Std-202, Method 107, Cond. F, ΔR ±(0.3 percent + 0.001 ohm) max.

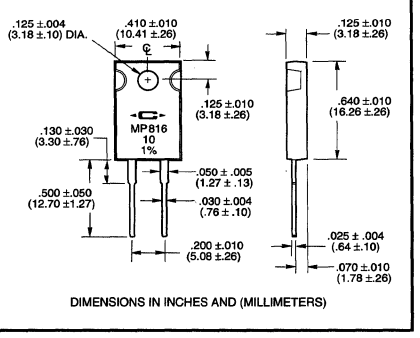
Momentary Overload: 2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR ±(0.3 percent + 0.001 ohm) max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR ±(0.5 percent + 0.001 ohm) max.

Load Life: Mil-R-39009, 2,000 hours at rated power, ΔR ±(1.0 percent + 0.001 ohm). Power rating dependent upon case temperature. See derating curve.

Shock: 100G, Mil-Std-202, Method 213, Cond. I, ΔR ±(0.2 percent + 0.001 ohm) max.

Vibration, High Frequency: Mil-Std-202, Method 204, Cond. D, ΔR ±(0.2 percent + 0.001 ohm) max.



DIMENSIONS IN INCHES AND (MILLIMETERS)

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MP 820 and MP 821 Kool-Tab™ Power Film Resistors

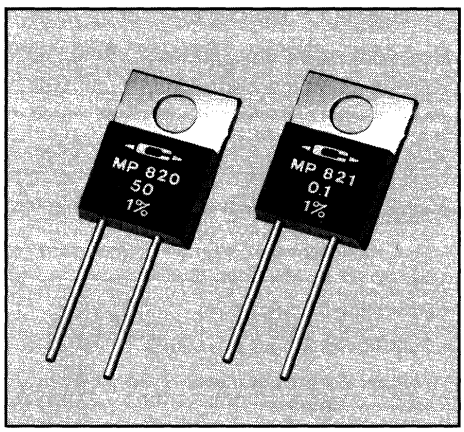
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

20 Watts in the TO-220 Power Package with Metal Mounting Tab - 0.1 ohm to 10 Kohm

Series MP820 Kool-Tab™ Power Film Resistors introduce our proven Micronox® resistance film system in the widely accepted TO-220 Power Package to provide a compact 20 watt heat sink mountable resistor. The non-inductive design makes this resistor ideal in high frequency communications and power switching circuits.

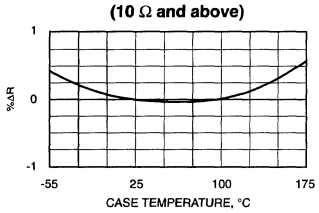
The special performance features of the series MP820 Kool-Tab™ Power Film Resistor include:

- 20 Watt power rating at 25°C case temperature.
- **Non-Inductive Design**
- Single screw mounting simplifies resistor attachment to the heat sink.
- Low profile provides an easier fit in tight places.
- A molded silicone case for environmental protection.
- Resistor element is electrically isolated from the metal heat sink tab.



Model No.	Power Rating	Dielect. Strength V_{RMS} AC	Max. Voltage	Resistance		Leadwire
				Min.	Max.	
MP820	20 Watts*	1,000	300	10 Ω	10 K	Tinned Copper
MP821	20 Watts*	1,000	——	0.1 Ω	9.99 Ω	Tinned Copper

MP 820 TYPICAL R-T CURVE
(10 Ω and above)



Temperature Coefficient:
TC referenced to 25°C, ΔR taken at +175°C

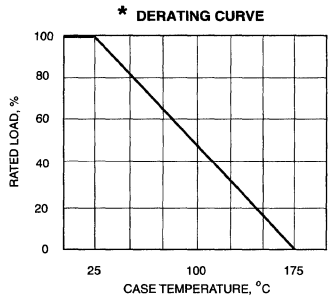
MP820:
All resistance values, 0 to +50 ppm/°C

MP821:
5 ohms to 9,99ohms, 0 to +50 ppm/°C
0.50 ohm to 4.99 ohms, 0 to +100 ppm/°C
0.10 ohm to 0.49 ohm, 0 to +200 ppm/°C

Non-Inductive Design

Series MP820 Kool-Tab™ Power Film Resistors are constructed with our Micronox® resistance film fired onto a flat substrate which is thermally bonded to the copper heat sink tab. The resistor body is then molded in silicone to finish the TO-220 configuration. The lead wire attachment and resistance element geometry are configured to provide outstanding non-inductive performance.

*** DERATING CURVE**



The case temperature is to be used for purposes of establishing the maximum applied power. See Derating Curve. The case temperature measurement is made on the metal mounting tab against the molded body. Without a heat sink, when in free air at 25°C, the MP820 / MP821 is rated for 2.25 watts.

Derating for case temperature above 25°C is 0.133 W/°C.

Mounting Note: Maximum torque to be applied to mounting screw is 8 in-lbs.

Specifications:

Resistance Tolerance: ±1% (0.5%, 2%, 5% and 10% are also available).

Insulation Resistance: 10,000 Megohms, min.

Terminal Strength: Mil-Std-202, Method 211, Cond. A (Pull Test) 5 lbs., ΔR ±(0.2 percent + 0.001 ohm) max.

Thermal Shock: Mil-Std-202, Method 107, Cond. F, ΔR ±(0.3 percent + 0.001 ohm) max.

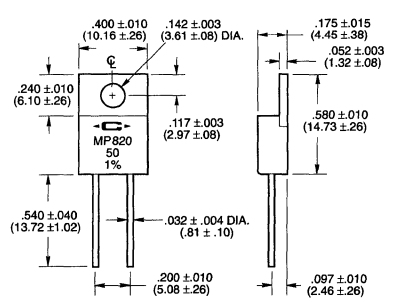
Momentary Overload: 2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR ±(0.3 percent + 0.001 ohm) max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR ±(0.5 percent + 0.001 ohm) max.

Load Life: Mil-R-39009, 2,000 hours at rated power, ΔR ±(1.0 percent + 0.001 ohm). Power rating dependent upon case temperature. See derating curve.

Shock: 100G, Mil-Std-202, Method 213, Cond. I, ΔR ±(0.2 percent + 0.001 ohm) max.

Vibration, High Frequency: Mil-Std-202, Method 204, Cond. D, ΔR ±(0.2 percent + 0.001 ohm) max.



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Power Radial-Lead Film Resistors

Non-Inductive with New Expanded Resistance Range — 1 Ohm to 100 Megohms

Here are the low cost precision resistors that provide high density packaging in large volume printed circuit applications. Available in two miniature rectangular package configurations with standard lead spacings, Type MK Precision Power Radial-Lead Film Resistors now cover the entire resistance range from 1 ohm to 100 Megohms.

Constructed with Caddock's Micronox® resistance films fired onto a solid ceramic substrate, Type MK Precision Film Resistors combine all of these outstanding advantages:

- **±1% Resistance Tolerance is Standard** - tolerances to ±0.1% are available on special order.
- **Operating Temperature** - from -55°C to +175°C.
- **Full Power Rating at +125°C.**
- **Temperature Coefficient is Only 50 ppm/°C from 5 ohms to 5 Megohms and 80 ppm/°C up to 100 Megohms** - referenced to 25°C with the ΔR taken at -15°C and +105°C.
- **Extended Life Stability is Typically Better Than 0.1% per 1,000 Hours.**
- **Caddock's Non-Inductive Performance** - provides faster settling times and minimum distortion in all types of high frequency circuits.

This combination of performance advantages in a small, standardized case can simplify many engineering and production problems:

One size of Type MK resistor can replace many sizes of axial-lead resistors.

This table of "RN" style axial-lead resistors shows the many sizes and power ratings that can be replaced with either of the two models of Type MK Precision Film Resistors within the maximum allowable voltage ratings.

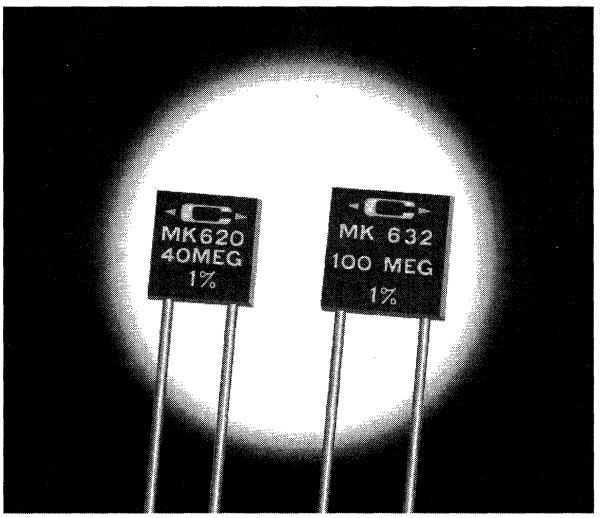
Comparison of Type MK and "RN" Ratings and Dimensions

Resistor Type	Power Rating	Maximum Resistance	Mounting Hole Spacing	
MK120 or MK620	**.50 W**	**40 Megohms**	**.150 (3.81)**	Even the smallest Type MK resistor can replace all of these RN type resistors
MK132 or MK632	**.75 W**	**100 Megohms**	**.200 (5.08)**	
RN50	.05 W	1 Megohm	.400 (10.15)	
RN55	.10 W	5 Megohms	.500 (12.70)	
RN60	.125 W	10 Megohms	.625 (15.90)	
RN65	.25 W	20 Megohms	.875 (22.20)	
RN70	.50 W	40 Megohms	1.000 (25.40)	

DIMENSIONS IN INCHES AND (MILLIMETERS)

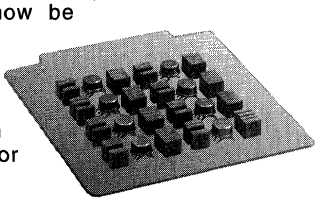
The largest Type MK - rated at .75 watt - requires less board space than even the .05 watt RN50.

The smallest Type MK - rated at .50 watt - provides power dissipation **equal** to the RN70 resistor. The RN70 resistor requires a mounting hole spacing of 1 inch and a side-to-side spacing of .25 inch, resulting in a total mounting area of .25 square inch - **10 times the area required for a .50 watt Type MK resistor!**



One standard resistor configuration can simplify board layouts.

With the exceptionally wide range of resistance values that are available in each model of Type MK Precision Film Resistors, circuits can now be designed for maximum packaging densities without the need for leaving extra space where resistor value changes can require larger resistors or non-uniform lead spacings.



Standardization of resistor size can speed assembly procedures and reduce procurement costs.

The standardization of resistor size can pay additional dividends by simplifying assembly procedures. The radial leads do not require additional bending prior to insertion, and the standard lead spacing can reduce the time required for assembly.

The combination of higher power ratings and smaller size can also lower procurement costs. By reducing the wide variety of sizes and types of axial-lead resistors to a single, standardized resistor type, unit prices can be lowered and inventory problems simplified. For specific price and delivery information, call or write our Sales Office.

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Type MK Precision Power Radial-Lead Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Film Resistors - Low and Standard Resistance Ranges

Model No.	Wattage	Max. Voltage	Oper. Temp. Max.	Dielect. Strength	Resistance			Dimensions	Encapsulation	Leadwire
					Low Min.	Standard Min.	Standard Max.			
MK120	.50	200	175°C	300	1 Ω	5 Ω	2 Meg.	Ref. Case "A" Dwg.	Transfer Molded	Tinned Copper
MK132	.75	400	175°C	400	1 Ω	5 Ω	5 Meg.	Ref. Case "B" Dwg.	Transfer Molded	Tinned Copper

Resistance Tolerance: ±1% (tolerances to ±0.1% available on values of 30 ohms or higher).

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR ±(0.15 percent + 0.01 ohm) max.

Operating Temperature: -55°C to +175°C.

Temperature Coefficient:

Resistance Range	Temp. Coef.
Standard : 5 Ω and above	50 ppm/°C
Low : 1 Ω to 4.99 Ω	200 ppm/°C

Temperature Coefficient referenced to +25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, minimum.

Load Life: 1,000 hours at rated power at +125°C, ΔR ±(0.4 percent + 0.01 ohm) max.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR ±(0.2 percent + 0.01 ohm) max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR ±(0.5 percent + 0.01 ohm) max.

Type MK Precision Film Resistors - Extended Resistance Range

Model No.	Wattage	Max. Voltage	Oper. Temp. Max.	Dielect. Strength	TC ppm/°C	Resistance		Dimensions	Encapsulation	Leadwire
						Min.	Max.			
MK620	.50	200	175°C	300	80	2.1 Meg.	40 Meg.	Ref. Case "A" Dwg.	Transfer Molded	Tinned Copper
MK632	.75	400	175°C	400	80	5.1 Meg.	100 Meg.	Ref. Case "B" Dwg.	Transfer Molded	Tinned Copper

Resistance Tolerance: ±1% (consult factory for tighter tolerances).

Overload/Overvoltage: 1.5 times max. voltage for 5 seconds, ΔR 0.5% max.

Operating Temperature: -55°C to +175°C.

Temperature Coefficient: See Table for TC value. TC referenced to +25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, minimum.

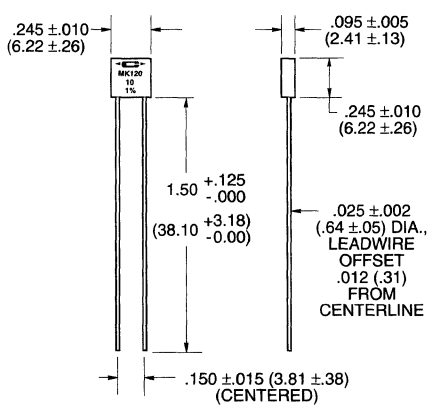
Load Life: 1,000 hours at rated power, ΔR 0.5% max.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR 0.5% max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.5% max.

Case "A"

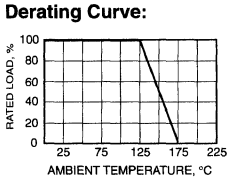
Model MK 120 and MK 620



ALL DIMENSIONS IN INCHES AND (MILLIMETERS)

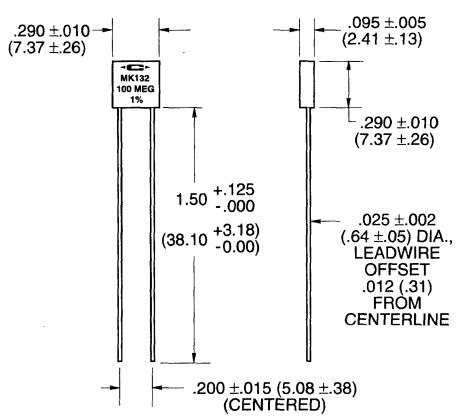
Measurement Note: Resistance measurement on low resistance values shall be made at a point within 0.2 inch (5.08 mm) of the body.

Derating Curve:



Case "B"

Model MK 132 and MK 632



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HIGH PERFORMANCE FILM RESISTORS

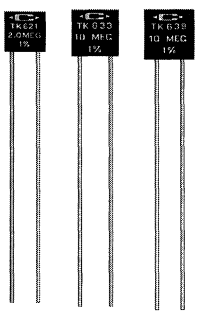
Type TK Low TC Precision Radial-Lead Film Resistors

Low TC of 5 ppm/°C, 10 ppm/°C or 20 ppm/°C and Resistance Range from 1Kohm to 10 Megs

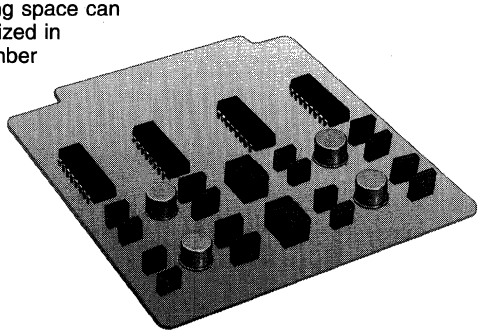
Caddock introduces a new design element for precision electronic circuitry - an advanced technology breakthrough that solves many critical circuit stability problems - the **Type TK Low TC Precision Radial-Lead Resistors with the Tetrinox® resistance system.**

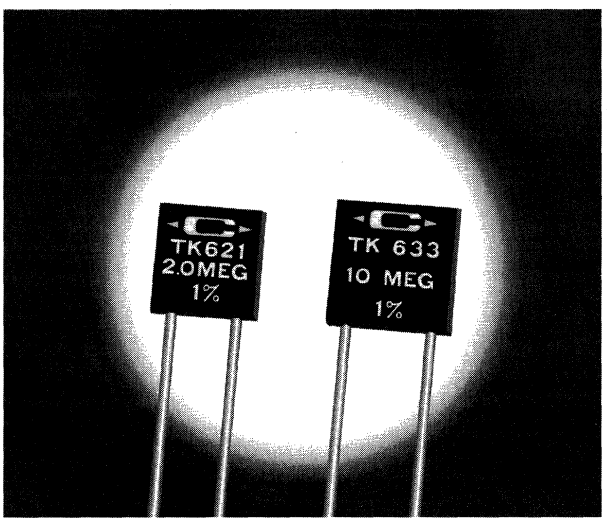
Type TK Low TC Precision Radial-Lead Film Resistors provide a combination of performance advantages never before available in a resistive component:

- **Low Temperature Coefficient** - better than 5 ppm/°C, 10 ppm/°C or 20 ppm/°C over the entire temperature range from -55°C to +125°C!
- **Long-Term Absolute Stability** - better than ±0.05% per 2,000 hours of operation.
- **Extended Resistance Range** - from 1,000 ohms to 10 Megohms.
- **Precision Tolerances** - ±1% is standard, and tolerances as close as ±0.05% are available.
- **Wide Operating Temperature Range** - from -55°C to +175°C.
- **Small Size** - with three miniature rectangular cases for maximum packaging density and minimum mounting area.
- **High Power Density** - with power ratings of .2 watt and .3 watt in molded cases, the largest of which is a standard CK06 package.



- **Caddock's Non-Inductive Performance** - provides faster settling times and minimum distortion in all types of high frequency circuits.
- **High Density Packaging** - the radial-lead mounting and small rectangular case of the Type TK resistors permit high packaging densities in low profile circuitry. Because the three models of the Type TK resistors are available in an exceptionally wide range of resistance values, lead spacing and mounting space can be standardized in a larger number of designs.





Building on over 20 years of experience with our unique complex oxide technology, Caddock has perfected the Tetrinox® resistance system - the first high resistance system to provide a TC that is well within 10 ppm/°C and that is also essentially linear over the entire temperature range from -55°C to +125°C.

The exceptional performance of Type TK resistors can achieve improvements in many circuit applications:

Low TC "Matched-Pair" Voltage Dividers Can be Assembled Without Pre-Selection of Resistors.

An important application for Type TK resistors is in "matched-pair" voltage dividers where the low 10 ppm/°C temperature coefficient provides ratio tracking of less than 20 ppm/°C without resistor pre-selection or special testing.

With factory selection, Type TK resistor pairs can be matched to within 1 ppm/°C.

Extended Resistance Range Reduces Power Requirements

Because the Type TK resistors provide resistance values as high as 10 Megohms - values that are up to 100 times higher than other types of ultra-low TC resistors - engineers can now design precision circuits with lower current drain and lower power requirements.

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Type TK Low TC Precision Radial-Lead Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TK Low TC Precision Radial-Lead Film Resistors - Standard Resistance Range

Model No.	Temperature Coefficient ppm/°C	Wattage @ +125°C	Max. Working Voltage	Dielect. Strength	Resistance Min.	Resistance Max.	Dimensions	Encapsulation	Leadwire
TK121	5, 10 or 20	.2	200	300	1 K	500 K	Ref. Case "A" Dwg.	Transfer Molded	Tinned Copper
TK133	5, 10 or 20	.3	300	400	1 K	1.5 Meg.	Ref. Case "B" Dwg.	Transfer Molded	Tinned Copper
TK139	5, 10 or 20	.3	300	400	1 K	1.5 Meg.	Ref. Case "C" Dwg.	Transfer Molded	Tinned Copper

Temperature Coefficient Identification:
5 ppm/°C Silver Dot
10 ppm/°C No Dot
20 ppm/°C Green Dot

Resistance Tolerance: ±1% (tolerances to ±0.05% on special order).
Operating Temperature: -55°C to +175°C.
TC Temperature Range: -55°C to +125°C.
Overload:* 6.25 times rated power for 5 seconds at voltage not to exceed 1.5 times maximum rated working voltage, ΔR less than 0.05%.
Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR less than 0.05%.
Low Temperature Operation:* ΔR less than 0.02%.
Dielectric Withstanding Voltage:* ΔR less than 0.02%.
Moisture Resistance:* Mil-Std-202, Method 106, ΔR less than 0.02%.
Load Life:* 2,000 hours at +125°C, ΔR less than 0.05%.
Shelf Life (Typical): 25 ppm/year.
Insulation Resistance: 10,000 Megohms.
Vibration:* ΔR less than 0.01%.
Shock:* ΔR less than 0.02%.
*Test methods per specifications and procedures of Mil-R-55182/9.

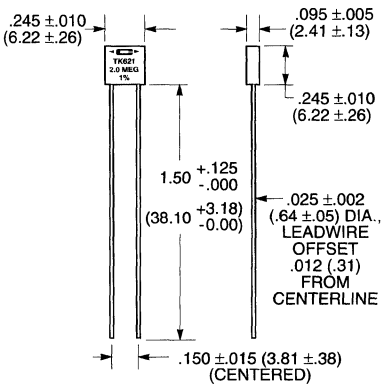
Type TK Low TC Precision Radial-Lead Film Resistors - Extended Resistance Range

Model No.	Temperature Coefficient ppm/°C	Wattage @ +125°C	Max. Working Voltage	Dielect. Strength	Resistance Min.	Resistance Max.	Dimensions	Encapsulation	Leadwire
TK621	5, 10 or 20	Limited by Maximum Working Voltage	200	300	501 K	2 Meg.	Ref. Case "A" Dwg.	Transfer Molded	Tinned Copper
TK633	5, 10 or 20		300	400	1.51 Meg.	10 Meg.	Ref. Case "B" Dwg.	Transfer Molded	Tinned Copper
TK639	5, 10 or 20		300	400	1.51 Meg.	10 Meg.	Ref. Case "C" Dwg.	Transfer Molded	Tinned Copper

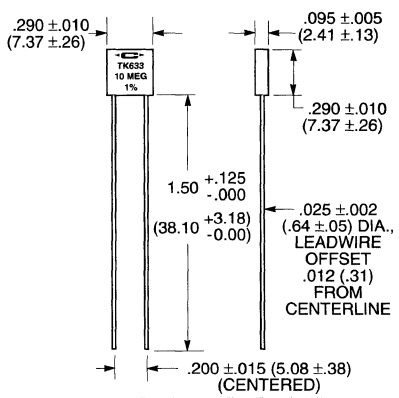
Temperature Coefficient Identification:
5 ppm/°C Silver Dot
10 ppm/°C No Dot
20 ppm/°C Green Dot

Resistance Tolerance: ±1% (tolerances to ±0.05% on special order).
Operating Temperature: -55°C to +175°C.
TC Temperature Range: -55°C to +125°C.
Overload:* 1.5 times rated working voltage for 5 seconds, ΔR less than 0.2%.
Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR less than 0.1%.
Low Temperature Operation:* ΔR less than 0.05%.
Dielectric Withstanding Voltage:* ΔR less than 0.05%.
Moisture Resistance:* Mil-Std-202, Method 106, ΔR less than 0.05%.
Load Life:* 2,000 hours at +125°C, ΔR less than 0.2%.
Shelf Life (Typical): 25 ppm/year.
Insulation Resistance: 10,000 Megohms.
Vibration:* ΔR less than 0.05%.
Shock:* ΔR less than 0.05%.
*Test methods per specifications and procedures of Mil-R-55182/9.

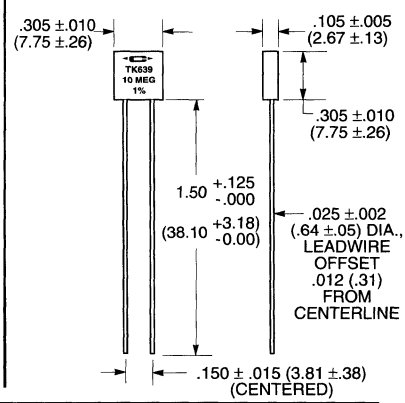
Case "A"
Model TK 121 and TK 621



Case "B"
Model TK 133 and TK 633



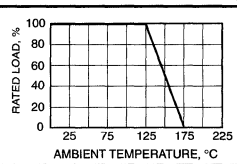
Case "C"
Model TK 139 and TK 639



Ordering Information

TK633 - 10 Meg - 0.1% - 10 ppm/°C
Model Number | Tolerance | Resistor Value | Temperature Coefficient

Derating Curve:



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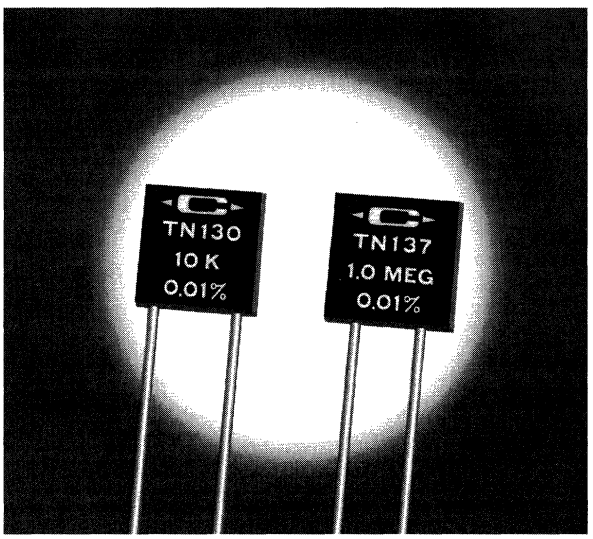
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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TN Lab Grade Low TC Precision Film Resistors

Low TC of 5 ppm/°C, 10 ppm/°C or 20 ppm/°C from 0°C to 70°C
Tolerance of ±0.01%, ±0.025%, ±0.05%, ±0.1% to ±1%, Values from 1 Kohm to 1 Meg

Type TN Lab Grade Low TC Film Resistors were specifically developed for use in 0°C to +70°C applications which require a low temperature coefficient and a high degree of precision. These resistors combine the outstanding characteristics of Caddock's Tetrinox® resistance system with a space efficient, non-inductive, radial-lead design. These resistors are intended for precision analog designs where the system is not exposed to full military or space grade operating conditions. For full military or space grade operating conditions, we recommend Caddock's **Type TK Low TC Precision Radial-Lead Film Resistors.** For lab grade applications which require higher voltage ratings (up to 1,400 volts) and power ratings (up to 0.75 watt), we recommend Caddock's **Type TF Low TC Ultra-Precision Film Resistors**.



The performance features of the Type TN Lab Grade Low TC Precision Film Resistors are:

- **Low Temperature Coefficient** - 5, 10 or 20 ppm/°C.
- **Ultra-Precision** - 7 standard tolerances from ±0.01% to ±1%.
- **Resistance Range** - from 1 Kohm to 1 Megohm.
- **Non-Inductive Design.**
- **Radial-Lead Design** - conserves board space.

Type TN Lab Grade Low TC Precision Film Resistors

Model No.	Temperature Coefficient ppm/°C	Wattage @ +70°C	Max. Working Voltage	Dielect. Strength	Resistance Min.	Resistance Max.	Dimensions
TN130	5, 10 or 20	.3	200	400	1 K	1 Meg	Ref. Case "A" Dwg.
TN137	5, 10 or 20	.3	200	400	1 K	1 Meg	Ref. Case "B" Dwg.

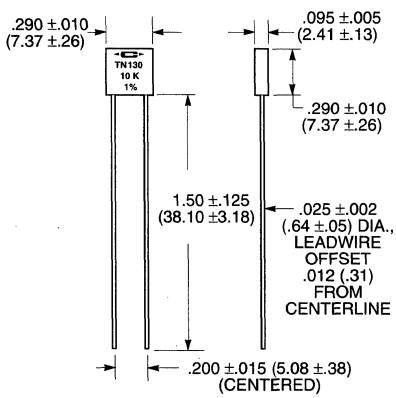
Temperature Coefficient Identification:
5 ppm/°C Silver Dot
10 ppm/°C No Dot
20 ppm/°C Green Dot

Ordering Information:

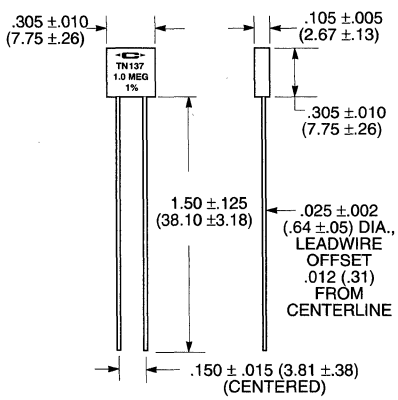
TN130 - 10 K - 0.01% - 10 ppm/°C
Model Number | Resistor Value | Tolerance | Temperature Coefficient

ALL DIMENSIONS IN INCHES AND (MILLIMETERS)

Case "A"
Model TN 130



Case "B"
Model TN 137

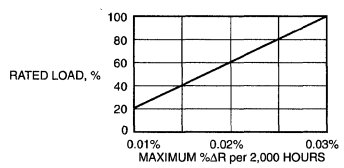


Specifications:

Resistance Tolerance: ±0.01%, ±0.025%, ±0.05%, ±0.10%, ±0.25%, ±0.50% or ±1.0%.

Absolute Temperature Coefficient: 5ppm/°C, 10 ppm/°C or 20 ppm/°C referenced 25°C, ΔR taken at 0°C and +70°C.

Load Stability at +70°C:



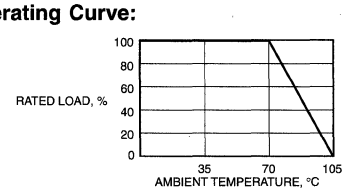
Shelf Life (Typical): 25 ppm/year.

Storage Temperature: -55°C to +105°C.

Encapsulation: Transfer Molded.

Leadwire: Tinned Copper.

Derating Curve:



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Type TF Low TC Ultra-Precision Film Resistors

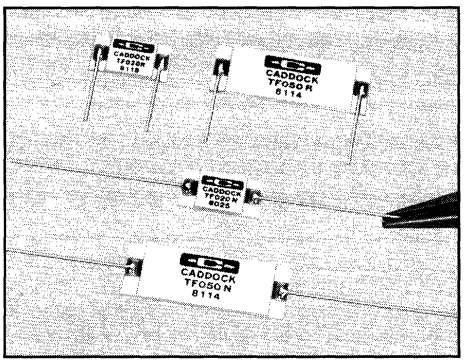
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Absolute TC to 5 ppm/°C, Values from 1 Kohm to 125 Megohms, Absolute Tolerance to ±0.01%

Type TF precision resistors employ the Caddock Tetrinox® resistance films - the resistance system that sets a new standard for high value, ultra-stable precision resistors that provide an exceptional combination of performance characteristics:

- **Ultra-Precision** - Seven standard resistance tolerances from ±1% to ±0.01%.
- **A Wide Range of Resistance Values** - from 1 Kohm to 125 Megohms.
- **Low Temperature Coefficient** - 5 ppm/°C, 10 ppm/°C or 15 ppm/°C.
- **Long-Term Stability** - to 0.01% per 1,000 hours.

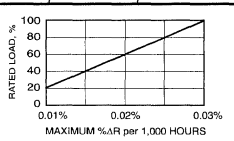
This completely new approach to quantity production of ultra-precision resistors is the result of combining our unique complex oxide technology with an advanced high thru-put laser manufacturing capability.



Type TF - Standard Resistance Range - 1 Kohm to 10 Megohms

Model Number		Wattage @ +70°C	Maximum Continuous Oper. Voltage	Resistance		Dimensions inches (mm)	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF020N	TF020R	.33	300	1 K	2 Meg.	.750 ±.020 (19.05 ±.51)	.375 ±.020 (9.53 ±.51)
TF050N	TF050R	.75	1,400	10 K	10 Meg.	1.500 ±.020 (38.10 ±.51)	.500 ±.020 (12.70 ±.51)

Load Stability:



Shelf Life: Typically 0.005% per year

Type TF - Extended Resistance Range - 2 Megohms to 125 Megohms

Model Number		Wattage @ +70°C	Maximum Continuous Oper. Voltage	Resistance		Dimensions inches (mm)	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF626N	TF626R	.33	300	2.01 Meg.	35 Meg.	.750 ±.020 (19.05 ±.51)	.375 ±.020 (9.53 ±.51)
TF656N	TF656R	.75	1,400	10.01 Meg.	125 Meg.	1.500 ±.020 (38.10 ±.51)	.500 ±.020 (12.70 ±.51)

Load Stability: 1,000 hours at rated voltage at +70°C, maximum ΔR 0.03%

Shelf Life: Typically 0.010% per year

Specifications:

Apply to all Type TF resistor models

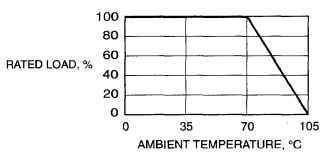
Absolute Temperature Coefficient: 5 ppm/°C, 10 ppm/°C or 15 ppm/°C referenced to 25°C, ΔR taken at -15°C and +105°C.

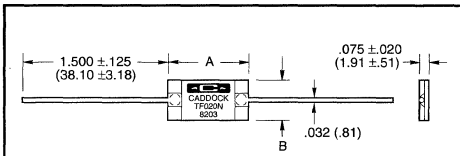
Resistance Tolerance: ±0.01%, ±0.025%, ±0.05%, ±0.10%, ±0.25%, ±0.50% or ±1.0%.

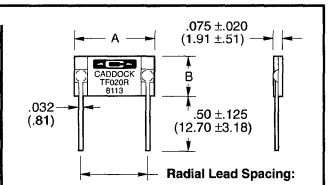
Storage Temperature: -55°C to +105°C.

Leadwire: Tinned Copper

Derating Curve:







DIMENSIONS IN INCHES AND (MILLIMETERS)

.600 ±.020 (15.24 ±.51) for Models TF020R and TF626R
1.350 ±.020 (34.29 ±.51) for Models TF050R and TF656R

Ordering Information

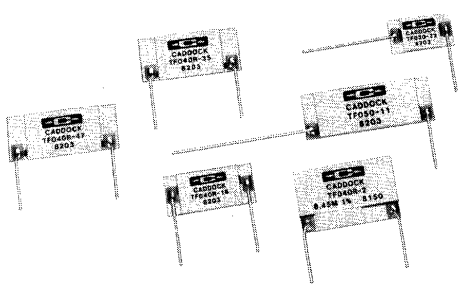
TF050R - 10 Meg - 0.01% - 10 ppm/°C

Model Number | Resistor Value | Tolerance | Temperature Coefficient

Custom Type TF Resistors

Additional cost savings can be realized when your high volume ultra-precision Type TF resistor is optimized for:

- Voltage rating
- Power rating
- Mechanical configuration
- Ratio matched sets



And for special requirements, custom Type TF resistors are available with:

- TC of 5 ppm/°C, 10 ppm/°C, 15 ppm/°C, 20 ppm/°C or 25 ppm/°C.
- Shelf stability of 0.0025% per year.

Type TF resistors can also be produced with custom-spaced radial leads that will plug directly into your existing circuit layout.

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

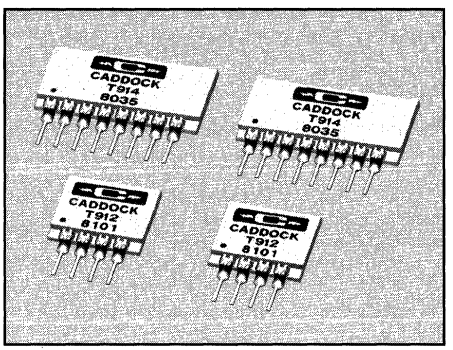
Type T912 and T914 Precision Resistor Networks

Resistor Pairs and Quads with Ratio Characteristics for Precision Analog Circuits

Type T912 and T914 Precision Resistor Networks are constructed with Caddock Tetrinox® resistance films to achieve the precise ratio performance and stability required by highly accurate amplifier circuits, voltage reference circuits and precision bridge circuits.

- **Ratio Tolerance** - from ±0.1% to ±0.01%.
- **Ratio Temperature Coefficient** - 10 ppm/°C, 5ppm/°C or 2 ppm/°C.
- **Absolute Temperature Coefficient** - 25 ppm/°C.
- **Ratio Stability of Resistance at Full Load for 2,000 hours** - within ±0.01%.
- **Shelf Life Stability of Ratio for 6 Months** - within ±0.005%.

Both the T912 and the T914 are available in 14 standard resistance values between 1,000 ohms and 1 Megohm. Caddock's high thru-put manufacturing capability assures that prototype and large-volume production quantities are available either from stock or within 6 weeks after receipt of order.



Standard Type T912 and Type T914 Precision Resistor Networks

In addition to the 14 standard **equal value** models of the Type T912 and T914, the Type T912 can also be ordered with -

- **10:1 Resistance Ratio** - for use in amplifier gain-setting.
- **9:1 Resistance Ratio** - for use in voltage reference dividers.

Ordering Information: T912 - A 10K - 010 - 02

Model Number

Ratio Code Letter: *
A - T912 with R_1: R_2 where $R_2 = 10R_1$
1K:10K 10K:100K 40K:400K
2K:20K 20K:200K 50K:500K
5K:50K 25K:250K 100K:1 Meg.
B - T912 with R_1: R_2 where $R_2 = 9R_1$
1K:9K 10K:90K 40K:360K
2K:18K 20K:180K 50K:450K
5K:45K 25K:225K 100K:900K
No Letter - T912 with $R_1 = R_2$
No Letter - T914 with $R_1 = R_2 = R_3 = R_4$

Ratio Temperature Track (0°C to 70°C): *
-10 = 10 ppm/°C -05 = 5 ppm/°C
-02 = 2 ppm/°C

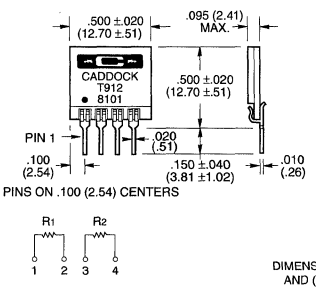
Ratio Tolerance: * -100 = 0.1% -020 = 0.02%
-050 = 0.05% -010 = 0.01%

Standard Resistance Values: * (R_1)
1K 10K 40K 200K 500K
2K 20K 50K 250K 1 Meg.
5K 25K 100K 400K

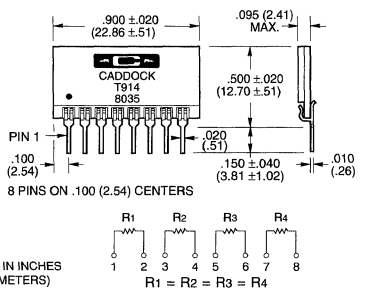
Special or mixed resistance values are available as custom networks. See the custom section at the bottom of this page.

* (This information appears on the back side of the network)

Type T912
Ratios Available: 1:1, 9:1, 10:1 and Custom.



Type T914
Ratios Available: 1:1 and Custom.



DIMENSIONS IN INCHES AND (MILLIMETERS)

Specifications:

Absolute Tolerance: ±0.1% for all resistors.

Absolute Temperature Coefficient: ±25 ppm/°C referenced to 25°C, ΔR taken at 0°C and 70°C.

Voltage Rating: 30 volts DC or RMS AC applied to R_1, R_2, R_3 and R_4.

Power Rating: 0.10 watt applied to R_1, R_2, R_3 and R_4 (not to exceed rated voltage).

Package Power Rating: Type T912, 0.200 watt. Type T914, 0.400 watt.

Storage Temperature: -55°C to +105°C.

Insulation Resistance Between Isolated Pins: Pin 2 to Pin 3, Pin 4 to Pin 5, or Pin 6 to Pin 7, 1,000 Megohms, minimum.

Dielectric Strength Between Isolated Pins: 50 volts RMS AC.

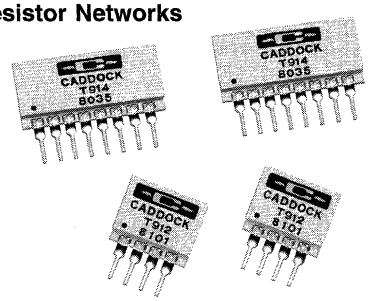
Ratio Stability Under Load: Ratio change between any two resistors in the network under full load for 2,000 hours at 70°C, 0.01% maximum.

Shelf Stability of Ratio: Six months at shelf conditions, 50 ppm maximum.

Custom Model T912 and T914 Precision Resistor Networks

For applications requiring non-standard resistance values, the T912 and T914 custom configurations can include these special features:

- Mixed resistance values with a maximum ratio of 250-to-1. (Example: 1.0 Megohm and 4 K)
- Absolute TC as low as 15 ppm/°C.
- Ratio TC as low as 2 ppm/°C.
- Custom voltage ratings.
- Matched resistors of any special value between 1 K and 2 Megohms.



Call or write our Applications Engineering for performance, price and availability of these custom resistor networks.

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Type T922 and T924 Low Profile Precision Resistor Networks

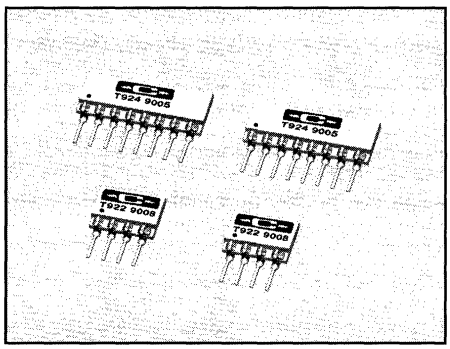
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HIGH PERFORMANCE FILM RESISTORS

New Low Profile Package with Precision and Ultra-Precision Ratio Performance

Type T922 and T924 Precision Resistor Networks are constructed with Caddock Tetrinox® resistance films to achieve the precise ratio performance and stability required by highly accurate amplifier circuits, voltage reference circuits and precision bridge circuits.

- **Ratio Tolerance** - from ±0.1% to ±0.01%.
- **Ratio Temperature Coefficient** - 10 ppm/°C or 5 ppm/°C.
- **Absolute Temperature Coefficient** - 25 ppm/°C.
- **Ratio Stability of Resistance at Full Load for 2,000 hours** - within ±0.01%.
- **Shelf Life Stability of Ratio for 6 Months** - within ±0.005%.

Both the T922 and the T924 are available in 8 standard resistance values between 10 Kohms and 250 Kohm. Caddock's high thru-put manufacturing capability assures that prototype and large-volume production quantities are available either from stock or within 6 weeks after receipt of order.



Standard Type T922 and Type T924 Precision Resistor Networks

In addition to the 8 standard **equal value** models of the Type T922 and T924, the Type T922 can also be ordered with -

- **10:1 Resistance Ratio** - for use in amplifier gain-setting.
- **9:1 Resistance Ratio** - for use in voltage reference dividers.

Ordering Information: T922 - A 10K - 010 - 05

Model Number

Ratio Code Letter: *
- **A** - T922 with R_1: R_2 where $R_2 = 10R_1$
  - 10K:100K
  - 20K:200K
  - 25K:250K
- **B** - T922 with R_1: R_2 where $R_2 = 9R_1$
  - 10K:90K
  - 20K:180K
  - 25K:225K
- **No Letter** - T922 with $R_1 = R_2$
- **No Letter** - T924 with $R_1 = R_2 = R_3 = R_4$

Standard Resistance Values: * (R_1)

10K	40K	200K
20K	50K	250K
25K	100K	

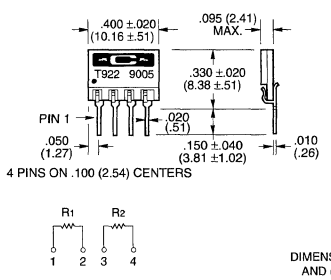
Special or mixed resistance values are available as custom networks. See the custom section at the bottom of this page.

Ratio Tolerance: * -100 = 0.1% -020 = 0.02% -050 = 0.05% -010 = 0.01%

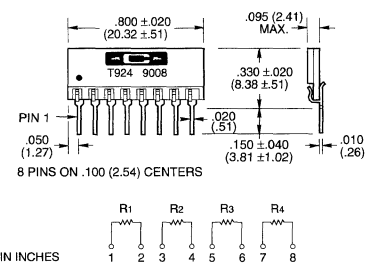
Ratio Temperature Track (0°C to 70°C): * -10 = 10 ppm/°C -05 = 5 ppm/°C

* (This information appears on the back side of the network)

Type T922
Ratios Available: 1:1, 9:1, 10:1 and Custom.



Type T924
Ratios Available: 1:1 and Custom.



DIMENSIONS IN INCHES AND (MILLIMETERS)

Specifications:

Absolute Tolerance: ±0.1% for all resistors.

Absolute Temperature Coefficient: ±25 ppm/°C referenced to 25°C, ΔR taken at 0°C and 70°C.

Voltage Rating: 30 volts DC or RMS AC applied to R_1, R_2, R_3 and R_4.

Power Rating: 75 milliwatts applied to R_1, R_2, R_3 and R_4 (not to exceed rated voltage).

Package Power Rating: Type T922, 0.150 watt. Type T924, 0.300 watt.

Storage Temperature: -55°C to +105°C.

Insulation Resistance Between Isolated Pins: Pin 2 to Pin 3, Pin 4 to Pin 5, or Pin 6 to Pin 7, 1,000 Megohms, minimum.

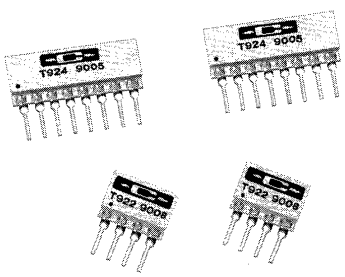
Dielectric Strength Between Isolated Pins: 50 volts RMS AC.

Ratio Stability Under Load: Ratio change between any two resistors in the network under full load for 2,000 hours at 70°C, 0.01% maximum.

Shelf Stability of Ratio: Six months at shelf conditions, 50 ppm maximum.

Custom Model T922 and T924 Low Profile Precision Resistor Networks

For applications requiring non-standard resistance values, the T922 and T924 custom configurations can include mixed resistance values and custom voltage ratings.



Call or write our Applications Engineering for performance, price and availability of these custom resistor networks.

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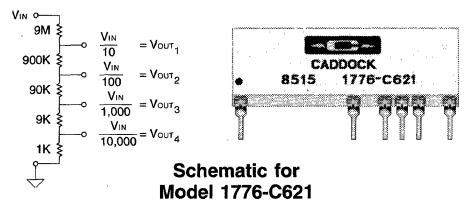
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type 1776 Precision Decade Resistor Voltage Dividers

Input Voltage Dividers for Digital Multimeters and Range-Switching Instruments

The exceptional performance of this extensive family of Type 1776 Precision Decade Resistor Voltage Dividers has been achieved through the special combination of advantages provided by Caddock's Tetrinox® resistance films. This advanced film resistor technology provides the performance characteristics required by the precision input signal circuits of both bench-type and laboratory digital instruments.

In addition to requiring less board space, these compact precision resistor networks deliver higher performance than selected discrete resistor sets and thin-film networks.



Schematic for Model 1776-C621

There are now 39 standard models in the expanded family of Type 1776 precision resistor networks that include -

- 3, 4 and 5 - decade voltage dividers with ratios from 10:1 to 10,000:1.
- 1,200 volts continuous ratings and overvoltage to 2,000 volts.
- Many combinations of Ratio and Absolute Tolerance, and Ratio and Absolute Temperature Coefficient.

For complete information on quantity price and delivery, call or write our Sales Office.

Model No.	Resistance Values					Fig.	Voltage Rating ⑦	Absolute Tolerance %	Ratio Tolerance % ①	Absolute TC ppm/°C	Ratio TC ppm/°C ②	Voltage Coefficient of Ratio ppm/volt ③	Ratio Stability % Change in Ratio		
	R1	R2	R3	R4	R5								Load Life ④	Shelf Life ⑤	Over-Voltage ⑥
1776-C61	9 Meg	900 K	90 K	9 K	900	6	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C611	9 Meg	900 K	90 K	9 K	900	6	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C6117	9 Meg	900 K	90 K	9 K	900	6	1200	0.1	0.02	30	10	0.1	0.01	0.005	0.01
1776-C62	9 Meg	900 K	90 K	9 K	1 K	6	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C621	9 Meg	900 K	90 K	9 K	1 K	6	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C6217	9 Meg	900 K	90 K	9 K	1 K	6	1200	0.1	0.02	30	10	0.1	0.01	0.005	0.01
1776-C732	9 Meg	900 K	90 K	9 K	900	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C73	9 Meg	900 K	90 K	9 K	900	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776-C742	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C74	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776-232	9 Meg	900 K	90 K	9 K	900	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776-23	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.1	50	50	0.2	0.02	0.01	0.02
1776-231	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.05	50	50	0.2	0.02	0.01	0.02
1776-242	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776-24	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.1	50	50	0.2	0.02	0.01	0.02
1776-241	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.05	50	50	0.2	0.02	0.01	0.02
1776-10	9 Meg	900 K	90 K	10 K	N/A	4	1200	+0, -0.5	0.1	30	10	0.02	0.01	0.005	0.01
1776-105	9 Meg	900 K	90 K	10 K	N/A	4	1200	+0, -0.5	0.1	30	5	0.02	0.01	0.005	0.01
1776-C10	9 Meg	900 K	90 K	10 K	N/A	9	1200	+0, -0.5	0.1	30	10	0.02	0.01	0.005	0.01
1776-C105	9 Meg	900 K	90 K	10 K	N/A	9	1200	+0, -0.5	0.1	30	5	0.02	0.01	0.005	0.01
1776-1	9 Meg	900 K	90 K	10 K	N/A	2	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776-14	9 Meg	900 K	90 K	10 K	N/A	2	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776-8	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.1	30	25	0.2	0.02	0.01	0.02
1776-81	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.05	30	25	0.2	0.02	0.01	0.02
1776-9	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776-91	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776-912	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.02	30	5	0.02	0.01	0.005	0.01
1776-C4	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	30	10	0.1	0.01	0.005	0.01
1776-C44	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C441	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C4417	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.1	0.02	30	10	0.1	0.01	0.005	0.01
1776-C3	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.5	0.5	50	50	0.5	0.04	0.02	0.04
1776-C34	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C532	900 K	90 K	9 K	900	N/A	5	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
1776-C53	900 K	90 K	9 K	900	N/A	5	750	0.1	0.1	25	15	0.3	0.02	0.01	0.02
1776-C531	900 K	90 K	9 K	900	N/A	5	750	0.1	0.05	25	15	0.3	0.02	0.01	0.02
1776-C542	900 K	90 K	9 K	1 K	N/A	5	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
1776-C54	900 K	90 K	9 K	1 K	N/A	5	750	0.1	0.1	25	15	0.3	0.02	0.01	0.02
1776-C541	900 K	90 K	9 K	1 K	N/A	5	750	0.1	0.05	25	15	0.3	0.02	0.01	0.02

Specifications:

(Numbers inside circles reference columns in Model No. table)

① **Ratio Tolerance:** Maximum ratio difference between two resistors in the network. (See the specific Figures for the Ratio Definition).

② **Ratio Temperature Coefficient:** Ratio track from 0°C to +70°C.

③ **Voltage Coefficient of Ratio (ppm/volt):** R1 in series with any combination of R2, R3, R4 and R5, 100 volts to rated voltage.

④ **Load Life:** Ratio stability of resistance under full load, rated voltage applied to R1 in series with any combination of R2, R3, R4 and R5.

⑤ **Shelf Stability of Ratio:** Six months at shelf conditions.

⑥ **Overvoltage:** Maximum voltage of 1.67 times rated DC voltage. Volts DC or peak AC applied to R1 and any combination of R2, R3, R4 and R5 in series with R1 for 10 seconds.

⑦ **Voltage Rating:** DC or RMS AC voltage applied to R1 in series with any combination of R2, R3, R4 and R5.

Storage Temperature: -55°C to +85°C.

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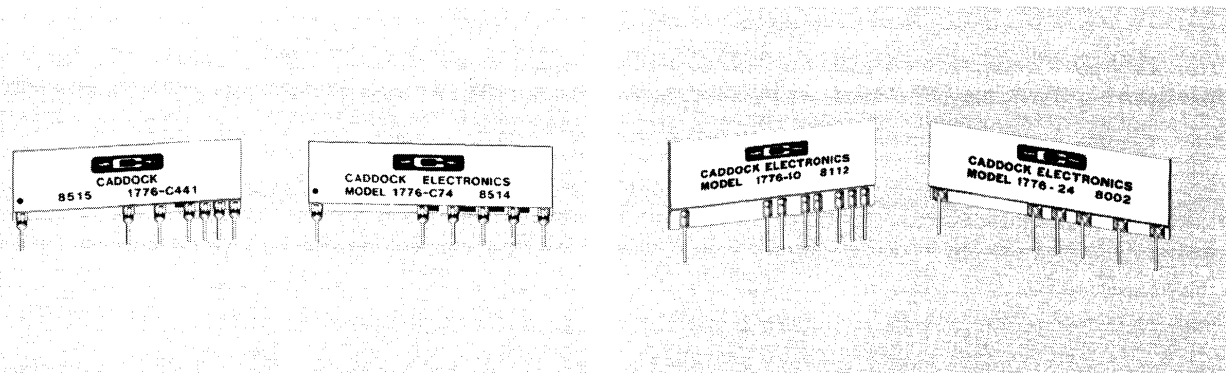
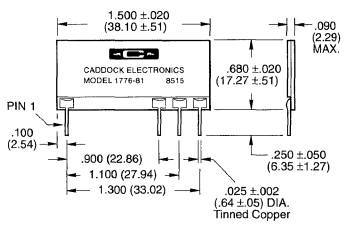


Figure 1



RATIO DEFINITION:
ALL RESISTORS RATIO
ONE ANOTHER

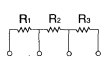
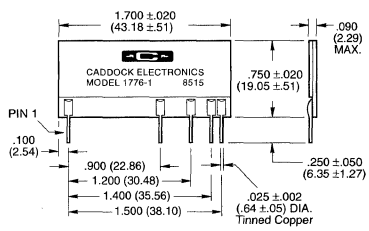


Figure 2



RATIO DEFINITION:
ALL RESISTORS RATIO
ONE ANOTHER

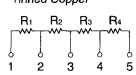
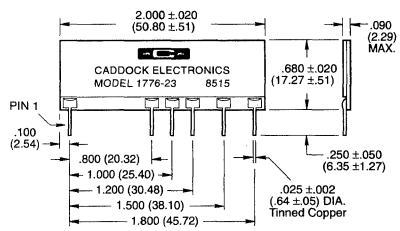


Figure 3



RATIO DEFINITION:
ALL RESISTORS RATIO
ONE ANOTHER

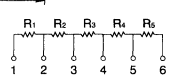
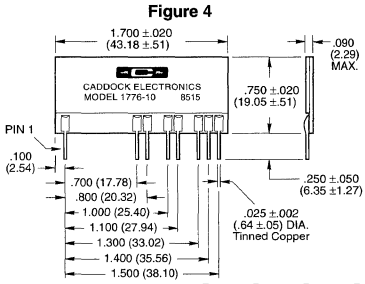


Figure 4



RATIO DEFINITION:
ALL RESISTORS RATIO
ONE ANOTHER

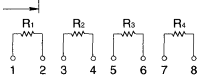
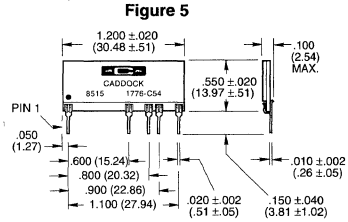


Figure 5



RATIO DEFINITION:
ALL RESISTORS RATIO
ONE ANOTHER

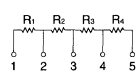
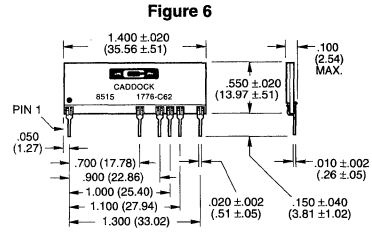


Figure 6



RATIO DEFINITION: Where $R_T = R_1 + R_2 + R_3 + R_4 + R_5$
RATIO 1 $(R_2 + R_3 + R_4 + R_5):R_T$
RATIO 2 $(R_3 + R_4 + R_5):R_T$
RATIO 3 $(R_4 + R_5):R_T$
RATIO 4 $(R_5):R_T$

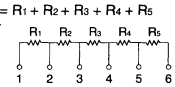
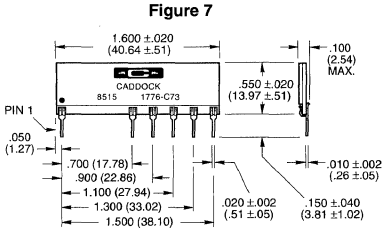


Figure 7



RATIO DEFINITION:
ALL RESISTORS RATIO
ONE ANOTHER

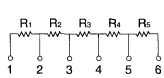
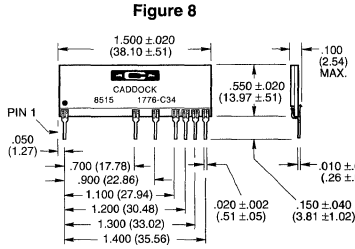


Figure 8



RATIO DEFINITION:
RATIO 1 $R_1:R_2$
RATIO 2 $R_1:R_3$
RATIO 3 $R_1:R_4$
RATIO 4 $R_1:R_5$

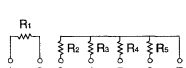
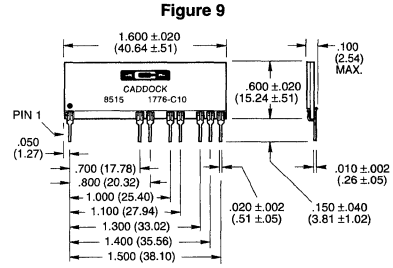
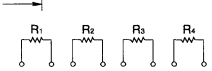


Figure 9



RATIO DEFINITION:
ALL RESISTORS RATIO
ONE ANOTHER



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HIGH PERFORMANCE FILM RESISTORS

Type 1787 Current Shunt Resistor Networks

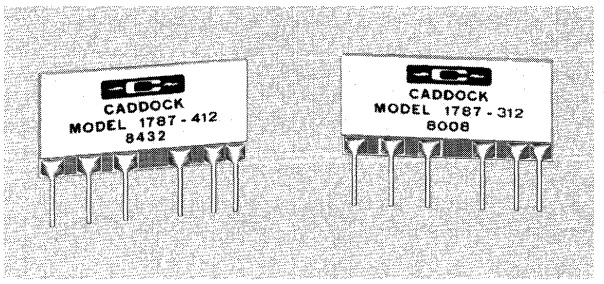
Accurate Current Sensing in Multi-Range Instrumentation

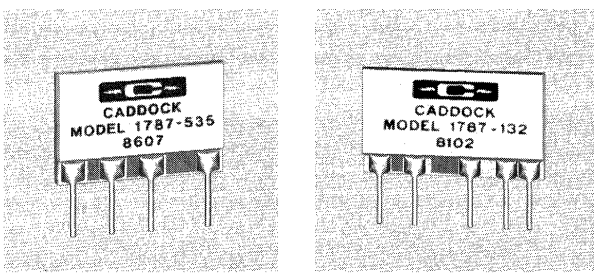
Type 1787 Current Shunt Resistor Networks utilize Caddock's Micronox® resistance films and advanced high thru-put laser manufacturing capabilities to achieve many vital advantages in precision current measurement circuits, including laboratory and bench-type digital instrumentation:

- The thin-profile single-package configuration replaces as many as four discrete current shunt resistors.
- The monolithic construction and standardized lead spacing simplify installation.
- Caddock Micronox® resistance films provide exceptional stability for improved long-term measurement accuracy.

Twelve standard models in five network arrangements provide the specific accuracy and resistance values required for a wide range of current measuring instruments and circuits.

Prototype quantities of most models of the Type 1787 Current Shunt Resistor Networks are available either from stock or within 6 weeks after receipt of order.





Model No.	Resistance Values				Power Rating Watts				Max. Power Rating Watts Total Pkg.	Fig.	Absolute Tolerance % ①	Maximum Absolute TC ppm/°C ②	Absolute Stability Max. % Change in Resistance Value	
	R_A	R_B	R_C	R_D	R_A	R_B	R_C	R_D					Load Life ③	Shelf Life ④
1787-31	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.25	80	0.05	0.03
1787-312	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.10	80	0.03	0.02
1787-41	1,000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.25	80	0.05	0.03
1787-412	1,000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.10	80	0.03	0.02
1787-5	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.25	50	0.04	0.02
1787-53	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.10	50	0.02	0.01
1787-535	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.05	50	0.02	0.01
1787-6	1,000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.25	50	0.04	0.02
1787-64	1,000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.10	50	0.02	0.01
1787-645	1,000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.05	50	0.02	0.01
1787-13	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	5	0.25	100	0.05	0.03
1787-132	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	5	0.10	100	0.03	0.02

① **Absolute Tolerance:** Tolerance of R_A, R_B, R_C or R_D when measured in accordance with proper Figure No.

② **Absolute Temperature Coefficient:** Temperature coefficient of R_A, R_B, R_C or R_D from 0°C to +70°C, referenced to +25°C.

③ **Load Life:** Stability of R_A, R_B, R_C or R_D with full power applied individually for 2,000 hours at +70°C.

④ **Shelf Life:** Stability of R_A, R_B, R_C or R_D for six months at shelf conditions.

Storage Temperature: -55°C to +85°C.

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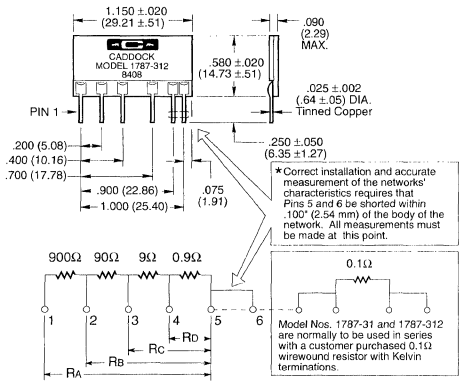
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Type 1787 Current Shunt Resistor Networks

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HIGH PERFORMANCE FILM RESISTORS

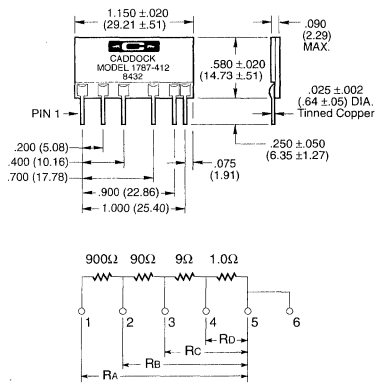
Figure 1 - Model Nos. 1787-31 and 1787-312



Model Nos. 1787-31 and 1787-312 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	999.9 Ω	Pin 1	Pin 1	Pin 5 *	Pin 6 *
R_B	99.9 Ω	Pin 1	Pin 2	Pin 5 *	Pin 6 *
R_C	9.9 Ω	Pin 1	Pin 3	Pin 5 *	Pin 6 *
R_D	0.9 Ω	Pin 1	Pin 4	Pin 5 *	Pin 6 *

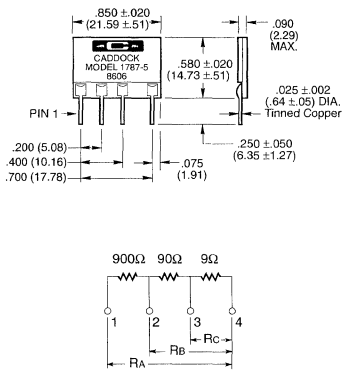
Figure 2 - Model Nos. 1787-41 and 1787-412



Model Nos. 1787-41 and 1787-412 Measurement Connections

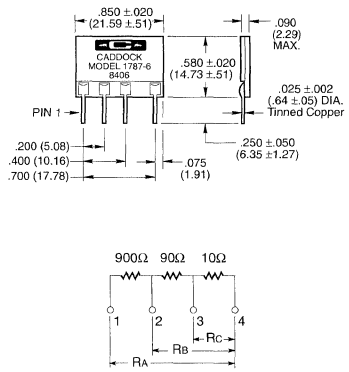
Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	1,000 Ω	Pin 1	Pin 1	Pin 5	Pin 6
R_B	100 Ω	Pin 1	Pin 2	Pin 5	Pin 6
R_C	10 Ω	Pin 1	Pin 3	Pin 5	Pin 6
R_D	1 Ω	Pin 1	Pin 4	Pin 5	Pin 6

Figure 3 - Model Nos. 1787-5, 1787-53 and 1787-535



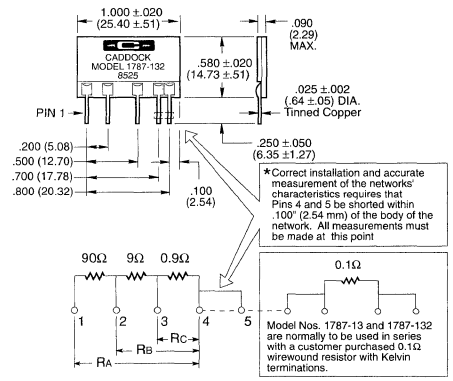
Resistances	
"R"	Total Value
R_A	999 Ω
R_B	99 Ω
R_C	9 Ω

Figure 4 - Model Nos. 1787-6, 1787-64 and 1787-645



Resistances	
"R"	Total Value
R_A	1,000 Ω
R_B	100 Ω
R_C	10 Ω

Figure 5 - Model Nos. 1787-13 and 1787-132



Model Nos. 1787-13 and 1787-132 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	99.9 Ω	Pin 1	Pin 1	Pin 4 *	Pin 5 *
R_B	9.9 Ω	Pin 1	Pin 2	Pin 4 *	Pin 5 *
R_C	0.9 Ω	Pin 1	Pin 3	Pin 4 *	Pin 5 *

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type T1794 Custom Low TC Precision SIP Resistor Networks

Low Absolute TC and Ratio TC in Resistor Networks with Custom Performance

The exceptional design flexibility provided by the Type T1794 Custom Low TC Precision SIP Resistor Networks gives each circuit designer the freedom to choose the precise combination of specifications required to optimize both the performance and the price of custom precision and ultra-precision resistor networks.

For precision analog designs with special circuit requirements, Caddock's Type T1794 Custom Low TC Precision SIP Resistor Networks are available with performance that includes:

- **Resistance Values:** from 500 ohms to as high as 50 Megohms.
- **Absolute Tolerances:** ±1.0%, ±0.50%, ±0.25%, ±0.20%, ±0.10%, ±0.05% or ±0.025%.
- **Ratio Tolerances:** ±1.0%, ±0.50%, ±0.25%, ±0.20%, ±0.10%, ±0.05% or ±0.025%.
- **Absolute Temperature Coefficient:** 50 ppm/°C, 25 ppm/°C or 15 ppm/°C from 0°C to +70°C.
- **Ratio Temperature Coefficient:** 50 ppm/°C, 25 ppm/°C, 10 ppm/°C or 5 ppm/°C from 0°C to + 70°C.
- **Ratio-of-Ratios:** as required, to as close as 0.025%.

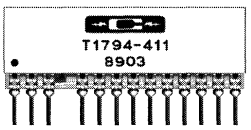
The unique thin-profile, single-in-line edge-mount package design allows the wide range of flexibility necessary to blend the performance of Tetrinox® resistance technology with particular circuit specifications to arrive at the final network package size, pin spacing and pin style.

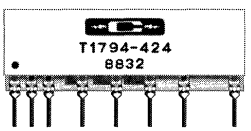
By optimizing both performance and configuration, many designers find that these precision networks can achieve savings in both component costs and insertion costs, as compared to discrete precision resistors - even in production lot quantities as low as 1,000 units.

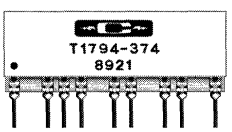
Applications for the Type T1794 Custom Low TC Precision SIP Resistor Networks include:

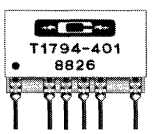
- **Voltage Divider Networks**
- **Amplifier Gain-Setting Networks**
- **Differential Input Networks**
- **Attenuator Networks**
- **Current-to-Voltage Converter Sense Networks**

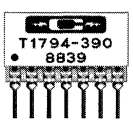
Our high thru-put manufacturing capability is now committed to the production of these custom precision resistor networks. Custom network designs for requirements that range from 500 networks per year to 400,000 networks per year are now in production.

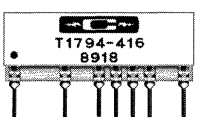


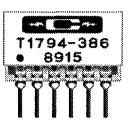


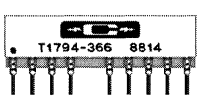


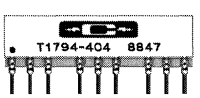












Optional Pin Style



Low profile, single-in-line package with one row of right-angle pins.

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Type 1789 Custom Low Resistance Value Precision SIP Resistor Networks

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Low Resistance Custom Resistor Networks with Values as Low as 0.5 ohm

The design flexibility achieved by Caddock's advanced resistance film technologies is extended to low resistance values in precision resistor networks through the application of Caddock's Micronox® resistance films.

By applying this technology to the low-profile, single-in-line package configuration, the Type 1789 Custom Low Resistance Value Precision SIP Resistor Networks are available with a combination of features, which include:

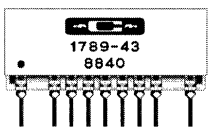
- **Resistance Values:** from 0.5 ohm to 10,000 ohms.
- **Absolute Tolerances:** ±1.0%, ±0.50%, ±0.25%, ±0.20%, ±0.10% or ±0.05%.
- **Ratio Tolerances:** ±1.0%, ±0.50%, ±0.25%, ±0.20%, ±0.10% or ±0.05%.
- **Absolute Temperature Coefficient:** 100 ppm/°C, 80 ppm/°C or 50 ppm/°C from 0°C to +70°C.
- **Ratio Temperature Coefficient:** 80 ppm/°C, 50 ppm/°C, 25 ppm/°C or 15 ppm/°C from 0°C to +70°C.
- **Power Rating:** 100 mW to 2 Watts per resistor.

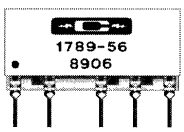
Where high accuracy and low resistance values must be combined - as in high accuracy current measurement circuitry - Kelvin terminations can be provided for low resistance values to minimize lead resistance errors.

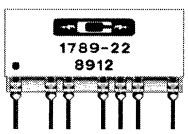
The optimum design of Type 1789 Custom Low Resistance Value Precision SIP Resistor Networks is best achieved when the performance of Micronox® resistance film technologies is blended with particular circuit specifications and the unique thin-profile, single-in-line package design to arrive at the final network package size, pin spacing and pin style.

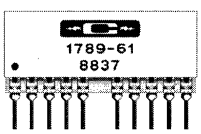
Applications for the Type 1789 Custom Low Resistance Value Precision SIP Resistor Networks include:

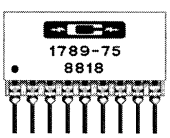
- **Current Summing Networks**
- **Precision Termination Networks**
- **Precision Current Shunts**
- **Current Sensing Networks**
- **Impedance Matching Networks**

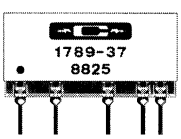








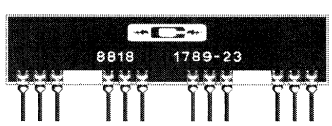


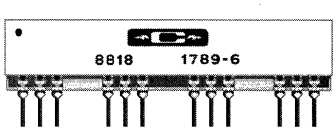


Lightning Transient Tolerant
Custom Low Resistance Precision Resistor Networks

Telephone Switch Line Card Applications are requiring line sense (line balancing) networks with lower resistance values and tighter precision. The performance of these networks include:

- Resistor pairs with values as low as 40 ohms.
- Ratio Tolerance of 0.10%, 0.15%, 0.25% or 0.50%.
- Lightning Transient (Surge) Capability of 1 KV peak (10 µsec. rise, 1,000 µsec. fall to 500 Volts).
- Designed to handle customer specific power cross requirements.





Design Assistance in Developing Custom Resistor Networks

For immediate engineering assistance on the custom precision resistor network configuration that can best meet your needs, call our Applications Engineering and we will be pleased to provide design assistance, technical performance information and pricing information.

SALES OFFICE
CORPORATE HEADQUARTERS
1717 CHICAGO AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE: (714) 788-1700
FAX: (714) 369-1151

CADDOCK
ELECTRONICS, INCORPORATED

APPLICATIONS ENGINEERING
APPLIED SCIENCES DIVISION
17271 NORTH UMPQUA HWY.
ROSEBURG, OREGON 97470
PHONE: (503) 496-0700
FAX: (503) 496-0408

CARBORUNDUM® NON-INDUCTIVE POWER RESISTORS

Choose Type SP for great A-C power handling capability, whether it be at power frequency or many megahertz.

Choose Type A when high resistance is required in a high power non-inductive resistor.

Choose Type AS for its ability to absorb huge amounts of energy and for its non-inductive property at high voltage.

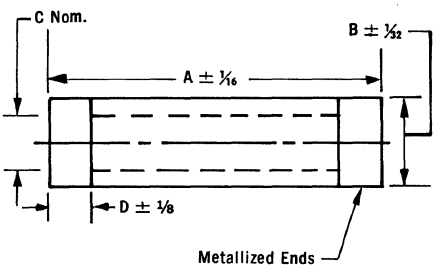
CHARACTERISTICS	Type SP	Type AS	Type A
Maximum Operating Temperature: °C	350	230 150*	230
Temperature Coefficient: Percent per degree C, −55°C to maximum rated temperature	±0.075	−0.075	−0.20
Voltage Coefficient: Maximum percent per kilovolt per inch active length (overall length less termination)	1.0	1.0	–
Short Time Overload: Maximum percent change after 5 cycles 10 times rated power, 5 seconds on, 90 seconds off	2.0	2.0	–
Moisture Resistance: Maximum percent change when tested per MIL-STD-202 method 103	2.5	2.5	2.5

*with epoxy insulation for use in oil

STANDARD SIZES

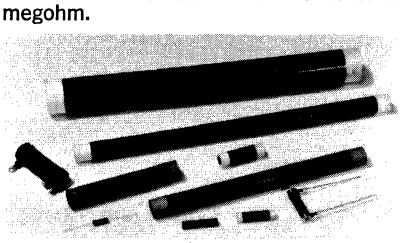
(Special sizes are also available: consult factory.)

Type	A	B	C (SP & AS)	C (A)	D
884 SP	2.0	0.50	0.22	—	0.25
885 SP, AS, & A	2.5	0.75	0.50	0	0.50
886 SP, AS, & A	5.0	0.75	0.50	0	0.62
887 SP, AS, & A	6.0	1.00	0.75	0.5	0.50
888 SP, AS, & A	8.0	1.00	0.75	0.5	0.88
889 SP, AS, & A	12.0	1.00	0.75	0.5	0.88
890 SP, AS, & A	18.0	1.00	0.75	0.5	0.88
891 SP	18.0	2.00	1.50	—	1.00
892 SP	24.0	2.00	1.50	—	1.00



SERIES 800 AND 1000

This general line is available in a wide variety of sizes and terminations. They retain the non-inductive and heavy load characteristics of all Carborundum ceramic resistors. These resistors can handle up to 1000 watts, 165 KJ and 165 KV in resistance values from 1 ohm to 1 megohm.



Parts are specified by the four or five character type number (for example 885SP, 888AS, 890A), the first two digits of the resistance, a single digit to indicate the power of ten multiplier, and a "J" for ±5%, a "K" for ±10%, or an "L" for ±20%. Where the resistance is less than ten ohms, the power of ten multiplier is not used, and an "R" replaces the decimal point. Thus R50 = 0.50 ohm, 7R5 = 7.5 ohm, 220 = 22.0 ohm, 152 = 1500 ohm, etc. Standard construction for SP resistors is aluminum metalization. Type A resistors have nickel metalization. *Type AS resistors have silver metalization with a dielectric coating. These standard features are designated by "DS." The AS resistor can also be supplied for oil applications with "GO" or "HO" which provide a radial or horizontal tab terminated resistor, coated for use in oil. "N" provides a no arc terminal with a dielectric coating for applications requiring high energy or current density performance. Consult Customer Service for additional options and part number detail. A typical part number would be 886AS501KD. This represents a type AS resistor, 5" long × ¾" diameter, 500 ± 10% ohms, with dielectric coating and silver terminations.

ELECTRICAL SPECIFICATIONS

Length and Diameter	Type	Resistance Available (ohms) Min.	to	Max.	Average Power @ 40°C (watts)	Peak Energy (joules)	Peak** Voltage (volts)
2" x ½"	884SP	1.0		200	22.5	250	1,000
2½" x ¾"	885SP	1.0		130	45	250	1,000
	885AS..D*	6.0		1200	15	2,800	8,000*
	885A	1500		220K	15	750	3,750
5" x ¾"	886SP	1.0		330	90	500	4,000
	886AS..D*	15.0		3300	30	7,000	20,000*
	886A	3900		390K	30	1,500	10,000
6" x 1"	887SP	1.0		330	150	1,600	4,000
	887AS..D*	12.0		3300	50	13,000	30,000*
	887A	3900		390K	50	6,000	12,000
6" x 1½"	1026AS..D*	5.0		1200	70	37,000	30,000*
8" x 1"	888SP	1.0		390	190	2,100	6,000
	888AS..D*	15.0		3900	75	16,500	45,000*
	888A	4700		470K	60	7,500	15,000
8" x 1½"	1028AS..D*	6.5		1875	100	46,000	45,000*
12" x 1"	889SP	1.0		680	275	3,200	10,000
	889AS..D*	25.00		6800	100	27,000	75,000*
	889A	8200		680K	90	12,500	25,000
12" x 1½"	1032AS..D*	9.0		2500	150	75,000	75,000*
18" x 1"	890SP	1.0		1000	375	4,200	16,000
	890AS..D*	40.0		10K	150	43,000	120,000*
	890A	12K		1M	125	20,000	40,000
18" x 1½"	1038AS..D*	15.0		3800	225	119,000	120,000*
18" x 2"	891SP	1.0		450	750	15,000	16,000
24" x 2"	892SP	1.0		600	1000	17,500	22,000
24" x 1½"	1044AS..D*	20.0		4800	300	164,000	165,000*

**Allowable peak energy/voltage will depend on the resistance value.

The Carborundum Company
Electronic Products Division
Post Office Box 664, Niagara Falls, NY 14302
Telephone 716-278-2521
Telefax 716-278-6270

CARBORUNDUM

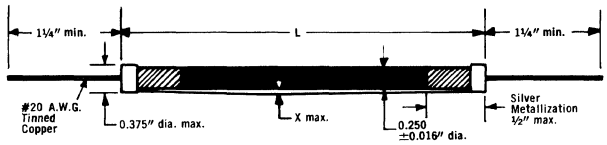
CARBORUNDUM® NON-INDUCTIVE POWER RESISTORS FOR SPECIAL PROBLEM SOLUTIONS

Series 102/104/106/109AS & SP Pencil-type Resistors

These ¼" diameter resistors are available in a variety of lengths. Pencil shaped resistors offer unique non-inductive and high-voltage properties in a compact, easily-wired configuration.

Type AS for high voltage and energy applications.

Type SP for high AC power handling capabilities.



Length	Type No.	Resistance Available (ohms) Min.	Resistance Available (ohms) Max.	Average Power @ 40°C (watts)	Peak Energy (joules)	Peak** Voltage (volts)
2"	102AS	30	9,000	5	600	3,000
	102SP	1	700	15	50	1,000
4"	104AS	55	18,000	9	1,200	9,000
	104SP	2	1,500	25	95	3,600
6"	106AS	90	30,000	13	1,900	15,000
	106SP	3	2,400	36	155	5,000
9"	109AS	150	48,000	20	3,000	25,000
	109SP	4	3,800	55	250	8,800

**Allowable peak energy/voltage will depend on the resistance value.

TYPE 234 AND 231 RESISTORS

Carborundum type 234 and 231 resistors are a small size non-inductive bulk type resistor (there are no spirals or windings), capable of dissipating a full 10 watts of power (Type SP) or absorbing **275** Joules of energy (Type AS).

234 — ¼" x 1"
231 — 5/32" x ¾"

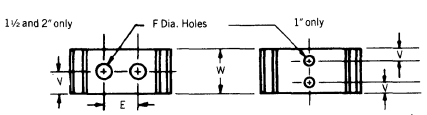
Specifications	234SP	234AS	231SP	231AS
Resistance, ohms ±5%, ±10%, ±20%	1-330	12-5000	1-1000	25-6250
Peak Voltage	500 Volts	2.5kv	375 Volts	1.5kv
Power at 40°C	10 Watts	3 Watts	2.5 Watts	1.5 Watts
Derate Linearly to 0 Watts at	350°C	230°C	350°C	230°C
Max operating temperature	350°C	230°C	350°C	230°C
Peak Energy	30 Joules	**275** Joules	15 Joules	75 Joules

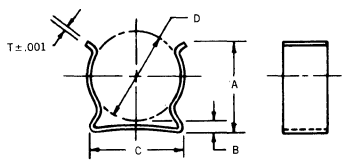
Characteristics	234SP	234AS	231SP	231AS
Short Time Overload • 10 Cycles of 1000% rated power • 5 sec. on, 90 sec. off	5% max.	1% max.	3.5% max.	1% max.
Life test 1000hr rated power	5% max.	5% max.	5% max.	5% max.
Temperature Coefficient	±0.075% /°C	−0.075% /°C	±0.075% /°C	−0.075% /°C

Termination and Mounting

Electrical connection to the resistive bodies of resistors is made by flame-sprayed metal end bands. The standard metal is aluminum for type SP, nickel or silver for types AS and A. Special terminations of brass or copper overspray or tinned ends are readily available specials. Add "B," "C," or "T" respectively to the part number to designate these special terminations.

In most cases, connections to the resistors may be made by stock clips such as these:





CLIPS DIMENSIONS

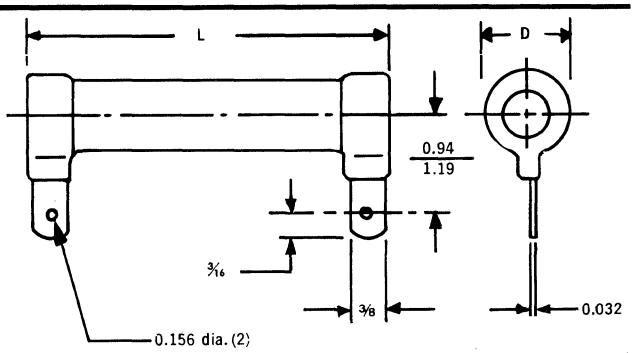
Stock No.	Size	Holes	A	B	C	D	E	F	T	V	W
35370	½"	1	0.620	0.090	0.560	0.500		0.093	0.020	0.188	0.375
35267	¾"	1	0.940	0.155	0.830	0.750		0.144	0.020	0.312	0.625
35268	1"	2	1.230	0.170	1.070	1.000		0.128	0.024	0.156	0.625
35371	1½"	2	1.650	0.100	1.650	1.500	0.925	0.103	0.032	0.250	0.500
35269	2"	2	2.375	0.544	1.080	2.000	0.375	0.125	0.043	0.375	0.750

Material: Beryllium Copper
Finish: Electro Tin Plate

TYPE AS EPOXY COATED STYLE

Carborundum Type AS High-Energy Ceramic Resistors are available with an epoxy coating which protects the resistors body from contaminants. It is especially useful where the resistor is employed in an application where it is not protected from a dirty ambient atmosphere or where it is immersed in a cooling or dielectric fluid. Energy level in oil should not exceed 300 joules/cc.

The overall length, L, of the coated resistor is approximately 0.25" longer than the uncoated part; the diameter, D, is approximately 0.30" greater. Coated resistors are also available with an axial mounted tab.



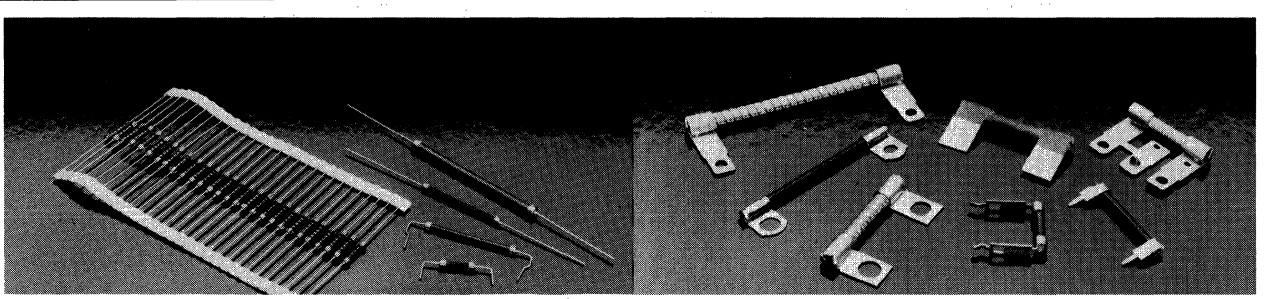
The Carborundum Company
Electronic Products Division
Post Office Box 664, Niagara Falls, NY 14302
Telephone 716-278-2521
Telefax 716-278-6270

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Wire Wound: Axial Lead – Type AL

NEW! 1/4 W SIZE

Most economical alternative for your power dispating needs

Features:

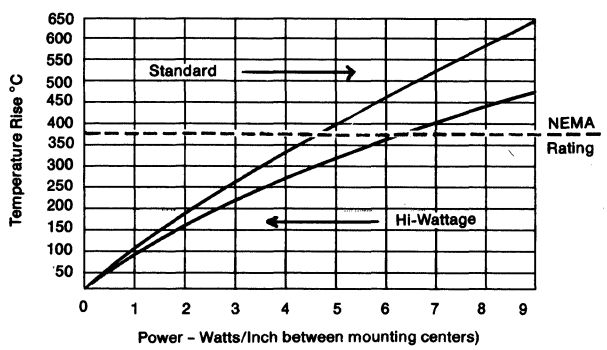
- ☐ High quality alloy resistance wire with silicone impregnated, interwoven fiberglass core
- ☐ Variety of core diameters and lengths
- ☐ Variety of temperature coefficients
- ☐ Available coated with proprietory silicone insulation
- ☐ Tape & reel packaging to customer specification
- ☐ U.S. made

Specifications:

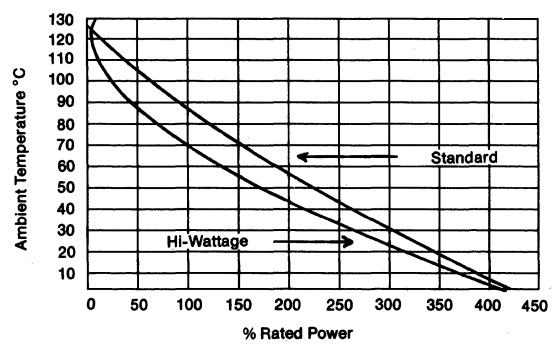
- ☐ Resistance range: .02 ohm min. to 13k (depending on core length)
- ☐ Tolerance: ±10% standard; down to ±2% available
- ☐ Temperature coefficient: to 200 PPM (consult factory)
- ☐ Power rating: ¼, 4, 5, or 6 watts per inch available
- ☐ Terminals: oxygen-free, tinned copper leads: .032"-.040", lead lengths up to 3"; 10 lb. minimum pull strength, formed leads available to customer specification

Performance:

Temperature Rise vs. Load Curve



Derating Curve for High Ambient Temperature



Wire Wound Radial Terminals (Flag) – Type AW

Standard electronic and auto industry terminals

Features:

- ☐ Variety of terminal materials and styles
- ☐ High quality alloy resistance wire with silicone impregnated, interwoven fiberglass core
- ☐ Variety of temperature coefficients available
- ☐ Variety of core diameters & lengths
- ☐ Available coated or uncoated
- ☐ U.S. made

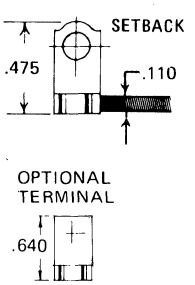
Specifications:

- ☐ Resistance range: to customer specifications
- ☐ Tolerance: ±10% standard, ±5% also available
- ☐ Temperature coefficients: to 300 PPM, consult factory
- ☐ Power rating: 4, 5, 6 watts per inch available
- ☐ Terminals: brass, tinned brass, or tinned steel, silicone base or epoxy coating available, resistance value stamped on terminal

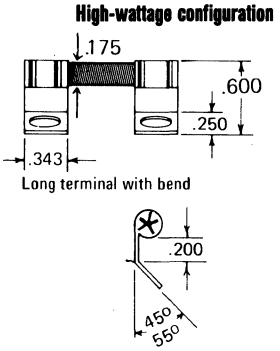
(Note: Performance same as Type AL.)

Mounting:

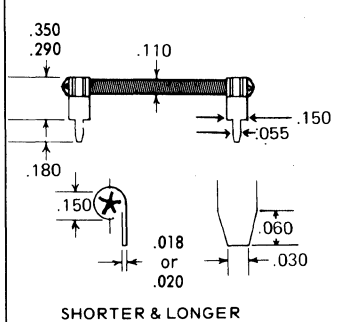
Standard configuration



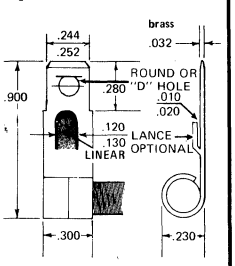
High-wattage configuration



Printed circuit terminals



Quick disconnect terminals



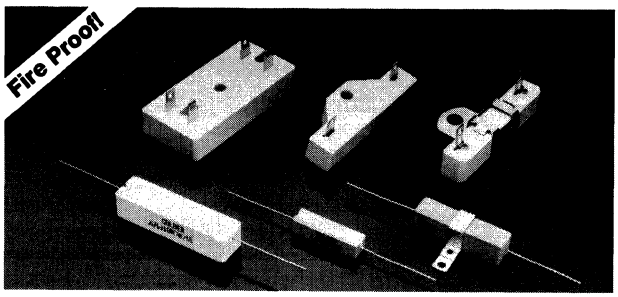
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Wirewound Resistors: Commercial Power – Type CW & RU

Electronic and automotive industry standard sizes

Features:

- ☐ Economical, reliable resitors from 2 to 50 watts
- ☐ High quality, fireproof ceramic case and inorganic fill
- ☐ Custom inorganic encapsulant provides high thermal conductivity
- ☐ High quality alloy resistance wire on silicone coated and impregnated, interwoven, fiberglass core
- ☐ Brackets and standoffs available
- ☐ Fusistor styles available
- ☐ Formed leads to customer specification
- ☐ U.S. made

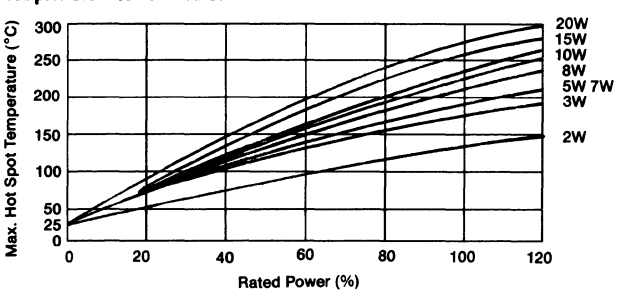
ALSO AVAILABLE: Moisture resistant, fireproof ceramic case and heat-treated, inorganic encapsulant with **silicone base.**

Specifications:

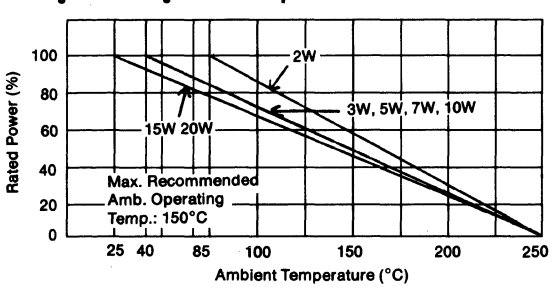
- ☐ Resistance range: .005 ohm min. to 13k (depending on core length)
- ☐ Tolerance: ±10% standard, down to ±2% also available
- ☐ Temperature coefficients: to 200 PPM, consult factory
- ☐ Power rating: 2-50 watts
- ☐ Terminals: brass, tinned brass, or tinned steel; axial lead or radial leads

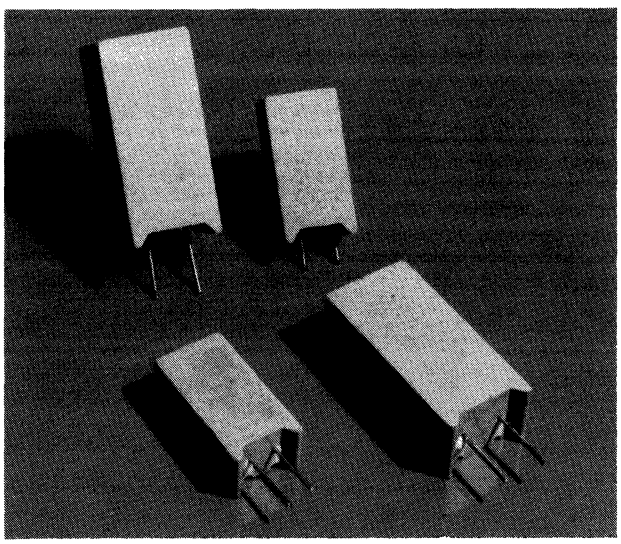
Performance:

Temperature Rise vs. Load Curve



Derating Curve for High Ambient Temperature





Vertical Mounted Resistors

Designed for minimum space on PC boards at various wattage

Features:

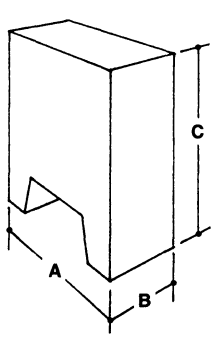
- ☐ Economical, reliable resistors in 3, 5 and 10 watts
- ☐ High quality, fireproof ceramic case and inorganic fill
- ☐ High quality alloy resistance wire on silicone coated and impregnated, interwoven, fiberglass core
- ☐ U.S. made
- ☐ Leads trimmed to customer specifications
- ☐ Variety of termperature coefficients
- ☐ Leads: oxygen-free, tinned copper: .030″-.040″

ALSO AVAILABLE: Moisture resistant, fireproof ceramic case and heat-treated, inorganic encapsulant with **silicone base.**

Specifications:

- ☐ Resistance range: .02 ohm min. to 13k (depending on core length)
- ☐ Tolerance: ±10% standard, down to ±2% also available
- ☐ Temperature coefficients: to 200 PPM, consult factory
- ☐ Power rating: 3, 5 & 10 watts

	A	B	C
3W	.475	.315	1.000
5W	.500	.350	1.000
10W	.630	.480	1.375



HEATER ROPE

Colber produces a high quality heater rope in continuous lengths for use in electrical appliances, blankets, heating pads, pipe wraps, etc.

For complete specifications, test data and prints, call for our catalogue.

CTS® CORPORATION
RESISTOR NETWORK DIVISION

LEADED SURFACE MOUNT RESISTOR NETWORKS

SPECIFICATIONS

***Resistance Range:** Standard 22 ohm to 1.0 Megohm
***Resistance Tolerance:** Standard ±2%
Special 0.5% or 0.5 ohm (whichever greater)
***Max. Operating Coltage.** 50V not to exceed rated power
***Temp. Coefficient:** ±100 PPM typical
***Operating Temp. Range:** −55°C to +125°C
Storage Temp. Range: −55°C to +12°C
Dielectric Strength. 100V
***Power Rating.** Total network power

	Series 766		Series 767		
	8 Pin	14 Pin	16 Pin	14 Pin	16 Pin
@ 70°C	0.6w	1.0w	1.2w	1.3w	1.5w
@ 25°C	0.9w	1.6w	1.8w	2.0w	2.3w

* Custom networks can usually be designed to exceed resistance range, individual resistor power, maximum operating temperature and maximum operating voltage standard. TCR may be affected by some custom network requirements.

Environmental Performance Specifications

Test		Max. % △ R	Mil. Std. 202 Method	Test Cond.	Test Description
Thermal Cycling	Series 766	0.5%	107	B	5 cycles, −65°C to +125°C
	Series 767	0.25%			
Short Time Overload	Series 766	0.5%	—	—	2½ x rated voltage, 5 sec. (100V max.)
	Series 767	0.25%			
Moisture Resistance		0.5%	106	—	240 hours, .1 rated load, −10°C to +65°C, 90% RH
High Temp. Exposure		1.0%	—	—	240 hours, no load @ 125°C
Load Life		1.0%	—	—	1000 hours @ 70°C, rated load
Resistance to Solder Heat		.25%	—	—	30 sec. @ 219°C, Flourinert*
Mechanical Shock		.25%	213	I	500g, 1 msec., 3 shocks ea. plane
Vibration		.25%	204	D	20g 10-2000 Hz, 4 hours/plane
Terminal Strength		.25%	—	—	2.0 pound pull, 30 sec., two 45° bends
Low Temp. Storage		.25%	—	—	24 hours @ −65°C, no load
Low Temp. Operation		.25%	—	—	1 hour @ −65°C, full load
Resistance to Solvents			215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC
Solderability			208	—	RMA flux, 230°C, sec. dip, 95% coverage

* Trademark of 3M Company

STANDARD PART NUMBER

766 — 14 1 R 10K T

Series — No. Pins — Circuit Designation — Resistance Value — Packaging

Examples:

766—163 R 100K 16 pin, 8 resistors, 100K ±2%

766—141 R 10K 14 pin, 13 resistors, 10K ±2%

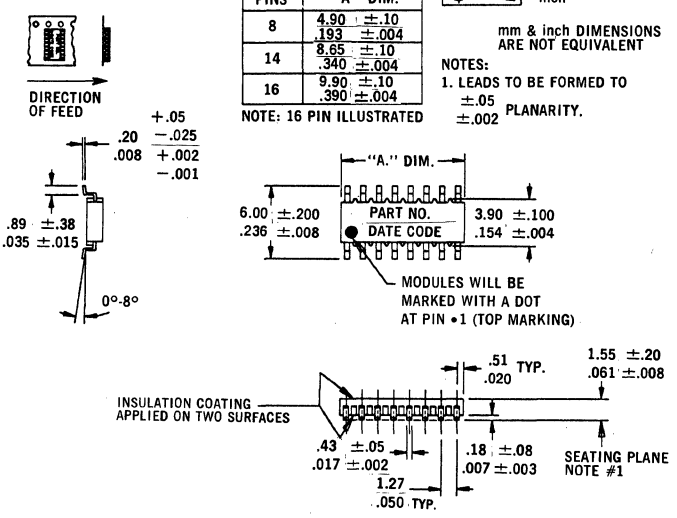
766—165R 220/330 16 pin, 28 resistors,

R_1 = 220 ohms ±2%, R_2 = 330 ohms ±2%

T — Tape & Reel
Series 766, 8 pins—12mm wide
Series 766, 14 & 16 pins—16mm wide
Series 767, 14 & 16 pins—24mm wide

S — Slide Pack All slide packs are 20" length

SERIES 766



NO. PINS	"A" DIM.
8	4.90 ±.10 / .193 ±.004
14	8.65 ±.10 / .340 ±.004
16	9.90 ±.10 / .390 ±.004

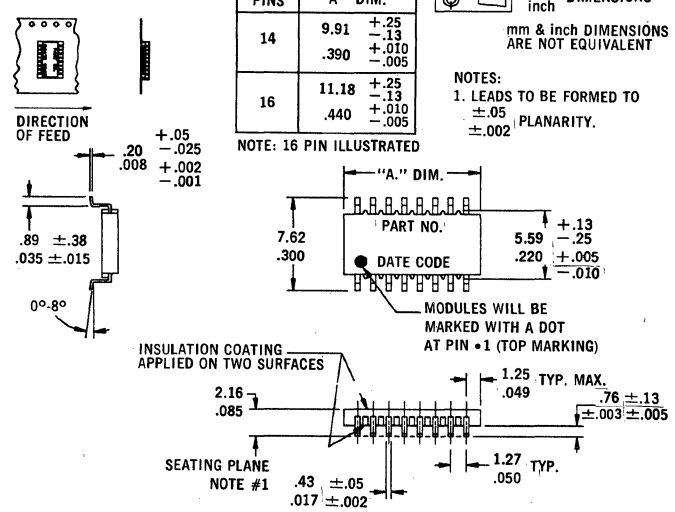
NOTE: 16 PIN ILLUSTRATED

mm / inch DIMENSIONS

mm & inch DIMENSIONS ARE NOT EQUIVALENT

NOTES:
1. LEADS TO BE FORMED TO ±.05 / ±.002 PLANARITY.

SERIES 767



NO. PINS	"A" DIM.
14	9.91 +.25 −.13 / .390 +.010 −.005
16	11.18 +.25 −.13 / .440 +.010 −.005

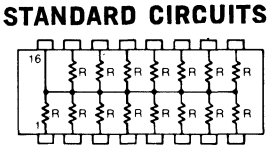
NOTE: 16 PIN ILLUSTRATED

mm / inch DIMENSIONS

mm & inch DIMENSIONS ARE NOT EQUIVALENT

NOTES:
1. LEADS TO BE FORMED TO ±.05 / ±.002 PLANARITY.

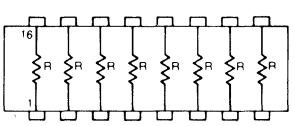
STANDARD CIRCUITS



— 1 Circuit

Maximum Resistor Power*

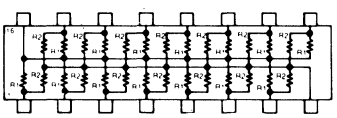
	Series 766	Series 767
@ 25°C	.12 w	.15 w
@ 70°C	.08 w	.1 w



— 3 Circuit

Maximum Resistor Power*

	Series 766	Series 767
@ 70°C	.16 w	.2 w
@ 25°C	.24 w	.3 w



— 5 Circuit

Maximum Resistor Power*

	Series 766	Series 767
@ 70°C	.08 w	.1 w
@ 25°C	.12 w	.15 w

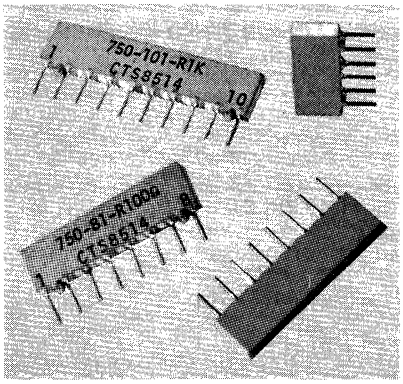
NOTE: 16 pin illustrated. * Not to exceed maximum network power.

ORDERING INFORMATION: Place orders using following address:
RESISTOR NETWORK DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • FAX (219) 589-3243

CTS® CORPORATION*

RESISTOR NETWORK DIVISION

750 SERIES SINGLE-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS



ELECTRICAL SPECIFICATIONS

Temperature Range:
−55°C to +125°C (operating)

Resistance Range:
Standard — 33Ω thru 1 MegΩ
Special — below 33Ω and above 1 MegΩ

Resistance Tolerance:
Standard ±2%
Special ±0.5% or 0.5Ω (whichever is greater)

Matching: (2 like resistors)
50Ω to 100 KΩ — 0.5% or 0.5Ω (whichever is greater)
100 KΩ to 500 KΩ — 1%
500 KΩ to 3 MegΩ — 2.5%

Ratio Matching:
50Ω to 100Ω — ±1%
100Ω to 100 KΩ — ±0.5%
100 KΩ to 1 MegΩ — ±2%
Note: Multiple matches available upon engineering approval

Temperature Coefficient*:
Standard ±300 PPM/°C
Special ±100 PPM/°C
Tracking available to 50 PPM/°C with same formulation on same side of substrate

Max. Operating Voltage*:
100V not to exceed rated power

Dielectric Strength:
200V

MECHANICAL SPECIFICATIONS

Substrate Material:
Alumina

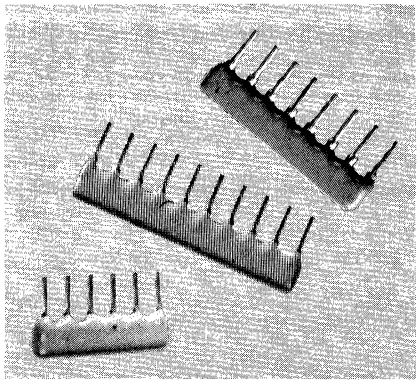
Resistor Material:
Cermet — thick film

Insulation Coating:
Organic — epoxy phenolic

Lead Material:
Solder coated copper alloy

Solder:
60/40 tin/lead

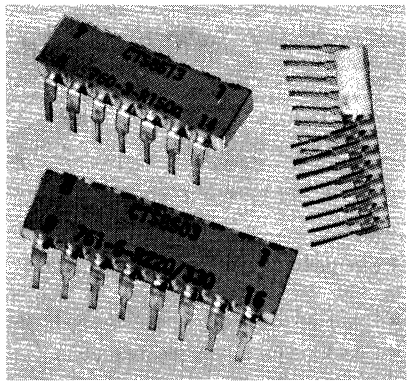
770 SERIES SINGLE-IN-LINE CONFORMAL COATED CERMET RESISTOR NETWORKS



ELECTRICAL AND MECHANICAL SPECIFICATIONS

Resistance Range:	Standard 33Ω to 1.0 MegΩ
Resistance Tolerance:	Standard: ±2% Special: ±1% or 0.5Ω (whichever is greater)
Maximum Operating Voltage:	Series 770: 50V not to exceed rated power Series 771: 100V not to exceed rated power
Temperature Coefficient:	±100 PPM 33Ω to 220 KΩ ±175 PPM above 220 KΩ to 1.0 MegΩ @ −55° to +125°C
Temp. Range:	−55° to +125°C (operating)
Storage Temp. Range:	−55° to +125°C
Dielectric Strength:	100V
Lead Material:	Solder coated copper alloy

760 SERIES DUAL-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS



ELECTRICAL SPECIFICATIONS

Temperature Range:
−55°C to +125°C (operating)

Resistance Range:
Standard — 22Ω through 1 MegΩ
Special — Below 22Ω and above 1 MegΩ

Resistance Tolerance:
Standard — ±2%
Special — ±0.5% or ½Ω (whichever is greater)

Resistance Matching:
(2 like resistors)
50Ω to 100 KΩ — 0.5% or 0.5Ω whichever is greater)
100 KΩ to 500 KΩ — 1%
500 KΩ to 3 MegΩ — 2.5%

Ratio Matching:
50Ω to 100Ω — ±1%
100Ω to 100K — ±0.5%
100K to 1 Meg — ±2%
Multiple ratio matching available upon engineering approval

Temperature Coefficient:
Standard — ±300 PPM/°C
Special — ±100 PPM/°C
Tracking — Available to 50 PPM/°C with same formulation and on same side of substrate

Maximum Operating Voltage*:
100V not to exceed rated power

Dielectric Strength:
200V

MECHANICAL SPECIFICATIONS

Substrate Material: Alumina

Resistor Material: Cermet — thick film

Insulation Coating: Organic — epoxy phenolic

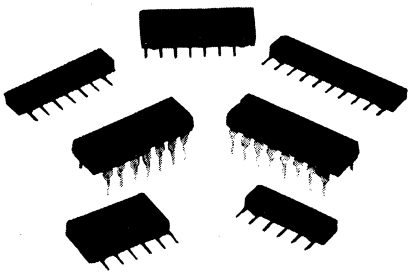
Lead Material: Solder coated copper alloy

Solder: 60/40 tin/lead

ORDERING INFORMATION: Place orders using following address:
RESISTOR NETWORK DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • FAX (219) 589-3243

A COMPANY OF VISHAY TECHNO

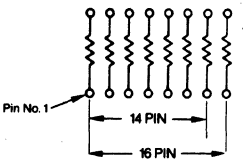
MIL-R-83401 THICK FILM RESISTOR NETWORKS



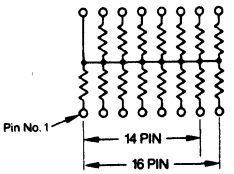
- Designed to withstand thermal stress from – 65° to + 125°C.
- Qualified to military specification M83401.
- Designed for automatic insertions.
- Conforms to IC package configurations.
- High temperature solder joints.
- Solderable leads.

01 = 14 Pin DIP **02** = 16 Pin DIP

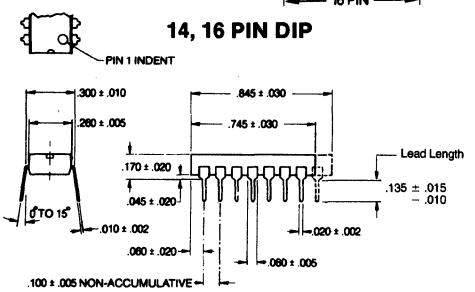
SCHEMATIC "A"



SCHEMATIC "B"

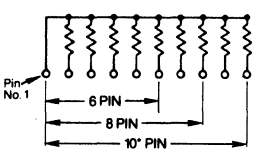


14, 16 PIN DIP



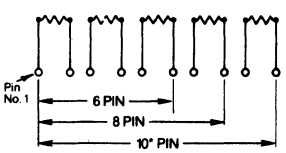
04 = 6 Pin Standard Profile SIP **07** = 6 Pin Low Profile SIP
05 = 8 Pin Standard Profile SIP **08** = 8 Pin Low Profile SIP
06 = 10 Pin Standard Profile SIP **09** = 10 Pin Low Profile SIP

SCHEMATIC "C"



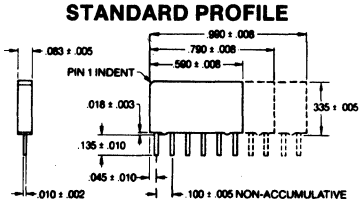
* Low profile only

SCHEMATIC "G"

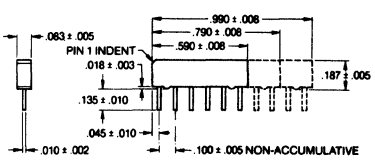


* Low profile only

6, 8, 10 PIN STANDARD PROFILE



6, 8, 10 PIN LOW PROFILE



SPECIFICATIONS

Resistance Range:	10Ω to 1 megohm, standard
Resistance Tolerances:	**F** = ±1%, **G** = ±2%, **J** = ±5% (Tighter tolerances available)
Operating Temperature Range:	−65°C to +125°C
100% Burned In:	Military type
Temperature Coefficient:	**M** = ±300 PPM/°C **K** = ±100 PPM/°C Over the temperature range −65°C to +125°C
Leads:	Solderable
Insulation Resistance:	10,000 megohms minimum

HOW TO ORDER
MIL-R-83401

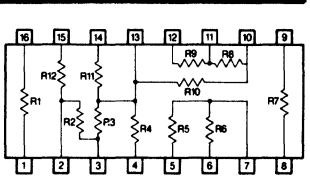
M83401 02 M 1003 F B
① ②③ ④ ⑤ ⑥

① Basic MIL #
② 01 = 14 pin DIP 04 = 6 pin std. profile SIP
02 = 16 pin DIP 05 = 8 pin std. profile SIP
06 = 10 pin std. profile SIP 07 = 6 pin low profile SIP
08 = 8 pin low profile SIP
09 = 10 pin low profile SIP
③ TC, M = ± 300ppm/°C
K = ± 100ppm/°C
④ R Value: First 3 digits significant.
Last digit = number of zeros.
Letter "R" represents decimal point for values less than 100 Ohms
1003 = 100,000 Ohms
37RO = 37 Ohms
⑤ Resistance Tolerance: F = ± 1%, G = ± 2%, J = ± 5%
⑥ Schematic — A, B, C or G

HOW TO ORDER
Techno Part No.

16 D M 1003 F B
① ②③ ④ ⑤ ⑥

① 16 = # pins
② D = DIP
S = Std. Profile SIP
L = Low Profile SIP
③⑤ Same as MIL



TYPICAL SPECIAL

CUSTOM CAPABILITIES

TECHNO has the capability of producing a nearly unlimited variety of custom schematics utilizing either single- or double-sided printing. We package in all of the standard sized molded DIP and SIP configurations, conformal coated SIP's, or will produce custom substrate configurations with or without leads.

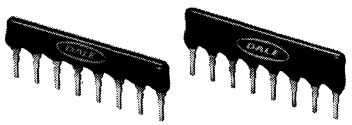
GENERAL SPECIFICATIONS AVAILABLE

Resistance Range: 3 ohms to 5 Megohms
Tolerance: ±1% standard with tighter available
TC: ±50 PPM/°C standard with tighter available
TCR Tracking: ±50 PPM/°C or tighter
Terminations Available: Gold, Palladium, Silver, Platinum Silver, or Platinum/Palladium Silver
Complete Military Screening and Power Conditioning Capabilities
TECHNO will design from customer schematics and welcomes the opportunity to work with customer engineers during the initial design phase.

CONTACT: TECHNO DIVISION
DALE ELECTRONICS, INC.
7803 Lemona Avenue, Van Nuys, CA 91405-1139 • Phone (818) 781-1642

A COMPANY OF VISHAY DALE

SINGLE-IN-LINE, Coated
THICK FILM RESISTOR NETWORKS



MODEL CSC
SPECIFICATIONS

Choice of .195" [4.95] "A" and .250" [6.35] "B" maximum seated heights.

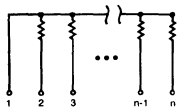
Resistance Range: 10Ω to 3.3 Meg.

Resistance Tolerance:
01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available

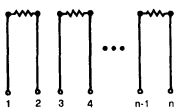
Resistance Temperature Coefficient:
±100 PPM/°C (−55°C to +125°C) typical

Terminals: Copper alloy, tin-lead plated

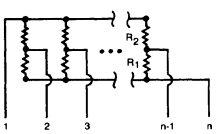
Body: High alumina. Resistors epoxy coated



01 SCHEMATIC
(Available in 4, 5, 6, 7, 8, 9, 10, 11 or 12* pin package)



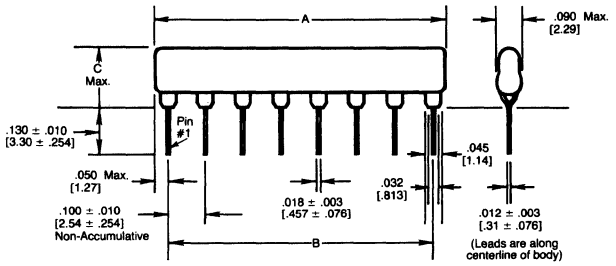
03 SCHEMATIC
(Available in 4, 6, 8, 10 or 12* pin package)



05 SCHEMATIC
(Available in 4, 5, 6, 7, 8, 9, 10, 11 or 12* pin package)

*"B" profile only

DIMENSIONAL AND TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

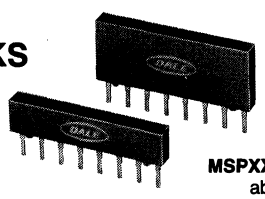


SCHEMATICS	TYPE	A (Max.)	B	C (Max.)
01, 03, 05	CSC04	.390 [9.91]	.300 [7.62]	
01, 05	CSC05	.490 [12.45]	.400 [10.16]	
01, 03, 05	CSC06	.590 [14.99]	.500 [12.70]	
01, 05	CSC07	.690 [17.53]	.600 [15.24]	"A" Profile = .195 [4.95]
01, 03, 05	CSC08	.790 [20.07]	.700 [17.78]	"B" Profile = .250 [6.35]
01, 05	CSC09	.890 [22.61]	.800 [20.32]	
01, 03, 05	CSC10	.990 [25.15]	.900 [22.86]	
01, 05	CSC11	1.090 [27.69]	1.000 [25.40]	
01, 03, 05	CSC12	1.190 [30.23]	1.100 [27.94]	

Contact factory for stock values.

A COMPANY OF VISHAY DALE

SINGLE-IN-LINE, Molded
THICK FILM RESISTOR NETWORKS



MSPXXC, .350" [8.89] above board

MSPXXA, .195" [4.95] above board

MODEL MSP
SPECIFICATIONS

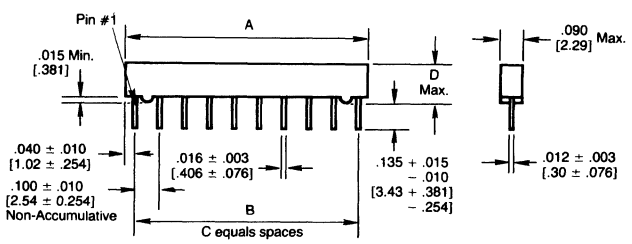
ELECTRICAL

Resistance Range: 10Ω to 3.3 Megohms

Resistance Tolerance: 01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available.

Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) typical

Terminals: Copper alloy, tin-lead plated

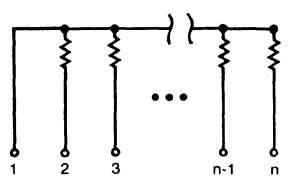


DIMENSIONAL AND TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

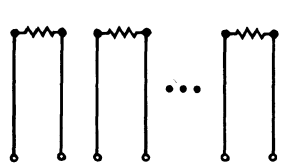
TYPE	A (Max.)	B	C	D
MSP06	.590 [14.99]	.500 [12.70]	5	.195" [4.95] for MSPXXA
MSP08	.790 [20.07]	.700 [17.78]	7	.350" [8.89] for MSPXXC
MSP10	.990 [25.15]	.900 [22.86]	9	

Contact factory for stock values.

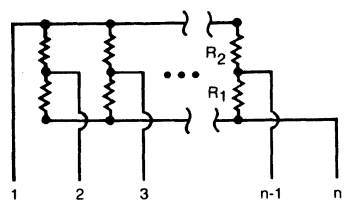
01 SCHEMATIC



03 SCHEMATIC



05 SCHEMATIC

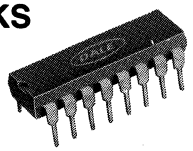


CONTACT: **DALE ELECTRONICS, INC.**, 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080

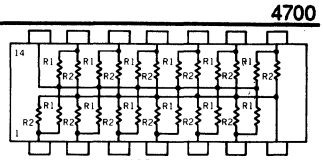
A COMPANY OF VISHAY DALE

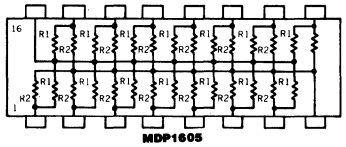
DUAL-IN-LINE, Molded
THICK FILM RESISTOR NETWORKS

MODELS MDP14, MDP16 and MDP18
01, 03, 05 Schematic



STANDARD SCHEMATICS





SPECIFICATIONS

ELECTRICAL

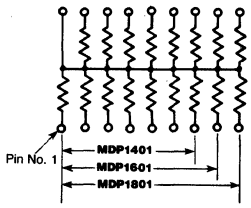
Resistance Range: 10Ω to 3.3 Megohms

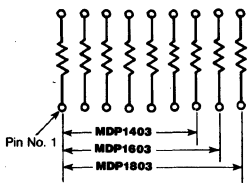
Resistance Tolerance: 01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard, ±1% and ±5% available.

Resistance Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) standard

Terminals: Copper alloy, tin-lead plated

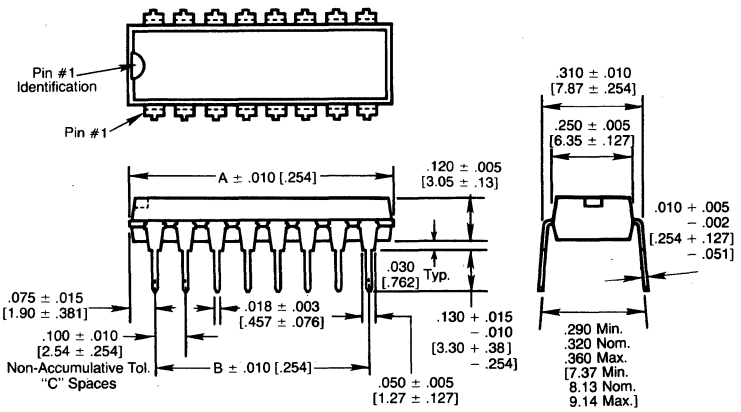
Body: Molded epoxy





DIMENSIONS AND TERMINAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

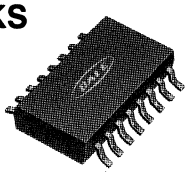


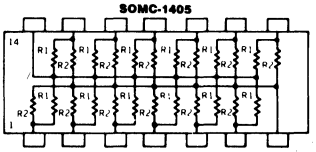
TYPE	A	B	C
MDP14	.750″ [19.05]	.600″ [15.24]	6
MDP16	.850″ [21.59]	.700″ [17.78]	7
MDP18	.950″ [24.13]	.800″ [20.32]	8

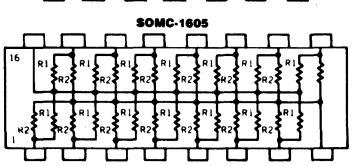
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SURFACE MOUNTED, SMALL OUTLINE MOLDED DIP
THICK FILM RESISTOR NETWORKS

MODELS SOMC-14 and SOMC-16
01, 03, 05 Schematic







SPECIFICATIONS

ELECTRICAL

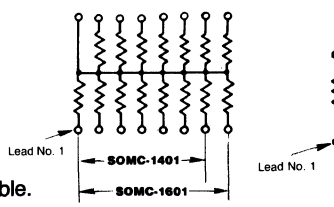
Resistance Range: 10Ω to 1 Megohms

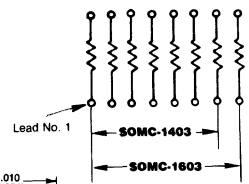
Resistance Tolerance:
01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available.

Resistance Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) typical

Terminals: Copper alloy, 60/40 solder dipped terminal

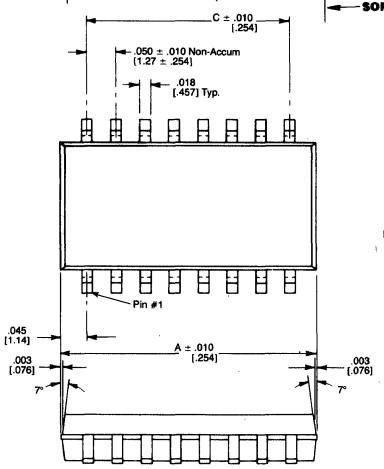
Body: Molded epoxy

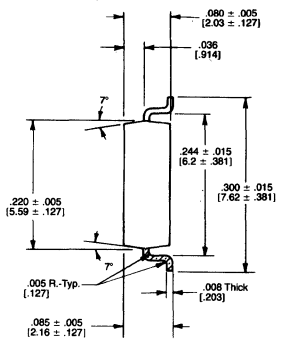




DIMENSIONAL AND TERMINAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]





TYPE	A	B	C
14	.390″ [9.906]	.350″ [8.89]	.300″ [7.62]
16	.440″ [11.176]	.400″ [10.16]	.350″ [8.89]

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A COMPANY OF VISHAY DALE

MILITARY QUALIFIED
THICK FILM RESISTOR NETWORKS

MIL-R-83401, STYLE RZ

SPECIFICATIONS (Applicable to all styles)

ELECTRICAL

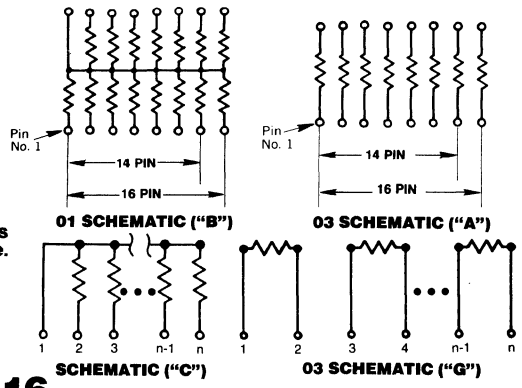
Resistance Range: 10Ω to 1 Megohm

Resistance Tolerances: ±1%, ±2%, ±5%

Temperature Coefficient: "M" = ±300 PPM/°C; "K" = ±100 PPM/°C over the temperature range of −55°C to +125°C (+25°C reference)

APPROVED SCHEMATIC ALTERNATIVES

NOTE: Mil-Qualified 05 schematics "H" and "J" also available.

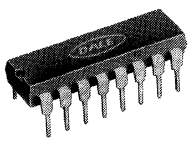


DUAL-IN-LINE, MODELS MDM14 & MDM16

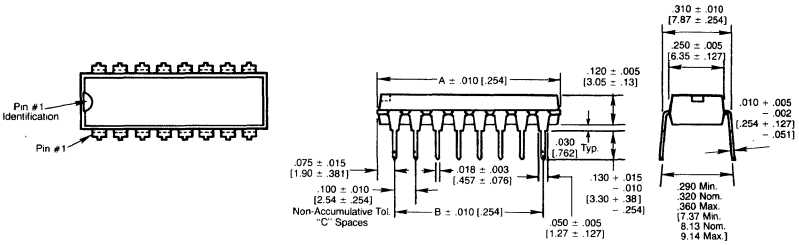
M8340101 = 14 PIN, M8340102 = 16 PIN

DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

NO. OF PINS	A	B	C
14	.750 [19.05]	.600 [15.24]	6
16	.850 [21.59]	.700 [17.78]	7



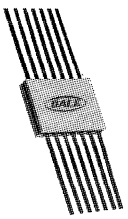
MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340101XXXXXXA	RZ010	MDM14-03	10Ω-1 Meg.
M8340101XXXXXXB	RZ010	MDM14-01	10Ω-1 Meg.
M8340102XXXXXXA	RZ020	MDM16-03	10Ω-1 Meg.
M8340102XXXXXXB	RZ020	MDM16-01	10Ω-1 Meg.



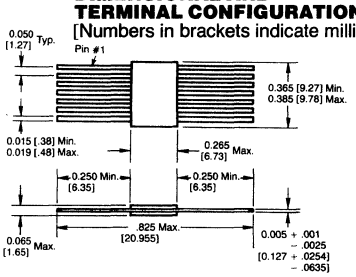
FLAT PACK, MODEL DFM M8340103 = 14 PIN

MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340103XXXXXXA	RZ030	DFM14-01 DFM14-11	10Ω-1 Meg. 10Ω-1 Meg.
M8340103XXXXXXB	RZ030	DFM14-02 DFM14-12	10Ω-1 Meg. 10Ω-1 Meg.

Leads: −01, −02 = gold plated, −11, −12 = hot solder dipped

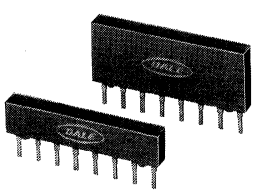


DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]



SINGLE-IN-LINE, MODEL MSM

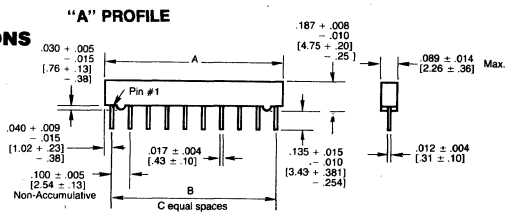
MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340104XXXXXXC	RZ040	MSM06C01	10Ω-1 Meg.
M8340104XXXXXXG	RZ040	MSM06C03	10Ω-1 Meg.
M8340105XXXXXXC	RZ050	MSM08C01	10Ω-1 Meg.
M8340105XXXXXXG	RZ050	MSM08C03	10Ω-1 Meg.
M8340106XXXXXXC	RZ060	MSM10C01	10Ω-1 Meg.
M8340106XXXXXXG	RZ060	MSM10C03	10Ω-1 Meg.
M8340107XXXXXXC	RZ070	MSM06A01	10Ω-1 Meg.
M8340107XXXXXXG	RZ070	MSM06A03	10Ω-1 Meg.
M8340108XXXXXXC	RZ080	MSM08A01	10Ω-1 Meg.
M8340108XXXXXXG	RZ080	MSM08A03	10Ω-1 Meg.
M8340109XXXXXXC	RZ090	MSM10A01	10Ω-1 Meg.
M8340109XXXXXXG	RZ090	MSM10A03	10Ω-1 Meg.



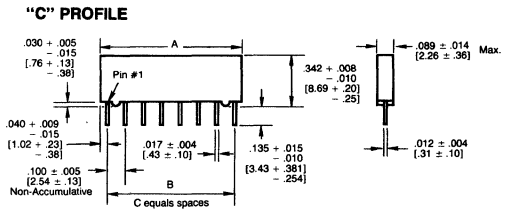
TYPE	A	B	C
MSM06	.583 ± .015 [14.81 ± .38]	.500 [12.70]	5
MSM08	.783 ± .015 [19.89 ± .38]	.700 [17.78]	7
MSM10	.983 ± .015 [24.97 ± .38]	.900 [22.86]	9

DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

"A" PROFILE



"C" PROFILE

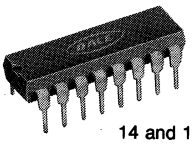


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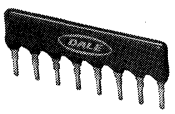
A COMPANY OF VISHAY DALE

DUAL & SINGLE-IN-LINE PACKAGES
RESISTOR/CAPACITOR NETWORKS

R/C Networks



14 and 16 Pin
Molded DIP styles



4 thru 12 Pin
Coated SIP styles

FEATURES

- Ideal where repetitive circuits are required.
- Wide range of R/C values for special applications.
- High density packaging for reduced assembly costs, improved performance and simplified board layout.
- Utilize same thick film circuit materials as those qualified to MIL-R-83401.
- Capacitors available to EIA RS 198 or MIL-C-55681.

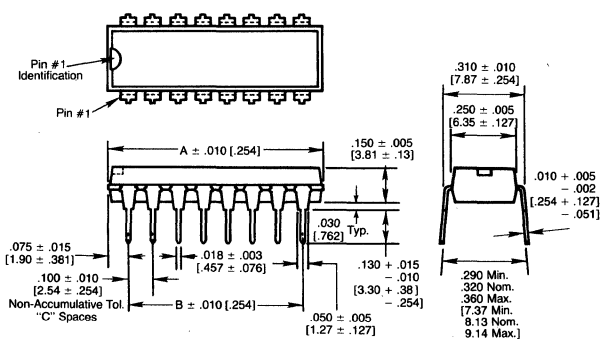
GENERAL SPECIFICATIONS

	RESISTORS	*CAPACITORS		
		NPO	BX	X7R
Value Range (SIP)	10Ω-3.3 meg	100pf-4700pf	500pf-0.1μf	500pf-0.1μf
(DIP)	10Ω-3.3 meg	100pf-2700pf	500pf-0.1μf	500pf-0.1μf
Tolerances	±2% standard, ±1%, ±5%, ±10%, ±20% available	±5% & ±10%	±10% & ±20%	±10% & ±20%
Temperature Characteristics (−55°C to +125°C)	±100ppm/°C Typical	±30ppm/°C	±15% @ OVDC & +15%, −25% @ rated VDC	±15%
Voltage Rating	100VDC	50VDC	50VDC	50VDC
Dissipation Factor (1V RMS @ 1 KHZ)	N/A	0.1% max	2.5% max	3.0% max
Operating Temperature Range	−55°C to +125°C			

*Capacitors tested at 1V RMS @ 1 KHZ @ 25°C

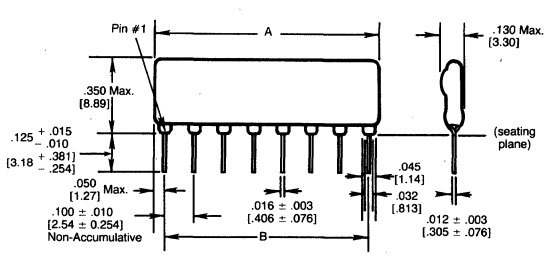
STANDARD PACKAGE CONFIGURATIONS
DIMENSIONAL AND TERMINAL CONFIGURATIONS: [Numbers in brackets indicate millimeters]

DUAL-IN-LINE



No. of Pins	A	B
14	.750 [19.05]	.600 [15.24]
16	.850 [21.59]	.700 [17.78]

SINGLE-IN-LINE

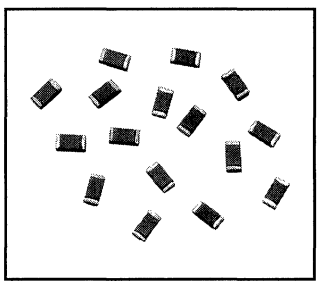


No. of Pins	A (Max.)	B
4	.390 [9.91]	.300 [7.62]
5	.490 [12.45]	.400 [10.16]
6	.590 [14.99]	.500 [12.70]
7	.690 [17.53]	.600 [15.24]
8	.790 [20.07]	.700 [17.78]
9	.890 [22.61]	.800 [20.32]
10	.990 [25.15]	.900 [22.86]
11	1.090 [27.69]	1.000 [25.40]
12	1.190 [30.23]	1.100 [27.94]

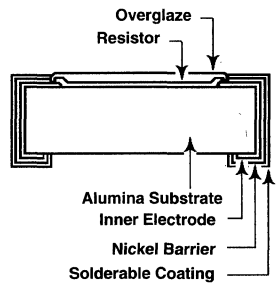
CONTACT: DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080

MODEL TNPW
Thin Film Chip Resistors
Industrial, Precision

A COMPANY OF VISHAY DALE®



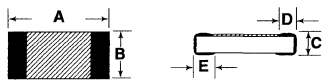
FEATURES
- Internationally standardized size
- Automatic placement compatibility
- Reflow solderable
- Thin film resistance element
- Wraparound termination
- Inner electrode protection
- 8mm reel or bulk packaging
- Operating temperature range is - 55°C to + 125°C



STANDARD ELECTRICAL SPECIFICATIONS

MODEL	RESISTANCE TEMPERATURE COEFFICIENT	RESISTANCE RANGE (Ohms)	TOLERANCE	MAXIMUM OPERATING VOLTAGE	POWER RATING @ 70°C
TNPW-0603	± 25PPM/°C	100-33k	± 0.5%	75	.062W
TNPW-0603	± 50PPM/°C	10-91	± 0.5%	75	.062W
TNPW-0603	± 100PPM/°C	36k-100k	± 0.5%	75	.062W
TNPW-0805	± 25PPM/°C	100-100k	± 0.1%, 0.5%	100	.100W
TNPW-0805	± 50PPM/°C	10-91	± 0.5%	100	.100W
TNPW-1206	± 25PPM/°C	49.9-1M	± 0.1%, 0.5%, 1.0%	100	.125W
TNPW-1206	± 25PPM/°C	22.1-48.7	± 0.5%, 1.0%	100	.125W
TNPW-1206	± 15PPM/°C	1k-1M	± 0.1%, 0.5%, 1.0%	100	.125W
TNPW-1206	± 10PPM/°C	1k-1M	± 0.1%, 0.5%, 1.0%	100	.125W
TNPW-1210	± 25PPM/°C	49.9-1M	± 0.1%, 0.5%, 1.0%	100	.250W

DIMENSIONAL CONFIGURATIONS

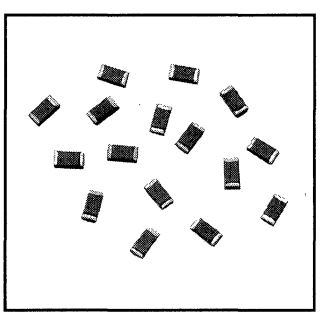


[Numbers in brackets indicate millimeters]

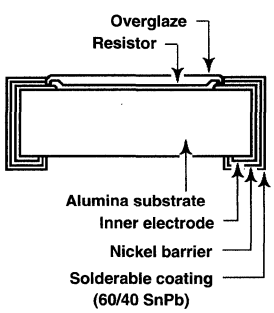
MODEL	A	B	C	D	E
TNPW	.063 ± .008	.032 ± .008	.016 ± .004	.012 ± .008	.012 ± .008
-0603	[1.60 ± .203]	[.813 ± .203]	[.406 ± .102]	[.305 ± .203]	[.305 ± .203]
TNPW	.080 ± .008	.049 ± .008	.016 ± .004	.016 ± .010	.016 ± .008
-0805	[2.03 ± .203]	[1.24 ± .203]	[.406 ± .102]	[.406 ± .254]	[.406 ± .203]
TNPW	.126 ± .006	.063 ± .006	.024 ± .006	.018 ± .008	.018 ± .004
-1206	[3.20 ± .152]	[1.60 ± .152]	[.610 ± .152]	[.457 ± .203]	[.457 ± .102]
TNPW	.126 ± .006	.098 ± .006	.024 ± .006	.018 ± .008	.018 ± .004
-1210	[3.20 ± .152]	[2.49 ± .152]	[.610 ± .152]	[.457 ± .203]	[.457 ± .102]

MODEL TNPWM
Thin Film Chip Resistors
Military/Established Reliability
MIL-R-55342/7 Qualified, Type RM, Precision

A COMPANY OF VISHAY DALE®



FEATURES
- Internationally standardized size
- Meets requirements of MIL-R-55342
- Established Reliability - Verified failure rate (contact factory)
- 8mm reel, tray or bulk packaging
- Flow solderable • 100% screen tested • Inner electrode protection
- Thin film resistance element and wraparound termination
- Automatic placement compatibility
- Operating temperature range is - 55°C to + 150°C
- Power rating at 70°C is .125 W
- Maximum operating voltage is 100 V
- Termination material is pretinned nickel barrier wraparound



STANDARD ELECTRICAL SPECIFICATIONS

DALE MODEL	MIL-55342 TYPE	MILITARY SHEET NUMBER	CHAR.	RESISTANCE RANGE (Ohms)	TOLERANCE
TNPWM-1206	RM1206	07	H	49.9-1M	1%, 2%, 5%
			E, H	49.9-1M	1%, 2%
			E, H	100-500k	0.1%, 1%, 2%

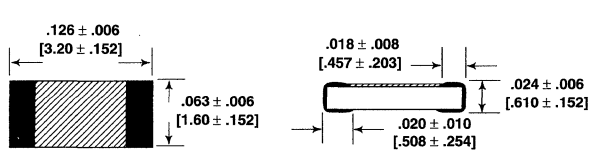
CODE LETTERS FOR TOLERANCE AND MULTIPLIER

± 0.1%	± 1%	± 2%	± 5%	MULTIPLIER	VALUE RANGE (Ohms)
A	D	G	J	1	1-9xx
B	E	H	K	1,000	1k-9xxk
C	F	T	L	1,000,000	1M -9xxM

Examples: 102A = 102Ω ± 0.1%. 49D9 = 49.9Ω ± 1%. 75G0 = 75Ω ± 2%. 68J0 = 68Ω ± 5%.

DIMENSIONAL CONFIGURATIONS

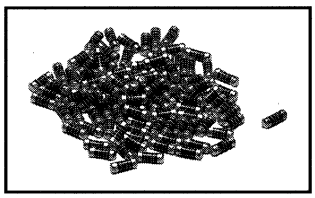
[Numbers in brackets indicate millimeters]



For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 871-0080 • Fax 402-644-4206

MODEL SMM0204
Cylindrical Thin Film Chip Resistors
Industrial, Precision

A COMPANY OF VISHAY DALE®



FEATURES

- Cylindrical, leadless body style (MELF)
- Automatic placement compatibility
- Reflow and wave solderable
- Thin film resistance element
- Solderable end cap construction
- Color band marking
- 8mm tape width reel or bulk packaging
- Maximum operating voltage is 200V
- Power rating at 70°C is 0.25W

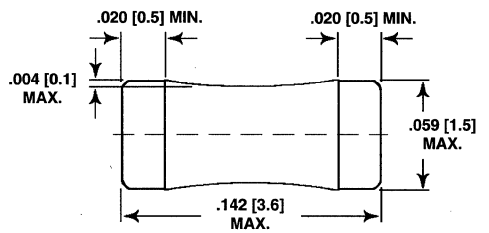
STANDARD ELECTRICAL SPECIFICATIONS

MODEL	TEMPERATURE COEFFICIENT	RESISTANCE RANGE (Ohms)	DECADE VALUES	TOLERANCE
SMM0204	± 15 PPM/°C	43-221k	E24-E192	± 0.1%
		22-221k	E24-E192	± 0.25%
		10-221k	E24-E192	± 0.5%
SMM0204	± 25PPM/°C	43-330k	E24-E192	± 0.1%
		22-330k	E24-E192	± 0.25%
		10-475k	E24-E192	± 0.5%
SMM0204	± 50PPM/°C	10-475k	E24-E192	± 0.5%
		1-2.2M	E24-E96	± 1%
SMM0204	± 100PPM/°C	1-10M	E24	± 2% & 5%
SMM0204 HF*	± 50PPM/°C	10-470	E96	± 1%
OMM0204 = Zero-ohm resistor. Rmax.: 15mΩ. Imax.: 2A				

* HF = High Frequency Version

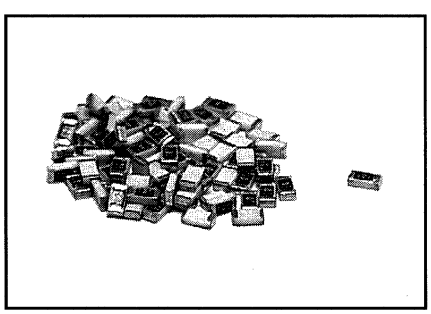
DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



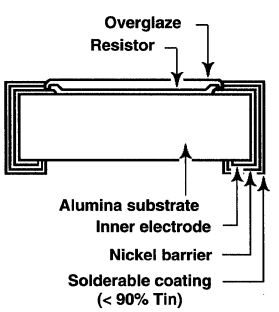
MODEL CRCW0603
Thick Film Chip Resistors
Industrial

A COMPANY OF VISHAY DALE®



FEATURES

- Internationally standardized size
- Automatic placement compatibility
- Flow solderable
- Inner electrode protection
- Thick film resistance element
- Wraparound termination
- Standard resistance values = E-24
- Operating temperature range is - 55°C to + 125°C



ELECTRICAL SPECIFICATIONS

Maximum RCWV: 50 V. Rated continuous working voltage (RCWV) shall be determined from RCWV = The square root of Rated Power x Resistance Value or from maximum RCWV (50 V) whichever is less.

Resistance Range: 10 ohm to 1 Megohm.

Resistance Tolerance: 1%, 5%.

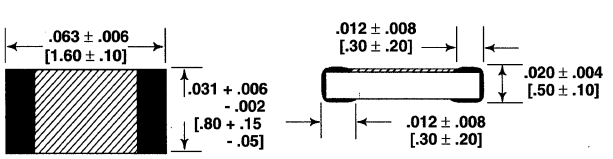
Power Rating at 70°C: 1/16 watt.

Maximum Overload Voltage: 100 V.

Dielectric Withstanding Voltage: 200 V.

DIMENSIONAL CONFIGURATIONS

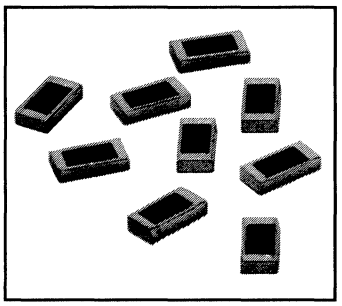
[Numbers in brackets indicate millimeters]



For more information contact:
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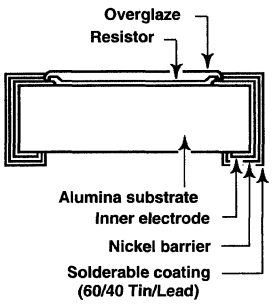
MODEL CRCW
Thick Film Chip Resistors
Industrial

A COMPANY OF VISHAY DALE®



FEATURES

- Internationally standardized size
- Automatic placement compatibility
- Flow solderable
- Thick film resistance element
- Wraparound termination
- Inner electrode protection
- Operating temperature range is - 55°C to + 150°C



STANDARD ELECTRICAL SPECIFICATIONS

DIMENSIONAL CONFIGURATIONS

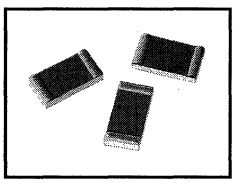
MODEL	RESISTANCE, TOLERANCE & TEMP. COEFFICIENT RANGE						Power Rating and Max. Operating Voltage (@ 70°C) (See derating curve)	Zero Ohm Jumper	[Numbers in brackets indicate millimeters]				
	E-12 Std. Res. Values	E-24 Std. Res. Values		E-96 Std. Res. Values									
	± 10% & ± 20%	± 5%	± 5%	± 1%	± 1%	± .5%							
	± 300 PPM/°C	± 300 PPM/°C	± 200 PPM/°C	± 200 PPM/°C	± 100 PPM/°C	± 100 PPM/°C			A	B	C	D	E
CRCW 0805		5.1Ω to 9.1Ω and 1.1 Meg to 5 Meg	10Ω to 1 Meg		10Ω to 1 Meg		1/10 W 100 V	0.05Ω Max. 1 AMP Max.	.079 ± .008 [2.00 ± .20]	.049 ± .008 [1.25 ± .20]	.020 ± .008 [.50 ± .20]	.016 ± .010 [.40 ± .25]	.016 ± .010 [.40 ± .25]
CRCW 1206	3.3Ω to 8.2Ω and 2.7 Meg to 22 Meg	3Ω to 9.1Ω and 2.4 Meg to 22 Meg	10Ω to 2.2 Meg	1.01 Meg to 2.15 Meg	10Ω to 1 Meg	1k to 5k	1/8 W 200 V	0.05Ω Max. 2 AMP Max.	.126 ± .006 [3.20 ± .15]	.063 ± .006 [1.60 ± .15]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]
CRCW 1210			10Ω to 1.5 Meg	221k to 1.5 Meg	10Ω to 215k		1/4 W 200 V	0.05Ω Max. 4 AMP Max.	.126 ± .008 [3.20 ± .20]	.098 ± .008 [2.50 ± .20]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]
CRCW 2010		3Ω to 9.1Ω	10Ω to 1 Meg		10Ω to 1 Meg		1/2 W 200 V		.200 + .009 - .006 [5.08 + .23 - .15]	.100 + .009 - .006 [2.54 + .23 - .15]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]
CRCW 2512		3Ω to 9.1Ω	10Ω to 240k		10Ω to 237k		1 W 200 V		.250 + .009 - .006 [6.35 + .23 - .15]	.126 + .008 - .006 [3.20 + .20 - .15]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]

☐ = Factory Stocked Resistance Range ▒ = Contact Factory for Delivery ▨ = Contact Factory for Availability

For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODELS RCM, RCWPM, RCWM
Thick Film Chip Resistors
Military/Established Reliability
MIL-R-55342/2/3/4/5/6/7/8/9 Qualified, Type RM

A COMPANY OF VISHAY DALE®



FEATURES

- Allows wide design flexibility for use with hybrid circuitry
- Meets requirements of MIL-R-55342
- Established Reliability - Verified failure rate (contact factory)
- Operating Temperature Range is - 55°C to + 150°C
- 100% screen tested per Group A, Subgroup 1 of MIL-R-55342
- Variety of termination material
- One-surface and wraparound terminations
- 95% minimum alumina body

STANDARD ELECTRICAL SPECIFICATIONS

DALE MODELS RCM, RCWPM, RCWM	MIL-R-55342 STYLE	MIL SHEET NO.	TERMINATIONS	CHAR.	RESISTANCE RANGE (Ohms)	TOL.	MAXIMUM OPERATING VOLTAGE	POWER RATING @ 70°C
-550	RM0505	02	S, R, T, U, B, C	M	5.6-470k	10%	40	50 mW
				K, M	10-470k	2%-10%		
				K, M	10-464k	1%-10%		
-5100	RM1005	03	S, R, T, U, B, C	M	5.6-1M	10%	40	100 mW
				K, M	10-1M	1%-10%		
-5150	RM1505	04	S, R, T, U, B, C	M	5.6-4.7M	10%	40	150 mW
				M	10-4.7M	2%-10%		
				K, M	10-1M	1%-10%		
-7225	RM2008	05	S, R, B, C	M	5.6-15M	10%	40	225 mW
				M	10-15M	2%-10%		
				K, M	10-2M	1%-10%		
-575	RM0705	06	S, R, T, U, B, C	M	5.6-1M	10%	50	100 mW
				K,M	10-1M	1%-10%		
-1206	RM1206	07	S, R, T, U, B, C	M	5.6-1M	10%	100	250 mW
				K, M	10-1M	2%-10%		
				K, M	10-499k	1%-10%		
-2010	RM2010	08	S, R, T, U, B, C	M	5.6-15M	10%	150	800 mW
				M	10-7.5M	1%-10%		
				K, M	10-1M	1%-10%		
-2512	RM2512	09	S, R, T, U, B, C	M	5.6-15M	10%	200	1000 mW
				M	10-7.5M	1%-10%		
				K, M	10-1M	1%-10%		

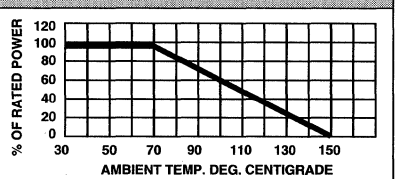
CODE LETTERS (Tol. & Multipliers)

TOLERANCE ±1%	±2%	±5%	±10%	MULTIPLIER	VALUE RANGE (Ohms)
D	G	J	M	1	1-9xx
E	H	K	N	1,000	1k-9xxk
F	T	L	P	1,000,000	1M-10M

Examples:

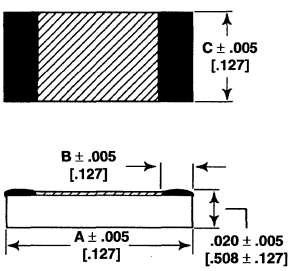
11D3	= 11.3Ω ± 1%	15J0	= 15Ω ± 5%
10E0	= 10kΩ ± 1%	10K0	= 10kΩ ± 5%
332D	= 332Ω ± 1%	560K	= 560kΩ ± 5%
2F21	= 2.21MΩ ± 1%	8L20	= 8.2MΩ ± 5%
51G0	= 51Ω ± 2%	10M0	= 10Ω ± 10%
10H0	= 10kΩ ± 2%	10N0	= 10kΩ ± 10%
33H0	= 33kΩ ± 2%	2P70	= 2.7MΩ ± 10%
22T0	= 22MΩ ± 2%	8P20	= 8.2MΩ ± 10%

DERATING

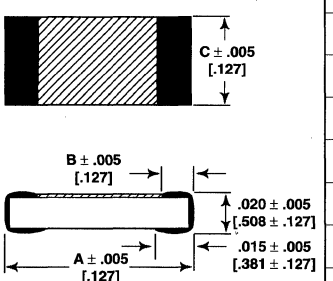


DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

RCM
(One-surface termination)



RCWPM/RCWM
(Wraparound termination)



DALE MODELS	MIL-R-55342 STYLE	MIL SHEET NO.	A	B	C
RCM-550	RM0505	02	.050 [1.27]	.010 [.254]	.050 [1.27]
RCWPM/RCWM-550	RM0505		.055 [1.40]	.010 [.254]	.050 [1.27]
RCM-5100	RM1005	03	.100 [2.54]	.015 [.381]	.050 [1.27]
RCWPM/RCWM-5100	RM1005		.105 [2.67]	.015 [.381]	.050 [1.27]
RCM-5150	RM1505	04	.150 [3.81]	.015 [.381]	.050 [1.27]
RCWPM/RCWM-5150	RM1505		.155 [3.94]	.015 [.381]	.050 [1.27]
RCM-7225	RM2208	05	.225 [5.72]	.015 [.381]	.075 [1.91]
RCWPM/RCWM-7225	RM2208		.230 [5.84]	.015 [.381]	.075 [1.91]
RCM-575	RM0705	06	.075 [1.91]	.015 [.381]	.050 [1.27]
RCWPM/RCWM-575	RM0705		.080 [2.03]	.015 [.381]	.050 [1.27]
RCM-1206	RM1206	07	.120 [3.05]	.015 [.381]	.060 [1.52]
RCWPM/RCWM-1206	RM1206		.125 [3.18]	.015 [.381]	.060 [1.52]
RCM-2010	RM2010	08	.200 [5.08]	.015 [.381]	.100 [2.54]
RCWPM/RCWM-2010	RM2010		.205 [5.21]	.015 [.381]	.100 [2.54]
RCM-2512	RM2512	09	.250 [6.35]	.015 [.381]	.125 [3.18]
RCWPM/RCWM-2512	RM2512		.255 [6.48]	.015 [.381]	.125 [3.18]

HOW TO ORDER – MILITARY PART NUMBER

M55342
MIL. SPEC. NO. INDICATING MIL-R-55342

D55342 applies to Style 07 (RM1206) only. M55342 applies to all other styles.

M
CHARACTERISTIC

M = ± 300PPM/°C
K = ± 100PPM/°C

02
MIL. SPEC. SHEET NO.

B
TERMINATION MATERIAL

B & R = Pre-tinned Nickel Barrier, wraparound (RCWPM) ("B" code is stocked)
C = Untinned Palladium Silver, wraparound (RCWM)
S = Pretinned Platinum-Gold, one-surface (RCM)
T = Untinned Platinum-Gold, one-surface (RCM)
U = Untinned Platinum-Gold, wraparound (RCWM)

10E0
RESISTANCE AND TOLERANCE

See Examples Above

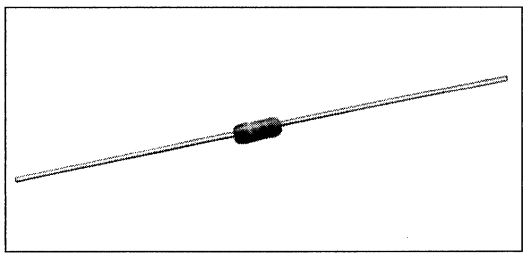
R
LIFE FAILURE RATE

M = 1.0%/1000 hours
P = 0.1%/1000 hours
R = 0.01%/1000hours

For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODEL CCF-07
Metal Film Resistors
Industrial, 2% and 5% Tolerance

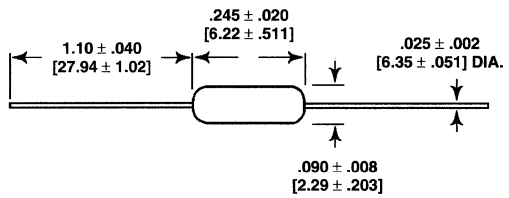
A COMPANY OF VISHAY DALE®



FEATURES
- 1/4 watt at 70°C power rating
- 2% and 5% tolerance
- 100PPM/°C and 200PPM/°C temperature coefficient
- Flame retardant epoxy conformal coating
- Standard 4 band color code marking for ease of identification after mounting
- Tape and reel packaging for automatic insertion. Meets EIA 296-E, Class I.

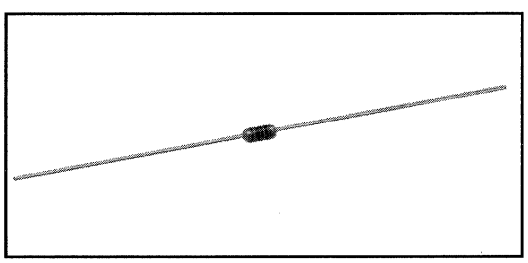
ELECTRICAL SPECIFICATIONS
Resistance Range:
10 ohm to 1 Megohm for ± 2% tolerance.
10 ohm to 2 Megohm for ± 5% tolerance.
Resistance Tolerance: ± 2%, ± 5%.
T. C.: (- 65°C to + 150°C).
± 100PPM/°C for 2% tolerance.
± 200PPM/°C for 5% tolerance.
Power Rating: 1/4 watt at + 70°C.
Maximum Working Voltage: 250 V RMS.
Insulation Resistance: 10,000 Megohm.
Operating Temperature Range: - 65°C to + 150°C.

DIMENSIONAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]



MODELS CCF-50, CCF-55, CCF-60
Metal Film Resistors
Industrial, 1% Tolerance

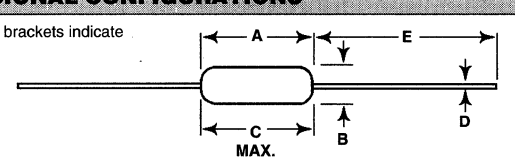
A COMPANY OF VISHAY DALE®



FEATURES
- Power Ratings: 1/4 and 1/2 watt at 70°C
- 100PPM/°C temperature coefficient
- Superior electrical performance
- Flame retardant epoxy conformal coating
- Standard 5 band color code marking for ease of identification after mounting
- Tape and reel packaging for automatic insertion. Meets EIA 296-E, Class I.

ELECTRICAL SPECIFICATIONS
Resistance Range: 10 ohm to 1 Megohm.
Resistance Tolerance: ± 1%.
T. C.: (- 65°C to + 165°C) ± 100PPM/°C.
Power Rating at 70°C:
CCF-50 = 1/4 watt.
CCF-55 = 1/4 watt, 1/2 watt.
CCF-60 = 1/2 watt, 3/4 watt.
Maximum Working Voltage:
200 V RMS for CCF-50.
250 V RMS for CCF-55.
350 V RMS for CCF-60.
Insulation Resistance: 10,000 Megohm.
Operating Temperature Range: - 65°C to + 165°C.

DIMENSIONAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

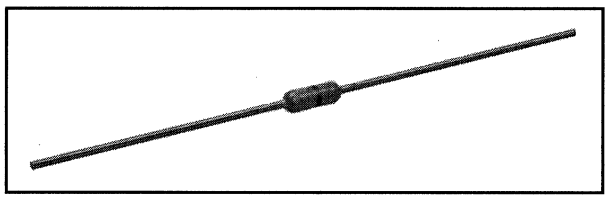


MODEL	A	B	C (Max.)	D	E
CCF-50	.133 ± .010 [3.38 ± .254]	.062 ± .004 [1.57 ± .102]	.143 [3.63]	.020 ± .002 [.508 ± .051]	1.125 ± .040 [28.58 ± 1.02]
CCF-55	.245 ± .020 [6.22 ± .508]	.090 ± .008 [2.29 ± .203]	.265 [6.73]	.025 ± .002 [.635 ± .051]	1.10 ± .040 [27.94 ± 1.02]
CCF-60	.344 ± .031 [8.74 ± .787]	.139 ± .009 [3.53 ± .229]	.400 [10.16]	.025 ± .002 [.635 ± .051]	1.0 ± .040 [25.4 ± 1.02]

For more information contact:
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MODELS FRJ-50 and FRJ-55
Metal Film Resistors
Industrial, Jumper Resistor

A COMPANY OF VISHAY DALE®



FEATURES
- Provides low resistance circuit interconnections
- Color band marking for ease of identification after mounting
- Flame retardant coating
- Compatible with automatic insertion equipment
- Tape and reel packaging

ELECTRICAL SPECIFICATIONS

Resistance: 0.01 ohm maximum.

Dielectric Strength: Atmospheric - 500 V RMS, reduced 325 V RMS.

Insulation Resistance: Dry 10,000 Megohm; wet 100 Megohm.

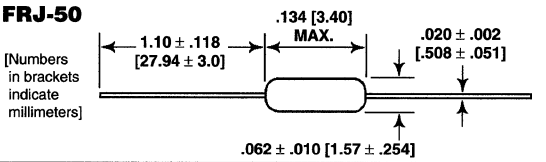
Current Rating: 25 amps at 25°C, derating to 0 amps at 150°C.

Insulation Flammability: Self extinguishing 10 seconds after flame is removed.

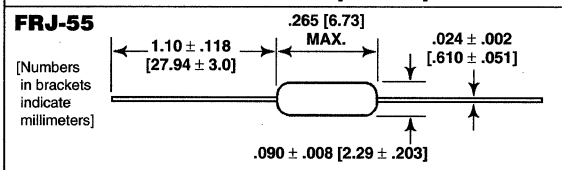
Lead Material: Tin-plated copper (maximum 98% tin).

DIMENSIONAL CONFIGURATIONS

FRJ-50

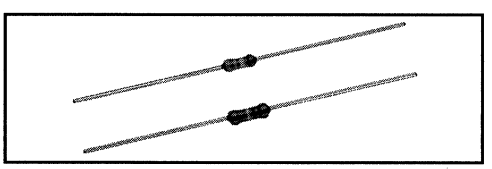


FRJ-55



MODELS SMA and OMA
Metal Film Resistors
Semi-Precision, Zero Ohm Jumpers (OMA)

A COMPANY OF VISHAY DALE®

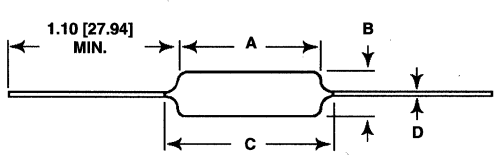


FEATURES
- Green, multilayer liquid epoxy system provides excellent moisture and mechanical protection
- Leads are electroplated, high purity copper
- Dual rated parts provide high density board mounting
- Temperature coefficient for SMA0207S, 1%, is ± 50PPM/°C

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE RATING STANDARD 70°C	WATTAGE RATING DUAL 125°C	WATTAGE RATING DUAL 70°C	VOLTAGE RATING	RESISTANCE RANGE (Ohms)	STANDARD TOLERANCE	TEMPERATURE COEFFICIENT PPM/°C
SMA0204	1/8	1/10	1/2	200	1-1M	1, 5%	100
SMA0207S	1/4	1/8	1/2	300	1-5.1M	1%	50
SMA0207S	1/4	1/8	1/2	300	1-5.1M	2, 5%	100
SMA0309S	1/2	1/4	1	350	1-2.21M	1%	100
SMA0309S	1/2	1/4	1	350	1-5.1M	2, 5%	100
OMA0207	(Zero Ohm Jumper)						
OMA0204	(Zero Ohm Jumper)						

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

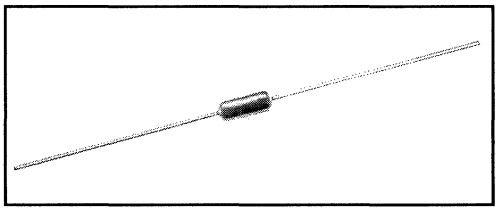


MODEL	A	B	C	D
SMA0204 OMA0204	.142 ± .010 [3.61 ± .254]	.071 [1.80] MAX.	.160 [4.06] MAX.	.020 [.508]
SMA0207S OMA0207	.235 ± .020 [5.97 ± .508]	.090 ± .008 [2.29 ± .203]	.281 [7.14]	.024 [.610]
SMA0309S	.303 ± .020 [7.70 ± .508]	.110 ± .008 [2.79 ± .203]	.375 [9.53]	.026 [.660]

For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODEL CMF
Metal Film Resistors
Industrial

A COMPANY OF VISHAY DALE®



FEATURES

- Small size - conformal coated
- Flame retardant epoxy coating
- Controlled temperature coefficient
- Excellent high frequency characteristics
- Low noise
- Low voltage coefficient

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	MAX. WORKING VOLTAGE	RESISTANCE RANGE (Ohms) VS - BEST AVAILABLE TOL./T. C. ± 2%** T-00	± 1% T-0	± 1% T-1	± 1% T-2	± 0.1% T-9
CMF-50	200 V	—	10-1M	10-1M	10-500k	10-500k
CMF-55	250 V	.1-.49	.5-22.1M	1-22.1M	10-5M	10-2.5M
CMF-07*	250 V	—	1-5M	5-5M	—	—
CMF-60	350V	.1-.49	.5-8M	1-8M	10-8M	10-2.5M
CMF-20*	350 V	—	1-8M	5-8M	—	—
CMF-65	500 V	.1-.49	.5-15M	1-15M	10-10M	10-2.5M
CMF-70	500 V	—	1-15M	1-15M	10-10M	10-2.5M

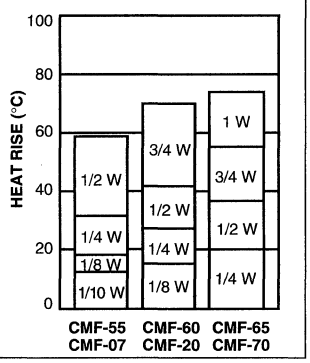
* CMF-07 and CMF-20 are available in 2% (G) or 5% (J) tolerances only.
** A .0005 ohm bridge error is allowed in resistance measurement. It has the greatest effect on values in this range and should be taken into account when verifying Tolerance and T. C.

TEMP. COEFFICIENT CODES

T. C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE
T-00	0 ± 200PPM/°C	- 55°C to + 175°C
T-0	0 ± 150PPM/°C	- 55°C to + 175°C
T-1	0 ± 100PPM/°C	- 55°C to + 175°C
T-2	0 ± 50PPM/°C	- 55°C to + 175°C
T-9	0 ± 25PPM/°C	- 55°C to + 175°C
T-3	0 + 100PPM/°C	- 55°C to + 175°C
T-4	0 - 100PPM/°C	- 55°C to + 175°C
T-5	0 ± 25PPM/°C	+ 25°C to + 145°C
T-6	0 + 50PPM/°C	- 55°C to + 175°C
T-7	0 - 50PPM/°C	- 55°C to + 175°C
T-8	0 ± 35PPM/°C	- 55°C to + 25°C
	0 ± 25PPM/°C	+ 25°C to + 175°C

HEAT RISE

The increase in resistor surface temperature due to the rated load is shown below. Resistor surface temperature = heat rise + ambient temperature.



COMMERCIAL POWER RATING

WATTAGE	70°C	125°C
1/20	CMF-50	CMF-50
1/10	CMF-50, -55	CMF-50, -55
1/8	CMF-50, -55, -60	CMF-50, -55, -60
1/4	CMF-55, -60, -65, -70, -07	CMF-55, -60, -65, -70
1/2	CMF-55, -60, -65, -70, -20	CMF-60, -65, -70
3/4	CMF-60*, -65*, -70	CMF-65*, -70
1	CMF-65*, -70	—

* .032 [.813] lead

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: ± 5%, ± 2%, ± 1%, ± .5%, ± .25%, ± .1% standard. Special tolerance and/or T. C. matching is available on request.

Noise: Dale metal film resistors have exceptionally low noise level. Average for standard resistance range is 0.10 micro-volts per volt over a decade of frequency, with low and intermediate resistance values typically below 0.05 micro-volts per volt.

Voltage Coefficient: Maximum voltage coefficient is 5PPM per volt when measured between 10% and full rated voltage.

Dielectric Strength:
450 VAC = CMF-50, CMF-55, CMF-07.
750 VAC = CMF-60, CMF-20. 900 VAC = all others.

Insulation Resistance: 10,000 Megohm minimum dry, 100 Megohm minimum after moisture test.

MECHANICAL SPECIFICATIONS

Terminal Strength: 2 pound pull test for CMF-50, CMF-55, CMF-60 and CMF-65. 5 pound test for all others.

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-10509.

MATERIAL SPECIFICATIONS

Element: Vacuum-deposited nickel-chrome alloy.

Core: Fire-cleaned high purity ceramic.

Coating: Flame retardant epoxy, formulated for superior moisture protection.

Termination: Standard lead material is solder-coated copper. Solderable and weldable.

ENVIRONMENTAL SPECIFICATIONS

Temperature Coefficient: CMF resistors are available in 11 standard T. C. codes of which 100PPM, 50PPM and 25PPM are the most commonly required.

Shelf Life: Resistance shifts due to storage at room temperature are negligible.

Power Rating: Power ratings are based on full power at temperatures and typical ΔR shown in the Environmental Table (1,000 hours load life).

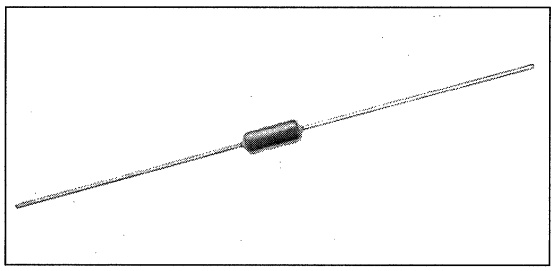
SPECIAL MODIFICATIONS

1. Terminals may be supplied in any commercial material with several type finishes.
2. Special pre-conditioning (power aging, temperature cycling, etc.) to customer specifications.
3. Non-helixed resistors can be supplied for critical high frequency applications.
4. Fusible, flameproof versions available.

For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODEL PTF
Metal Film Resistors
Industrial, Precision
Low T.C. - Tight Tolerance

A COMPANY OF VISHAY DALE®



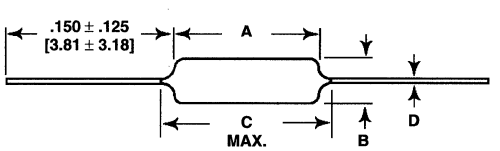
FEATURES
- Extremely low temperature coefficients of resistance
- Standard T. C.: T-10, ± 15PPM/°C. T-13, ± 10PPM/°C. T-16, ± 5PPM/°C.
- Very low noise and voltage coefficient
- Wide precision resistance range in small package
- 100% laser spiralled
- Very good high frequency characteristics
- Acceptance testing available
- Proprietary epoxy coating provides superior moisture protection
- Can replace wirewound bobbins

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	85°C RATING	MAXIMUM WEIGHT (Grams)	MAXIMUM WORKING VOLTAGE	RESISTANCE RANGE (Ohms)	AVAILABLE TOLERANCE RANGE
PTF-51	1/20 W	.11	200	50-100k	± 1% to ± 0.02%
PTF-56	1/8 W	.35	300	50-500k	± 1% to ± 0.01%
PTF-65	1/4 W	.75	500	50-1M	± 1% to ± 0.05%

DIMENSIONAL SPECIFICATIONS

[Numbers in brackets indicate millimeters]

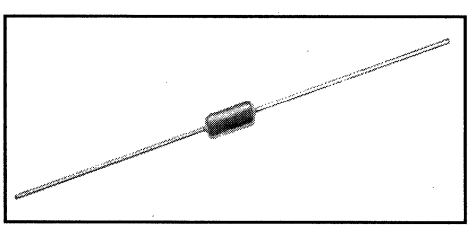


MODEL	A	B	C (Max.)	D
PTF-51	.150 ± .020 [3.81 ± .508]	.070 ± .010 [1.78 ± .254]	.200 [5.08]	.016 [.406]
PTF-56	.250 + .031 - .046 [6.35 + .787 -1.17]	.091 ± .009 [2.31 ± .229]	.300 [7.62]	.025 [.635]
PTF-65	.375 ± .062 [9.53 ± 1.57]	.145 ± .016 [3.68 ± .406]	.475 [12.07]	.025 [.635]

MATERIAL SPECIFICATIONS
Element: Precision deposited nickel-chrome alloy with controlled annealing
Core: Fire-cleaned high purity ceramic
Encapsulant: Specially formulated epoxy compounds. Coated construction.
Termination: Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type C.

MODEL CMH-55-100
Metal Film Resistors
Industrial, High Value

A COMPANY OF VISHAY DALE®

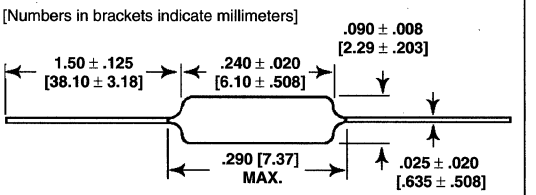


FEATURES
- 1/4 watt at 70°C power rating
- ± 0.5%, ± 1%, ± 2% tolerance
- Tape & reel packaging for automatic insertion available. Meets EIA 296-E.
- Non decade values available
- Flame retardant epoxy conformal coating
- Small dimensional size to value ratio
- 50PPM/°C and 100PPM/°C temperature coefficients

ELECTRICAL SPECIFICATIONS
Resistance Range: 5.01MΩ thru 15MΩ.
Resistance Tolerance:
5.01MΩ - 10MΩ = ± 0.5%, ± 1%, ± 2%. 10.1MΩ - 15MΩ = ± 1%, ± 2%.
Temperature Coefficient: (- 20°C to + 125°C). 5.01MΩ -10MΩ = 0 ± 50PPM/°C, 0 ± 100PPM/°C. 10.1MΩ - 15MΩ = 0 ± 100PPM/°C.
Power Rating: Limited by maximum working voltage.
Maximum Working Voltage: 250 V RMS.
Insulation Resistance: 10,000 Megohm minimum.
Operating Temperature Range: - 65°C to + 165°C.

DIMENSIONAL CONFIGURATIONS

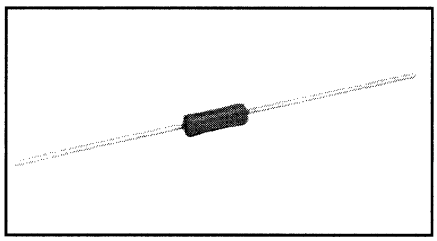
[Numbers in brackets indicate millimeters]



For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODEL CPF
Metal Film Resistors
Industrial, Power, Flameproof

A COMPANY OF VISHAY DALE®



FEATURES
- High power rating, small size
- Flameproof, high temp. coating
- Special filming and coating processes
- Low noise
- Low voltage coefficient
- Excellent high frequency characteristics

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE RATING (70°C)	VOLTAGE RATING	RESISTANCE RANGE 1% AND ABOVE (Ohms)
CPF-1	1	250 W	0.1-150k
CPF-2	2	350 W	0.1-150k
CPF-3	3	500 W	0.1-150k

Contact factory for resistance range in precision tolerance.

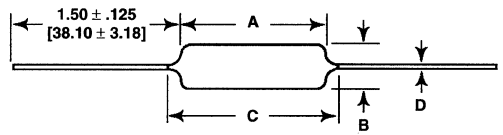
ELECTRICAL SPECIFICATIONS
Resistance Tolerance: .1%, .25%, .5%, 1%, 5%.
T. C.: (-55°C to +125°C) ±100PPM/°C, ±50PPM/°C, ±25PPM/°C.
Dielectric Strength: 900 VAC.
Insulation Resistance: 10,000 Megohm minimum.
Operating Temperature Range: - 65°C to + 230°C.

MATERIAL SPECIFICATIONS
Element: Proprietary nickel-chrome alloy.
Core: Fire-cleaned high purity ceramic.
Coating: Special high temperature conformal coat.
Termination: Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type "C".

MECHANICAL SPECIFICATIONS
Terminal Strength: 2 pound pull test.
Solderability: Continuous satisfactory coverage when tested in accordance with MIL-STD-202, Method 208.

DIMENSIONAL CONFIGURATIONS

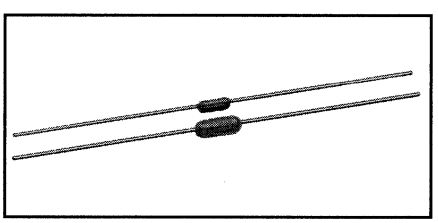
[Numbers in brackets indicate millimeters]



MODEL	A	B	C (Max.)	D
CPF-1	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.310 [7.87]	.025 ± .002 [.635 ± .051]
CPF-2	.344 ± .031 [8.74 ± .787]	.145 ± .015 [3.68 ± .381]	.425 [10.80]	.032 ± .002 [.813 ± .051]
CPF-3	.555 ± .041 [14.10 ± 1.04]	.180 ± .015 [4.57 ± .381]	.650 [16.51]	.032 ± .002 [.813 ± .051]

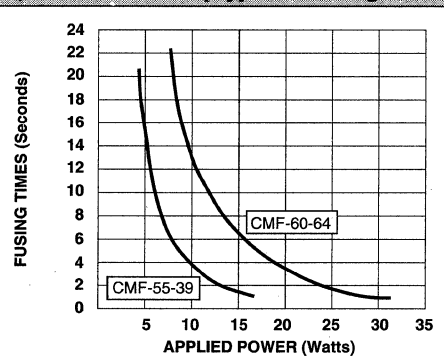
MODELS CMF-55-39 and CMF-60-64
Metal Film Resistors
Special Purpose, Fusible, Flameproof

A COMPANY OF VISHAY DALE®



FEATURES
- Fusible - Circuit protection in case of other component failure
- Flameproof - Meets EIA RS-325, will not flame when overloaded
- Special filming and coating processes

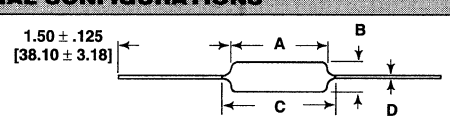
FUSIBLE, FLAMEPROOF (Typical Fusing Times)



ELECTRICAL SPECIFICATIONS
Resistance Range: 5 ohm to 10 kilohm
Resistance Tolerance: ± 1%
T. C.: (- 65°C to + 165°C) ± 100PPM/°C
Power Rating: CMF-55-39 = 1/4 watt and CMF-60-64 = 1/2 watt at + 70°C (Derate linearly from rated power at + 70°C to zero power at + 165°C)
Maximum Flame Test Voltage:
CMF-55-39 = 350 V RMS or DC
CMF-60-64 = 500 V RMS or DC
Insulation Resistance: 10,000 Megohm
Operating Temperature Range: - 65°C to + 165°C

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

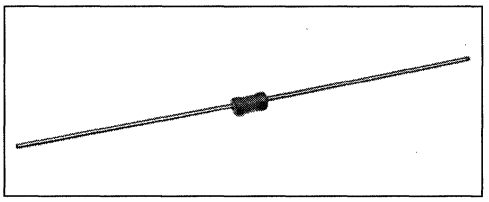


MODEL	A	B	C (Max.)	D
CMF-55-39	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.278 [7.06]	.025 ± .002 [.635 ± .051]
CMF-60-64	.370 ± .035 [9.40 ± .889]	.145 ± .010 [3.68 ± .254]	.425 [10.80]	.032 ± .002 [.813 ± .051]

For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODEL RNX
Metal Oxide Resistors
High Voltage, Special Purpose

A COMPANY OF VISHAY DALE®



FEATURES

- Low T.C.: ± 200PPM/°C standard. ± 100PPM/°C, ± 50 PPM/°C available.
- Tolerance: ± 1% standard to 1 Gigohm. ± 5% above 1 Gigohm. ± 0.5% available in 50PPM/°C only. Special tolerances and/or T.C. matching available upon request.
- For oil bath or open air operation

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE RATING*			VOLTAGE RATING	RESISTANCE (Ohms)**			
	25°C	70°C	125°C		M	K	H	N***
RNX-1/4	.5	.36	.25	750 V	1k-100M	1k-100M	1M-22M	100-100k
RNX-3/8	1.0	.72	.50	1.5KV	1k-1G	1k-100M	1M-50M	100-100k
RNX-1/2	1.2	.86	.60	2.0KV	1k-2.0G	1k-250M	1M-100M	100-100k
RNX-3/4	2.0	1.44	1.0	3.0KV	1k-3G	1k-500M	1M-100M	100-100k
RNX-1	2.5	1.80	1.25	4.0KV	1k-5G	1k-500M	1M-100M	100-1M
RNX-1-1/4	3.0	2.16	1.50	5.0KV	2k-10G	1k-500M	—	100-1M
RNX-1-1/2	4.0	2.88	2.0	6.0KV	2k-10G	1k-500M	—	100-1M
RNX-2	5.0	3.60	2.50	8.0KV	2k-10G	1k-500M	—	100-1M

* Increase wattage by 25% for .032 [.813] diameter leads. ** For resistance values above and below those listed, contact factory. *** Non-inductive. ± 200PPM/°C T. C. only. All resistance readings referenced at 100 VDC. Other voltages upon request.

TEMPERATURE COEFFICIENT CODE

CODE	T.C.	RANGE
M	± 200PPM/°C	- 55°C to + 125°C
K	± 100PPM/°C	- 55°C to + 125°C
H	± 50PPM/°C	- 5°C to + 125°C

ELECTRICAL SPECIFICATIONS

Dielectric Strength: 750 VDC all styles.

Insulation Resistance: 10,000 Megohm minimum.

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pound pull test for all styles.

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-10509.

MATERIAL SPECIFICATIONS

Element: High temperature fired cermet film.

Core: High purity 96% alumina.

Coating: Flameproof silicone or flame-retardant epoxy.

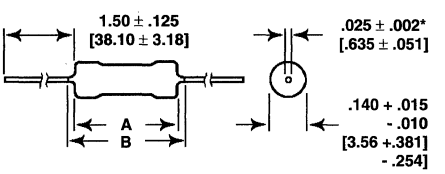
Termination: Standard lead material is solder-coated copper. Solderable and weldable.

SPECIAL MODIFICATIONS

1. Special preconditioning (power aging, temperature cycling, etc.) to customer specifications.
2. Non-helixed resistors can be supplied for critical high frequency applications. (Non-inductive.)
3. Matched sets available.
4. Flameproof silicone coating available.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



MODEL	A	B (Max.)
RNX-1/4	.290 ± .020 [7.37 ± .508]	.358 [9.09]
RNX-3/8	.420 ± .020 [10.67 ± .508]	.470 [11.94]
RNX-1/2	.540 ± .020 [13.72 ± .508]	.595 [15.11]
RNX-3/4	.790 ± .020 [20.07 ± .508]	.845 [21.46]
RNX-1	1.04 ± .020 [26.42 ± .508]	1.10 [27.81]
RNX-1-1/4	1.29 ± .020 [32.77 ± .508]	1.35 [34.16]
RNX-1-1/2	1.54 ± .020 [39.12 ± .508]	1.60 [40.51]
RNX-2	2.04 ± .020 [51.82 ± .508]	2.10 [53.34]

* Available with .032 [.813] leads ± .002 [.051].

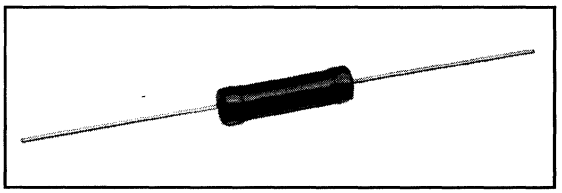
RESISTANCE VALUE CODES

K/KILO/10^3		M/MEGA/10^6		G/GIGA/10^9		T/TERA/10^{12}	
VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE
1k	1k0	1M	1M0	1KM	1G0	1MM	1T0
5.5k	5k5	5.5M	5M5	5.5KM	5G5	5.5MM	5T5
9.99k	9k99	9.99M	9M99	9.99KM	9G99	9.99MM	9T99

For more information contact:
DALE ELECTRONICS, INC., 550 High Street, Bradford, PA 16701-0930 • Phone (814) 362-5700 • Fax 814-362-5635

MODEL ROX
Metal Oxide Resistors
High Voltage, Special Purpose

A COMPANY OF VISHAY DALE®



FEATURES
- Low T.C.: ± 200PPM/°C standard. ± 100PPM/°C, ± 50PPM/°C available.
- Tolerances: ± 10%, ± 5%, ± 2%, ± 1%, ± .5%
- For oil bath or open air operation
- Matched sets available
- Special testing available upon request

STANDARD ELECTRICAL SPECIFICATIONS

	WATTAGE RATING*			MAXIMUM VOLTAGE	RESISTANCE RANGE (Ohms)							
					T.C. ± 200PPM/°C		T.C. ± 100PPM/°C		T.C. ± 50PPM/°C		NON-INDUCTIVE T.C. ± 200PPM/°C	
MODEL	25°C	70°C	125°C		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
ROX-1/2	2.0	1.4	1.0	2.0KV	1k	1G	1k	100M	1M	100M	—	—
ROX-3/4	3.0	2.16	1.5	5.0KV	1k	4G	1k	500M	1M	100M	100	1M
ROX-1	4.0	2.88	2.0	7.5KV	1k	5G	1k	500M	1M	100M	100	1M
ROX-1-1/2	5.0	3.6	2.5	11.0KV	1.5k	7.5G	1.5k	500M	1M	100M	100	1M
ROX-2	6.0	4.32	3.0	15.0KV	2k	10G	2k	1G	1M	500M	100	1M
ROX-3	10.0	7.2	5.0	22.5KV	3k	15G	3k	1G	1M	500M	400	10M
ROX-4	12.0	8.64	6.0	30.0KV	4k	20G	4k	1G	1M	500M	500	10M
ROX-5	16.0	11.52	8.0	37.5KV	5k	25G	5k	1G	1M	500M	500	10M
ROX-6	20.0	14.4	10.0	45.0KV	6k	30G	6k	1G	1M	500M	500	10M

* Wattage increases by 25% with .040 [1.02] lead. All resistance readings referenced at 100 VDC. Other voltages available on request. 1% not available above 10G.

ELECTRICAL SPECIFICATIONS
Insulation Resistance: 10^{11} ohm minimum.

MECHANICAL SPECIFICATIONS
Terminal Strength: 10 pound pull test.

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-10509.

MATERIAL SPECIFICATIONS
Element: High temperature fired cermet film.

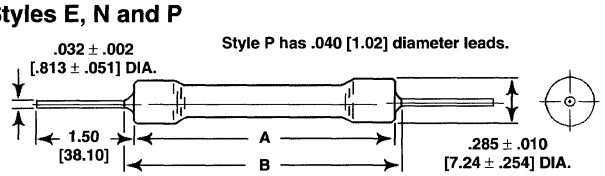
Core: High purity 96% alumina.

Coating: Flameproof silicone or flame-retardant epoxy.

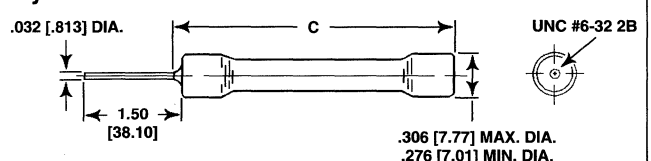
Termination: Standard lead material is solder-coated. copper. Solderable and weldable.

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

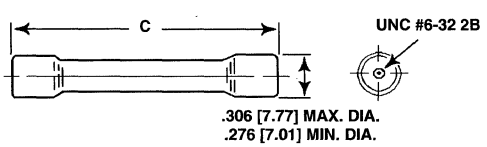
Styles E, N and P



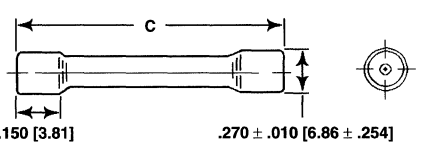
Style Y



Style T



Style Z

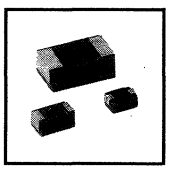


	STYLE E, N, P		STYLE T	STYLE Y	STYLE Z
MODEL	A	B	C	C (Max.)	C
ROX-1/2	.600 ± .032 [15.24 ± .813]	.700 [17.78]	NA	NA	NA
ROX-3/4	.800 ± .032 [20.32 ± .813]	.900 [22.86]	1.168 ± .022 [29.67 ± .559]	1.045 [26.54]	.780 ± .022 [19.81 ± .559]
ROX-1	.920 ± .032 [23.37 ± .813]	1.02 [25.91]	1.288 ± .022 [32.72 ± .559]	1.165 [29.59]	.900 ± .022 [22.86 ± .559]
ROX-1-1/2	1.55 ± .032 [39.37 ± .813]	1.65 [41.91]	1.918 ± .022 [48.72 ± .559]	1.795 [45.59]	1.53 ± .022 [38.86 ± .559]
ROX-2	2.05 ± .032 [52.07 ± .813]	2.15 [54.61]	2.418 ± .022 [61.42 ± .559]	2.295 [58.29]	2.03 ± .022 [51.56 ± .559]
ROX-3	3.05 ± .032 [77.47 ± .813]	3.15 [80.01]	3.416 ± .022 [86.82 ± .559]	3.295 [83.69]	3.03 ± .022 [76.96 ± .559]
ROX-4	4.05 ± .032 [102.87 ± .813]	4.15 [105.41]	4.418 ± .022 [112.22 ± .559]	4.295 [109.09]	4.03 ± .022 [102.36 ± .559]
ROX-5	5.05 ± .032 [128.27 ± .813]	5.15 [130.81]	5.418 ± .022 [137.62 ± .559]	5.295 [134.49]	5.03 ± .022 [127.76 ± .559]
ROX-6	6.05 ± .032 [153.67 ± .813]	6.15 [156.21]	6.418 ± .022 [163.02 ± .559]	6.295 [160.89]	6.03 ± .022 [153.16 ± .559]

For more information contact:
DALE ELECTRONICS, INC., 550 High Street, Bradford, PA 16701-0930 • Phone (814) 362-5700 • Fax 814-362-5635

MODEL WSC
Wirewound Resistors
Precision Power, Surface Mount

A COMPANY OF VISHAY DALE®



FEATURES

- Molded high-temperature encapsulation
- Available in non-inductive styles with Aryton-Perry windings for lowest reactive components

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	POWER RATING	RESISTANCE RANGE (Ohms) .05%	.1%	.25%	.5%, 1% 3%, 5%	MAXIMUM WORKING VOLTAGE*
WSC-1/2	1/2 W	0.5-527	.30-527	.20-1.41k	0.1-1.41k	22.9 V
WSC-1	1 W	0.62-1k	0.43-1k	0.43-2.77k	0.1-2.77k	28.2 V
WSC-2	2 W	1.0-2.74k	.499-2.74k	.499-10.4k	.005-10.4k	52.4 V

* Maximum working voltage determined @ .0008 diameter resistance value.

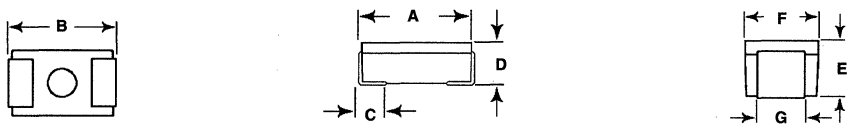
ELECTRICAL SPECIFICATIONS

Resistance Tolerance: 5%, 3%, 1%, .5%, .25%, .1%, .05%.
Temperature Coefficient: ± 90PPM/°C, 0.1 ohm-0.99 ohm. ± 50PPM/°C, 1.0 ohm-9.9 ohm. ± 20PPM/°C, 10 ohm and above. (Below 0.1 ohm, consult factory).
Dielectric Strength: 500 VAC.
Insulation Resistance: 1000 Megohm minimum dry, 100 Megohm after moisture test.
Short Time Overload: 5 seconds at 5 times rated power.
Solderability: 60/40 electro tin plated terminals to facilitate soldering.

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value.
End Caps: Nickel silver alloy.
Molding: Special high temperature encapsulation.
Standard Terminals: Tinned copper alloy.

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]



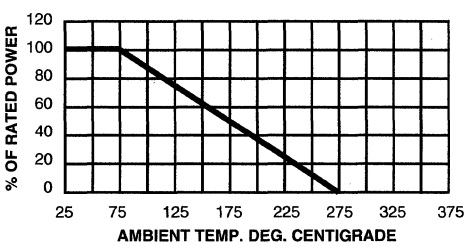
MODEL	A	B	C	D	E	F	G
WSC-1/2	.188 ± .005 [4.77 ± .127]	.200 ± .020 [5.08 ± .508]	.040 ± .010 [1.02 ± .254]	.096 ± .015 [2.44 ± .381]	.090 ± .005 [2.29 ± .127]	.125 ± .005 [3.18 ± .127]	.050 ± .010 [1.27 ± .254]
WSC-1	.238 ± .005 [6.05 ± .127]	.250 ± .020 [6.35 ± .508]	.045 ± .010 [1.14 ± .254]	.110 ± .015 [2.79 ± .381]	.104 ± .005 [2.64 ± .127]	.150 ± .005 [3.81 ± .127]	.098 ± .005 [2.49 ± .127]
WSC-2	.433 ± .005 [11.0 ± .127]	.445 ± .032 [11.30 ± .813]	.100 ± .010 [2.54 ± .254]	.162 ± .015 [4.11 ± .381]	.156 ± .005 [3.96 ± .127]	.275 ± .005 [6.98 ± .127]	.215 ± .005 [5.46 ± .127]

ENVIRONMENTAL PERFORMANCE

TEST	DALE MAXIMUM
Temperature Coefficient	20 to 90 PPM/°C
Thermal Shock	± (.2% + .05Ω) ΔR
Short Time Overload	± (.2% + .05Ω) ΔR
Dielectric	± (.1% + .05Ω) ΔR
Low Temp. Storage	± (.2% + .05Ω) ΔR
High Temp. Exposure	± (.5% + .05Ω) ΔR
Moisture Resistance	± (.2% + .05Ω) ΔR
Shock	± (.1% + .05Ω) ΔR
Vibration	± (.1% + .05Ω) ΔR
Load Life	± (.5% + .05Ω) ΔR

NOTE: Environmental specifications referenced @ 25°C.

DERATING



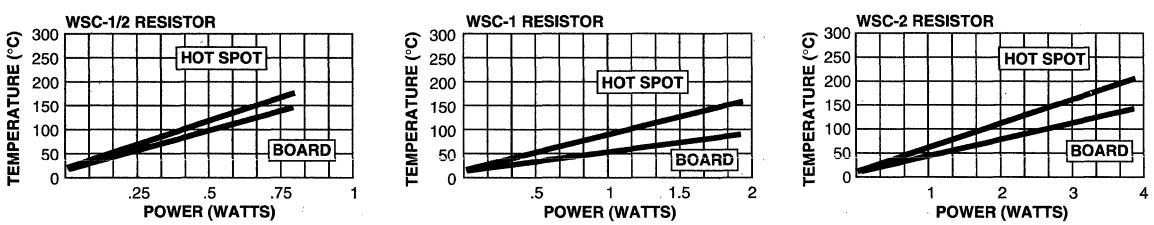
PART MARKING

1/2 WATT STYLE
— Dale logo
— Value

1 WATT STYLE
— Style
— Value and tolerance
— Date code

2 WATT STYLE
— Dale logo
— Style
— Value and tolerance
— Date code

SURFACE TEMPERATURE VS POWER



PACKAGING

Embossed Carrier Tape per EIA-481-1, 2.
Tape Widths: WSC-1/2 = 12mm/2000 pieces/13" reel.
WSC-1 = 16mm/2000 pieces/13" reel. WSC-2 = 24mm/1200 pieces/13" reel.

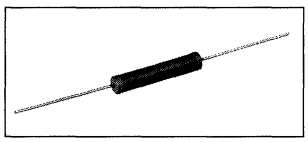
HOW TO ORDER

WSC-1	10	1%
MODEL	RESISTANCE	TOLERANCE

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

MODEL CW
Wirewound Resistors
Coated

A COMPANY OF VISHAY DALE®



FEATURES
- High performance for low cost
- High-temperature silicone coating
- Complete welded construction
- Excellent stability in operation
- High power/size ratio

STANDARD ELECTRICAL SPECIFICATIONS

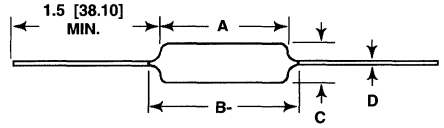
MODEL	POWER RATING (Max. Hot Spot) 275°C	350°C	RESISTANCE RANGE (Ohms)	MAX. WT. (Grams)	MAXIMUM * WORKING VOLTAGE 275°C	350°C
CW-2	4.0	5.5	.1-28.7k	2.1	200	235
CW-2B**	3.0	3.75	.1-15k	.70	125	140
CW-2C	2.5	3.25	.1-19.9k	1.6	130	150
CW-2C-14	2.5	3.25	.1-19.9k	1.6	130	150
CW-5**	5.0	6.5	.1-58.5k	4.2	320	365
CW-5-2	4.0	5.0	.1-40.3k	4.2	240	265
CW-5-3	5.0	6.5	.1-58.5k	4.2	320	365
CW-7	7.0	9.0	.1-95.2k	4.7	460	520
CW-10	10.0	13.0	.1-167k	9.0	765	875
CW-10-3	10.0	13.0	.1-167k	9.0	765	875

* Maximum working voltage determined at .0008" diameter wire resistance values.
** Values available down to .005 ohm in 10% tolerance.

ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ± 5% 1Ω and above. ± 10% below 1Ω. ± 2% and ± 3% available.
Temperature Coefficient: (- 55°C to + 350°C). ± 90PPM/°C below 1Ω. ± 50PPM/°C 1Ω to 9.9Ω. ± 30PPM/°C 10Ω and above.
Dielectric Strength: 1000 VAC minimum.

DIMENSIONAL CONFIGURATIONS

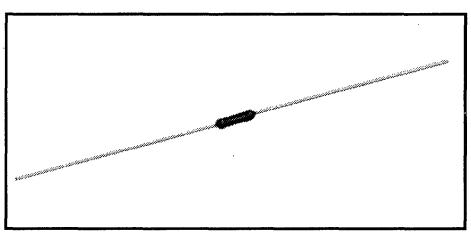
[Numbers in brackets indicate millimeters]



MODEL	A ± .062 [1.57]	B (Max.)	C ± .032 [.813]	D ± .002 [.051]
CW-2	.625 [15.87]	.765 [19.43]	.250 [6.35]	.040 [1.02]
CW-2B	.562 [14.27]	.622 [15.80]	.188 [4.78]	.032 [.813]
CW-2C	.500 [12.70]	.593 [15.06]	.218 [5.54]	.040 [1.02]
CW-2C-14	.500 [12.70]	.593 [15.06]	.218 [5.54]	.032 [.813]
CW-5	.875 [22.22]	1.0 [25.40]	.312 [7.92]	.040 [1.02]
CW-5-2	.875 [22.22]	1.0 [25.40]	.250 [6.35]	.032 [.813]
CW-5-3	.875 [22.22]	1.0 [25.40]	.312 [7.92]	.032 [.813]
CW-7	1.218 [30.94]	1.281 [32.54]	.312 [7.92]	.040 [1.02]
CW-10	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.040 [1.02]
CW-10-3	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.032 [.813]

MODEL CW
Wirewound Resistors
Commercial, Miniature, Coated

A COMPANY OF VISHAY DALE®



FEATURES
- High power/size ratio
- High performance for low cost
- High-temperature silicone coating
- Complete welded construction
- Excellent stability in operation

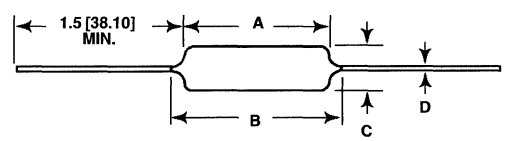
STANDARD ELECTRICAL SPECIFICATIONS

MODEL	POWER RATING	RESISTANCE RANGE (Ohms)	MAX. WORKING VOLTAGE*	MAX. WEIGHT (Grams)
CW-1/2	.5 W	0.1-1.54k	19.6 V	.21
CW-1	1.0 W	0.1-5.50k	45.9 V	.34
CW-1M	1.0 W	0.1-3.30k	37.4 V	.30
CW-2M	3.0 W	0.1-8.38k	83.0 V	.65

*** Max. working voltage determined @ .0008 diameter resistance value.**

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



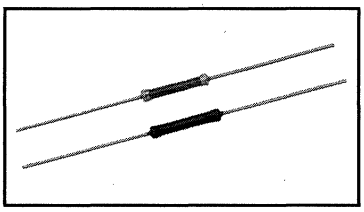
MODEL	A	B (Max.)	C	D
CW-1/2	.250 ± .015 [6.35 ± .381]	.265 [6.73]	.078 ± .015 [1.98 ± .381]	.020 ± .002 [.508 ± .051]
CW-1	.422 ± .015 [10.72 ± .381]	.437 [11.10]	.110 ± .015 [2.79 ± .381]	.020 ± .002 [.508 ± .051]
CW-1M	.295 ± .015 [7.50 ± .381]	.311 [7.90]	.110 ± .015 [2.79 ± .381]	.020 ± .002 [.508 ± .051]
CW-2M	.500 ± .062 [12.70 ± 1.57]	.562 [14.27]	.185 ± .015 [4.70 ± .381]	.032 ± .002 [.813 ± .051]

ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ± 5% standard 1Ω and above. ± 10% standard below 1Ω. ± 2% and ± 3% available
Temperature Coefficient: (- 55°C to + 275°C). ± 90PPM/°C below 1Ω. ± 50PPM/°C 1Ω - 9.9Ω. ± 30PPM/°C 10Ω and above.
Dielectric Strength: 1000 VAC minimum for CW-2M. 500 VAC minimum for CW-1/2, CW-1, CW-1M.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

MODEL CA
Wirewound Resistors
Commercial, Power

A COMPANY OF VISHAY DALE®

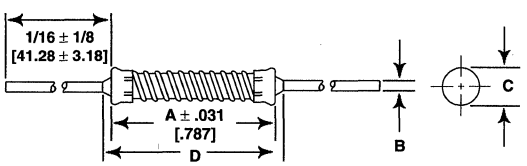


FEATURES
- Low cost, high performance
- CA-5000 models available with special silicone coating for corrosion and abrasion protection

ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ± 10% standard. ± 5% available.
Temperature Coefficient: Below 1 ohm 0 ± 800PPM. 1 ohm and above 0 ± 400PPM.
Power Rating: CA-4000 Series = 4 watts per inch. CA-5000 Series = 5 watts per inch.
Maximum Working Voltage: $\sqrt{PR}$.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



(CA-4000 Model shown.)

MODEL	A	B ± .001 [.025]	C ± .140 [3.56]	D ± 1/32 [.794]
CA-4000	See Table	.032 [.813]	.140 [3.56]	A + .062 [1.57]
CA-5000	at Right.	.036 [.914]	.160 [4.06]	*A + .093 [2.36]

* Dimension "D" on CA-5000 Model is clean lead to clean lead length.

STANDARD ELECTRICAL SPECIFICATIONS				DIMENSION A
MODEL	POWER RATING	OHMIC VALUE (Min.)	OHMIC VALUE (Max.)	A ± .031 [.787]
CA-4050	2.0 W	.10	270	.50 [12.70]
CA-4055	2.2 W	.10	300	.55 [13.97]
CA-4060	2.4 W	.11	350	.60 [15.24]
CA-4070	2.8 W	.13	430	.70 [17.78]
CA-4080	3.2 W	.16	510	.80 [20.32]
CA-4090	3.6 W	.18	590	.90 [22.86]
CA-4100	4.0 W	.20	670	1.00 [25.40]
CA-4150	6.0 W	.33	1,080	1.50 [38.10]
CA-4200	8.0 W	.45	1,480	2.00 [50.80]
CA-4220	8.8 W	.50	1,640	2.20 [55.88]
CA-5050	2.5 W	.10	2,400	.50 [12.70]
CA-5055	2.75 W	.10	2,700	.55 [13.97]
CA-5060	3.0 W	.11	3,100	.60 [15.24]
CA-5070	3.5 W	.13	3,900	.70 [17.78]
CA-5080	4.0 W	.16	4,600	.80 [20.32]
CA-5090	4.5 W	.18	5,300	.90 [22.86]
CA-5100	5.0 W	.20	6,000	1.00 [25.40]
CA-5150	7.5 W	.33	9,700	1.50 [38.10]
CA-5200	10.0 W	.45	13,300	2.00 [50.80]
CA-5220	11.0 W	.50	14,800	2.20 [55.88]

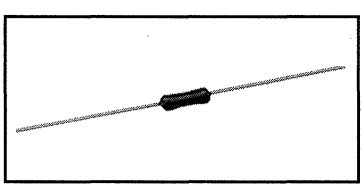
NOTE: CA-4000 Models available with silicone coating. Maximum resistance value will be the same as CA-5000 Models. Consult factory.

APPLICATIONS
Kitchen appliances: percolators, blenders, mixers, ranges, toasters, deep fryers. Automotive devices: horns, ignitions, windshield wipers, voltage regulators, instrument gauges. Entertainment devices: radios, televisions. Also computer and power supplies.

CONSTRUCTION
High quality, premium resistance wire is wound on a woven fiberglass core impregnated and coated with a special grade silicone.

MODELS CA-1 and CA-2
Wirewound Resistors
Commercial, Power

A COMPANY OF VISHAY DALE®

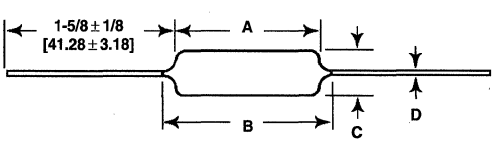


FEATURES
- High performance for low cost
- Axial leads
- Special grade silicone for additional environmental protection
- Auto insertable
- Value and tolerance printed

ELECTRICAL SPECIFICATIONS
Resistance Range: CA-1 = .1Ω to 1000Ω. CA-2 = .1Ω to 2400Ω.
Resistance Tolerance: ± 10% standard. ± 5% available.
T. C.: ± 600PPM/°C below 1Ω. ± 300PPM/°C 1Ω and above.
Power Rating: CA-1 = 1 watt. CA-2 = 2 watt.
Maximum Working Voltage: $\sqrt{PR}$.
Dielectric Withstanding Voltage: 600 V RMS.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



MODEL	A Typical	B Maximum	C Maximum	D ± .001 [.025]
CA-1	.400 [10.16]	.460 [11.68]	.170 [4.32]	.032 [.813]
CA-2	.570 [14.48]	.630 [16.00]	.170 [4.32]	.032 [.813]

APPLICATIONS: Kitchen appliances: percolators, blenders, mixers, ranges, toasters, deep fryers. Automotive devices: horns, ignitions, windshield wipers, voltage regulators, instrument gauges. Entertainment devices: radios, televisions. Also computer and power supplies

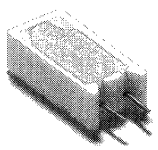
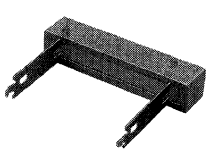
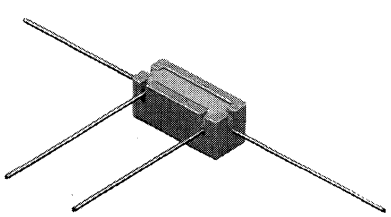
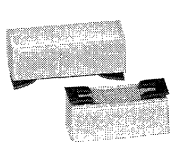
CONSTRUCTION: High quality, premium resistance wire is wound on a woven fiberglass core impregnated and coated with a special grade silicone.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

COMMERCIAL, POWER Wirewound Resistors

Axial Lead, Vertical Mount, Four Lead Radial Terminals, Surface Mount

A COMPANY OF VISHAY DALE®

	**MODEL CP** **Wirewound Resistors** Commercial, Power, Axial Lead, Fireproof Inorganic Construction, Meets or Exceeds EIA Standard RS-344	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 10% std. ± 5% available. **Resistance Range:** .1Ω to 30kΩ. **T. C.:** Below 1Ω = 0 ± 800PPM/°C, typical. 1Ω and above = 0 ± 400PPM/°C, typical. **Maximum Working Voltage:** $\sqrt{PR}$. **Operating Temperature:** - 55°C to + 275°C. **Wattage Rating:** 2, 3, 5, 7, 10, 15, 20 and 22. **Note:** Models with mounting pads available.
	**MODELS CPCL, CPCC, CPCP, CPCF** **Wirewound Resistors** Commercial, Power, Vertical Mount, Fireproof Inorganic Construction, Space Saving, Models Vary by Construction, Contact Factory for All Details	**ELECTRICAL SPECIFICATIONS** * **Resistance Tolerance:** ± 1%, ±3%, ± 5%, ± 10%. * **Resistance Range:** .1Ω to 150kΩ. **T. C.:** Depends on model. **Dielectric Strength:** 1000 VAC. **Maximum Working Voltage:** $\sqrt{PR}$. **Operating Temperature:** - 55°C to + 275°C. **Wattage Rating:** 2, 3, 5 and 10. * Depends on model, models vary by construction.
	**MODEL CPL** **Wirewound Resistors** Military, MIL-R-49465, Type RLV & Commercial Models, Power, Axial Lead, Fireproof Inorganic Construction	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 5% std. Lower available. Military Tolerance, Characteristic L: ± 5%, ± 10%. **Resistance Range:** .01Ω to .10Ω. Resistance is measured 3/8" [9.50] from resistor body. **T. C.:** Varies by resistance values. ± 550PPM/°C maximum. Consult factory. **Dielectric Strength:** 1000 VAC. **Terminal Strength:** 5 pounds minimum.
	**MODEL CPR** **Wirewound Resistors** Commercial, Power, Circuit Board Lock-In Mounting Tabs, Radial Terminals, Fireproof Inorganic Construction	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 5%, ± 10%. **Resistance Range:** .1Ω to 2000Ω. . **T. C.:** Below 1Ω = 0 ± 800PPM/°C. 1Ω and above = 0 ± 400PPM/°C. **Power Rating:** 3 watt to 20 watt. **Maximum Working Voltage:** $\sqrt{PR}$. **Operating Temperature:** - 55°C to + 275°C. **Wattage Rating:** 3, 5, 7, 10, 15 and 20.
	**MODEL CPSL** **Wirewound Resistors** Military, MIL-R-49465 Type RLV & Commercial Models, Power, Four Lead, Fireproof Inorganic Construction	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 5% std. ± 3% available. Military Tolerance, Characteristic L: ± 5%, ± 10%. **Resistance Range:** .01Ω to .10Ω. . **T. C.:** ± 100PPM/°C maximum. **Operating Temperature:** - 55°C to + 275°C. **Wattage Rating:** 3, 5, 7, 10 and 15. **Dielectric Strength:** 1000 VAC. **Terminal Strength:** 5 pounds minimum.
	**MODEL CPSM** **Wirewound Resistors** Commercial, Power, Surface Mount, Fireproof Inorganic Construction	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 5%, ± 10%. **Resistance Range:** .1Ω to 700Ω. . **T. C.:** Below 1Ω = 0 ± 800PPM/°C. 1Ω and above = 0 ± 400PPM/°C. **Power Rating:** 3 watt and 5 watt. **Operating Temperature:** - 55°C to + 275°C.

For more information contact:
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COMMERCIAL, POWER Wirewound Resistors

Axial Lead, Vertical Mount, Four Lead Radial Terminals, Surface Mount

A COMPANY OF VISHAY DALE®

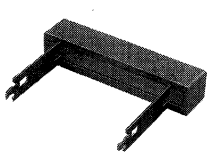
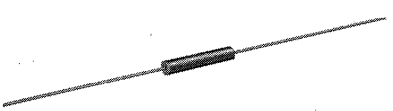
	**MODEL CPW** **Wirewound Resistors** Commercial, Power, Axial Lead, Fireproof Inorganic Construction, High Surge Capabilities, Non-inductive Models Available	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 1%, ± 2%, ± 3%, ± 5%. **Resistance Range:** .1Ω to 45kΩ. **T.C.:** Below 9.9Ω, ± 50PPM/°C. 10Ω & up, ± 30PPM/°C. **Maximum Working Voltage:** $\sqrt{PR}$. **Operating Temperature:** - 55°C to + 275°C. **Wattage Rating:** 2, 3, 5, 7, 10, 15 and 20.

COMMERCIAL, POWER Wirewound Fuse Resistors

Axial Lead, Radial Terminals

Custom Designed Molded Models Available

A COMPANY OF VISHAY DALE®

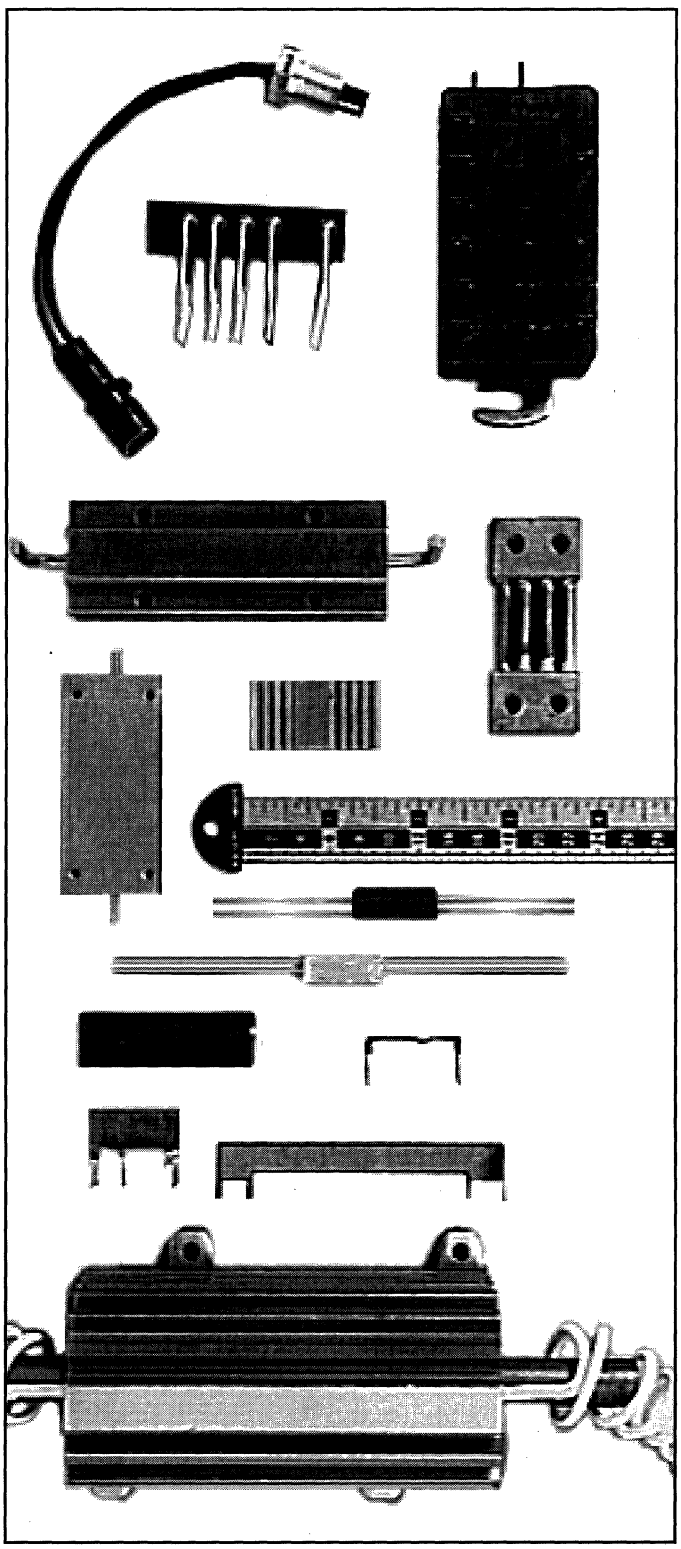
	**MODEL CA-(X)F** **Wirewound** **Fuse Resistors** Commercial, Power, Axial Lead, Multiple Physical Configurations Available	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 10% std. ± 5% available. **Maximum Working Voltage:** $\sqrt{PR}$. **Power Rating:** Model 4000, 4 watts per inch. Note: Generally standard processed units will fuse before 60 seconds when subjected to 12 x rated power minimum. By combining special alloys, materials and other techniques, faster fusing times may be accomplished. **Applications:** Kitchen appliances, automotive and entertainment devices, computers and power supplies.
	**MODEL CP-(X)F** **Wirewound** **Fuse Resistors** Commercial, Power, Axial Lead, Fireproof Inorganic Construction, Multiple Physical Configurations Available	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 5% minimum. **Resistance Range:** .05Ω to 1200Ω. **Operating Temperature:** - 55°C to + 275°C. **Terminal Strength:** 7 pound pull test. **Wattage Rating at 25°C:** 2, 3, 5, 7, 10, 15, 20 and 22. Note: Generally standard processed units will fuse before 60 seconds when subjected to 15 x rated power minimum. By combining special alloys, materials and other techniques, faster fusing times may be accomplished.
	**MODEL CPR-(X)F** **Wirewound** **Fuse Resistors** Commercial, Power, Circuit Board Lock-In Mounting Tabs, Radial Terminals, Multiple Phyical Configurations Available	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 5% minmum. **Resistance Range:** .1Ω to 1100Ω. **Operating Temperature:** - 55°C to + 275°C. **Terminal Strength:** 7 pound pull test. **Wattage Rating at 25°C:** 5, 7, 10, 15 and 20. Note: Generally standard processed units will fuse before 60 seconds when subjected to 15 x rated power minimum. By combining special alloys, materials and other techniques, faster fusing times may be accomplished.
	**MODEL RS-1F** **Wirewound** **Fuse Resistors** High Temperature Silicone Molded, Low T. C., Fast Acting, Custom Designed For Your Application	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 3%, ± 5% ± 10%. **Resistance Range:** .12Ω to 500Ω. **T.C.:** ±50PPM/°C, 1Ω thru 9.9Ω. ±30PPM/°C, 10Ω & up. **Power Rating:** 1.0 watt std. Higher ratings available. **Dielectric Strength:** 750 VAC. **Fusing Times:** 1 millsecond to 1 second. **Minimum Fusing Current:** Approximately 4 times the continuous operating current obtainable on some designs. Larger ratios produce better designs.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

SPECIAL PURPOSE Wirewound Resistors

Engineered to Your Special Requirements

A COMPANY OF VISHAY DALE®



The photo at left illustrates only a few of the many special purpose wirewound resistors built by the Dale Special Products Section in the Wirewound Division.

Full-time engineers assigned to this section draw on the industry's largest file of non-standard resistor design and production information. Often, in a matter of minutes, these engineers determine a fast, practical route to the production of your non-standard part.

The list below shows some of the options and combinations which can be achieved:

WIREWOUND OPTIONS

Construction: Heat sink, silicone coated, epoxy or silicone molded (single or multi-element), hermetic seal (ceramic tube or metal can encapsulated), clip mounted or fireproof inorganic construction.

Leads: Radial and axial type, special materials and dimensions, spaded, threaded, insulated, quick-disconnect eyelet, printed circuit, ferrule.

Matching: T. C. by pairs, value and set, close tolerance, resistance ratio.

Special Types: Extended low or high resistance range, adjustable, low reactance, special wire alloys, very low or high T. C., high stability, special tolerances, tapped, water cooled, temperature sensitive, inductive.

Pre-conditioning: Power aging, temperature cycling, temperature and power, short-time overload, thermal shock, X-ray, temperature aging.

Shunts: Low value, 4-terminal resistors built to customer specifications or designed by our engineers to meet your current sensing requirements.

Fuse Resistors: Our hybrid components designed to act as an ordinary resistor under normal circuit conditions, and as a fuse under fault conditions. Dale offers a variety of standard types, physical sizes and basic styles. Each application should be referred to Dale for an individual design to insure optimum performance in any particular circuit. See our special pages on fuse resistors.

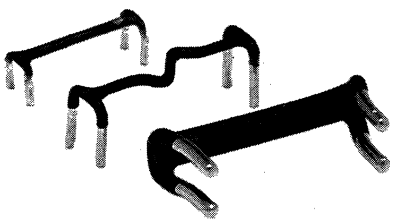
For Fast Attention to Your Special Resistor Requirements, Call or Write:

Special Products Section
Wirewound Division
DALE ELECTRONICS, INC.
1122 23rd Street, Columbus, NE 68601-3647
Phone (402) 563-6506

SPECIAL PURPOSE Wirewound Resistors

Four Terminal, Current Sensing For Instrumentation and Control

A COMPANY OF VISHAY DALE®



MODELS SPR-676 SPR-2039, SPR-2093 Wirewound Resistors

Special Purpose
Open Style
Designed for
Printed Circuit Boards

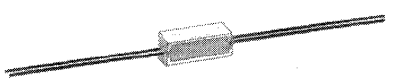
STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE	RESISTANCE RANGE (Ohms)	TYPICAL TOLERANCE
SPR-676	1	.0015-.05	.5%
SPR-2039	3.5	.0033-.05	1%
SPR-2093	13*	.0005-.002	1.5%

* Limited to 115 Amps.

DIMENSIONAL CONFIGURATIONS

MODEL	HOLE PATTERN	TERMINAL DIAMETER
SPR-676	.20 [5.08] x .70 [17.78]	.040 [1.02]
SPR-2039	.25 [6.35] x 1.0 [25.4]	.051 [1.30]
SPR-2093	.25 [6.35] x 1.0 [25.4]	.081 [2.06]



MODELS SPR-2073 SPR-2123, SPR-2091 Wirewound Resistors

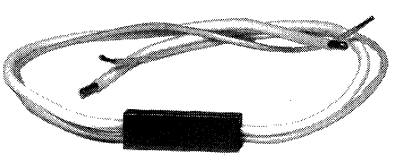
Special Purpose
Ceramic Potted
Designed for
Rugged Applications

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE	RESISTANCE RANGE (Ohms)	STANDARD TOLERANCE
SPR-2073	3	.001-.25	1%
SPR-2123	5	.001-.25	1%
SPR-2091	10	.001-.25	1%

DIMENSIONAL CONFIGURATIONS

MODEL	LENGTH	WIDTH	HEIGHT	TERMINAL
SPR-2073	.875 [22.22]	.312 [7.94]	.312 [7.94]	.040 x 2.0 [1.02 x 50.80]
SPR-2123	.875 [22.22]	.375 [9.52]	.344 [8.73]	
SPR-2091	1.875 [47.62]	.375 [9.52]	.344 [8.73]	



MODEL SPR-383 Wirewound Resistors

Special Purpose
Heat Sink Style, Silicone Molded Aluminum Housed Unit Featuring Flexible Teflon Insulated Leads to Meet Those Tough Environmental Requirements

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE	RESISTANCE RANGE (Ohms)	STANDARD TOLERANCE
SPR-383	3-5*	.005-.05	1%

* 3 watts free air, 5 watts heat sink.

DIMENSIONAL CONFIGURATIONS

MODEL	LENGTH	WIDTH	HEIGHT	TERMINAL
SPR-383	1.0 [25.40]	.312 [7.94]	.312 [7.94]	14 Awg or 22 Awg x 6 [152.38]



MODEL SPR-1005 Wirewound Resistors

Special Purpose
Silicone Molded
SPR-1005-26/MIL-R-49465/1 Qualified, Type RLV-10

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE	RESISTANCE RANGE (Ohms)	STANDARD TOLERANCE
SPR-1005	5*	.0008-.5	1%

* Limited to 25 Amps.

DIMENSIONAL CONFIGURATIONS

MODEL	LENGTH	WIDTH	TERMINAL
SPR-1005	.975 [24.77]	.380 [9.65]	.040 x 2.0 [1.02 x 50.80]



MODEL SPR-1014 Wirewound Resistors

Special Purpose
Fuse Clip
Mounted Style

FEATURES

- Designed for use in equipment requiring an easily changeable resistor for calibration of equipment to specific installation requirements. The 1 1/4 x 1/4 [31.75 x 6.35] unit mounts in a standard fuse clip. The value range is 1 ohm to 1 kilohm in 5% or 10% tolerance and dissipates 3 watts at 25°C. Extended value range and lower tolerances are available on request.

For more information contact:
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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

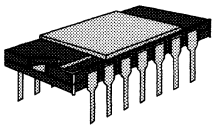
V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

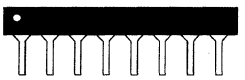
Y
YIG yttrium iron garnet

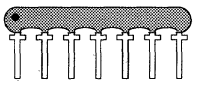
Z
ZIF zero insertion force

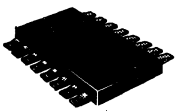
PRECISION THIN - FILM RESISTOR



HERMETIC DIP

MOLDED SIP 

COATED SIP 

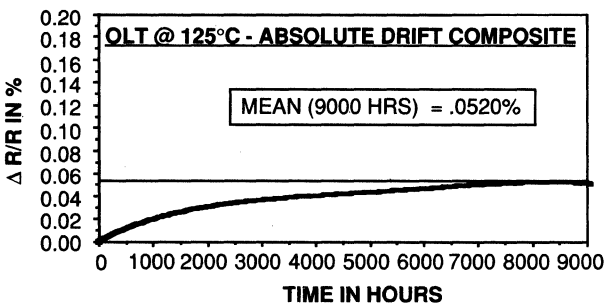
SOIC 

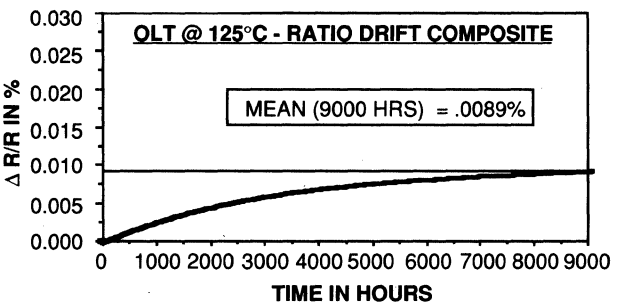
Electro - Films Inc. is a leading supplier of thin-film resistive components offering the broadest line of products in the industry. The products range from hybrid substrates, unpackaged resistor networks and chip resistors to a wide variety of packaged resistor networks including surface mount components.

Both NiCr and TaN resistor material can be sup - plied depending upon the application. Parts can be produced to MIL STD 883C level B or S, 83401 or 55342 as appropriate for the particular product. The table below illustrates the range of parameters attainable. All tolerances and values are not available in every type package or configuration. EFI Application Engineering looks forward to discussing your particular application and suggesting appropriate packaging solutions.

GENERAL PRODUCT CAPABILITY CHART

PARAMETER	NiCr	TaN
Resistance Values	1 ohm to 2 Megohm	1 ohm to 25 Megohm
Absolute Tolerance	±0.05%	±0.1%
Absolute TCR	5 PPM / °C to 50 PPM / °C	10 PPM /°C to 100 PPM / °C
Ratio Tolerance	±0.003%	±0.02%
Ratio TCR	±0.5 PPM / °C	±2.0 PPM / °C
Stability: 1000 Hrs. @ 125°C	0.020% Absolute; 0.005% Ratio	<0.2% Absolute; <0.04% Ratio
Stability: 1 Yr. @ 125°C	0.052% Absolute; 0.010% Ratio	
Stability: 1000 Hrs. @ 200°C	0.15% Absolute	





HYBRID CIRCUIT SUBSTRATES

* Patterned and etched
* With / without resistors
* Sizes to 3" x 4"
* Conductors: Au standard, Cu available
* Ni barrier for solderability
* Sputtered metals available: NiCr, TaN, TiW, TaW,Ti, Mo, Ni, Pd
* Plated metals: Au, Cu, Ni
* Overcoat for wirebond crossovers available
* MIL STD 883C, 2032 visual

UNPACKAGED RESISTOR NETWORKS

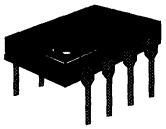
* Wide range of values on same chip
* Silicon or alumina substrates
* NiCr or TaN resistors
* MIL STD 883C, 2032 visual
* Tight ratio tolerance, to 0.003%
* Tight TCR tracking to ±0.5 PPM / °C

ELECTRO - FILMS INCORPORATED

111 GILBANE STREET, WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886
Tel. (401) 738-9150 TWX-EFI WRWK 710-382-0405 FAX 401-738-4389

COMPONENTS & PACKAGED NETWORKS

LLCC 

MOLDED DIP 

SLRC 

VERSA - CHIP 

PACKAGES

Electro-Films Inc. supplies custom designed resistor networks in almost all types of standard packages in addition to proprietary packages. Standard resistor interconnect configurations are available in some packages as indicated below. Both industrial and military versions, including MIL STD 883C level S for space applications, are available. Performance characteristics are summarized on the facing page. Ratio tolerances to 0.01% can readily be achieved in most packages.

PLUG - IN

DIPS (Dual In-Line Packages)

HERMETIC:
* 8, 14, 16, 18, 20, 24 leads
* MIL STD 883C level B or S, MIL STD 83401

MOLDED:
* MIL STD 83401
* 8, 14, 16, 18, 20, 24 leads

COATED:
* Even lead count 4 to 24 leads
* Industrial

Circuit Configurations for Hermetic, Molded & Coated DIPS
* Ladders (8,10, 12 Bits; both R /2R and Binary/BCD); 1 / 4 LSB @ room temperature , 1 / 2 LSB over temperature range of -55°C to 125°C
* MIL STD 83401 configurations A, B, F
* Voltage Dividers
* Standard and custom designs

SIPS (Single In-Line Packages)

MOLDED:
* 7, 8, 9, 10 leads
* MIL STD 83401 and Industrial

COATED:
* 3 to 10 leads
* Industrial

Circuit Configurations for Molded & Coated SIPS
* Series and common bus interconnections
* Mixed values and tolerances in the same package
* Standard and custom designs

TO-Headers:

HERMETIC:
* 3 to 10 leads
* MIL STD 883C level B or S

SURFACE MOUNT

LLCC: Leadless Chip Carrier:
* Hermetic: 16, 18, 20, 28 pads
* Industrial; MIL STD 83401
* MIL STD 883C level B or S

FLAT - PAKS:
* Hermetic: 14, 16, 24 leads STD.
* MIL STD 883C level B or S
* MIL STD 83401

PLCC: Plastic Leadless Chip Carrier:
*16, 18, 20, 28, 44 pads
* Industrial; MIL STD 83401
* Mixed values and tolerances

SOIC: Small Outline Integrated Circuit:
* 8, 14, 16 leads
* Industrial; MIL STD 83401

SLRC: Single Layer Resistor Carrier:
* 4 to 36 pads
* Industrial

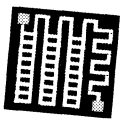
VERSA-CHIP:
* Plastic coated
* Leaded; 20 leads
* Industrial
* LLCC footprint

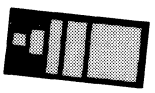
WRAP-AROUND CHIP RESISTORS:
* Std. 805, 1206; Other sizes available
* Tolerances to ±0.05% Abs.
* TCR's 10, 25 or 50 PPM /°C
* Solder coated or Gold terminals
* Nickel barrier for excellent solderability

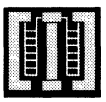
ELECTRO - FILMS INCORPORATED

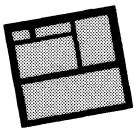
111 GILBANE STREET, WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886
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THIN - FILM CHIP RESISTORS

SFM 

CBB 

CTR 

CBC 

This is the broadest line of thin-film chip resistors available - silicon or alumina substrates, TaN or NiCr resistive material, wire bond or solder attach, tight absolute and center-tap ratio tolerances, low TCR and excellent long term stability. (For Microwave Chip Resistors, see our ad under Microwave Components.)

SILICON CHIP RESISTORS

TYPE	SIZE (Mils)	FEATURE	RESISTOR MATERIAL	* POWER
CTR	30 X 20	Center Tap - 1 Ω to 1MΩ	TaN or NiCr	250 mw
SFM	20 X 20	Single Value - 4.3 Ω to 1MΩ	TaN or NiCr	250 mw
BCR	20 X 20	Single Value, Back Contact	TaN	250 mw
SFX	40 X 40	Single Value - 1M to 2.5 MΩ	TaN	20 mw
MTR	33 X 33	Multi-Tap, 11 Taps 400 Ω to 240 KΩ	TaN	250 mw
PWA	30 X 45	Single Value - High Power	TaN or NiCr	500 mw
NET	30 X 30	(2) Resistors, series or isolated	TaN or NiCr	125 mw

* Power @70°C derated to 0 @ 175°C (100V max.)

ELECTRICAL SPECIFICATIONS	
TCR	± 100 PPM / °C STD ± 10, ±25, ±50 Special
Stability	< 0.2% Type dependent (1000 Hrs. @ 125°C)
Tolerance	0.1% to 10 %

MATERIAL SPECIFICATIONS		
Substrate	Silicon	10 ± 2 Mils
Dielectric	SiO2	10 KÅ Min.
Metalization	Aluminum	10 KÅ Min.
	Gold	15 KÅ Min.

ALUMINA CHIP RESISTORS

TYPE	SIZE** (Mils)	FEATURE	RESISTOR MATERIAL	POWER @ 125°C
1	20 X 40	20Ω to 24KΩ	TaN or NiCr	40 mw
2	30 X 30	25Ω to 40 KΩ	TaN or NiCr	40 mw
3	50 X 50	20Ω to 125 KΩ	TaN or NiCr	100 mw
4	50 X 100	40Ω to 400 KΩ	TaN or NiCr	175 mw
5	100 X 100	20Ω to 1 MΩ	TaN or NiCr	400 mw
6	30 X 45	20Ω to 59 KΩ	TaN or NiCr	60 mw

** All sizes available in Center Tapped versions.

ELECTRICAL SPECIFICATIONS		
TCR	±10, 25, 50 PPM / °C ± 100, 200 PPM / °C	NiCr TaN
Stability	< 0.05% / 1000 Hrs.@125°C	NiCr
Tolerance	±0.05% to 10 % C.T. Ratio to 0.01%	NiCr

MATERIAL SPECIFICATIONS		
Substrate	Alumina 99.6%	10 ± 2 Mils
Metalization	Gold	15 KÅ Min.
	Ni Barrier	5 KÅ Min.
	Solder	———

CHIP CAPACITORS

Thin Film MOS / MNOS Capacitor Chips

TYPE	SIZE (Mils)	FEATURE	Working Voltage (DC)
NCA	20 X 20	0.5 pf - 51 pf	100 V - 40 V
NCB	30 X 30	33 pf - 100 pf	100 V - 50 V
NCC	40 X 40	50 pf - 220 pf	100 V - 50 V
NCD	55 X 55	150 pf - 510 pf	100 V - 50 V
NCE	60 X 60	500 pf - 1000 pf	40 V - 25 V
CBA	20 X 30	0.25, 0.50, 1.0, 2.0 pf ±25% 1, 2, 4, 8 pf ±10%	100 V, 30 V
CBB	20 X 50	Binary 1, 2, 4, 8, 16 pf	75 V
CBC	46 X 46	Binary 3, 6, 12, 24, 48 pf	75 V

MATERIAL SPECIFICATIONS		
Substrate	Silicon	10 ±2 Mils
Dielectric	MOS / MNOS	———
Metalization	Aluminum	10 KÅ Min.
	Gold	15 KÅ Min.

ELECTRO - FILMS INCORPORATED
SEMI EF FILMS DIVISION
P.O. BOX 188, WEST HURLEY, NY, 12491 Tel. (914) 338-7714 FAX 914-338-6329

PRECISION WIREWOUND RESISTORS

GENERAL RESISTANCE
A PRIME TECHNOLOGY COMPANY

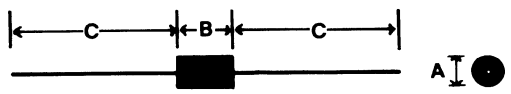
1,500,000 resistors in stock — all manufactured to meet the most exacting standards of accuracy, stability and reliability.

General Resistance has been engaged in the development and manufacture of precision wirewound resistors for over 30 years. The widest possible range of form factors is available, including axial and PC mounting types, in resistance values and accuracies to meet virtually any requirement.

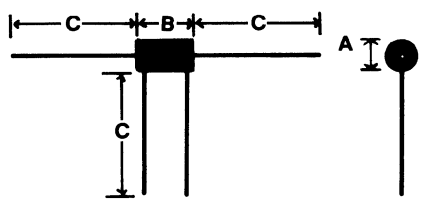
"Standard values" are normally available from stock. And *any* resistance value from 1Ω to 1,100,000Ω, as well as accuracies other than the "standard" ±0.1%, ±0.025% and ±0.01%, are available.

All General Resistance resistors are manufactured to the exacting standards typified by military specifications such as MIL-R-93/ MIL-R-39005 (RB and RBR styles).

ECONISTOR, MINI-OHM, AND MAXI-OHM

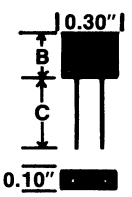


CURRISTOR

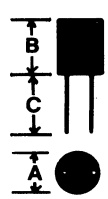


Type		Basic Resistance Range	Standard Accuracies	Stability	Tempco	Power Δ Rating ±0.1%@ +85°C	Max. Voltage	A Dia.	B Length	C Length of Wire	D† Wire Gauge
ECONISTOR (Axial-Leads)	8E16	1Ω to 1.1 Meg	±0.01% ±0.025% ±0.1% (others available)	±35ppm/ year	±5ppm/ °C max. −55°C to +125°C (others available)	8E16, 0.33W	200VDC or AC pk.	1/4" 6.4 mm	1/2" 12.7 mm	1-1/2" typ. 38 mm	22 AWG 0.6 mm
	8E24					8E24, 0.40W		1/4" 6.4 mm	3/4" 19.1 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
SQUARISTOR (PC Mounting)	GR102	1Ω to 100K				0.30W	150VDC or AC pk.	N/A	0.32" 8.1 mm	1" typ. 25 mm	22 AWG 0.6 mm
MAXI-OHM (Axial-Leads)	12E32	1Ω to 3.5M				12E32, 0.75W	600VDC or AC pk.	3/8" 9.5 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
	16E32	1Ω to 5M				16E32, 1.00W		1/2" 12.7 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
PLUGISTOR (PC Mounting)	8P13	1Ω to 200K				0.30W	150VDC or AC pk.	1/4" 6.4 mm	13/32" 10.3 mm	1" typ. 25mm	22 AWG 0.6 mm
MINI-OHM (Axial Leads)	5E10	1Ω to 80K		±50ppm/ year		0.2W	175VDC or AC pk.	5/32" 4 mm	5/16" 0.5 mm	1-1/2" typ. 38 mm	24 AWG 0.4 mm
CURRISTOR	8C24	0.01Ω to 100Ω			±10ppm/ °C std. (others available)	0.50W*		1/4" 6.4 mm	3/4" 19.1 mm	1" 25 mm	22 or 20 AWG 0.6 or 0.8 mm
	12C20					0.75W*		3/8" 9.5 mm	5/8" 15.9 mm	1" 25 mm	20 AWG 0.8 mm
	16C32					1.50W*		1/2" 12.7 mm	1" 25.4 mm	1" 25 mm	20 AWG or Terminals
	16C64					2.50W*		1/2" 12.7 mm	2" 51 mm	1" 25 mm	20 AWG or Terminals
	32C64					6.00W*		1" 25.4 mm	2" 51 mm	N/A	Terminals

SQUARISTOR



PLUGISTOR



ΔFor other tolerances consult factory

*Power ratings for Curristor are at + 100°C

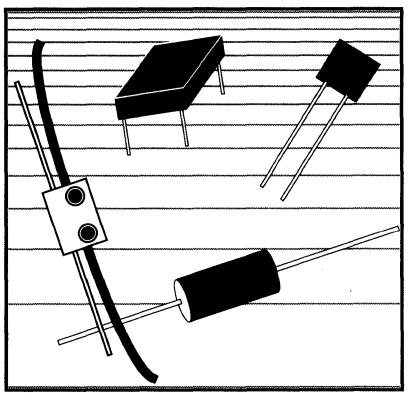
†All leads are tinned copper

GENERAL RESISTANCE
P.O. Box 185, North Branford, Connecticut 06471
TWX: 710-452-3092/FAX: (203) 481-8937
CALL **203 481-5721**

A COMPANY OF VISHAY ELLIOTT JORDAN

Precision Wirewound Resistors

Commercial/Industrial



Features

- All-welded construction
- Moisture-resistant epoxy encapsulation
- Electro-tinned oxygen-free copper leads (standard)
- Non-inductive reverse-PI wound (unless otherwise specified)
- Markings impervious to solvents
- Excellent long-term stability

General Specifications

- Resistance Range: 0.1Ω to 55MΩ
- Resistance Tolerance: ±0.005%, ±0.01%, ±0.02%, ±0.05%, ±0.1%, ±0.5%, ±1.0%
- Temperature Coefficient (TCR): < ±5 ppm/°C (–10°C to +80°C) < ±10 ppm/°C (–55°C to +125°C)
- TCR Tracking: Available to 2 ppm/°C
- Power Ratings: 0.030 Watts to 2 Watts @ +125°C
- Shelf-Life Stability: <50 ppm/yr.
- Insulation Resistance: >1000MΩ

Axial Leaded Styles

Sub-Miniature-Style Selection

E/J STYLE	OLD PART NUMBER		POWER RATING		MAX. WORKING VOLTAGE	CRITICAL RESISTANCE VALUE	RESISTANCE RANGE		DIMENSIONS		LEADS		MIL[2] EQUIV.
	ELLIOTT	JORDAN	75°C	125°C			MIN.	MAX.	DIA.[1] D±0.010	LENGTH[1] L±0.064	AWG	DIA.[1] d ±0.002	
A0931	-	J40	0.038	0.030	75	187K	0.1Ω	200K	0.097	0.312	24	0.020	
A0940	-	J40	0.050	0.040	75	140K	0.1Ω	300K	0.097	0.406	24	0.020	
A1020	E15-200	-	0.063	0.050	150	-	0.1Ω	250K	0.100	0.200	24	0.020	
A1025	E14	J60	0.063	0.050	75	113K	0.1Ω	250K	0.105	0.250	24	0.020	
A1030	E15	-	0.063	0.050	200	-	0.1Ω	250K	0.100	0.300	24	0.020	
A1221	-	J80	0.063	0.050	100	200K	0.1Ω	250K	0.125	0.215	24	0.020	
A1225	E12	J90	0.125	0.100	100	100K	0.1Ω	300K	0.125	0.250	24	0.020	
A1231	E17	-	0.125	0.100	200	-	0.1Ω	350K	0.125	0.312	22	0.025	
A1236	-	-	0.125	0.100	100	100K	0.1Ω	400K	0.125	0.375	24	0.020	
A1237	E18	J100	0.125	0.100	100	100K	0.1Ω	400K	0.125	0.375	22	0.025	
A1527	E29	J102	0.125	0.100	100	100K	0.1Ω	650K	0.155	0.270	22	0.025	
A1531	E24	-	0.156	0.125	300	720K	0.1Ω	800K	0.156	0.310	22	0.025	
A1535	E25	-	0.156	0.125	300	720K	0.1Ω	800K	0.156	0.350	22	0.025	
A1550	-	J105	0.188	0.150	150	150K	0.1Ω	1.5M	0.155	0.500	22	0.025	
A1825	E9	-	0.156	0.125	300	720K	0.1Ω	1.0M	0.187	0.250	22	0.025	
A1831	E28	-	0.156	0.125	300	720K	0.1Ω	1.0M	0.187	0.312	22	0.025	
A1838	E27	J110	0.188	0.150	150	150K	0.1Ω	1.5M	0.187	0.375	22	0.025	
A1850	-	J112	0.250	0.200	200	200K	0.1Ω	1.5M	0.187	0.500	22	0.025	RB74
A1862	E32	-	0.250	0.200	300	450K	0.1Ω	1.5M	0.187	0.625	22	0.025	

1. Dimensions listed are in inches. 2. Military type is for reference only, and does not imply QPL approval

Miniature-Style Selection

E/J STYLE	OLD PART NUMBER		POWER RATING		MAX. WORKING VOLTAGE	CRITICAL RESISTANCE VALUE	RESISTANCE RANGE		DIMENSIONS		LEADS		MIL[2] EQUIV.
	ELLIOTT	JORDAN	75°C	125°C			MIN.	MAX.	DIA.[1] D±0.010	LENGTH[1] L±0.064	AWG	DIA.[1] d ±0.002	
A2525	E31	J115	0.188	0.150	200	267K	0.1Ω	1.0M	0.250	0.250	22	0.025	
A2529	-	J116	0.218	0.175	300	515K	0.1Ω	2.0M	0.250	0.295	22	0.025	RB75
A2535	E40	J118	0.250	0.200	300	450K	0.1Ω	2.0M	0.250	0.350	22	0.025	
A2536	E40-20	-	0.313	0.250	300	360K	0.1Ω	2.0M	0.250	0.350	20	0.032	RB56
A2550	E48	J120	0.313	0.250	300	360K	0.1Ω	2.5M	0.250	0.500	22	0.025	
A2552	E48-20	-	0.412	0.330	300	360K	0.1Ω	2.5M	0.250	0.500	20	0.032	RB55
A2575	E56	J130	0.412	0.330	400	273K	0.1Ω	5.0M	0.250	0.750	22	0.025	
A2576	E56-20	-	0.625	0.500	600	485K	0.1Ω	4.0M	0.250	0.750	20	0.032	RB54
A25100	-	J132	0.625	0.500	400	320K	0.1Ω	5.0M	0.250	1.000	22	0.025	
A25101	E58	-	0.150	0.600	600	320K	0.1Ω	4.5M	0.250	1.000	20	0.032	
A3175	E71	-	0.562	0.450	400	356K	0.1Ω	5.0M	0.312	0.750	22	0.025	
A3181	-	J135	0.625	0.500	600	320K	0.1Ω	5.0M	0.312	0.812	22	0.025	RB76[2]
A3481	-	J138	0.750	0.600	600	267K	0.1Ω	5.0M	0.343	0.812	20	0.032	
A3750	E72	J140	0.412	0.330	400	485K	0.1Ω	7.5M	0.375	0.500	20	0.032	
A3762	E74	-	0.500	0.400	400	400K	0.1Ω	7.5M	0.375	0.625	20	0.032	
A3775	E57	J150	0.625	0.500	600	320K	0.1Ω	10.0M	0.375	0.750	20	0.032	RB53
A37100	E60	J160	1.250	1.000	600	360K	0.1Ω	13.0M	0.375	1.000	20	0.032	RB52
A5050	-	J170	0.625	0.500	400	320K	0.1Ω	12.5M	0.500	0.500	20	0.032	
A5062	E73	-	0.750	0.600	400	267K	0.1Ω	12.5M	0.500	0.625	20	0.032	
A5075	E59	J180	0.938	0.750	400	213K	0.1Ω	18.0M	0.500	0.750	20	0.032	
A50100	E61	J190	1.250	1.000	800	640K	0.1Ω	25.0M	0.500	1.000	20	0.032	RB57
A50125	E512	-	1.562	1.250	800	512K	0.1Ω	28.0M	0.500	1.250	20	0.032	
A50150	E64	J200	1.875	1.500	900	540K	0.1Ω	40.0M	0.500	1.500	20	0.032	RB58
A50200	E63	J210	2.500	2.000	1200	720K	0.1Ω	55.0M	0.500	2.000	20	0.032	RB59

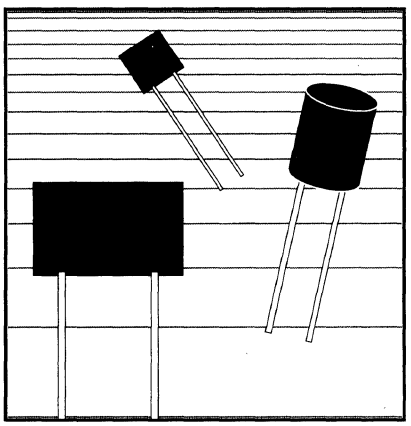
1. Dimensions listed are in inches. 2. Lead diameter per MIL-R-93 is 0.032" (20AWG). 3. Military type is for reference only, and does not imply QPL approval.

461 North 22nd Street ■ P.O. Box 1090 ■ Grand Junction, CO 81502 ■ (619) 690-2401 ■ FAX (619) 690-0132

A COMPANY OF VISHAY ELLIOTT JORDAN

Precision Wirewound Resistors

Space Saving Printed Circuit Styles



Features

- Space saving configurations
- All-welded construction
- Moisture-resistant epoxy encapsulation
- Electro-tinned oxygen-free copper leads (standard)
- Non-inductive reverse-PI wound (unless otherwise specified)
- Marking impervious to solvents
- Excellent long-term stability

General Specifications

- Resistance Range: 0.1Ω to 7MΩ
- Resistance Tolerance: ±0.005%, ±0.01%, ±0.02%, ±0.05%, ±0.1%, ±0.5%, ±1.0%
- Temperature Coefficient of Resistance (TCR):
  < ±5 ppm/°C (–10°C to +80°C)
  < ±10 ppm/°C (–55°C to +125°C)
- TCR Tracking: Available to 2 ppm/°C
- Power Ratings: 0.100 Watts to 0.700 Watts @ 125°C
- Shelf-Life Stability: <50 ppm/yr.
- Insulation Resistance: >1000MΩ

Printed-Circuit Cylindrical (P) Style Selection

E/J STYLE	OLD PART NUMBER		POWER RATING		MAX. WORKING VOLTAGE	CRITICAL RESISTANCE VALUE	RESISTANCE RANGE		DIMENSIONS		LEADS			MIL[2] EQUIV.
	ELLIOTT	JORDAN	75°C	125°C			MIN.	MAX	DIA.[1] D ±0.010	LENGTH[1] L ±0.032	SPACING[1] S ±0.005	AWG	DIA.[1] d ±0.002	
P1831	-	S302P	0.125	0.100	150	225K	0.1Ω	300K	0.187	0.315	0.100	24	0.020	
P1837	-	PB20	0.163	0.130	150	173K	0.1Ω	800K	0.187	0.375	0.100	22	0.025	
P2525	-	PB27	0.188	0.150	175	204K	0.1Ω	800K	0.250	0.250	0.100	24	0.020	
P2526	111P	-	0.250	0.200	175	153K	0.1Ω	1.0M	0.250	0.250	0.150	22	0.025	
P2527	111P-200	-	0.250	0.200	175	153K	0.1Ω	1.0M	0.250	0.250	0.200	22	0.025	
P2528	-	PB32	0.188	0.150	200	267K	0.1Ω	1.0M	0.250	0.280	0.150	22	0.025	
P2531	-	PB37	0.225	0.180	225	281K	0.1Ω	1.0M	0.250	0.312	0.200	22	0.025	RB71
P2535	114P	-	0.250	0.200	250	313K	0.1Ω	1.0M	0.250	0.350	0.150	22	0.025	
P2537	-	PB42	0.250	0.200	250	313K	0.1Ω	1.0M	0.250	0.375	0.150	24	0.020	
P2550	-	PB47	0.313	0.250	400	640K	0.1Ω	1.3M	0.250	0.500	0.175	22	0.025	
P2551	112P	-	0.313	0.250	300	360K	0.1Ω	1.3M	0.250	0.500	0.150	22	0.025	
P3750	72P	-	0.413	0.330	400	485K	0.1Ω	1.3M	0.375	0.500	0.250	20	0.032	
P3751	110P	PB52	0.500	0.400	400	400K	0.1Ω	5.0M	0.375	0.500	0.200	20	0.032	RB70
P5050	116P	-	0.625	0.500	400	320K	0.1Ω	7.0M	0.500	0.500	0.300	20	0.032	
P5051	-	PB57	0.625	0.500	400	320K	0.1Ω	7.0M	0.500	0.500	0.400	20	0.032	

1. Dimensions listed are in inches. 2. Military type is for reference only, and does not imply QPL approval.

Printed-Circuit Rectangular (PR) Style Selection

E/J STYLE	OLD PART NUMBER		POWER RATING		MAX. WORKING VOLTAGE	CRITICAL RESISTANCE VALUE	RESISTANCE RANGE		DIMENSIONS			LEADS		
	ELLIOTT	JORDAN	+75°C	+125°C			MIIN.	MAX.	HEIGHT[1] H ±0.020	LENGTH[1] L ±0.020	WIDTH[2] W ±0.020	SPACING S ±0.005	AWG	DIA.[1] d ±0.002
PR2525	-	HD10	0.250	0.200	100	80K	0.1Ω	1.0M	0.250	0.250	0.125	0.125	20	0.032
PR2526	192P	-	0.156	0.125	100	50K	0.1Ω	1.0M	0.250	0.250	0.125	0.125	22	0.025
PR3230	191P	-	0.375	0.300	200	133K	0.1Ω	1.5M	0.320	0.300	0.100	0.150	22	0.025
PR2550	-	HD20	0.313	0.250	200	160K	0.1Ω	1.5M	0.250	0.500	0.140	0.250	20	0.032
PR3231	-	HD102	0.375	0.300	200	133K	0.1Ω	1.0M	0.328	0.306	0.110	0.150	22	0.025
PR5256	190P	-	0.625	0.500	300	180K	0.1Ω	1.5M	0.520	0.565	0.150	0.400	22	0.025
PR5387	189P	-	0.875	0.700	400	229K	0.1Ω	1.5M	0.530	0.875	0.180	0.650	22	0.025

1. Dimensions listed are in inches.

Other Available Wirewound Products

- Ultra High Stability
  - Hermetically Sealed
- Four Terminal Low ohmic Value
  - Tight tolerance
- Networks
- Special TCR to +6000 ppm/°C
  - Temperature compensating
  - Temperature sensing
- Low Reactance - High Speed
- Matched Sets

461 North 22nd Street ■ P.O. Box 1090 ■ Grand Junction, CO 81502 ■ (619) 690-2401 ■ FAX (619) 690-0132

HY-MEG CORPORATION
852-854 WESTGATE DR. ADDISON, IL 60101

PHONE (708) 543-9250 FAX (708) 543-9260

HA PRECISION RESISTORS

- Excellent long term stability
- TCR'S-25 PPM to 100 PPM
- Tolerances–0.1% to 10.0%
- Matched sets available
- Preconditioning available to 10 kV

SPECIFICATIONS

HMC Type	Watt-age	Voltage Rating	Resistance* Min.	Resistance* Max.	Maximum Dimensions CL	Maximum Dimensions BD	Maximum Dimensions LD +/–.002"
HA-55	.25W	500VDC	10K	100M	.290 (7.366)	.100 (2.54)	.025 (.635)
HA-60	.50W	750VDC	10K	100M	.405 (10.287)	.165 (4.191)	.032 (.812)
HA-600	.75W	1000VDC	20K	100M	.590 (14.986)	.165 (4.191)	.032 (.812)
HA-65	1.0W	1500VDC	20K	100M	.620 (15.748)	.195 (4.953)	.032 (.812)
HA-650	1.5W	3000VDC	50K	100M	1.210 (30.734)	.195 (4.953)	.032 (.812)
HA-70	2.0W	3500VDC	50K	100M	.835 (21.209)	.255 (6.477)	.032 (.812)
HA-80	3.0W	5000VDC	75K	100M	.965 (24.511)	.340 (8.636)	.032 (.812)
HA-100	4.0W	7500VDC	100K	100M	1.815 (46.101)	.340 (8.636)	.032 (.812)
HA-120	5.0W	10,000VDC	150K	100M	2.130 (54.102)	.340 (8.636)	.032 (.812)

* For other resistance values consult factory.

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

LOADLIFE (1000 hrs. RATED VOLTAGE AT 70 C)	.25%
OVERLOAD (1.5 TIMES RATED VOLTAGE FOR 10 SEC)	.2%
MOISTURE RESISTANCE (NO LOAD POLAR)	.5%
THERMAL SHOCK	.25%
SOLDER EFFECT	.1%
TERMINAL STRENGTH	.2%
SHELF LIFE (1 yr. AT 25 C)	.1%
INSULATION RESISTANCE (AT 500 VDC)	10KMegs
LOW TEMPERATURE OPERATION	.25%
HIGH-TEMPERATURE EXPOSURE	
150 C FOR 2000 HRS.	.5%
175 C FOR 2000 HRS.	.75%
DIELECTRIC STRENGTH	.25%

HV HIGH VOLTAGE RESISTORS

- TCR'S–25 PPM to 100 PPM
- Tolerances-0.5% to 10%
- Resistance values to 50 GIG OHM
- VCR'S to 1 PPM available
- Preconditioning available

SPECIFICATIONS

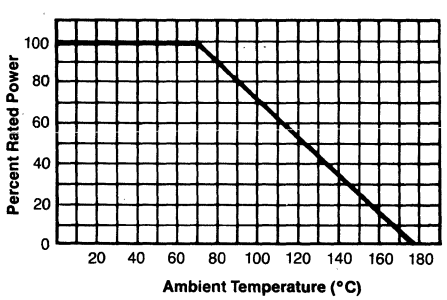
HMC Type	Watt-age	Voltage Rating	Resistance* Min.	Resistance* Max.	Maximum Dimensions CL	Maximum Dimensions BD	Maximum Dimensions LD +/–.002"
HV-55	.50W	750VDC	25K	1000M	.290 (7.366)	.100 (2.54)	.025 (.635)
HV-60	1.0W	1500VDC	25K	5000M	.405 (10.287)	.165 (4.191)	.032 (.812)
HV-600	1.5W	1750VDC	50K	10KM	.590 (14.986)	.165 (4.191)	.032 (.812)
HV-65	2.0W	2500VDC	50K	10KM	.620 (15.748)	.195 (4.953)	.032 (.812)
HV-650	2.5W	4000VDC	100K	20KM	1.210 (30.734)	.195 (4.953)	.032 (.812)
HV-70	3.0W	5000VDC	100K	20KM	.835 (21.209)	.255 (6.477)	.032 (.812)
HV-80	4.0W	7500VDC	150K	30KM	.965 (24.511)	.340 (8.636)	.032 (.812)
HV-100	5.0W	15,000VDC	200K	50KM	1.815 (46.101)	.340 (8.636)	.032 (.812)
HV-120	6.0W	20,000VDC	300K	50KM	2.130 (54.102)	.340 (8.636)	.032 (.812)

* For other resistance values consult factory.

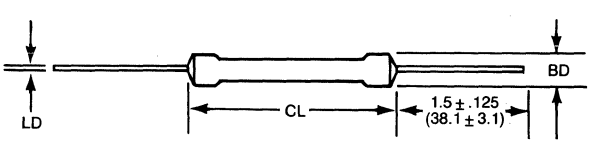
ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

LOADLIFE (1000 hrs. RATED VOLTAGE AT 70 C)	.5%
OVERLOAD (1.5 TIMES RATED VOLTAGE FOR 10 SEC)	.3%
MOISTURE RESISTANCE (NO LOAD POLAR)	.5%
THERMAL SHOCK	.25%
SOLDER EFFECT	.1%
TERMINAL STRENGTH	.2%
SHELF LIFE (1 yr. AT 25 C)	.25%
INSULATION RESISTANCE (AT 500 VDC)	10KMegs
LOW TEMPERATURE OPERATION	.25%
HIGH-TEMPERATURE EXPOSURE	
150 C FOR 2000 HRS.	.5%
175 C FOR 2000 HRS.	.75%
DIELECTRIC STRENGTH	.25%

POWER DERATING CURVE



DIMENSIONS inches (mm)



FOR FAST HELP ON NEW & RUSH ORDERS CALL 1-800-322-1953
FOR TECHNICAL INFORMATION CALL 1-708-543-9252

HY-MEG CORPORATION
852-854 WESTGATE DR. ADDISON, IL 60101

PHONE (708) 543-9250 FAX (708) 543-9260

HM ULTRA PRECISION METAL FILM

- Low Temperature Coefficients
- Resistance Tolerances— 0.5%, 0.25%, 0.1%, 0.05%, 0.02%
- Excellent long term stability
- Long term shelf life
- Fast delivery available

SPECIFICATIONS

HMC Type	Wattage		Volts	Resistance*		Max. Dimensions		
	70C	125C	Max.	Min.	Max.	CL	BD	LD
HM125	1/8	1/10	200	10 ohms	250k	.290 (7.366)	.100 (2.54)	.025 (.635)
HM250	1/4	1/8	250	10 ohms	500k	.405 (10.287)	.165 (4.191)	.032 (.812)
HM500	1/2	1/4	300	10 ohms	500k	.620 (15.748)	.195 (4.953)	.032 (.812)

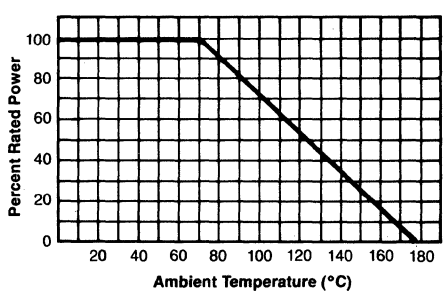
TRC CODE

CODE	MIL CHAR.	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE
T-2	C	+/– 50ppm/C	-20C to +85C
T-9	E	+/– 25ppm/C	–20C to +85C
T-13		+/– 10ppm/C	–20C to +85C
T-16		+/– 5ppm/C	–20C to +85C

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

LOADLIFE (1000 hrs. AT 25 C)	.25%
SHORT TIME OVERLOAD (2 TIMES RATED VOLTAGE FOR 10 SEC)	.05%
MOISTURE RESISTANCE	.05%
THERMAL SHOCK	.15%
DIELECTRIC STRENGTH	.02%
INSULATION RESISTANCE	10KM
SHELF LIFE (1 yr. AT 25 C)	.03%
TERMINAL STRENGTH	.01%
LOW TEMPERATURE STORAGE	.05%
SHOCK	.02%
VIBRATION	.03%
HIGH TEMPERATURE EXPOSURE	.1%

POWER DERATING CURVE



HW PRECISION WIRE WOUND RESOURCES

- Resistance Tolerances to .02%
- Temperature Coefficients ±10 & 20 PPM
- Both Tol. & T.C.R. matched sets available
- Fast delivery available
- All welded construction

SPECIFICATIONS

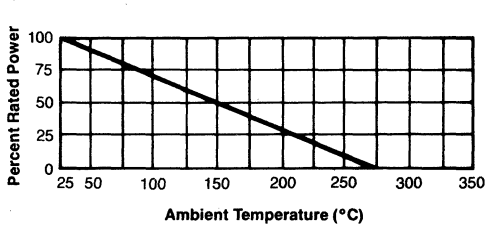
HMC Type	Watt-age	Voltage Rating	Resistance*		Maximum Dimensions		
			Min.	Max.	CL	BD	LD +/–.002"
HW-2	.25W	20VDC	1 ohm	600 ohms	.290 (7.366)	.109 (2.768)	.025 (.635)
HW-5	.50W	35VDC	2 ohms	2.0k	.460 (11.684)	.130 (3.302)	.032 (.812)
HW-10	1.0W	44VDC	2 ohms	2.5k	.435 (11.044)	.165 (4.191)	.032 (.812)
HW-15	1.5W	65VDC	3 ohms	3.0k	.520 (13.208)	.205 (5.207)	.032 (.812)
HW-30A	3.0W	130VDC	4 ohms	6.0k	.550 (13.970)	.240 (6.096)	.032 (.812)
HW-30	3.0W	130VDC	4 ohms	6.0k	.620 (15.748)	.205 (5.207)	.032 (.812)
HW-40	4.0W	210VDC	8 ohms	10.0k	.830 (21.082)	.290 (7.366)	.032 (.812)
HW-50	5.0W	360VDC	10 ohms	15.0k	.970 (24.638)	.325 (8.255)	.032 (.812)

* For other resistance values consult factory.

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

LOADLIFE (1000 hrs. AT 25 C)	.25%
SHORT TIME OVERLOAD (2 TIMES RATED VOLTAGE FOR 10 SEC)	.05%
MOISTURE RESISTANCE	.05%
THERMAL SHOCK	.15%
DIELECTRIC STRENGTH	.02%
INSULATION RESISTANCE	10KM
SHELF LIFE (1 yr. AT 25 C)	.03%
TERMINAL STRENGTH	.01%
LOW TEMPERATURE STORAGE	.05%
SHOCK	.02%
VIBRATION	.03%
HIGH TEMPERATURE EXPOSURE	.1%

POWER DERATING CURVE



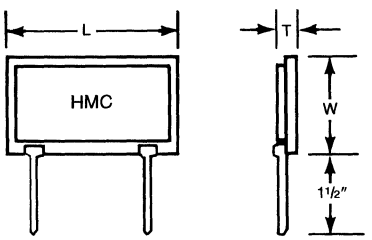
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FOR TECHNICAL INFORMATION CALL 1-708-543-9252

HY-MEG CORPORATION
852-854 WESTGATE DR. ADDISON, IL 60101

PHONE (708) 543-9250 FAX (708) 543-9260

FV HIGH VOLTAGE PLATE RESISTORS

- Non-inductive design
- Tolerances - 0.5% to 20%
- TCR's - 25 PPM to 150 PPM
- Extremely low VCR's available
- Power Conditioning to 10kVDC available
- Wide Resistance Range to 10,000 Megohms



HMC Type	Wattage	Voltage Rating	Resistance* Min.	Resistance* Max.	Dimensions +/– .010" L	W	T	LD +/– .002"
FV-3	2.0W	5KVDC	1 MEG	1.2KM	1.000 (25.400)	.350 (8.890)	.100 2.540	.032 (.812)
FV-4	4.0W	10KVDC	1 MEG	5.0KM	2.000 (50.800)	.350 (8.890)	.100 (2.540)	.032 (.812)
FV-5	2.0W	7.5KVDC	1 MEG	5.0KM	1.000 (25.400)	.500 (12.70)	.100 (2.540)	.032 (.812)
FV-7	3.0W	12KVDC	1 MEG	5.0KM	1.100 (27.940)	.580 (14.73)	.100 (2.540)	.032 (.812)
FV-10	4.0W	20KVDC	1 MEG	5.0KM	2.000 (50.080)	.500 (12.70)	.100 (2.540)	.032 (.812)
FV-15	6.0W	30KVDC	1 MEG	10KM	2.000 (50.080)	1.00 (25.40)	.100 (2.540)	.032 (.812)

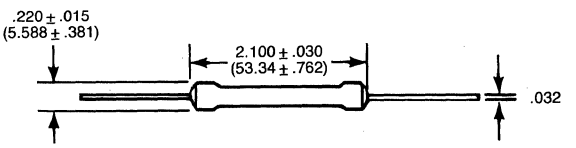
* For other resistance values consult factory.

UH-1M–NEW RESISTOR PRODUCT

Hy-Meg Corporation, thru the use of state-of-the-art thick film technology, is now able to offer resistance values up to 3 teraohms with nearly identical performance as standard thick film axial leaded resistors. By using a cermet film element, we are able to manufacture a resistor with electrical and mechanical properties far exceeding those of the older carbon element type resistor.

The protective coating used on UH-1M resistors was developed to provide long term stability and exceptional protection against moisture.

DIMENSIONS



POWER RATING: The power rating for any UH-1M resistor is 1 watt at 25°C.

RESISTANCE: UH-1M resistors are available in values from 1×10^8 to 3×10^{12} Ohms.

TOLERANCE: 1,2,5,10 and 20 percent are available over the entire value range.

MAXIMUM WORKING VOLTAGE: 1,500 volts DC.

MAXIMUM OPERATING TEMPERATURE: 125°C ambient.

TYPICAL TEMPERATURE AND VOLTAGE COEFFICIENTS (IN PPM)					
Resistance Decade (ohms)	10^8	10^9	10^{10}	10^{11}	10^{12}
Temperature Coefficient	100	100	150	250	350
Voltage Coefficient	1	1	1	2	2

NOTE: Voltage Coefficient between 100VDC and 1000VDC.
Temperature Coefficient from 25°C to 125°C

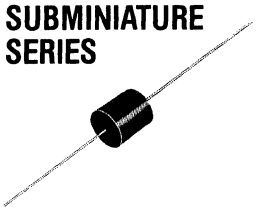
OTHER PRODUCTS AND SERVICES

- CUSTOM RESISTORS AND RC. NETWORKS ON SUBSTRATES
- MATCHED RESISTOR SETS
- 100% VOLTAGE COEFFICIENT TESTING AVAILABLE
- POWER CONDITIONING AND OTHER SPECIALIZED TESTING AVAILABLE.

FOR FAST HELP ON NEW & RUSH ORDERS CALL 1-800-322-1953
FOR TECHNICAL INFORMATION CALL 1-708-543-9252

Precision Wirewound Resistors

AXIAL SUBMINIATURE SERIES



Imperial Type	Commercial Wattage	Maximum Voltage	Maximum* Resistance	Minimum ± Tolerance	Diameter ± .005"	Length ± .025"	Lead AWG	Diameter MM	Length MM
M02	.06	75	50 K	.1%	.100	.210	24	2.5	5.3
M03	.08	100	150 K	.05%	.125	.260	24	3.2	6.6
M04	.10	100	250 K	.05%	.125	.375	24	3.2	9.5
M05	.125	150	400 K	.01%	.187	.250	22	4.7	6.3
M06	.15	150	500 K	.01%	.187	.295	22	4.7	7.5
M07	.25	250	1.0 M	.005%	.210	.465	22	5.3	11.8
M012	.20	200	750 K	.005%	.187	.450	22	4.7	11.4
MO13	.10	100	250 K	.05%	.156	.312	24	4.0	7.9
M015	.175	200	750 K	.005%	.187	.375	22	4.7	9.5

* Minimum Resistance of above Series is 100 OHMS

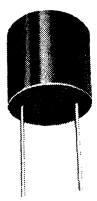
AXIAL MINIATURE SERIES



Imperial Type	Commercial Wattage	Maximum Voltage	Maximum* Resistance	Minimum ± Tolerance	Diameter ± .025"	Length ± .025"	Lead AWG	Diameter MM	Length MM
A00	.20	200	800 K	.005%	.250	.375	20/22	6.3	9.5
A01	.25	300	1.2 MEG	.005%	.250	.500	20/22	6.3	12.7
A02	.33	400	2.5 MEG	.005%	.250	.750	20/22	6.3	19.1
A03	.50	400	7.5 MEG	.005%	.375	.885	20	9.5	22.4
A04	.50	400	7.0 MEG	.005%	.500	.500	20	12.7	12.7
A05	.60	400	7.0 MEG	.005%	.500	.625	20	12.7	15.9
A06	1.00	800	12 MEG	.005%	.500	1.000	20	12.7	25.4
A07	1.50	900	15 MEG	.005%	.500	1.500	20	12.7	38.1
A08	2.00	1000	25 MEG	.005%	.500	2.000	20	12.7	50.8
A20	.40	300	3.0 MEG	.005%	.375	.500	20	9.5	12.7
A21	.50	400	6.0 MEG	.005%	.375	.750	20	9.5	19.1
A29	.75	600	10 MEG	.005%	.375	1.000	20	9.5	25.4

* Minimum Resistance of above Series is 50 OHMS

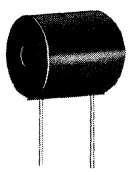
PRINTED CIRCUIT SERIES



Imperial Type	Commercial Wattage	Maximum Voltage	Maximum* Resistance	Minimum ± Tolerance	Diameter ± .005"	Length ± .025"	Lead Diameter	Lead Spacing ± .010"	
A00PC	.125	150	500 K	.01%	.250	.375	AWG 22	.150	
A01PC	.25	150	600 K	.005%	.250	.500	AWG 22	.150	
A04PC	.50	400	1 MEG	.005%	.500	.500	AWG 22	.300	
A20PC	.50	300	800 K	.005%	.375	.500	AWG 20	.200	
A30PC	.125	150	500 K	.01%	.250	.312	AWG 22	.150	
A31PC	.125	150	500 K	.01%	.250	.312	AWG 22	.200	

* Minimum Resistance of above Series is 50 OHMS

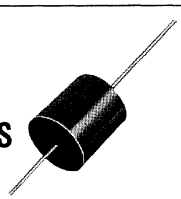
RADIAL LEAD AND LUG



Imperial Type	Commercial Wattage	Maximum Voltage	Maximum* Resistance	Minimum ± Tolerance	Diameter ± .025"	Length ± .025"	Type Terminal	Terminal Spacing ± .015"	Mounting Hole
A01RL	.25	150	750 K	.005%	.250	.500	AWG 22	.400	NONE
A04RL	.50	400	4 MEG	.005%	.500	.500	AWG 20	.400	#6 Screw
A06RL	1.00	800	8 MEG	.005%	.500	1.000	AWG 20	.850	#6 Screw
A21RL	.50	300	1.0 MEG	.005%	.375	.750	AWG 20	.600	#6 Screw
A39RL	.125	100	500 K	.01%	.250	.250	AWG 22	.200	NONE
A04L	.50	400	4 MEG	.005%	.500	.500	LUG	.325	#6 Screw

* Minimum Resistance of above Series is 50 OHMS

FAST RISE SERIES



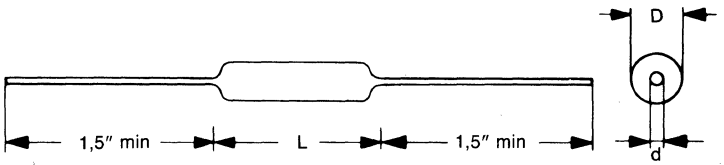
Imperial Type	Commercial Wattage	Maximum Voltage	Maximum* Resistance	Minimum ± Tolerance	Diameter ± .025"	Length ± .025"	Lead AWG	Diameter MM	Length MM
FM015	.175	200	500 K	.01%	.187	.375	22	4.7	9.5
FA01	.25	300	1.0 MEG	.01%	.250	.500	20	6.3	12.7
FA02	.33	400	1.25 MEG	.01%	.250	.750	20	6.3	19.1
FA21	.50	400	5 MEG	.01%	.375	.750	20	9.5	19.1
FA06	1.00	800	10 MEG	.01%	.500	1.000	20	12.7	25.4

* Minimum Resistance of above Series is 50 OHMS

IMPERIAL ASTRONICS
An ANDIG Company
19151-J Parthenia Street, Northridge, California 91324 • (818) 886-7672 - Fax: (818) 886-4658

Power Precision Wirewound Resistors

- ❑ 0.4W to 10.0W at 275°C
- ❑ Space efficient
- ❑ Welded Construction
- ❑ High temperature conformal coating
- ❑ Radial leads available
- ❑ Tolerances to ±.01%
- ❑ Meets MIL-R-26 requirements



Imperial Type	MIL-R-24/ MIL-R-39007	Wattage Rating	Maximum Resistance		Dimensions (inches)		Lead Diameter "d"
			Imp.	Mil.	Length "L" ±.067"	Diameter "D" ±.03"	A
PA ½ A		.4	2.5 K		.250	.078	#22/#24
PA ½		.75	7.5 K		.330	.078	#24
PA 1 A	RW-70	1.6	10 K	3.16 K	.406	.094	#22/#24
PA 2 A	RW-69	2.5	2.2 K	2 K	.500	.187	#20
PA 2		1.5	12.5 K	10.5 K/	.350	.156	#22/#20
PA 2 B	RW-79 RWR-89	3.0	2,2 K	4.12 K	.560	.187	#20
PA 2 C		3.0	40 K		.500	.250	#20/#18
PA 3		4.0	45 K	38.3 K/	.625	.250	#20/#18
PA 5	RW-74 RWR-74	5.0	91 K	12,1 J	.875	.312	#18
PA 5 A		5.0	65 K		.970	.203	#20/#18
PA 6	RW-67	5.0	95 K	8.2 K	1.094	.312	#18
PA 7 A		7.0	150 K		1.375	.375	#18
PA 10	RW-78 RWR-78	10.0	200 K	90.0 K	1.780	.375	#18

STANDARD TOLERANCES (±): 0.05%, 0.10%, 0.25%, 1.0%, 3.0%, 5.0%

STANDARD TEMPERATURE COEFFICIENTS:

1 to 9 Ω ±50 PPM/°C
10 Ω and above ±20 PPM/°C
below 1 Ω ±90 PPM/°C

Consult factory for special temperature coefficient requirements.

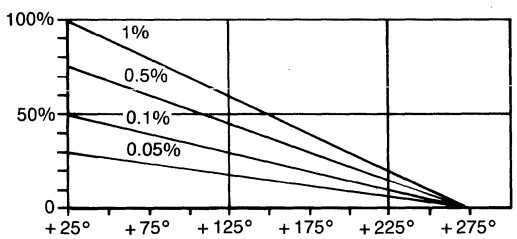
CONSTRUCTION:

Alumina Oxide Core. Coppernickel alloy or nickel chrome alloy resistance wire. Leads are copperweld, tinned, solderable and weldable.
Lead diameter: AWG#18 (.040"), #20 (.032"), #22 (.025"), #24 (.020").

Non-inductive winding available: Divide maximum resistance by two; mulitply maximum voltage by 0.707. Specify Imperial type "NPA.

POWER RATING:

Maximum continuous operating temperature is 275°C per MIL-R-26.



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An ANDIG Company
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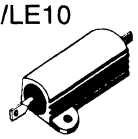
Aluminum Housed Power Precision Wirewound Resistors

- 6.0W to 50.0W at 275°C
- Designed to provide maximum heat dissipation
- Ideal high power to size ratio
- Aluminum housing allows chassis mounting and heat sink capabilities
- "LE" Type is an ideal substitute for our "PL" type (slightly longer lead time).
- Meets or exceeds MIL-R-18546 and MIL-R-39009

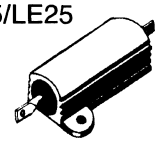
PL5/LE5



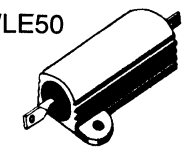
PL10/LE10



PL25/LE25



PL50/LE50

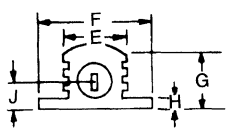


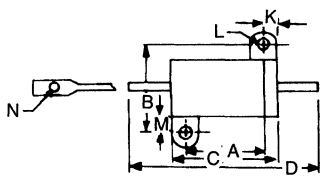
Imperial Type		MIL-R-39009 MIL-R-18546D	Wattage Rating			Maximum Resistance		Max. Weights (Grams)
Standard	Ecopower		PL	LE	MIL	PL	LE	
PL5	LE5	RER-60/RE-60	7.5	6	5	22K	18K	3
PL10	LE10	RER-65/RE-65	12.5	10	10	47K	40K	7
PL25	LE25	RER-70/RE-70	25	25	20	90K	80K	14
PL50	LE50	RER-75/RE-75	50	30	30	250K	200K	29

CHASSIS DIMENSIONS: (inches).

4 × 6 × 2 × .040 PL5, LE5, PL10, LE10

5 × 7 × 2 × .040 PL25, LE25, PL50, LE50





Imperial Type														
Standard	Ecopower	A	B	C	D	E	F	G	H	J	K	L	M	N
PL5	LE5	444 ±.005	.490 ±.005	.600 ±0.31	1.125 ±.062	.334 ±.015	.646 ±.015	.320 ±.015	.065 ±.010	.140 ±.010	.078 ±.020	.093 ±.005	.078 ±.015	.050 ±.005
PL10	LE10	.562 ±.005	.625 ±.005	.750 ±0.31	1.375 ±.062	.430 ±.015	.800 ±.015	.400 ±.015	.075 ±.010	.190 ±.010	.093 ±.010	.093 ±.005	.102 ±.015	.086 ±.005
PL25	LE25	.719 ±.005	.781 ±.005	1.062 ±0.31	1.938 ±.062	.530 ±.015	1.080 ±.015	.560 ±.015	.085 ±.010	.260 ±.010	.172 ±.010	.125 ±.005	.125 ±.015	.086 ±.005
PL50	LE50	1.563 ±.005	.844 ±.005	1.968 ±0.31	2.781 ±.062	.615 ±.015	1.140 ±.015	.615 ±.015	.085 ±.010	.300 ±.031	.196 ±.010	.125 ±.005	.125 ±.015	.086 ±.005

STANDARD TOLERANCES: ±0.05% to ±3.0%

STANDARD TEMPERATURE COEFFICIENTS: ±20 PPM/°C. Other temperature coefficients available. Higher T.C. on low Ω values.

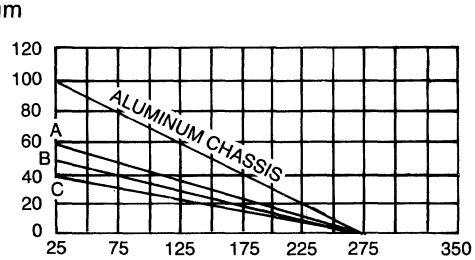
CONSTRUCTION: Steatite or Alumina core. Completely welded.

Non-Inductive Winding: Divide maximum resistance by two; multiply working voltage by .707. Specify Imperial Type "NPL" or "NLE".

POWER RATING: Operating temperature range: −55°C to +275°C Maximum hotspot under full rated power at ±25°C ambient per MIL-R-18546.

Derating is required for reduced chassis mounting area and for high ambient temperatures.

A = PL/LE 5, PL/LE 10
B = PL/LE 25
C = PL/LE 50



IMPERIAL ASTRONICS
An ANDIG Company

19151-J Parthenia Street, Northridge, California 91324 • (818) 886-7672 - Fax: (818) 886-4658

Since 1974
INTERNATIONAL MANUFACTURING SERVICES, INC.
IMS

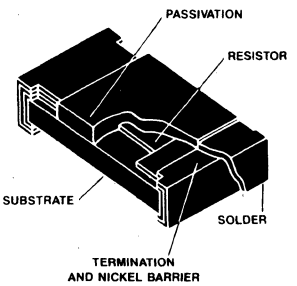
Solderable SURFACE MOUNT Chip Resistors

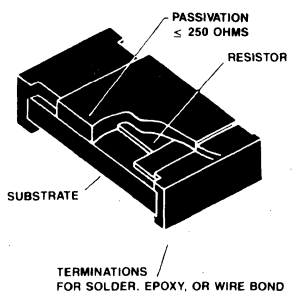
24 Hour Delivery Our Specialty.

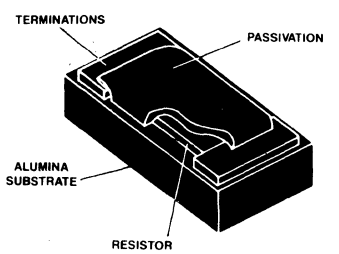
LARGE SELECTION OF VALUES IN STOCK FOR SAME DAY SHIPMENT

Testing to MIL-R-55342 and MIL-STD-883 and Certificate of Compliance can be provided.

IMS No.	Typ. Long (in.)	Typ. Wide (in.)	Max. Thick (in.)	Free Air Power Rating	Max Volts	Value Range	Toler. "X" to 20%	Standard PACKAGING Tape/ Reel**	Bulk
Wraparound Terminations: Ni Barrier & tinned:									
RC0603	0.063	0.032	0.022	63mW	50	3.9 Ohms-3.3 Meg	1%	+	
(mm)	1.6	0.8	0.55						
RC0805	0.079	0.049	0.022	175mW	150	1 Ohm-5.6 Meg	1%	+	
(mm)	2	1.25	0.55			>500 values in stock			
RC1206	0.122	0.061	0.026	250mW	200	1 Ohm-10 Meg	1%	+	
(mm)	3.1	1.55	0.65			>500 values in stock			
RC2010	0.200	0.100	0.026	500mW	200	1 Ohm-100K	1%	+	
(mm)	5	2.5	0.65						
RC2512	0.250	0.126	0.026	1W	350	1 Ohm-10K	1%		+
RT2512	0.250	0.126	0.026			Customer trimmable	+0/−30%		+
(mm)	6.3	3.15	0.65						
***Wraparound Terminations: PtAu (Platinum gold); or PtAu & solder:**									
RC0402	0.045	0.025	0.020	125mW	60	1 Ohm-20 Meg	2%		+
RC-85	0.065	0.045	0.013	175mW	150	3.3 Meg to 200 M	5%		+
***Flipchip: PdAg (Palladium silver) & solder: or PdAg: or PtAu**									
IMS000	0.045	0.030	0.016	125mW	60	1 Ohm-25 Meg	1%		+
IMS001	0.050	0.050	0.016	125mW	45	0.1 Ohm-25 Meg	1%		+
IMS002	0.075	0.050	0.016	175mW	100	1 Ohm-250 Meg	1%		+
IMS003	0.100	0.050	0.016	250mW	160	1 Ohm-25 Meg	1%		+
IMS004	0.150	0.050	0.016	350mW	350	1 Ohm-25 Meg	1%		+
IMS005	0.100	0.100	0.016	500mW	160	0.1 Ohm-25 Meg	1%		+
IMS008	0.100	0.025	0.016	100mW	175	1 Ohm-1,000,000 Meg	1%		+
IMS010	0.125	0.050	0.016	250mW	230	1 Ohm-250 Meg	1%		+
IMS024	0.240	0.120	0.021	1W	350	1 Ohm-1 Meg	1%		+
IMS026	0.120	0.240	0.035	1W	200	0.05 Ohm-1 Ohm	10%		+
IMS202	0.360	0.140	0.035	2W	800	1 Ohm-25 Meg	1%		+
IMS204	0.440	0.180	0.035	4W	1100	1 Ohm-1 Meg	1%		+
IMS206	0.520	0.220	0.035	6W	1400	1 Ohm-1 Meg	1%		+
IMS208	0.560	0.240	0.035	8W	1500	1 Ohm-1 Meg	1%		+
IMS210	0.620	0.270	0.035	10W	1800	1 Ohm-1 Meg	1%		+
IMST11	0.170	0.100	0.035	Customer trimmable			15%		+
IMST26	0.120	0.240	0.035	Customer trimmable			15%		+







* 100% made in USA

ALL FLIP CHIP SIZES AVAILABLE WITH GOLD TERMINATIONS FOR WIRE BOND ATTACHMENT.
Others as CUSTOM items (consult factory).

International Manufacturing Services, Inc.

50 Schoolhouse Lane • Portsmouth, R. I. 02871-2418 / Tel: (401) 683-9700 • Fax: 683-5571

Iskra RESISTORS

• FERRITES • FILM/FOIL CAPACITORS • SUPPRESSION COMPONENTS • DIODES • BRIDGE RECTIFIERS • VARISTORS •

METAL OXIDE VARISTORS

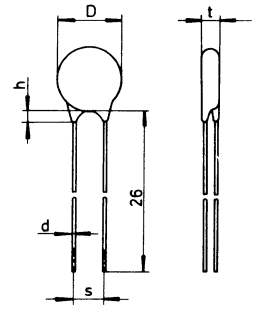
SERIES VXXX KXX

- Very non-linear bidirectional breakdown
- High non-linear exponent (>20)
- Very low leakage current
- High current density capability
- Reliable and Effective Suppression in a small package
- Can be used in place of Filters, Zeners, Selenium Cells
- Applications: Computers, Telecommunications, Consumer Goods, Measuring Devices
- T/R Available on K5 and K7 Sizes
- Lead Forming Available on All Sizes
- Durez or Epoxy Coatings Available
- UL File Number E 103662

A metal oxide varistor (MOV) is a voltage dependent non-linear resistor with V-1 curves similar to back-to-back zener diodes. The current through the varistor is exponentially dependent on the voltage. It is intended for safeguarding sensitive electronic components against voltage surges.

ORDERING EXAMPLE:

V 60 K10
- K10 — Disc Diameter Size Code
- 60 — Maximum Allowable Continuous RMS Voltage
- V — Varistor



Operating Ambient Temperature	—40°C to +85°C
Voltage Temperature Coefficient	—0.05%/°C
Nominal Voltage Defined at (DC)	K5 (0.1 mA) K7, 10, 14, 20 (1 mA)
Tolerance of V_N	±10%

* Additional Literature Available upon request.
* Custom Designing of Protection Assemblies Also Available. Call us with your design problems.

Size Code	Dimensions (mm)					Maximum Allowable Continuous RMS Voltage At 50-60 Hz (V)
	D (max)	s±1	t (max)	h (max)	d	
K5	7.5	5	6	2	0.6	11, 14, 17, 20, 25, 30, 35, 40, 50, 60, 75, 95, 115, 130, 140, 150, 175, 230, 250, 275, 300, 320
K7	9.0	5	7	2	0.6	11, 14, 17, 20, 25, 30, 35, 40, 50, 60, 75, 95, 115, 130, 140, 150, 175, 230, 250, 275, 300, 320
K10	13.5	7.5	7.5	3	0.8	17, 20, 25, 30, 35, 40, 50, 60, 75, 95, 115, 130, 140, 150, 175, 230, 250, 275, 300, 320, 385, 420, 460, 510, 550, 625, 680, 750
K14	17	7.5	7.5	3	0.8	20, 25, 30, 35, 40, 50, 60, 75, 95, 130, 140, 150, 175, 230, 250, 275, 300, 320, 385, 420, 460, 510, 550, 625, 680, 750
K20	24	10 or 7.5	8	4	0.8	20, 25, 30, 35, 40, 50, 60, 75, 95, 130, 140, 150, 175, 230, 250, 275, 300, 320, 385, 420, 460, 510, 550, 625, 680, 750

TRIMMING POTENTIOMETERS

Iskra offers a comprehensive choice of standard sizes as well as mounting and adjustment options. The wide variety of spindles and thumbwheels further enhance our ability to satisfy new as well as existing designs.

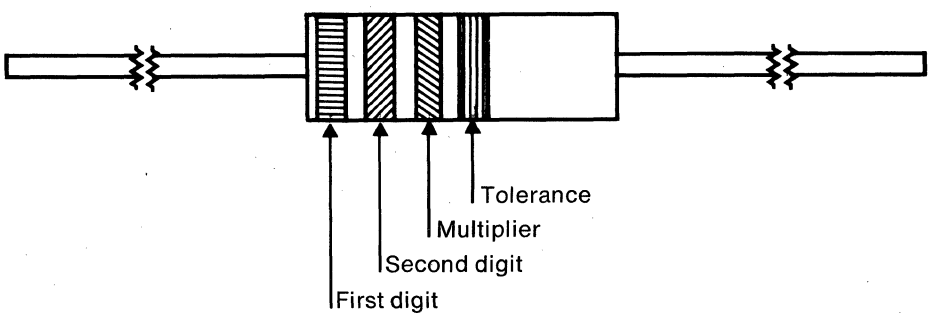
Basic Outline/Shape	Element	Design	Power Rating	Resistance Range	Operating Temperature
15MM round	Carbon or Cermet Available	Closed	Carbon 0.1W @ 70°C, 0.25W @ 40°C Cermet 0.5W @ 70°C, 0.75W @ 40°C	Carbon 50-10 Meg. Cermet 50-1 Meg.	—25°C to +70°C Carbon —40°C to +90°C Cermet
10MM square	Carbon or Cermet Available	Closed	Carbon 0.06W @ 70°C, 0.15W @ 40°C Cermet .33W @ 70°C, .50W @ 40°C	Carbon 50-10 Meg. Cermet 50-1 Meg.	—25°C to +70°C Carbon —40°C to +90°C Cermet
6MM square	Carbon	Closed	0.1W at 40°C	100-5 Meg.	—25°C to +70°C
3.8x4.5MM Chip	Cermet	Open	0.1W at 70°C	100-1 Meg.	—55°C to +70°C

CONTACT FACTORY FOR LITERATURE, SAMPLES AND INFORMATION ON THE ABOVE TYPES AS WELL AS INFORMATION ON OUR MANY OTHER POTENTIOMETERS.

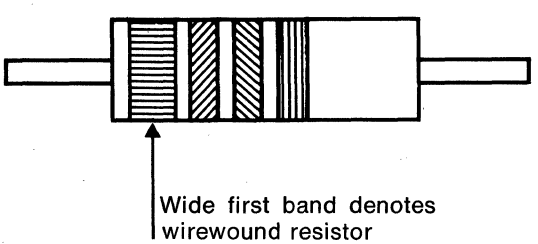
ISKRA ELECTRONICS INC.
155 Dupont Street, Plainview, N.Y. 11803 • 516-349-0222 • Toll Free: 800-862-2101 • Fax: 516-349-7642 • TLX: 221527

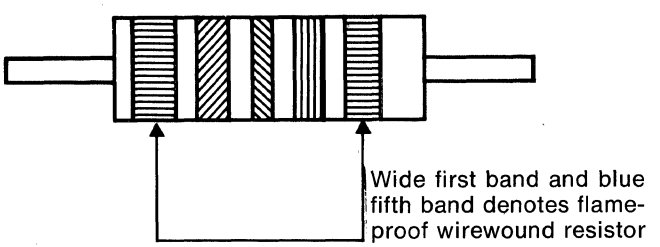
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

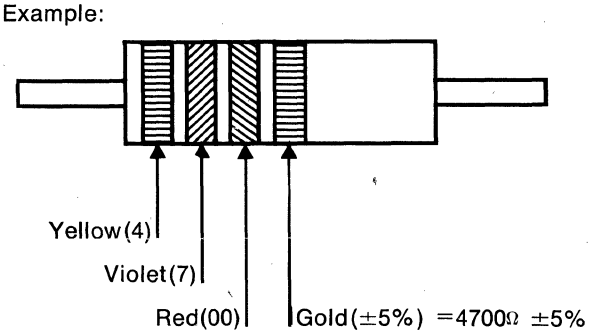




Color code for general-purpose wirewound resistors

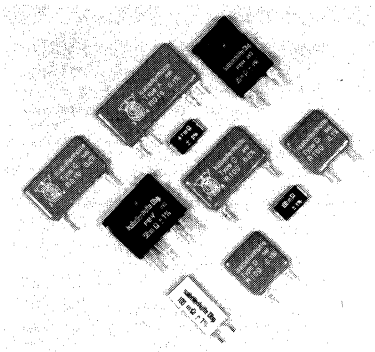
Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



ISOTEK CORPORATION
566 WILBUR AVE / SWANSEA, MA 02777 USA
TEL 508-673-2900 / FAX 508-676-0885

ISA-PLAN® PRECISION RESISTORS



ISA-PLAN® precision resistors, or current sensors are ideal for sensing and controlling current. ISA-PLAN® resistors are the result of long term development with the intention of creating a small and effective measuring resistor for current measurement up to 50 A and more. Using a new and advanced production technology we are able to offer a product with excellent physical properties at a very low price.

ISA-PLAN® resistor elements are etched from a foil rolled from the high precision resistance alloy MANGANIN®. The shape of the resistor is ideal with respect to the power rating, accuracy and inductance. The substrate is either a specially treated aluminum sheet, or a glass fibre laminate with high thermal and mechanical stability and a coefficient of thermal expansion specially adapted to MANGANIN®. To maximize heat dissipation additional copper foils are placed in the laminate. The high power limits of the resistor are achieved by using high temperature resistant materials of special construction with a good heat dissipation over the substrate towards the terminals. To protect the resistors against environmental influences and moisture, type C and A resistors are coated with a chemically resistant and insulating sintered epoxy. Resistor types PBH and PBV are constructed similar to TO-power semiconductors and are transfer-molded in a special high temperature resistant epoxy. Self-heating under nominal load is typically 30°C. The maximum temperature of an application depends on the required accuracy as indicated in the temperature/resistance curve of MANGANIN®.

HIGH POWER CAPABILITY

High power resistors are bonded onto an anodized aluminum plate so that the heat generated can effectively flow to an external heat sink.

The very low thermal resistance of less than 1.5K/Watt for type A and C high-load resistors allows power ratings up to 10 Watt without losing the 0.1% accuracy.

Type PBH and PBV resistors allow power ratings up to 10 Watts, also. Because of their higher internal heat resistance of less than 4K/Watt and because of their slightly different design, the accuracy remains within 0.5% of nominal resistance value at full rated power.

FOUR-POLE TECHNIQUE (KELVIN-TERMINATIONS)

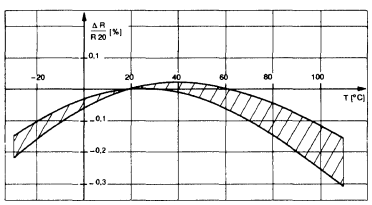
When testing a low-ohmic resistor, the resistance of the lead-wire and its influence on the temperature coefficient must be considered. This influence can be eliminated if the voltage drop is measured on the resistor itself, or even better, inside the resistor. ISA-PLAN® etching technique allows the use of internal Kelvin connections to the resistor element.

Using this design a 1mΩ resistor with a tolerance of 0.2%, or a 10mΩ resistor with a tolerance of 0.1% having a temperature coefficient of resistance below 10ppm/°C is possible. Whereas with wire-wound resistors this can only be achieved with rather high additional costs and moderate success.

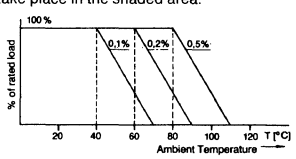
EXTREMELY LOW TCR

ISA-PLAN® resistor elements embody a foil rolled from the high precision resistance alloy MANGANIN®.

The resistance-temperature curve for MANGANIN® is parabolic. Therefore the temperature coefficient of MANGANIN® is not constant.



Temperature dependence of resistance of ISA-PLAN resistors. Due to different design and nominal values a variation may take place in the shaded area.



Power derating curve for resistors type A and C for different tolerances.

TWO-POLE TECHNIQUE

Due to the influence of the leadwires, two pole resistors show a distinct increase of tcr for values of less than 50 mΩ.

For resistance values below 50 mΩ and where high accuracy is required, four-pole resistors (type A, type PBV) instead of two pole resistors (type C, type PBH) are recommended.

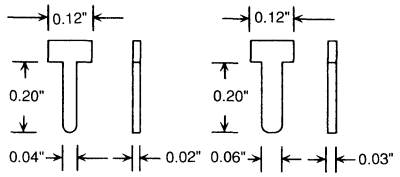
DIMENSIONS AND TERMINALS

The use of large, solid copper alloy terminals of high conductivity and mechanical strength guarantees very low connector resistances and an optimal current density within the resistor. A considerable amount of the heat being produced in the resistors can be dissipated by these terminals over the whole printed circuit.

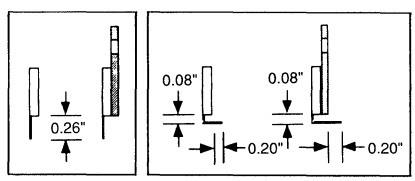
Regarding type A and type C resistors, terminal type K2 is normally used for resistors below 10mΩ and on the high-load version for values less than 50mΩ to 100mΩ. Terminal K2 can be used on other types on request.

PBH and PBV resistors are manufactured with standard terminals (see detail drawings). For special applications, i.e. horizontal mounting or plug connectors we offer style F2.

TYPE OF TERMINALS



CONNECTION TYPES



The tcr varies with temperature according to graph 1255 in a narrow range of values.

The dotted lines in graph 1255 represent a tcr of 10 ppm/°C and illustrate the simplifications made in context with MANGANIN® and its parabolic resistance-temperature curves when linear equations are used.

It should be noted however, that the resistance variation with temperature in graph 1255 covers an absolute range of only ±200ppm.

The resistivity of MANGANIN® is specified in DIN 46460. Although resistance-temperature curves for MANGANIN® can lie between the curves 1 and 5, ISA-PLAN®'s process is designed to conform to the space limited by curves 2 and 3.

From the mathematical point of view, the parabolic shape of the resistance-temperature curve is determined by specifying ∂20 and by a coefficient β which determines the spread of the parabola. ∂20 is the temperature coefficient at 20°C. Setting the origin into the maximum, the resistance-temperature curve for MANGANIN® and its possible range can be determined from the formula:

$R_t = R_{20}(1 + \partial_{20}(t-20) + \beta(t-20)^2)$

The range of variations for ∂20 and β is given:

∂_{20} = 0 to = 20 * 10^{-6}

β = approx. $-0.5 * 10^{-6}$

R_t = Resistance at the temperature t

R_{20} = Resistance at the temperature 20°C.

ORDERING EXAMPLE:

A-H1-470-F1-K1-0.1

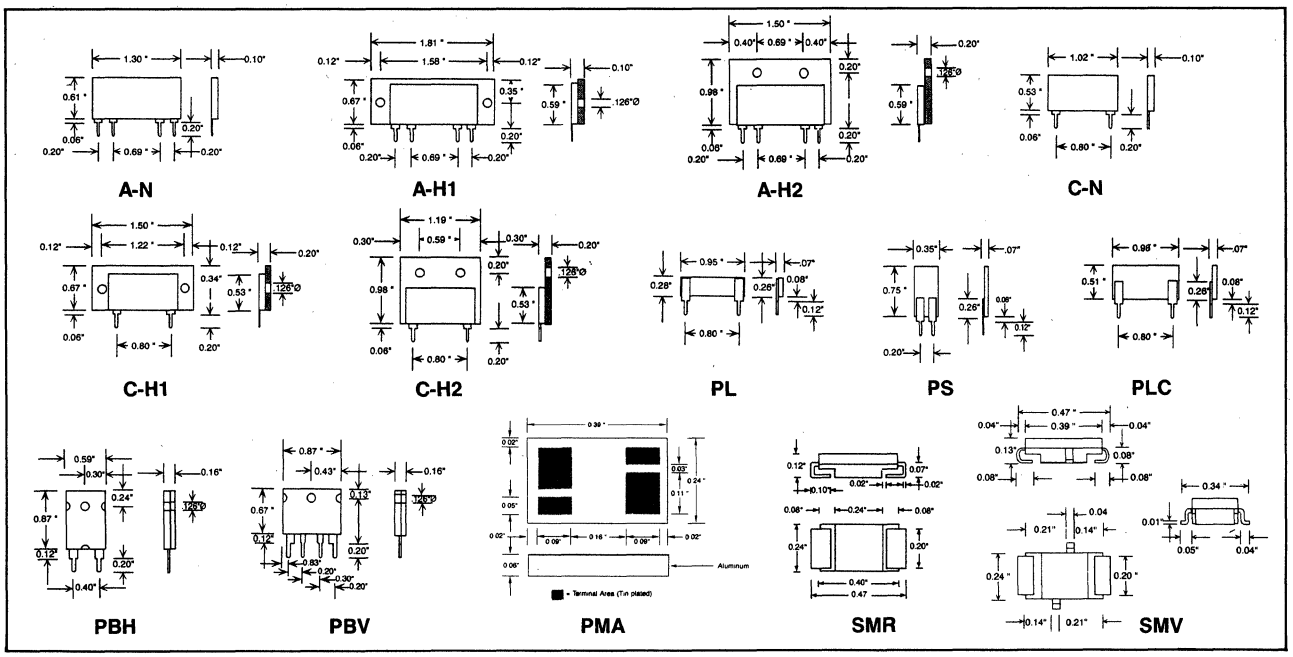
- Model
- Resistance value in mOhm
- Connection type
- Type of terminal
- Tolerance in %

PERFORMANCE DATA

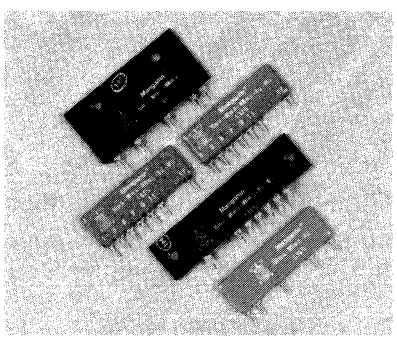
Model	Resistance Range	Available Tolerance ±%	Power	*TCR -20°C +60°C	Inductance	# of Terminals
C-N	2.5mΩ—100Ω	0.1,0.2,0.5,1	1	<25ppm	<20nH	2
C-H1	2.5mΩ—100Ω	0.1,0.2,0.5,1	10	"	"	2
C-H2	2.5mΩ—100Ω	0.1,0.2,0.5,1	10	"	"	2
A-N	1mΩ—100Ω	0.1,0.2,0.5,1	1	<10ppm	"	4
A-H1	1mΩ—100Ω	0.1,0.2,0.5,1	10	"	"	4
A-H2	1mΩ—100Ω	0.1,0.2,0.5,1	10	"	"	4
PBH	2mΩ—100Ω	0.5,1,5	10	<30ppm	"	2
PBV	1mΩ—1Ω	0.5,1,2,5	10	"	"	4
PS	5mΩ—100Ω	0.5,1,2	0.5	<50ppm	"	2
PL	5mΩ—100Ω	0.5,1,2	0.5	"	"	2
PLC	2.5mΩ—100Ω	0.5,1,2	1	"	"	2
PMA	10mΩ—10Ω	1,3,10	1	<20ppm	"	4
SMR	10mΩ—10Ω	0.5,1,2,5	1	<50ppm	"	2
SMV	10mΩ—10Ω	0.5,1,2,5	1	"	"	4

ISOTEK CORPORATION
566 WILBUR AVE / SWANSEA, MA 02777 USA
TEL 508-673-2900 / FAX 508-676-0885

ISA-PLAN® PRECISION RESISTORS



ISA-PLAN® PRECISION CURRENT SHUNT RESISTOR NETWORK



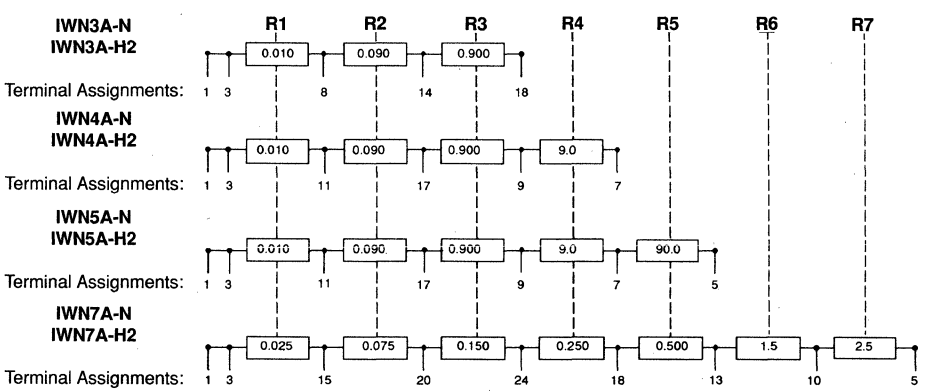
ISA-PLAN® resistor networks were specially designed for application in digital and analog current measuring and regulation devices in which the current has to be very accurately measured and controlled in a range of several orders of magnitude.

ISA-PLAN® has developed networks made out of a precision resistance material without additional connections. Since each resistor element is etched from the same physical section of MANGANIN® foil, the matching of the resistors to each other is unsurpassed in the industry. Using four-terminal termination (Kelvin-technique) the influence of leads and terminals on the resistors is completely eliminated.

FOUR-POLE TECHNIQUE (KELVIN-TERMINATIONS)

In all networks, terminal 1 is the common current connector (I_L) and terminal 3 the common connector for the voltage (E_L). The terminal for the lowest current is both the terminal for current and voltage. In this case, the influence of the very low-ohmic copper connector is almost nil.

RESISTANCE VALUES AND SCHEMATIC FOR TERMINAL ASSIGNMENT



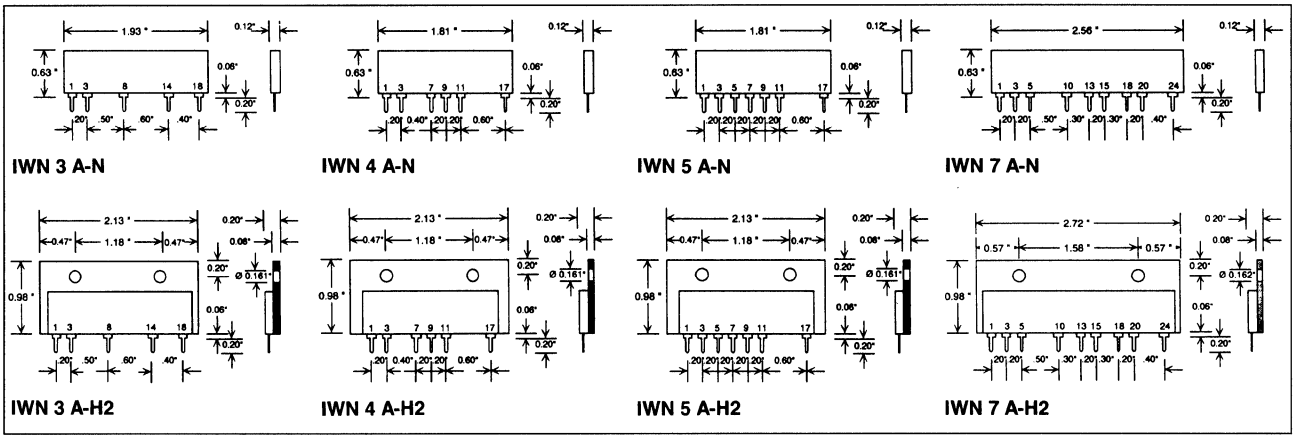
ORDERING EXAMPLE:

IWN 3A-H2 - F2 - 0.2

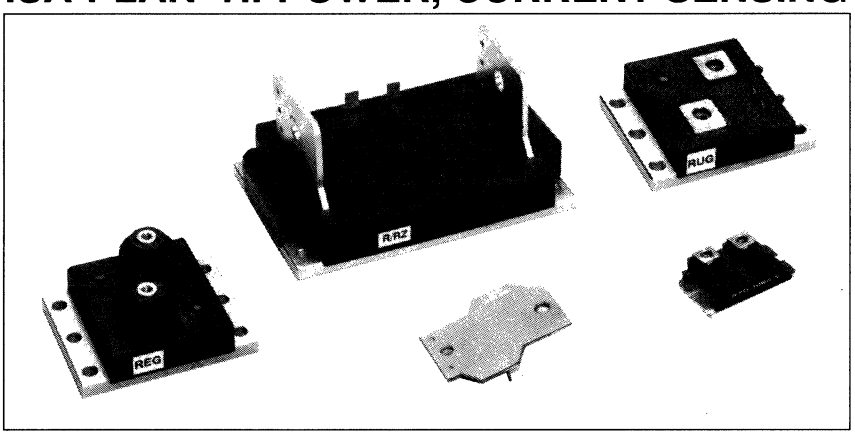
Model
Connection type
Tolerance in %

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ISA-PLAN® PRECISION CURRENT SHUNT RESISTOR NETWORK



ISA-PLAN® HI-POWER, CURRENT SENSING RESISTORS



Type **R** precision resistors are four-terminal (Kelvin devices and are outstanding for their high accuracy at a high power rating. The resistor element is etched from MANGANIN foil carefully aged in a special procedure, which is mounted directly to a 6mm copper plate for optimal dissipation. The heat resistance is below 0.1 K/W. Type R should be mounted on a heat sink whose heat resistance should not be more than 0.1 K/W.

The connectors consist of copper sheet 3mm thick and 50mm wide, thus providing a very low lead resistance and an even current density within the resistor. The current sense terminals are similar to AMP contacts, allowing easy and quick mounting.

REG is a high power, high insulation resistor which has been specially developed for use in RC snubber protection circuits for high current GTO's and thyristors.

REG is designed for a continuous power load of 250 Watts and can withstand instantaneous pulse power up to 2KW. The Manganin resistive element is mounted directly on a ceramic plate that is again bonded on the large copper baseplate. This construction guarantees a very low internal heat resistance of less than 0.1K/W as well as extremely high electrical insulation between resistor and baseplate. The package design maximizes creepage distance between terminals and ground.

Type **RUG** has been designed for applications in which high DC and low frequency AC currents must be measured and regulated with high accuracy and reproducibility. One example is the power supply for superconducting magnets. The RUG resistance element can employ either Zerinan (tcr = 1-3ppm/°C +20°C to +60°C), or Manganin (tcr = 10ppm/°C +20°C to +60°C).

When mounted on a heatsink (water or air cooled) the resistance change which is generated by the temperature increase of the resistance element and its tcr value is negligible.

RUG's package geometry is common to high power transistor modules. The current terminals can be screw-connected with bus-bars or cable connectors via the built-in nuts which are torque secured by the molded case.

BSH is ideal for use in high-current power supplies, UPS equipment and power drive modules for electrical motors.

The BSH resistor is constructed with two 1mm copper-plates that sandwich the isolated manganin resistor element. The resistor is electrically connected to either one of the two copper plates near the terminal holes. This results in a mechanically-rigid construction with a very low heat resistance (<1.5K/Watt). The unique design enables mounting between current rails (bus-bar mounting) which act as a heat sink.

BSH is constructed in a four-terminal (Kelvin) configuration with tab-type terminals (similar to Amp #110) as the sense connectors.

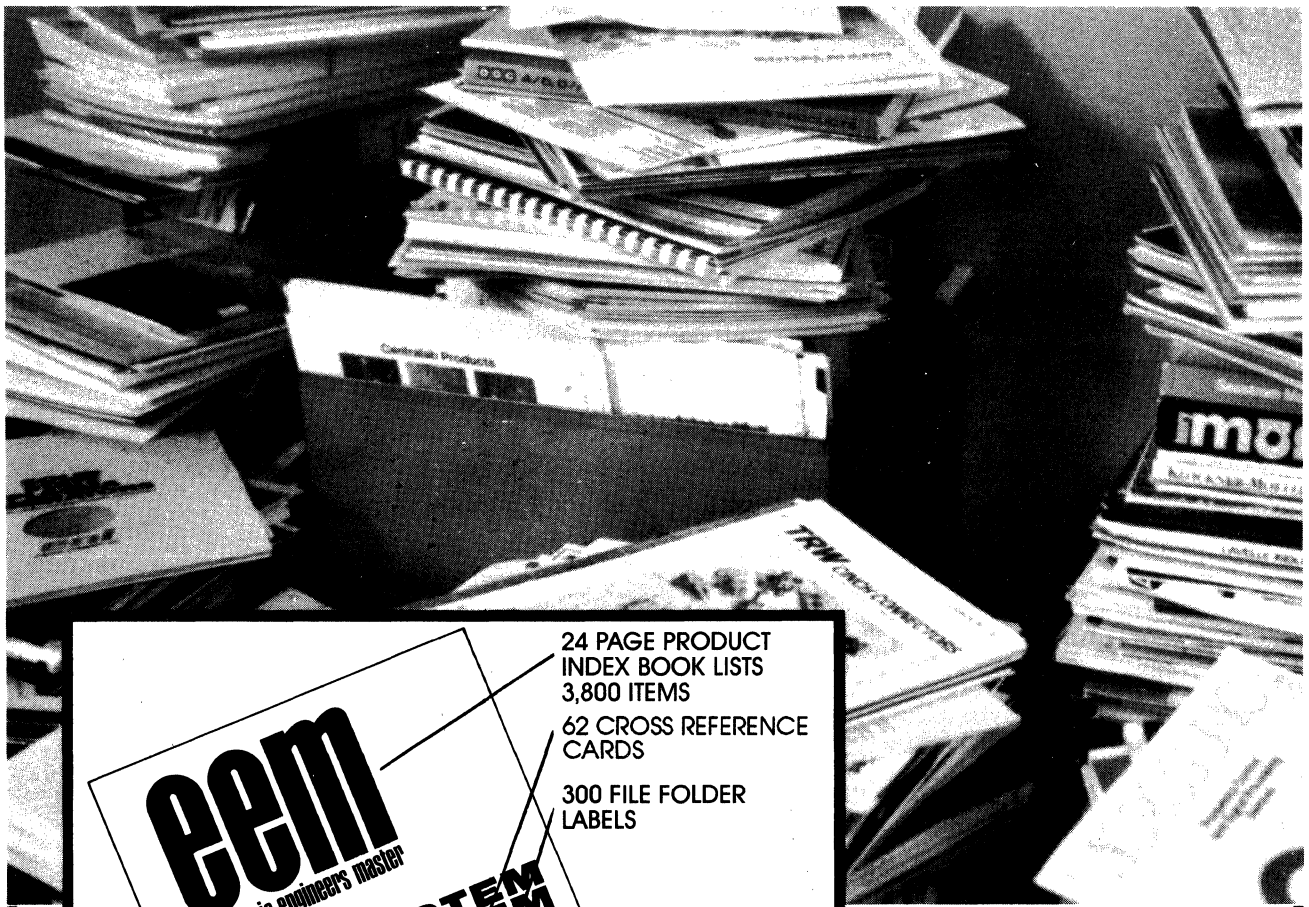
The **RTO** resistor is identical to the SOT-227B 'ISOTOP' package (TO-238). The RTO power resistor is now available for easy mounting with active components on a heat sink. This provides for an effective and low cost assembly of power modules for power supplies and power drives for electrical motors.

Due to the extremely high dielectric withstanding voltage to the base p[late the resistor can be operated at the high side of the a.c. line (i.e. 380 VAC). The RTO is ideal for application as a current sense resistor or as a power resistor in snubber RC-bypass of transistors and thyristors or GTOs.

The heavy copper-leads allow continuous currents up to 150A and short pulse currents to 1500A.

RTO is produced in two-and four-terminal configurations. Single packages with double- or triple-resistors are also available.

Model	Resistance Range	Available Tolerance	TCR .–20 - +60°C	Rated Power	Isolation to Base	Inductance	# of terminals
	Ω	%	ppmK^-1	W	VAC	nH	
BSH	0.0005-0.1	0.1, 0.2, 0.5, 1	3, 10	30	n/a	0.3 (R002)	4
RTO	0.0002-100	1, 2, 5	20, 50	30	2500	6 (R010)	2,4
RUG	0.001-1.0	0.1, 0.2, 1.0	1, 3, 10	100	100	9 (R010)	4
R	0.0005-0.1	0.1, 0.2, 0.5, 1	20	250	100	2.3 (R001)	4
REG	1.0-1500	0.1, 0.5, 1.0, 5.0	20	250	5000	400 (22R0)	2



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JULIE RESEARCH LABORATORIES INCORPORATED

PRECISION WIREWOUND RESISTORS

PRECISION RESISTORS FOR EVERY APPLICATION

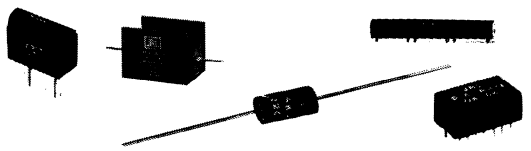
Precision Resistors for every application imaginable; high quality, low priced precision resistors are available for your every design need and at delivery schedules even distributors can't beat!! JULIE RESEARCH resistors are guaranteed for a lifetime performance in almost every value, tolerance and stability.

Available as individual, ratio or network assemblies, these expertly manufactured and trimmed resistors assist you in eliminating countless hours of Production Test time from your design. In addition, the use of these very stable resistors contribute to reliable design and reduced component count. Specify a Julie Resistor. Better yet, call us and we will assist in helping you get the best price-performance unit your application and budget will allow.

JUST A FEW OF THE PROVEN APPLICATIONS FOR THESE LOW REACTANCE HIGH PERFORMANCE RESISTORS ARE:

- Transducer Calibrating Networks
- Current Metering
- Gyro Torquing
- AC and DC Precision Bridge Elements
- Amplifier Summing Elements
- D/A Converters
- Reference Divider
- Precision Multiplier
- Resistive Divider Networks
- Shunting
- AC or DC Ratio
- High Performance MIL Spec
- Zener Trimming Networks

RESISTOR STYLES



HIGH LOAD-LIFE STABILITY, PRECISION NETWORKS

Type	Construction Dual In-Line	Resistor Configuration	Dimensions (Inches) L x W x H	Max Res Per Resistor	Max Volt Per Resistor	Max Power Per Resistor
RNX-14	14 pin	3 max.	.740 x .39 x .43	100K	125V	1/10W
RNX-16	16 pin	4 max.	.840 x .39 x .43	100K	125V	1/10W

LOWEST, LOW REACTANCE OIL FILLED AND ENCAPSULATED THA-H, CH, HCH, RESISTORS AXIAL WIRE LEAD CONSTRUCTION

Style	Size Inches	Size MM	AWG Leads	Max. Res.	Volt	Power	MIL R-93
H-32	3/8 x 1/2	9.5 x 12.7	20	250 K	250	1/2 W	—
H-33	3/8 x 3/4	9.5 x 19.1	20	350 K	450	1/2 W	RB 53
H-34	3/8 x 1	9.5 x 25.4	20	500 K	500	1/2 W	RB 52
H-42	1/2 x 1/2	12.7 x 12.7	18	750 K	250	1/2 W	—
H-44	1/2 x 1	12.7 x 25.4	18	2 Meg	500	1 W	RB 57
H-46	1/2 x 1/2	12.7 x 38.1	18	3 Meg	750	1 1/2	RB 58
H-48	1/2 x 2	12.7 x 50.8	18	5 Meg	1000	2 W	RB 59
HCH-32	3/8 x 1/2	9.5 x 12.7	20	150 K	—	3/4 W*	—
HCH-33	3/8 x 3/4	9.5 x 19.1	20	250 K	—	1 W*	—
HCH-34	3/8 x 1	9.5 x 25.4	20	350 K	—	1.5 W*	—
HCH-35	3/8 x 1 1/4	9.5 x 31.8	20	500 K	—	1.8 W*	—
HCH-42	1/2 x 1/2	12.7 x 12.7	18	375 K	—	1.5 W*	—
HCH-44	1/2 x 1	12.7 x 25.4	18	750 K	—	3 W*	—
HCH-46	1/2 x 1 1/2	12.7 x 38.1	18	1 M	—	4.5 W*	—
HCH-48	1/2 x 2	12.7 x 50.8	18	1.5 M	—	6 W*	—
CH-32	3/8 x 1/2	9.5 x 12.7	20	300 K	—	3/4 *	—
CH-33	3/8 x 3/4	9.5 x 19.1	20	500 K	—	1 W*	—
CH-34	3/8 x 1	9.5 x 25.4	20	700 K	—	1.5*	—
CH-35	3/8 x 1 1/4	9.5 x 31.8	20	1 Meg	—	1.8*	—
CH-42	1/2 x 1/2	12.7 x 12.7	18	750 K	—	1.5*	—
CH-44	1/2 x 1	12.7 x 25.4	18	1.5 M	—	3.0*	—
CH-46	1/2 x 1 1/2	12.7 x 38.1	18	2 M	—	4.5*	—
CH-48	1/2 x 2	12.7 x 50.8	18	5 M	—	6 W*	—
THA-36	3/8 x 1/2	9.5 x 12.7	18	1 M	100	—	RB 53
THA-38	3/8 x 3/4	9.5 x 19.1	18	1 M	100	—	RB 53

* When mounted on heat sink.

SUPER ACCURATE, SUPER STABLE ENCAPSULATED, MINIATURE PRECISION R, XG, RS, L, GL RESISTORS

TYPE R AND C — AXIAL WIRE LEAD-CONSTRUCTION

R-21A	1/4 x 3/8	6.4 x 9.5	22	250 K	125	1/8 W	—
R-22	1/4 x 9/16	6.4 x 14.3	22	500 K	125	1/8 W	—
R-23	1/4 x 3/4	6.4 x 19.1	22	750 K	125	1/8 W	RB 54
R-24	9/16 x 1	7.9 x 25.4	20	1 Meg	350	1/4 W	—
R-32	3/8 x 1/2	9.5 x 12.7	20	750 K	350	1/4 W	—
R-33	3/8 x 3/4	9.5 x 19.1	20	1 Meg	350	1/2 W	RB 53
R-34	3/8 x 1	9.5 x 25.4	20	1.5 Meg	250	1/2 W	RB 52
R-35	3/8 x 1 1/4	9.5 x 31.8	20	2 Meg	250	5/8 W	—
R-42	1/2 x 1/2	12.7 x 12.7	18	1.5 Meg	125	1/2 W	—
R-44	1/2 x 1	12.7 x 25.4	18	4 Meg	250	1 W	RB 57
R-46	1/2 x 1 1/2	12.7 x 38.1	18	7.5 Meg	250	1 1/2 W	RB 58
R-48	1/2 x 2	12.7 x 50.8	18	10 Meg	250	2 W	RB 59

TYPE L AND RB — RADIAL LUG CONSTRUCTION

L-10A	5/8 x 9/16	15.9 x 14.3	Solder Lug	1.5 Meg	125	1/2 W	RB 16
L-HB	5/8 x 1 1/4	15.9 x 31.8	Solder Lug	4 Meg	250	1 W	RB 18

TYPE XG — RADIAL WIRE LEAD CONSTRUCTION

R-32XG	3/8 x 9/16	9.5 x 14.3	22	500 K	125	1/4 W	—
R-42XG	1/2 x 9/16	12.7 x 14.3	20	1 Meg	125	1/2 W	—
R-44XG	1/2 x 1 5/32	12.7 x 29.3	20	3.5 Meg	250	1 W	—
R-46XG	1/2 x 1 3/8	12.7 x 34.9	20	5 Meg	250	1 1/2 W	—
R-48XG	1/2 x 2 1/16	12.7 x 52.4	20	10 Meg	250	2 W	—
R-52XG	5/8 x 1 5/32	15.9 x 15.1	20	1 Meg	125	3/4 W	—

TYPE RS — TOP HAT CONSTRUCTION

RS-36	11/32 x 1/2	10.3 x 12.7	22	750 K	125	1/4 W	—
RS-26	9/32 x 1/2	7.1 x 12.7	22	250 K	125	1/8 W	—

TYPE PRS-1 AND PRSH-1—BANANA PLUG CONSTRUCTION

PRS-1	19/16 x 5/8 x 13/16	Banana Plug	2 megohms	125	1/2 W	—
PRSH-1	19/16 x 5/8 x 13/16	Banana Plug	2 megohms	250	1/2 W	—

LOW OHM, LONG TERM STABILITY, OIL FILLED AND ENCAPSULATED 4-TERMINAL CH46-T4, R-46-T4, R46xG-T4 AXIAL AND RADIAL CONSTRUCTION

Style	Size	MM	AWG Leads	Max. Res.	Current	Power
R-46T4	1/2 x 1 1/2	12.7 x 38.1	18	100 Ohms	2 Amps	1 1/2 W
R-46XG-T4	1/2 x 1 1/2	12.7 x 38.1	20	100 Ohms	2 Amps	1 1/2 W
CH-46T4	1/2 x 1 1/2	12.7 x 38.1	18	100 Ohms	2 Amps	3 W*
CH-48T4	1/2 x 2	12.7 x 50.8	18	100 Ohms	4 Amps	6 W*
CH-48T4HK	2 x 1.5 x 1.5	50.8 x 38.1 x 38.1	18	100 Ohms	4 Amps	6 W

* When mounted on heat sink.

SPECIFICATIONS

Precision wirewound resistor accuracy and stability available in standard DIP styles.

Range: 100Ω to 100 KΩ per resistor.

Ratio Accuracy: To .001% for ratio 1:1.

Stability: Network .002% for standard ranges.

Temperature Coefficient: 1 ppm/°C to 20 ppm/°C.

Custom designs available — contact factory for other package styles.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 5 megohms. Ratio Sets, 1:1 to 10^6:1 depending on total resistance required.

Accuracy: Standard accuracy of resistors, 0.005% for values from 1000 ohms to 5 megohm. Standard accuracy of ratio sets, 0.0025% for ratios near 1:1. Accuracies from 0.002% to 0.1% are available (at corresponding prices) on special order.

Stability: Resistors, 0.002% per year for standard ranges.

Accuracy Over Military Temperature Range: ±0.02% from −45°C to +85°C.

Matching Over Military Temperature Range: ±0.005% from −45°C to +85°C.

Retrace Over Military Environmental Conditions: 0.002%.

Temperature Coefficient: Resistors, 5 ppm/°C standard. (Available as low as 1.0 ppm/°C). Ratio sets, 2.5 ppm/°C standard.

Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

Thermal Transients: All thermal-induced transient effects, e.g.: self-heating, Seebeck and Peltier effects, are less than 0.0015% at rated power dissipation. Self-heating and time constants of thermal transients are reduced to 10% of normal values in air.

Current Capability: To 2 amperes.

Voltage: Between Terminals, 300 volts maximum, Terminals to Case, 500 volts maximum.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 10 megohms. Ratios, 1:1 to 10^6:1, depending on total resistance required.

Accuracy: Standard accuracy of resistors, 0.01%, for values from 100 ohms to 5 megohm. Standard accuracy of ratios, 0.005%, for ratios near 1:1. Intermediate accuracies of 0.05% and up and higher accuracies to .0025% are available on special order.

Stability: Resistors 0.003% per year for standard ranges.

Accuracy Over Military Temperature Range: 0.02% from −30°C to +85°C.

Retrace Over Military Environmental Conditions: 0.003%.

Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 1.0 ppm/°C). Ratios, 2.5 ppm/°C standard.

Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

SPECIFICATIONS

Range: Individual Resistors, 0.1 ohm to 100 ohms.

Accuracy: Standard accuracy of resistors, 0.01%, for values from 1.0 ohm to 100 ohms. (R_1 x G) .005% (CH).

Stability: Resistors 0.003% per year for standard ranges.

Accuracy Over Military Temperature Range: 0.02% fom −30°C to +85°C.

Retrace Over Military Environmental Conditions: 0.003%.

Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 2.5 ppm/°C).

Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

Voltage and Power Ratings: See chart.

Construction: See charts.

Group Encapsulation: Special techniquies permit group encapsulation of high-accuracy units on a high-yield basis, enabling better accuracies at competitive costs. (See JRL Bulletin B-11.)

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SURFACE MOUNT "MELF" RESISTORS

Parameter	CARBON FILM				METAL FILM			
	A	B	D	E	A	B	D	E
Size ℓ x d (mm)	2.00 x 1.25	3.5 x 1.45	3.20 x 1.55	5.90 x 2.20	2.00 x 1.25	3.5 x 1.45	3.20 x 1.55	5.90 x 2.20
Wattage	0.100	0.125	0.200	0.250	0.100	0.125	0.200	0.250
Resistance Range	2.2Ω∼1.0M	2.2Ω∼1.0M	1.0Ω∼1.0M	1.0Ω∼2.2M	100Ω∼100K	100Ω∼604K	10Ω∼604K	10Ω∼1.0M
Resistance Tolerance (%)	5	5	5	5	1	0.25, 0.50, 1.00	1	0.25, 0.50, 1.00
Temp. Coefficient (ppm/°C)	+350∼−1300	+350∼−1300	+350∼−1300	+350∼−1300	100	25, 50, 100	0, 100	25, 50, 100
Max. Working Voltage	150	200	250	350	150	200	250	300
Working Temp. Range	-55°C∼+155°C	-55°C∼+155°C	-55°C∼+155°C	-55°C∼+155°C	-55°C∼+155°C	-55°C∼+155°C	-55°C∼+155°C	-55°C∼+155°C
Low Temp. Operation (%)	0.30	0.30	0.30	0.30	0.20	0.20	0.20	0.20
Short Time Overload (%)	0.50	0.50	0.50	0.50	0.30	0.30	0.30	0.30
Effects of Solder (%)	1.0	1.0	1.0	1.0	0.20	0.20	0.20	0.20
Moisture Resistance (%)	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0
Load Life (%)	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0
Marking	Clr. band (3)	Clr. band (3)	Clr. band (3)	Clr. band (3)	Clr. band (4)	Clr. band (4)	Clr. band (4)	Clr. band (4)

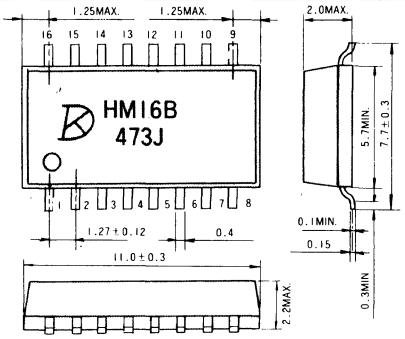
SURFACE MOUNT RESISTOR CHIPS

Parameter	GENERAL PURPOSE TYPE				PRECISION		
	0805 (2012)	1206 (3216)	1210 (3225)	2010 (5025)	0805 (2012)	1206 (3216)	1210 (3225)
Size - ℓ x w (mm)	2.00 x 1.25	3.20 x 1.60	3.20 x 2.50	5.00 x 2.50	2.00 x 1.25	3.2 x 1.60	3.20 x 2.50
Wattage	0.100	0.125	0.250	.0500	0.100	0.125	0.250
Resistance Range	1.0Ω ~ 10.0M	1.0Ω ~ 10.0M	1.0Ω ~ 1.0M	1.0Ω ~ 1M	100Ω ~ 510K	10Ω ~ 1.0K	10Ω ~ 200K
Resistance Tolerance (%)	5	5	5	5	0.1 ~ 1.0	0.1 ~ 1.0	0.1 ~ 1.0
Temp. Coefficient (ppm/°C)	200 ~ 400	200 ~ 400	200 ~ 400	200 ~ 500	10 ~ 100	10 ~ 100	25 ~ 100
Max. Working Voltage	100	200	250	250	100	200	250
Working Temp. Range	−55°C ~ +125°C	−55°C ~ +125°C	−55°C ~ +125°C	−55°C ~ +125°C	−55°C ~ +125°C	−55°C ~ +125°C	−55°C ~ +125°C
Low Temp. Operation (%)	0.30	0.30	0.30	0.30	0.20	0.20	0.20
Short Time Overload (%)	0.50	0.50	0.50	0.50	0.30	0.30	0.30
Resistance to Bonding (%)	0.30	0.30	0.30	0.30	0.20	0.20	0.20
Moisture Resistance (%)	1.0	1.0	1.0	1.0	0.50	0.50	0.50
Load Life (%)	1.50	1.50	1.50	1.50	0.50	0.50	0.50
Marking	XXX	XXX	XXX	XXX	XXXX	XXXX	XXXX

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SURFACE MOUNT RESISTOR NETWORKS



Parameter	STANDARD CIRCUIT CONFIGURATION		
	Bussed	**Isolated**	**Pull-Up**
Circuit Symbol	B	S	R
Power Rating (Element)	62.5mW	125 mW	31.25 mW
Resistance Range	100Ω ~ 2.2MΩ	100Ω ~ 2.2MΩ	100 . mo ~ 2.2MΩ
Resistance Tolerance	1,5%	1,5%	1,5%
Maximum Working Voltage	50vDC	50vDC	50vDC
Temperature Coefficient	−55°C ~ +125°C	−55°C ~ +125°C	−55°C ~ +125°C
Operating Temperature Range	±100 ppm/°C, ±200 ppm/°C	±100 ppm/°C, ±200 ppm/°C	±100 ppm/°C, ±200 ppm/°C
Short Time Overload	±0.50%	±0.50%	±0.50%
Temperature Cycling	±0.30%	±0.30%	±0.30%
Resistance to Solder	±0.50%	±0.50%	±0.50%
Moisture Resistance	±1.0%	±1.0%	±1.0%
Load Life	±1.0%	±1.0%	±1.0%

Custom Circuits - R/2R Ladders, Dual Terminators, Translators, User specified

SURFACE MOUNT TRIMMER RESISTORS

Parameter	TYPE						
	C4202	**C4212**	**C4302**	**C4312**	**C4304**	**C4314**	**C4315**
Terminal Configuration	① ②		① ③ ②		② ① ③		② ① ③
Construction	open		open		open		sealed
Power Rating	0.20		0.20		0.20		0.10
Maximum Working Voltage	100		100		100		50
Maximum Working Temp.	−30°C~+100°C		−30°C~+100°C		−30°C~+100°C		−30°C~+100°C
Resistance Taper	Linear		Linear		Linear		Linear
Resistance Range	100Ω~1.0M		100Ω~1.0M		100Ω~1.0M		100Ω~1.0M
Resistance Tolerance (%)	E6 30		E6 30		E6 30		E6 25
Temperature Coefficient	250 ppm/°C		250 ppm/°C		250 ppm/°C		250 ppm/°C
Rotation Angle	270°		270°		270°		270°
End Stop	None		None		None		None
Setting Torque (g/cm)	≤200		≤200		≤200		≤200
Adjustment Access	Hex	Slot	Hex	Slot	Hex	Slot	Slot
Effects of Solder (%)	1.5		1.5		1.5		1.5
Rotational Life (%)	10		10		10		10
Moisture (%)	2.0		2.0		2.0		1.5
Load Life (%)	1.0		1.0		1.0		1.0
Temperature Cycling (%)	0.5		0.5		0.5		0.3
Size (mm) ℓ x w	3.80 x 4.50		3.80 x 4.50		3.80 x 4.50		4.0 x 4.50

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You Can't Resist KOA!

FIXED RESISTORS

Parameter	METAL FILM						CARBON FILM			
	Ultra Precision	Precision	Semi Precision	MIL	Multi-Related		Gen. Purp.	Flameproof	Multi-Related	
Type Designation	H	MF	ML	P*1	SN2C	MS50	CF	CFP	RDS	RDS/FP
Wattage	1/8, 1/4, 1/2, 1	1/8, 1/4, 1/2, 1	1/8, 1/4, 1/2	1/10, 1/8, 1/4, 1/2	1/8, 1/4	1/4, 1/2	1/8, 1/4, 1/2,	1/8, 1/4, 1/2	1/8/1/4, 1/4/1/2	1/8/1/4, 1/4/1/2
Temp. Coefficient (ppm/°C)	5, 10, 15	25, 50, 100	200	50, 100	50, 100	50, 100	250~3000	250~3000	300~1000	300~1000
Resistance Tol. (%)	0.05, 0.10, 0.25	0.1, 0.25, 0.50, 1	2, 5	0.50, 1	1	1	2, 5	2, 5	2, 5	2, 5
Oper. Temp. Range	−55°C~+175°C	−55°C~+155°C	−55°C~+155°C	−55°C~+175°C	−55°C~+155°C	−55°C~+155°C	−55°C~+150°C	−55°C~+150°C	−55°C~+150°C	−55°C~+150°C
Short Time Overload (%)	≤0.10	≤0.30	0.30	≤0.10	0.25	0.15	≤0.50	≤0.50	≤0.20	≤0.20
Temp Cycling (%)	≤0.10	0.30	0.50	0.10	0.15	0.15	0.50	0.50	0.15	0.15
Load Life (%)	≤1.0	≤1.0	1.5	≤1.0	0.25	0.50	≤2.0	≤2.0	≤1.5	≤1.5
Moisture Resistance (%)	≤1.0	≤1.0	1.5	≤1.0	0.30	0.30	≤2.0	≤2.0	<1.0	1.0
Voltage Coefficient (ppm/v)	<5	<5	<10	<5	<5	<5	≤10	≤10	<10	<10
Failure Rate (1000 hrs)	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$
Marking	Alpha-Num	Clr. Band (5)	Clr. Band (4)	Alpha-Num	Clr. Band (5)	Clr. Band (5)	Clr. Band (4)	Clr. Band (4)	Clr. Band (4)	Clr. Band (4)

FIXED POWER RESISTORS

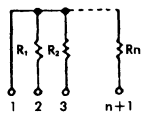
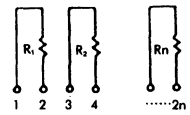
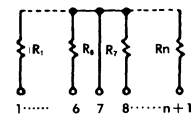
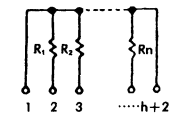
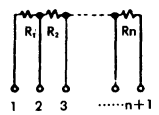
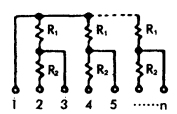
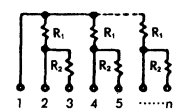
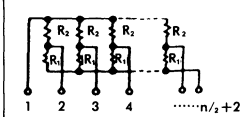
Parameter	METAL OXIDE		CARBON	CERAMIC
	Standard	Reduced Size	Standard	Standard
Type Designation	MO	RSS	SPR	HPC
Wattage	½, 1, 2, 3, 5, 7	1/2, 1, 2, 3, 5	1/2, 1, 2, 3, 5	1~30
Temperature Coefficient (ppm/°C)	200	200	150~600	NA
Resistance Tolerance (%)	2, 5	1, 2, 5	2, 5	10, 20
Operating Temperature Range	−55°C~+200°C	−55°C~+200°C	−55°C~+200°C	1000~2000
Short Time Overload (%)	0.50	0.50	1.0	2.0
Temperature Cycling (%)	0.50	0.50	1.0	2.0
Load Life (%)	2.0	2.5	3.0	5.0
Moisture Resistance (%)	2.0	2.5	3.0	5.0
Voltage Coefficient (ppm/v)	<10	<10	<10	<20
Failure Rate (1000 hrs)	$<10^{-4}$	$<10^{-3}$	$<10^{-3}$	$<10^{-5}$

SEE OUR AD IN CAPACITOR SECTION.

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SIP RESISTOR NETWORKS

CIRCUIT SYMBOL			S	C	D
CIRCUIT CONSTRUCTION		 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 $R_1=R_2\cdots+Rn$ (n=2 to 7)	 $R_1=R_2\cdots+Rn$ (n=4 to 12)	 $R_1=R_2\cdots=Rn$ (n=3 to 12)
MARKING	RKC	10KΩJ	[4]S10KΩJ	10KΩJ ●	10KΩJ
	RKL	103J	S103J	C103J	D103J
	RKH	103J	[4]S103J	[6]C103J	[6]D103J
CIRCUIT SYMBOL		A	T	E	R
CIRCUIT CONSTRUCTION		 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 (n=4 to 12)	 (n=4 to 12)	 (n=6 to 18)

Parameter	TYPE		
	RKL	RKC	RKH
Seated Height (mm)	5.0	6.0	10.70
Element Power (watts)	0.125 ex "s" 0.200 "s"	0.125 ex "s" 0.250 "s"	0.250 ex "s" 0.500 "s"
Maximum Working Voltage	100	200	250
Operating Temperature Range	−55°C∼+155°C	−55°C∼+155°C	−55°C∼+155°C
Resistance Range	22Ω∼1.0M	22Ω∼10M	56Ω∼10M
Resistance Tolerance (%)	2, 5	1, 2, 5	1, 2, 5
Temperature Coefficient (ppm/°C)	200	100∼500	100∼500
Short Time Overload (%)	0.50	≤0.50	≤0.50
Resistance to Solder Heat (%)	0.50	≤0.50	≤0.50
Temperature Cycling (%)	0.50	≤0.50	≤0.50
Moisture Resistance (%)	<2.0	<1.5	<1.5
Load Life	<2.0	<1.0	<1.0

• Custom SIP Networks - R/2R Ladders, Attenuators, Op Amp Feedbacks, Matched & Tracking, User defined.

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SPECIALTY RESISTORS

JUMPER (Zero Ohm)

KSE PT#	Form	Size	Resistance	Amperage
Z12	Axial	3.7 x 1.6	0.01Ωmax	1.5A
Z16	Axial	3.4 x 1.7	0.01Ωmax	1.5A
Z25	Axial	6.3 x 2.4	0.01Ωmax	2.5A
Z33	Axial	8.5 x 3.0	0.01Ωmax	3.0A
J-1/6	Axial	3.4 x 1.7	0.01Ωmax	10.0A
J-1/4	Axial	5.0 x 2.3	0.01Ωmax	15.0A
2AZ	SM	2.0 x 1.25	50MΩmax	1.25A
2BZ	SM	3.2 x 1.6	50MΩmax	2.0A
CC10	MELF	2.0 x 1.25	10MΩmax	2.0A
CC12	MELF	3.5 x 1.45	10MΩmax	2.0A
CC20	MELF	3.2 x 1.55	10MΩmax	2.0A
CC25	MELF	5.9 x 2.2	10MΩmax	5.0A

FUSING RESISTORS

KSE PT#	Form	Size	Power	Res. Range	Res. Tolerance
RF25	Axial	6.5 x 2.3	0.250W	1.0Ω~1K	5%
RF50	Axial	8.5 x 3.0	0.500W	1.0Ω~1K	5%
RF1	Axial	9.0 x 3.5	1.000W	1.0Ω~1K	5%

LINEAR POSITIVE TEMP. COEFFICIENT RESISTORS

KSE PT#	Form	Size	Power	TC Range	Res. Range	Res. Tolerance
LT1/8	Axial	3.7 x 1.6	0.125W	150~4,500ppm	10Ω~100K	2.5%
LT1/4	Axial	6.5 x 2.3	0.250W	150~4,500ppm	10Ω~100K	2.5%
MLT2B	MELF	3.50 x 1.45	0.125W	250~4,500ppm	10Ω~100K	2.5%
MLT2E	MELF	5.9 x 2.2	0.250W	250~4,500ppm	10Ω~100K	2.5%

RESISTOR LAB KITS

Type	Wattages	# of Values	Tolerance	# pcs/value	Draws/Kit
Carbon Film	1/8, 1/4, 1/2	60	5%	100	15
Flameproof CF	1/4, 1/2	60	5%	100	15
Metal Film	1/8, 1/4, 1/2	126	1%	10	18
SM Chip	1206 (1/8)	60	5%	50	15
SM Chip	1206 (1/8)	126	1%	25	24

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ors ☘ Ultra Precision Resistors ☘ Ultra Precision Resi
.5% .5% 1% ☘ .005% .01% .025% .05% .1% .2% .5% 1%
ing ☘ Ratio Matching ☘ TC Tracking ☘ Ratio Matchi
Axial & Radial Leads ☘ Axial & Radial Leads ☘ A al
Sensing ☘ Temperature Compensating

s ☘ Precision Power Resisist
Molded & Coated ☘ M
HM ☘ Low Ohm ☘
nse ☘ Current Sensing
nt ☘ Surface Mount ☘

ose ☘ General Purpose
Vertical Mount ☘ Vertica
al Oxide ☘ Metal Oxide
ool Watt ☘ KRL 'Kool Watt
num Heatsink Resistors ☘

gns ☘ Custom Designs ☘ Cust
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U.S.A. ☘ Made in The U.S.A. ☘ M
lity ☘ High Quality/Reliability ☘ Hi lab

ors ☘ Nonflame Fusible Metal Film Resistors ☘ Nonfl
ircuit Protection Components ☘ Circuit Protection



Quick Response, Competitive $, & a Four Week Standard Lead Time...

KRL
BANTRY COMPONENTS, INC.

KRL's complete product line is now available in Surface Mount Packaging, including: Precision wirewound resistors with temperature coefficients from ±1 PPM to ±10 PPM with tolerances from ±.005% to ±1%; Power Resistors from 1 to 3.5 watts with Wirewound or Metal Oxide elements; Linear Response Temperature Compensating resistors; and Specialty Fuse resistors. While other manufacturers rely on mechanical terminations and connections, KRL has chosen to utilize standard Manufacturing techniques for thru-hole resistors, including Mil-R-93 and Mil-R-26 standards for wirewound resistors and applied them to the production of a surface mountable device. As always, KRL's Application Specialists are available to assist with design criteria for any Surface Mount or Thru-Hole resistive component need.

GENERAL SPECIFICATIONS

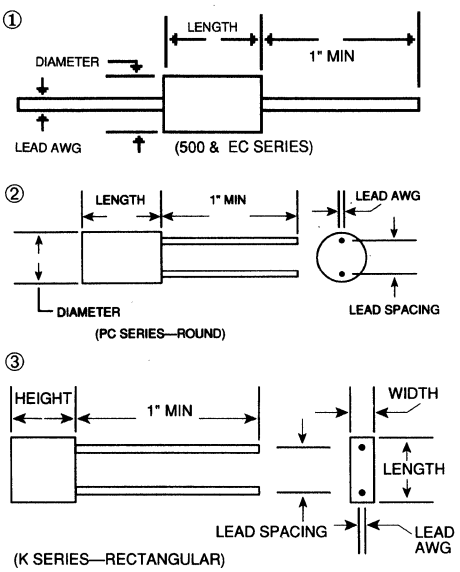
- Standard Tolerances: .005%, .01%, .02%, .05%, .1%, 0.2%, 0.5%, & 1%
- Standard Temperature Coefficient ±5 PPM to ±10 PPM (±1 PPM avail)
- Temperature Compensating TC's from +80 through +6000 PPM
- Custom Designs Welcome
- TC Matching to ±0.5 PPM/°C @25°C
- Stability: 0.0025% (1st Year), 0.005% (2nd Year). 0.001% is available

KRL STYLE	MIL-R-93	MIL-R-39005	DIMENSIONS[1] LENGTH ±.015	DIAMETER ±.015	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
532			.200	.100	24	.025	.050	100	100 K
†533			.260	.100	24	.050	.100	100	150 K
†534			.300	.100	22	.050	.100	100	150 K
†535			.250	.125	22	.065	.125	150	300 K
536			.312	.125	22	.075	.150	200	400 K
†537			.375	.125	22	.100	.200	200	500 K
†538			.375	.187	22	.125	.250	300	1 Meg
539			.250	.187	22	.115	.225	250	550 K
†540		RBR-74	.500	.187	22	.175	.350	300	1.5 Meg
550		RBR-75	.295	.250	22	.125	.250	200	1.5 Meg
†555	RB-56	RBR-56	.375	.250	20	.175	.350	300	1.5 Meg
†560	RB-55	RBR-55	.500	.250	20	.250	.500	400	2 Meg
†565	RB-54	RBR-54	.750	.250	20	.375	.750	500	3.5 Meg
570	RB-53	RBR-53	.750	.375	20	.450	.900	600	4 Meg
575	RB-52	RBR-52	1.00	.375	20	.750	1.50	750	5 Meg
578			.500	.500	20	.330	.660	400	2 Meg
580	RB-57	RBR-57	1.00	.500	20	.850	1.75	850	10 Meg
585	RB-58		1.50	.500	20	1.00	2.00	1.5KV	15 Meg

KRL STYLE	MIL-R-10509 EQUIVALENT	LENGTH ±.062	DIAMETER ±.032	LEAD AWG	POWER in WATTS	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
EC-10	RN-55	.250	.125	22	0.5	200	100 K
EC-20	RN-60	.375	.125	22	1.0	300	150 K
EC-25		.375	.187	22	1.0	325	175 K
EC-30	RN-65	.500	.187	22	1.0	350	200 K
EC-40	RN-70	.750	.250	20	1.0	400	300 K
EC-50	RN-75	1.00	.375	20	1.0	600	500 K

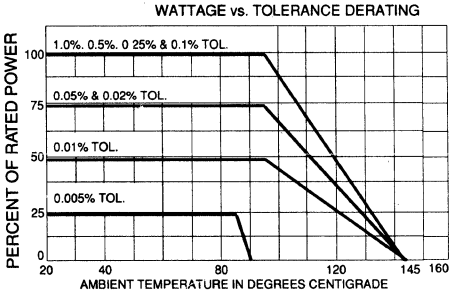
KRL STYLE	MIL-R-93	DIMENSIONS[2] LENGTH ±.032	DIAMETER ±.015	LEAD SPACING ±.010	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
†PC-50	RB-71	.312	.250	.200	22	.125	.250	300	500 K
PC-51		.375	.250	.200	22	.125	.250	300	650 K
PC-52		.500	.250	.200	22	.250	.500	300	700 K
PC-53		.375	.375	.200	20	.250	.500	300	1 Meg
PC-55	RB-70	.500	.375	.200	20	.350	.700	300	1.5 Meg

KRL STYLE	DIMENSIONS[3] HEIGHT ±.032	WIDTH ±.020	LENGTH ±.020	LEAD SPACING ±.010	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
K-250	.250	.125	.250	.125	20	.125	.250	150	500 K
K-300	.300	.125	.300	.150	20	.150	.300	150	1 Meg
K-500	.300	.150	.500	.250	20	.250	.500	150	1.5 Meg



PERCENT OF RATED POWER

KRL PRECISION WIRE WOUND RESISTOR DERATING CHART—500, EC, PC & K series resistors must be derated for tolerances below 0.1%. Use the chart below to select tolerance vs. operating temperature to determine the percent of rated power for operations. No derating is required for operations below +20°C.



KRL/BANTRY COMPONENTS, INC. 160 Bouchard St., Manchester, NH 03103-3399
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☘ KRL SURFACE MOUNT WIREWOUND RESISTORS "S" SERIES

"P"-POWER:

ORDER CODE	WORKING VOLTAGE	HIGH TC AVAILABLE	STANDARD TOLERANCES
SP-1	35V	+80 PPM to +6000 PPM	±.1% thru ±5%
SP-2	79V		
SP-3	158V		

"L"-LO-OHM:

ORDER CODE	INDUCTANCE	STANDARD TOLERANCES
SL-1	≤7 NANOHENRIES	1%, 3%, 5%
SL-2		
SL-3		

"U"-ULTRA PRECISION:

ORDER CODE	STANDARD TOLERANCES	RATIO MATCHING		HIGH TC AVAILABLE
		TC	TOLERANCES	
SU-1	±.005% thru ±1%	1 PPM	.01%	+80 PPM to +6000 PPM
SU-2				
SU-3				

"F"-FUSIBLE:

ORDER CODE	TYPICAL FUSING TIMES PER RATED WATTAGE									
	16 TIMES		20 TIMES		24 TIMES		28 TIMES		32 TIMES	
SF-1	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
SF-2	30	1	20	40	10	30	8	20	5	15
SF-3	Sec	Min	Sec	Sec	Sec	Sec	Sec	Sec	Sec	Sec

RESISTANCE RANGE:

TYPE	(L) LOW OHM	(P) POWER	(U) PRECISION	(F) FUSIBLE
S1	.01Ω-.1Ω	.11Ω-5KΩ	1Ω-100KΩ	.22Ω-100KΩ
S2	.005Ω-.1Ω	.11Ω-18KΩ	1Ω-1 MegΩ	.22Ω-100KΩ
S3	.005Ω-2Ω	.21Ω-25KΩ	1Ω-1.5 MegΩ	.22Ω-100KΩ

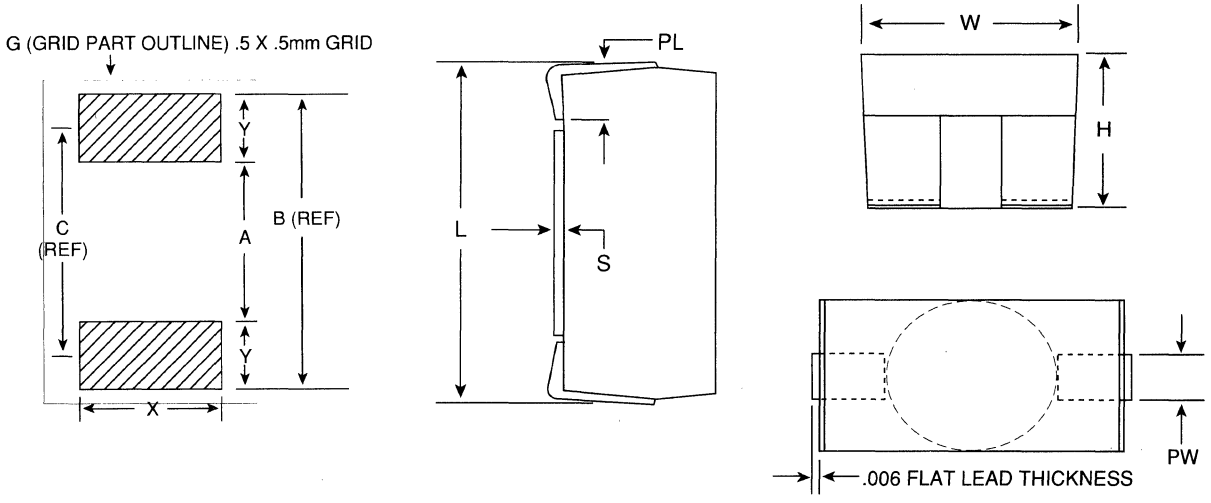
POWER RATING:

TYPE	WATTS			
	(L) LOW OHM	(P) POWER	(U) PRECISION	(F) FUSE
S1	1	1.5	.125	.25
S2	2	2.5	.250	.5
S3	3	3.5	.500	1

DIMENSIONS:

KRL TYPE	SUGGESTED LAND PATTERN (Per ANSI/IPC-SM-782 Guidelines)						CASE DIMENSIONS					
	A	B	C	X	Y	G (mm)	L Length	W Width	H Height	S Stand Off	PW Pad Width	PL Pad Length
S1	.145 (3.6)	.337 (8.6)	.240 (6.1)	.080 (2.0)	.096 (2.4)	8×16	.250 (6.3)	.140 (3.5)	.140 (3.5)	.020 (.5)	.060 (1.5)	.050 (1.25)
S2	.225 (5.7)	.505 (12.8)	.365 (9.3)	.080 (2.0)	.140 (3.55)	12×24	.435 (10.9)	.235 (5.9)	.210 (5.3)	.020 (.5)	.060 (1.5)	.060 (1.5)
S3	.390 (9.9)	.670 (17)	.530 (13.45)	.080 (2.0)	.140 (3.55)	12×24	.580 (14.5)	.250 (6.3)	.250 (6.3)	.020 (.5)	.070 (1.75)	.070 (1.75)

Inches (mm)



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♣ KRL Temperature Compensating WIRE WOUND RESISTORS

KRL High T.C. Resistors are available in any of the packages listed in this Catalog

RESISTANCE RANGE—10Ω to 5MegΩ

TOLERANCE—Standard from 10%, 5%, 3% and 1%. Accuracies to 0.1% are available. Consult factory for special requirements.

TEMPERATURE RANGE—From −55°C to +145°C

TEMPERATURE COEFFICIENTS—Available from +80PPM/°C to +6000PPM/°C (See Table Right). Use Order Code A thru T for standard T.C.'s shown.

SPECIAL TEMPERATURE COEFFICIENTS—If you need a special...non-standard T.C., use Order Code X and specify the exact T.C. required and temperature range of operation with +25°C as reference temperature. (Factory must approve all non-standard T.C.)

APPLICATIONS—Since there are many packages that a High T.C. Resistor can accommodate, it is impossible to show all types. Most often a customer will have a unique situation and our engineering department will gladly aid in any design and development of customer requirements. KRL High T.C. Resistors have found their way into Power Supplies, Motor Controllers, Computers, Electronic Circuits for D to A and A to D Converters, Temperature Sensors for the Medical Electronics Field, Aircraft Systems, Aerospace Flight Modules, and in Automotive Electronic Ignition Systems.

KRL Order Code	TEMPERATURE COEFFICIENT		Maximum (2) Resistance In Percent
	Cold Range In PPM/°C −55°C to +25°C	Heat Range In PPM/°C +25°C to +125°C	
A	+80±20	+80±20	80
B	+100±10	+100±10	80
C	+120±10	+120±10	80
D	+140±30	+140±30	80
E	+180±30	+180±30	80
G	+290±30	+290±30	25
H	+380±40	+400±40	70
J	+450±50	+450±50	60
K	+700±200	+700±200	60
L	+850±80	+850±80	50
M	+1000±100	+1000±100	50
N	+1500±200	+1400±200	50
P	+2600±200	+2600±200	50
Q	+3500±300	+3500±300	40
R	+4000±400	+4500±400	10
T	+5000±300	+6000±300	10
X	SPECIAL T.C., SPECIFY EXACT TCR.		
(1)	SUBJECT TO FACTORY APPROVAL		

(1) KRL will manufacturer to any T.C.R. to meet customer specifications.
(2) Maximum resistance in percent should be applied to the style chosen in the normal catalog listing column marked Maximum Resistance.

♣ KRL Nonflame Fusible Metal Film Resistors FPR SERIES

FPR Nonflame Fusible Metal Film Resistors

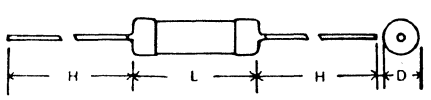
The FPR Nonflame Fusible Metal Film Resistors were designed to limit thermal surge and resulting circuit damage due to excessive voltage. FPR Resistors provide reliable and accurate blow characteristics. The FPR resistors fail in an open mode. These resistors are available in ohmic values from .22 to 100k ohms, and wattage sizes from ¼ to 3 watts.

Various telephone power line, and tip & ring circuits utilize the FPR resistor to protect sensitive parts from lightning strike surges. Other circuits that would benefit from these fusible resistors are inputs that may be exposed to line voltage faults, or power supplies that need current limiting with a safe, nonflame failure mode. Since each circuit has different and custom requirements, KRL/Bantry will work with your engineering staff to choose the correct part for your application.

FEATURES

- Small package size.
- Noncombustible insulating coating.
- Coating resists freon cleaning solvents.
- Temperature coefficients less than ±200 PPM.
- Uniform fusing characteristics.

DIMENSIONS:



TYPE	L±.04	D±.024	H±.25	Lead Awg	Resistance Range
FPR-¼W	.276	.104	1.25	24	0.22Ω—100K Ω
½W	.360	.120	1.25	22	0.22Ω—100K Ω
1W	.400	.160	1.25	22	0.22Ω—100K Ω
2W	.480	.180	1.25	20	0.3Ω—100K Ω
3W	.640	.220	1.25	20	0.3Ω—100K Ω

FUSING CHARACTERISTICS:

POWER	FUSING TIME	
	Typical	Maximum
16 × Wattage	30 Sec.	1 Min.
20	20 Sec.	40 Sec.
24	10 Sec.	30 Sec.
28	8 Sec.	20 Sec.
32	5 Sec.	15 Sec.

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♣ KRL Multi-Purpose Resistors

OX, OXH, CB, LB, LB4 & V SERIES

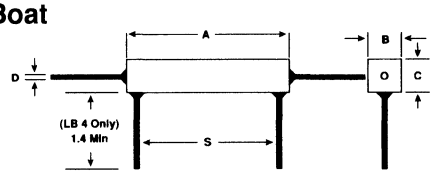
Miniature and Standard Metal Oxide Resistors

- Non Inductve Design
- Non-Flammable Coating
- Standard Temperature Coefficient ±300 PPM/°C

KRL STYLE		WATTAGE RATING @75°C		MAXIMUM VOLTAGE		DIELECTRIC WITHSTANDING VOLTAGE	RESISTANCE RANGE		DIMENSIONS		
OXH	OX	OXH	OX	WORKING	OVERLOAD		MIN	MAX	L ±.040	D ±.020	AWG ±.005
	OX-05		0.5	350V	600V	350V AC	.5Ω	120KΩ	.352	.128	24
OXH-10	OX-10	1.0	1.0	350V	600V	350V AC	.5Ω	120KΩ	.420	.140	22
OXH-20	—	2.0	—	350V	650V	500V AC	.5Ω	150KΩ	.480	.180	20
OXH-30	OX-20	3.0	2.0	350V	700V	600V AC	.5Ω	150KΩ	.640	.200	20
OXH-50	OX-30	5.0	3.0	350V	700V	1000V AC	.5Ω	150KΩ	1.00	.340	20
OXH-60	OX-40	6.0	4.0	450V	800V	1000V AC	1Ω	180KΩ	1.28	.340	20
OXH-70	OX-50	7.0	5.0	500V	1000V	1000V AC	1Ω	200KΩ	1.64	.340	20
OXH-100	OX-60	10.0	6.0	600V	1200V	1000V AC	1Ω	250KΩ	2.16	.340	20

Ceramic Boat Axial Lead Wirewound & Ultra Low Ohm Ceramic Boat

- Fireproof Construction
- Controlled Atmosphere Processing Technique (LB (4) Only)
- Six Sided Crimped Terminals (CB Only)
- Low TC & Noninductive Design (LB (4) Only)



KRL TYPE	Power @ 25°C	Maximum Current Amps	Resistance Range (Higher custom Ohm values available)	Typical TC (PPM)		A ±.03	B ±.03	C ±.03	D ±.005	S ±.062
				<1 Ohm	>1 Ohm					
LB-1	1	10	.003 to .2 Ohm	±100	—	.580	.250	.250	.032	.490
LB-2	2	10	.003 to .5 Ohm	±100	—	.690	.250	.250	.032	.563
CB-3/LB-3	3	10	.003 to 500 Ohm	±100	±400	.875	.312	.312	.032	.563
CB-5/LB-5	5	10	.003 to 500 Ohm	±100	±400	.875	.375	.375	.040	.563
CB-7/LB-7	7	20	.003 to 1K Ohm	±100	±400	1.40	.375	.375	.040	1.013
CB-10/LB-10	10	20	.003 to 1K Ohm	±100	±400	1.88	.375	.375	.040	1.388
CB-15/LB-15	15	20	.003 to 1K Ohm	±100	±400	1.88	.500	.500	.040	1.388
CB-25/LB-25	25	40	.003 to 1K Ohm	±100	±400	2.50	.500	.500	.040	2.00

Vertical Mount Resistors

- Tolerances from 1%-10%
- Space Saving Design

STYLE	POWER @25°C	A .039	B .059	C .039	D .015	Resistance Range	Temperature Coefficient
V-2	2	.275	.800	.435	.197	.01-20K Ohms	±30 PPM (TYP)
V-3	3	.320	1.00	.475	.197	.01-22K Ohms	±30 PPM (TYP)
V-5	5	.350	1.00	.520	.197	.01-22K Ohms	±30 PPM (TYP)
V-10	10	.365	1.50	.520	.197	.01-100K Ohms	±30 PPM (TYP)
V-15	15	.500	1.40	.640	.297	.01-100K Ohms	±30 PPM (TYP)

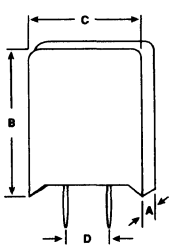
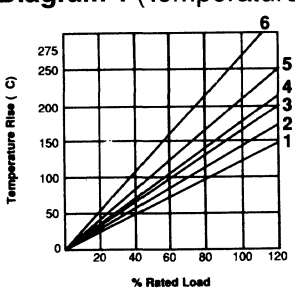


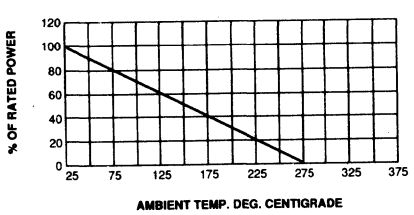
Diagram 1 (Temperature Rise)



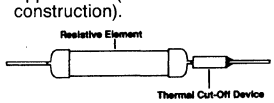
1) LB-3, CB-3, V2 & V3
2) LB-5, CB-5, & V-5
3) LB-7, & CB-7
4) LB-10, CB-10, & V-10
5) LB-15, CB-15, & V-15
6) LB-25 & CB-25

Diagram 2 (Derating)

Line A = OX & OXH Series
Line B = LB, CB, & V Series



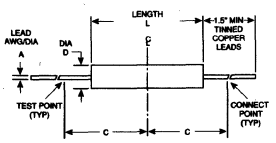
Note: Most of the above styles may be ordered with the following options: (F) for custom fusing action; and (TF) for Failsafe Thermal Fuse Applications (see below for TF construction).



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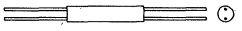
♣ KRL LO-OHM Power Resistors

- Zero micro henries inductance • Low temperature coefficient
- Higher heat dissipation/power to size ratio
- Ideal for test instruments, power amplifiers, all types of current sensing applications, including switching and linear power supplies.



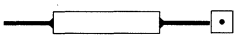
ALTERNATE CASE DESIGNS:
POTTED & MOLDED KELVIN LEADS





POTTED CERAMIC CASE

CURRENT SHUNTS





STYLE	WATTS	L LENGTH	D DIA	C TEST POINT	LEAD AWG/DIA
NP-1A	1	.430±.010	.120±.010	.590	22 AWG/.025
NP-2A	3	.600±.010	.210±.010	.675	20 AWG/.032
NP-3	4	.680±.010	.265±.010	.715	20 AWG/.032
NP-5	5	.925±.010	.335±.010	.838	18 AWG/.040

♣ KRL Wire Wound Power Resistors "HOT" MOLDED P & COATED C SERIES

KRL STYLE		MIL-R-26	MIL-R-39007	WATTAGE RATING U	WATTAGE RATING V	WORKING VOLTAGE (2) U	WORKING VOLTAGE (2) V	MAXIMUM RESISTANCE IN OHMS	DIMENSIONS LENGTH ±.062	(±.010)	DIAMETER ±.032	(±.010)	LEAD AWG
	C-1/2A			.5	1.0	18	20	3.4K	.250		.094		24
(P-1/2)	C-1/2			.75	1.2	30	35	4.5K	.280	(.300)	.094	(.120)	24
(P-1A)	C-1A	RW-70		1.0	1.5	50	55	10K	.406	(.425)	.094	(.120)	22
	C-1B			1.1	1.6	62	67	12K	.530		.094		22
(P-1C)	C-1C			1.0	1.5	28	33	5K	.330	(.360)	.094	(.120)	22
	C-1D			3.25	4.5	175	200	38K	.700		.110		22
(†P-2)	†C-2			1.5	2.0	72	79	10K	.385	(.420)	.187	(.190)	20
(†P-2A)	†C-2A	RW-79		3.0	3.75	135	148	22K	.560	(.600)	.187	(.210)	20
	C-2B		RWR-71	3.25	4.75	185	220	42K	.812		.187		20
(†P-2C)	†C-2C			3.0	3.5	138	157	32K	.500	(.535)	.250	(.265)	20
(†P-2D)	†C-2D	RW-69		2.5	3.0	135	148	20K	.500	(.535)	.210	(.210)	20
(P-2E)	C-2E			3.0	3.75	135	148	22K	.560	(.600)	.158	(.173)	20
(P-2F)	C-2F			2.5	3.00	135	148	20K	.490	(.530)	.158	(.190)	20
(†P-3)	†C-3			4.0	5.5	210	250	45K	.625	(.680)	.250	(.265)	20
(†P-5)	†C-5	RW-74	RWR-74	5.0	6.0	325	375	90K	.875	(.925)	.312	(.335)	18
(P-6)	C-6	RW-67		6.0	6.5	360	400	95K	1.000	(1.080)	.312	(.335)	18
	C-7			7.0	8.0	360	400	100K	1.200	±.094	.312	±.062	18
	C-7A	RW-55		7.5	9.0	510	580	150K	1.375	±.094	.375	±.062	18
	†C-10			10.0	13.0	800	930	250K	1.815	±.094	.375	±.062	18
	C-10A	RW-78	RWR-78	10.0	12.0	800	930	240K	1.780	±.094	.375	±.062	18
	†C-10B	RW-68		10.5	14.0	800	930	275K	1.875	±.094	.375	±.062	18

†Indicates Most popular types P = Molded ( ); C = Coated

♣ KRL Heat Sink Power Resistors

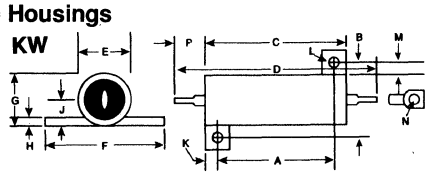
KW & AT SERIES

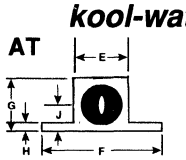
In Anodized Aluminum Housings

KW & AT SERIES

kool-watt

KRL STYLE	MIL-R-18546D	POWER RATING IN WATTS (1) KRL	POWER RATING IN WATTS (1) MIL	MAXIMUM RESISTANCE IN OHMS (2)	MAXIMUM WORKING VOLTAGE	DIELECTRIC VOLTS RMS
KW-5	RE-60	8	5	25K	160	1500
KW-10	RE-65	14	10	45K	265	1500
KW-25	RE-70	25	20	95K	550	2500
AT-50	RE-75	50	30	275K	1250	2500





DIMENSIONS (INCHES)

TYPE	MIL	A ±.005	B ±.005	C ±.031	D ±.062	E ±.015	F ±.015	G ±.015	H ±.010	J ±.010	K ±.010	L ±.005	M ±.015	N ±.005	P ±.062
KW-5	RE-60	.444	.490	.600	1.125	.334	.646	.320	.065	.133	.078	.093	.078	.050	.262
KW-10	RE-65	.562	.625	.750	1.375	.420	.800	.390	.075	.165	.093	.093	.102	.086	.312
KW-25	RE-70	.719	.781	1.062	1.938	.550	1.080	.546	.088	.231	.172	.125	.115	.086	.438
AT-50	RE-75	1.563	.844	1.968	2.781	.630	1.140	.610	.088	.260	.196	.125	.107	.086	.406

FAX US—603/624-0634—FOR MORE INFORMATION ON . . .

♣ KRL Space Miser Wirewound Resistors

♣ KRL SMT & Axial Tape & Reel Specifications

♣ KRL Econo Power Wirewound Resistors

♣ KRL Precision Dual Action Fuse Resistors

♣ **KRL/BANTRY COMPONENTS, INC.** 160 Bouchard Street, Manchester, NH 03103- 3399
Phone: 603-668-3210 FAX: 603-624-0634 TLX: 80-4294 SPEDEX

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Tecnicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

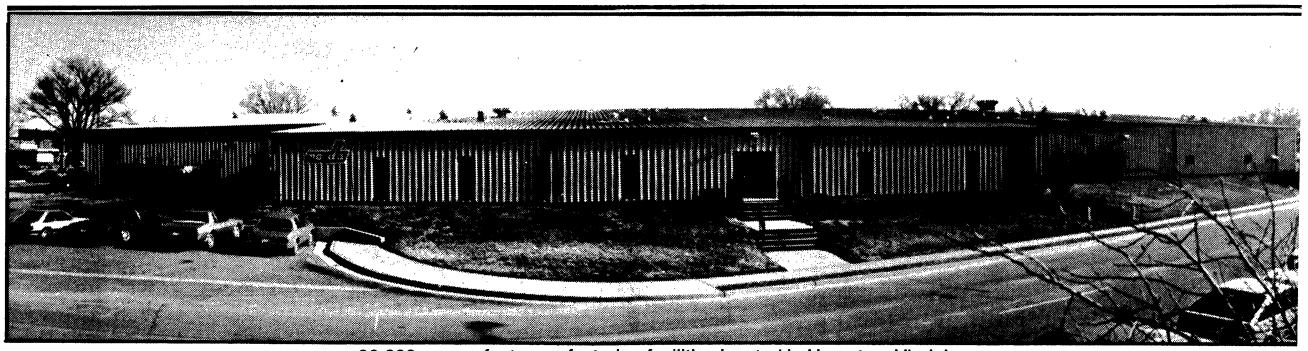
Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

ZINC OXIDE VARISTOR

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"



90,000 square foot manufacturing facilities located in Hampton, Virginia

Maida

serving the electronics industry as partners in progress for more than forty-five years.

Maida Development Corporation is a domestically owned and operated manufacturer of a wide variety of electronic ceramic components. Since 1947, we have specialized in the custom design and fabrication of ceramic disk capacitors - from ceramic dielectric powder formulation through finished devices - to meet the specific requirements of our customers. Maida's major capacitor products include (1) Class I, Class II, and Class III high voltage disk capacitors, 1 KVDC thru 30 KVDC; (2) capacitors safety-recognized by UL, CSA, and VDE, for across-the-line, line-by-pass, and antenna-coupling applications; (3) close tolerance adjusted NPO disk capacitors; (4) low-inductance leadless disks; (5) slot-mountable "trapezoids" for printed circuits; (6) trimmer capacitors; (7) post insulators/capacitors; (8) radial tubular capacitors; (9) feedthrus and (10) sparkgaps.

Maida Development Company also produces a complete line of metal oxide varistors (MOV's) designed for transient voltage suppression and surge energy absorption. We are now the only U.S. manufacturer of these components, with ceramic formulation, powder preparation, fabrication, and assembly facilities all located in this country. Maida's varistors are recognized by UL, CSA, and VDE. Please contact Maida's Sales Department to request our full-line varistor catalog.

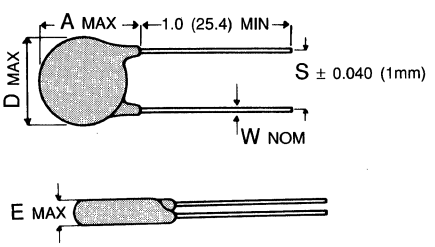
Delivery is both timely and reliable - with either bulk or tape-and-reel packaging.

Our sales representatives are strategically located throughout the USA and the world. Maida welcomes the opportunity to discuss and bid on capacitor requirements not covered by this catalog. Please contact our Engineering Department.

MAXIMUM TRANSIENT POWER RATINGS (Pm)

Series	PM-watts	Series	PM-watts
D58	0.15	D63	0.8
D73	0.25	D65	1.0
D61	0.4	D78	1.2
D69	0.6	D75	1.4

STANDARD DIMENSIONS: inches (mm)



Style Designation: (typical)

D69--ZOV511RA110

WHERE:

D- Coating identification, D means standard flame-retardent fluid bed epoxy.

69- Size code, 2 numbers. See Dimensions Table.

-- Lead Configuration code, 1 or 2 numbers used for non-standard leads. Standard leads use no code.

ZOV- Material identifier, zinc oxide varistor.

511 AC Voltage Rating code, 2 significant figures plus number of zeroes that follow, i.e. 511 is 510 VAC.

RA- Special instructions code, RA is standard.

110- Energy Rating code, up to 3 numbers. See Ratings Tables

Size	A	D	S	W	E				
Code				VAC	50-95	120-180	230-320	420-580	620-1000
D58	.394 (10)	.276 (7)	.197 (5)	.025 (.63)	.197 (5)	.236 (6)	NA	NA	NA
D73	.472 (12)	.354 (9)	.197 (5)	.025 (0.63)	.197 (5)	.236 (6)	.276 (7)	NA	NA
D61	.590 (15)	.472 (12)	.296 (7.5)	.032 (.81)	.197 (5)	.236 (6)	.276 (7)	.354 (9)	NA
D69	.770 (19.5)	.650 (16.5)	.296 (7.5)	.032 (.81)	.197 (5)	.236 (6)	.276 (7)	.354 (9)	.472 (12)
D63	.912 (23)	.787 (20)	.296 (7.5)	.032 (.81)	NA	.236 (6)	NA	NA	NA
D65	1.020 (26)	.905 (23)	.296 (7.5)	.032 (.81)	.197 (5)	.236 (6)	.276 (7)	.354 (9)	.472 (12)
D78	1.8 (45.7)	1.57 (40)	NA	NA	NA	.236 (6)	.276 (7)	.354 (9)	.472 (12)
D75	2.1 (53.3)	1.89 (48)	NA	NA	NA	.236 (6)	.276 (7)	.354 (9)	.472 (12)

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VARISTORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

ZINC OXIDE VARISTORS FOR SURGE VOLTAGE PROTECTION-ZOV RATINGS

SAFETY RECOGNITIONS (footnotes)	STYLE NUMBER	MINIMUM MARKING	MAXIMUM RATINGS				ELECTRICAL CHARACTERISTICS				
			CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE (@ 1.0mADC)		MAX CLAMPING VOLTAGE @ TEST CURRENT (8 x 20µS)		TYPICAL CAPACITANCE 1KHz @ 25C ± 30%
			APPLICABLE VOLTAGE (AC)	APPLICABLE VOLTAGE (DC)	ENERGY (10 x 1000µS)	PEAK CURRENT (8 x 20µS)	MIN	MAX			
			VOLTS	VOLTS	JOULES	AMPERES	VOLTS	VOLTS	VOLTS	AMPERES	PICOFARADS
	D58ZOV400RA01	Z400-01	40	56	61	75	1.2	100	150	1	350
	D58ZOV500RA01	Z500-01	50	66	74	90	2	100	165	5	250
	D58ZOV600RA01	Z600-01	60	85	90	110	2.0	400	175	5	200
	D58ZOV750RA01	Z750-01	75	102	108	132	2.5	400	245	5	170
	D58ZOV950RA01	Z950-01	95	127	135	165	3	400	300	5	140
4	D58ZOV131RA02	Z131-02	130	175	184	224	4	400	380	5	80
4	D58ZOV141RA02	Z141-02	140	180	198	242	4.5	400	410	5	70
4	D58ZOV151RA02	Z151-02	150	200	212	259	5	400	430	5	70
4	D58ZOV181RA02	Z181-02	180	230	255	311	6	400	510	5	65
	D58ZOV231RA08	Z231-08	230	300	326	397	7.5	400	620	5	50
	D58ZOV251RA08	Z251-08	250	320	354	432	8	400	675	5	50
	D58ZOV271RA09	Z271-09	270	350	382	466	9	400	745	5	45
	D58ZOV301RA10	Z301-10	300	385	425	518	10	400	810	5	40
	D73ZOV400RA03	Z400-03	40	56	61	75	2.5	250	135	2.5	700
	D73ZOV500RA02	Z500-02	50	66	74	90	4	250	157	10	550
	D73ZOV600RA02	Z600-02	60	81	90	110	5	250	190	10	450
	D73ZOV750RA02	Z750-02	75	102	108	132	6	1200	230	10	450
	D73ZOV950RA02	Z950-02	95	127	135	165	8	1200	255	10	350
1 2 3 4	D73ZOV131RA03	Z131-03UL	130	175	184	224	11	1200	340	10	250
1 2 3 4	D73ZOV141RA03	Z141-03UL	140	180	198	242	12	1200	360	10	220
1 2 3 4	D73ZOV151RA03	Z151-03UL	150	200	212	259	13	1200	395	10	200
1 2 3 4	D73ZOV181RA03	Z181-03UL	180	230	255	311	15	1200	470	10	170
1 2 3 4	D73ZOV231RA20	Z231-20UL	230	300	326	397	20	1200	595	10	150
1 2 3 4	D73ZOV251RA21	Z251-21UL	250	330	354	432	21	1200	650	10	130
1 2 3 4	D73ZOV271RA23	Z271-23UL	270	360	382	466	23	1200	710	10	110
1 2 3 4	D73ZOV301RA25	Z301-25UL	300	390	425	518	25	1200	790	10	100
	D61ZOV400RA07	Z400-07	40	56	61	75	6.5	500	135	5	1600
1	D61AOV500RA03	Z500-03UL	50	66	74	90	6	2500	147	25	1500
1	D61ZOV600RA03	Z600-03UL	60	81	90	110	7	2500	175	25	1400
1	D61ZOV750RA03	Z750-03UL	75	102	108	132	8	2000	210	25	1100
1	D61ZOV950RA03	Z950-03UL	95	127	135	165	10	2000	255	25	900
1 2 3 4	D61ZOV131RA04	Z131-04UL	130	175	184	224	14	2000	340	25	500
1 2 3 4	D61ZOV141RA04	Z141-04UL	140	180	198	242	16	2000	360	25	450
1 2 3 4	D61ZOV151RA04	Z151-04UL	150	200	212	259	17	2000	395	25	400
1 2 3 4	D61ZOV181RA04	Z181-04UL	180	230	255	311	20	2000	465	25	350
1 2 3 4	D61ZOV231RA35	Z231-35UL	230	300	326	397	35	2000	595	25	300
1 2 3 4	D61ZOV251RA40	Z251-40UL	250	330	354	432	40	2000	650	25	270
1 2 3 4	D61ZOV271RA43	Z271-43UL	270	360	382	466	43	2000	710	25	250
1 2 3 4	D61ZOV301RA45	Z301-45UL	300	390	425	518	45	2000	790	25	230
1 2 3 4	D61ZOV321RA45	Z321-45UL	320	420	453	553	45	2000	850	25	200
1 2 3	D61ZOV391RA45	Z391-45UL	390	505	552	674	45	2500	1025	25	150
1 2 3 4	D61AOV421RA45	Z421-45UL	420	560	594	725	45	2000	1120	25	130
1 2 3	D61ZOV461RA50	Z461-50UL	460	615	651	795	50	2500	1240	25	120
1 2 3 4	D61ZOV481RA50	Z481-50UL	480	640	679	829	50	2000	1290	25	120
1 2 3 4	D61ZOV511RA55	Z511-55UL	510	675	722	881	55	2000	1350	25	110
1 2 3 4	D61ZOV551RA60	Z551-60UL	550	700	778	950	60	2000	1400	25	100
1 2 3 4	D61ZOV581RA65	Z581-65UL	580	735	821	1002	65	2000	1500	25	95
1 2	D61ZOV621RA65	Z621-65UL	620	825	877	1071	65	2500	1650	25	90
1 2	D61AOV681RA70	Z681-70UL	680	895	962	1175	70	2500	1815	25	80
1	D69ZOV400RA12	Z400-12UL	40	56	61	75	12	1000	135	10	3300
1	D69ZOV500RA06	Z500-06UL	50	66	74	90	15	1000	147	50	2900
1	D69ZOV600RA06	Z600-06UL	60	81	90	110	20	1000	175	50	2400
1	D69ZOV750RA06	Z750-06UL	75	102	108	132	22	4500	210	50	1900
1	D69ZOV950RA06	Z950-06UL	95	127	135	165	30	4500	255	50	1500
1 2 3 4	D69ZOV131RA09	Z131-09UL	130	175	184	224	38	4500	340	50	1100
1 2 3 4	D69ZOV141RA09	Z141-09UL	140	180	198	242	42	4500	360	50	1000
1 2 3 4	D69ZOV151RA09	Z151-09UL	150	200	212	259	45	4500	395	50	900
1 2 3 4	D69ZOV181RA09	Z181-09UL	180	230	255	311	55	4500	465	50	750
1 2 3 4	D69ZOV231RA70	Z231-70UL	230	300	326	397	70	4500	595	50	550
1 2 3 4	D69ZOV251RA72	Z251-72UL	250	330	354	432	72	4500	650	50	500
1 2 3 4	D69ZOV271RA75	Z271-75UL	270	360	382	466	75	4500	710	50	450
1 2 3 4	D69ZOV301RA80	Z301-80UL	300	390	425	518	80	4500	790	50	400
1 2 3 4	D69ZOV321RA90	Z321-90UL	320	420	453	553	90	4500	850	50	350
1 2 3	D69ZOV361RA85	Z361-85UL	360	470	522	638	85	4500	960	50	300
1 2 3	D69ZOV391RA85	Z391-85UL	390	505	552	674	85	4500	1025	50	280
1 2 3	D69ZOV410RA85	Z401-85UL	400	530	585	715	85	4500	1070	50	270
1 2 3 4	D69ZOV421RA90	Z421-90UL	420	560	594	725	90	4500	1120	50	250
1 2 3	D69ZOV461RA100	Z461-100UL	460	615	651	795	100	4500	1240	50	230
1 2 3 4	D69ZOV481RA105	Z481-105UL	480	640	679	829	105	4500	1240	50	220
1 2 3 4	D69ZOV511RA110	Z511-110UL	510	675	722	881	110	4500	1350	50	200
1 2 3 4	D69ZOV551RA115	Z551-115UL	550	700	778	950	115	4500	1400	50	180
1 2 3 4	D69ZOV581RA120	Z581-120UL	580	735	821	1002	120	4500	1500	50	170
1 2 3 4	D69ZOV621RA130	Z621-130UL	620	800	877	1071	130	4500	1620	50	160
1 2 3 4	D69ZOV681RA150	Z681-150UL	680	860	962	1175	150	4500	1800	50	150
1 2 3 4	D69ZOV102RA220	Z102-220UL	1000	1200	1414	1728	220	4500	2700	50	100

1 = UL1449 File E86730—Transient Voltage Surge Suppression
2 = UL1414 File E38785—Across-The-Line Applications
3 = CSA C22.2 File LR33468
4 = VDE/CECC 42000/42201 File 58819

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VARISTORS

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"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

ZINC OXIDE VARISTORS FOR SURGE VOLTAGE PROTECTION-ZOV RATINGS

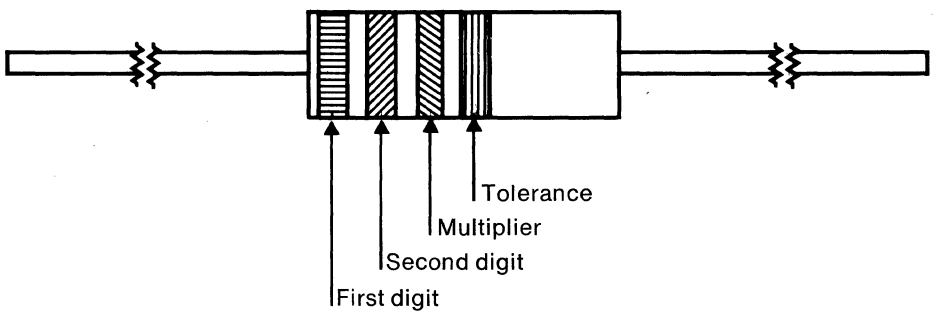
SAFETY RECOGNITIONS (footnotes)	STYLE NUMBER	MINIMUM MARKING	MAXIMUM RATINGS				ELECTRICAL CHARACTERISTICS				
			CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE (@ 1.0mADC)		MAX CLAMPING VOLTAGE @ TEST CURRENT (8 x 20µS)		TYPICAL CAPACITANCE 1KHz @25C ±30%
			APPLICABLE VOLTAGE (AC)	APPLICABLE VOLTAGE (DC)	ENERGY (10 x 1000µS)	PEAK CURRENT (8 x 20µS)	MIN	MAX			
			VOLTS	VOLTS	JOULES	AMPERES	VOLTS	VOLTS	VOLTS	AMPERES	PICOFARADS
1 2 3	D63ZOV131RA70	Z131-70UL	130	175	184	224	70	6500	340	100	2300
1 2 3	D63ZOV141RA75	Z141-75UL	140	180	198	242	75	6500	360	100	2150
1 2 3	D63ZOV151RA80	Z151-80UL	150	200	212	259	80	6500	395	100	2000
1	D65ZOV400RA40	Z400-40UL	40	56	61	75	40	2000	135	20	7000
1	D65ZOV500RA42	Z500-42UL	50	65	74	90	42	6500	135	100	5500
1	D65ZOV600RA45	Z600-45UL	60	85	90	110	45	6500	165	100	4800
1	D65ZOV750RA55	Z750-55UL	75	100	108	132	55	6500	200	100	3800
1	D65ZOV950RA65	Z950-65UL	95	125	135	165	65	6500	250	100	3000
1 2 3 4	D65ZOV131RA20	Z131-20UL	130	175	184	224	70	6500	340	100	2300
1 2 3 4	D65ZOV141RA20	Z141-20UL	140	180	198	242	75	6500	360	100	2150
1 2 3 4	D65ZOV151RA20	Z151-20UL	150	200	212	259	80	6500	395	100	2000
1 2 3 4	D65AOV181RA20	Z181-20UL	180	230	255	311	100	6500	465	100	1300
1 2 3 4	D65ZOV231RA115	Z231-115UL	230	300	326	397	115	6500	595	100	1000
1 2 3 4	D65ZOV251RA130	Z251-130UL	250	330	354	432	130	6500	650	100	920
1 2 3 4	D65ZOV271RA140	Z271-140UL	270	360	382	466	140	6500	710	100	850
1 2 3 4	D65ZOV301RA150	Z301-150UL	300	390	425	518	150	6500	790	100	770
1 2 3 4	D65ZOV321RA160	Z321-160UL	320	420	453	553	160	6500	850	100	720
1 2 3	D65ZOV391RA150	Z391-150UL	390	505	552	674	150	6500	1025	100	760
1 2 3 4	D65ZOV421RA160	Z421-160UL	420	560	594	725	160	6500	1120	100	910
1 2 3	D65ZOV461RA175	Z461-175UL	460	615	651	795	175	6500	1240	100	840
1 2 3 4	D65ZOV481RA180	Z481-180UL	480	640	679	829	180	6500	1240	100	800
1 2 3 4	D65ZOV511RA190	Z511-190UL	510	675	722	881	190	6500	1350	100	740
1 2 3 4	D65ZOV551RA200	Z551-200UL	550	700	778	950	200	6500	1400	100	690
1 2 3 4	D65ZOV581RA220	Z581-220UL	580	735	821	1002	220	6500	1500	100	670
1 2 3 4	D65ZOV621RA230	Z621-230UL	620	800	877	1071	230	6500	1620	100	620
1 2 3 4	D65ZOV681RA260	Z681-260UL	680	860	962	1175	260	6500	1800	100	560
1 2 3 4	D65ZOV102RA360	Z102-360UL	1000	1200	1414	1728	360	6500	2700	100	380
	D78ZOV131RA200	Z131-200	130	175	184	224	200	25000	350	200	4700
	D78ZOV141RA210	Z141-210	140	185	198	242	210	25000	380	200	4300
	D78ZOV151RA220	Z151-220	150	200	212	259	220	25000	410	200	4000
	D78ZOV181RA250	Z181-250	180	230	255	311	250	25000	490	200	3500
	D78ZOV231RA300	Z231-300	230	300	326	397	300	25000	625	200	2800
	D78ZOV251RA330	Z251-330	250	330	354	432	330	25000	680	200	2500
	D78ZOV271RA360	Z271-360	270	360	382	466	360	25000	750	200	2200
	D78ZOV301RA380	Z301-380	300	390	425	518	380	25000	810	200	2000
	D78ZOV321RA390	Z321-390	320	420	453	553	390	25000	850	200	1900
	D78ZOV391RA400	Z391-400	390	505	552	674	400	25000	1025	200	1600
	D78ZOV421RA400	Z421-400	420	560	594	725	400	25000	1200	200	1500
	D78ZOV461RA430	Z461-430	460	615	651	795	430	25000	1265	200	1400
	D78ZOV481RA450	Z481-450	480	640	679	829	450	25000	1300	200	1300
	D78ZOV511RA500	Z511-500	510	675	722	881	500	25000	1440	200	1200
	D78ZOV551RA530	Z551-530	550	700	778	950	530	25000	1530	200	1150
	D78ZOV581RA550	Z581-550	580	735	821	1002	550	25000	1600	200	1100
	D78ZOV621RA580	Z621-580	620	800	877	1071	580	25000	1705	200	1000
	D78ZOV681RA630	Z681-630	680	860	962	1175	630	25000	1865	200	900
	D78ZOV751RA700	Z751-700	750	970	1062	1300	700	25000	2050	200	800
	D78ZOV102RA900	Z102-900	1000	1200	1414	1728	900	25000	2550	200	600
	D75ZOV131RA270	Z131-270	130	175	184	224	270	30000	345	250	10000
	D75ZOV141RA285	Z141-285	140	180	198	242	285	30000	375	250	9000
	D75ZOV151RA300	Z151-300	150	200	212	259	300	30000	405	250	8000
	D75ZOV181RA320	Z181-320	180	230	255	311	320	30000	480	250	7100
	D75ZOV231RA350	Z231-350	230	300	326	397	350	30000	600	250	5600
	D75ZOV251RA370	Z251-370	250	330	354	432	370	30000	650	250	5000
	D75ZOV251RA400	Z271-400	270	360	382	466	400	30000	730	250	4500
	D75ZOV301RA430	Z301-430	300	390	425	518	430	30000	780	250	4000
	D75ZOV321RA460	Z321-460	320	420	453	553	460	30000	830	250	3800
	D75ZOV391RA560	Z391-560	390	505	552	674	560	30000	1040	250	3300
	D75ZOV421RA600	Z421-600	420	560	594	725	600	30000	1130	250	3000
	D75ZOV461RA630	Z461-630	460	615	651	795	630	30000	1170	250	2600
	D75ZOV481RA650	Z481-650	480	640	679	829	650	30000	1240	250	2700
	D75ZOV511RA700	Z511-700	510	675	722	881	700	30000	1350	250	2500
	D75ZOV551RA740	Z551-740	550	700	778	950	740	30000	1380	250	2300
	D75ZOV581RA770	Z581-770	580	735	821	1002	770	30000	1480	250	2200
	D75ZOV621RA820	Z621-820	620	800	877	1071	820	30000	1600	250	2100
	D75ZOV681RA920	Z681-920	680	860	962	1175	920	30000	1785	250	2000
	D75ZOV751RA1050	Z751-1050	750	970	1062	1300	1050	30000	2000	250	1800
	D75ZOV102RA1400	Z102-1400	1000	1200	1414	1728	1400	30000	2490	250	1300

1 = UL1449 File E86730—Transient Voltage Surge Suppression
2 = UL1414 File E38785—Across-The-Line Applications
3 = CSA C22.2 File LR33468
4 = VDE/CECC 42000/42201 File 58819

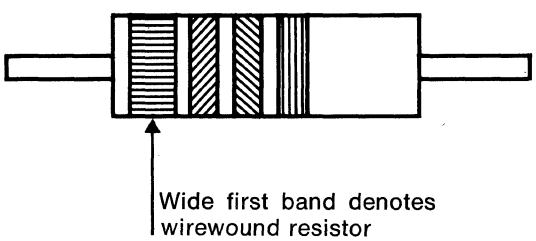
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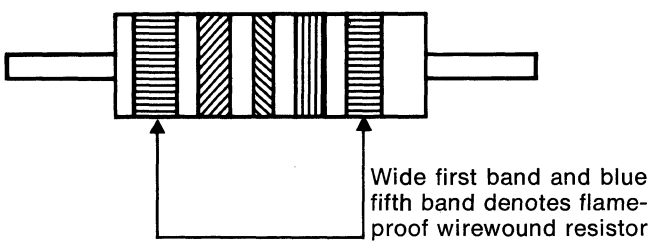
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

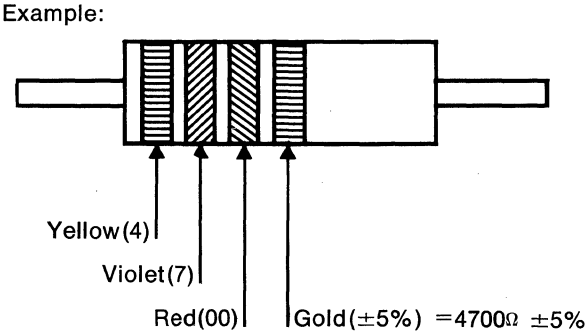




Color code for general-purpose wirewound resistors

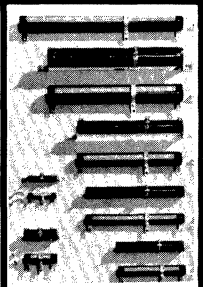
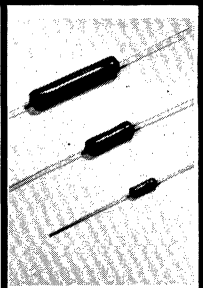
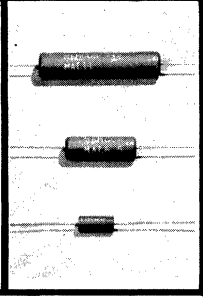
Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

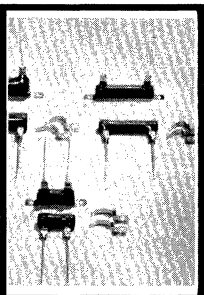
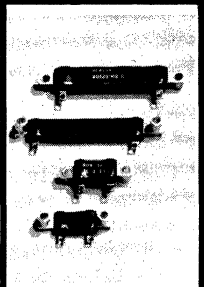
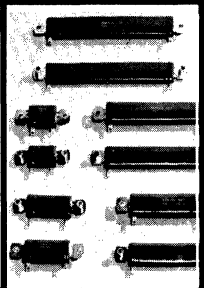
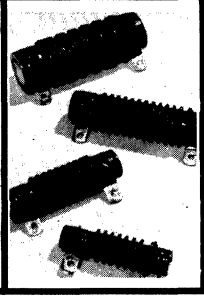
Example:



MEMCOR-TRUOHM INC.

WIRE WOUND RESISTORS

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
FR VITREOUS ENAMEL FIXED TUBULAR WITH TABS		5	25K	1 x 5/16
		10	50K	1 3/4 x 5/16
		20	100K	2 x 7/16
		25	100K	2 x 9/16
		50	250K	4 x 9/16
		100	100K	6 1/2 x 3/4
		160	100K	8 1/2 x 1 1/8
		200	100K	10 1/2 x 1 1/8
AR VITREOUS ENAMEL ADJUSTABLE TUBULAR WITH TABS		10	10K	1 3/4 x 5/16
		25	25K	2 x 9/16
		50	50K	4 x 9/16
		75	50K	6 x 9/16
		100	100K	6 1/2 x 3/4
		160	100K	8 1/2 x 1 1/8
		200	100K	10 1/2 x 1 1/8
VL VITREOUS ENAMEL AXIAL LEADS		3	10K	7/32 x 17/32
		5	25K	5/16 x 1 1/64
		10	50K	3/8 x 1 25/32
SL SILICONE AXIAL LEADS		1	2500	.100 x .383
		2	3500	.205 x .352
		3	10K	.205 x .475
		5	50K	.305 x .917
		10	100K	.24 x 1.72

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
FR w/LEADS VITREOUS ENAMEL FIXED TUBULAR		5-8	25K	1 x 5/16
		10-12	50K	1 3/4 x 5/16
		20	100K	2 x 7/16
MZ VITREOUS ENAMEL MIDGET OVALS WITH TABS		10	5000	3/8 x 5/32 x 3/4
		20	25K	3/8 x 5/32 x 2
ZR VITREOUS ENAMEL OVALS TAB TERMINAL		30	10K	5/16 x 1 x 1 1/4
		40	15K	5/16 x 1 x 2
		55	25K	5/16 x 1 x 3 1/2
		75	25K	5/16 x 1 x 6
RR VITREOUS ENAMEL EDGEWOUND WITH TABS		40	1.8	2 x 9/16
		90	3	4 x 9/16
		100	2.5	3 1/2 x 3/4
		160	5.5	6 x 3/4
		150	6.0	5 x 1
		300	13	8 1/2 x 1 1/8
		500	36	10 1/2 x 1 5/8
		750	40	12 x 2 1/2
		1500	100	20 x 2 1/2

MEMCOR-TRUOHM represent the cumulative design and production knowledge gained during 30 years experience in the industry.

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For price, quality, and delivery look to MEMCOR-TRUOHM. Immediate delivery on stock value resistors. Typical 3-5 week delivery on other standard values and special requirements. These products are available from MEMCOR-TRUOHM's Nationwide Authorized Distributor Network.

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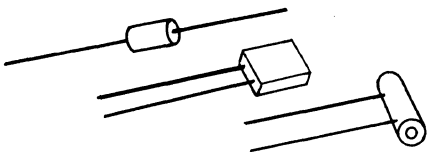
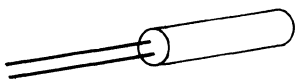
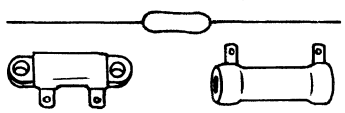
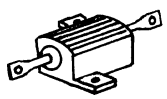
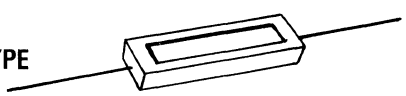
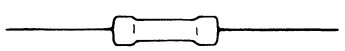
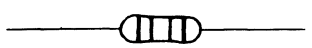
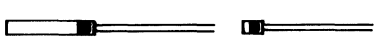
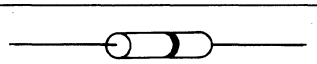
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	POWER RANGE (WATTS)	RESISTANCE RANGE (OHMS)	TEMPERATURE COEFFICIENT (PPM/°C)	RESISTANCE TOLERANCE (%)	DELIVERY (WEEKS)
PRECISION WIREWOUND MIL R-93 EQUIV. 	.01 to 2	.05 to 20M	±1 to +6000	.005 to 5	stock 4
WIREWOUND TEMP. SENSORS RTD'S 	1	40 to 1K	+3850 to +6720	1 to 5	4-6
WIREWOUND PRECISION FUSE 	.3 to 1	.2 to 200	+30 to +50	3 to 10	4-6
POWER WIREWOUND MIL R-26 EQUIV. 	.25 to 100	.002 to 265K	± 10 to +6000	.05 to 10	stock 4
POWER WIREWOUND MIL R 18546 EQUIV. CHASSIS MOUNT 	5 to 250	.05 to 200K	±5 to +90	.025 to 5	4
POWER WIREWOUND "BATHTUB" TYPE 	2 to 50	.01 to 40K	±300 to ±800	5 & 10	4-6
KP SERIES POWER WIREWOUND 	2 to 8	.2 to 36K	+260 to +800	5 & 10	8-10
METAL FILM RN 50, 55, 60, & 65 	.1 to 1	.5 to 10M	+25 to +200	.1 to 1	stock 8
METAL OXIDE 	.5 to 7	.2 to 240K	±200	2 & 5	stock 8
METAL GLAZE 	.25 to 2	1M to 2000M	±100	1, 2 & 5	stock 8
CARBON FILM RC 05, 07, 20, 32 & 42 	.125 to 2	.5 to 22 M	-200 to -800	2 & 5	stock 8
TYPE CRZ PT. THIN FILM ELEMENTS 	(CURRENT) 1MA-2MA	100 & 1K	+3850	.06 to .50	4-6
METAL FILM TEMP. SENSITIVE LPTC 12 POSITIVE LINEAR TC 	.125	5 to 15K	+2500 to +4000	2 & 5	8
ZERO OHM 	.125 & .250	—	—	—	stock

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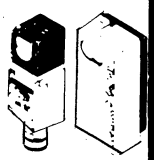
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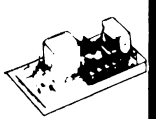
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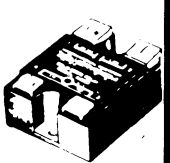
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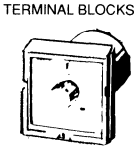

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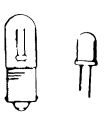
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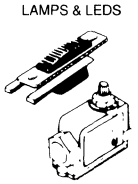
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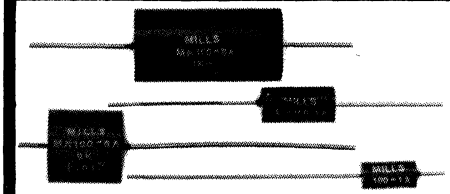
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STANDARDS

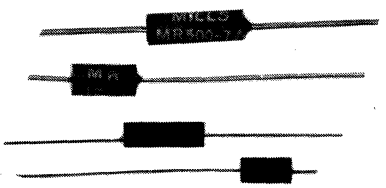


Part No.	Watt	Max. R	Dia.	Length	Lead
MR100-1	.15	100K	.187	.375	#22
MR100-2	.25	1.5M	.250	.500	#22
MR100-3	.30	2.75M	.250	.750	#22
MR100-4	.35	3.0M	.375	.625	#20
MR100-5	.50	4.0M	.375	.828	#20
MR100-6	.50	5.0M	.50	.50	#20

Many other sizes available

- Lead Configuration:
  "A" after Part No. for Axial Leads
  "R" for Radial Leads
  "L" for Lugs
- For high speed applications (minimum distributed L and C) specify MR200 Series.
- For high stability applications specify MR300 Series.

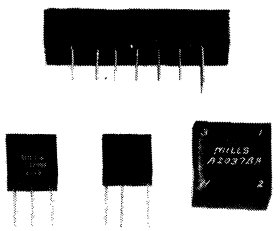
MINIATURE PARTS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR500-1	.04	100K	.080	.210	#20
MR500-2	.05	125K	.080	.375	#24
MR500-3	.04	100K	.125	.125	#24
MR500-4	.05	125K	.100	.210	#24
MR500-5	.10	125K	.125	.187	#24
MR500-6	.10	125K	.125	.250	

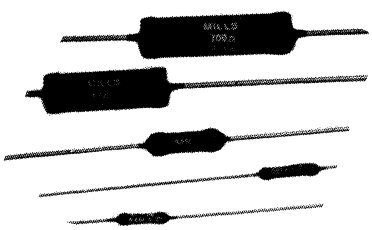
- Tolerance: .005% and up; to .002% in some cases.
- Ask for our Precision Resistor Catalogue.

NETWORKS



- Any configuration you desire.
- Matched 2, 3 or 4 Network configurations available in standard sizes.
- Standard R, 2R, 4R types, etc. available.
- Tolerances: To .005%, closer in some cases; Temperature Coefficient tracking to 1 PPM; Ratio matches to .001%.
- Ask for our Network Flyer.

PRECISION POWER WIREWOUND RESISTORS



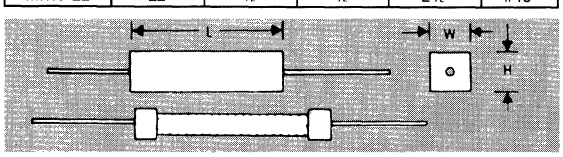
Part No.	Watt	Max. R	Dia.	Length	Lead
MRP-½	½	4.9K	.093	.343	#24
MRP-1	1	10.4K	.093	.406	#24
MRP-3	3	18K	.187	.562	#20
MRP-5	5	90K	.312	1.032	#18
MRP-10	10	370K	.344	1.719	#18

Many other sizes available

- To 15 watts.
- Silicone covered for maximum heat transfer.
- Tolerance: 5%, 1% standard, available to .05%.
- Non-Inductive winding available.
- Ask for our Power Resistor Catalogue.

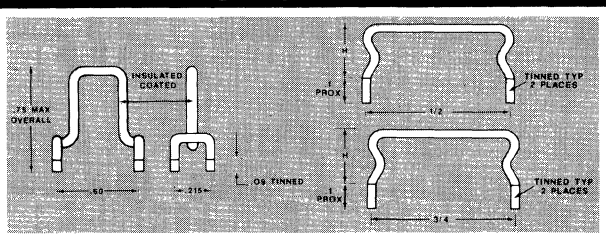
FIBERGLASS CORE WIREWOUND RESISTORS

Part No.	Watt	Dimensions W	H	L	Leads
MRW-5	5	⅜	⅜	⅞	#20
MRW-7	7	⅜	⅜	1⅜	#20
MRW-10	10	⅜	⅜	1⅞	#20
MRW-15	15	½	½	1⅞	#18
MRW-22	22	½	½	2½	#18



AVAILABLE CASED OR UNCASED

SHUNTS



FOUR-LEAD SHUNTS

- Best for close-tolerance sensing.
- Resistance values from .005 to .500.
- Tolerance ±.5% standard.
- Silicone coated body for good insulation and maximum heat transfer.

TWO-LEAD SHUNTS

- Resistance values per your requirements.
- ½", 1", 1½" centers are standard.
- Tinned for convenient insertion.
- Ask us about any configuration to suit your needs.

MILLS RESISTOR COMPANY, INC.

3840 CATALINA STREET
LOS ALAMITOS, CA 90720
(213) 598-2454
FAX (213) 430-8309

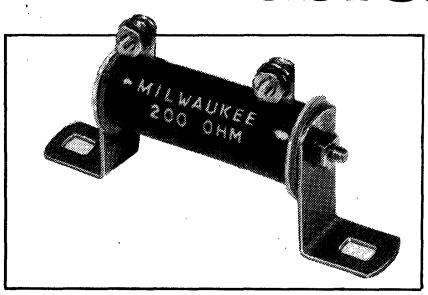
6965 LUTHER DR. #5
SACRAMENTO, CA 95823
(916) 422-5461
FAX (916) 422-1409

CUSTOM ROUNDWIRE POWER RESISTORS

BASIC CONSTRUCTION

MRC can build a resistor to your specifications on any of the basic cores shown. If these do not fit your needs, engineering assistance is available for 32 additional cores. Ratings based on 325°C above 25°C ambient. Consider the following options to meet your requirements, special applications, and size limitations.

- **MIL-R-15109**
- **Special Tolerance**
  Resistance tolerances to ±1%
- **Special Coatings**
  Silicone-cement



- **Special Taps**
  Most any to fit your specifications
- **Special Windings**
  Aryton-Perry (non-inductive round-wire only)
  Bifilar (non-inductive)

- **Special T.C.**
  Temperature coefficient to 20 ppm/°C
- **Special Terminals**
  Single and double ¼" quick connect
  Metal sleeve ferrule
  Live-bracket
- **Hardware**
  Terminal hardware
  L-bracket mounting
  Spring clip mounting
  Vertical mounting hardware

LOAD BANKS

MRC will custom design and build load banks to your requirements.

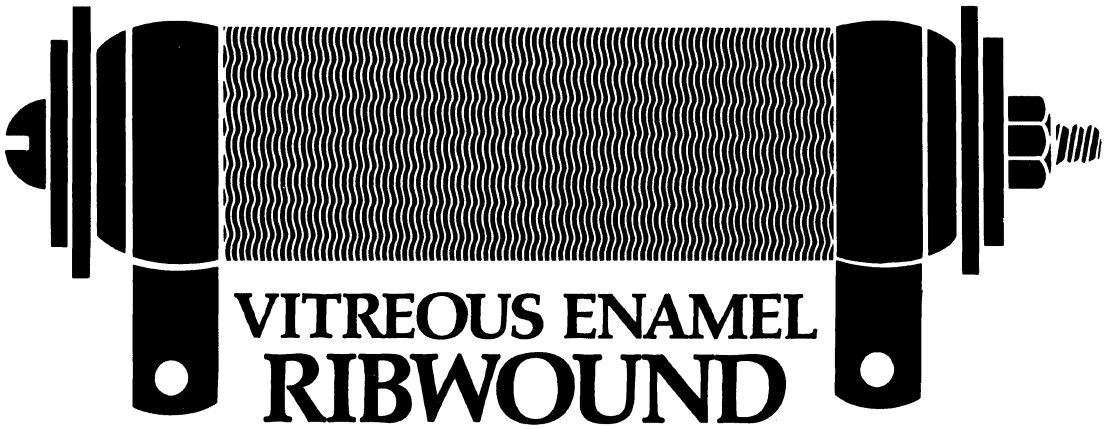
AVAILABLE WATTAGE RATINGS by core size. Ratings based on 325°C above 25°C ambient.

	Core Size	Ohmic Range				
Watts	O.D.xI.D.xL.	Fixed †		Adjustable †		Part No.*
		Min Ω	Max Ω	Min Ω	Max Ω	
8(5)†	5/16x3/16x1	.82	13.5K	N.A.	N.A.	5-16-Ω
12(10)†	5/16x3/16x1¾	.12	49K	0.27	10.6K	5-28-Ω
11(8)	7/16x5/16x1	1.39	7.2K	N.A.	N.A.	7-16-Ω
15(10)	7/16x5/16x1½	.16	28.7K	N.A.	N.A.	7-24-Ω
20(15)†	7/16x5/16x2	.13	53.2K	N.A.	N.A.	7-32-Ω
26	7/16x5/16x3	.11	122K	N.A.	N.A.	7-48-Ω
25(20)†	9/16x5/16x2	.22	35K	0.50	19K	9-32-Ω
31(25)	9/16x5/16x2½	.11	55K	0.71	28K	9-40-Ω
50(35)†	9/16x5/16x4	.21	119K	1.34	54K	9-64-Ω
75	9/16x5/16x6	.33	207K	2.18	89K	9-96-Ω
24	¾x½x1½	.33	13K	N.A.	N.A.	12-24-Ω
30(25)	¾x½x2	.28	29K	0.66	26K	12-32-Ω
45(35)	¾x½x3	.18	63K	1.21	49K	12-48-Ω
51(40)	¾x½x3½	.22	83K	1.49	61K	12-56-Ω
61(45)	¾x½x4	.27	97K	1.77	73K	12-64-Ω
65(50)	¾x½x4½	.31	122K	2.04	84K	12-72-Ω
75(60)	¾x½x5	.35	134K	2.32	96K	12-80-Ω
90	¾x½x6	.43	172K	2.87	119K	12-96-Ω
100†	¾x½x6½	.47	186K	3.15	131K	12-104-Ω
40(33)	1⅛x¾x2	.48	7.9K	N.A.	N.A.	18-32-Ω

	Core Size	Ohmic Range				
Watts	O.D.xI.D.xL.	Fixed †		Adjustable †		Part No.*
		Min Ω	Max Ω	Min Ω	Max Ω	
80	1⅛x¾x4	.06	53K	0.40	48K	18-64-Ω
95	1⅛x¾x5	.08	79K	.56	79K	18-80-Ω
120	1⅛x¾x6	.11	100K	.71	100K	18-96-Ω
130(115)	1⅛x¾x6½	.12	111K	.78	111K	18-104-Ω
160	1⅛x¾x8	.15	144K	1.00	144K	18-128-Ω
175(160)†	1⅛x¾x8½	.16	156K	1.08	156K	18-136-Ω
225†	1⅛x¾x10½	.21	200K	1.38	200K	18-168-Ω
235	1⅛x¾x11¼	.22	216K	1.49	216K	18-180-Ω
240	1⅛x¾x11¾	.24	227K	1.56	227K	18-188-Ω
220	1⅝x1⅛x8½	.21	69K	1.38	69K	26-136-Ω
275	1⅝x1⅛x10½	.27	90K	1.81	90K	26-168-Ω
300	1⅝x1⅛x11¾	.31	104K	2.07	104K	26-188-Ω
500‡	2½x1¾x12	.49	34K	3.24	34K	40-192-Ωc
750‡	2½x1¾x15	.63	44K	4.22	44K	40-240-Ωc
1000‡	2½x1¾x20	.89	62K	5.85	62K	40-320-Ωc
1150‡	3¼x1¾x20	1.140	41K	7.58	41K	52-320-Ωc

• Wattages shown in parenthesis are Navy ratings per Mil-R-15109.
† Resistors shown are standard wattages
* Add "A" after part number for adjustable types.
† For resistance values outside the limits shown, consult MRC.
‡ Cement coating standard — Silicone available.
• Unable to find what you need above? The same cores can be wound with ribbon wire for higher wattage capability--See the ribwound **A•1951.**

MRC MILWAUKEE RESISTOR CORPORATION
700 WEST VIRGINIA STREET • MILWAUKEE, WI 53204-0219
P.O. BOX 04219 • TELEPHONE 414/271-9900 • FAX 414/271-9876



VITREOUS ENAMEL RIBWOUND RESISTORS



BASIC CONSTRUCTION

Crimped ribbon resistance wire is edgewound and then locked to the ceramic core with vitreous enamel. The resistance wire is spot welded to the terminal bands. MRC Ribwounds can be supplied in fixed, adjustable, or tapped styles. Cement or silicone coatings are optional.

HI-OHM RIBWOUNDS AN EXCLUSIVE WITH MRC

In the chart below, note that the maximum ohmic value shown for each wattage is 3 to 4 times higher than that normally available. This development is the result of precision rib winding machines designed specifically by MRC. Unique in the industry, these precision machines produce a winding with extreme uniformity. This allows much closer turns providing significantly higher resistance. Hi-Ohm Ribwounds can replace lower ohmic value round wire power resistors with savings in size.

OHMS	OHMS	OHMS
0.1	1.0	6.0
0.15	1.25	8.0
0.2	1.5	10.0
0.25	2.0	12.0
0.4	2.5	15.0
0.5	3.0	20.0
0.6	4.0	25.0
0.75	5.0	33.0

Many 300 watt units are stocked in both fixed and adjustable styles. Listed are the more popular 300 watt ohmic values. All other wattage ratings and styles are made to order.

APPLICATIONS

Recommended for use where high energy is to be dissipated in the lower ohmic ranges. With its ability to dissipate greater heat, the ribwound resistor is almost one half the physical size of an equally rated roundwire.

Ribwound wattage ratings are based on a temperature rise of 375°C above an ambient of 40°C.

They can be mounted with spring clips (thru 1⅛" dia.); thrubolt hardware individual or multiple-stacked bracket assemblies or live-bracket assemblies.

WATTS	CORE SIZE	OHMIC RANGE #		PART NUMBER	
	O.D. x I.D. x L.	FIXED	ADJ.	FIXED	ADJ.
40	9/16x5/16x2	.010-10.6	N.A.	9-32-ΩR	USE SAME PART NUMBER BUT SUBSTITUTE "AR" FOR "R".
50	¾x½x2	.020-8.2	N.A.	12-32-ΩR	
60	¾x½x2½	.010-13.7	N.A.	12-40-ΩR	
75	¾x½x3	.010-19.3	N.A.	12-48-ΩR	
90	9/16x5/16x4	.015-28.3	.014-25.3	9-64-ΩR	
100	¾x½x3½	.012-24.5	.011-20.7	12-56-ΩR	
110	¾x½x4	.015-30.6	.014-26.8	12-64-ΩR	
120 (110)	¾x½x4½	.018-36.8	.017-32.9	12-72-ΩR	
135	¾x½x5	.021-42.9	.020-39.0	12-80-ΩR	
150	1⅛x¾x4	.019-44.8	.018-39.0	18-64-ΩR	
160	¾x½x6	.027-55.0	.027-51.3	12-96-ΩR	
160 (155)	1⅛x¾x4¼	.021-49.2	.020-43.6	18-68-ΩR	
175	1⅛x¾x4½	.023-53.7	.022-48.1	18-72-ΩR	
180	¾x½x6½	.030-61.3	.030-57.4	12-104-ΩR	
220	1⅛x¾x6	.035-80.6	.035-75.0	18-96-ΩR	

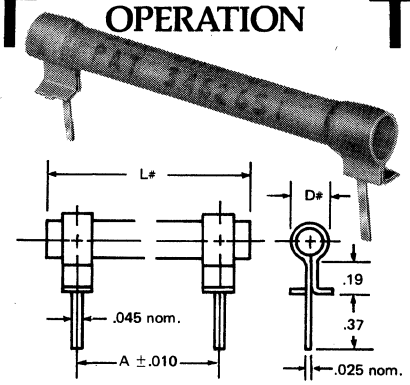
WATTS	CORE SIZE	OHMIC RANGE #		PART NUMBER	
	O.D. x I.D. x L.	FIXED	ADJ.	FIXED	ADJ.
225 (220)	1⅛x¾x6⅛	.036-82.8	.036-77.2	18-98-ΩR	USE SAME PART NUMBER BUT SUBSTITUTE "AR" FOR "R".
240 (240)	1⅛x¾x6½	.038-89.5	.039-83.9	18-104-ΩR	
300 (300)†	1⅛x¾x8½	.054-125	.055-120	18-136-ΩR	
375	1⅛x¾x10½	.069-161	.072-156	18-168-ΩR	
400	1⅛x¾x11¼	.075-175	.078-169	18-180-ΩR	
400 (400)	1⅝x1⅛x8½	.061-159	.062-149	26-136-ΩR	
420	1⅛x¾x11¾	.079-184	.082-178	18-138-ΩR	
500 (500)	1⅝x1⅛x10½	.081-210	.083-200	26-168-ΩR	
550 (550)	1⅝x1⅛x11¾	.093-242	.097-232	26-188-ΩR	
750‡	2½x1¾x12	.128-166	.130-158	40-192-ΩRC	
1000‡	2½x1¾x15	.168-217	.176-209	40-240-ΩRC	
1500‡	2½x1¾x20	.234-303	.248-294	40-320-ΩRC	
2000‡	3¼x1¾x20	.281-391	.300-380	52-320-ΩRC	

Standard resistance tolerance is ±10% — closer on request.
† Stock wattage — see stock list above.
‡ Cement coating is standard rather than vitreous enamel.
Wattages in parenthesis are Navy ratings per Mil-R-15109, Form EW.
Unable to find what you need above? The same cores can be wound with ribbon wire for higher wattage capability--See the ribwound **A•1951.**

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PCB RESISTORS

MOUNT AND TERMINATE IN ONE OPERATION



- **Built-in Standoffs Keep Board COOL.**
- Mounting feet prevent rocking.
- Power ratings 3 to 20 watts.
- Wide ohmic range.
- One-piece welded terminals.
- Standard pin spacing: 1/10″ cc multiples, special spacing on request.
- Rectangular pins .025 x .045 in. (mount in .078″ dia. PCB holes).
- Silicone-Quartz coating.
- Standard tolerances ±5% over 1 ohm, ±10% under 1 ohm & adjustable.
- 20 PPM upon request.
- Wattages based on 275° C rise above an ambient of 25° C.

* U.S. Patent 3,462,651.

FIXED

Watts	L#	A	D#	Min.Ω‡	Max.Ω‡	Part Number
3	1 1/32	0.6	5/16	.86	10K	3.5-13-Ω PCB
5	1 5/16	0.9	5/16	.181	19K	3.5-18-Ω PCB
7	1 23/32	1.3	5/16	.29	31K	3.5-24-Ω PCB
10	2 1/8	1.7	5/16	.4	43K	3.5-30-Ω PCB
15	2 1/8	1.7	13/32	.106	65K	5-32-Ω PCB
20	2 5/8	2.2	13/32	.142	88K	5-40-Ω PCB

ADJUSTABLE

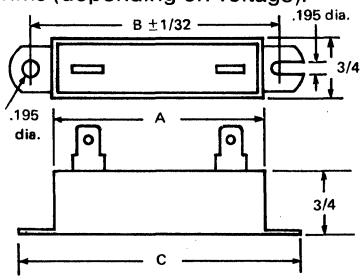
Watts†	L#	A	D#	Min.Ω‡	Max.Ω‡	Part Number
15	2 1/8	1.7	13/32	.69	14K	5-32-Ω A PCB
20	2 5/8	2.2	13/32	.93	19K	5-40-Ω A PCB

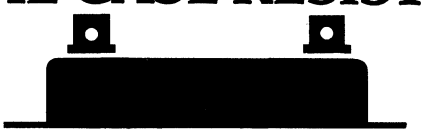
† Non-standard wattages in the range of 3-29 watts are possible—contact M.R.C.
‡ For resistances above or below the limits shown, contact M.R.C.
# Maximum measurements.

METAL CASE RESISTORS

For Motor Starting, Speed Control, Solid State Ignition Systems, Shunts, Potted Circuits, and Voltage Dropping

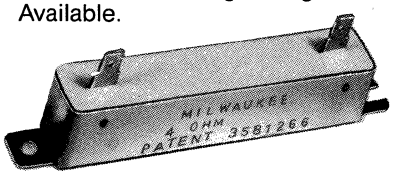
- High Heat Sink Capability—Flush Mounted Metal Case dissipates heat faster.
- Rugged—Shock Resistant.
- Wattage Rating—20 to 100 Watts (higher on specials)—based on 275° C rise above 25° C ambient.
- Resistance Range 0.2 ohm to 66,000 ohms (depending on voltage).





- Dielectric Strength—1500 Volts RMS (must be specified).
- Terminals—quick connect—screw/solder lugs.

- Additional Wattages Available.
- Additional Mounting Configurations Available.

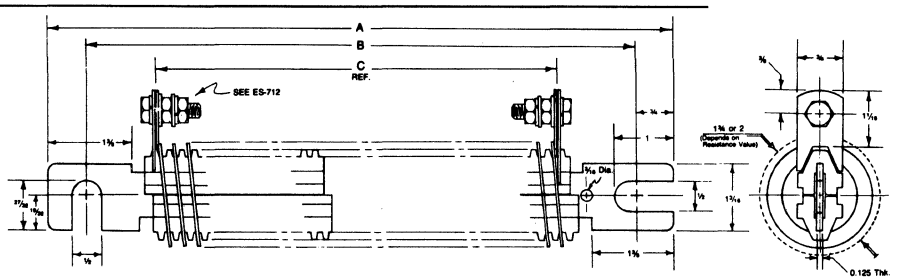


Watts Ratings at 275° C rise showing benefit of mounting flush for full heat sink.††		Dimensions			Ohmic Range		Part Number
Without Heat Sink	With Heat Sink	A	B	C	Min.Ω	Max.Ω	(Specify Terminal)
20	45	1	1 7/16	1 1/8	1.1	2750	12M16-Ω†
40	70	2 1/2	3	3 3/8	0.2	22K	12M40-Ω‡
50	100	3 11/16	4 1/8	4 9/16	0.2	66K	12M59-Ω‡

†† Ratings based on mounting on steel panel 10″ x 10″ x .040″; (heat transfer to heat sink is improved by the use of thermal conductive grease or epoxy).
† Standard terminal is 3/16″ wide with hole, Type AB.
‡ Standard terminal is single quick connect, Type H.

PAT. 3,581,266

EDGEWOUND POWER RESISTORS



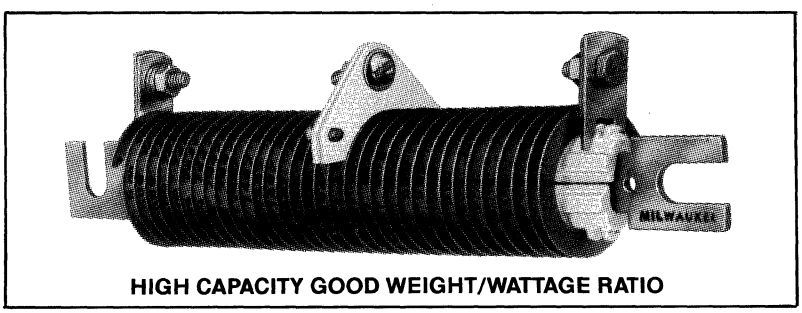
Form 3			Form 4			Form 5			Form 6			Form 7			Form 8		
600 Watt			800 Watt			1,000 Watt			1,200 Watt			1,400 Watt			1,600 Watt		
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
12¼	11	8¼	15¼	14	11¼	18¼	17	14¼	21¼	20	17¼	24¼	23	20¼	27¼	26	23¼

Wattage rating based on 375°C rise above an ambient of 40°C

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EDGEWOUND POWER RESISTORS

EDGE·POWER



HIGH CAPACITY GOOD WEIGHT/WATTAGE RATIO

New **EDGE-POWER** resistors complement Milwaukee Resistor's roundwire, ribwound and grid resistors which have been the industry's workhorse of electrical power dissipation for many years.

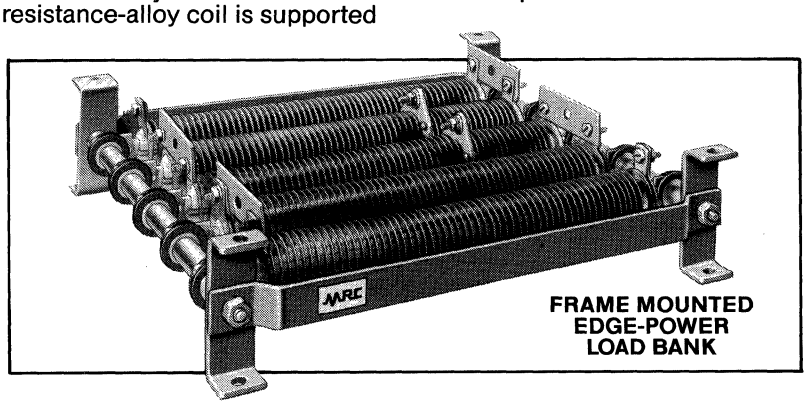
A continuous range of resistor types are now available for your high current applications. EDGE-POWER falls naturally between MRC's ribwound and grid resistors and allows full design versatility from one source.

Because of the open coil construction of EDGE-POWER resistors, heat dissipation is efficient, and reasonable surges/overloads are easily accommodated.

The heavy duty resistance-alloy coil is supported on specially designed porcelain insulators which provide insulation and proper turn-to-turn spacing. The end-slot/side-slot support bar provides versatility in mounting and adapts easily to many existing installations.

Movable tap terminals are available as an option. Terminal hardware for cable attachment is provided as a standard item on all terminals and taps.

Frame mounted load banks (as shown below) can be furnished with taps and jumpers to meet your circuit specifications (series, parallel or combination). Your load bank inquiries are invited.



FRAME MOUNTED EDGE-POWER LOAD BANK

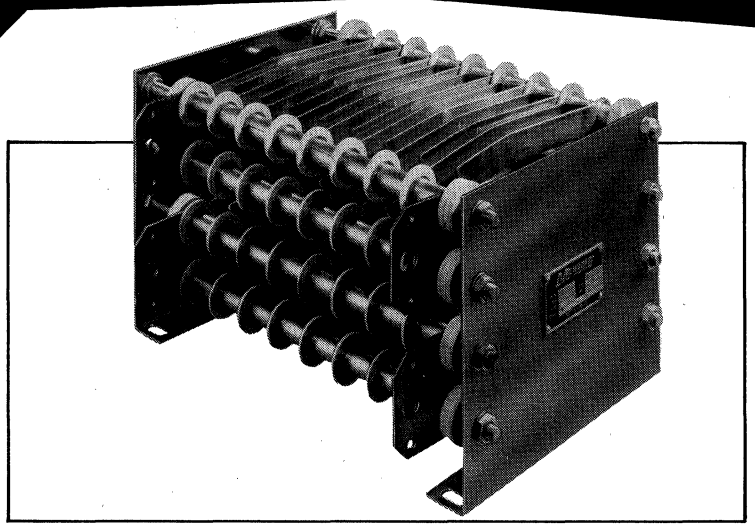
Typical Applications of **EDGE-POWER** resistors include motor control (starting, plugging, speed control and braking), load dumping, ballast, current limiting, and voltage dropping. Edgewound resistors are commonly found in:

- Overhead Cranes
- Locomotives
- Lift Trucks
- Plating Baths
- Elevators
- Power Supplies
- Arc and Spot Welders
- Battery Lines/Chargers
- Many Industrial Controls

MRC MILWAUKEE RESISTOR CORPORATION

700 WEST VIRGINIA STREET • MILWAUKEE, WI 53204-0219
P.O. BOX 04219 • TELEPHONE 414/271-9900 • FAX 414/271-9876

GRID RESISTORS



...For High Current and High Power Circuits

Milwaukee Grid Resistors are among the most versatile grid resistors developed. They are custom designed with the aid of a computer for specific applications.

Special features that assure longer life include: a patented* grid design that withstands overloads that would destroy conventional grids. Corrosion resistant stainless steel or special alloy elements. All-welded construction to eliminate hot spots and resistance fluctuations. Vibration-proof insulation that allows extended operation at higher voltages.

Taps and independent sections can be easily incorporated into the design to provide added flexibility. MRC grid units can be designed for use with natural convection cooling or with forced ventilation if size reduction is necessary.

They are competitively priced and incorporate more life and greater dependability than usually provided by conventional grid resistors.

*U.S. Patent 3,212,045

Typical Characteristics:

- 375° C temperature rise above an ambient of 40° C.
- Temperature coefficient of 150 ppm/° C.
- Hi potential test at 1500 VRMS—Higher on request.
- Resistances available to approximately 2 Ohms maximum.

Typical Applications:

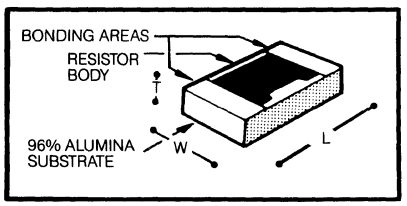
- Motor starting
- Braking
- Power systems
- Crane controls
- Dummy loads
- Grounding resistors
- Speed controls
- Feedback resistors
- Heaters
- Industrial controls

MRC MILWAUKEE RESISTOR CORPORATION

700 WEST VIRGINIA STREET • MILWAUKEE, WI 53204-0219
P.O. BOX 04219 • TELEPHONE 414/271-9900 • FAX 414/271-9876

PRECISION THICK/THIN FILM CHIP RESISTORS

MINI-SYSTEMS, INC.
20 David Road, P.O. Box 69, North Attleboro, MA 02761
TELEPHONE: (508) 695-0203 • TWX NO. 710-348-0564
FAX (508) 695-6076



MINI-SYSTEMS, INC., thick/thin film chip resistor components are ideally suited for the fabrication of microelectronic circuits where tight resistance tolerance, wide range of resistance values, or short production runs make the conventional screening and firing of thick/thin film resistance networks too costly. MINI-SYSTEMS, INC., chip resistors are made from a carefully engineered selection of materials. Geometries are mechanically precise and uniform. Careful testing and inspection result in the highest quality resistors.

STANDARD "MSR" SERIES

- Sizes Available: .020" × .040" up to .661" × .494".
- PDIS Rating (25°C free air): 40 mW to 15 W.
- Resistors manufactured with palladium silver or platinum gold with or without nickel plating.
- Tolerances available: ±.5%, 1%, 2%, 5%, 10%, and 20% for most resistance values.
- All types available in untinned versions for conductive epoxy attachment.
- Hi-Rel screening available on all resistor types.
- Backside metalization available upon request.
- "Flip-Chip" resistors are solder tinned (SN-62).
- Wire bond resistors have gold metalization optimized for wire bonding.
- Sandwich metalization standard on all wrap-around resistors.
- Over 150 styles readily available.

***Wrap-Around Terminations**

WA-	Size (L × W)	PDIS Rating 25°C (Milliwatts)	Ohmic Range
10	.040 × .037	35	1Ω to 75MΩ
4	.057 × .052	250	1Ω to 100MΩ
13	.083 × .052	400	1Ω to 100MΩ
9	.110 × .052	500	1Ω to 100MΩ
7	.110 × .102	1000	1Ω to 100MΩ
24	.160 × .052	600	1Ω to 100MΩ

*Other standard sizes available.
Write for free literature with detailed resistor chart.

ESTABLISHED RELIABILITY QPL MIL-R-55342 CHIP RESISTORS FOR ALL CRITICAL APPLICATIONS

- Sizes 55342/1 through /6
- Terminations Available: S, R, W, T, U
- Tolerances Available: F, G, J, K
- Meet or exceed Characteristic K
- Delivery: Typically 4 weeks ARO
- Anti-Static Tape & Reel Available

NEW LOW COST "JR" SERIES COMPUTER/INDUSTRIAL GRADE WRAP AROUND CHIP RESISTOR

TYPE #JR13—.075(L) × .050(W) × .017(T)

- Resistance Range: 10Ω to 10MΩ to standard EIA/MIL/IEC resistance decade values.
- PDIS Rating (25°C free air): 200 milliwatts.
- Untinned for either epoxy or solder attachment.
- Delivery typically 2 weeks ARO.

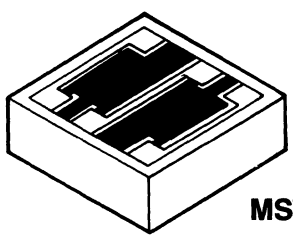
THIN FILM

MSTF-2 SERIES (.020" × .020")

MSTF-3 SERIES (.030" × .030")

MSTF-4 SERIES (.040" × .040")

CUSTOM NETWORKS



MSTF-3

- Nichrome or Tantalum Nitride
- Choice of Substrates:
  a) Oxidized Silicon—.010" ±.003"
  Oxide Thickness—10,000 Å min.
  b) Ceramic, 99.6% —.010" ±.001"
- Values range through the RETMA Series from 2Ω up to 1 Gigohm, depending on chip size.
- Tolerances: ±20%, 10%, 5%, 2%, 1%, 0.5% and 0.1% for most values.
- Backside gold available (5,000 Å typ.) on request.
- MSTF-3 series includes standard center tap dual resistor pattern.
- Visual requirements designed to meet MIL-STD-883 Method 2010.6 with full lot traceability of material and processing.
- Bond pad size: .005" × .005" minimum. Bond pad conductor material: Gold (20,000 Å typ.) standard. Bondable with normal wire bonding methods, such as thermocompression, thermosonic, or ultrasonic. Aluminum pads available.
- Nichrome resistors passivated with silicon dioxide (5,000 Å typ.) for moisture protection and reliability. TCR (absolute) can be provided from 0-25 ppm. Special TCR's available on request.
- Noise: −30 to −35 dB typical for most values.
- Stability: 0.05% max. 0.02% typical. ±.003% typical Ratio. (After 1000 hours @ + 125°C.)
- Trimmable: Designed for customer active trimming with Xenon or YAG Laser.
- Microwave Attenuators: 1 dB - 24 dB—Quartz/Ceramic Substrate

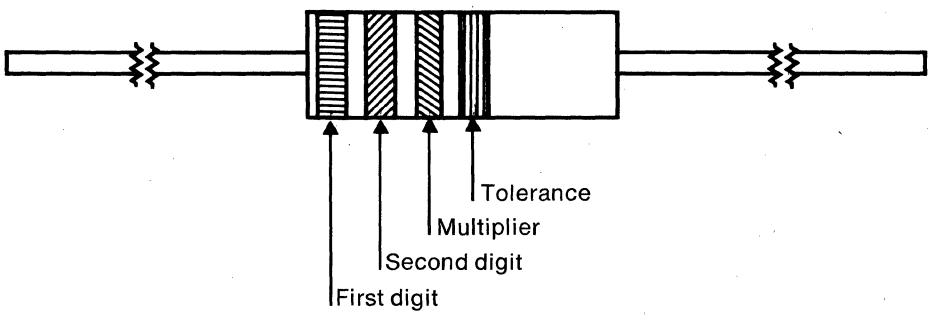
FOR ANY CUSTOM REQUIREMENTS, CONTACT FACTORY

THICK/THIN MULTILAYER SUBSTRATES/ HYBRID MICROCIRCUITS

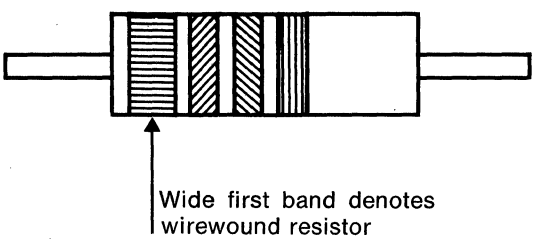
MINI-SYSTEMS, INC. has the latest materials technology processing capabilities for thick film and thin film multilayer substrates/monolithic substrates, and custom resistor networks coupled with complete facilities for hybrid assembly, packaging, and testing. Fully automatic wire bonders and fully automatic laser trim systems give substantial production quantity capablilites.

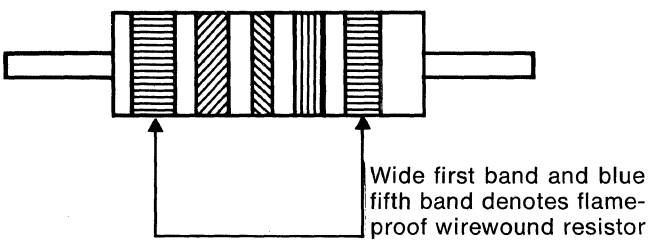
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

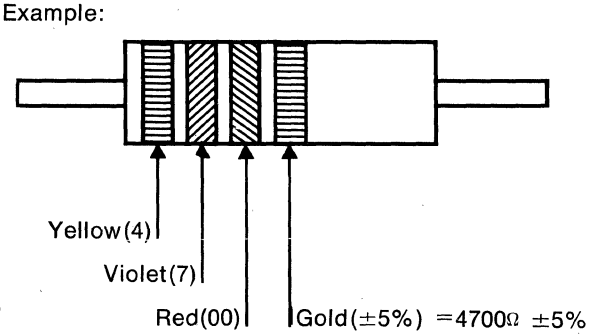




Color code for general-purpose wirewound resistors

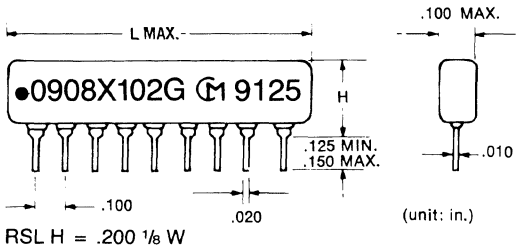
Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



sip resistor networks

MURATA ERIE NORTH AMERICA



RSL H = .200 1/8 W
RSC H = .256 1/8 W
RSH H = .355 1/4-1/2 W

X-CIRCUIT

No. Pins	No. of Elements	L
4	3	.398
5	4	.496
6	5	.594
7	6	.693
8	7	.795
9	8	.894
10	9	.996
11	10	1.094
12	11	1.201
13	12	1.299
14	13	1.398

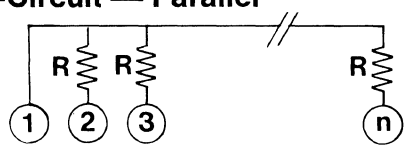
Y-CIRCUIT

No. Pins	No. of Elements	L
6	3	.594
8	4	.795
10	5	.996
12	6	1.201
14	7	1.398

Z-CIRCUIT

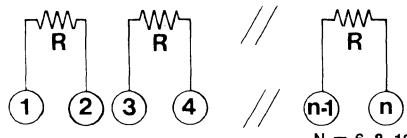
No. Pins	No. of Elements	L
6	8	.594
7	10	.693
8	12	.795
9	14	.894
10	16	.996

X-Circuit — Parallel



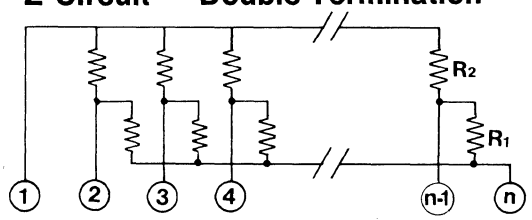
13 Elements Max. N = Pins 4 through 14

Y-Circuit — Discrete



7 Elements Max. N = 6, 8, 10, 12 and 14 Pins

Z-Circuit — Double Termination



16 Elements Max. N = 6, 7, 8, 9 and 10 Pins

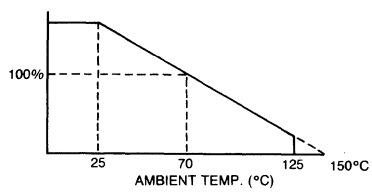
7 other circuits are std. plus custom design circuits available upon request.

SPECIFICATIONS

Electrical

Temp. Range:	−55°C to +125°C
Resistance Range:	22Ω to 1MΩ
Resistance Tolerance:	±1%(F), ±2%(G), ±5%(J)
Temp. Coefficient:	±200 ppm/°C max. (±100 ppm/°C max. on special order)
Power:	100% at 70°C. Maximum ambient temperature at 0 Watt is 125°C.

Power Derating Characteristics:



Mechanical

Substrate Material:	Alumina
Resistor Material:	Cermet, thick film
Lead Pull Strength:	2 lbs.

STANDARD RESISTANCES

Res. (ohms)	Code	Res. (ohms)	Code
100	101	1K	102
150	151	1.5K	152
220	221	2.2K	222
330	331	3.3K	332
470	471	4.7K	472
680	681	6.8K	682

Res. (ohms)	Code	Res. (ohms)	Code
10K	103	100K	104
15K	153	150K	154
22K	223	220K	224
33K	333	330K	334
47K	473	470K	474
68K	683	680K	684

TYPICAL RESISTANCE COMBINATIONS*

R_1/R_2	R_1/R_2	R_1/R_2
160/240	330/390	330/390
180/390	330/470	1.5K/3.3K
220/330	330/680	3K/6.2K

*** Note 1:** In addition to $R_1=R_2$ resistance combinations, the typical resistor combinations shown in the chart are available on special order.
2: RC networks also available. Contact Murata Erie for technical details.

MARKING: Pin 1 Location; No. of Pins/Resistors; Circuit Type; Resistance Value; Tolerance; Mfr. Logo/Date Code

PART NUMBERING SYSTEM RSL 6 X 102 G

SINGLE IN-LINE RESISTOR NETWORK	NO. OF PINS	CIRCUIT TYPE	RESISTANCE CODE	RESISTANCE TOLERANCE
RSL (Low Profile) = 1/8 W RSC (Medium Profile) 1/4 W (Y), 1/32 W (L) RSH (High Profile) = 1/4 W (X,Z)	4 pins thru 14 pins standard	X = Parallel Y = Discrete Z = Double Termination, etc.	First two digits are significant. Last digit specifies number of zeros to follow	J = ±5% G = ±2% F = ±1%

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

Axial Lead Resistors

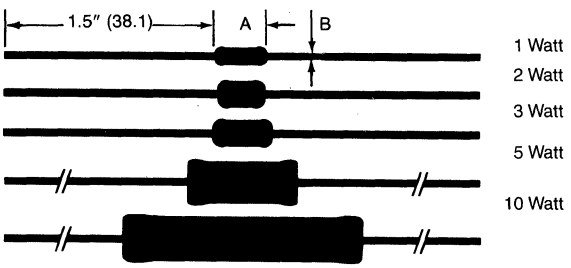
Wirewound

OHMITE®
Manufacturing Company

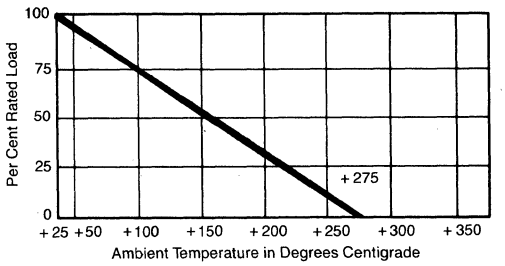
40 Series Ohmicone®

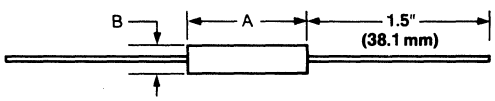
- 1% and 5% Tolerance
- Conformal Silicone
- Industrial Grade

(Drawings Not to Scale)



Derating: For Axial Lead Power Resistor

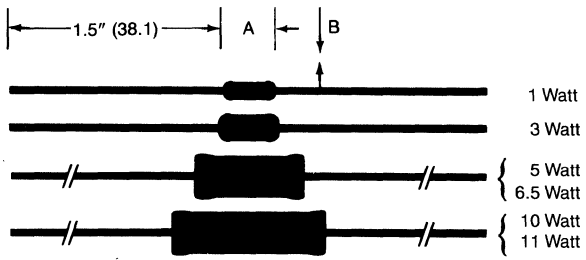




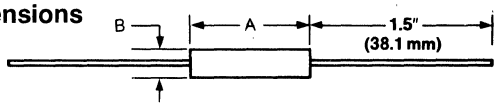
Power Rating Watts	Body Dimensions				Leads Ga.	Ohmic Range
	Max. Lgth.—A		Max. Dia.—B			
	in.	mm	in.	mm		
1	.437	11.1	.125	3.2	24	.1-6K
2	.406	10.3	.219	5.6	20	.1-8K
3	.563	14.3	.250	6.4	20	.1-20K
5	.937	23.8	.343	8.7	18	.1-80K
10	1.843	46.8	.406	10.3	18	.1-200K

80 Series Acrasil®

- 1% and 5% Tolerance
- Stabilized
- Conformal Silicone
- Military Approved



Dimensions



Power Rating Watts	MIL-R-26 Designation	Body Dimensions				Leads Ga.	Ohmic Range
		Max. Lgth.—A		Max. Dia.—B			
		in.	mm	in.	mm		
1	RW70U—F	.437	11.1	.125	3.2	24	.1-10K
3	RW79U—F	.597	15.2	.218	5.5	20	.1-35K
5	RW74U—F	.937	23.8	.343	8.7	18	.1-129K
10	RW78U—F	1.842	46.8	.406	10.3	18	.1-319K
3	RW69V—	.563	14.3	.250	6.4	20	.1-35K
6.5	RW67V—	.937	23.8	.343	8.7	18	.1-180K
11	RW68V—	1.842	46.8	.406	10.3	18	.1-319K

89 Series Metal-Mite®

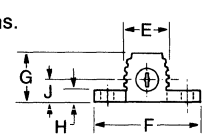
- 1% and 5% Tolerance
- Aluminum Housed
- Military Approved

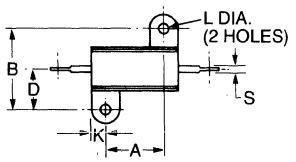
Features

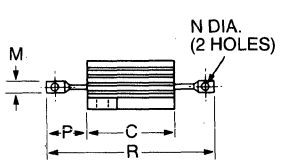
- **High Stability** ±0.5%ΔR.
- **High power** to size ratio.
- **Metal** housing allows chassis mounting and provides heat sink capability.
- **In accordance** with MIL-R-18546 specifications.
- **Resistors marked** with "Mil" designation and Ohmite stock part number.

Specifications

Overload: 5 times rated wattage for 5 seconds.
Temperature Coefficient:
Under 1 Ohm: ±90 ppm/°C.
1 to 9.99 Ohms: ±50 ppm/°C.
10 Ohms and Over: ±20 ppm/°C.
Dielectric Withstanding Voltage:
1000 VAC: 5 and 10 watt rating.
2500 VAC: 25 and 50 watt rating.







Inches		A ±.005	B ±.005	C ±.031	D ±.0025	E ±.015	F ±.015	G ±.015	H ±.010	J ±.015	K ±.010	L ±.005	M Min.	N ±.005	P ±.062	R ±.062	S Min. AWG	Ohmic Range
Mil-R-type	Watts																	
RE60G	5†	.444	.490	.600	.245	.334	.646	.320	.060	.156	.078	.093	.085	.050	.266	1.125	16	1.0-25K
RE65G	10†	.562	.625	.750	.312	.420	.800	.390	.075	.183	.093	.093	.140	.086	.312	1.375	12	1.0-50K
RE70G	20††	.719	.781	1.062	.391	.550	1.080	.546	.088	.231	.172	.125	.140	.086	.438	1.938	12	1.0-75K
RE75G	30††	1.563	.844	1.968	.422	.630	1.140	.610	.088	.260	.196	.125	.140	.086	.438	2.781	12	1.0-100K

3601 Howard Street • Skokie, Illinois 60076 • (708) 675-2600 • FAX (708) 675-1505 • TELEX 72-4433

Axial Lead Resistors

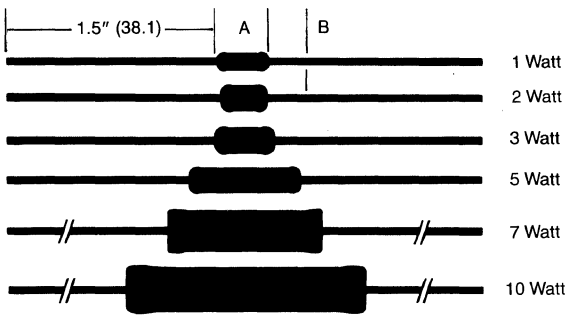
OHMITE®

Power Resistors Wirewound–Radial/Lug Terminals

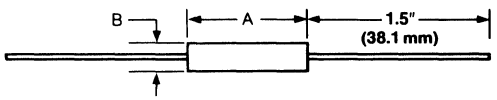
Manufacturing Company

20 Series Axial Lead Resistor

- 5% Tolerance
- Conformal Vitreous Enamel
- Industrial Grade



Dimensions



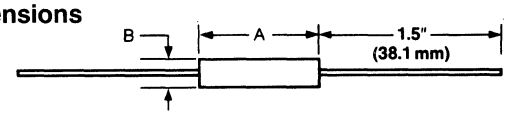
Power Rating Watts	Body Dimensions				Leads Ga.	Ohmic Range
	Max. Lgth.—A		Max. Dia.—B			
	in.	mm	in.	mm		
1	.406	10.3	.156	4.0	24	.1-6.1K
2	.406	10.3	.219	5.6	20	.1-8.7K
3	.562	14.3	.250	6.4	20	.1-22K
5	1.000	25.4	.250	6.4	20	.1-54K
7	1.250	31.8	.343	8.7	20	.1-118K
10	1.797	45.6	.343	8.7	20	.1-190K

90 Series Axial Lead Resistor

- 5% Tolerance
- Molded Vitreous Enamel
- Premium Grade



Dimensions



Power Rating Watts	Body Dimensions				Leads Ga.	Ohmic Range
	Max. Lgth.—A		Max. Dia.—B			
	in.	mm	in.	mm		
1½	.437	11.1	.140	3.6	24	.1-6.1K
2¼	.390	9.9	.219	5.6	20	.1-6.4K
3¼	.562	14.3	.234	5.9	20	.1-22K
5	.953	24.2	.234	5.9	20	.1-53K
11	1.796	45.6	.343	8.7	20	.1-187K

PC-58 Series Radial Lead Power Resistor for PC Boards

- 5% Tolerance
- Vitreous Enamel/Silicone
- PC Board Mounting

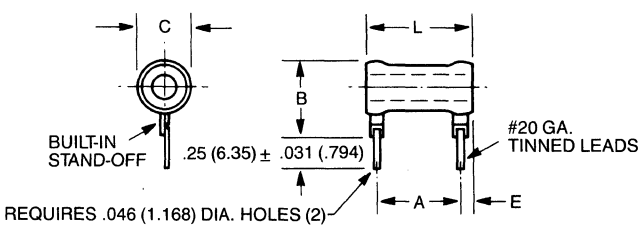
Features

- **Radial lead** construction for direct insertion into printed circuit boards; fit standard 0.10 inch matrix boards with standard 0.046 inch diameter holes. Provides a built in stand-off to reduce board temperature.
- **Space saving** radial leads reduce the total length requirement compared to axial lead resistors and increase packaging density possibilities.
- **Flame resistant** vitreous enamel coating.

  Radial-lead resistors are designed specifically for direct insertion into printed circuit boards. Direct insertion reduces manufacturing costs by eliminating the cutting, bending and forming of leads required with axial-lead resistors.

  Radial lead resistors feature all-welded construction to assure stable performance even during heavy usage.

Dimensions



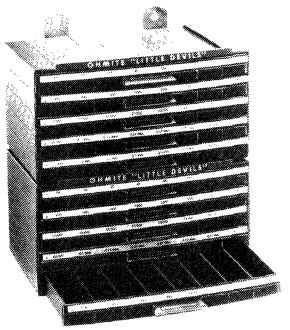
Power Rating Watts	A ± .010	B ± 1/32	C Max.	E Min.	L ± 1/64	Ohmic Range
3	0.30 in.	0.469 in.	0.313 in.	0.031 in.	0.438 in.	1.0-10K
	7.62 mm	11.91 mm	7.95 mm	.79 mm	11.13 mm	
5¼	0.50 in.	0.516 in.	0.344 in.	0.031 in.	0.625 in.	1.0-20K
	12.70 mm	13.11 mm	8.74 mm	.79 mm	15.18 mm	

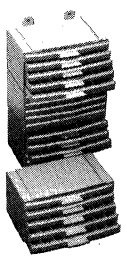
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Axial Lead Cabinet Resistor Assortments

OHMITE®
Manufacturing Company

Stock Part Numbers For Standard Resistance Values







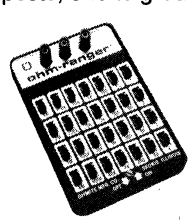
Features

- **Popular** resistance values.
- **Cabinets** are stackable and interlock for better space utilization.
- **Each** cabinet drawer clearly identifies contents.
- **"Mil"** type resistors available.
- **Resistors** contained in the cabinets also available as stock items.

Resistor Series-Axial Lead	Power Rating Watts	Part No.	Tol.	Qty.	No. of values	No. of cab. in assort.	Resistance Range
Wirewound							
Conformal Vitreous Enamel (20 Series)	1	CAB-221	5%	167	40	1	1Ω- 3KΩ
Conformal Vitreous Enamel (20 Series)	3	CAB-223	5%	325	71	2	1Ω-10KΩ
Conformal Vitreous Enamel (20 Series)	5	CAB-225	5%	357	77	2	1Ω-25KΩ
Conformal Vitreous Enamel (20 Series)	10	CAB-220	5%	185	40	1	1Ω-50KΩ
Conformal Ohmicone® (40 Series)	1	(CAB-441)	5%	120	40	1	.1Ω-10KΩ
Conformal Ohmicone® (40 Series)	3	(CAB-443)	5%	120	40	1	.1Ω-10KΩ
Conformal Ohmicone® (40 Series)	5	(CAB-445)	5%	120	40	1	.1Ω-10KΩ
Conformal Ohmicone® (40 Series)	10	(CAB-440)	5%	120	40	1	.1Ω-10KΩ
Little Rebel							
Carbon Film	1/8	CAB-5F	5%	150	31	1	10Ω to 22MΩ
Carbon Film	1/8	CAB-22F	5%	500	52	2	10Ω to 22MΩ
Carbon Film	1/8	**CAB-34F**	5%	1000	104	3	10Ω to 22MΩ
Carbon Film	1/4	**CAB-6F**	5%	150	36	1	1Ω to 1MΩ
Carbon Film	1/4	**CAB-23F**	5%	1000	75	2	1Ω to 1MΩ
Carbon Film	1/4	**CAB-43F**	5%	1500	137	4	1Ω to 1MΩ
Carbon Film	1/2	CAB-7F	5%	150	36	1	1Ω to 1MΩ
Carbon Film	1/2	**CAB-24F**	5%	1000	75	2	1Ω to 1MΩ
Carbon Film	1/2	**CAB-44F**	5%	1500	137	4	1Ω to 1MΩ
Little Devil							
Carbon Composition	1/8	CAB-21	5%	500	80	2	10Ω-1.0MΩ
Carbon Composition	1/8	**CAB-45**	5%	1000	160	4	2.7Ω-22MΩ
Carbon Composition	1/4	**CAB-54**	5%	124	40	1	10Ω-22MΩ
Carbon Composition	1/4	**CAB-525**	5%	800	80	2	2.7Ω-22MΩ
Carbon Composition	1/4	CAB-46	5%	1500	160	4	2.7Ω-22MΩ
Carbon Composition	1/2	**CAB-510**	5%	120	40	1	10Ω-10MΩ
Carbon Composition	1/2	**CAB-526**	5%	800	80	2	2.7Ω-22MΩ
Carbon Composition	1/2	**CAB-47**	5%	1500	160	4	2.7Ω-22MΩ
Carbon Composition	1	**CAB-52**	5%	100	40	1	10Ω-10MΩ
Carbon Composition	1	**CAB-527**	5%	480	80	2	2.7Ω-22MΩ
Carbon Composition	1	**CAB-48**	5%	900	160	4	2.7Ω-22MΩ
Carbon Composition	2	**CAB-53**	5%	100	40	1	10Ω-10MΩ
Metal Devil							
Metal Film	1/4	**CAB-8M**	1%	250	40	1	10Ω to 301KΩ
Metal Film	1/4	**CAB-28M**	1%	500	80	2	10Ω to 301KΩ
Metal Film	1/4	**CAB-34M**	1%	1000	120	3	10Ω to 301KΩ
Metal Film	1/2	**CAB-9M**	1%	250	40	1	10Ω to 1MΩ
Metal Film	1/2	**CAB-29F**	1%	500	80	2	10Ω to 1MΩ
Metal Film	1/2	**CAB-32M**	1%	1000	120	3	10Ω to 1MΩ

Ohm-Ranger Model No. 3420

An economical, portable resistance selector with a range to over 11,000,000 Ohms, in 1 Ohm increments. Has three binding posts, one to ground the case.

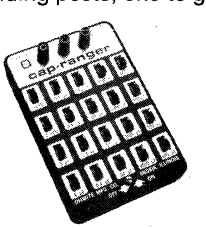


Features

- **Sliding** switches.
- **Handy** slimline size.
- **Rugged** metal construction.

Cap-Ranger Model No. 3430

An economical, portable capacitance selector with three binding posts, one to ground the metal case.



Specifications

Accuracy: ±2%.
Maximum Voltage: 200 VDC.
Residual Capacitance: 60 pf (typical).
Range: 100 picofarads to 11.111 microfarads in 100 picofarad steps.
Dimensions: 4″ × 6″ × 1″.
Weight: 13 oz.

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Vitreous Enamel Power Resistors

OHMITE®
Manufacturing Company

270 Type

- 5% Tolerance
- Vitreous Enamel
- Radial Lugs

Features

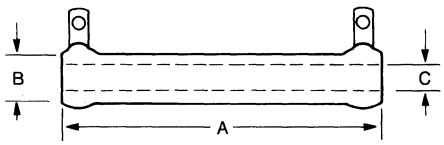
- **Terminals** suitable for soldering or bolt connection.
- **High** wattage applications.
- **Rugged** vitreous enamel coating.
- **Flame resistant** coating.
- **All**-welded construction.

Select 270 Type fixed resistors for applications requiring wattage ratings from 12 to 225 watts.

The 270 Type resistors are equipped with lug terminals suitable for soldering or sturdy bolt connection. When secure mounting is required, the hollow core of these resistors permit fastening with spring-type brackets, thru bolts or thru bolts with slotted-steel brackets.

Suitable for rugged applications, the 270 Type resistors feature all-welded construction and durable vitreous enamel coating.

Dimensions



Power Rating Watts	Core Dimensions A in.	A mm	B in.	B mm	C in.	C mm	Ohmic Range
12	1.75	44.4	.313	7.94	.188	4.76	.1-50K
25	2.0	50.8	.562	14.3	.313	7.94	.15-100K
50	4.0	101.6	.562	14.3	.313	7.94	.38-260K
100	6.5	165.1	.75	19.1	.50	12.7	.23-100K
175	8.5	215.9	1.125	28.6	.75	19.1	.13-100K
225	10.5	266.7	1.125	28.6	.75	19.1	.16-129K

210 Type Adjustable

- 10% Tolerance
- Vitreous Enamel
- Radial Lugs

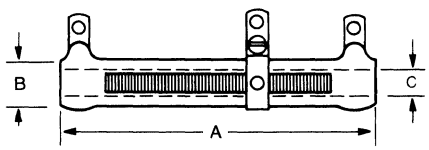
Features

- **Terminals** suitable for soldering or bolt connection.
- **Adjustable** slotted lug supplied.
- **High** wattage applications.
- **All**-welded construction.
- **Rugged** vitreous enamel coating.
- **Flame resistant** coating.

Choose Ohmite's 210 Type adjustable resistors for applications requiring settings at different resistance values. These wirewound resistors are equipped with an adjustable lug, making them ideal for adjusting circuits, obtaining odd resistance values and setting equipment to meet various line voltages.

210 Type resistors feature a hollow core to permit secure fastening with spring-type clips, thru bolts or thru bolts with washers. They also offer the durability of vitreous enamel coating and all-welded construction

Dimensions



Power Rating Watts	Core Dimensions A in.	A mm	B in.	B mm	C in.	C mm	Ohmic Range
12	1.75	44.4	.313	7.94	.188	4.76	1.0-30K
25	2.0	50.8	.562	14.3	.313	7.94	.25-67K
50	4.0	101.6	.562	14.3	.313	7.94	.62-176K
75	6.0	152.4	.562	14.3	.313	7.94	1.0-284K
100	6.5	165.1	.75	19.1	.50	12.7	1.0-101K
175	8.5	215.9	1.125	28.6	.75	19.1	.7-101K
225	10.5	266.7	1.125	28.6	.75	19.1	.86-129K

250 Type

- 5% Tolerance
- Vitreous Enamel
- Stackable Radial Lug

Features

- **Small** size to power ratio.
- **Stackable.**
- **Integral** mounting bracket conducts heat to mounting surface.
- **Low** profile for use in equipment where space is limited.
- **All**-welded construction.

Dimensions

Figure No. 1
Miniature thin resistor with stacking-type box bracket.

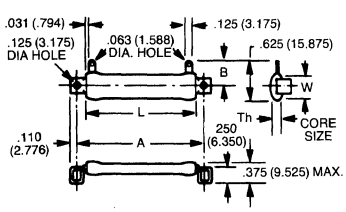
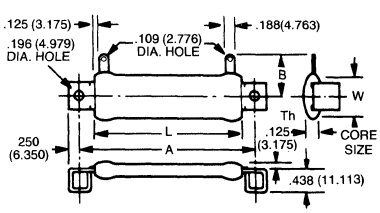


Figure No. 2
Standard resistor with stacking-type box bracket.



Power Rating Watts	Fig. No.	Core Dimensions Length (L) in.	Length (L) mm	Width (W) in.	Width (W) mm	Thickness (Th) in.	Thickness (Th) mm	A in.	A mm	B in.	B mm	Ohmic Range
10	1	.750	19.050	.375	9.525	.125	3.175	1.000	25.400	.375	9.525	1-15K
20	1	2.000	50.800	.375	9.525	.125	3.175	2.313	58.750	.375	9.525	1-50K
30	2	1.250	31.750	1.000	25.400	.250	6.350	2.000	50.800	.938	23.813	1-10K
40	2	2.000	50.800	1.000	25.400	.250	6.350	2.750	69.850	.938	23.813	1-25K
55	2	3.500	88.900	1.000	25.400	.250	6.350	4.250	107.950	.938	23.813	1-30K

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Vitreous Enamel Power Resistor

OHMITE®
Manufacturing Company

200 Type

- 5% Tolerance
- Vitreous Enamel
- Radial Lugs/Axial Leads

Ohmite's Brown Devils are small, exceptionally durable power resistors. They feature all-welded construction and rugged, flame resistant conformal vitreous enamel coating to ensure successful performance under high temperatures.

The wirewound 200 type resistors have a hollow-core construction, which accommodates rigid mounting with brackets or thru bolts.

200 Type Resistor Mounting Hardware
Mounting Brackets:

Fits inside core of 200 type and remains in place by spring tension. Standard brackets, plated steel, have no suffix; Spring steel brackets indicated by an "S" suffix.

Part No.		Mfg. Screw Size (Max.)	Fits Models
5	5S	6	8 and 12 Watt
7	7S	6	20 Watt

Thru-Bolts

Thru-Bolts along with Centering and Mica Insulatinsg Washers premit mounting 200 Type Resistors perpendicularly to panels up to 1/4" thick.

Part No.	Bolt Size		For Resistors (Power Ratings)
	Length	No.	
7PA5	1¾" in.	8	8 Watt
7PA10	2½" in.	8	12 Watt
7PA20	2¾" in.	8	20 Watt

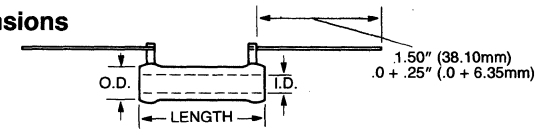
Resistor Hardware

Thru Bolts Mounting Brackets for 300 Watt Corrib

Includes 2 each bracket, bolt, washers (centering, mica, lock) and nut.
Note: Single unit mounting contains 1 each bolt and nut. 2 each all Washers.

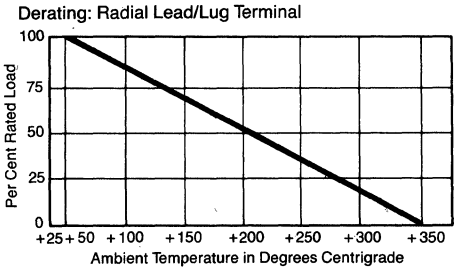
Part No.		No. of Resistors	Mounting Derating %	Part No.	For 300 Watt Adjustable Corrib
Slotted	Elongated				
6110-8½	6126-P-8½	1	100%	1974-A	E300KR40–E300KR63 E300K1R0–E300K5R0 E300K8R0–E300K20R
—	6127-P-8½	2	83%		
—	6128-P-8½	3	80%	1974-B	E300KR10–E300KR31 E300KR80 & E300K6R3
—	6129-P-8½	4	80%		

Dimensions



Power Rating Watts	Core Dimensions Only						Leads Ga.	Ohmic Gauge
	Length		O.D.		I.D.			
	in.	mm	in.	mm	in.	mm		
5¼	.625	15.88	0.250	6.35	0.135	3.43	20	.1- 20K
8	1.000	25.40	0.313	7.94	0.188	4.76	18	.1- 25K
12	1.750	44.45	0.313	7.94	0.188	4.76	18	.1- 51K
20	2.000	50.80	0.438	11.11	0.250	6.35	18	.1-100K

Derating: Radial Lead/Lug Terminal



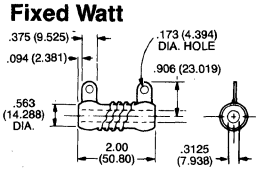
Corrib

- 10% Tolerance
- Vitreous Enamel
- High Current Lug
- Fixed
- Adjustable

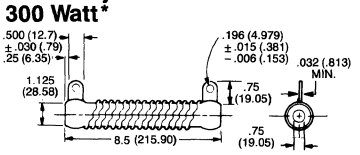
Watts	Ohmic Gauge	Max. Amps
35	0.2-1.25	41.8-5.8
300	.1-20.0	54.7-3.8

Dimensions (NOTE in mm)

Fixed Watt



Fixed/Adjustable 300 Watt*



*For resistance values over .16 ohms terminal dimensions same as 35 watt Corrib shown above

Powr-Rib

- 10% Tolerance
- Clamp Terminals
- High Current

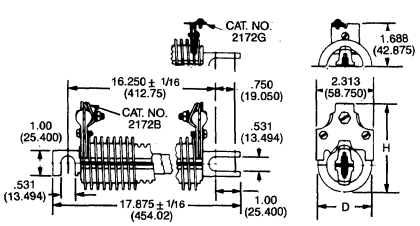
Features

- **Rugged** construction withstands shock and vibration.
- **Thick** metal and porcelain construction
- **Extremely** high power capacity, from 700 to 1000 watts as stock models
- **Edgewound** designed for very low resistance and high power capacity.
- **Round wire** designed for higher resistance with lower power capacity requirements.

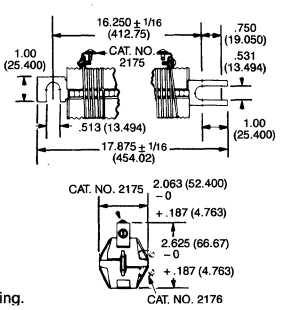
Extra Adjustable Lugs for 300 Watt Adjustable Corrib

Dimensions NOTE in mm)

Edgewound



Round Wire



1. Terminal 2175 standard on models with 8.30 amperes rating or less.
2. Terminal 2176 optional for 90° terminal mounting.

OHMS	H ±.125 (3.175)		D ±.125 (3.175)		Max. Amps
	In.	mm	In.	mm	
.10-.22	3.313	84.150	2.125	53.975	100-68
.25-1.00	3.125	79.375	1.875	47.625	63-33
1.30-1.60	2.563	65.100	1.875	47.625	29-26
2.30, 2.80, 4.50, 5.40	2.500	63.500	1.750	44.450	18.4-11.8
3.50, 6.80, 8.50	2.438	61.925	1.625	41.275	14.6-9.4
11.0-25.0	2.625	66.67	2.063	52.4	8.3-5.1

1. Terminal 2172B standard on models with .10 to 1.00 ohms.
2. Terminal 2172G standard on models with 1.30 to 8.50 ohms.

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Rheostats (Potentiometers)

Wirewound

OHMITE®
Manufacturing Company

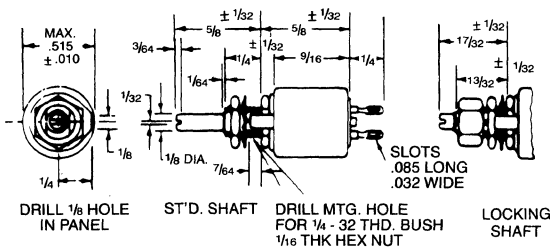
Features

- **Potentiometer** and Rheostat applications
- **Linear** windings on stock models; tapered windings available on a special order basis.
- **Windings** secured to prevent shifting.
- **Fine** graduation of control.

Model C • 7½ Watt

Model C

7.5 Watt Standard and Locking Shaft

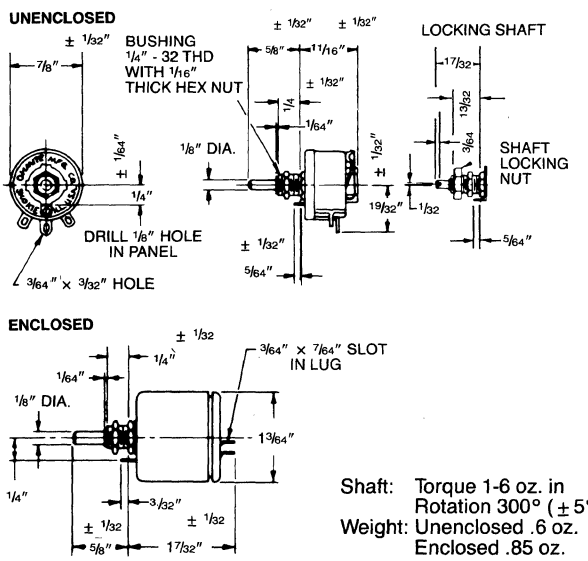


Shaft: Torque .25–3 oz. in.
Rotation 300° (±5°)
Weight: .27 oz.

Model E • 12½ Watt

Model E

12.5 Watt Enclosed and Unenclosed
(Standard and Locking Shaft)



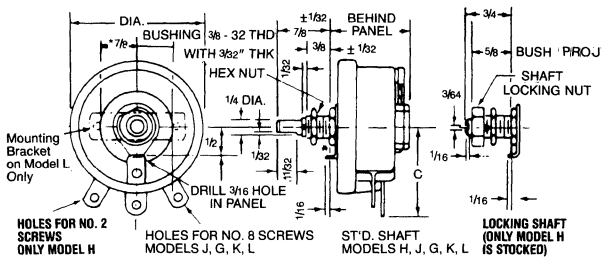
Shaft: Torque 1-6 oz. in
Rotation 300° (±5°)
Weight: Unenclosed .6 oz.
Enclosed .85 oz.

Models H, J, G, K, L

Models	Watts	Diameter
H	25	19/16 in.
J	50	25/16 in.
G	75	23/4 in.
K	100	21/8 in.
L	150	4 in.

Models H, J, G, K, L*
25, 50, 75, 100, 150 Watt

* No non-turn on Model L. Mounting Bracket on Model L only: (2) 10-32 screw mounting holes. 7/8" each side of shaft center.

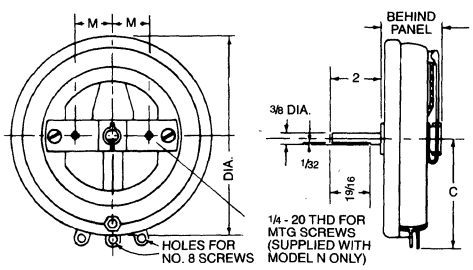


Models	H	J	G	K	L
Dia. (in.)	19/16	25/16	13/4	31/8	4
C Dim. (in.)	15/16	19/16	125/32	125/32	29/32
Behind Panel (in.)	13/8	13/8	13/4	13/4	2
Shaft Torque (lb. in.)	.25-5	.25-2	.5-2	.5-2	.5-3
Rotation (±5°)			300°		
Weight (lbs.)	.19	.32	.52	.64	1.1

Models P, N, R, T, U

Models	Watts	Diameter
P	225	5 in.
N	300	6 in.
R	500	8 in.
T	750	10 in.
U	1000	12 in.

Models P, N, R, T, U
225, 300, 500, 750, 1000 Watt



Models	P	N	R	T	U
Dia. (in.)	5	6	8	10	12
M Dim. (in)	7/8	13/16	11/2	17/8	3
C Dim. (in.)	231/32	37/16	45/16	59/16	63/8
Behind Panel (in.)	21/8	23/8	21/8	3	3
Shaft Torque (lb. in.)	2.5-4	2.5-5	4.5-7	3.5-7	3.5-7
Rotation (±5°)	310°	320°	325°	330°	335°
Weight (lbs.)	2	2.6	4	7.6	10

Standard Mounting

Model	Description
C, E	Panels to 1/8" (max.) thickness with 1/4—32 bushing and hex nut. Non turn lug requires 1/8" hole 1/4" below shaft center
H, J, G, K, L	Panels to 1/4" (max.) thickness with 3/8—32 bushing and hex nut, (or with 10-32 x 3/4" F.H. screws for Model L only. Non turn lug requires 3/16" hole 1/2" below center of shaft, does not apply to model L.
P, N, R, T, U	Panels to 1 1/4" (max.) thickness with 1/4—20 flat head screws

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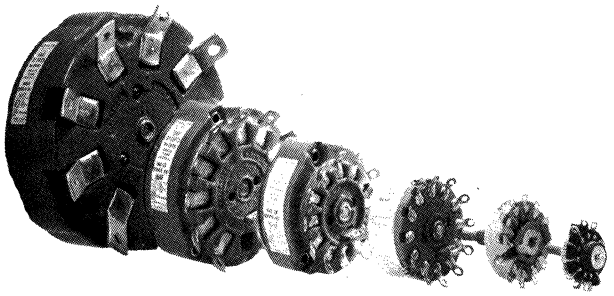
Power Tap Switches

High Current, Non-Shorting Type

OHMITE®
Manufacturing Company

Features

- **"Slow-breaking, Quick-make"** action proved best for switching AC current
- **Non-Shorting Type** disconnects previous circuit before establishing contact for succeeding tap.
- **Tandem Assemblies** available as stock models.



Specifications

- **Material**

Body:
Ceramic, arc-proof (Models 111, 212, 312, 412 608). Melamine Phenolic (Model 711).

Contacts: Silver Alloy. Common contact is rounded for assured seating. Self-cleaning with built in wiping action.

General Specifications

Model	Amps	Volts		Shaft Torque	Number of Taps Maximum	Terminals	Average Weight Single Unit	UL Listed File E-14245
		Ac Standard	DC Non-Inductive Load					
711	7	125	20	7-12 oz.-in	11	Soldering or 3/16" quick connectors	21.3 gms	—
111	15	125	20	15-3.8 in.-lbs.	11	Soldering Type	72.7 gms	Yes
212	20	150	20	3-7 in.-lbs.	12		4 lbs.	Yes
312	30	300[1]	20	3-7 in.-lbs.	12		.75 lbs.	Yes
412	50	300[1]	20	3-8 in. lbs.	12	Soldering Lugs/#10 Screws	1.4 lbs.	Yes
608	100	300	20	25-35 in.-lbs.	8	Soldering Lugs or 1/4" Bolts	5 lbs.	—

[1]150 VAC Between Tapsl

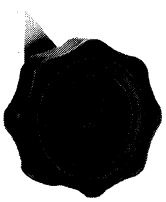
Dimensions

Model	Body Diameter	Shaft Diameter	Depth Behind Panel		
			Single Unit	2-in Tandem	3-in Tamdem
711	1 1/8"	1/4"	13/16"	1 25/32"	2 15/16"
111	1 3/4"	1/4"	1 1/8"	2 3/4"	—
212	2 1/4"	1/4"	1 3/4"	4 3/16"	6 3/16"
312	3 5/16"	1/4"	2 1/4"	4 5/8"	7"
412	4 3/16"	1/4"	2 7/16"	5 1/32"	7 5/8"
608	6"	3/8"	3 5/16"	6 13/16"	10 5/16"

* Since all tap switches are electro-mechanical devices, they are subject to mechanical wear and, therefore have a finite life.

Knobs

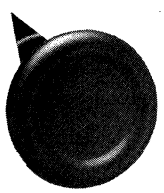
Any knob can be used with any tap switch model which has the corresponding shaft diameter. Knobs are fastened to shafts with slotted set screws.



Finger-Grip With Pointer



Finger-Grip Without Pointer



Handwheel With Pointer



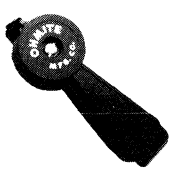
Handwheel Without Pointer



Finger Grip



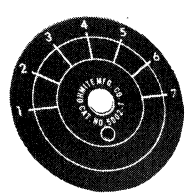
Bar Knob 1 1/2" Long

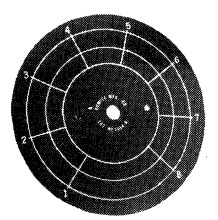


Bar Knob 4 3/4" Long

Dials

- Dial markings are easily readable.
- Number of dial positions are identical with number of switch positions.
- Dials are aluminum, enameled black and etched.





Part No.	For Models	For Knobs	Dial Dia.
5002-*	111, 212 (Single), 312 (Single)	5109 5116 5150	2 3/4"
5003-*	212 (Tamdem), 312 (Tamdem), 412	5111, 5152A	3 3/4"
5004-*	608	5104, 5115	5 1/2"

* Specify no. of positions as a suffix.

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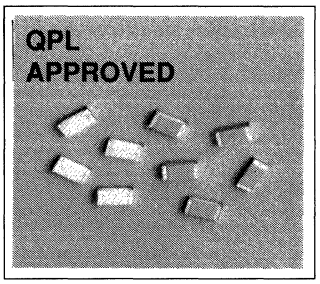
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Surface Mount Resistors Chips/Networks



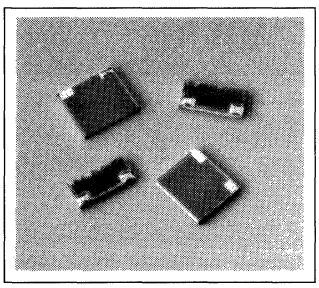
CERMET WRAPAROUND CHIP RESISTORS Mil-R-55342, Char. "K"

- Greater design flexibility
- Resistance range: 10Ω to 10MΩ
- Tolerances to 1%
- Low TCR to ±100 ppm/°C
- Several standard sizes (including 1206)
- Customs available
- Wave or reflow mounting
- Auto placement compatibility
- Tape and reel or bulk packaging



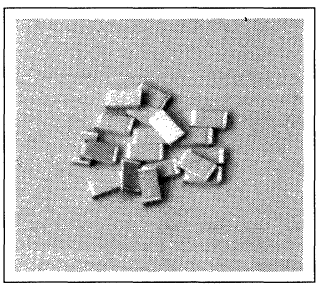
PRECISION THIN FILM WRAPAROUND CHIP RESISTORS Mil-R-55342, Char. "E"

- Resistance range: 10 ohms to 600k ohms
- Tolerances to 0.1%
- Low TCR to ±25 ppm/°C
- Standard sizes (including 1206)
- Ideal for high frequency, low noise, and tight TCR applications requiring good stability



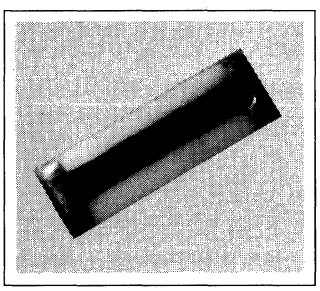
ULTRA PRECISION SURFACE MOUNT CHIP

- Bulk Metal® Foil resistor
- Resistance values 5Ω to 150KΩ
- TCR ±5 ppm/°C
- TC tracking 0.5 ppm/°C
- Tolerance 0.05%
- Low noise
- Low voltage coefficient



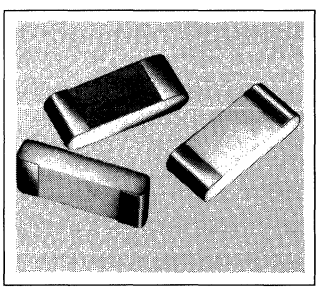
PRECISION THIN FILM

- Resistance range: 5 ohms to 600k ohms
- TCR ±25 ppm/°C, ±50 ppm/°C
- Tolerances: 0.1% to 10%
- Standard sizes: 0505, 0705, 1005, 1206, 1505
- Pre-tinned or gold over nickel barrier



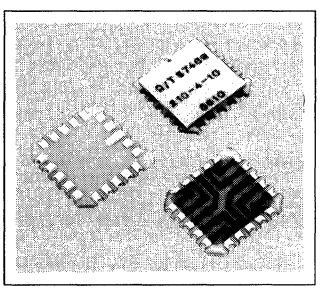
ULTRA-HIGH VALUE CERMET WRAPAROUND CHIP RESISTORS

- High ohm resistance range: 10 megohms to 500 megohms
- Tolerances: 5%, 10%, 20%
- Standard sizes available
- Bulk or tape and reel packaging
- Economically priced industrial grade features



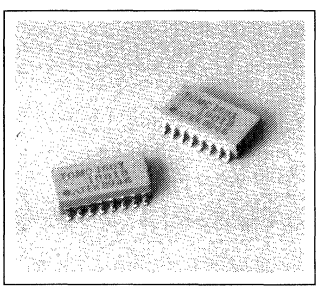
ULTRA-LOW VALUE WRAPAROUND CHIPS

- Low ohm resistance range: 0.05 ohm to 10 ohms
- Precision tolerances for current sensing applications
- Good stability — TCR better than ± 100 ppm/°C
- High power: up to 0.5 watt/+75°C
- 1206 Case size
- Wave or reflow mounting
- Solder coating with nickel barrier



LEADLESS CHIP CARRIERS Designed to meet Mil-R-83401 Characteristic "K", "M"

- Saves board space and reduces assembly costs
- Wide resistance range: 10 ohms to 1.0 megohms
- Tolerances to 1%
- Low TCR to ±100 ppm/°C
- 14 through 28 terminals (20 standard)
- JEDEC standard "A" & "B" schematics or custom circuits
- Glazed overcoat or ceramic cover
- Auto placement compatability



PRECISION SMALL OUTLINE RESISTOR NETWORK

- Wide resistance range 100Ω to 100KΩ
- Low TCR ±25 ppm/°C
- Tracking ±5 ppm/°C
- Rugged molded case construction
- Voltage coefficient < 5 ppm/V
- Maximum voltage 100V
- Compatible with auto - placement equipment
- Standard circuits available

Features

- All wraparound connections feature a thin film adhesion layer covered with a leach-resistant nickel barrier layer and solder coated for +150°C applications.
- Ruthenium-based cermet thick film yields dependable performance and low cost.
- Hi-Rel screening available on all resistor types with all Mil-Spec Qualification testing in-house.
- Special metalization and custom sizes available upon request.
- Non inductive.
- Tape and Reel or static free waffle pack packaging is standard.
- Glass fired passivation as standard adds reliability and stability to the resistor elements.

Performance/Design Characteristics

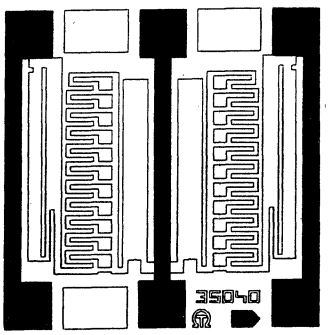
- Tolerances: ±0.1% to ±20%
- Resistance values: 0.1 ohm to 500 megohms
- TCR: Thin Film: ±50 ppm/°C (standard)
  Thick Film: ±100 ppm/°C (standard)
- Operating temperature range: -55°C to +150°C

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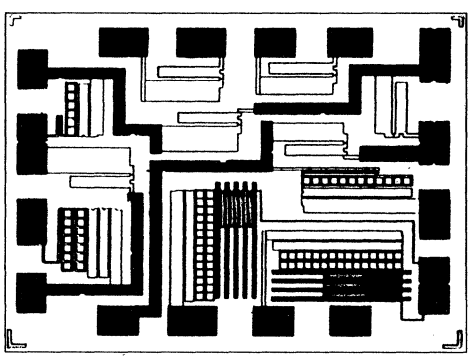
Hybrid Microelectronic Resistor Wire Bondable Products

Thin Film Wire Bondable Chip Resistors



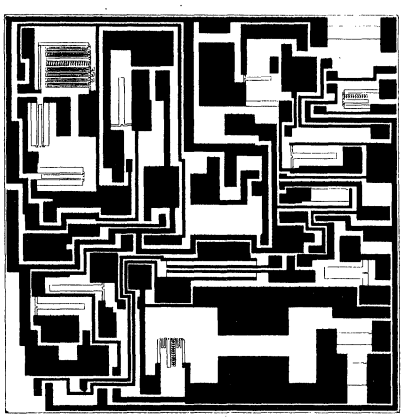
- Standard single value and center tap style
- Gold or aluminum terminations
- 4.7Ω to 1MΩ resistance range
- Silicon or alumina substrates
- Off the shelf availability
- Custom values available

Thin Film Resistor Networks



- Custom resistor design
- Standard schematic available
- Tantalum and Nichrome based films
- Silicon and alumina substrates
- User trimmable networks available

Thin Film Hybrid Substrates



- Custom layouts
- 15 and 25 mil alumina substrates
- Nickle barrier metalization available
- Resistor/conductor or conductor only
- Back side metalization available
- User trimmable substrate available

- **Visual inspection per MIL-S-833, method 2032 class B**
- **Testing per MIL-S-883, method 5008 class B**
  MIL-R-55342 group A, B and C
- **Quality system per MIL-S-790**

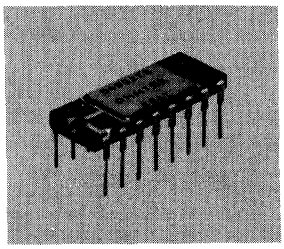
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Precision Resistor Networks

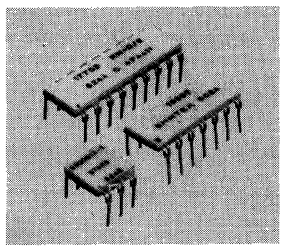
Close Tracking — Tight Ratio Tolerance

Rugged Construction Provides Dependable Performance at Minimum Cost



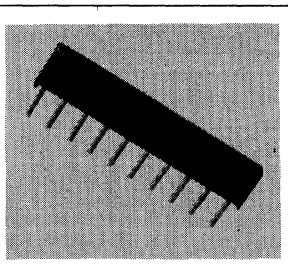
DUAL-IN-LINE HERMETIC

- Meets MIL-R-83401 characteristic "C"
- 8, 14, 16, 18 and 20 lead packages available
- Chip and wire construction



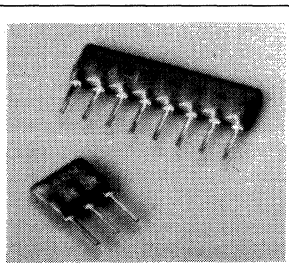
DUAL-IN-LINE CERAMIC SANDWICH

- Rugged monolithic construction
- 4 – 20 leads available
- Thermal compression bonded lead attach
- Wide resistance offering



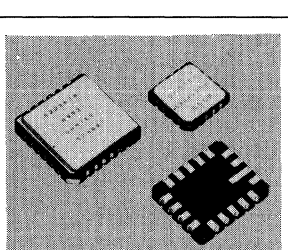
SINGLE-IN-LINE MOLDED

- Meets MIL-R-83401 characteristics "V" and "H"
- 6, 8 and 10 lead molded construction
- High and low profile available
- Thermal compression bonded lead attach



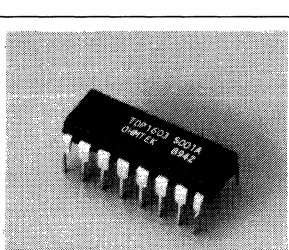
SINGLE-IN-LINE CONFORMAL

- 3 – 13 lead packages available
- Standard and custom circuits
- Off the shelf standards available
- Low cost precision circuits available



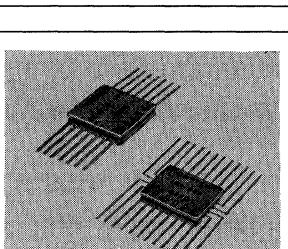
LEADLESS CHIP CARRIERS HERMETIC

- Hermetic JEDEC packages
- 16, 20 and 24 terminal packages standard
- Standard and custom circuits available
- Meets MIL-R-83401 characteristic "C"



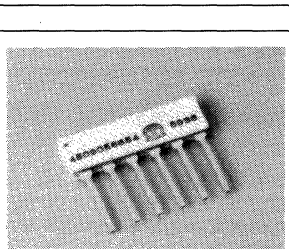
DUAL-IN-LINE MOLDED

- Low cost standard circuits avalable
- 14 and 16 lead packages standard
- Off the shelf delivery



FLATPACKS

- Hermetic and ceramic sandwich construction
- 14 and 16 terminal packages standard
- Meets MIL-R-83401 characteristics "C", "V" or "H"



SINGLE-IN-LINE CERAMIC SANDWICH

- 3 – 10 lead packages
- Thermal compression bonded lead attach
- High and low profiles

Features

- Standard and custom circuits as required for demanding military and commercial applications
- Tracking less than 1 ppm
- Operating temperature range: –55°C to +125°C
- Low Noise: –35dB
- Full mil-spec screening available in-house
- Tolerances: 0.005% to 1%
- Resistance values: 10 ohms to 10 megohm
- Low TCR: 25 ppm/°C typical
- Nichrome or Tantalum based films optional

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POWER WIREWOUND RESISTORS
AXIAL LEAD - MIL QUALIFIED

PACIFIC RESISTOR CO.

PHONE (818) 345 - 7811 (800) 835 - 3355 FAX (818) 345 - 1507

These Superbly Reliable Resistors meet and exceed MIL - R - 26. Their ALL MOLDED construction provides for exceptional strength and moisture resistance! Resistors are available in any resistance value up to the maximum lisited. FAST DELIVERY TIMES! PACIFIC HAS BUILT QUALITY WIREWOUNDS FOR 40 YEARS!

Type A Molded
1 to 13 Watts

PACIFIC N1A 15.4 1%

Electrical

- **Non Inductive Styles Available**
- **Matched Sets Available**
- **Tolerances:** 5%,3%,1%,.5%,.25% .1%,.05%,.02%
- **Temperature Coefficient:** 90 PPM< 1 ohms; 50 PPM< 10 ohms; 20 PPM> 10 ohms
- **Special TC's Available**
- **Dielectric Strength:** 1000VRMS - all except listed below; 500 VRMS-04A,05A,B1,B3
- **Insulation Resistance:** not<1000 Meg

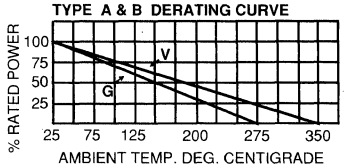
Mechanical

- **Encapsulation:** Molded High Temp. Silicone
- **Core:** Type A-Ceramic; Type B - Beryllium or Alumina
- **End Caps:** Stainless Steel
- **Leads:** Tinned Copperweld (others available)
- **Construction:** Completely Welded
- **Marking:** Alpha Numeric

Type A SPECIFICATIONS

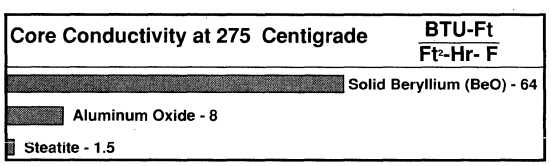
RESISTOR STYLE		POWER RATING		DIMENSIONS				MAX. RES. VAL.	MAX. Work Volts
PACIFIC	MIL	G 275	V 350	LENGTH ±.010	DIA. ±.010	LEADS AWG	LEADS Inch		
04A	-	.4	.75	.250	.090	24	.020	3.5K	30
05A	-	.75	1	.330	.110	24	.020	6.OK	50
15A	RW70	1.25	2	.412	.115	24	.020	7.5K	75
20A	-	1.25	2	.550	.115	24	.020	10K	100
S1A	-	1.75	2.5	.490	.162	22	.025	15K	150
N1A	-	3	3.75	.535	.220	20	.032	20K	200
1A	RW79	3	3.75	.610	.210	20	.032	20K	200
25A	-	4	4.5	.890	.210	20	.032	28K	200
2A	-	3.25	4.5	.535	.270	18	.040	20K	200
3A	-	4	5.5	.656	.270	18	.040	30K	200
5A	RW74	5.5	7.5	.900	.312	18	.040	75K	400
7A	-	7	9	1.187	.312	18	.040	100K	600
10A	RW78/68	10	13	1.825	.405	18	.040	200K	1000
55AC	RW55	7	9	1.250	.470	18	.040	100K	600
56AC	RW56	10	12	2.000	.470	18	.040	200K	1000

TYPE A & B DERATING CURVE



Type B Molded - Exceptional Power to Size Ratio
.4 to 10 Watts

These Resistors feature from 1.4 to 4 times HIGHER POWER RATINGS than conventional resistors of equivalent size. In addition to having all of the features of our Type A resistors, Type B resistors have Solid Beryllium or Alumina cores to provide exceptional power dissipation.



Type B SPECIFICATIONS

RESISTOR STYLE		POWER RATING		DIMENSIONS				MAX. RES. VAL.	MAX. Work Volts
PACIFIC	MIL	G 275	V 350	LENGTH ±.010	DIA. ±.010	LEADS AWG	LEADS Inch		
B1	-	1	1.5	.250	.090	24	.020	3.5K	35
B1A	RW81	1		.250	.090	24	.020	3.5K	35
B2	-	1.5	2	.325	.090	24	.020	4.9K	48
B3	-	2.25	3	.412	.115	24	.020	10.4K	85
B3A	RW80	2		.412	.115	24	.020	10.4K	85
B5	-	4	5	.610	.210	20	.032	24.5K	172
B5C	-	5	7	.540	.240	18	.040	32.3K	260
B6	-	6	8	.656	.270	18	.040	47.1K	300
B10	-	7	10	.900	.312	18	.040	96K	470

HOW TO ORDER: (sample part no.) **N1A - 15.4 - 1% - 3W**

Style — Resistance — Tolerance — Watts

N1AN - 15.4 - 1% - 3W

To order **Non Inductive** styles, add suffix **N** to style (e.g.:**N1AN**)

Pacific Resistor Co.

18300 OXNARD ST.
TARZANA, CA 91356

PRECISION POWER RESISTORS

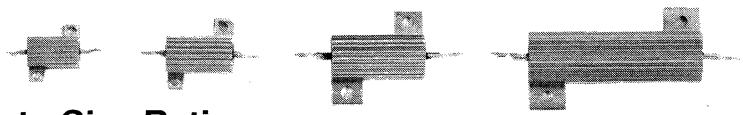
CHASSIS MOUNT - ALUMINUM FINNED HEAT SINK - MIL QUALIFIED

PACIFIC RESISTOR CO.

PHONE (818) 345 - 7811 (800) 835 - 3355 FAX (818) 345 - 1507

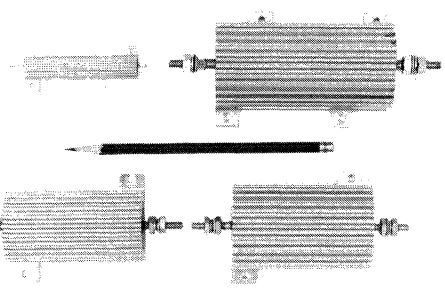
Pacific's Chassis Mount type CH Resistors are designed for maximum heat dissapation by mounting to metal chassis surfaces for maximum heat transfer. These Superbly RELIABLE resistors are outstanding for their high power dissipation with precision tolerances in minimum physical sizes. FAST DELIVERY TIMES! MIL-R-18546 Qualified. PACIFIC HAS BUILT QUALITY WIREWOUNDS FOR 40 YEARS!

Type CH Chassis Mount
5 to 250 Watts - MIL-R-18546



Type BCH - Exceptional Power to Size Ratio
15 to 35 Watts - Solid Beryllium Core



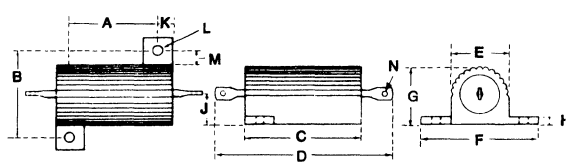


Electrical

- **Long Stable Load Life**
- **Non Inductive Styles Available**
- **Tolerances:** 5%,3%,1%,.5%,.25%, .1%,.05%
- **Temperature Coefficient:**
  90 PPM< 1 ohms, 50 PPM<10 ohms, 20 PPM>10 ohms
- **Special TC's Available**
- **Dielectric Strength:**
  1000 VRMS-5CH,10CH,B5CH,B10CH
  2500 VRMS-25CH,50CH,100CH,B25CH
  5500 VRMS-ALL OTHERS
- **Insulation Resistance:** not<1000 Meg

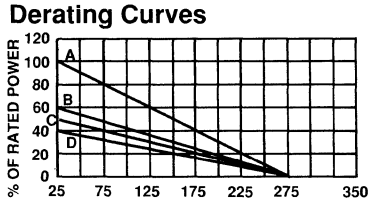
Mechanical

- **Body:** Anodized-Aluminum finned
- **Core:** Type CH- Ceramic, Type BCH - Beryllium
- **End Caps:** Stainless Steel
- **Leads:** Heavy Spaded Lugs - 5 to 70 Watts
  Threaded Stud Terminals- 100 to 250 Watts
- **Construction:** Completely Welded

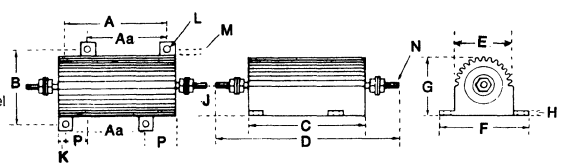


5CH, 10CH, 25CH, 50CH, 100CH, B5CH, B10CH, B25CH

Derating Curves



Derating is required for reduced chassis mounting area and high ambient temps.
A - When Mounted on proper alum. chassis
5CH,B5CH,10CH,B10CH - 4x6x2x.040 alum.
25CH,B25CH - 5x7x2x.040 alum. chassis
50CH,100CH - 12x12x.059 alum. panel
110CH,180CH,250CH - 12x12x.125 alum. panel
B - Unmounted 5CH, B5CH, 10CH, B10CH
C - Unmounted 25CH, B25CH, 100CH, 110CH
D - Unmounted 50CH, 180CH, 250CH



PACIFIC STYLE	MIL-R 18546	COM. WATTS	MAX. RES.	A	Aa	B	C	D	E	F	G	H	J	K	L	M	N	P	Mtg. Screw
5CH	RE60	5	20K	.444	-	.490	.500	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050	-	2-#2
B5CH	RE60	15	20K	.444	-	.490	.500	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050	-	2-#2
10CH	RE65	10	30K	.562	-	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086	-	2-#2
B10CH	RE65	20	30K	.562	-	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086	-	2-#2
25CH	RE70	25	75K	.719	-	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086	-	2-#2
B25CH	RE70	35	75K	.719	-	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086	-	2-#2
50CH	RE75	50	200K	1.563	-	.844	1.968	2.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086	-	2-#4
100CH	-	70	275K	2.625	-	.844	2.968	3.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086	-	2-#4
110CH	RE77	100	50K	2.750	-	2.250	3.500	5.478	1.800	2.813	1.750	.188	.800	.375	.188	.250	12-24	-	2-#8
180CH	-	180	50K	2.750	-	2.500	3.500	5.478	2.125	3.000	2.188	.250	.950	.375	.188	.200	12-24	-	2-#8
250CH	RE80	250	50K	3.875	3.000	2.500	4.500	7.000	2.125	3.000	2.188	.250	1.000	.312	.188	.200	1/4-20	.875	4-#8

HOW TO ORDER: (sample part no.) **5CH - 21.3 - 1% - 5W**

- **Style**
- **Resistance**
- **Tolerance**
- **Watt**

5CHN - 21.3 - 1% - 5W

To order **Non Inductive** styles, add suffix **N** to style (e.g.:**5CHN**)

Pacific Resistor Co.
18300 OXNARD ST.
TARZANA, CA 91356

WIREWOUND RESISTORS
SPECIAL PURPOSE DESIGNS

PACIFIC RESISTOR CO.

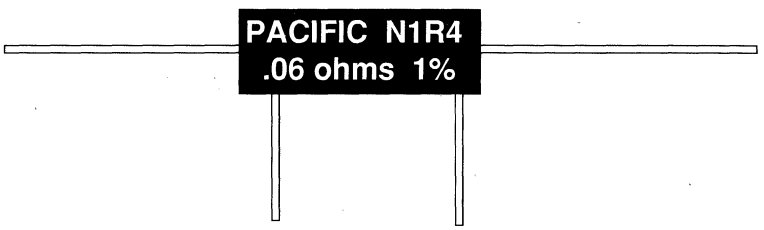
PHONE (818) 345 - 7811 (800) 835 - 3355 FAX (818) 345 - 1507

Four - Terminal Molded Resistors

Available in a wide range of values and wattages, these resistors are extremely useful in Low Resistance Current-Shunting and Current-Sensing applications where Voltage - Current relationships(i.e.resistance) needs to be accurately specified and be independant of leads resistance effects. PACIFIC'S ALL MOLDED Construction provides for Exceptional moisture resistance and strength! *CUSTOM DESIGNS AVAILABLE*

Electrical

- **Non Inductive Styles Available**
- **Matched Sets Available:** Tracking to .5 PPM
- **Tolerances:** 5%,3%,1%,.5%,.25% .1%,.05%,.02%,.01%
- **Temperature Coefficient:** 50 PPM< 1 ohms 10 PPM> 1 ohms
- **Special TC's Available**



Mechanical

- **Encapsulation:** Molded High Temp. Silicone
- **Leads:** Tinned Copper or Tinned Copperweld
- **Marking:** Alpha Numeric



Ultra Low Ohm Molded Power Resistors

These Superbly Reliable resistors meet and exceed MIL - R - 26 and extend to values below it's range. Resistors are made to order and available in any resistance within their range. FAST DELIVERY TIMES!

- **Wattages:** 1,3,4,5
- **Tolerances:** 5%,3%,1%,.5%
- **Inductance:** 0 micro henries
- **Ideal for Power Amps, Test Equip., Power Supplies** (Switching & Linear), **& Current Sensing.**



Current Shunts - Low Ohm, High Precision

Pacific Current Shunts are particularly well suited to current sensing applications where the Voltage-Current Relationships (Resistance) requirements must be precise and independent of Lead resistance effects. Pacific manufactures a line of shunts including standard and Custom Designs. Pacific's Applications Engineering Dept. will design shunts to meet customer supplied specifications or schematics. Pacific is happy to work with your engineering dept. in designing for Your Needs!

Networks - Custom Designed to Meet Your Needs!

Pacific has been building High Quality Custom Resistor Networks for 40 Years. We offer the design skills and manufacturing capabilities to meet your Wirewound Resistor Network needs. Pacific's networks are used in Missles, Aircraft, Spacecraft, Communications, Test equipment, and a variety of other applications. Submit your next requirement to Pacific's Engineering Dept.

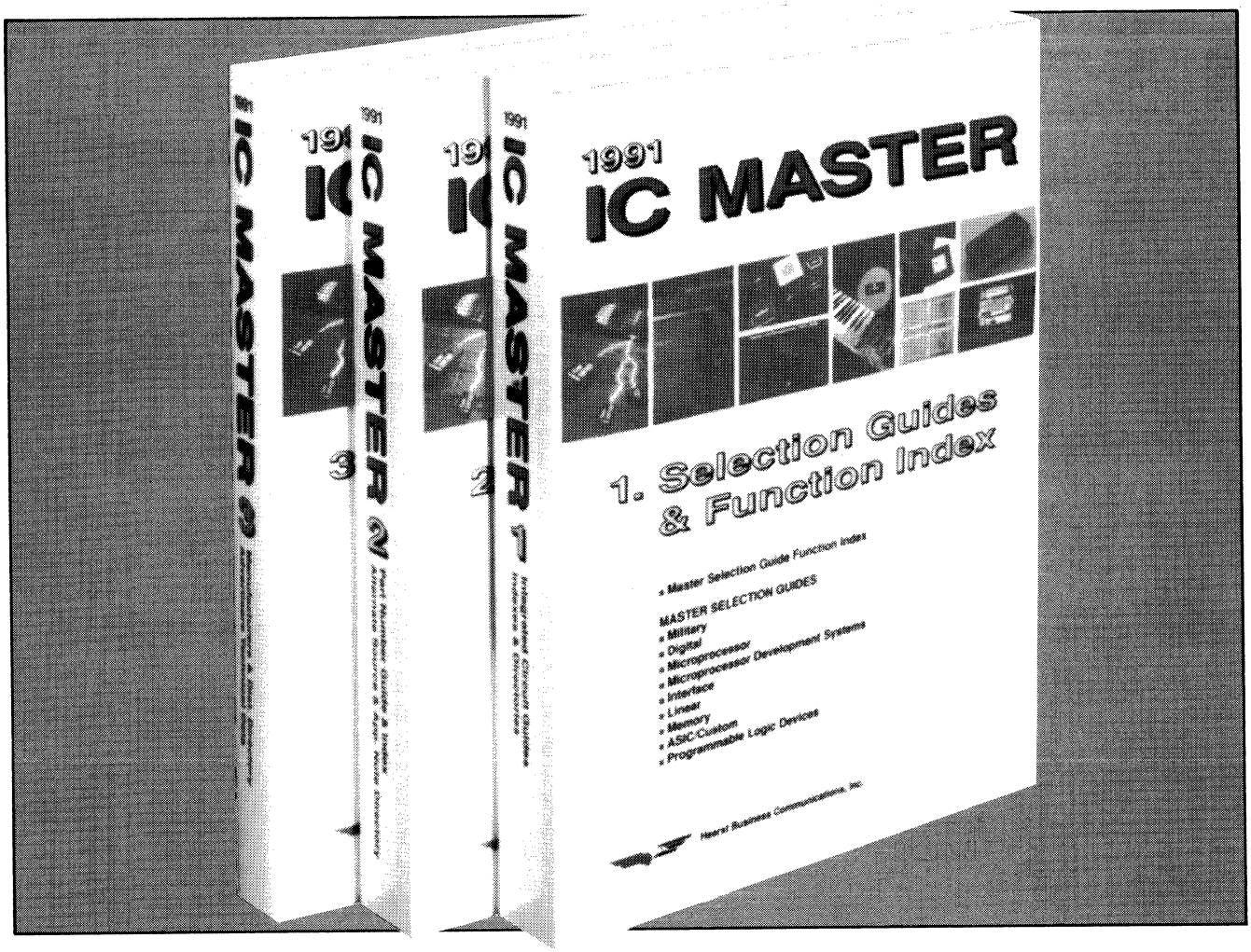
- **High Precision Resistors**
- **Fusing Resistors**
- **Temperature Sensors**
- **Custom Coils**
- **Matched Sets**
- **High TCR Resistors**
- **Toroids**
- **Delay Lines**

PACIFIC RESISTOR offers a wide spectrum of Quality engineered and manufactured products. We build many Custom Products to meet Customer Requirements. Please call, FAX, or writes us for information on any of our products or your custom needs. We welcome the opportunity to work with your engineers to fill your requirements.

Pacific Resistor Co.

18300 OXNARD ST.
TARZANA, CA 91356

SUPER TIME SAVER!



Do you work with ICs? Do you have trouble finding the IC you need? Are you sick and tired of sifting through dozens of manufacturers' data books? Do you have trouble comparing one set of specs to another? Are you sick and tired of wasting time?

Do we have good news for you! Get your hands on the latest annual copy of the IC Master. The Master will save you both time and money. Here's how.

The Master lists every single IC you can buy. Better yet, the Master lists ICs by function. You know what you want to do. The Master tells you who makes what for what you want to do.

There's more! The Master lists every known alternate source to every integrated circuit. If somebody makes a substitute for an IC, the Master tells you. And fast!

Want to find a custom or semicustom IC? The Master tells you who the manufacturers are, what their capabilities are, and what design tools you need.

Looking for a distributor or a local sales office? The Master tells you where they are. Got a technical problem? The Master tells you who to call. Can't figure out a part number? The Master tells you how the part number systems work.

There's more! The Master has a section on microprocessor development tools with complete performance parameters. There's another section on programmable logic devices giving you everything from output configuration to PLD development systems.

Want to know if there's an application note available on a given part? The Master tells you!

If your question has anything to do with integrated circuits, you need the IC Master. Subscribe now by calling (516) 227-1314. Ask for Marie Botta. Tell Marie you need the Master now.

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And, if you tell her you saw it in the 1991/92 EEM, she'll take $10 off the subscription price!

IC MASTER

Philips Components

Discrete Products Division

A North American Philips Company

FILM RESISTORS

General Purpose, Carbon Film, SFR, Precision Film, Mil-R-10509 (RN), Mil-R-22684 (RL), Mil-R-39017 (RLR), UPR, Mil-R-55182 (RCN), Mil-R-55182 (RNR)
Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: 817-325-1052 Telex: GPR-881857; SPR-820545

INDUSTRIAL/CONSUMER GROUP

Philips Components Series	Category	Body Type	Resistance Range (ohms)	Tolerance Range (±%)	Temperature Coefficient Range (PPM/°C)	Power Range @ 70°C (watts)	Max. Voltage Range (watts)
SPACE MISER®	GENERAL PURPOSE	METAL FILM Conformal-Coated	.22Ω-10 Meg 1Ω-10 Meg	5% 1%	±100 ±100	⅓ ⅓	200 200
CR	GENERAL PURPOSE	CARBON FILM Conformal-Coated	1Ω-10 Meg	5%	−200 to +500, ±300	¼ ½	250-350
SFR	GENERAL PURPOSE	METAL FILM Conformal-Coated	1Ω-10 Meg	1%-2% 5%	±200 and ±100	¼ ½	250-350
SPR 5000Y	STANDARD PRECISION	METAL FILM Conformal-Coated	1Ω-250 Meg	0.5%-5%	±50 to ±150	¼-1	250-500
UPR & MATCHED SETS	ULTRA PRECISION	METAL FILM Conformal-Coated	51.1Ω-511 K	.01%-1%	±2 to ±25	@ 85°C 1/20 ⅛-¼, ⅓	200-300
MIL Style	**MIL Specs**	**INDUSTRIAL/STANDARD MILITARY**					
RL	MIL-R-22684	METAL FILM Conformal-Coated	4.3Ω-470K	2% 5%	±100	¼-½	250-350
RN	MIL-R-10509	METAL FILM Conformal-Coated	1Ω-4 Meg	0.1%-1%	±25 to ±100	1/10-½	200-350
ESTABLISHED RELIABILITY (MIL)							
RLR	MIL-R-39017 'S' Failure Rate	METAL FILM Conformal-Coated	4.3Ω-1.33M	1%-2%	±100	¼-½	250-350
RNC	MIL-R-55182 'S' Failure Rate	METAL FILM Conformal-Coated	10Ω-3.01M	0.1%-1%	±25 to ±100	@ +125°C 1/20-½	200-300
RNR/RNN Hermetic	MIL-R-55182 'S' Failure Rate	METAL FILM Hermetic Seal	10Ω-1.21M	0.1%-1%	±25 to ±50	@ +125°C 1/10-½	200-300

SERIES 9B PRECISION MELF RESISTORS

Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: 817-325-1052 Telex: GPR-881857; SPR-820545

Philips Components Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Dimensions (Inches)	
						Length	Dia.
9B1406	.22-10M	.1-5%	15, 25, 50	.25W	200V	.142 Max.	.055 Max.
9B0805	.22-220K	.1-5%	50 ppm	.125W	200V	.087 Max.	.043 Max.

SMD® RESISTORS

Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871

SERIES 9C COMMERCIAL CHIP RESISTORS

SMD (chip) resistors consist of a ceramic body (alumina) on which is deposited resistive paste. Variations in the composition of the paste result in different resistant values. A wrap around termination is deposited at each end of the resistor to allow reflow or wave soldering. The resistive layer is covered with a protective coating to assure mechanical and environmental integrity.

Philips Components Series	Resistance Range	Tolerance	T.C.	Power Rating	Maximum Voltage	Dimension (Inches) Length	Width
9C1206	10 ~ – 1 MEG	1%	100 ppm	⅛ w	200 V RMS	.126″	.063″
9C1206	1 ~ – 10 MEG	5%	200 ppm	⅛ w	200 V RMS	.126″	.063″
9C0805	1 ~ – 10 MEG	5%	200 ppm	1/10 w	200 V RMS	.078″	.049″

Philips Components
Discrete Products Division
A North American Philips Company

SERIES 9C COMMERCIAL CHIP RESISTORS

Philips Components Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Outline Drawing All Dimensions in mm (inches		
						Length (L)	Width W)	Thickness (T)
9C1206	10Ω-10MΩ	1%- 5%	100, 200	.125W	200V (R.M.S.)	3.0-3.35 (.118-.132)	1.6 ±0.15 (.063 ±.006)	0.5 ± 0.10 (.020 ± .004)

PERFORMANCE

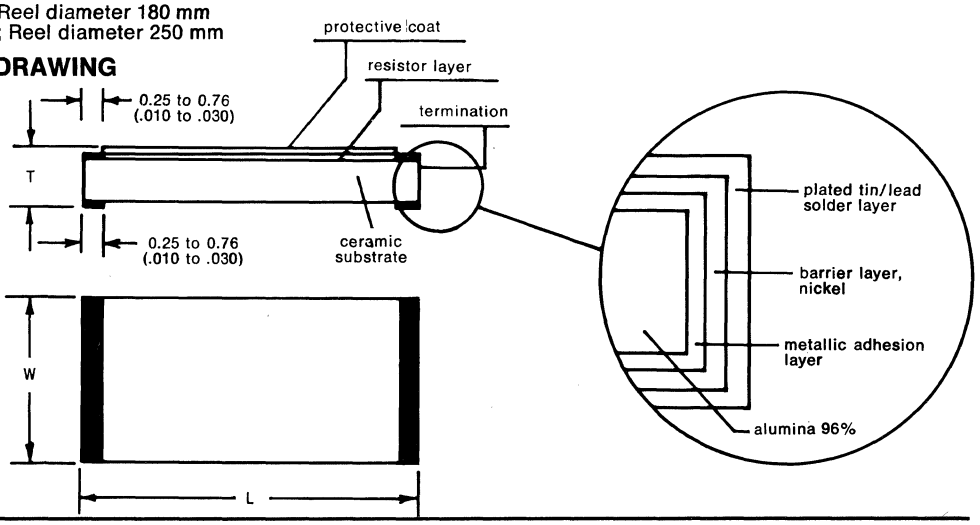
Test	Procedure	Requirements
Effects of Soldering	Unmounted chips completely Immersed for 4 ± 1 seconds in a solder bath of 230° ±10°C	95% coverage minimum No damage △R max. = (±1% +0.1Ω)
Thermal Shock	½ h.−55°C/½ h.+125°C 5 cycles	△R max. = (0.5% +0.1 Ω)
Vibration	Frequency: 10-500 Hz Displacement 1.5 mm or Acceleration 10 g., three directions: total 6 h.	No damage △R max. = (0.5% +0.1 Ω)
Moisture	Per Mil Std., 202 Method 106 per conditions of Mil-R-55342	IR min. 1000 MΩ △R max. = (0.5% + 0.1Ω) for 100 PPM and (2% + .2Ω) for 200 PPM
Life Test	1000 h. 70°C: nominal dissipation	△R max. = (1.0% + 0.1Ω) for 100 PPM and (5.0% + .2Ω) for 200 PPM
Short Time Overload	Room temp. dissipation 2.5 x rated voltage for 5 seconds 400 V max.	△R max. = (0.5% + 0.1Ω) for 100 PPM and (2.0% + 0.2Ω) for 200 PPM

HOW TO SPECIFY
Philips Components Chip Resistors can be completely specified using the following designation:

9C	1206	3	A	1002	F	K	R
SMD (Chip) Resistor	Chip Size 3.2mm x 1.6mm (.126″ x .063″)	Power Rating (70°C) 3 = ⅛ w	Product Class A = Standard	Resistance Value 100 = Significant Digits 2 = Multiplier (for values less than 100 Ω use "R" as decimal designator.) i.e.: 68R1 = 68.1Ω 1002 = 10KΩ	Tolerance F = ±1% J = ±5%	Temperature Coefficient (PPM/°C) K = ±100 L = ±200	Termination R = Wrap Around

STANDARD PACKAGING
Tape and Reel packaging, per EIA RS-481
Quantity 4000 resistors per reel; Reel diameter 180 mm
Quantity 10000 resistors per reel; Reel diameter 250 mm

TERMINATION OUTLINE DRAWING



Philips Components

Discrete Products Division

A North American Philips Company

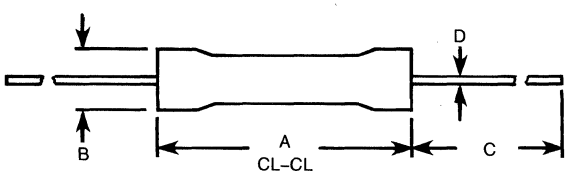
PRECISION POWER FILM RESISTOR METAL FILM

.05% to 5% Tolerances
1, 2, 3 and 5 Watt
(25°C) Power Rating

DESCRIPTION

The PPR5000 series is a precision power film that achieves the inherently low inductance and reliability of metal film resistors and the stability and power handling capability of wirewound resistors.

DIMENSIONS



FEATURES

- **Low Inductance**
- **Excellent Stability**
- **Small Size**
- **Tight Tolerances**
- **Low TC's**

PERFORMANCE SPECIFICATIONS

	Max. % Delta R
Thermal Shock	.2%
Terminal Strength	.1%
Dielectric Withstanding Voltage	
Atmospheric	.1%
Barometric	.1%
S.T.O.L.	
Moisture Resistance (Load)	
Life (1000 hr @ rated power)	
Vibration	.1%
Effect of Solder	.1%
Shock	.1%

SPECIFICATIONS

Philips Style	Resistance Range (OHMS)	Resistance Tolerance (%)	Temperature Coefficient (PPM/°C)	25°C Power Rating	Maximum Voltage (Volts)	Dimensions			
						A Max	B Max	C Max	D Max
5073P	5R->25K	.05, .1,(1) .25, .5, 1	±20->100(2)	1 Watt	160	.265″	.098″	1.5″	.025″
5083P	5R->25K	.05, .1,(1) 25, .5, 1	±20->100(2)	2 Watts	225	.365″	.150″	1.5″	.025″
5093P	5R->25K	.05, .1,(1) .25, .5, 1	±20->100(2)	3 Watts	275	.550″	.225″	1.5″	.032″
50A3P	5R->100K	.05, .1,(1) 25, .5, 1	±20->100(2)	5 Watts	500	.800″	.225″	1.5″	.032″(3)

NOTES: (1) .05% and .1% available 100 ohms and higher only. Also available in 2% and 5% over the entire range.
(2) Value below 10 ohms will have TC of ± 50 PPM.
(3) .040″ wire available upon request.

PICONICS

THICK AND THIN FILM RESISTOR CHIPS

Piconics manufactures high quality Thick and Thin Film Resistor chips and custom networks.

Our products are produced utilizing the latest in automatic lasers, fast cycle sputter and E-Beam equipment, furnaces, precision photolithographic machinery and dicing tools all under environmentally controlled conditions. Both NICHROME AND TANTALUM NITRIDE resistors are available using various conductor combinations with both suitable for wire bonding or soldering (SMD). Piconics specializes in products on BERYLLIA and Aluminum Nitride. Custom layouts, designs, test requirements, and non-standard performance specifications are welcome. All products are manufactured to meet the requirements of MIL-STD-883, MIL-R-55342, MIL-Q-9858 and all other pertinent military specifications. Our Specialties are Wraparound Thick/Thin Film Resistors and high power chips up to 20 watts. dissipation. Group A, Group B and Group C testing available.

Thick/Thin Film Product Codes

CR-	XXX	-XXXX	-XX	-X	-X	-X
SR						
CR- Thin Film SR- Thick Film	Value in [1] Ohms	Size Code [2]	Thickness Code	Tolerance Code	Termination Code	Substrate Code
Sizes: 0302** Avail- 0304 able 0303* 0402 0403 0404** 0502** 0504 0505* 0604 0703** 0705 0202 0503 0705		0805 1005** 1008 1010** 1206 1510 1612 2010** 2512** 3725** Custom	Standard 05 = .005 10 = .010 25 = .025 40 = .040 Others Available	M = ±20% K = ±10% J = ± 5% G = ± 2% F = ± 1% B = ± .1% Others Available C = ± .25% D = ± .5%	**Thin Film:** W-Gold One Side 2W-Gold Two Sides S-Solder (SN 62) R-Wraparound (Platinum Gold) 2R-Half Wrap **Thick Film:** D-Palladium Silver T-Platinum Gold W-Gold 2-Metal Two Sides R-Wraparound S-Solder (SN62) **Note:** Platinum Palladium Gold used on all wraparounds.	**Substrate** A-Aluminum B-Beryllia S-Silicon G-Glass N-Aluminum Nitride (Thin Film Only) Q-Quartz (Special Order Only)

Note: *Other Sizes Available.

Available

1. Nichrome or Tantalum Nitride Thin Film
2. Passivation or Glassivation
3. Aluminum conductor
4. Tolerances below ± 1%
5. Specific TCR's
6. High Temp Operating Capabilities
7. Custom Testing
8. Nickel Barrier (CR)

CUSTOM THIN FILM COATINGS

Piconics is equipped to provide custom THIN FILM coatings as a product or service. Our Cryo Pumped in Line Auto Sputter and Fast Cycle E-Beam capability together with peripheral controls gives Piconics a broad range of Film Capabilities. We provide coated substrates of Alumina, Beryllia, Quartz, Aluminum Nitride, Glass with materials such as Gold, Aluminum, Nichrome, Tantalum, Nickel, Chrome, Titanium/Tungsten, Indium Tin, Silicon Nitride, Silicon Dioxide, Palladium, Titanium, Copper, and others upon request. NOTE: Tantalum and Nichrome coating to your Specified Sheet Resistivity and TCR. Process assistance provided.

General Performance Specifications

Property	Conditions	Thin Film	Thick Film
Temp Coefficient	—55°C to + 150°C	Nichrome 0 - 50 PPM Tantalum 0 to 100 ppm	0 ± 100 ppm Typ.
Temp Track (Networks)	—55°C to + 150°C	1 - 2 ppm typ.	5 - 10 ppm typ.
Noise*	MIL-STD-202 M 308	−20 dB to −35 dB	+10 dB to −30 dB
Voltage Coefficient	—	<.1 microvolt/volt	0.1% / volt typ. (depending on value)
Value Range	—	0.1 ohm - 5 meg. (Higer as Custom)	1 ohm - 100 meg.
Operating Voltage	Typical 100 V.	Layout/Value dependent	Layout/Value dependent
Stability	1000 hours +125°C w/Power	±0.3% Max. Δ R	±0.5% Max. Δ R
Short Term Overload	2.5x Max Rated Current	±.25% Max.	±.5% Max. ±.25% max.
Moisture Resistance	MIL-STD-202 M106	±0.5% Max.	±0.5% Max.
Thermal Shock	MIL-STD-202 M107	±.15% Max.	±.25% Max.
Solder Exposure	300°C − 30 sec.	±0.4% Max. ±.25% max.	±0.5% Max. ±.25% max.
High Frequency	Layout/Film dependent	to 18 GHz	To 5 GHz
Power Rating: Alumina Berylia+Aluminum Nitride Silicon	Size Dependent	50mw to 5w 200mw − 20w 200mw − 20w	50mw to 15w 200mw to 20w N.A.
High Temp Exposure	150°C, 100 hours	±.25% Max.	±0.25% Max.
Resistance to Bonding	—	±.1% Max.	±.25% Max.

Notes: 1. TCR may be "tailored" at times to meet needs to ± 5ppm.
2. High Temperature Resistors available to operate at up to +300°C.
3. Operating Voltage may be custom designed to 1200V.
4. Parts inspected to MIL-STD-883 Method 2010/2017/2032 Level B.
5. Testing meets MIL-R-55342 Requirements.
6. Custom Requirements Welcomed.
7. Wraparounds available on most sizes for Surface Mounting.
8. Silicon Dioxide Passivation available on Thin Film and Glassivation on Thick Film (Moisture Barrier).

*The Johnson Noise level is dependent on Resistor value and film sheet resistivity with lower noise levels found on lower resistivity Films.
**Derate Power from Max at 70°C to zero at 150°C

CUSTOM LASER SERVICES

Our In-House Tooling/Probe Card assembly and YAG Laser Systems provide customers with resistor trimming of THICK AND THIN FILM circuits on a rapid turn-around basis. We can process prototype quantities or large production runs rapidly to provide our customers with a "panic" turnaround or back-up to their own shop. Piconics is equipped for passive or active trimming of thin or thick film materials automatically, semi-automatically or manually. In addition our CO_2 laser provides custom ceramic machining and hole drilling. (Including Beryllia)

Piconics provides low impedance plated through holes in Thick or Thin Film products.

PICONICS, INC. 26 CUMMINGS ROAD, TYNGSBORO, MA 01879 • TEL: (508) 649-7501 • TELEX: 754759 • FAX: 508-649-9643

PRECISION RESISTIVE PRODUCTS, INC.
HIGHWAY 61 SOUTH, MEDIAPOLIS, IOWA 52637
(319) 394-9131 • TWX: 510-100-8039 • FAX: (319) 394-9280

METAL FILM RESISTORS

PR-SERIES

ULTRA PRECISION METAL FILM RESISTORS

- **Low Temperature Coefficients**
- **Tight Tolerance • High Stability • Low Noise**

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
PR-/20	0.170	0.072	0.200	AWG #26
PR1/10	0.280	0.102	0.300	AWG #22
PR1/8A	0.280	0.102	0.300	AWG #22
PR1/8	0.400	0.150	0.450	AWG #22
PR1/4A	0.416	0.161	0.450	AWG #22
PR1/4	0.600	0.200	0.685	AWG #22

SPECIFICATIONS

Style	Resistance Range (Ohms)	Wattage Rating @ 85°C	Voltage Rating
PR-/20	10R-300K	1/20	200
PR1/10	10R-5ooK	1/10	300
PR1/8A	10R-500K	1/8	250
PR1/8	10R-1M	1/8	400
PR1/4A	10R-500K	1/4	300
PR1/4	10R-1M	1/4	500

TYPICAL PERFORMANCE	%ΔR
1000 Hr. Load Life 85°C	0.02
Humidity	0.04
Thermal Shock	<0.01
Short Time Overload	<0.01
Dielectric Withstanding	<0.01
Noise	<–30dB
Insulation Resistance	>10000 M. Ohm
Shelf Life	<50 PPM/YR.

TEMPERATURE COEFFICIENTS
TC25 = 0 ±25 PPM/°C –20 to +85°C
TC20 = 0 ±20 PPM/°C –20 to +85°C
TC15 = 0 ±15 PPM/°C –20 to +85°C
TC10 = 0 ±10 PPM/°C –20 to +85°C
TC5 = 0 ± 5 PPM/°C –20 to +85°C

RESISTANCE TOLERANCES
±1.0%, ±0.5%, ±.25%, & ±0.1%, ±0.5%, ±.02%, ±.01%

LEAD MATERIAL
OFHC with 60/40 Tin/Lead Coating.

RL-SERIES

ULTRA PRECISION METAL FILM RESISTORS

- **Radial Leads • Small Size**
- **Low TC • High Stability**

DIMENSIONS (INCHES)

H	Height	0.365
L	Length	0.260
W	Width	0.140
LS	Lead Spacing Lead Gage #22	0.150

SPECIFICATIONS

Style	Temperature Coefficient	Resistance Range (Ohms)	Standard Tolerance	Wattage @ 85°C
RL 1	20 PPM/°C 15 10 5	20 thru 100K	1%, 5%, .25%, .10%, .05%, & .02% .01%	0.1
RL 3	20 PPM/°C 15 10 5 2	20 thru 100K	1%, 5%, .25%, .1% .05%, & .02% .01%	0.3

TYPICAL ENVIRONMENTAL PERFORMANCE	
	% ΔR
1000 Hr. Load Life	±0.02%
Humidity	±0.04%
Temperature Cycling	±0.01%
Short Time Overload	±0.01%
Insulation Resistance	>100 Megohms
Noise Index	<–30dB
Voltage Coefficient	<0.05 PPM/Volt
1 Year Shelf Life	±50 PPM

TEMPERATURE COEFFICIENTS
TC20 = 0 ±20 PPM/°C –20 to +85°C
TC15 = 0 ±15 PPM/°C –20 to +85°C
TC10 = 0 ±10 PPM/°C –20 to +85°C
TC 5 = 0 ± 5 PPM/°C –20 to +85°C

CUSTOMIZED RESISTORS

SETS AND NETWORKS

- **Custom Designed • Cost Effective**
- **Low TCR • High Stability**

CUSTOMIZED RESISTOR SETS AND NETWORKS

Because of the high consistency and uniformity of the film deposition process and the high, repeatable accuracy of automated trimming equipment, descrete film resistors are available in matched pairs, multivalue sets and discrete networks with high precision and very dependable performance at reasonable cost. Resistance values, tolerances, temperature coefficients, as well as the matching and/or tracking of these parameters, can be specified and meet to exceptionally high degrees. The optimum range for the tightest requirements is 100 ohms thru 100,000 ohms, but 10 ohms thru 1 megohms is a practical range for less stringent requirements.

NOTE:
Cost savings can be realized when relatively tight matching requirements are specified while permitting the absolute parameters of the discrete resistor to have more relaxed specifications.
Application engineers are available to assist you in specifying your requirements in the most economical way possible.
Please contact the factory for complete information.

GENERAL SPECIFICATIONS	
Nominal Resistance	10 ohms thru 1 megohm
Resistance Tolerance	±1% thru ±0.01%
Wattage	1/20 watt thru 1 watt
Temperature Coefficient	±100 PPM thru ±5 PPM
Resistance Matching	±1% to ±.005%
Temperature Coef. Tracking	±50 PPM/°C to ±1 PPM/°C

PACKAGING

Matched sets are individually packaged in coin envelopes and identified by customer part number.

Discrete resistor networks are available in S.I.P. and D.I.P. configurations and can be customized in an infinite variety of shapes and sizes to meet customer requirements.

PRECISION RESISTIVE PRODUCTS, INC.
HIGHWAY 61 SOUTH, MEDIAPOLIS, IOWA 52637
(319) 394-9131 • TWX: 510-100-8039 • FAX: (319) 394-9280

METAL FILM RESISTORS

SGP¼-SERIES

GENERAL PURPOSE MINIATURE ¼ WATT RESISTORS

- **Small Size** • **¼ Watt Rating**
- **Conformal Coating** • **Metal Film Performance**

DIMENSIONS

Style	Max. L.	Max. Dia.	Dim. A	Lead L.
SGP¼	0.170	0.072	0.020	1.0 ±0.062

SPECIFICATIONS

Style	Resistance Tolerance	Resistance Range (Ohms)	Wattage Rating @ 70°C	Voltage Rating
SGP¼	1%, 5%	10R-500K	¼	200

NOTE:
The SPG¼ is suitable for high density applications and is capable of being auto Inserted. Standard metal film performance has been enhanced by using a ceramic core, .020 leads, in line testing and a state of the art coating system for environmental protection. Marking is alpha-numeric.

TYPICAL PERFORMANCE	% ΔR
1000 Hr. Load Life @ 70°C	±0.25
Temperature Cycling	0.25
Noise	<−30dB
Shelf Life	<100 PPM
Humidity	0.40
Short Time Overload	0.25
Insulation Resistance	>1000 M

TEMPERATURE COEFFICIENTS
50 PPM/°C & 100 PPM/°C

RESISTANCE TOLERANCES
±5.0%, ±2.0% ±1.0%

LEAD MATERIAL
The core material is OFHC and is electroplated with a 200 micro inch coating of 60/40 tin/lead.

GP-SERIES

GENERAL PURPOSE PRECISION METAL FILM RESISTORS

- **Economical** • **High Performance**
- **Very Stable** • **Low Noise**

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
GP⅛	0.170	0.072	0.200	AWG #26
GP¼	0.280	0.102	0.325	AWG #22
GP½	0.400	0.150	0.450	AWG #22
GP¾	0.600	0.200	0.685	AWG #22
GP1	0.600	0.200	0.685	AWG #20

SPECIFICATIONS

PRP Style	Mil. Style	Resist. Range (Ohms)	Wattage Rating @ 70°C	Wattage Rating @ 125°C	Voltage Rating
GP⅛	RN50	10—500K	⅛	1/20	200
GP¼	RN55	2.5—500K	¼	1/10	300
GP½	RN60	2.5—1 M	½	⅛	500
GP¾	RN65	10—1.5M	¾	¼	500
GP1	RN70	10—1.5M	1	½	500

NOTE:
The GP-Series of resistors is conformally coated and fully protected against moisture by a multi-paint coat system and a hard epoxy outer coating.
Marking is alpha-numeric and meets the most demanding marking requirements. Special marking is available upon request.
Consult the factory concerning failsafe, flameproof, and fusing requirements.

TYPICAL PERFORMANCE	%ΔR
Thermal Shock	0.05
Low Temperature Operation	0.03
Terminal Strength, 5 Lb. Load	0.02
Resistance To Soldering Heat	0.04
Dielectric Withstanding Voltage	0.02
Short Time Overload	0.05
Humidity	0.20
1000 Hour Load Life @ 125°C	0.15

TEMPERATURE COEFFICIENTS
TC25 = 0 ± 25 PPM/°C −20 to +85°C
TC50 = 0 ± 50 PPM/°C −20 to +85°C
TC100 = 0 ±100 PPM/°C −20 to +85°C
TC250 = 0 ±250 PPM/°C −20 to +85°C
1010

RESISTANCE TOLERANCES
±5.0%, ±2.0%, ±1.0%, ±0.5%, ±.25%, & ±0.1%

LEAD MATERIAL
OFHC with 60/40 Tin/Lead Coating

LCR¼-SERIES

GENERAL PURPOSE PRECISION METAL FILM RESISTORS

- **Low Cost** • **Taped and Reel Package**
- **Color Band Marking** • **Exceeds Mil-R-22684B & Mil-R-10509F Performance Requirements**

DIMENSIONS

Max. L.	Max. Dia.	Lead L.	Lead Dia.
0.270″	0.098″	1¼″	0.025

GENERAL SPECIFICATIONS

Resist. Tolerance	Resist. Range	Temp. Coef. of Resist.	Power Rating	Max. Volt.
1% 2% 5%	10Ω through 1M	50 & 100 PPM/°C	¼W (70°C)	250 VRMS

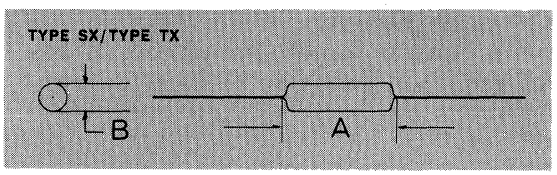
Performance Characteristics		PRP	Mil-R-22684B	Mil-10509F
Type No. (Style)		LCR¼	RL07	RN55D
Size: Inch	Body Length	.270	.243 ±.038	.250 ±.031
	Body Dia.	.098 Max.	.090 ±.008	.109 ±.031
	Lead Dia.	.024 ±.002	0.23 ±.004	.025 ±.002
Power Rating		0.25W at 70°C 0.125W at 125°C	0.25W at 70°C 0.078W at 125°C	0.125W at 70°C 0.0625W at 25°C

Performance Characteristics		PRP	Mil-R-22684B	Mil-10509F
Max. Rated Continuous Working Voltage		250V	250V	200V
Max. Ambient Temperature		165°C	150°C	165°C
TCR		±50 & ±100 PPM/°C	±200 PPM/°C	+200 −500 PPM/°C
Nominal Resistance Range		10Ω to 1MΩ	47Ω to 150kΩ	10Ω to 301kΩ
Standard Tolerances		1%, 2% & 5%	5% & 2%	1%
Dielectric Withstanding Voltage	ΔR	0.25%	0.5%	0.5%
Insulation Resistance		10,000 MΩ	1,000 MΩ	10,000 MΩ
Temperature Cycling	ΔR	0.25%	1.0%	0.5%
Short-Time Overload	ΔR	0.25%	0.5%	0.5%
Moisture Resistance	ΔR	0.5%	1.5%	1.5%
Load Life	ΔR	1.0%	2.0%	1.0%
Terminal Strength	ΔR	0.2%	0.5%	0.2%
Resistance to Soldering Heat	ΔR	0.5%	0.5%	0.5%
Shock	ΔR	0.2%	0.5%	0.5%
Vibration	ΔR	0.2%	0.5%	0.5%
Low Temperature Operation	ΔR	0.25%	0.5%	0.5%
Shelf Life	ΔR	0.2%	0.2%	N.A.

PRECISION

TYPE SX (SILICONE PROTECTION)
TYPE TX (ECONOMY LINE)

- Internationally popular and our best selling high performance wire wound resistors.
- Widest selections available.
- 100% testing to assure uniform quality.
- Economically priced with no minimums.
- For custom special-purpose applications.



ELECTRICAL AND PHYSICAL SPECIFICATIONS

PRC Types				$P=\frac{E^2}{R}$	$E=\sqrt{PR}$	Body Dimensions ±.787mm (.031″)				1.5″L. (Leads)†	Resistance (Ohms)		
TYPE SX		TYPE TX				(A) Length		(B) Diameter					
Inductive	Non-Inductive	Inductive	Non-Inductive	Max. Watts	Max. Volts	mm	(ins.)	mm	(ins.)	Max. Diam.	Min.	Max. Standard	Max. Special*
SX030	—	TX030	—	.03W	25V	5.59	(.220″)	1.27	(.050″)	.020″	1.0	3K	5K
SX062	SX062N	TX062	TX062N	.04W	35V	6.86	(.270″)	2.03	(.080″)	.020″	1.0	17K	30K
SX063	SX063N	TX063	TX063N	.05W	50V	8.43	(.332″)	2.03	(.080″)	.020″	0.1	20K	50K
SX072	SX072N	TX072	TX072N	.06W	45V	6.86	(.270″)	2.29	(.090″)	.020″	0.1	25K	35K
SX073	SX073N	TX073	TX073N	.07W	65V	8.43	(.332″)	2.29	(.090″)	.020″	0.1	30K	65K
SX093	SX093N	TX093	TX093N	.1W	85V	8.43	(.332″)	2.92	(.115″)	.025″	0.1	35K	75K
SX094	SX094N	TX094	TX094N	.1W	100V	10.03	(.395″)	2.92	(.115″)	.025″	0.1	50K	100K
SX095	SX095N	TX095	TX095N	.125W	125V	11.61	(.457″)	2.92	(.115″)	.025″	0.1	60K	180K
SX105	SX105N	TX105	TX105N	.166W	165V	11.61	(.457″)	3.3	(.130″)	.025″	0.1	75K	210K
SX123	SX123N	TX123	TX123N	.166W	165V	8.43	(.332″)	3.68	(.145″)	.025″	0.1	40K	120K
SX106	SX106N	TX106	TX106N	.2W	200V	13.21	(.520″)	3.3	(.130″)	.025″	0.1	100K	280K
SX124	SX124N	TX124	TX124N	.2W	200V	10.03	(.395″)	3.68	(.145″)	.025″	0.1	50K	160K
SX143	SX143N	TX143	TX143N	.2W	200V	8.43	(.332″)	4.06	(.160″)	.028″	0.1	50K	130K
SX154	SX154N	TX154	TX154N	.25W	250V	10.03	(.395″)	4.47	(.176″)	.028″	0.1	100K	200K
SX155	SX155N	TX155	TX155N	.25W	250V	11.61	(.457″)	4.47	(.176″)	.028″	0.1	100K	300K
SX156	SX156N	TX156	TX156N	.33W	330V	13.21	(.520″)	4.47	(.176″)	.028″	0.1	140K	400K
SX174	SX174N	TX174	TX174N	.33W	330V	10.03	(.395″)	4.83	(.190″)	.028″	0.1	130K	220K
SX175	SX175N	TX175	TX175N	.33W	330V	11.61	(.457″)	4.83	(.190″)	.028″	0.1	135K	350K
SX158	SX158N	TX158	TX158N	.5W	500V	16.38	(.645″)	4.47	(.176″)	.028″	0.1	450K	600K
SX177	SX177N	TX177	TX177N	.5W	500V	14.78	(.582″)	4.83	(.190″)	.028″	0.1	400K	540K
SX185	SX185N	TX185	TX185N	.5W	500V	11.61	(.457″)	5.26	(.207″)	.028″	0.01*	135K	360K
SX186	SX186N	TX186	TX186N	.5W	500V	13.21	(.520″)	5.26	(.207″)	.028″	0.01*	150K	480K
SX188	SX188N	TX188	TX188N	.6W	600V	16.38	(.645″)	5.26	(.207″)	.028″	0.01*	450K	720K
SX2210	SX2210N	TX2210	TX2210N	.8W	800V	19.56	(.770″)	6.10	(.240″)	.032″	0.1	511K	1.1 MEG
SX3110	SX3110N	TX3110	TX3110N	1W	1000V	19.56	(.770″)	8.43	(.332″)	.032″	0.1	750K	1.6 MEG
SX2812	SX2812N	TX2812	TX2812N	1.25W	1000V	22.73	(.895″)	7.62	(.300″)	.032″	0.1	1 MEG	1.8 MEG
SX3114	SX3114N	TX3114	TX3114N	1.33W	1000V	25.91	(1.020″)	8.43	(.332″)	.032″	0.1	1.25 MEG	2 MEG
SX3712	SX3712N	TX3712	TX3712N	1.5W	1000V	22.73	(.895″)	11.1	(.437″)	.032″	0.25	1.5 MEG	2.5 MEG
SX3716	SX3716N	TX3716	TX3716N	2W	1250V	29.08	(1.145″)	11.1	(.437″)	.032″	0.5	2 MEG	3.5 MEG
SX3724	SX3724N	TX3724	TX3724N	3W	1250V	41.78	(1.645″)	11.1	(.437″)	.032″	0.5	3 MEG	5 MEG
SX3730	SX3730N	TX3730	TX3730N	5W	1500V	51.31	(2.020″)	11.1	(.437″)	.032″	0.5	4 MEG	6 MEG

* 0.01 ohm to 0.1 ohm and maximum special resistance values available in non-standard physical sizes — 0 +.062″
† Commercially pure copper (Electrolytic Tough Pitch/Oxygen-Free High Conductivity).

ENGINEERING DATA:

1 RESISTANCE RANGE AND TOLERANCE "Repeatable (part-to-part)"
Any ohmic value or decimal part of an ohm desired with tolerances to ±0.05%. Refer to type HR for closer resistance tolerances.

2 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)
Zero ±10ppm/°C. (Standard)
For specific TCR characteristics to ±1 ppm/°C refer to type HR. See type PT for Precision Positive (+) TCR characteristics to +6000 ppm/°C.

3 STABILITY VS. TIME CHARACTERISTICS "Low ΔR"
To ±0.005%/year at 25°C (no load).

4 POWER RATINGS VS. AMBIENT TEMPERATURE AND RESISTANCE TOLERANCE
(Full power ratings are based upon standard ±1% resistance tolerance. Derating is required for higher temperatures and closer resistance tolerances.)
Type SX: To +125°C.
Type TX: To + 85°C.

5 INDUCTANCE
The standard Type SX/TX resistors are inductively wound. Non-inductive resistors are available — add suffix letter "N" in part number.

6 TERMINALS
Solderable hot-tinned (63% Sn — 37% Pb) copper wire leads. Low thermal EMF, noise free construction.

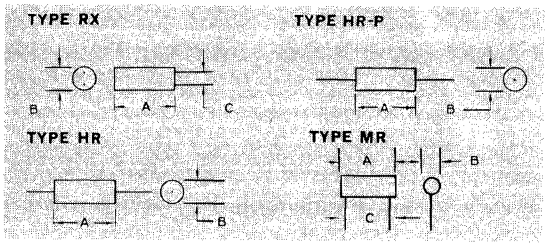
7 PROTECTIVE COATINGS
Type SX: New **solvent resistant** silicone-epoxy-seal.
Type TX: Commercial plastic conformal coating.

8 PURCHASING INFORMATION
Please specify: Quantity, type, resistance value, resistance tolerance and special features which may apply.

PRC PRECISION RESISTOR CO., INC.
10601 75th STREET NO. • LARGO, FL 34647 U.S.A. • TEL: (813) 541-5771 • TELEX: 821788 • FAX: (813) 546-9515

AXIAL LEAD TYPE HR
HIGH VOLTAGE TYPE HR-P
PC AND RADIAL LEAD TYPES RX/MR

ULTRA



- Ultra-precision wire wound resistors.
- Greater stability of calibration for all resistance tolerances.
- TCR zero ±5 ppm/°C (std.) matched to exact temperature span of operation.
- Ideal for precise DC measurements, transfer standards and state-of-the-art voltage dividers.
- N.I.S.T. traceability and certification available.

ELECTRICAL AND PHYSICAL SPECIFICATIONS

PRC Types	Meets or Exceeds Environmental Conditions of: MIL-R-39005	MIL-R-93	Max. Watts 1% Res. Tol.	Max. Volts	Body Dimensions ±.787mm (.031″) (A) Length mm	(ins.)	(B) Diameter mm	(ins.)	Standard Space C	(ETP/OFHC)* Tinned Copper Leads Diam. Max.	Length† (±.125″)	Resistance (Ohms) Min.	Max. Standard	Max. Special
PRINTED CIRCUIT														
RX378N	—	RB70	.5W	200V	12.7	(.500″)	9.53	(.375″)	.200″	.032″	1″	0.1	301K	500K
RX255N	RBR71	RB71	.25W	100V	7.92	(.312″)	6.35	(.250″)	.200″	.025″	1″	0.1	100K	150K
RX258N	—	—	.33W	300V	12.7	(.500″)	6.35	(.250″)	.200″	.025″	1″	0.1	250K	350K
RADIAL LEAD														
MR165N	RBR80	—	.2W	100V	8.26	(.325″)	4.06	(.160″)	.225″	.020″	1″	0.1	80K	120K
MR168N	RBR81	—	.2W	100V	12.7	(.500″)	4.06	(.160″)	.400″	.020″	1″	0.1	150K	250K
AXIAL LEAD														
HR103	—	—	.1W	50V	5.08	(.200″)	2.54	(.100″)	—	.020″	1.5″	1.0	10K	20K
HR175N	—	—	.2W	100V	7.92	(.312″)	3.96	(.156″)	—	.020″	1.5″	0.1	80K	100K
HR186N	—	—	.2W	150V	9.53	(.375″)	4.75	(.187″)	—	.025″	1.5″	0.1	100K	150K
HR188N	RBR74	—	.25W	150V	12.7	(.500″)	4.9	(.193″)	—	.025″	1.5″	0.1	125K	200K
HR255N	RBR75	—	.25W	150V	7.49	(.295″)	6.35	(.250″)	—	.025″	1.5″	0.1	110K	316K
HR256N	RBR56	RB56	.25W	200V	9.53	(.375″)	6.35	(.250″)	—	.032″	1.5″	0.1	127K	200K
HR258N	RBR55	RB55	.33W	300V	12.7	(.500″)	6.35	(.250″)	—	.032″	1.5″	0.1	226K	500K
HR2512N	RBR54	RB54	.5W	300V	19.05	(.750″)	6.35	(.250″)	—	.032″	1.5″	0.1	511K	1 MEG
HR3114N	RBR76	—	.5W	300V	20.62	(.812″)	7.92	(.312″)	—	.032″	1.5″	0.1	600K	1.5 MEG
HR3712N	RBR53	RB53	.66W	300V	19.05	(.750″)	9.53	(.375″)	—	.032″	1.5″	0.1	750K	2 MEG
HR3716N	RBR52	RB52	1W	600V	25.4	(1.000″)	9.53	(.375″)	—	.032″	1.5″	0.1	1.5 MEG	3 MEG
HR5016N	RBR57	RB57	1.5W	600V	25.4	(1.000″)	12.7	(.500″)	—	.032″	1.5″	0.1	2 MEG	5 MEG
HR5024N	—	RB58	2W	900V	38.1	(1.500″)	12.7	(.500″)	—	.032″	1.5″	0.1	3.01 MEG	7.5 MEG
HR5032N	—	RB59	2.5W	1200V	50.8	(2.000″)	12.7	(.500″)	—	.032″	1.5″	0.1	5.11 MEG	10 MEG

PRC Types	Meets or Exceeds Environmental Conditions of: MIL-R-39005	MIL-R-93	Max. Watts 1% Res. Tol.	Max. Volts	Body Dimensions ±.787mm (.031″) (A) Length mm	(ins.)	(B) Diameter mm	(ins.)	(ETP/OFHC)* Tinned Copper Leads Diam. Max.	Length† (±.125″)	Resistance vs. Wattage Max. Res. @ Max. Watts	Max. Res. @ Derated Watts	Std. Res. vs. Power
HIGH VOLTAGE/HIGH VALUE AXIAL LEAD													
HR5024NP	—	RB58	2W	1350V	38.1	(1.500″)	12.7	(.500″)	.032″	1.5″	911K @ 2W	1.8 MEGS @ 1W	1 MEG @1.5W
HR5032NP	—	RB59	2.5W	1800V	50.8	(2.000″)	12.7	(.500″)	.032″	1.5″	1.3 MEGS @ 2.5W	3.2 MEGS @ 1W	2 MEGS @ 1.5W

* Commercially pure copper (Electrolytic Tough Pitch/Oxygen-Free High Conductivity). † 2″ leads on MIL-Styles

ENGINEERING DATA:

1 RESISTANCE RANGE AND TOLERANCE "MIL Guidelines"
Standard: Any ohmic value or decimal part of an ohm desired with tolerances to ±0.01%. 10Ω min. res. (.01%).
Special: Higher or lower values beyond the standard limits with tolerances to ±0.005% at calibrated temp. (25°C).

2 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)
Standard: Zero±5 ppm/°C (100 ohms and above). **Zero ±15 ppm/°C** (values below 100 ohms).
Special: To ±1 ppm/°C. TCR matching to within 0.5 ppm/°C. Please specify temp. span of operation.

3 INDUCTANCE
Standard: Non-inductively wound with balanced reverse pi winding.

4 STABILITY OF CALIBRATION
To ±0.001% (10 ppm) per year at 25°C — no load — regardless of resistance tolerance.

5 POWER RATINGS VS. AMBIENT TEMPERATURE
These resistors are designed for full load operation providing the ambient temperature plus the temperature rise due to power dissipation does not exceed +125°C. (Derated to zero power at +145°C.)

6 HIGH VOLTAGE RATINGS
Type HR-P high operating voltage winding patterns also eliminate dangerous crossovers and potential problems of standard bobbin style resistors. To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

7 STABILITY VS. THERMAL EMF (With respect to copper terminals)
Standard: <+2 microvolts per °C (100 ohms and above). <−3 microvolts per °C. (values below 100 ohms).

8 PROTECTIVE ENCAPSULATION
Expansion — stress free base coat and epoxy seal. Solder — heat and solvent resistant.

9 MARKING (Identification)
Standard: PRC symbol, type, resistance value and tolerance.
Special: Military or custom marking.

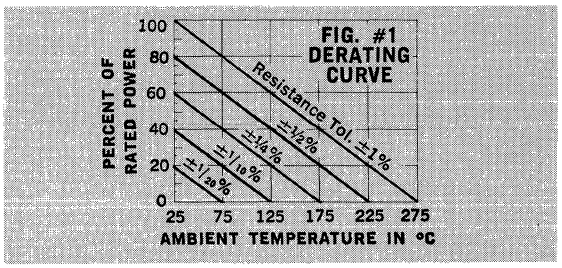
10 TRACEABILITY TO N.I.S.T.
Certification (Absolute values in ohms) to N.I.S.T. is available.

PRC PRECISION RESISTOR CO., INC.
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POWER

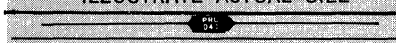
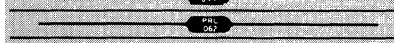
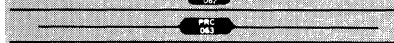
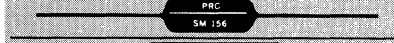
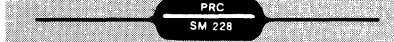
TYPE SM AXIAL LEAD

- Subminiature 2-terminal precision power wire wound resistors.
- Widest range of resistance in the industry.
- Highest operating voltage ratings.
- Extremely high or low-value non-inductive designs available.
- Instrument grade low EMF vs. copper.
- Excellent thermal stability.



ELECTRICAL AND PHYSICAL SPECIFICATIONS

For higher resistance values (at max. rated voltage) decrease max. power rating ($P = E^2/R$)
For lower resistance values (at max. rated power) decrease max. voltage rating ($E = \sqrt{PR}$)
* Resist. values based upon max. power and max. voltage.

TWO (2) TERMINAL ALL DRAWINGS ILLUSTRATE ACTUAL SIZE	PRC Type	RW Styles MIL R-26	Max. Power Rating (Watts)	*Min. Allowable Resist. (Ohms)	*Resist. ($R=E^2/P$)	*Max. Allowable Resist. (Ohms)	Max. Voltage Rating	Body Dimensions ±.787mm (.031") Length mm	Length (ins.)	Diameter mm	Diameter (ins.)	1.5"L. Lead Diam. Tinned Copper
	SM041	—	⅛W	1.0	5K	10K	25V	6.35	(.250")	1.52	(.060")	.020"
	SM062	—	¼W	1.0	17K	30K	65V	6.35	(.250")	2.03	(.080")	.020"
	SM063	—	½W	0.1	24K	50K	110V	7.92	(.312")	2.03	(.080")	.020"
	SM094	RW70	1W	0.1	40K	80K	200V	10.31	(.406")	2.92	(.115")	.025"
	SM076	—	1⅛W	0.1	53K	180K	245V	12.7	(.500")	2.29	(.090")	.020"
	SM156	—	1½W	0.1	90K	400K	375V	13.49	(.531")	4.47	(.176")	.028"
	SM1711	—	2W	0.1	225K	900K	670V	20.62	(.812")	4.83	(.190")	.028"
	SM186	RW69	3W	*0.025	80K	480K	500V	12.7	(.500")	5.26	(.207")	.028"
	SM177	RW79	3W	0.1	80K	540K	500V	14.27	(.562")	4.83	(.190")	.028"
	SM228	—	3W	*0.02	120K	720K	600V	15.88	(.625")	6.10	(.240")	.032"
	SM2812	RW74	5W	*0.02	200K	1 MEG	1000V	22.23	(.875")	7.92	(.312")	.032"
	SM3114	RW67	6½W	0.1	154K	1.5 MEG	1000V	25.4	(1.000")	7.92	(.312")	.032"
	SM3726	RW78	10W	*0.07	156K	4 MEG	1250V	45.21	(1.780")	10.03	(.395")	.032"

* 0.02 ohm to 0.1 ohm and maximum resistance values available in non-standard physical sizes −0 +.062".
All low value 2-terminal designs are calibrated and tested at mid-point on lead unless otherwise specified.

CONSIDER THESE INNOVATIVE FEATURES:

1 WIDE RESISTANCE RANGE

"Widest in the industry" any ohmic value or decimal part of an ohm from 0.02 ohm to 4 megohms.

2 DEPENDABLE TOLERANCES

Small quantity lots, as well as, competitive high volume production quantities are accurately checked 100% to assure specified limits . . . ±1% (Std.), ±0.5%, ±0.25%, ±0.1% and ±0.05% resistance tolerances.

Call us about your design requirements and questions. Engineering samples are available for testing and evaluation.

3 STABILITY VS. TEMPERATURE CHARACTERISTICS

Carefully selected materials/processes & quality control procedures insure low temperature (TCR) and power coefficients. **Standard:** Zero ±10 ppm/°C 100Ω and above. Zero ± 15 ppm/°C below 100 ohms. **Special** to ±2 ppm.

4 HIGH VOLTAGE RATINGS

(D.C. Voltage or Peak Voltage)
Precision's high operating voltage winding patterns also eliminate dangerous crossovers and potential problems of standard mandrel style resistors. To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

5 PRECISION POWER RATINGS

All (Std.) Type SM 1% tolerance resistors are designed for continuous full load operation at 25°C (% Δ under load ≈ .06%/W.). Derate to zero power at +275°C. (Fig. #1)

6 SOLVENT RESISTANT COATING

All Type SM resistors are sealed in a tough solvent resistant—high temperature silicone coating . . . with indelible marking.

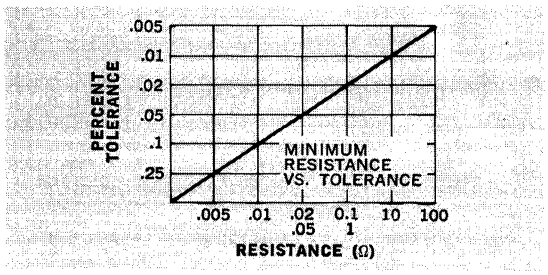
7 PURCHASING INFORMATION

Please Specify: Quantity, type, resistance value, resistance tolerance and special features which may apply. TCR characteristic together with temperature span of operation should be specified in behavior spec.

PRC PRECISION RESISTOR CO., INC.
10601 75th STREET NO. • LARGO, FL 34647 U.S.A. • TEL: (813) 541-5771 • TELEX: 821788 • FAX: (813) 546-9515

FOUR TERMINAL TYPE SM-(4)

POWER



- Precision power 4-terminal shunts provide extremely precise low-value resistance measurements.
- Reliable current sensing by voltage drop method.
- Part-to-part interchangeability.
- Resistance values to 0.005 ohm.
- Exact engineering samples available.

ELECTRICAL AND PHYSICAL SPECIFICATIONS

Precise low-value repeatability. Eliminates lead-out and contact resistance. "Single Joint" design makes lead identification academic.

PRC Type	Max. Power Rating	Body Dimensions ±.787mm (.031") Length mm	Length (ins.)	Diameter mm	Diameter (ins.)	Std. Space	1.4"L* Std. Lead Diam. (±.001")	Standard Min. Res. @ Max. Watts Ω	W	Special* Min. Res.* @ Derated Power Ω	W	FOUR (4) TERMINAL ALL DRAWINGS ILLUSTRATE ACTUAL SIZE
SM155-4	1¼W	13.21	(.520")	5.08	(.200")	.110"	.0285"	.015 @ 1¼W		.005 @ .5W		
SM186-4	2½W	16.5	(.650")	6.35	(.250")	.110"	.0285"	.025 @ 2½W		.005 @ .5W		
SM228-4	3W	19.69	(.775")	7.11	(.280")	.110"	.0285"	.03 @ 3W		.005 @ .5W		
SM2212-4	4W	26.04	(1.025")	7.11	(.280")	.110"	.0285"	.028 @ 4W		.005 @ .75W		
SM2812-4	5W	26.04	(1.025")	8.71	(.343")	.118"	.032"	.02 @ 5W		.005 @ 1.125W		
SM3724-4	7½W	45.72	(1.800")	11.10	(.437")	.243"	.032"	.03 @ 7½W		.005 @ 1.125W		

* Heavier current carrying capacity leads are available for low resistance — full power applications. Refer to Type PLV for custom millivolt drop requirements.

ENGINEERING DATA:

1 RESISTANCE RANGE AND TOLERANCE

Standard: Any ohmic value or decimal part of an ohm desired from 0.015 ohm to 100 ohm with tolerances to ±0.005%.

Special: 0.005 ohm through 0.01 ohm with microhm tolerances to ±0.1%.
(See resistance vs. tolerances graph above)

2 TEMPERATURE COEFFICIENT OF RESISTANCE

Zero ±15 ppm/°C — please specify temperature span of operation.

3 STABILITY VS. TIME CHARACTERISTICS (No Load)

To ±0.001%/year @ 25°C.

4 SOLVENT RESISTANT COATING

. . . with indelible marking.

5 PRECISION POWER RATINGS

Minimum resistance values @ full power ratings are based upon ±1% resistance tolerances at 25°C. Derating is required for higher temperatures, closer tolerances and lower resistance values.

6 TERMINALS

Solderable "hot-tinned" copper wire leads act as an excellent wetting agent and provide long shelf life. Low EMF construction reduces thermal effects. Select any two terminals as current leads (directly or diagonally opposite) and the other two potential leads for voltage drop.

7 TWO TERMINALS VS. FOUR TERMINALS

Two-wire devices are for relatively high values where the effects of lead-out resistance and contact resistance are minimal. Allow approx. +.001 ohm per inch for lead-out resistance on 2-wire designs. Adder may be eliminated by using a 4-terminal resistor for very accurate, repeatable low resistance measurements.

Four-wire circuits will only indicate the voltage drop across the resistor eliminating lead-out and lead-heating errors.

PRC PRECISION RESISTOR CO., INC.
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RCD RESISTORS • COILS • DELAY LINES

WORLD'S WIDEST RANGE OF RESISTORS: 0.0002Ω TO 2 x 10^{14}, TO ±0.0005% ¼ PPM/°C, UP TO 1000W 300KV!
APPROXIMATELY ½ BILLION PIECES IN STOCK! CONTACT FACTORY FOR NEW 78 PAGE CATALOG.
MOST PRODUCTS AVAILABLE ON EXCUSIVE "SWIFT™" PROGRAM (1-week delivery) IF UNAVAILABLE FROM STOCK!



Precision Wirewound Resistors

SA: .05Ω-25M, ⅛ -2W, to ±0.005%, 2ppm
MA: Mini sizes, 1/20-½W, .05Ω-1.2M
Q: Economy .01% to .5%, 1/10-1W
PC: Radial lead, .15W-1W, .05Ω-2M



Carbon & Metal Film Resistors

CF/CFS: Carbon film ⅛-3W & mini sizes
MF/PMF: Precision 1Ω-22M, to .01% 5ppm
HM: Hermetic sealed MF, 1/20W-5W
GP/GPS: Low cost MF, mini sizes, ⅛-2W



Flameproof Fuse Resistors

BW: Economy film, ¼-3W, .1Ω-100K
FR: Wirewound, ½-50W, .05Ω-25K
TF: Thermal fuse, axial & radial, 1W-60W
TFP: Failsafe pulse withstanding



Power Wirewound Resistors

100: ½-50W, .01%-10%, .005Ω-1M
200: Mini sizes, 1W-10W
RW: Economy 1W-3W



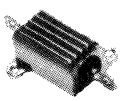
Precision Radial Resistors

HP: Ultra precision foil to .01% ¼ppm
VS: .3W-2W, .005%-1%, 10Ω-10M
BC: High megohm up to 1000M



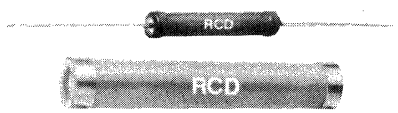
Microminiature Resistors

MFA: World's smallest, axial, 1Ω-4.7M
MR: Microsize, radial, 4.7Ω-1000M
MG: Mini ½W & 1W are ⅛W & ¼W size



Chassis Mount Wirewound

600: 5W-1000W, .005Ω-250K, .01%-5%
600L: Insulated leadwires, 10W-50W



Surge/Pulse Withstand Resis.

PCN: Ceramic comp., 2-270W, 14-30Kjoule
P: Low cost, lightning/cap discharge, failsafe



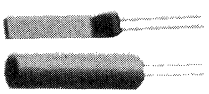
Metal Oxide Resistors

RSF: ½W-10W, 0.1Ω-510K, 1%-5%
RMF: Mini sizes, ½W-7W, .2Ω-150K



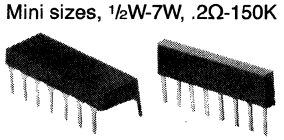
Ceramic Encased Resistors

PW: Axial lead, 2W-25W, low cost
PWB: Mini sizes, 3W-10W
PV: Radial lead, 2W-10W
PWV: Vertical mount, 5W-25W
ULV: Ultra low value, to .005Ω 0.5%
LVF: Four terminal, as low as .0005Ω



Temp. Sensitive Resistors/RTD'S

PTF: Platinum thin film, 100/500/1K, 640°C
PTC: Wirewound RTD elements, Pt/Ni/Nife
PTS: RTD probes with metal sheaths, 500°C
ATB/ATS: WW, +80 to 6000ppm, .1Ω-1M
LP: Econ. film, +150 to 7000ppm, 1Ω-100K
LPT: Economy platinum, 10Ω-500Ω, 300°C



Networks/Hybrids

C/CL: Std & low profile thick film SIPs
CLL: Super low profile SIP, .100" Max.
CLL-50/-25: 50-mil & 25-mil pin spacing
CP: Precision thin film SIP
CDN/CSN: Custom DIP & SIP networks
H: SIP, DIP, SM Hybrids, Active & Passive



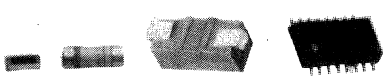
Tubular Power WW Resistors

TL: 5-500W, 0.1Ω-500K, 1%-10%
TLA/TLR: Axial or Radial lead
TLV/TLT: Adjustable & tapped versions



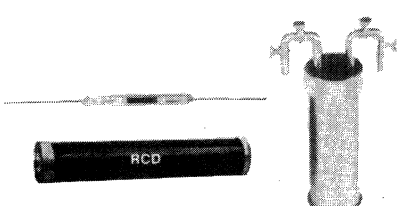
Inductor Chokes/Coils

AL: Economy, 3 sizes, .1µH-2.2mH
P/PF: Molded or shielded, .1µH-10mH
CA/CH: High current chokes, 1A-20A
HVI: High values 1mH to 2H
LE/ST: Ethernet, starlan pulse transformer
T: Toroidal inductors, transformers



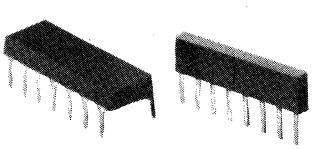
Surface Mount Products

MC: Thick-film chips, 1/20-3W, 1Ω-22M
MCT: Thick-film chips, Military-grade
BLU: Thin-film chips, to 0.05% 5ppm/°C
MW: Wirewound, 1-5W, .01Ω-25K, .01-5%
MGP/MCF: 1/10-½W, MF & CF MELF's
MHM: Hermetically sealed metal film
HR: High-megohm to 10^{12}Ω
SRH: High voltage, 1KV to 5KV
MLP: Temp. sensitive, +450 to 5000ppm
MBW: Flameproof fusible resistors
SF: 4-terminal, 0.001Ω to 25KΩ
SMN/SMTF: Thick- and thin-film networks
SMM: SM thick-film SIP networks
SMN25: Fine pitch, 25-mil networks
SMN2010: Leadless chip networks
CI/MCI: Chip inductors, 5 sizes
MSI: Molded shielded chip inductors
SMA/SMP: Active & passive delay lines
STT: Programmable 3-bit delay lines
SPT: Pulse transformers
SM Kits: 0805 & 1206, thick & thin chips



Specialty Resistors

A: Resistance standards to ±0.0005%
RG: Metal glaze, up to 20KV, 1M-10GΩ
RH: Precision high-megohm, to 0.1% 10ppm
UHV: Ultra high value to 2 x 10^{14}Ω
SR: High power thick film, to 250W 300KV
HF: High frequency to 10GHZ
ZJ: Zero-ohm jumpers, 2A-20Amp



Delay Lines

SA: Active SIP, 20-1000ns
A: Active DIP, 10-1000ns
SP: Passive SIP, 5-500ns
P: Passive DIP, 0.1-2000ns
E: ECL Active DIP, 10-200ns
TT: Programmable TTL, 3-8 Bit
EC: Programmable ECL, 3-8 Bit

Refer to EEM Section 1800 for RCD coils & inductors and EEM Section 2350 for RCD delay lines.

RCD COMPONENTS INC. *520 E. INDUSTRIAL PARK DR., MANCHESTER, N.H. 03109 USA TEL (603) 669-0054 FAX (603) 669-5455*

We've Put up a LOT of Resistance...



Reliable Performance *Wherever* Needed!

Also Military Versions:
RW29, 30, 31. RS 32, 33, 35.
RW67, 68, 69. RX29, 32, 33, 35.

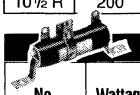
For More Than 40 Years Our Famous, *Versatile* Ohmic Capabilities have met the rigid demands of smart buyers with unerring consistency—saving time, tempers and money.

Against this enviable background our engineers envision even greater challenges in solving future OEM and industrial resistor application problems. For prompt, practical answers to your requirements, send us your prints or specs.



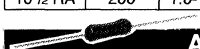
FIXED LUG

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1 M	5	0.1-11,000	5/16 x 1
1 3/4 M	10	0.1-50,000	5/16 x 1 3/4
2 E	20	0.25-100,000	7/16 x 2
2 B	25	0.25-100,000	9/16 x 2
4 B	50	0.5-175,000	9/16 x 4
6 1/2 C	100	1.0-300,000	3/4 x 6 1/2
8 1/2 R	160	1.0-300,000	1 1/8 x 8 1/2
10 1/2 R	200	1.0-400,000	1 1/8 x 10 1/2



ADJUSTABLE

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1 3/4 MA	10	1.0-10,000	5/16 x 1 3/4
2 BA	25	1.0-25,000	9/16 x 2
4 BA	50	1.0-100,000	9/16 x 4
6 BA	75	1.0-100,000	9/16 x 6
6 1/2 CA	100	1.0-100,000	3/4 x 6 1/2
8 1/2 RA	160	1.0-100,000	1 1/8 x 8 1/2
10 1/2 RA	200	1.0-100,000	1 1/8 x 10 1/2

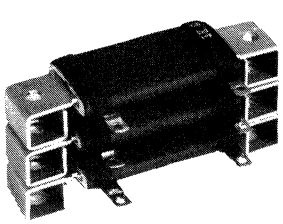


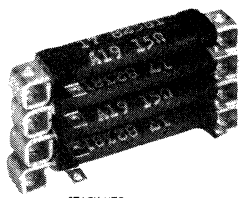
AXIAL LEAD

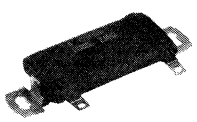
No.	Watts	Resistance Min. Max.	Dimensions O.D. x Lgth.
3 AX	3	0.1-10,000	1/4 max. x 9/16
5 AX	5	0.1-30,000	11/32 max. x 1 1/16
10 AX	10	0.1-50,000	13/32 max. x 15/16

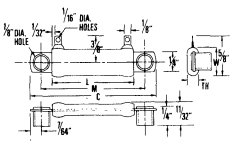
NON-INDUCTIVE RESISTORS: for high frequency power circuits. Available in all types except adjustable, 10 watts and larger. Standard tolerances: ±10%.

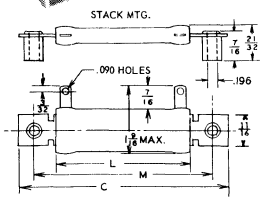
RESISTANCE TOLERANCES: Standard: ±5%, 1.0 ohm and over. Special: down to ±1%.

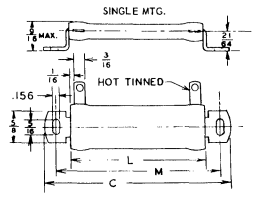








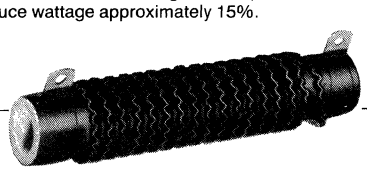




FLAT OVAL

Watts* Free Air	Core—L	Min. Ohms	Maximum Ohms Vitreous	Maximum Ohms Silicone	Mounting	C	M
10	3/4"	.23	15K	6.9K	Stack	1 7/32	1"
15	1"	.389	25K	12.7K	Stack	1 15/32	1 1/4
20	2"	.66	50K	27.6K	Stack	2 17/32	2 5/16"
25	2"	1.01	—	51.7K	Stack	2 5/16	2 3/8
30	1 1/4	0.1	10K	7.7K	Single Stack	2 1/8 2 1/2	1 3/4 2
40	2	0.2	30K	25K	Single Stack	2 7/8 3 1/4	2 1/2 2 3/4
55	3 1/2	0.3	60K	76K	Single Stack	4 3/8 4 3/4	4 4 1/4
65	4 3/4	0.4	85K	132K	Single Stack	5 5/8 6	5 1/4 5 1/2
75	6	0.5	100K	193K	Single Stack	6 7/8 7 1/4	6 1/2 6 3/4

* Ratings of flat oval resistors based on mounting on steel panel 10" x 10" x .040". When mounted on non-metallic surface, reduce wattage approximately 15%.



RIBBON WOUND For Heavy Current

RIBBON WOUND RESISTORS

Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.	Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.
400	1 1/8	11 1/4	0.24	18.00	135	3/4	5	0.06	4.25
375	1 1/8	10 1/2	0.22	16.50	105	3/4	4	0.04	3.00
300	1 1/8	8 1/2	0.17	13.00	100	3/4	3 1/2	0.03	2.40
240	1 1/8	6 1/2	0.11	8.20	135	9/16	6	0.06	5.50
185	1 1/8	5	0.09	6.40	105	9/16	5	0.05	3.65
180	3/4	6 1/2	0.08	6.00	90	9/16	4	0.04	2.75

Available with adjustable tap bands or with tapped windings.

NEW

FLEXIBLE WIREWOUND

Conforms to available shape. Fiberglass sleeve.
Wattage Rating: 2 watts per inch.
Resistance Range: 1200 Ohms per inch, max. .35 Ohms per inch, min.
Tolerance: 10% standard. Others on request.
Size: 1 inch long per 2 watts.
Leads: Hot tinned, 1-3/8" long.

UPRIGHT PC Mount

NEW



Fiberglass core, Ceramic Case.
Wattage Ratings: 10, 15, 20, 25, 30, 35, 40 & 45
Resistance Range: Min: .14 Ohms (10 Watt) Max: 11K Ohms (45 Watt)
Tolerance: 10% standard. Others on request.
Size: 1" to 5" long x 19/32" Dia.
Leads: Tinned, for .070" PC holes.

Write For Complete Catalog

Resistors, Inc.
5226 West 26th Street, Chicago, Illinois 60650
Phone: 708-863-4262
FAX: 708-863-4272

ROHM CORPORATION
ROHM Electronics Division
3064 Owen Drive, Antioch, TN 37013
Telephone (615) 641-2020 ■ Fax (615) 641-2022

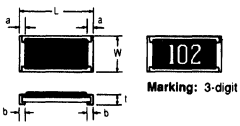
Resistors

Rectangular Chip Fixed Resistors (EIAJ Standard: RC-2690A)

Operating Ambient Temperature: -55~+125 °C

Type	Rated Dissipation (70°C)	Maximum Working Voltage (V)	Resistance Tolerance	Resistance Range
MCR01	0.063W	12.5	J (±5%)	5.6Ω~1.5MΩ
MCR03	0.063W	50	J (±5%)	3.3Ω~1.5MΩ
MCR10	0.100W	150	F (±1%) G (±2%) J (±5%) K (±10%)	10Ω~2.2MΩ
MCR18	0.125W	200		10Ω~2.2MΩ 2.2Ω~3.3MΩ 1Ω~10MΩ
MCR25	0.25W	200		1Ω~3.3MΩ
MCR50	0.50W	200	J (±5%)	2.2Ω~180kΩ
MCR100	1.00W			2.2Ω~82kΩ

Note: Jumper chips of the same shape are available (50mΩ Max.)



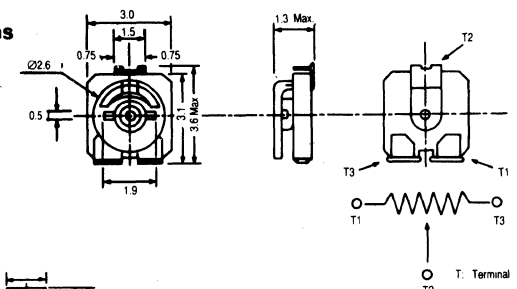
Marking: 3-digit IEC coding system

Type	L	W	t	a	b
MCR01	1.00±0.20	0.50±0.15	0.35±0.10	0.20±0.15	0.20±0.15
MCR03	1.55±0.10	0.80 +0.15 -0.10	0.45±0.05	0.30±0.20	0.3 +0.20 -0.10
MCR10	2.00±0.10	1.25±0.10	0.55±0.10	0.35±0.20	0.35±0.20
MCR18	3.10±0.10	1.55 +0.15 -0.10	0.55±0.10	0.45±0.20	0.45±0.20
MCR25	3.20±0.20	2.60±0.20	0.55±0.10	0.50±0.20	0.50±0.20
MCR50	5.00±0.20	2.50±0.20	0.55±0.10	0.60±0.20	0.60±0.20
MCR100	6.30±0.20	3.15±0.20	0.55±0.10	0.60±0.20	0.60±0.20

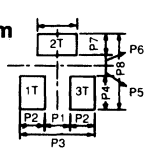
Chip Trimmer Potentiometer

Type	MVR32
Size	3mm
Terminals	3
Adjustment	Surface adjustment
Rated Dissipation	0.1W
Working Voltage	50 V Max.
Resistance Range	100Ω~1MΩ
Resistance Tolerance	N(±25%)
Taper	B (linear)
Operating Temperature	-55~+125 °C ambient

Dimensions
(Unit: mm)



Circuit Diagram



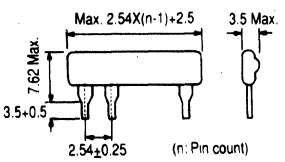
Pattern Unit

P1	P2	P3	P4	P5	P6	P7	P8	P9
0.8	1.2	3.2	1.2	1.0	0.9	1.5	4.6	1.6

RC Networks

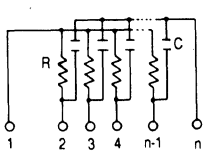
Type	RC
Rated Dissipation	0.125W
Temperature Coefficient	±300 ppm /°C
Resistance Tolerance	J (±5%), G (±2%)
Resistance Range	47Ω~470kΩ
Capacitance Range	220pF~0.047μF (CK)
Package	SIP5~14 pin
Operating Temperature	-25~+85°C ambient

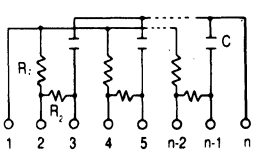
Dimensions
(Unit: mm)



Application Circuits

Below are typical application circuits. Other application circuits are available at customer request.





Ladder Resistor Networks

Temperature Coefficient: ±200ppm/° C Absolute Value; ±50ppm /°C Tracking

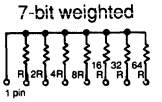
Type	No. of Bits	Applicable Circuit	Resistance Values	Linearity	Resistance Tolerance
RKM5LWxxxx	4 weighted	R/2R/4R/8R	1kΩ~15kΩ	±1/2LSB(±3.12%)	J (±5%) G (±2%) F (±1%)
RKM6LWxxxx	5 weighted	R/2R/4R/8R/16R		±1/2LSB(±1.56%)	
RKM7LWxxxx	6 weighted	R/2R/4R/8R/16R/32R		±1/2LSB(±0.78%)	
RKM8LWxxxx	7 weighted	R/2R/4R/8R/16R/32R/64R		±1/2LSB(±0.39%)	
RKM6Lxxxx	4 R/2R type	R/2R	750Ω, 5kΩ 10kΩ, 24kΩ 50kΩ, 100kΩ 120kΩ	±1/2LSB(±3.12%)	J (±5%) G (±2%) F (±1%)
RKM7Lxxxx	5 R/2R type	R/2R		±1/2LSB(±1.56%)	
RKM8Lxxxx	6 R/2R type	R/2R		±1/2LSB(±0.78%)	
RKM9Lxxxx	7 R/2R type	R/2R		±1/2LSB(±0.39%)	
RKM10Lxxxx	8 R/2R type	R/2R		±1/2LSB(±0.20%)	

Applicable Circuit

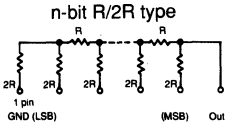
4-bit weighted



7-bit weighted



n-bit R/2R type



ROHM CORPORATION
ROHM Electronics Division
3034 Owen Drive, Antioch, TN 37013
Telephone (615) 641-2020 ■ Fax (615) 641-2022

Resistors

Since the founding of our company almost forty years ago, we have been committed to the idea of quality and reliability being absolutely primary in importance.

ROHM was first in the industry to introduce, and meet, quality levels measurable in parts-per-billion.

Quality is our passion. We breathe it. We live it. And we believe that rigorous, uncompromising product quality results in the greatest possible economy for you.

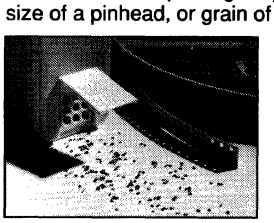
But that doesn't mean we are slow to take on new challenges. Quite the contrary.

ROHM was a pioneer in surface mount technology. Since the introduction of the MCR-18, the original worldwide standard for chip resistors, ROHM has introduced a broad range of new surface mount components. These include standard-setting chip resistors ranging from .063W to 1W with 1% or 5% tolerance levels.

And now we're introducing a totally new geometry to resistive component packaging.

Smallest-Ever Chip Resistor

Our newest package is just about the size of a pinhead, or grain of pepper.

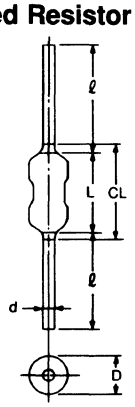


Measuring 1.0 x 0.5mm, the tiny MCR-01 occupies 60% less surface area than the MCR-03, formerly the industry's smallest chip resistor. The MCR-01 weighs 75% less than the larger part.

Rated power for the new package is 0.032W (1/32W) at 70°C, with a maximum operating voltage of 12.5V. Resistance range is 5.6L to 1.5ML; tolerance is ±5%. Opera-ting temperatures range from -55°to +125°C.

Call us for complete specifications on chips, fixed resistors, resistor networks and resistor arrays.

Fixed Resistor Dimensions (Unit:mm)



Fixed Carbon Film Resistors *Operating Ambient Temperature: -55~+155°C*

Type	Rated Dissipation (70°C)	Maximum Working Voltage (V)	Resistance Tolerance	Resistance Range	Isolation Voltage (V)
R20	0.20W	250	J (±5%)	0.47Ω~10MΩ	300
	0.25W		G (±2%)	10Ω~270kΩ	
R25X	0.33W	300	J (±5%)	0.47Ω~10MΩ	600
			G (±2%)	10Ω~3.3MΩ	
R50X	0.50W	350	J (±5%)	0.47Ω~15MΩ	700
			G (±2%)	10Ω~5.6MΩ	
R75X	0.75W	350	J (±5%)	0.47Ω~15MΩ	700
			G (±2%)	10Ω~5.6MΩ	
F20*	0.20W	250	J (±5%)	0.47Ω~100kΩ	350
	0.25W		G (±2%)	10Ω~100kΩ	
F25X*	0.33W	300	J (±5%)	0.47Ω~1.5MΩ	350
			G (±2%)	10Ω~100kΩ	
F50X*	0.50W	350	J (±5%)	0.47Ω~100kΩ	500
			G (±2%)	10Ω~100kΩ	
F75X*	0.75W	350	J (±5%)	0.47Ω~56kΩ	500
			G (±2%)	10Ω~56kΩ	

Non-flammable

Fixed Metal Film Resistors *Operating Ambient Temperature: -55~+165°C*

Type	Rated Dissipation (70°C)	Maximum Working Voltage (V)	Temperature Coefficient (ppm /°C)	Resistance Tolerance	Resistance Range
CRB20	0.20W	250	X(±100),Y(±50)	F (±1.0%)	10Ω~1MΩ
	0.25W			D (±0.5%)	10Ω~1MΩ
CRB25	0.25W	300	X(±100),Y(±50)	F (±1.0%)	10Ω~2.2MΩ
			Z(±25)	D(±0.5%) C (±0.25%)	49.9Ω~1MΩ
				B (±0.1%)	
CRB50	0.50W	300	X(±100),Y(±50)	F (±1%)	10Ω~2.7MΩ
			Z(±25)	D (±0.5%), C (±0.25%)	49.9Ω~680kΩ
				B (±0.1%)	

Temperature coefficient of •100ppm/°C available from 10Ω to 2MΩ. Tolerances of 1% or 0.5% available from 10Ω to 2MW.

Fixed Metal Oxide Film Resistors *(EIAJ Standard: RC-2655A)*

Operating Ambient Temperature: -25~+200°C

Type	Rated Dissipation (70°C)	Maximum Working Voltage (V)	Resistance Tolerance*	Resistance Range	Isolation Voltage (V)
CRH50	0.50W	350	J (±5%) G (±2%)	0.22Ω~68kΩ	350
CRH100X	1.00W	350		0.22Ω~100kΩ	600
CRH100	1.00W	350		0.22Ω~100kΩ	600
CRH200	2.00W	350		0.22Ω~120kΩ	600
CRH300	3.00W	350		0.33Ω~120kΩ	700

** Tolerance grade F (±1%) and temperature coefficient X (±100 ppm /°C) available.*

	R20	R25X	R50X	R75X	F20	F25X	F50X	F75X
Body Diameter D	1.9±0.1	2.4±0.1	2.85±0.2	3.5±0.2	1.8±0.2	2.4±0.1	2.65±0.2	3.5
Length L	3.2±0.2	6.3±0.3	6.4±0.2	9.0±1.0	3.2±0.2	6.3±0.3	6.6±0.2	9.0±1.0
Clean Lead Length CL	3.4 Max.	7.3 Max.	7.5 Max.	11.0 Max.	3.4 Max.	7.5 Max.	7.5 Max.	11.0 Max.
Lead Diameter d	0.45	0.6	0.6	0.8	0.45	0.6	0.6	0.8
Lead Length ℓ	30±3	30±3	30±3	28±3	30±3	30±3	30±3	28±3
Marking	Four-band color code indicates resistance and tolerance.							

	CRB20	CRB25	CRB50	CRH50	CRH100X	CRH100	CRH200	CRH300
Body Diameter D	1.9±0.1	2.4±0.1	3.5±0.2	2.3	2.8±0.5	3.5±0.5	4.0±1.0	5.5±1.0
Length L	3.2±0.2	6.0±0.3	8.5±0.5	6.35±0.6	9.0±1.0	9.0	12.0±1.0	15.0±1.5
Clean Lead Length CL	3.4 Max.	7.0 Max.	10 Max.	7.5 Max.	11.0 Max.	11.0 Max.	14.0 Max.	19.0 Max.
Lead Diameter d	0.45	0.6	0.8	0.65±0.05	0.65±0.05	0.65±0.05	0.80±0.05	0.80±0.05
Lead Length ℓ	30±3	28±2	28±3	30±3	26 Min.	26 Min.	24 Min.	22 Min.
Marking	5-band color code indicates resistance and tolerance.			A four-band color code indicates resistance and tolerance. (Type FX has five bands.)				



When your Hybrid Microelectronics and Surface Mount applications demand proven performance, our resistive products deliver.

When designing hybrid microelectronic circuits, you want components you can count on. Since 1969, State of the Art, Inc. has been a major supplier of thick film and thin film resistive products. Worldwide. As the leader in innovation, we provide higher densities, better performance, and greater stability and precision.

We offer a broad range of high reliability chip resistors, QPL chip resistors (the only S-level manufacturer in the world), metallized substrates, custom networks, and surface mount resistor networks to meet your most stringent specifications. Call us today.

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Thick Film Chip Resistors

Chip resistors were State of the Art's first manufactured product. Since we began production, our line has grown into the broadest range of thick film chip resistors offered anywhere. We produce lower values, higher values, closer tolerances, lower temperature coefficients, smaller sizes, etc.

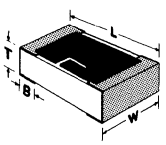
RESISTOR PERFORMANCE

PERFORMANCE CHARACTERISTICS STANDARD PRODUCTION	MAX CHANGE IN RESISTANCE
RESISTANCE TO SOLDERING	0.25%
THERMAL SHOCK	0.25%
SHORT TIME OVERLOAD	0.25%
HIGH TEMPERATURE STORAGE	0.50%
LOAD LIFE (1000 hrs)	0.50%

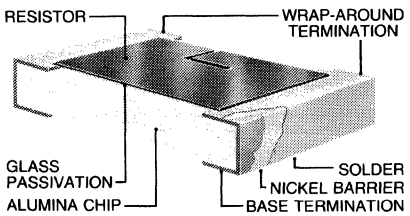
SIZES AVAILABLE

State of the Art offers fourteen standard resistor chip sizes, ranging from the extremely compact .030" x .020" chip to a 2-watt chip measuring .250" x .125".

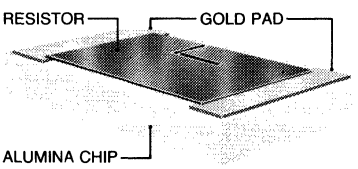
OTHER SIZES AVAILABLE
0703
1002
1507
CHECK WITH FACTORY FOR FULL DETAILS



Additional sizes, tolerances and temperature characteristics are available in THIN FILM construction. See the following pages for details.



STYLE C CONSTRUCTION



STYLE A CONSTRUCTION

TABLE I | MEASUREMENT IN INCHES | MEASUREMENT IN mm — 1mm = .03937 inch.

SIZE CODE	LENGTH (L)	WIDTH (W)	MAXIMUM THICKNESS (T)	END-BAND (B)	MAXIMUM POWER (mW)	MAXIMUM VOLTAGE
0302	.030±.005 .76 ±.13	.020±.005 .51 ±.13	.015 .38	.004- .015 .10 - .38	35	15
0402	.040±.005 1.02 ±.13	.020±.005 .51 ±.13	.020 .51	.007- .015 .18 - .38	50	30
0404	.035±.005 .89 ±.13	.035±.005 .89 ±.13	.020 .51	.006- .015 .15 - .38	35	25
0504	.050±.005 1.27 ±.13	.040±.005 1.02 ±.13	.020 .51	.007- .017 .18 - .43	125	40
0705	.075±.007 1.91 ±.18	.050±.005 1.27 ±.13	.020 .51	.007- .020 .18 - .51	200	50
1005	.100±.008 2.54 ±.21	.050±.005 1.27 ±.13	.020 .51	.010- .025 .25 - .64	250	75
1206	.125±.010 3.17 ±.25	.065±.010 1.65 ±.25	.025 .64	.009- .029 .23 - .74	250	100
1505	.150±.010 3.81 ±.25	.050±.005 1.27 ±.13	.020 .51	.010- .030 .25 - .76	330	125
1010	.100±.010 2.54 ±.25	.100±.010 2.54 ±.25	.020 .51	.010- .025 .25 - .64	500	75
2010	.200±.010 5.08 ±.25	.100±.010 2.54 ±.25	.030 .76	.009- .029 .23 - .74	1000	150
2512	.250±.010 6.35 ±.25	.125±.010 3.18 ±.25	.030 .76	.009- .029 .23 - .74	2000	200

PART NUMBERING SYSTEM

Our part numbering system is explained on the right. As an example, we show the part number of our standard production; passivated; 50 x 40-mil chip; with pretinned nickel barrier wrap-around terminations, 15 ohm ± 5%. The part number is S0504CPX150J:

PACKAGING

Standard production resistors are bulk packed in anti-static bags. High reliability units are packed in anti-static "waffle pack" chip trays. Tape and reel packaging is available for sizes 0504 and larger.

HIGH RELIABILITY SCREENING

State of the Art can supply chip resistors with optional high reliability screening. Any size or style can be processed and tested in a manner that will meet specific high reliability needs. Our standard product could serve as a starting base to which special testing or 100% screening can be added. This can be in accordance with MIL-R-55342 with the addition of Group A and B screening.

If in doubt about the proper codes, or if there is more information than the part number allows, use plain language.

S 0504 C PX 150 J

SPECIAL TERMINATION
G - Gold **PS** - Platinum silver **PG** - Platinum gold **Z**-Gold over nickel

TCR CERTIFICATION
10: 100 ppm/°C **20:** 200 ppm/°C **30:** 300 ppm/°C

RESISTANCE TOLERANCE
M: 20% **K:** 10% **J:** 5% **G:** 2% **F:** 1% **D:** ½%

RESISTANCE VALUE
Use a three or four digit code. Four digits are used for 1% tolerance or lower, otherwise three digits are used. The first two or three digits represent significant figures and the last digit specifies the number of zeros to follow. The letter 'R' shall be used to represent the decimal point when fractional values of an ohm are required: i.e., 1 ohm = 1R0; 4.7 ohms = 4R7; 16.9 ohms = 16R9, etc.

P: Passivated (glass)
X: Tinned NICKEL BARRIER
U: Untrimmed resistor

TERMINATION STYLE
A — Single surface for gold wire bonding
C — Wrap-around style
D — Metallized bottom side
E — Metallized bottom with one side wrap-around

SIZE CODE
See Table I for size code

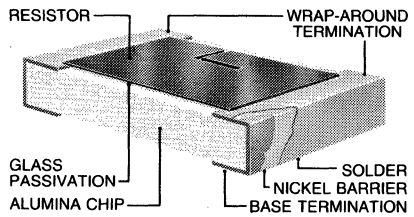
PREFIX
C — Commercial/industrial (please consult factory)
S — Standard production
H — High reliability testing

CALL TOLL FREE
800-458-3401

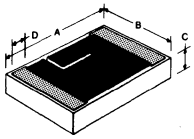
State of the Art, Inc.
2470 FOX HILL ROAD, STATE COLLEGE, PA 16803-1797
PHONE: 814-355-8004, TELEX: 866633, FAX: 814-355-2714
SOURCE CODE: 56235

MIL-R-55342 Thick Film Chip Resistors

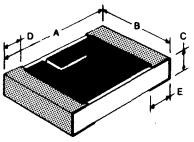
CHARACTERISTICS



TECHNICAL SPECIFICATIONS	TEMPERATURE CHARACTERISTICS K	M
RESISTANCE TEMPERATURE CHARACTERISTICS (In ppm)	0 ± 100	0 ± 300
MAXIMUM AMBIENT TEMP. FULL POWER	70°C	70°C
MAXIMUM TEMPERATURE ZERO WATTAGE	125°C	125°C
THERMAL SHOCK (max. % change)	±0.50	±0.50
LOW TEMP. OPERATION (max. % change)	±0.25	±0.50
SHORT TIME OVERLOAD (max. % change)	±0.25	±0.50
HIGH TEMPERATURE EXPOSURE (max. % change)	±0.50	±1.00
RESISTANCE TO BONDING EXPOSURE (max. % change)	±0.25	±0.25
MOISTURE RESISTANCE (max. % change)	±0.50	±0.50
LIFE, 2000 HOURS (max. % change)	±0.50	±2.00



'W' TERMINATION
GOLD WIRE BONDABLE



'B' TERMINATION
PRETINNED NICKEL BARRIER

DIMENSIONS

SIZE	M55342/02 RM0505	M55342/06 RM0705	M55342/03 RM1005	M55342/04 RM1505	D55342/07 RM1206	M55342/05 RM2208	M55342/08 RM2010	M55342/09 RM2512
LENGTH A	.050 +.010 −.005	.075 +.010 −.005	.100 +.010 −.005	.150 +.010 −.005	.125 +.010 −.005	.225 +.010 −.005	.200 +.010 −.005	.250 +.010 −.005
WIDTH B	.050 +.005 −.005	.050 +.005 −.005	.050 +.005 −.005	.050 +.005 −.005	.065 +.005 −.005	.075 +.005 −.005	.100 +.008 −.005	.125 +.008 −.005
THICKNESS C	.015 +.007 −.000	.015 +.007 −.000	.015 +.007 −.000	.015 +.007 −.000	.015 +.007 −.000	.025 +.007 −.000	.025 +.007 −.000	.025 +.007 −.000
TOP END BAND D	.010 ±.005	.015 ±.005	.015 ±.005	.015 ±.005	.019 +.010 −.010	.015 ±.005	.019 +.010 −.010	.019 +.010 −.010
BOTTOM END BAND E	.015 ±.005	.015 ±.005	.015 ±.005	.015 ±.005	.019 +.010 −.010	.015 ±.005	.019 +.010 −.010	.019 +.010 −.010
RATINGS	**50mW,40v**	**100mW,50v**	**100mW,40v**	**150mW,40v**	**250mW,100v**	**225mW,40v**	**800mW,150v**	**1000mW,200v**

NOTE: Dimensions A, B, and C above are SOTA listed dimensions. MIL-R-55342 allows much wider tolerances. (EX. +.025 on dim. A; +.010 on dim. B; and +.010 to +.040 on dim. C.)

PRODUCTION TESTING

Inspection of Product for Delivery

Each production batch must be subjected to and pass the group A screening listed below. Subgroup 1 is performed on a 100% basis. Subgroups 2 and 3 are on a sampling basis with no failures permitted. Long term data must show <100 ppm defect rate.

In addition, 13 units are submitted to each subgroup of the group B tests below. No failures are permitted.

GROUP A — INSPECTION

SUBGROUP 1
THERMAL SHOCK
DC RESISTANCE

SUBGROUP 2
DC RESISTANCE — PPM VERIFICATION
MECHANICAL — PPM VERIFICATION

SUBGROUP 3
VISUAL INSPECTION

GROUP B — INSPECTION

SUBGROUP 1
RESISTANCE to BONDING EXPOSURE
RESISTANCE-TEMPERATURE CHARACTERISTICS
LOW-TEMPERATURE OPERATION
SHORT TIME OVERLOAD

SUBGROUP 2
ADHESION

SUBGROUP 3
SOLDERABILITY

PACKAGING

Resistors are packaged in anti-static waffle packs. Tape and reel is available on request. Individual chips are not marked. Each package contains a noncorrosive label indicating source code, lot number, military part number, quantity, date code, resistance value and tolerance. Unit packages are heat sealed in water-vapor proof conductive bags in conformance with MIL-B-81705 (type I) and are labeled per MIL-STD-129.

PART NUMBERING SYSTEM

To order MIL-R-55342 thick film chip resistors, develop part numbers using the following chart. For example, a .075" x .050", 100 ohm, ±1% tolerance, ±100 PPM, tinned, wrap-around resistor is indicated with part number: M55342K06B100DS.

M55342 K 06 B 100D S

LIFE FAILURE RATE:
M: 1% per 1000 hours **R**: .01% per 1000 hours
P: .1% per 1000 hours **S**: .001% per 1000 hours

RESISTANCE AND TOLERANCE CODE:
Three significant digits, with a letter indicating the decimal location, the tolerance, and the value range (Ω, KΩ, MΩ).

*TOLERANCE and VALUE CODES

D: 1%Ω	**G**: 2%Ω	**J**: 5%Ω	**M**: 10%Ω
E: 1%KΩ	**H**: 2%KΩ	**K**: 5%KΩ	**N**: 10%KΩ
F: 1%MΩ	**T**: 2%MΩ	**L**: 5%MΩ	**P**: 10%MΩ

TERMINATION TYPE:
R: Pre-tinned, wrap around style.
B: Pre-tinned, wrap around barrier (Ni) style.
C: Untinned, wrap around (for epoxy bonding).
W: Wire bondable single surface, (Au)

SIZE CODE:
02: RM0505 **04**: RM1505 **06**: RM0705 **08**: RM2010
03: RM1005 **05**: RM2208 **07**: RM1206 **09**: RM2512

***TEMPERATURE CHARACTERISTIC:**
K: ± 100 ppm M ± 300 ppm ***E**: ± 25 ppm ***H**: ± 50 ppm

MILITARY SPECIFICATION INDICATING MIL-R-55342

**See the following pages for additional MIL-R-55342 qualified products.*

Features:

- **'S' Failure Rate Level (above 51.1 ohms)**
- **Industry's Broadest Value/Tolerance/TCR Range**
- **Extensive Stocking Program**

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800-458-3401

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2470 FOX HILL ROAD, STATE COLLEGE, PA 16803-1797
PHONE: 814-355-8004, TELEX: 866633, FAX: 814-355-2714
SOURCE CODE: 56235

Thin Film Chip Resistors

Through continuous research and development and a commitment to maintaining our position of technical leadership, State of the Art, Inc. provides a full line of Thin Film Resistive Components.

ELECTRICAL CHARACTERISTICS

TEMPERATURE COEFFICIENT
−55°C TO ±125°C
±100ppm/°C, ±50ppm/°C, ±25ppm/°C
TRACKING <5ppm

TOLERANCE
0.1% ABSOLUTE
0.05% RATIO MATCHING

OPERATING TEMPERATURE RANGE
−55°C TO ±150°C

NOISE −35dB TYPICAL
Ref: Mil-Std-202 method 308

PERFORMANCE CHARACTERISTICS

TEST CONDITION	TYPICAL SOTA RESISTOR FILMS*	MIL-R-55342 CHAR E ±25ppm REQUIREMENTS
THERMAL SHOCK	<0.1%	0.1%
BONDING EXPOSURE	<0.1%	0.2%
LOW TEMP OPERATION	<0.05%	0.1%
SHORT TIME OVERLOAD	<0.05%	0.1%
HIGH TEMP EXPOSURE	<0.1%	0.1%
MOISTURE RESISTANCE	<0.1%	0.2%
LIFE (2000 HRS, 70°C)	<0.2%	0.5%
STABILITY (1000 HR., 125°C)	<0.1%	—
CURRENT NOISE INDEX	−35 dB	—

**Extreme high and low resistance values may not meet the typicals listed. Please consult our engineering department for further details.*

CHIP RESISTORS ON ALUMINA



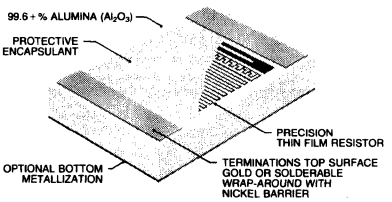
STYLE A
100 μ INCH GOLD FOR WIRE BONDING

STYLE D
BOTTOM METALLIZED

STYLE C
SOLDERABLE WRAP-AROUND WITH NICKEL BARRIER

STYLE E
BOTTOM METALLIZED WITH ONE WRAP-AROUND

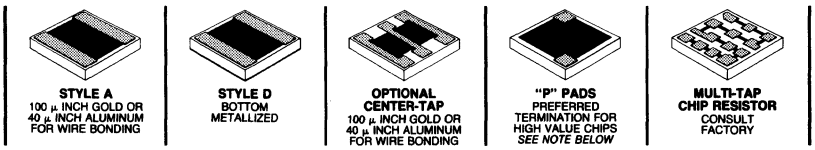
OPTIONAL CENTER-TAP
DUAL RESISTORS
100 μ INCH GOLD FOR WIRE BONDING



SIZE	LENGTH	WIDTH	THICK.	POWER RATING (mW)	RESISTANCE RANGE (Ohms)
0202	.020	.020	.010	25	40K
0303	.030	.030	.010	35	100K
0402	.040	.020	.010	50	90K
0404	.040	.040	.010	75	200K
0505	.050	.050	.015	125	470K
0705	.075	.050	.015	200	1M
1005	.100	.050	.015	250	1M
1206	.125	.065	.015	300	1.5M
1505	.150	.050	.015	350	1.5M

Dimensions in inches. Tolerance is ±.003 inches (±.005 inches, Styles C and E)

CHIP RESISTORS ON SILICON



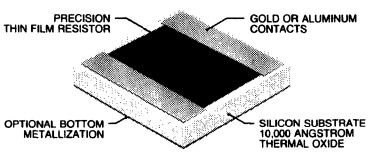
STYLE A
100 μ INCH GOLD OR 40 μ INCH ALUMINUM FOR WIRE BONDING

STYLE D
BOTTOM METALLIZED

OPTIONAL CENTER-TAP
100 μ INCH GOLD OR 40 μ INCH ALUMINUM FOR WIRE BONDING

"P" PADS
PREFERRED TERMINATION FOR HIGH VALUE CHIPS
SEE NOTE BELOW

MULTI-TAP CHIP RESISTOR
CONSULT FACTORY



SIZE	LENGTH	WIDTH	THICK.	POWER RATING (mW)	RESISTANCE RANGE (Ohms)
0202	.020	.020	.010	100	250K
0303	.030	.030	.010	250	1M
0404	.040	.040	.010	350	1.5M
0505	.050	.050	.010	500	2.5M

Dimensions in inches. Tolerance is ±.003 inches

NOTE: Contact arrangement and termination area may be altered to accommodate higher resistance values. Minimum pad size is held to 4 mil by 4 mil.

ORDERING INFORMATION

PACKAGING

Resistors are packaged in anti-static waffle pack chip trays. Each package contains a noncorrosive label indicating the quantity, part number, lot number, date code, resistance value and tolerance.

Tape and reel is available for larger size resistors on alumina. Please consult our factory for alternate packaging needs.

HIGH RELIABILITY SCREENING

State of the Art can supply thin film chip resistors with optional high reliability screening. Any size or style can be processed and tested in a manner that will meet specific high reliability needs. Standard product could serve as a starting base to which special batch testing or 100% screening can be added. This screening can be in accordance with MIL-R-55342 with the addition of Group A and B screening. Other types of screening are available including element evaluation of MIL-STD-883, Method 5008 or visual inspection to Methods 2010 and 2017.

Consult our experienced engineering staff for assistance in developing the most cost effective means of assuring reliability.

MIL-R-55342 QUALIFIED PRODUCTS

See the following pages for details.

If in doubt about the proper codes, or if there is more information than the part number allows, use plain language.

PART NUMBERING SYSTEM

To order thin film chip resistors, develop part numbers using the following chart. For example, a .050" x .050" resistor on silicon having gold wire bondable terminations on the top side with a value of 1000 ohms ±1%, and TCR of ±50 PPM is properly indicated with part number: SO505AS1001FHW.

S 0505 A S 1001 F H W — OPTIONS

TERMINATION TYPE
A — Aluminum
B — Pretinned Nickel
W — Gold

TEMPERATURE COEFFICIENT
E: ±25 ppm **K:** ±100 ppm
H: ±50 ppm **T:** 0 to −150 ppm

TOLERANCE
B: .1% **C:** 25% **D:** 5% **F:** 1% **G:** 2% **J:** 5% **K:** 10% **M:** 20%

RESISTANCE VALUE
Three or four digits are used with all leading digits significant. The last digit specifies the number of zeros to add. The letter "R" is used to represent the decimal for fractional ohmic values. Example: 5R6 is 5.6 ohms; 10R0 is 10 ohms.

SUBSTRATE MATERIAL
A — Alumina Ceramic **S** — Silicon

TERMINATION STYLE
A — Top-side Termination
C — Wrap-Around
D — Style "A" with Bottom Metallized
E — Single Wrap-Around with Bottom Metallized
P — "P" Pads

SIZE CODE
See Physical and Mechanical Data

TESTING LEVEL
S — Standard Production
H — High Reliability

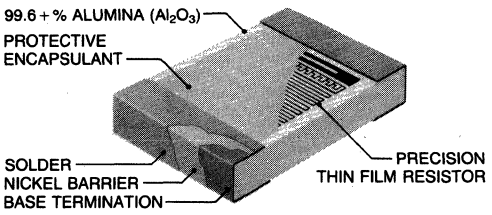
OPTIONS — CTx Center-tapped with x indicating ratio tolerance.
Example: S0505AS1001JKA-CTF Total R = 1000 ± 5% with ratio of 1%.

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SOURCE CODE: 56235

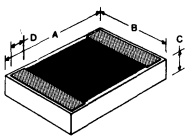
MIL-R-55342 Thin Film Chip Resistors

CHARACTERISTICS

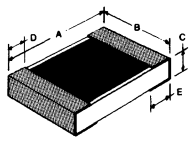


TECHNICAL SPECIFICATIONS	TEMPERATURE CHARACTERISTICS E	H	K
RESISTANCE TEMPERATURE CHARACTERISTICS (In ppm)	0±25	0±50	0±100
MAXIMUM AMBIENT TEMP. FULL POWER	70°C	70°C	70°C
MAXIMUM TEMPERATURE ZERO WATTAGE	150°C	150°C	150°C
THERMAL SHOCK (max. % change)	±0.1	±0.25	±0.5
LOW TEMP. OPERATION (max. % change)	±0.1	±0.25	±0.25
SHORT TIME OVERLOAD (max. % change)	±0.1	±0.1	±0.25
HIGH TEMPERATURE EXPOSURE (max. % change)	±0.1	±0.2	±0.5
RESISTANCE TO BONDING EXPOSURE (max. % change)	±0.2	±0.25	±0.25
MOISTURE RESISTANCE (max. % change)	±0.2	±0.4	±0.5
LIFE, 2000 HOURS (max. % change)	±0.5	±0.5	±0.5

DIMENSIONS



TYPE W TERMINATION
100 MICROINCH GOLD FOR WIRE BONDING APPLICATIONS



TYPE B TERMINATION
PRETINNED WRAP-AROUND WITH NICKEL BARRIER FOR ALL TIN/LEAD SOLDERING APPLICATIONS

RATINGS

SIZE	M55342/2 RM0505	M55342/6 RM0705	M55342/3 RM1005	M55342/4 RM1505	M55342/7 RM1206
LENGTH A	.050 $^{+.010}_{-.005}$	.075 $^{+.010}_{-.005}$	.100 $^{+.010}_{-.005}$	.150 $^{+.010}_{-.005}$	.126 $^{+.010}_{-.005}$
WIDTH B	.050 $^{+.010}_{-.005}$	.050 $^{+.005}_{-.005}$	.050 $^{+.005}_{-.005}$	.050 $^{+.005}_{-.005}$	.063 $^{+.005}_{-.005}$
THICKNESS C	.015 $^{+.007}_{-.000}$	.015 $^{+.007}_{-.000}$	.015 $^{+.007}_{-.000}$	.015 $^{+.007}_{-.000}$	.015 $^{+.007}_{-.000}$
TOP END BAND D	.010 ±.005	.015 ±.005	.015 ±.005	.015 ±.005	.014 ±.006
BOTTOM END BAND E	.015 ±.005	.015 ±.005	.015 ±.005	.015 ±.005	.020 ±.010
CHAR. E,H	25mW,40v	50mW,50v	50mW,40v	100mW,40v	125mW,100v
CHAR. K	50mW,40v	100mW,50v	100mW,40v	150mW,40v	250mW,100v

PRODUCTION TESTING

Inspection of Product for Delivery

Each production batch must be subjected to and pass the group A screening listed below. Subgroup 1 is performed on a 100% basis. Subgroups 2 and 3 are on a sampling basis with no failures permitted. Long term data must show <100 ppm defect rate.

In addition, 13 units are submitted to each subgroup of the group B tests below. No failures are permitted.

GROUP A — INSPECTION

SUBGROUP 1
THERMAL SHOCK
DC RESISTANCE

SUBGROUP 2
DC RESISTANCE — PPM VERIFICATION
MECHANICAL — PPM VERIFICATION

SUBGROUP 3
VISUAL INSPECTION

GROUP B — INSPECTION

SUBGROUP 1
RESISTANCE to BONDING EXPOSURE
RESISTANCE-TEMPERATURE CHARACTERISTICS
LOW-TEMPERATURE OPERATION
SHORT TIME OVERLOAD

SUBGROUP 2
ADHESION

SUBGROUP 3
SOLDERABILITY

PACKAGING

Resistors are packaged in anti-static waffle packs. Tape and reel is available on request. Individual chips are not marked. Each package contains a noncorrosive label indicating source code, lot number, military part number, quantity, date code, resistance value and tolerance. Unit packages are heat sealed in water-vapor proof conductive bags in conformance with MIL-B-81705 (type I) and are labeled per MIL-STD-129.

PART NUMBERING SYSTEM

To order MIL-R-55342 thin film chip resistors, use part numbers as in the following example. A .050 inch by .050 inch, 100 ohm ±1%, ±50 ppm, with gold wire bondable terminations is properly indicated with the part number, M55342HO2W100DM, which has the code elements shown below.

M55342 H 02 W 100D M

LIFE FAILURE RATE
M: 1% per 1000 hours **R:** .01% per 1000 hours
P: 1% per 1000 hours **S:** .001% per 1000 hours

RESISTANCE AND TOLERANCE CODE
Three significant digits, with a letter indicating the decimal location, the tolerance, and the value range (Ω, KΩ, MΩ).
* TOLERANCE AND VALUE CODES

A: 0.1%Ω	D: 1%Ω	G: 2%Ω	J: 5%Ω	M: 10%Ω
B: 0.1%KΩ	E: 1%KΩ	H: 2%KΩ	K: 5%KΩ	N: 10%KΩ
C: 0.1%MΩ	F: 1%MΩ	T: 2%MΩ	L: 5%MΩ	P: 10%MΩ

TERMINATION TYPE
W—Wire bondable single surface terminations
B—Pre-tinned, NICKEL BARRIER, wrap-around

SIZE CODE
02: RM0505 **03:** RM1005 **04:** RM1505 **06:** RM0705 **07:** RM1206

*** TEMPERATURE CHARACTERISTIC**
E: ±25 ppm/°C **H:** ±50 ppm/°C **K:** ±100 ppm°C

MILITARY SPECIFICATION INDICATING MIL-R-55342

**See previous pages for additional MIL-R-55342 qualified products.*

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PHONE: 814-355-8004, TELEX: 866633, FAX: 814-355-2714
SOURCE CODE: 56235

Surface Mount Resistor Networks

State of the Art produces a variety of surface mount resistor and resistor/capacitor networks. These devices feature thick film materials on alumina substrates, providing good thermal management and electrical stability. The standard "lead" configuration is a pretinned wrap-around with NICKEL BARRIER, offering excellent resistance to leaching in rigorous soldering applications such as reflow and vapor phase. For high volume applications where maximum economy is needed, top surface only terminations are available.

RESISTANCE VALUES

10 ohm to 1 Mohm, STANDARD
1 ohm to 100 Mohm, SPECIAL ORDER

TOLERANCE

10%, 5%, 2%, 1%

TEMPERATURE COEFFICIENT

300 ppm, 200 ppm, 100 ppm

PERFORMANCE CHARACTERISTICS

	MAXIMUM CHANGE IN RESISTANCE 100 PPM UNITS	OTHER UNITS
LOW TEMPERATURE OPERATION	±0.25	±0.5
SHORT TIME OVERLOAD	±0.25	±0.5
MOISTURE RESISTANCE	±0.5	±0.5
THERMAL SHOCK	±0.5	±0.5
RESISTANCE TO SOLDERING HEAT	±0.25	±0.5
HIGH TEMPERATURE EXPOSURE	±0.5	±1.0
LIFE	±2.0	±2.0

CUSTOM DESIGNS

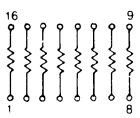
State of the Art can produce a variety of custom network designs for surface mount applications. Using the SLAMDIP, JEDEC, or non-JEDEC style substrates, the individual resistors can be altered to suit the need; other resistance patterns can be applied — limited only by what can be put into the available space.

We can also produce other substrate designs. Custom length, width, and "lead" configuration can be provided. Please contact State of the Art's engineering department for information and quotations.

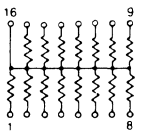
SLAMDIP RESISTOR NETWORK

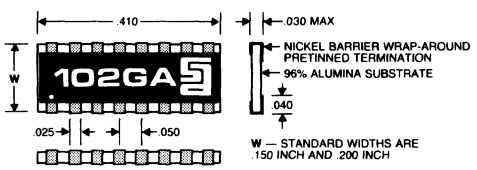
When State of the Art's "SLAM DIP" resistor network replaces individual chip resistors, you will save space and reduce your placement labor. Other benefits, such as better tracking and lower board cost, may also develop.

CONFIGURATION A
SLAMDIP 8
POWER RATING
Package 500 mW
Resistor 62 mW
Maximum Voltage: 100V



CONFIGURATION B
SLAMDIP 15
POWER RATING
Package 500 mW
Resistor 31 mW
Maximum Voltage: 50V

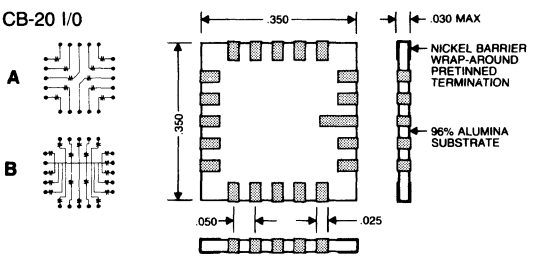




JEDEC LCCC RESISTOR AND RESISTOR/CAPACITOR NETWORKS

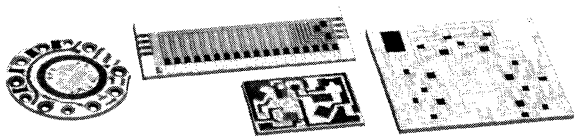
Having a maximum profile height of .030" (resistor circuits only), these packages are ideal in circuits where small size and low head space is needed. Limited only by the available space, almost any conductor, resistor or resistor/capacitor circuit can be placed on these substrates. Our 20 I/O configuration is shown below, but a wide variety of sizes is available.

CB-20 I/0



Thick Film Custom Networks

State of the Art produces a variety of custom conductor networks, resistor networks, and resistor/capacitor networks in low and high volume. We can quote and manufacture from a complete network layout or from a schematic with size, component, and output pad location requirements. Our design staff will be glad to assist you in developing your network.



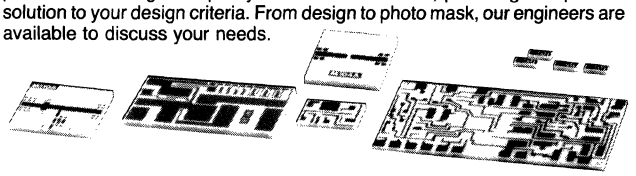
NETWORK CONSTRUCTION

SUBSTRATE: 96% Alumina std — 99% Alumina optional
THICKNESS: .025 inch std — .012 .015. 020 .040 inch optional
LINEAR TOOLING: Laser scribed, green scored, diamond saw cut
HOLE TOOLING: Laser drilled, green punched
CONDUCTORS: Silver, palladium silver, platinum silver, gold, platinum gold, etc. NICKEL BARRIER is available on some types of networks.
RESISTORS: Screened on substrate or thick film chip
PASSIVATION: Glass or silicone based
TINNING: Solder dip or solder paste
CAPACITORS: Screened on thick film or multilayer ceramic chip
COMPONENT MOUNTING: Conductive epoxy or solder reflow; Other components: consult factory

Thin Film Custom Networks

State of the Art provides custom thin film circuits to allow the design engineer the necessary flexibility to meet high density, low TCR, close thermal tracking, and high stability requirements.

A wide variety of packaging options, styles, and sizes combined with in-process screening and quality control are available, providing an optimum solution to your design criteria. From design to photo mask, our engineers are available to discuss your needs.



SUBSTRATE TYPES AVAILABLE

- **ALUMINA** (99.6% Al_2O_3)
  10, 15, 25 Mil Thick
  As-Fired and Polished
  Surface Finish <2 Microinch
- **SILICON**
  10, 15, 18 Mil Thick
  10,000 angstroms thermal oxide

SOTA can also furnish thin films on a variety of other substrate types such as sapphire or BeO. Please consult our factory for your specific needs.

CONDUCTORS/TERMINATIONS

- GOLD
- TITANIUM TUNGSTEN
- CHROME
- COPPER
- ALUMINUM
- NICKEL

RESISTOR FILMS

- Tantalum Nitride, Nichrome
- Resistor values to 0.1% tolerance
- Ratio matching to 0.05%
- Temperature coefficient to ±25ppm/°C
- TCR tracking to 2ppm

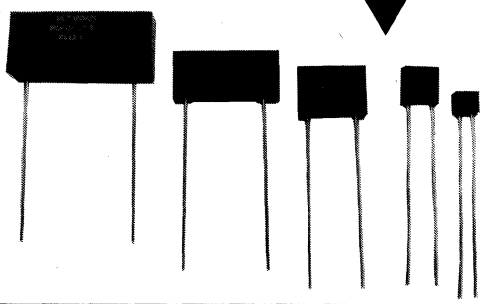
CALL TOLL FREE
800-458-3401

State of the Art, Inc.
2470 FOX HILL ROAD, STATE COLLEGE, PA 16803-1797
PHONE: 814-355-8004, TELEX: 866633, FAX: 814-355-2714
SOURCE CODE: 56235

A COMPANY OF VISHAY ULTRONIX

Metal Foil and Precision Resistive Networks

Metal Foil Resistor Nicrocer® Process
Very High Precision and Stability
MIL qualification to MIL-R-55182/9 (RNC90Y)



Features
- Very Tight Tolerances: ±1%, matching to 0.002%
- Very Low TCR: typical <±3ppm/°C (-55°C to +155°C)*; ±1 ppm (0°C to +60°C), tracking to 0.5ppm/°C
- Very High Stability: <25 ppm/year or <50 ppm/3 years (shelf life)
- Negligible Rise Time: approximately 1 x 10^{-9} second

* *The TC of RCK resistors is always better than ±5 ppm/°C in the temperature range -55°C to +155°C.*

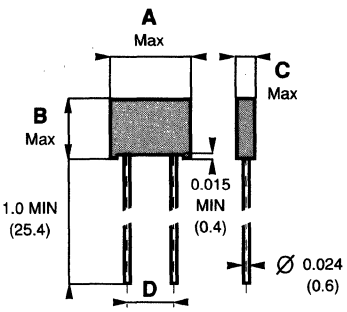
New!
A low TCR of ±1 ppm/°C is now available over entire mil temperature range. *Request the RNK Series in place of the RCK Series.*

For a group of resistors, TC matching can be made to better than ±0.5 ppm/°C.
Consult ULTRONIX for additional information.

Standard Electrical Specifications

Ultronix Type	MIL Type	Power Rating +70°C	Power Rating +125°C	Max. Working Voltage	Resistance Range ± 0.005%	±0.02% ±0.01%	±0.05%	±0.1%±0.2% ±0.5%±1%
RCK01		0.1W	0.06W	50V	50 Ω-100K	50 Ω-100K	50 Ω-100K	5 Ω-100K
RCK02/02A	RNC90Y*	0.6W	0.3W	300V	50 Ω-250K	25 Ω-250K	10 Ω-250K	1 Ω-250K
RCK04	—	1.0W	0.6W	350V	50 Ω-500K	25 Ω-500K	10 Ω-500K	1 Ω-500K
RCK05/05A	—	1.2W	0.9W	500V	50 Ω-750K	25 Ω-750K	10 Ω-750K	1 Ω-750K
RCK06/06A	—	1.5W	1.2W	650V	50 Ω-1.5M	25 Ω-1.5M	10 Ω-1.5M	1 Ω-1.5M

*Consult Ultronix for QPL Max. and Min. Values



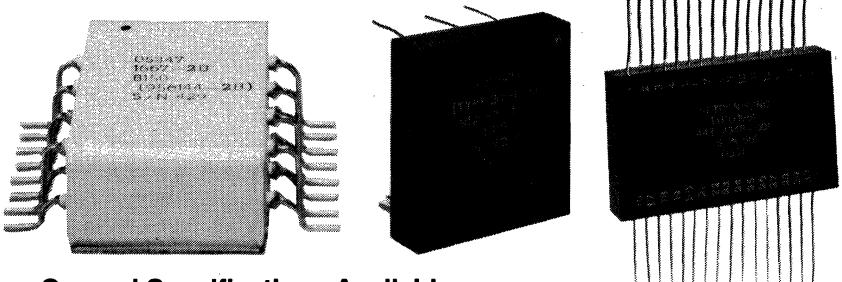
Dimensions are in inches (mm).

Physical Configurations

Type	Dim. A	Dim. B	Dim. C	Dim. D
RCK01	0.210	0.210	0.110	0.100
RCK02*	0.320	0.345	0.120	0.200
RCK02A	0.320	0.345	0.120	0.150*
RCK04	0.575	0.413	0.138	0.400
RCK05	0.890	0.413	0.138	0.700
RCK05A	0.890	0.413	0.138	0.650
RCK06	1.215	0.545	0.260	0.900
RCK06A	1.215	0.545	0.260	0.650

*RCK02 Lead Spacing: 0.20

Custom Designed Networks and Matched Sets



Network quality is determined by the precision of its individual resistors plus packaging and mounting techniques. ULTRONIX offers a unique background of experience, reliability, data, manufacturing and testing skills for wirewound resistor networks. For a sample of this ability, submit your next network requirements for evaluation by ULTRONIX engineers.

Matched resistor sets and custom designed networks are available from ULTRONIX for equipment design requiringclose ratio matching and temperature tracking of resistors.

Our networks are used in a wide variety of applications such as communications satellites, precision instrumentation, aircraft controls, etc.

General Specifications Available
- Ambient Operating Temperature Range: –55°C to +125°C
- Resistances Values: 0.1Ω to 40MΩ
- Absolute Resistor Tolerances: to ±0.005%
- Matched Resistance Ratios: to ±0.001%
- Temperature Coefficient Match and Tracking Between Resistors: within ±1 ppm from 0°C to +85°C

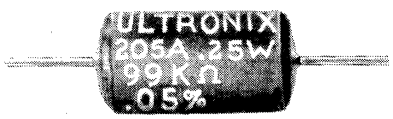
LowReactance and Rise Times as low as 0.02 microseconds.
AC Resistance Match at frequence determined by user.

A COMPANY OF VISHAY ULTRONIX

Precision Wirewound Resistors

Very High Precision Wirewound Resistors

MIL qualifications to MIL-R-39005 and MIL-R-93



Minimum Values

- Generally 0.1 Ω for 1% and 0.5% and 10 Ω for 0.1% and tighter.

Tolerances (±)

- Standards are 0.005%, 0.01%, 0.02%, 0.05%, 0.1%, 0.5%, and 1% depending on style and value.

Temperature Coefficients

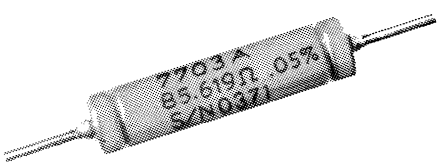
- ±5 ppm/°C standard for 10Ω and above. Higher TC's on low ohmic values. ±1 ppm/°C available TC match to ± 0.5 ppm/°C. High TC's up to +6000 ppm/°C are available.

Specifications

MIL Style			Max. Value Ω			Power Rating at +125°C (Watts)		Max.	Dimensions ±0.020		Ø Leads	
MIL-R 93	MIL-R 39005	Ultronix Type	MIL-R 93	MIL-R 39005	Comm.	MIL.	Comm.	Volts	Dia. inch	Length inch	AWG	inch
—	—	123A	—	—	111K	—	0.05	150	0.100	0.230	24	0.020
—	—	118A	—	—	192K	—	0.05	150	0.130	0.180	26	0.016
—	—	122A	—	—	199K	—	0.05	150	0.123	0.218	24	0.020
—	—	102A	—	—	334K	—	0.10	150	0.110	0.250	24	0.020
—	—	101A	—	—	410K	—	0.10	300	0.130	0.375	22	0.020
—	—	101P	—	—	453K	—	0.125	150	contact factory		22	0.026
—	—	103A	—	—	633K	—	0.10	150	0.150	0.300	22	0.026
—	—	105A	—	—	468K	—	0.125	300	0.160	0.500	22	0.026
—	—	102P	—	—	821K	—	0.125	150	contact factory		22	0.026
—	—	184A	—	—	817K	—	0.125	300	0.187	0.375	22	0.026
—	RBR74	185A	—	6.52K	961K	0.125	0.125	300	0.188	0.500	22	0.026
RB56	RBR75	202A	42K	150K	968K	0.125	0.25	200	0.250	0.310	22	0.026
RB56	RBR56	203A	42K	220K	1.7M	0.125	0.25	200	0.250	0.343	20	0.032
RB71	RBR71	203PA	100K	150K	1.48M	0.125	0.25	150	contact factory		20	0.026
RB55	RBR55	205A	80K	332K	1.93M	0.15	0.33	400	0.250	0.500	20	0.032
RB54	RBR54	207A	170K	562K	3.0M	0.25	0.50	800	0.250	0.750	20	0.032
—	RBR76	308A	—	3.344K	3.0M	0.50	0.60	800	0.312	0.810	20	0.032
—	—	210A	—	—	4.10M	—	0.50	800	0.250	1.000	20	0.032
RB53	RBR53	307A	320K	1.1M	5.63M	0.33	0.60	800	0.375	0.750	20	0.032
RB52	RBR52	310A	610K	1.21M	7.68M	0.50	1.00	800	0.375	1.000	20	0.032
RB57	RBR57	510A	830K	1.37M	24M	0.75	1.25	800	0.500	1.000	20	0.032
—	—	515A	—	—	35M	—	1.50	1200	0.500	1.500	20	0.032
—	—	517A	—	—	43M	—	1.75	1200	0.500	1.750	20	0.032
—	—	520A	—	—	43M	—	2.00	1200	0.500	2.000	20	0.032

Hermetically Sealed — Ultra High Stability Wirewound Resistors

0.125W to 1.8W at +125°C



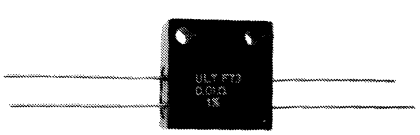
Features

- Accuracy to 25 ppm absolute
- Shelf life to 10 ppm/year
- Temperature coefficient to ±1 ppm/°C
- Zero voltage coefficient
- Noise free
- Low thermal EMF

Specifications

Style	Max. Value (Ω)	Power rating at +25°C (W)	Max. Volts	Dimensions Dia. ±0.01 inch	Dimensions Length ±0.02 inch	Ø Leads AWG	Ø Leads inch
HS185A	817K	0.125	300	0.187	0.500	22	0.026
HS205A	1.93M	0.25	300	0.250	0.500	20	0.032
HS207A	2.3M	0.40	600	0.250	0.750	20	0.032
HS210A	4.10M	0.50	600	0.250	1.000	20	0.032
HS307A	4.10M	0.60	600	0.375	0.750	20	0.032
HS310A	5.63M	0.80	600	0.375	1.000	20	0.032
HS510A	24M	1.00	600	0.500	1.000	20	0.032
HS520A	43M	1.80	900	0.500	2.000	20	0.032

Very Low Ohm, Ultra Precision Four Terminal Resistors



Ultronix manufactures a large variety of four-terminal resistors and networks for specialized applications. These are used in requirements of low value where high precision and low temperature coefficient is required. Tolerances available 1.0% or greater. Temperature coefficient for the FT1, FT2, and FT3 is 100 ppm/°C (+25°C to +125°C); TCR for the FT5 and FT7 is 10 ppm/°C (+25°C to +125°C).

Contact Ultronix Applications Engineering Department for assistance.

Standard Ohmic Values & Wattages Available

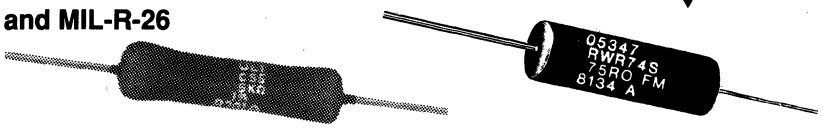
Ohmic Value	Product Type FT1	FT2	FT5	FT7
0.003	—	2 watts	—	—
0.00455	—	2 watts	—	—
0.005	—	2 watts	—	—
0.010	1 watt	2 watts	—	—
0.0139	—	2 watts	—	—
0.025	1 watt	2 watts	—	—
0.050	1 watt	2 watts	—	—
1.0 - 35.0	—	—	5 watts	7 watts

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Power Wirewound Resistors

Axial Leaded Power Wirewound Resistors

MIL qualifications to MIL-R-39007 and MIL-R-26



Electrical:

- Tolerance Standard: 0.1%, 0.5%, 1.0%
- Temperature Coefficient:
  ±650 ppm/°C, 0.1Ω ≤ R < 0.499Ω
  ±400 ppm/°C, 0.499Ω ≤ R < 1Ω
  ±50 ppm/°C, 1Ω ≤ R < 10Ω
  ±20 ppm/°C, R ≥ 10Ω
- Dielectric Strength:
  RWR 74, 78, 84, 89 = 1000 VRMS
  RWR 80, 81, 82 = 500 VRMS
  (voltage applied for one minute)
- Insulation Resistance: not <1000 MΩ

Mechanical

- Resistance Element: nickel chromium alloy
- Core: ceramic
- End Caps: stainless steel
- Encapsulation: RWR 80, 81, 82, 89 (molded silicone resin); RWR 74, 78, 84 (conformal coated silicone resin)
- Terminals: solderable–tinned copper weld (S and N); weldable–nickel (W and Z)

Specifications

Product Selection			Power Rating at +25°C/Max Value			Dimensions			
						Ø Diameter A	Length B	Ø Lead	
Ultronix	Mil-R 26	Mil-R 39007	Commercial	Mil-R-26	39007	inch	inch	AWG	inch
MSI	RW81	RWR81	1W/1.25K	1W/1K	1W/1.00K	0.085 ±0.020	0.250 ±0.031	24	0.020
MS101	—	RWR82	1.5W/1.5K	—	1.5W/1.3K	0.093 max.	0.343 max.	24	0.020
MS2	RW70	—	2.5W/3.16K	1W/3.16K	—	0.094 ±0.031	0.406 ±0.031	24	0.020
MS2	RW80	RWR80	2W/3.16K	2W/2.67K	2W/3.16K	0.094 ±0.031	0.406 ±0.031	24	0.020
MS25/CS3	RW69	—	3W/10K	3W/2K	—	0.200 ±0.031	0.500 ±0.062	20	0.032
MS3/CS4	RW79	RWR89	3W/11K	3W/10.5K	3W/4.12K	0.187 ±0.031	0.560 ±0.062	20	0.032
CS5	—	—	4W/20K	—	—	0.200 ±0.031	0.812 ±0.062	20	0.032
CS6	RW74	RWR74	5W/38K	5W/12.1K	5W/12.1K	0.312 ±0.031	0.875 ±0.062	18	0.040
CS7	RW87	—	6.5W/45K	6.5W/8.2K	—	0.312 ±0.031	1.000 ±0.062	20	0.032
CS6	—	RWR84	7W/38K	—	7W/12.4K	0.312 ±0.031	0.875 ±0.062	18	0.040
CS8	—	—	8W/84K	—	—	0.375 ±0.031	1.375 ±0.062	18	0.040
CS10	RW78	RWR78	10W/115K	10W/39.2K	10W/39.2K	0.375 ±0.031	1.780 ±0.062	18	0.040
CS11	RW68	—	11W/115K	11W/20K	—	0.375 ±0.031	1.780 ±0.062	18	0.040

Temperature-Sensing Resistor

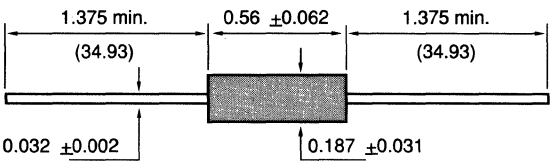
3 W at +25°C; Style Q 81

Electrical

- Resistance Range: 100Ω to 4KΩ (consult factory for higher or lower values)
- Standard Tolerance: 0.5% to 5.0%
- Power Rating: 3.0 watts at 25°C
- Temperature Coefficient: 3500 ±350ppm/°C (0°C to +125°C)
- Dielectric Strength: 1000 VRMS, 1 minute
- Insulation Resistance: not <1000MΩ

Mechanical

- Resistance Element: metal alloy wire
- Core: ceramic
- Encapsulation: conformal coated silicone resin
- Terminals: tinned copper weld



Dimensions are in inches.

The Q 81 style resistor provides a change in resistance when subjected to a change in body temperature. Applications are found in temperature-sensing circuitry and temperature compensation for other temperature-sensitive components. Ultronix' dedication to quality and excellence shows through in this high performance, ultra reliable resistor.

Surface Mount Wirewound Resistors

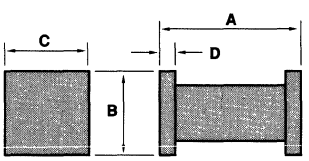
0.75 W to 3.5 W at +25°C; Styles SM1, 2, 3

Electrical

- Minimum Values: 0.10Ω for 1%, 3%, 5% and 10Ω for 0.5% and tighter
- Standard Tolerance: 0.1%. 0.25% and 0.50% depending on resistance values; 1%, 3% and 5% available for all values
- Temperature Coefficient: <1Ω = ±90ppm/°C; ≥1Ω to <10Ω = ±50ppm/°C; ≥10Ω = ± 30ppm/°C
- Dielectric Strength: 500 VRMS, 1 minute
- Insulation Resistance: not <10,000MΩ

Mechanical

- Resistive Element: nickel chromium alloy
- Core: ceramic
- Encapsulation: molded silicone resin
- End Caps: solder plated copper clad steel



The design of the SM wirewound resistors allows the body to remain above the board surface for proper cleaning as well as reducing hot spot temperatures. These resistors exceed the requirements of MIL-R-26E for style RW70.

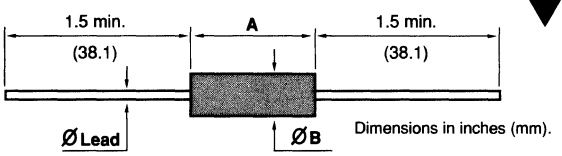
	Max. Value (Ω)		Characteristic U	Characteristic V	Dimensions							
					A		B		C		D	
Ultronix Style	0.1% To 0.50%	1% To 5%	Power Rating at + 25°C (W)	Power Rating at + 25°C (W)	inches ± 0.031	mm ± 0.79	inches ± 0.010	mm ±0.25	inches ±0.010	mm ±0.25	inches ±0.010	mm ±0.25
SM1	1K	1.5K	0.75	1.00	0.290	7.37	0.125	3.17	0.125	3.17	0.035	0.89
SM2	2K	6K	1.00	1.25	0.410	10.41	0.125	3.17	0.125	3.17	0.035	0.89
SM3	8K	15.4K	2.50	3.50	0.577	14.66	0.250	6.35	0.250	6.35	0.050	1.27

A COMPANY OF VISHAY ULTRONIX

Power and Precision Wirewound Resistors

Ultra Low Ohm Power Resistor

1 W to 5 W at +25°C; Styles TLO1, 3, 5



These reliable resistors meet MIL-R-26 specifications for style RW 70 (TLO1), RW 79 (TLO3) and RW 74 (TLO5) without consideration of the 0.05Ω allowance for low values which is added to all MIL-R-26 maximum resistance changes. Units are manufactured to order so that any resistance value is available within the ranges listed.

Electrical

- Dielectric Strength: 500VRMS (TLO1) 1000 VRMS (TLO3, TLO5)
- Insulation Resistance: not less than 1000 MΩ
- Thermal EMF: ±2μV max. /°C differential between opposite ends
- Temperature Range: -55°C to +275°C

Mechanical

- Encapsulation: molded high temperature silicone compound
- Terminals: tinned copper weld
- Solderability: at least 95% covered by new solder coating when dipped in molten solder up to 0.05 inch of the body for 5 seconds.

Ultronix Style	Resistance Range	Power Rating at +25°C	Resistance Measurement Points from Body	Dimensions Length (A) Inch ±0.015	Length (A) mm ±0.38	Diameter (B) Inch ±0.015	Diameter (B) mm±0.38	Lead Diameter Inch ±0.002	Lead Diameter mm ±0.05	Minimum Available Tolerance	Temperature Coefficient
TLO1	0.008Ω to 0.075Ω	1.0W	0.375 inch each side	0.406	10.3	0.094	2.39	0.025	0.64	5% under 0.015Ω 3% 0.015Ω to 0.029Ω 1% 0.03Ω to 0.059Ω 0.5% 0.06Ω to 0.075Ω	0 to +750ppm under 0.01Ω 0 to +600ppm 0.01Ω to 0.019Ω 0 to +300ppm 0.02Ω to 0.039Ω 0 to +150ppm 0.04Ω to 0.075Ω
TLO3	0.005Ω to 0.075Ω	3.0W	0.375 inch each side	0.560	14.2	0.210	5.33	0.032	0.81	5% under 0.01Ω 3% 0.01Ω to 0.019Ω 1% 0.02Ω to 0.039Ω 0.5% 0.04Ω to 0.075Ω	0 to +750ppm under 0.01Ω 0 to 400ppm 0.01Ω to 0.019Ω 0 to 200ppm 0.02Ω to 0.039Ω 0 to +100ppm 0.04Ω to 0.075Ω
TLO5	0.004Ω to 0.075Ω	5.0W	0.375 inch each side	0.920	23.4	0.330	8.38	0.040	1.02	3% under 0.01Ω 1% 0.01Ω to 0.019Ω 0.5% 0.02Ω to 0.075Ω	0 to +600ppm under 0.01Ω 0 to +250ppm 0.01Ω to 0.019Ω 0 to +125ppm 0.02Ω to 0.039Ω 0 to +75ppm 0.04Ω to 0.075Ω

Four-Terminal Molded Resistors

4.0 W to 6.0 W at +25°C; Styles Q 239, 267

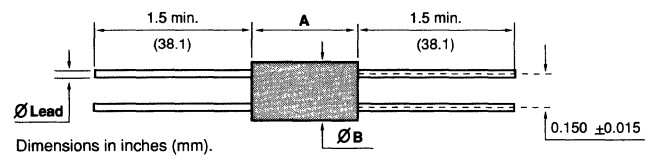
Useful in low resistance current-shunting and current-sensing applications where voltage - current relationships (i.e. resistance) must be precisely specified and independent of lead resistance effects. The all molded construction provides exceptional strength and moisture resistance.

Electrical

- Resistance Range: 0.01Ω to 100Ω
- Standard Tolerances: 0.1%, 0.5%, 1%, 3% and 5%. Tighter tolerances available on request. Please contact factory for assistance.
- Temperature Coefficient: ±10 ppm/°C max. for 1Ω and up ±50 ppm/°C below 1Ω

Mechanical

- Encapsulation: molded
- Terminals: tinned copper



Dimensions in inches (mm).

Ultronix Style	Power Rating at +25°C	Dimensions A inch ±0.015	A mm ±0.38	B inch ±0.015	B mm ±0.38	Ø Leads AWG	Ø Leads inch	Ø Leads mm
Q239	6.0W	1.870	47.5	0.437	11.1	18	0.040	1.02
Q267	4.0W	1.000	25.4	0.375	9.5	18	0.040	1.02

Very Low Ohm, High Precision Wire Current Shunts

10A to 25A at +25°C; Style RCS

Electrical

- Maximum Values: 0.1Ω for all styles
- Standard Tolerances: 0.1%, 0.5%, 1.0%, 3.0%, 5.0% and 10.0%
- Dielectric Strength: 1000 volts RMS, one minute
- Insulation Resistance: not less than 1,000 MΩ

Mechanical

- Resistive Element: metal alloy wire
- Terminals: solder plated leads
- Solderability: at least 95% covered by new solder coating when dipped in molten solder at 245°C up to 0.06" of the body for 5 seconds

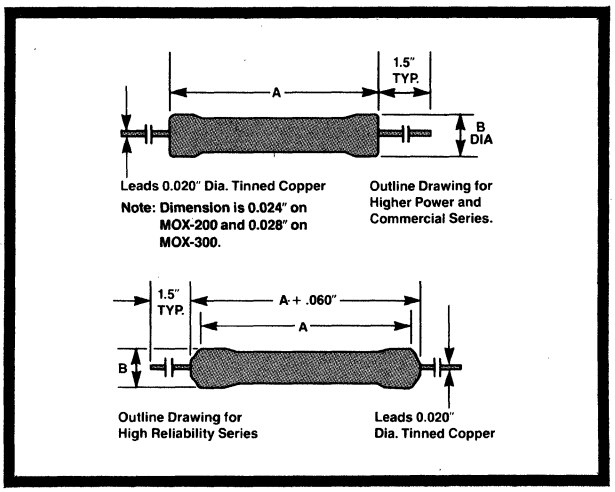
Current shunts are useful in current sensing applications where voltage— current relationships (i.e., resistance) must be precisely specified and independent of lead resistance effects. Ultronix has the capability to design special current shunts from customer supplied schematics, and welcomes the opportunity to work with customer engineers during the design phase.

Specification	RCS01	RCS02, 03	RCS04
Minimum Resistance Value	0.003Ω	0.005Ω	0.01Ω
Tolerance Standard*	0.50%	1.00%	0.50%
Current Rating	25A	10A	10A
Power Rating	1.875W	0.50W	1.0W min.
Temperature Coefficient	±50 ppm/°C (0°C to +100°C)	±100 ppm/°C (0°C to +50°C)	±100 ppm/°C (+25°C to +125°C)

*Tolerance is measured when current is supplied through a center and an outside lead at each end of the resistor, and with voltage measured at the remaining two leads.

VICTOREEN MINI-MOX Resistors

- **Metal Oxide Resistive Element**
- **Wide resistance range 10 Kohms to 100,000 Megohms**
- **Voltage rating to 6KV**
- **Power rating to 1.5 watt**
- **Available with silicone or epoxy coatings**



VICTOREEN MINI-MOX TYPE NUMBER

MOX – 400 – 2 3

TYPE — SIZE — COATING — LEAD

LEAD:
2 = 0.020″ Tinned copper
3 = 0.020″ Tinned dumet
7 = 0.032″ Tinned copper
9 = Other

COATING:
2 = High temperature
3 = High reliability
9 = Other

Please call or write:
VICTOREEN, INC.
6000 Cochran Road
Cleveland, Ohio 44139-3395 U.S.A.
(216) 248-9300
FAX: (216) 248-9301 TWX: (810) 421-8287

HIGHER POWER SERIES *(silicone coated)*

Type	Resistance Range (ohms)	Power @70°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-400-22	1 K to 10,000 Meg	0.35W	1000V	1,2,5	0.520″	0.140″
MOX-750-22	1K to 10,000 Meg	0.70W	2000V	1,2,5	0.820″	0.140″
MOX1125-22	1K to 10,000 Meg	1.40W	5000V	1,2,5	1.210″	0.140″

HIGH RELIABILITY SERIES *(epoxy coated)*

Type	Resistance Range (ohms)	Power @70°C	Maximum Voltage Rating	Avail* Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-400-23	1 K to 30,000 Meg	0.25W	1000V	0.5,1,2,5	0.540″	0.165″
MOX-750-23	1K to 70,000 Meg	0.50W	2000V	0.5,1,2,5	0.860″	0.165″
MOX1125-23	1K to 100,000 Meg	1.00W	5000V	0.5,1,2,5	1.250″	0.165″

*Values beyond 10,000 Meg are available in 5% and 10% tolerance.

COMMERCIAL SERIES *(epoxy coated)*

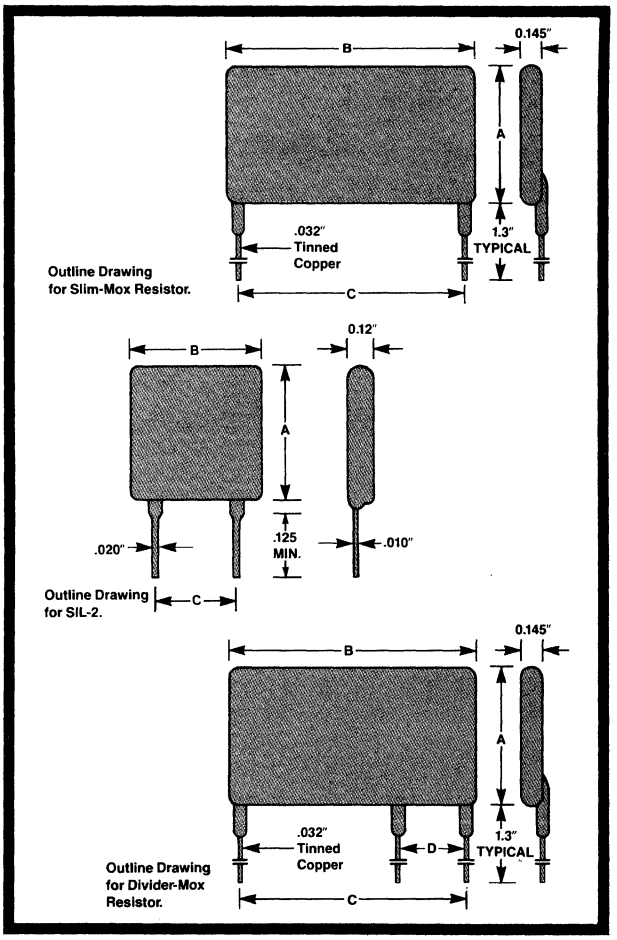
Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-200	1 K to 1,000 Meg	0.25W	500V	0.5,1,2,5	0.275″	0.105″
MOX-300	1 K to 1,000 Meg	0.50W	1000V	0.5,1,2,5	0.435″	0.145″
MOX-400-23	1 K to 10,000 Meg	0.75W	2500V	0.5,1,2,5	0.540″	0.165″
MOX-750-23	1 K to 10,000 Meg	1.00W	4000V	0.5,1,2,5	0.860″	0.165″
MOX-1125-23	1 K to 10,000 Meg	1.50W	6000V	0.5,1,2,5	1.250″	0.165″

STANDARD TEMPERATURE COEFFICIENT

Type	100 PPM/°C	250 PPM/°C	500 PPM/°C
MOX-200	1 Meg - 100 Meg	101 Meg - 1,000 Meg	—
MOX-300	1 Meg - 400 Meg	401 Meg - 1,000 Meg	—
MOX-400	10 K - 500 Meg	501 Meg - 1,000 Meg	1,001 Meg - 30,000 Meg
MOX-750	20 K - 1,000 Meg	1,001 Meg - 2,000 Meg	2,001 Meg - 70,000 Meg
MOX1125	50 K - 1,500 Meg	1,501 Meg - 3,000 Meg	3,001 Meg - 100,000 Meg

VICTOREEN SLIM-MOX Resistors

- **Metal Oxide Resistive Element**
- **Noninductive resistor design**
- **Wide resistance range to 5,000 Megohms**
- **Voltage rating to 20KV**
- **Power rating to 15 watts**
- **High dielectric and low outgassing epoxy coating**
- **Resistance tolerances range from 0.5, 1, 5, 10, and 20%**



SLIM-MOX RESISTOR DIVIDER SERIES

Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Max Ratio	Dimension D(Inches) ±.032"
SLIM-MOX104RD	1 Meg - 1,000 Meg	1.0W	3,750V	1,000:1	.2
SLIM-MOX108RD	1 Meg - 3,000 Meg	2.0W	7,500V	1,000:1	.6
SLIM-MOX204RD	1 Meg - 3,000 Meg	2.0W	7,500V	1,000:1	.2
SLIM-MOX208RD	1 Meg - 5,000 Meg	4.0W	12,000V	4,000:1	.4
SLIM-MOX308RD	2 Meg - 5,000 Meg	5.0W	15,000V	4,000:1	.3
SLIM-MOX408RD	5 Meg - 5,000 Meg	6.0W	20,000V	5,000:1	.3

Ratio tolerances available 0.5, 1, 3%

SLIM-MOX SERIES

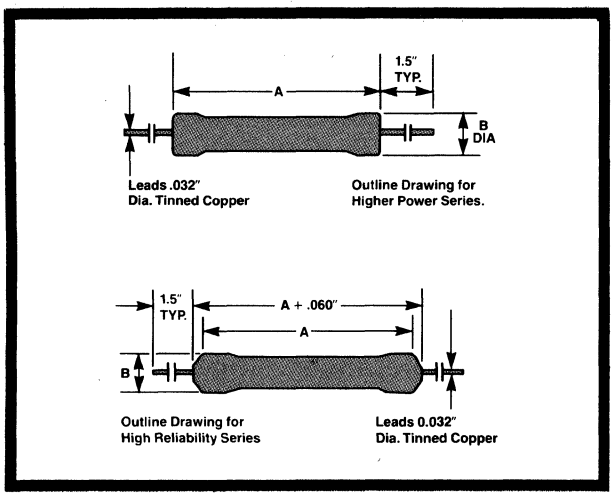
Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Dimensions (inches) A (max)	B (max)	C ±.032"
SIL-2	1 K to 100 Meg	0.25W	1.5KV	0.30"	0.30"	0.10"
SLIM-MOX101	1 K to 250 Meg	0.5W	2.0KV	0.34"	0.33"	0.2"
SLIM-MOX102	1 K to 1,000 Meg	1.0W	5.0KV	0.34"	0.58"	0.4"
SLIM-MOX104	1 K to 1,200 Meg	1.5W	10.0KV	0.34"	1.08"	0.9"
SLIM-MOX108	1 K to 5,000 Meg	2.5W	20.0KV	0.34"	2.08"	1.9"
SLIM-MOX202	1 K to 1,200 Meg	1.5W	5.0KV	0.59"	0.58"	0.4"
SLIM-MOX204	1 K to 5,000 Meg	2.0W	10.0KV	0.59"	1.08"	0.9"
SLIM-MOX208	2 K to 5,000 Meg	3.0W	20.0KV	0.59"	2.08"	1.9"
SLIM-MOX308	4 K to 5,000 Meg	4.0W	20.0KV	0.84"	2.08"	1.9"
SLIM-MOX408	5 K to 5,000 Meg	5.0W	20.0KV	1.09"	2.08"	1.9"

STANDARD TEMPERATURE COEFFICIENT

Type	100 PPM/°C	250 PPM/°C	500 PPM/°C
SLIM-MOX101	1 K - 20 Meg	21 Meg - 100 Meg	101 Meg - 250 Meg
SLIM-MOX102	1 K - 50 Meg	51 Meg - 250 Meg	251 Meg - 1,000 Meg
SLIM-MOX104	1 K - 100 Meg	101 Meg - 500 Meg	501 Meg - 1,200 Meg
SLIM-MOX202	1 K - 100 Meg	101 Meg - 500 Meg	501 Meg - 1,200 Meg
SLIM-MOX108	1 K - 200 Meg	201 Meg - 1,000 Meg	1,001 Meg - 5,000 Meg
SLIM-MOX204	1 K - 200 Meg	201 Meg - 1,000 Meg	1,001 Meg - 5,000 Meg
SLIM-MOX208	2 K - 400 Meg	401 Meg - 2,000 Meg	2,001 Meg - 5,000 Meg
SLIM-MOX308	4 K - 600 Meg	601 Meg - 3,000 Meg	3,001 Meg - 5,000 Meg
SLIM-MOX408	5 K - 600 Meg	601 Meg - 3,000 Meg	3,001 Meg - 5,000 Meg

VICTOREEN MAXI-MOX Resistors

- **Metal Oxide Resistive Element**
- **Wide resistance range 1 Kohms to 10,000 Megohms**
- **Voltage rating to 37.5KV**
- **Power rating to 12.5 watts**
- **Available with silicone or epoxy coatings**



VICTOREEN MAXI-MOX TYPE NUMBER

MOX – 2 – 1 3
SIZE — COATING — LEAD
TYPE

LEAD:
1 = 0.032" Tinned copper
5 = 0.032" Tinned dumet
6 = 6-32 Threaded Formula*
9 = Other

COATING:
2 = High temperature
3 = High reliability
9 = Other

*Available with the High Temperature coating only.

Please call or write:

VICTOREEN, INC.
6000 Cochran Road
Cleveland, Ohio 44139-3395 U.S.A.
(216) 248-9300
FAX: (216) 248-9301
TWX: (810) 421-8287

HIGH RELIABILITY SERIES *(epoxy coated)*

Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-1-13	1 K to 10,000 Meg	2.0W	7.5KV	0.5.1.2.5	1.140"	0.345"
MOX-2-13	1 K to 10,000 Meg	3.0W	15.0V	0.5.1.2.5	2.140"	0.345"
MOX-3-13	1 K to 10,000 Meg	4.0W	22.5V	0.5.1.2.5	3.140"	0.345"
MOX-4-13	1 K to 10,000 Meg	5.0W	30.0V	0.5.1.2.5	4.140"	0.345"
MOX-5-13	1 K to 10,000 Meg	6.0W	37.5V	0.5.1.2.5	5.140"	0.345"

HIGHER POWER SERIES *(silicone coated)*

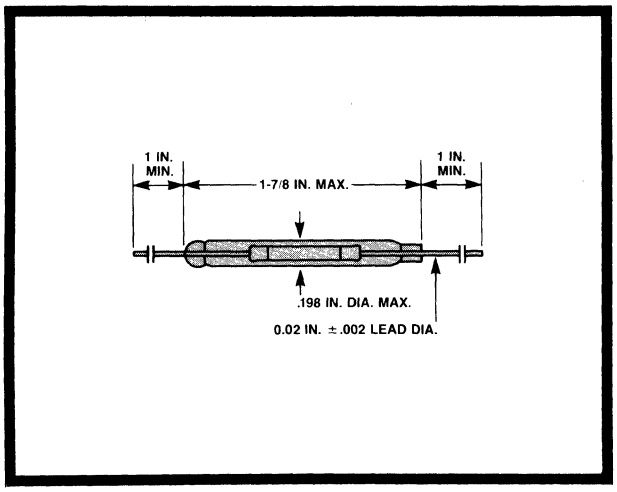
Type	Resistance Range (ohms)	Power @70°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-1-12	1 K to 10,000 Meg	2.5W	7.5KV	1,2,5	1.120"	0.310"
MOX-2-12	1 K to 10,000 Meg	5.0W	15.0V	1,2,5	2.120"	0.310"
MOX-3-12	1 K to 10,000 Meg	7.5W	22.5V	1,2,5	3.120"	0.310"
MOX-4-12	1 K to 10,000 Meg	10.0W	30.0V	1,2,5	4.120"	0.310"
MOX-5-12	1 K to 10,000 Meg	12.5W	37.5V	1,2,5	5.120"	0.310"

STANDARD TEMPERATURE COEFFICIENT

Type	100 PPM/°C	250 PPM/°C	500 PPM/°C
MOX-1	1 K - 300 Meg	301 Meg - 1,000 Meg	1,001 Meg - 10,000 Meg
MOX-2	1 K - 600 Meg	601 Meg - 2,000 Meg	2,001 Meg - 10,000 Meg
MOX-3	1 K - 900 Meg	901 Meg - 3,000 Meg	3,001 Meg - 10,000 Meg
MOX-4	1 K - 1,200 Meg	1,201 Meg - 4,000 Meg	4,001 Meg - 10,000 Meg
MOX-5	1 K - 1,500 Meg	1,501 Meg - 5,000 Meg	5,001 Meg - 10,000 Meg

VICTOREEN RX-1 and RX-1M HI-MEG Resistors

Victoreen GLASS SEAL: HI-MEGS are vacuum sealed in a glass envelope which is treated with a special silicone varnish to keep the resistor relatively free from the effects of moisture.



RX-1

POWER RATING: ½ watt @ 25°C.
RESISTANCE: HI-MEG resistors are available in values from 10^7 to 10^{13} ohms.
TOLERANCE: HI-MEG resistors can be supplied in the following tolerances; 1% below 2.5 x 10^{11} ohms, 2% and 5% below 10^{12} ohms, 10% below 10^{13} ohms and 20% at 10^{13}.
MAXIMUM WORKING VOLTAGE: 1000 volts.
MAXIMUM OPERATING AMBIENT TEMPERATURE: 100°C.

TYPICAL TEMPERATURE AND VOLTAGE COEFFICIENT (IN PPM)						
Resistance Decade (ohms)	10^8	10^9	10^{10}	10^{11}	10^{12}	10^{13}
Temperature Coefficient	600	700	800	1,000	1,500	2,000
Voltage Coefficient	200	200	200	300	600	1,200

RX-1M

The RX-1M is available with resistance tolerances of 0.5, 1, 2, and 5% through 10,000 megohm, and 5% and 10% through 100,000 meg ohm. The use of the metal oxide resistive elements allows for vastly improved temperature and voltage coefficient performance characteristics.

SPECIFICATIONS:

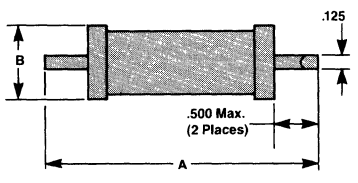
RESISTANCE RANGE: 1 Megohm to 100,000 megohm
VOLTAGE RATING: 1000 volts
POWER RATING: ½ WATT AT 25°C.

TYPICAL TEMPERATURE AND VOLTAGE COEFFICIENT (IN PPM)						
Resistance Decade (megohms)	10^8	10^9	10^{10}	10^{11}	10^{12}	10^{13}
Temperature Coefficient	100	100	500	500		
Voltage Coefficient	5	5	5	5		

VICTOREEN RX-1 HI MEG resistors are commonly used for high resistance standards. By special order, Victoreen can calibrate these resistors at any voltage from 1 to 1000 volts. (Preference to decade multiples of 1, 2.5, and 5.)

CERAMIC SPARK GAPS

- **Energy discharge capability up to 70% better than similar glass spark gaps**
- **Firing voltage from 1 KV to 35 KV**
- **Ideal for ignition or over-voltage protection**



TYPICAL DATA FOR COMMON TYPES OF SPARK GAPS					
Type	D.C. Firing Voltage Range	To.	Max. Energy/ Pulse	Dimensions (Inches) A	B
SGCA	1,000-12,000	±10%	100 Joules	1.930 Ref.	.562 Ref.
SGCB	12,000-20,000	±10%	100 Joules	2.180 Ref.	.562 Ref.
SGCC	20,000-35,000	±10%	100 Joules	2.680 Ref.	.562 Ref.

Other Spark Gaps are available. Consult Victoreen for details.

Please call or write:
VICTOREEN, INC.
6000 Cochran Road Cleveland, Ohio 44139-3395 U.S.A.
(216) 248-9300 FAX: (216) 248-9301 TWX: (810) 421-8287
Customer Service Bulletin Board: (216) 248-9043

Hearst Engineering Software



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You can personalize the **ICMASD** for your application. The program allows you to add comments, up to 20 digits long, to each listing. These comments can be part numbers, prices, or any information specific to your needs. You may also add, delete and/or discontinue devices!

For greater flexibility the base number search feature enables you to access parts by base number, i.e., the device number stripped of prefixes and suffixes. You don't need to know the manufactures codes to call up any of the alternates to these devices.

The **1991 ICMASD** is fast, convenient and very user friendly!

Complete program documentation is included. When ordering, be sure to specify if you want the **1991 ICMASD** on three, double-sided, double-density disks OR on one high-density disk.

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Garden City, New York 11530
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Published Annually in March

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A COMPANY OF VISHAY BULK METAL® RESISTORS

Bulk Metal®Foil Military Resistors

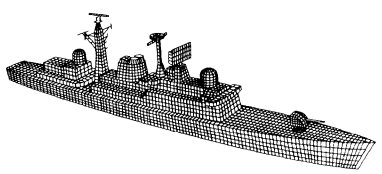
Established Reliability

- TCR: ±2.5 ppm/°C (–55°C to +125°C)
- Load Life Stability: 0.015% (150 ppm) ΔR for 10,000 hrs.
- Shelf Life: 0.0025% (25 ppm) for 3 yrs.
- Voltage Coefficient: <0.1 ppm/V
- Current Noise: –32dB
- Thermal EMF: 0.05 μV/°C

At the cutting edge of today's advanced technology, military programs (such as the space shuttle and the sky lab, satellites, SDI, the Aegis, MK48, missiles and military aviation like the F18) often require established-reliability precision resistors beyond the level of existing military specifications. VISHAY can take the basic generic military resistor, and, with specific testing, offer improved performance specifications such as are detailed here below.

RNC90Y
MIL-R-55182/9

(See Catalog VMF-2000)



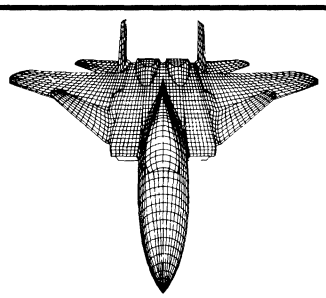
The VISHAY RNC90Y (S555) resistor is qualified to the "R" reliability level for resistance values from 4.99Ω through 121KΩ and for tolerances from ±0.005% to ±1.0%. VISHAY has accumulated over 160 million unit hours of testing on the RNC90Y resistor. The VISHAY RNC90Y high-performance resistors are designed for both the critical military systems market and for demanding industrial applications.

The same resistors are also available as a non-qualified product (S555) for customers desiring extended resistance range. Both the qualified and the non-qualified version are manufactured on the same product line facilities and are subjected to the same process, lot control, conditioning, and basic QPL testing requirements.

The VISHAY RNC90Y resistor is approved to MIL-STD-975D (NASA). It is also manufactured and packaged to comply with ESD requirements.

M122/1
MIL-R-122

(See Data Sheet VMF-300)



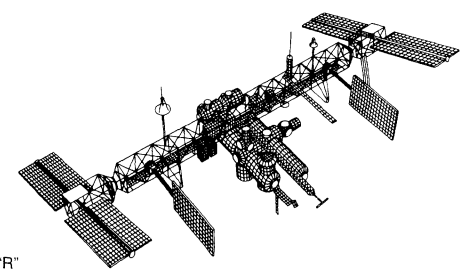
The VISHAY M122/1 (S22-1) resistor is qualified to the "R" reliability level for resistance values from 4.99Ω through 50KΩ and for tolerances from ±0.005% to ±1.0%. VISHAY M122/1 high-performance resistors are designed for both the critical military systems market and for demanding industrial applications.

The same resistors are also available as a non-qualified product (S22-1) for customers desiring extended resistance range. Both the qualified and the non-qualified version are manufactured on the same product line facilities and are subjected to the same process, lot control, conditioning, and basic QPL testing requirements.

The VISHAY M122/1 resistor is manufactured and packaged to comply with ESD requirements.

VISHAY
Improved Performance Testing (IPT)

(Contact Application Engineering Dept.)



VISHAY also provides the basic MIL resistors with specific conditioning to ensure improved long term stability. This specific conditioning could include:

- Thermal Shock
- Specific Burn In Cycles
- Short Time Overload

The guaranteed level of the Improved Performance Testing (IPT) Specifications are shown below.

Comparison of Specifications

SPECIFICATION	MIL-R-55182/9 Characteristic Y Limits	MIL-R-122 Characteristic A Limits	VISHAY Improved Performance Testing (IPT) Limits
Temperature Coefficient of Resistance - Maximum TCR	±5 ppm/°C (–55°C to +125°C) ±10 ppm/°C (+125°C to +175°C)	±2.5 ppm/°C (–55°C to +125°C) ±3.5 ppm/°C (+125°C to +150°C) ±4.5 ppm/°C (+150°C to +175°C)	±2.5 ppm/°C (–55°C to +25°C) ±2.5 ppm/°C (+25°C to +125°C) ±2.5 ppm/°C (0°C to +25°C) ±2.5 ppm/°C (+25°C to +60°C)
Selected TCR Tracking	Not Specified	Not Specified	3.0 ppm/°C, Standard Spread
Load-Life Stability (0.3W @ 125°C) at 2000 hours at 10,000 hours	 0.05% Maximum ΔR (500 ppm) 0.5% Maximum ΔR (5000 ppm)	 0.05% Maximum ΔR (500 ppm) 0.2% Maximum ΔR (2000 ppm)	 0.005% Maximum ΔR (50 ppm) 0.015% Maximum ΔR (150 ppm)
Current Noise (Not Specified)	–32dB	–32dB	–32dB
High Frequency Operation Rise-Decay Time Inductance (L) Capacitance (C) Reactance	 Not Specified Not Specified Not Specified Not Specified	 Not Specified Not Specified Not Specified ≤ 10%	 1.0 ns for 1KΩ 0.1μH Maximum, 0.08μH Typical 1.0pF Maximum, 0.05pF Typical <1%
Voltage Coefficient	0.0005%/V (5 ppm/V)	0.0001% /V (1 ppm/V)	<0.00001% /V (<0.1 ppm/V)
Working Voltage	300 Volts Maximum	300 Volts Maximum	300 Volts Maximum
Thermal EMF	Not Specified	1μV/°C	0.1μV/°C Maximum

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VISHAY Chips

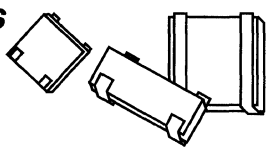
BULK METAL® RESISTORS

Microchip (V5X5) and Minichips (V15X5, V15X10) Resistors for Hybrid Microcircuits

Model Number	Resistance[1] (Ohms)	Trim Range	Tolerance To	Power at 70°C	Max. Working Voltage	Nominal Chip Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max. ΔR)	Load-Life Stability (Max. ΔR)	Nominal TCR
V5X5	5 - 10K	0 to 1.2x the nominal prevalue	±0.01%	0.05W	22V	0.050 x 0.050 x 0.020 (1.27) x (1.27) x (0.508)	0.005% /Yr. 0.0005% /Yr. Hermetically Packaged	0.05% 2000 Hrs. @ 70°C	0°C to +25°C +0.6 ppm/°C ±1.5 ppm/°C +25°C to +60°C -0.6 ppm/°C ±1.5 ppm/°C −55°C to +25°C +2.2 ppm/°C ±2.0 ppm/°C +25°C to +125°C -1.8 ppm/°C ±2.0 ppm/°C
V15X5	5 - 33K	0 to 1.3x the nominal prevalue		0.1W	54V	0.150 x 0.050 x 0.020 (3.81) x (1.27) x (0.508)			
V15X10	33K - 80K	0 to 1.5x the nominal prevalue		0.15W	100V	0.150 x 0.100 x 0.020 (3.81) x (2.54) x (0.508)			

1. Higher resistance ranges and larger size chips available.

Bulk Metal® Foil Precision Surface Mount Chip Resistors



- TCR: ±0.6 ppm/°C
- Tolerance: to 0.01%
- Very High Stability
- Designed to Exceed Requirements of MIL-R-55342

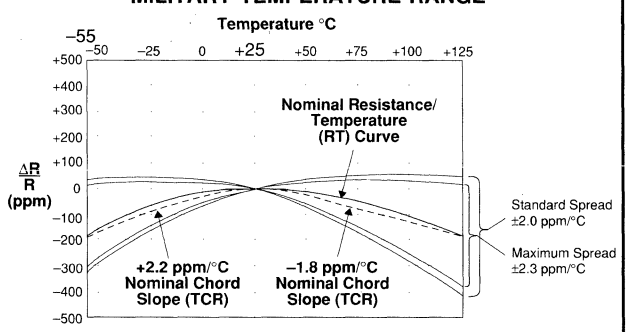
VISHAY VSM resistors offer an order-of-magnitude improvement in performance over other surface mounted chip resistors. Until now, the best chips available had a ±50 ppm/°C (−55°C to +125°C) Temperature Coefficient of Resistance (TCR); the VISHAY chips, however, exhibit a nominal TCR of only +2.2 ppm/°C over the temperature range of −55°C to +25°C and −1.8 ppm/°C from +25°C to +125°C. The VISHAY standard TCR spread from nominal is ±2.0 ppm/°C over the full temperature range. This TCR characteristic is accomplished automatically without selection and regardless of the date of manufacture — even if years apart! Selected TCR tracking is available to 0.5 ppm/°C. Where other chip resistors are, at best, supplied only as close as ±0.1% resistance tolerance, VISHAY surface mounted chips have standard resistance tolerances to ±0.01%.

VISHAY surface mounted precision chip resistors exhibit performance which dramatically exceeds the requirements of MIL-R-55342. In Trident passivation tests, VISHAY chips repeatedly showed no deterioration when exposed to destructive ceric ammonium nitrate solutions (three 15 second etches), indicating a high order of protection and absence of "nichrome migration."

Model Number	Resistance (Ohms)	Power at 70°C	Max. Working Voltage	Maximum Chip Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max. ΔR)	Load-Life Stability (Max. ΔR)	Nominal TCR
VSM16X6	5-33K	0.10W	60V	0.160 x 0.065 x 0.035 (4.064) x (1.651) x (0.889)	0.005% /Yr. 0.0005% /Yr. Hermetically Packaged	0.05% 2000 Hrs. @ 70°C	0°C to +25°C +0.6 ppm/°C ±1.5 ppm/°C +25°C to +60°C −0.6 ppm/°C ±1.5 ppm/°C −55°C to +25°C +2.2 ppm/°C ±2.0 ppm/°C +25°C to +125°C −1.8 ppm/°C ±2.0 ppm/°C
VSM16X11	33K-80K	0.15W	100V	0.160 x 0.110 x 0.035 (4.064) x (2.794) x (0.889)			
VSM21X11	5-100K	0.20W	140V	0.210 x 0.110 x 0.035 (5.334) x (2.794) x (0.889)			
VSM21X20	5-150K	0.30W	200V	0.210 x 0.205 x 0.035 (5.334) x (5.207) x (0.889)			

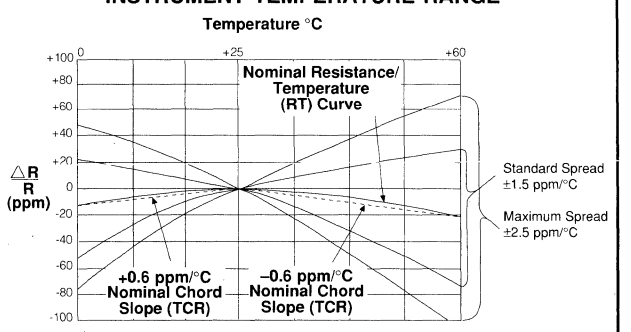
Resistance Value Vs. Tolerance		
Value (Ohms)	Tolerance	
	Tightest	Loosest
5Ω - <10Ω	0.10%	1.0%
10Ω - <50Ω	0.05%	1.0%
50Ω - <100Ω	0.02%	1.0%
100Ω - <150K	0.01%	1.0%

MILITARY TEMPERATURE RANGE



(−55°C, +25°C, +125°C are the reference temperature test points)

INSTRUMENT TEMPERATURE RANGE

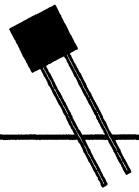


0°C, +25°C, +60°C are the reference temperature test points)

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Fixed Resistors



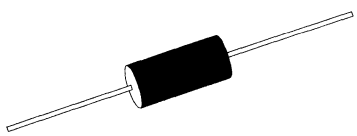
BULK METAL® RESISTORS

Precision Resistors
High Performance Industrial & Aerospace Group

Model Number	Resistance (Ohms)	Tolerance[1] Available To	Power at +70°C	Power at +125°C	Maximum Working Voltage	Maximum Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)[3]	Temperature Coefficient of Resistance (TCR)
S102C[TM][4] (1 chip)	1 - 100K >100K - 250K	±0.005%	0.6W 0.4W	0.3W 0.2W	300	0.115 x 0.310 x 0.336 (2.92) x (7.87) x (8.53) Dim. Tol. ±0.010 (0.25) Lead Spacing 0.150 (3.81) Nom.	25 ppm after 1 year and 50 ppm after 3 years	0.005% 2,000 hrs. 0.1W per chip @ +70°C	Nominal[2] / Standard Spread 0°C to +25°C: +0.6 ppm/°C / ±1.5 ppm/°C +25°C to +60°C: −0.6 ppm/°C / ±1.5 ppm/°C -55°C to +25°C: +2.2 ppm/°C / ±2.0 ppm/°C +25°C to +125°C: −1.8 ppm/°C / ±2.0 ppm/°C
S104D (2 chips)	1 - 200K >200K - 500K	±0.005%	1.0W 0.6W	0.5W 0.3W	350	0.160 x 0.575 x 0.413 (4.06) x (14.61) x (10.49) Lead Spacing 0.400 (10.16) Nom.		0.015% 2,000 hrs. 0.3W per chip @ +125°C	
S105D (3 chips)	1 - 300K >300K - 750K	±0.005%	1.5W 0.8W	0.75W 0.4W	350	0.160 x 0.820 x 0.413 (4.06) x (20.83) x (10.49) Lead Spacing 0.650 (16.51) Nom.			
S106D (4 chips)	0.5 - 400K >400K - 1M	±0.005%	2.0W 1.0W	1.0W 0.5W	500	0.260 x 1.200 x 0.413 (6.60) x (30.48) x (10.49) Lead Spacing 0.900 (22.86) Nom.		0.05% 10,000 hrs. 0.3W per chip @ +125°C	

1, 2, 3, 4 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

Fixed Axial Leaded Resistors



Value Engineered and
Standard Stock Axial Leaded Precision Resistors

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at +70°C	Power at +125°C	Maximum Working Voltage	Nominal Dimensions Inch (mm) D x L	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)[3]	Temperature Coefficient of Resistance (TCR) Limits
VTA52 (RBR52)	5 - 750K 25 - 750K	±0.1 ±0.01	1.0W	0.5W	300	0.375 x 1.00 (9.53) x (25.4)	25 ppm after 1 year	0.05% 2,000 hrs. @ +125°C	0°C to +60°C: ±4 ppm/°C -55°C to +125°C: ±8 ppm/°C
VTA53 (RBR53)	5 - 500K 25 - 500K	±0.1 ±0.01	0.66W	0.33W	300	0.375 x 0.750 (9.53) x (19.05)			
VTA54 (RBR54)	5 - 500K 25 - 500K	±0.1 ±0.01	0.5W	0.25W	300	0.260 x 0.750 (6.60) x (19.05)			
VTA55 (RBR55)	5 - 250K 25 - 250K	±0.1 ±0.01	0.3W	0.15W	300	0.260 x 0.500 (6.60) x (12.70)			
VTA56 (RBR56)	5 - 250K 25 - 250K	±0.1 ±0.01	0.25W	0.125W	300	0.260 x 0.356 (6.60) x (9.04)			
VMTA55 (RNC55)	5 - 30K 50 - 30K	±0.1 ±0.01	0.2W	0.1W	200	0.120 x 0.270 (3.05) x (6.86)			
VMTB60 (RNC60)	5 - 60K 50 - 60K	±0.1 ±0.01	0.25W	0.125W	250	0.160 x 0.375 (4.06) x (9.53)			
VSA100	5 - 150K 50 - 150K	±0.1 ±0.01	0.6W	0.3W	300	L: 0.305 (7.75)max. T: 0.102 (2.59)max. H: 0.260 (6.60)max.			

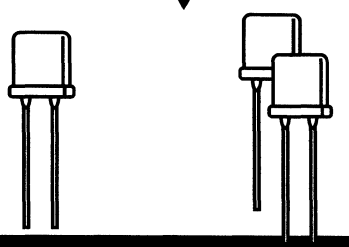
1, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

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Ultra Precision Low TCR Resistors

BULK METAL® RESISTORS

VHP-100, the New Improved VISHAY Resistor with Self-Correcting Resistance versus Temperature Performance



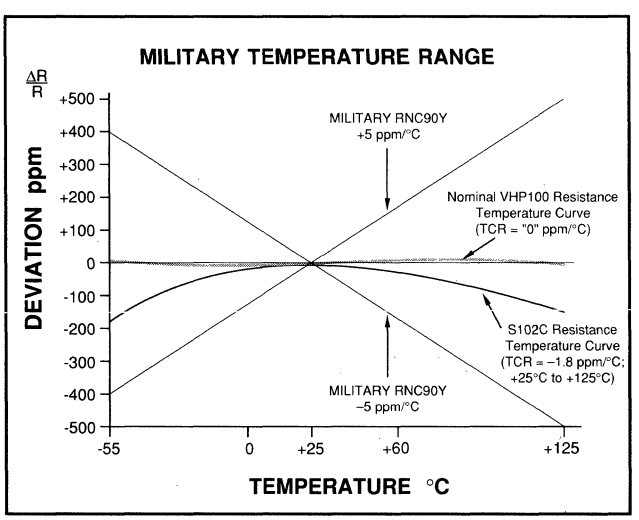
- Essentially Zero TCR
- No Humidity Effect
- Lowest Thermal EMF in the Industry
- Excellent Stability
- Essentially Non-Inductive Performance

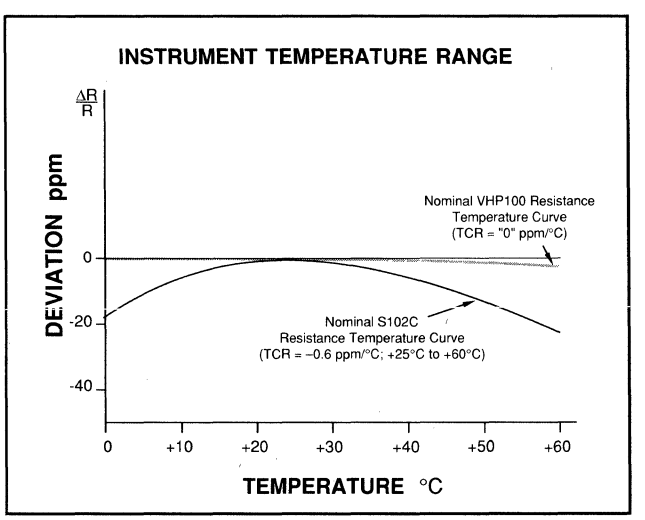
VISHAY has achieved an essentially zero temperature coefficient resistor. By combining equal and opposite temperature effects, resistance changes due to temperature are kept to a minimum, to the extent that the resistance deviation of the Model VHP100 resistor remains within a 60 ppm window over the military temperature range from –55°C to +125°C.

Specifications

TCR VHP-100 VHP-101	<0.6 ppm/°C (–55°C to +125°C) <0.3 ppm/°C (+15°C to +45°C)
Resistance Range	100Ω to 150KΩ
Tolerance at +25°C[1]	±0.005% to ±1.0%
Power at +70°C at +125°C	 0.3 watts 0.15 watts
Load-Life Stability[2] (For 2000 hours)	0.3W @ +70°C; 0.015% (150 ppm) Max ΔR 0.15W @ +125°C; 0.015% (150 ppm) Max ΔR
Shelf-Life Stability[3]	0.0005% (5 ppm) Max ΔR after 1 yr.; 0.0010% (10 ppm) Max ΔR after 3 yrs.
Thermal EMF Due to temperature difference bt. leads Due to self-heating under 0.1 watts	 0.05 μV/°C 0 to 2 μV
High-Frequency Operation Rise/Decay Time Inductance (L) Capacitance (C)	 1.0 ns for 1KΩ 0.1 μH Max.; 0.08 μH typical 1.0 pF Max.; 0.5 pF typical
Maximum Working Voltage	300V
Voltage Coefficient	<0.1 ppm/V (non-measurable)
Current Noise	<0.025 μV (RMS)/volt (–32dB)
Hermeticity	10^{-7} atmospheric cc/second Max
Nominal Dimensions — Inch (mm) Width Length Height Lead Spacing	 0.185 ±0.020 (4.70 ±0.51) 0.435 ±0.020 (11.05 ±0.51) 0.430 ±0.020 (10.92 ±0.51)[4] 0.150 (3.81) nominal

1, 3 Refer to VISHAY's Short Form catalog or contact VISHAY at the number listed below.
2 Load-life stability is considerably improved by reducing the temperature, power, or by "burn-in."
4 0.375H (9.53) available on special order.





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Power Resistors and Plates

BULK METAL® RESISTORS

Precision Power and Current Sensing Resistors

VISHAY Model	Resistance Range	Resistance Tolerance[1]	TCR	Load Life Stability[3]	Shelf Life Stability[3]	Power	Current Noise	Inductance	Capacitance	Maximum Dimensions (mm) W x L x H
VHP3	0.1Ω to 80K	To 0.01%	±5 ppm/°C (50 to 80K)	0.05% max R under full rated power at +25°C	0.0005% (5 ppm) Max R/yr	10 watts on heat sink at +25°C	<0.025 µV (RMS)/Volt	0.1 µH Max 0.08 µH typical	1.0 pF Max 0.5 pF typical	1.000 x 1.530 x 0.335 (25.4) x (38.86) x (8.51) (std. TO-3 case)
VHP4	0.05 to 500		±5 ppm/°C (10 to 500)							1.000 x 1.530 x 0.375 (25.4) x (38.86) x (9.53)
VPR5	1 to 100K	To 0.01%	±5 ppm/°C (10 & above) and ±10 ppm°C (below 10)	—	0.0025% (25 ppm) Max R/yr	5 watts	—	<0.08 µH	—	0.450 x 0.630 x 0.315 (11.43) x (16.00) x (8.00)
VPR7						7 watts				0.450 x 1.030 x 0.315 (11.43) x (26.16) x (8.00)

1, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

Precision Power Plate Resistors for Current Sensing & Power Surge Applications

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at +25°C	Nominal Plate Dimensions Inch (mm) W x L x H	Shelf-Life Stability/Yr. (Max. ΔR)[3]	Load-Life Stability/Yr. (Max. ΔR)[3]	Resistance Element Area Sq. In.	Nominal TCR[2]
V3PR-300589	10-5K	±0.005%	3W in air; 10W on heat sink	1.000 x 1.000 x 0.025 (25.4) x (25.4) x (0.635)	25 ppm after 1 year	0.03% 2,000 hrs. @ +125°C	0.98	±2 ppm/°C
V3PR-300586 (2 R's)	0.25	±15%	25W*	1.600 x 1.700 x 0.025 (40.64) x (43.18) x (0.635)			0.98	±10 ppm/°C
V3PR-300338	0.5	±0.5%						
V3PR-300571	1.0	±0.25%	20W*	1.750 x 1.120 x 0.025 (44.45) x (28.45) x (0.635)			0.658	
V3PR-300572	2.0	±0.25%	20W*	1.750 x 1.120 x 0.025 (44.45) x (28.45) x (0.635)			0.658	
V3PR-300610 (4 R's)[7]	2.0	±15%	>100W*	4.000 x 5.000 x 0.025 (101.6) x (127.0) x (0.635)			11.20	

*Power is 10 W/sq. in. when a heat sink, which keeps the foil temperature below 100°C, is used.
1, 2, 3, 7 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

Molded Precision Power and Current Sensing Resistors

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Maximum Working Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability/Yr. (Max. ΔR)[3]	Load-Life Stability/Yr. (Max. ΔR)[3]	Nominal TCR[2]	Standard Spread
VFP-3	0.10 – 80K	±0.01% tightest	3W in air; 10W on heat sink	350V	0.276 x 1.575 x 0.787 (7.0) x (40.0) x (20.0)	0.0025% R/year	0.05% Maximum R under full rated power of 3 watts @ +25°C	0°C to +25°C	±1.5 ppm/°C
VFP-4	0.05 – 500	to ±5.0% loosest						+0.6 ppm/°C	
								+25°C to +60°C	±1.5 ppm/°C
								−0.6 ppm/°C	
								−55°C to +25°C	±2.0 ppm/°C
								+2.2 ppm/°C	
								+25°C to +125°C	±2.0 ppm/°C
								-1.8 ppm/°C	

1, 2, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

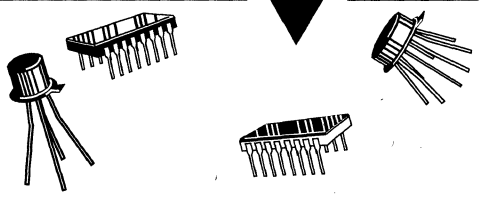
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Resistor Networks

BULK METAL® RESISTORS

Precision, Hermetically-Sealed, Miniature TOs, DIPs and Other Packages



Product Capabilities

- Ratio tolerance to 0.0025%
- TCR tracking to 0.5 ppm/°C combined with absolute TCR of 1.0 ppm/°C — virtually not affected by temperature gradients
- Ratio stability under load-life conditions better than 10 ppm
- Rise time to 1 nanosecond, no ringing
- Noise better than -32dB
- Hermetically sealed

The Precision Resistor Network Division of VISHAY manufactures products that add a new dimension of performance to Bulk Metal® Foil technology.

Smaller package sizes, tighter resistance matches, closer tracking and high stability are all achieved when foil chip resistors are bonded into a ceramic DIP or metal enclosure and hermetically sealed.

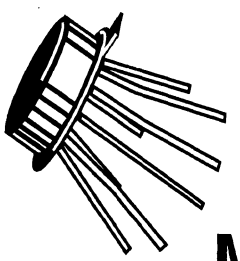
Model Number	Type Package	Max Quantity of V5 x 5 (V15x5) Resistors	Max R Value Each V5 x 5 (V15x5) Resistors	Tolerance Ratio Between Resistors @ +25°C To	Max. Dimensions Excluding leads Inch (mm) H x D – pin circle	TCR (Ref. @+25°C)
1401	3 pin TO-18	2 (1)	10K (30K)	N/A	0.200 x 0.230 - 0.100 (5.08) x (5.84) - (2.54)	0° to +60°C –55°C to +125°C Nominal ±0.6 ppm/°C +2.2 ppm/°C (–55°C to +25°C) –1.8 ppm/°C (+25°C to +125°C) Standard Spread ±1.5 ppm/°C ±2.0 ppm/°C Maximum Spread ±2.5 ppm/°C ±2.3 ppm/°C Tracking Available To ±0.5 ppm/°C ±0.5 ppm/°C
1403	4 pin TO-18	5 (1)	10K (30K)	0.0025%	0.200 x 0.230 - 0.100 (5.08) x (5.84) - (2.54)	
1413	8 pin TO-5	9 (3)	10K (30K)	0.0025%	0.200 x 0.370 - 0.200 (5.08) x (9.40) - (5.08)	
1417	8 pin TO-5	12 (3)	10K (30K)	0.0025%	0.200 x 0.370 - 0.230 (5.08) x (9.40) - (5.84)	
1419	10 pin TO-5	12 (3)	10K (30K)	0.0025%	0.200 x 0.370 - 0.230 (5.08) x (9.40) - (5.84)	
1421	12 pin TO-8	49 (16)	10K (30K)	0.0025%	0.150 x 0.610 - 0.400* (3.81) x (15.49) - (10.16)*	
1422	16 pin TO-8	49 (16)	10K (30K)	0.0025%	0.200 x 0.610 - 0.375* (5.08) x (15.49) - (9.53)*	
1442	8 pin DIP	12 (4)	10K (30K)	0.0025%	H x L x W - Lead Spacing 0.200*** x 0.540 x 0.310 - 0.300 (5.08) x (13.72) x (7.87) - (7.62)	
1445	14 pin DIP	30 (10)	10K (30K)	0.0025%	0.200*** x 0.785 x 0.310 - 0.300 (5.08) x (19.94) x (7.87) - (7.62)	
1446	16 pin DIP	36 (12)	10K (30K)	0.0025%	0.200*** x 0.810 x 0.310 - 0.300 (5.08) x (20.57) x (7.87) - (7.62)	
1457	18 pin DIP	80 (25)	10K (30K)	0.0025%	0.200*** x 1.020 x 0.510 - 0.300 (5.08) x (25.91) x (12.95) - (7.62)	
1460	20 pin 1" x 1" Plug-in	221 (73)	10K (30K)	0.0025%	0.230*** x 1.020 x 0.910 - 0.900 (5.84) x (25.91) x (23.11) - (22.86)	
1476	30 pin 1" x 1" Flat Pack	225 (75)	10K (30K)	0.0025%	0.125 x 1.148 x 0.960 - 0.05** (3.18) x (29.16) x (24.38) - (1.27)**	
1485	16 pin Leadless Chip Carrier	12 (4)	10K (30K)	0.0025%	0.090 x 0.295 x 0.360 - 0.050 (2.29) x (7.49) x (9.14) - (1.27)	

* pin square ** axial lead pin spacing *** height from standoff

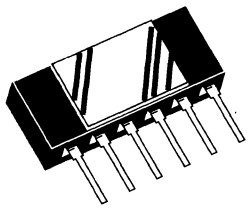
VISHAY's Precision Resistor Network products are based on fabrication from a standing inventory of packages and resistor chips. This permits quick delivery of prototypes since there are no masks to design or trial processings to be made. Further, it allows any combination of values, tolerances and circuits. There are normally no engineering or setup charges, and no minimum quantities are required. Delivery can be in as few as five days.

The sequence of fabrication includes selection of chips, die attachment, wirebonding, value trimming, and hermetic sealing. The finished product provides the stability associated with foil resistors in a hermetically sealed miniature package.

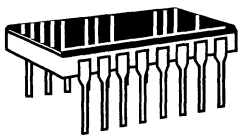
63 Lincoln Hwy. ■ Malvern, PA 19355 ■ (215) 644-1300 ■ FAX (215) 296-0657 ■ Sales FAX (215) 640-9081 ■ TWX 510-668-8944



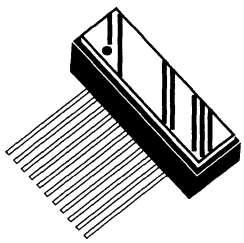
VISHAY
Bulk Metal® Resistors
of VISHAY Intertechnology, Inc.

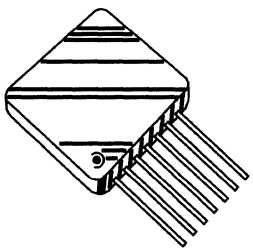


Precision, Hermetically-Sealed
Miniature Resistor Networks



Prototypes In 10 Working Days
No N.R.E., Setup or Front End Design Costs





Ratio tolerance to 0.005%

Resistance Range: 5Ω to 30K and beyond

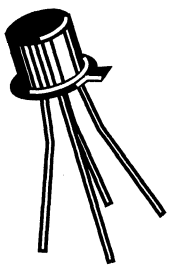
TCR: ±5 ppm/°C (-55°C to +125°C, ref +25°C)

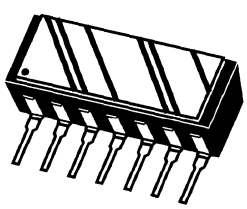
TCR tracking: to 0.5 ppm/°C

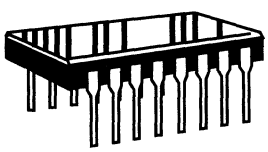
Ratio stability under load-life conditions < 0.01%

Rise time to 1 nanosecond, no ringing

Noise less than –32dB







To place your prototype order, contact applications engineering at (215) 644-1300.
Tighter specifications* are available, see Catalog VPN2500.

*Longer delivery for prototypes may be required.

Using an inventory of DIPs, SIPs, LCCs, TOs and flatpack packages, coupled with a comprehensive inventory of wire-bondable chips in Bulk Metal®Foil and Thin Film, we can help you design your network, manufacture and ship it within 10 working days of design finalization! Should your application call for thick film, these prototype networks will allow you to test your design easily and efficiently in its early stages.

Technologies: Bulk Metal® Foil, Thin Film

Packages: DIPs, SIPs, LCCs, TOs, Flatpacks

63 Lincoln Hwy. ■ Malvern, PA 19355 ■ (215) 644-1300 ■ FAX (215) 296-0657 ■ Sales FAX (215) 640-9081 ■ TWX 510-668-8944

A COMPANY OF VISHAY BULK METAL® RESISTORS

R/2R Ladder Combined Technology Networks

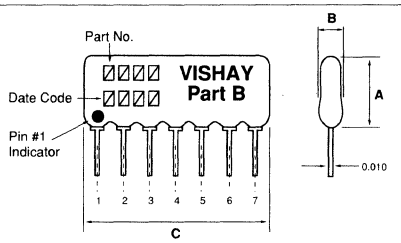
Gives a specified performance at lowest possible price.

- Networks in thick, thin, and foil technologies.
- Networks in SIP, DIP, and hermetic packages.
- 1/2 LSB accuracy from 5 to 15 bits.
  1 LSB accuracy — 16 bits.
- Temperature compensated.
- R = 1K, 10K or 100K.

When resistors are grouped in an array, with access to various bit switches, their electrical schematic appears to look like a ladder — hence, the name "ladder networks".

Dimensions

5 BITS, Thick Film, Part Numbers 314945 - 314947

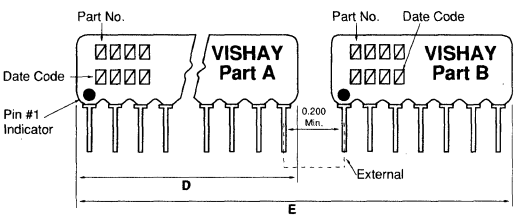


Dimensions	
A	0.350 Max.
B	0.100 Max.
C	0.716 Max.
Leads	0.020 x 0.010 x 0.120 Min length on 0.100 centers
PIN #1 is output PIN #2 is MSB	

Dimensions are in inches.

6 - 11 BITS, Thick Film/Thin Film, Part Numbers 314948 - 314965

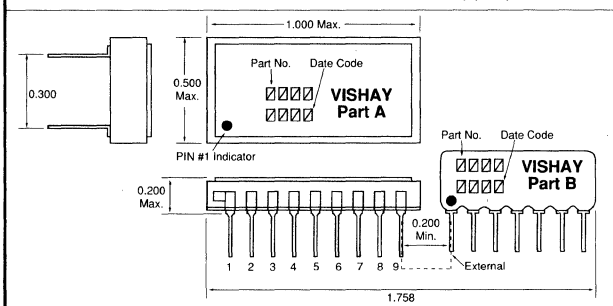
Include the appropriate Thick and Thin Film parts.



Dimensions		
Bits	D	E
6	0.316	1.116
7	0.416	1.216
8	0.516	1.316
9	0.616	1.416
10	0.716	1.516
11	0.816	1.616
PIN #1 is output PIN #2 is MSB		

Dimensions are in inches.

12 - 16 BITS, Thick Film/Bulk Metal®Foil, Part Numbers 314966 - 314970 and 316030 - 316034 *Include the appropriate Thick Film and Foil parts.*



Pin Connection	
Bits	B to Pin # of A
12	9
13	10
14	11
15	12
16	13
PIN #1 is output PIN #2 is MSB	

Dimensions are in inches.

Part Numbers, Minimum Quantity, Price

Ladder # Bits	Min Qty	R=1K VISHAY P/N	R=10K VISHAY P/N	R=100K VISHAY P/N	Package Style & # Pins A	Total Pins A & B	Length† A	Total Length† (In Line)	Technology	TCR ppm/°C 0° to 60°C	Track ppm/°C 0°C to 60°C
5	250	314945	314946	314947	—	7	—	0.716	Thick Film	100	20
6	100	314948	314954	314960	SIP-3	10	0.316	1.116	Thick Film/Thin Film	25	5
7	100	314949	314955	314961	SIP-4	11	0.416	1.216	Thick Film/Thin Film	25	5
8	100	314950	314956	314962	SIP-5	12	0.516	1.316	Thick Film/Thin Film	10	2
9	50	314951	314957	314963	SIP-6	13	0.616	1.416	Thick Film/Thin Film	10	2
10	25	314952	314958	314964	SIP-7	14	0.716	1.516	Thick Film/Thin Film	10	2
11	25	314953	314959	314965	SIP-8	15	0.816	1.616	Thick Film/Thin Film	10	2
12	1	314966	316030	N/A	DIP-18	25	1.00	1.758	Thick Film/Bulk Metal®Foil	5	1
13	1	314967	316031	N/A	DIP-18	25	1.00	1.758	Thick Film/Bulk Metal®Foil	5	1
14	1	314968	316032	N/A	DIP-18	25	1.00	1.758	Thick Film/Bulk Metal®Foil	5	1
15	1	314969	316033	N/A	DIP-18	25	1.00	1.758	Thick Film/Bulk Metal®Foil	5	1
16	1	314970	316034	N/A	DIP-18	25	1.00	1.758	Thick Film/Bulk Metal®Foil	5	1

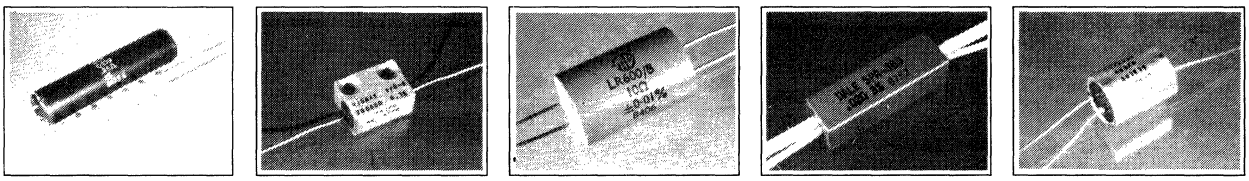
* Divide by 2 to get the 100 piece price N/A: not available † Length: dimensions are in inches

VISHAY BULK METAL®RESISTORS ■ 63 Lincoln Highway ■ Malvern, PA 19355
Phone (215) 644-1300 ■ Fax (215) 296-0657 ■ Sales Fax (215) 640-9081 ■ TWX 510-668-8944

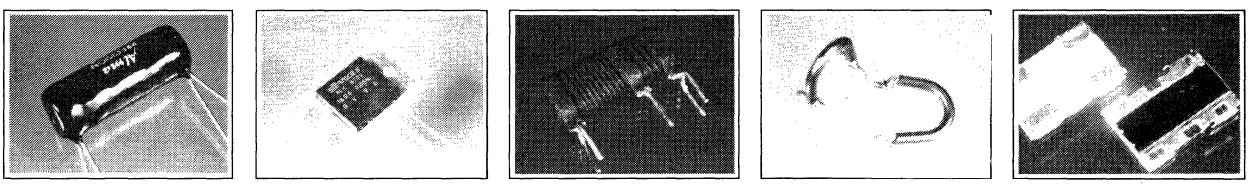
Precision Current Sensors

Tight Tolerance — Low TCR

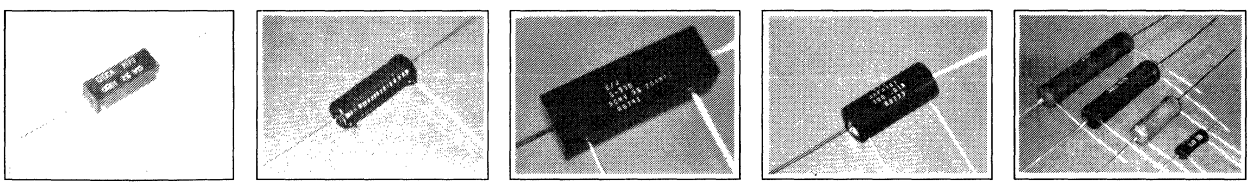
Axial Leaded Current Sensors



Radial Leaded Current Sensors



Axial/Radial Leaded Current Sensors



Precision Current Sensors are not normally considered high current devices. For high current and power devices, refer to EEM section 2900, Precision Current Shunts, VISHAY Electronic Components Group.

From the various VISHAY Electronic Components Group's facilities around the world, comes a range of products based on resistive foil, wire, thin film and thick film technologies. Precision current sensors from 0.005 Ω to "K" range values are available in a variety of four terminal configurations. Tolerances of ±0.001% are available, depending upon the device and resistance values. TCR as low as ±1 ppm/°C is available over limited temperature ranges.

Both thin film and thick film technologies are available in chip form with sub-ohmic values and four terminal wrap-around terminations.

FAX your requirements to (619) 690-2632,
or call our Shunt Coordinator at (619) 690-1432 for assistance.

W O R L D P R O D U C T S

SANKEN ELECTRIC METAL OXIDE VARISTORS–SNR SERIES



ELECTRIC CHARACTERISTICS-ASIAN STANDARD (Featuring Sanken's New Super "S" Series)

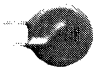
Part Number (SNR)	Actual Part Marking	Disc. Dia. Size (mm)	Rated Voltage		Varistor Voltage @ 1mA DC (Volts)	Rated Peak Single Pulse Transient Current 8/20μs (Amps)	Rated Single Pulse Transient Energy (Joules)			Maximum Clamping Voltage @ Test Current 8/20μs		Typical Capacitance @ 1KHZ (Picofards)
			AC Volts (RMS)	DC (Volts)			8/20μs	10/1000μs	2ms	(Volts)	(Amps)	
8ROMD05	8ROM	5	4.0	5.5	8(6 ~ 11)	50	0.05	0.2	0.2	22	1	2000
8ROMD07	8ROM	7				125	0.1	0.4	0.4	20	2.5	5000
8ROMD10	8ROM	10				250	0.2	0.8	0.8	20	5	9500
120MD05	120M	5	6.0	8.0	12(9 ~ 16)	50	0.07	0.3	0.3	32	1	1500
120MD07	120M	7				125	0.15	0.6	0.6	30	2.5	3500
120MD10	120M	10				250	0.25	1.2	1.2	30	5	7000
180LD05	180L	5	11	14	18(15 ~ 21)	100	0.15	0.3	0.3	42	1	1000
180LD07	180L	7				250	0.4	0.8	0.8	38	2.5	2300
180LD10	180L	10				500	0.8	1.5	1.5	38	5	5500
180LD14	180L	14				1000	1.6	3.5	3.5	38	10	9500
220KD05	220K	5	14	18	22(20 ~ 24)	100	0.2	0.4	0.4	48	1	950
220KD07	220K	7				250	0.5	0.9	0.9	43	2.5	2000
220KD10	220K	10				500	1	2	2	43	5	4500
220KD14	220K	14				1000	2	4	4	43	10	8000
270KD05	270K	5	17	22	27(24 ~ 30)	100	0.25	0.5	0.5	60	1	930
270KD07	270K	7				250	0.65	1	1	53	2.5	1800
270KD10	270K	10				500	1.3	2.5	2.5	53	5	3500
270KD14	270K	14				1000	2.7	5	5	53	10	6700
330KD05	330K	5	20	27	33(30 ~ 36)	100	0.3	0.6	0.6	73	1	800
330KD07	330K	7				250	0.8	1.2	1.2	65	2.5	1500
330KD10	330K	10				500	1.6	3	3	65	5	3000
330KD14	330K	14				1000	3.4	6	6	65	10	5800
390KD05	390K	5	25	31	39(35 ~ 43)	100	0.3	0.8	0.8	86	1	600
390KD07	390K	7				250	0.95	1.5	1.5	77	2.5	1300
390KD10	390K	10				500	1.9	3.5	3.5	77	5	2500
390KD14	390K	14				1000	3.8	7.2	7	77	10	5000
470KD05	470K	5	30	38	47(42 ~ 52)	100	0.4	1	1	104	1	450
470KD07	470K	7				250	1.1	1.8	1.8	93	2.5	1100
470KD10	470K	10				500	2.3	4.5	4.5	93	5	2200
470KD14	470K	14				1000	4.5	8.8	8.5	93	10	4000
560KD05	560K	5	35	45	56(50 ~ 62)	100	0.45	1	1	123	1	350
560KD07	560K	7				250	1.25	2.3	2.2	110	2.5	950
560KD10	560K	10				500	2.8	5.5	5.5	110	5	1900
560KD14	560K	14				1000	5.5	10	10	110	10	3800
680KD05	680K	5	40	56	68(61 ~ 75)	100	0.6	1.2	1.2	150	1	320
680KD07	680K	7				250	1.6	3	2.5	135	2.5	850
680KD10	680K	10				500	3.5	6.5	6.5	135	5	1600
680KD14	680K	14				1000	6.9	13	12	135	10	3400
820KD05	820K	5	50	66	82(74 ~ 90)	400	1.9	1.7	1.7	143	5	150
820KD07	820K	7				1200	6.8	4	3.5	135	10	400
820KD10	820K	10				2500	15	8	8	135	25	800
820KD14	820K	14				4500	27	15	14	135	50	1600
101KD05	101K	5	60	85	100(90 ~ 110)	400	2.3	2	2	172	5	130
101KD07	101K	7				1200	8.4	5	4	165	10	320
101KD10	101K	10				2500	20	10	10	165	25	700
101KD14	101K	14				4500	30	20	18	165	50	1400
121KD05	121K	5	75	102	120(108 ~ 132)	400	2.8	2.5	2.5	210	5	110
121KD07	121K	7				1200	10	6	5	200	10	280
121KD10	121K	10				2500	24	12	12	200	25	550
121KD14	121K	14				4500	38	22	20	200	50	1200
151KD05	151K	5	95	127	150(135 ~ 165)	400	3.5	3	3	260	5	95
151KD07	151K	7				1200	12	8	6	250	10	230
151KD10	151K	10				2500	26	15	16	250	25	470
151KD14	151K	14				4500	45	30	25	250	50	950
201KD05	201K	5	130	175	205(184 ~ 225)	400	4.2	4	4	355	5	70
201KD07	201K	7				1200	15	11	10	340	10	170
201KD10	201K	10				2500	32	20	20	340	25	350
201KD14	201K	14	130	175	205(184 ~ 225)	4500	55	38	35	340	50	700
*201KD20(S)	201K(S)	20				6500	80	70	70	340	100	1500
***S201K20(S)**	**S20120(S)**	17				**9000**	**120**	**100**	**100**	**340**	**100**	**1250**
221KD05	221K	5	140	185	220(198 ~ 242)	400	4.6	4.5	4.5	375	5	60
221KD07	221K	7				1200	16	12	10	360	10	150
221KD10	221K	10				2500	36	22	23	360	25	310
221KD14	221K	14				4500	60	42	40	360	50	650
*221KD20(S)	221K(S)	20				6500	90	75	75	360	100	1300
***S221K20(S)**	**S22120(S)**	17				**9000**	**135**	**110**	**110**	**360**	**100**	**1150**
241KD05	241K	5	150	200	240(216 ~ 264)	400	5	5	5	415	5	60
241KD07	241K	7				1200	17	13	10	395	10	140
241KD10	241K	10				2500	40	25	25	395	25	290
241KD14	241K	14				4500	65	45	40	395	50	600
*241KD20(S)	241K(S)	20				6500	95	80	80	395	100	1200
***S241KD20(S)**	**S24120(S)**	17				**9000**	**150**	**120**	**120**	**395**	**100**	**1050**

Note: Power dissipation not to exceed 0.1, 0.25, 0.4, 0.6, 1.0 watts for sizes 5, 7, 10, 14, 17 and 20, respectively. *(S)=10mm±0.8mm or 0.39"±0.031" leadspacing (W, dimension).

WP® WORLD PRODUCTS INC.
19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380

W O R L D P R O D U C T S

SANKEN ELECTRIC METAL OXIDE VARISTORS–SNR SERIES

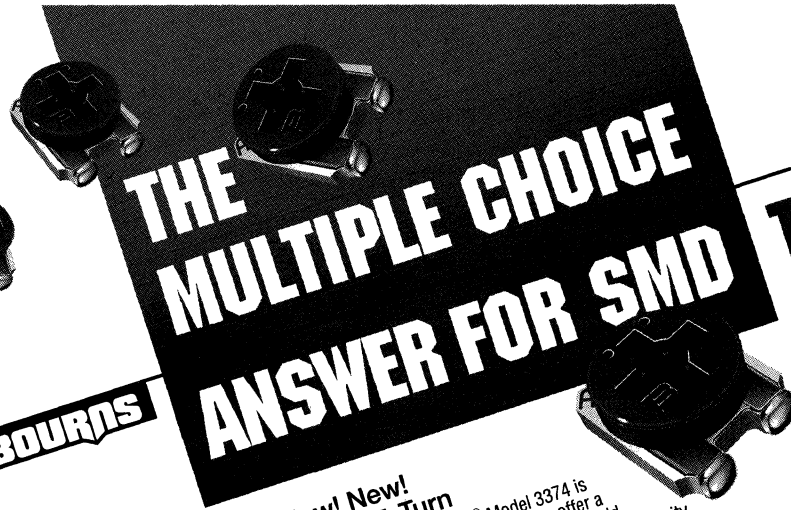


ELECTRIC CHARACTERISTICS-ASIAN STANDARD (Featuring Sanken's New Super "S" Series)

Part Number (SNR)	Actual Part Marking	Disc. Dia. Size (mm)	Rated Voltage		Varistor Voltage @ 1mA DC (Volts)	Rated Peak Single Pulse Transient Current 8/20µs (Amps)	Rated Single Pulse Transient Energy (Joules)			Maximum Clamping Voltage @ Test Current 8/20µs		Typical Capacitance @ 1KHZ (Picofards)
			AC Volts (RMS)	DC (Volts)			8/20µs	10/1000µs	2ms	(Volts)	(Amps)	
271KD05	271K	5	175	225	270(247 ~ 303)	400	6	6	6	475	5	55
271KD07	271K	7				1200	19	15	12	455	10	120
271KD10	271K	10				2500	43	30	30	455	25	270
271KD14	271K	14				4500	68	55	50	455	50	540
*271KD20(S)	271K(S)	20				6500	110	90	90	455	100	1100
***S271K20(S)**	**S27120(S)**	17				**9000**	**165**	**135**	**135**	**455**	**100**	**950**
331KD05	331K	5	210	270	330(297 ~ 363)	400	7.5	7.5	7.5	570	5	55
331KD07	331K	7				1200	23	16	15	540	10	110
331KD10	331K	10				2500	45	35	35	540	25	270
331KD14	331K	14				4500	75	60	60	540	50	500
*331KD20(S)	331K(S)	20				6500	132	110	110	540	100	1000
***S331K20(S)**	**S33120(S)**	17				**9000**	**195**	**160**	**160**	**540**	**100**	**800**
361KD05	361K	5	230	300	360(324 ~ 396)	400	7.5	7.5	7.5	620	5	50
361KD07	351K	7				1200	25	20	15	595	10	100
361KD10	361K	10				2500	50	35	35	595	25	250
362KD14	361K	14				4500	85	70	65	595	50	450
*361KD20(S)	361K(S)	20				6500	140	120	120	595	100	950
***S361K20(S)**	**S36120(S)**	17				**9000**	**215**	**180**	**180**	**595**	**100**	**740**
391KD05	391K	5	250	330	390(351 ~ 429)	400	8	8	8	675	5	50
391KD07	391K	7				1200	26	21	17	650	10	90
391KD10	391K	10				2500	55	40	40	650	25	190
391KD14	391K	14				4500	92	72	70	650	50	360
*391KD20(S)	391K(S)	20				6500	140	130	130	650	100	770
***S391KD20(S)**	**S39120(S)**	17				**9000**	**225**	**195**	**195**	**650**	**100**	**680**
431KD05	431K	5	275	370	430(387 ~ 473)	400	9	9	9	745	5	45
431KD07	431K	7				1200	29	23	20	710	10	85
431KD10	431K	10				2500	60	45	45	710	25	180
431KD14	431K	14				4500	100	75	75	710	50	350
*431KD20(S)	431K(S)	20				6500	150	140	140	710	100	700
***S431K20(S)**	**S43120(S)**	17				**9000**	**240**	**215**	**215**	**710**	**100**	**620**
471KD05	471K	5	300	405	470(423 ~ 517)	400	10	10	10	810	5	40
471KD07	471K	7				1200	32	25	20	775	10	80
471KD10	471K	10				2500	65	45	45	775	25	170
471KD14	471K	14				4500	110	80	80	775	50	320
*471KD20(S)	471K(S)	20				6500	160	150	150	775	100	650
***S471K20(S)**	**S47120(S)**	17				**9000**	**255**	**250**	**250**	**775**	**100**	**580**
561KD10	561K	10	350	460	560(504 ~ 616)	2500	69	45	45	910	25	170
561KD14	561K	14				4500	140	85	85	910	50	280
*561KD20(S)	561K(S)	20				6500	215	150	150	910	100	620
***S561K20(S)**	**S56120(S)**	17				**9000**	**315**	**250**	**250**	**910**	**100**	**500**
621KD10	621K	10	385	505	620(558 ~ 682)	2500	80	45	45	1025	25	150
621KD14	621K	14				4500	150	85	85	1025	50	250
*621KD20(S)	621K(S)	20				6500	230	150	150	1025	100	570
***S621K20(S)**	**S62120(S)**	17				**9000**	**350**	**250**	**250**	**1025**	**100**	**450**
681KD10	681K	10	420	560	680(612 ~ 748)	2500	85	45	45	1120	25	120
681KD14	681K	14				4500	150	90	90	1120	50	230
*681KD20(S)	681K(S)	20				6500	230	160	160	1120	100	470
***S681K20(S)**	**S68120(S)**	17				**9000**	**375**	**270**	**270**	**1120**	**100**	**420**
751KD10	751K	10	460	615	750(675 ~ 825)	2500	100	50	50	1240	25	120
751KD14	751K	14				4500	175	100	100	1240	50	220
*751KD20(S)	751K(S)	20				6500	270	175	175	1240	100	480
***S751K20(S)**	**S75120(S)**	17				**9000**	**390**	**300**	**300**	**1240**	**100**	**380**
781KD10	781K	10	485	640	780(702 ~ 858)	2500	105	50	50	1290	25	110
781KD14	781K	14				4500	185	108	105	1290	50	210
*781KD20(S)	781K(S)	20				6500	285	185	180	1290	100	470
***S781K20(S)**	**S78120(S)**	17				**9000**	**410**	**310**	**310**	**1290**	**100**	**370**
821K10	821K	10	510	675	820(738 ~ 902)	2500	110	55	55	1355	25	100
821KD14	821K	14				4500	185	110	110	1355	50	200
*821KD20(S)	821K(S)	20				6500	280	190	190	1355	100	410
***S821K20(S)**	**S82120(S)**	17				**9000**	**430**	**325**	**325**	**1355**	**100**	**350**
911KD10	911K	10	550	745	910(819 ~ 1001)	2500	125	63	60	1500	25	95
911KD14	911K	14				4500	215	125	120	1500	50	190
*911KD20(S)	911K(S)	20				6500	335	220	215	1500	100	420
***S911K20(S)**	**S91120(S)**	17				**9000**	**455**	**360**	**360**	**1500**	**100**	**320**
102KD10	102K	10	625	825	1000(900 ~ 1100)	2500	135	68	65	1650	25	90
102KD14	102K	14				4500	240	136	130	1650	50	180
*102KD20(S)	102K(S)	20				6500	360	235	230	1650	100	380
***S102K20(S)**	**S10220(S)**	17				**9000**	**495**	**400**	**400**	**1650**	**100**	**290**
112KD10	112K	10	680	895	1100(990 ~ 1210)	2500	155	75	70	1815	25	85
112KD14	112K	14				4500	262	152	140	1815	50	170
*112KD20(S)	112K(S)	20				6500	405	259	250	1815	100	360
***S112K20(S)**	**S11220(S)**	17				**9000**	**540**	**440**	**440**	**1815**	**100**	**270**

Note: Power dissipation not to exceed 0.1, 0.25, 0.4, 0.6, 1.0 watts for sizes 5, 7, 10, 14, 17 and 20, respectively. *(S)=10mm±0.8mm or 0.39″±0.031″ leadspacing (W, dimension).

WORLD PRODUCTS INC.
19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380



THE MULTIPLE CHOICE ANSWER FOR SMD TRIMMERS

BOURNS

New! New! New! 4mm Sealed 5-Turn

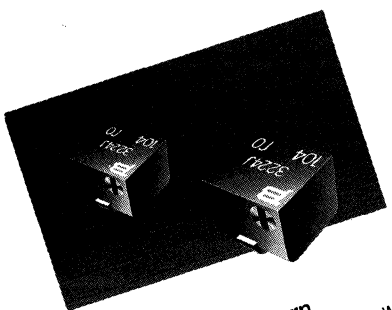
The all process compatible Bourns® Model 3374 is the first elastomer sealed chip-style device to offer a minimum 5-turn seal life. The Model 3374 allows field adjust capability after soldering while maintaining seal integrity.

Size	4.9mmL x 4.0mmW x 2.0mmH
Contact Resistance Variation	3% max.
Resistance Range	10 ohms to 2 megohms ± 20%
Temperature Coefficient	±100ppm/°C
Seal Life	5 cycles
Rotational Life	100 cycles



Model 3304 4mm Open-Frame Single-Turn

Size	4.8mmL x 3.8mmW x 2.4mmH
Contact Resistance Variation	5% max.
Resistance Range	10 ohms-2 megohms, ±25%
Temperature Coefficient	±200ppm/°C
Rotational Life	20 cycles



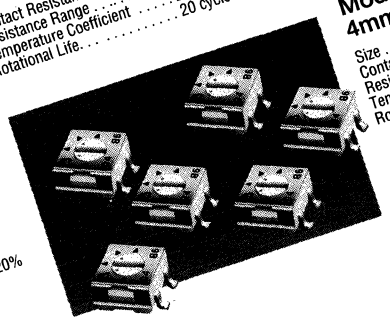
Model 3224 4mm Sealed Multiturn

Size	4.6mmL x 4.8mmW x 3.7mmH
Contact Resistance Variation	1% max.
Resistance Range	10 ohms-2 megohms, ±10%
Temperature Coefficient	±100ppm/°C
Rotational Life	200 cycles



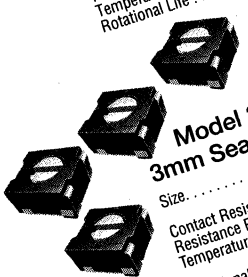
Model 3363 3mm Open-Frame Single-Turn

Size	3.6mmL x 3.0mmW x 1.3mmH
Contact Resistance Variation	5% max.
Resistance Range	100 ohms-1 megohm, ±25%
Temperature Coefficient	±250ppm/°C
Rotational Life	20 cycles



Model 3314 4mm Sealed Single-Turn

Size	4.5mmSq x 2.55mmH
Contact Resistance Variation	1% max.
Resistance Range	10 ohms-2 megohms, ±20%
Temperature Coefficient	±100ppm/°C
Rotational Life	100 cycles



Model 3313 3mm Sealed Single-Turn

Size	3.5mmL x 3.2mmW x 2.2mmH
Contact Resistance Variation	2% max.
Resistance Range	10 ohms to 2 megohms ± 20%
Temperature Coefficient	≤100 ohms ±150ppm/°C >100 ohms ±100ppm/°C
Rotational Life	100 cycles

Trimmer Processability Guidelines

Model	Packaging	Sealed/Open	Soldering
3224	7 In. Reel	Sealed	Wave & Reflow
3304	7 In. Reel & 13 In. Reel	Open	Reflow Only
3313	7 In. Reel & 13 In. Reel	Sealed	Wave & Reflow
3314	7 In. Reel	Sealed	Wave & Reflow
3363	7 In. Reel	Open	Wave & Reflow
3374	7 In. Reel & 13 In. Reel	Sealed	Wave & Reflow

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BOURNS®

BOURNS TRIMPOT

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POTENTIOMETERS/RHEOSTATS†

Manufacturer	Starting EEM Page No.	Features: Resistive Element Material: Carbon Film	Carbon Comp.	Conductive Plastic	Hybrid	Wirewound	Features: Mechanical Adjustment: Single turn	Multi-turn	Slider Motion	Non-linear Tapers	High Power >5 W	Precision	Mounting: Linear Thru Panel	PCB	Servo Adj.	Surface	Switch	Multi-sect.	Other Features
Angstrom Precision	A•2015					√	√	√			√	√	√			√			
Beckman Industrial Corp.	A•2016			√	√	√	√	√	√			√	√	√	√			√	
Bourns Inc.	A•2018			√	√	√	√	√		√		√		√	√				
Clarostat Mfg. Inc.	A•2030		√	√			√	√		√			√	√			√	√	
CRL Comps.	A•2031	√	√				√			√			√	√					
Dale Electronics	A•2032	√		√	√	√	√	√	√	√	√	√	√	√		√			
Duncan Electronics	A•2038			√	√	√	√	√	√	√		√	√		√		√	√	
ETI Systems	A•2040				√	√		√	√			√	√		√	√			
ISL Products Int'l	A•2042	√	√			√	√	√	√	√		√	√	√		√	√	√	
JDK Controls	A•2043			√			√			√		√			√			√	Element & wiper assembs.
Mallory Controls	A-2064					√	√		√	√	√		√				√		
Maurey Instrument Corp.	A•2045			√		√	√					√	√				√		MIL
Memcor-Truohm	A•2054					√				√			√						
Murata Erie	A•2058	√	√				√	√						√		√			
Noble USA	A•2061	√				√	√		√	√			√	√		√	√	√	Custom
Precision Control Manufacturing Inc.	A•2062					√	√	√				√	√						Vernier & decade
RDI Electronics	A•2063	√					√		√	√			√	√			√		
Shokai Far East	A•2069	√				√	√	√	√	√			√	√			√	√	
Spectrol Electronics	A•2066			√	√	√	√	√		√	√	√	√	√	√		√	√	
Tocos America Inc.	A•2070	√				√	√		√	√			√	√			√	√	
Vernitech	A•2072			√	√	√	√	√	√	√		√	√	√	√		√	√	
Vernitron International	A•2073			√		√	√	√	√	√	√	√	√	√		√	√	√	Cermet
Vishay Resistive Systems Group	A•2076						√	√				√							
Waters Mfg./ Talley Industries	A•2078			√		√	√	√	√			√			√				Torque watch gauges
Wilbrecht	A•2077			√			√			√			√	√		√	√		

† A rheostat is a two-terminal variable resistor. When both ends of the resistance element and the slider contact (three terminals) are used, it's called a potentiometer . By tradition, nevertheless, power variable resistors are often referred to as rheostats, no matter how used.

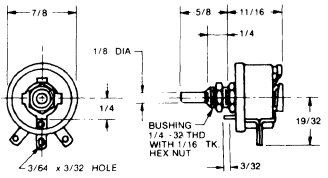
TRIMMERS

Manufacturer	Starting EEM Page No.	Resistive Element Material						Features								
								Mechanical Adjustment		Motion			Mounting			
		Carbon Film	Carbon Comp.	Cermet	Conductive Plastic	Metal Film	Wirewound	Single Turn	Multi-turn	Linear	Non-linear	Precision	Thru Panel	PCB	Surface	Multi-section
Beckman Industrial Corp.	A•2016			√				√	√	√			√	√	√	
Bourns Inc.	A•2018	√		√			√	√	√					√	√	
Clarostat Mfg. Inc.	A•2030		√	√	√		√	√	√		√	√		√		
Dale Electronics	A•2032	√		√	√	√	√	√	√	√	√	√	√	√	√	
ISL Products International	A•2042	√	√	√		√	√	√	√	√	√	√	√	√	√	√
Mallory Controls	A•2064						√	√			√		√			
Murata Erie North America Inc.	A•2058	√	√	√				√	√					√	√	
Noble U.S.A.	A•2061	√		√		√		√						√	√	
Shokai Far East	A•2069	√		√				√	√	√	√		√	√		
Spectrol Electronics	A•2066			√			√	√	√				√	√	√	
Tocos America Inc.	A•2070	√		√			√	√	√	√				√	√	
Vernitech	A•2072			√			√	√	√	√	√	√	√	√	√	
Vernitron/VRN International	A•2073			√	√		√	√	√	√	√	√	√	√	√	√
Vishay Resistive Systems Group	A•2076							√	√			√		√		
Wilbrecht	A•2077				√			√		√	√				√	

A COMPANY OF VISHAY ANGSTROHM

Power Rheostat

Type MP06 12.5 watt

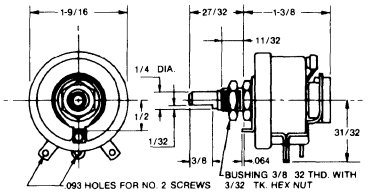


Diameter 7/8" ... Depth behind panel 11/16" ... Shaft 1/8" diameter ... Rotation 300°, ±5°. Mounts on panels up to 1/8" by means of 1/4"-32 bushing and hex nut ... Non-turn lugs require 1/8" hole 1/4" below center of shaft (Type "A" shaft). Weight: 0.037 lb., 17 Gms.

Resistance Values

Total Ohms	Max. Amps	Approx. Steps
1.0	3.53	29
2.0	2.50	42
2.5	2.24	38
3.0	2.04	44
5.0	1.58	40
6.0	1.44	48
8.0	1.25	51
10.0	1.12	51
15.0	0.91	51
25.0	0.71	73
35.0	0.60	75
50.0	0.50	86
75.0	0.41	103
100.0	0.35	108
125.0	0.32	128
150.0	0.29	128
175.0	0.27	148
200.0	0.25	130
250.0	0.22	166
350.0	0.19	185
500.0	0.16	215
750.0	0.13	255
1000.0	0.11	260
1500.0	0.091	310
2500.0	0.071	321
3500.0	0.060	378
5000.0	0.050	430

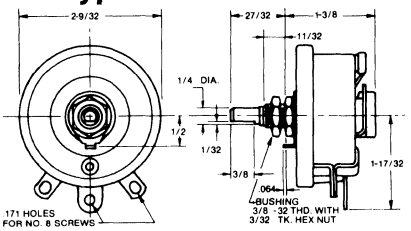
Type MP10 25 watt



Diameter 1 9/16" ... Depth behind panel 1 3/8" ... Shaft 1/4" diameter ... Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut ... Non-turn lugs require 3/16" hole 1/2" below center of shaft (Type "A" shaft). Weight: 0.180 lb., 82 Gms.

Total Ohms*	Max. Amps	Approx. Steps
1.0	5.00	28
2.0	3.54	31
3.0	2.89	48
6.0	2.04	51
8.0	1.77	54
10.0	1.58	54
15.0	1.29	64
25.0	1.00	86
35.0	0.85	105
50.0	0.71	115
75.0	0.58	135
100.0	0.50	152
125.0	0.45	143
175.0	0.38	160
250.0	0.32	185
350.0	0.27	205
500.0	0.22	230
750.0	0.18	270
1000.0	0.16	292
1500.0	0.13	353
2500.0	0.10	358
3500.0	0.08	392
5000.0	0.07	440

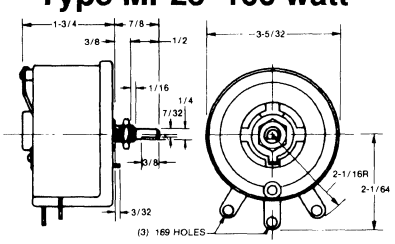
Type MP15 50 watt



Diameter 2 9/32" ... Depth behind panel 1 3/8" ... Shaft 1/4" diameter ... Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing andhex nut ... Non-turn lugs require 3/16" hole 1/2" below center of shaft (Type "A" shaft). Weight: 0.321 lb., 145 Gms.

Total Ohms	Max. Amps	Approx. Steps
0.5	10.00	24
1.0	7.07	46
2.0	5.00	50
4.0	3.54	44
6.0	2.89	74
8.0	2.50	85
12.0	2.04	108
16.0	1.76	108
22.0	1.50	123
35.0	1.19	148
50.0	1.00	113
80.0	0.79	147
125.0	0.63	178
150.0	0.58	173
225.0	0.47	203
300.0	0.41	214
500.0	0.32	290
800.0	0.25	365
1000.0	0.22	358
1600.0	0.18	367
2500.0	0.14	460
3500.0	0.12	505
5000.0	0.10	565
8000.0	0.08	695
10000.0	0.07	693

Type MP25 100 watt

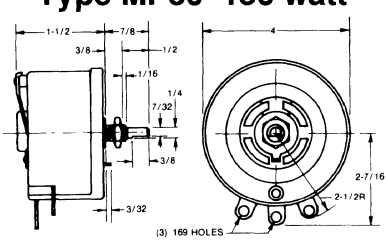


Diameter 3 5/32" ... Depth behind panel 1 1/2" ... Shaft 1/4" diameter ... Rotation 300°, ±5° ... Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut ... Non-turn lugs require a 3/16" hole 1/2" below center of shaft (Type "A" shaft). Weight: 0.594 lbs., 268 Gms.

Resistance Values

Total Ohms	Max. Amps	Approx. Steps
0.5	14.140	30
1.0	10.000	30
2.0	7.071	56
3.0	5.774	66
5.0	4.472	56
7.5	3.652	66
10.0	3.162	104
15.0	2.582	113
25.0	2.000	144
50.0	1.414	180
75.0	1.155	180
100.0	1.000	216
200.0	0.707	252
300.0	0.577	252
400.0	0.500	252
500.0	0.447	324
750.0	0.365	396
1000.0	0.316	410
2000.0	0.224	410
2500.0	0.200	410
5000.0	0.141	685
7500.0	0.115	820
10000.0	0.100	820

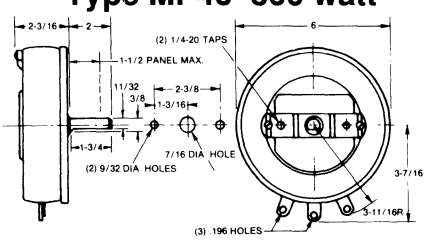
Type MP30 150 watt



Diameter 4" ... Depth behind panel 1 3/4" ... Shaft 1/4" diameter ... Rotation 300°, ±5° ... Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut ... Non-turn lugs require a 3/16" hole 1/2" below center of shaft (Type "A" shaft). Weight: 1.014 lbs., 460 Gms.

Total Ohms*	Max. Amps	Approx. Steps
0.5	17.350	35
1.0	12.247	39
2.0	8.660	39
3.0	7.071	70
5.0	5.477	73
7.5	4.472	70
10.0	3.873	70
15.0	3.162	120
25.0	2.449	152
50.0	1.732	190
75.0	1.414	228
100.0	1.225	228
200.0	0.866	265
300.0	0.707	303
400.0	0.612	342
500.0	0.548	342
750.0	0.447	418
1000.0	0.387	432
2000.0	0.274	575
2500.0	0.244	456
5000.0	0.173	865
7500.0	0.141	1000
10000.0	0.122	1000

Type MP40 300 watt



Diameter 6" ... Depth behind panel 2 3/16" ... Shaft 3/8" diameter ... Rotation 315°, ±5° ... Mounts on panels up to 1 1/4" by means of mounting bracket with two 1/4"-20 flat head screws (Type "A" shaft). Weight: 2.625 lbs., 1.191 Kg.

Total Ohms*	Max. Amps	Approx. Steps
1.0	17.320	40
1.5	14.142	58
2.0	12.247	78
2.5	10.954	78
3.0	10.000	73
4.0	8.660	78
5.0	7.745	78
7.5	6.324	148
10.0	5.477	154
15.0	4.472	147
25.0	3.464	155
35.0	2.927	231
50.0	2.449	267
75.0	2.000	308
100.0	1.732	326
150.0	1.414	270
200.0	1.224	308
300.0	1.000	340
400.0	0.866	370
500.0	0.774	455
750.0	0.632	514
1000.0	0.547	578
1500.0	0.447	675
2500.0	0.346	720

* Higher ranges available to 25,000 Ohms

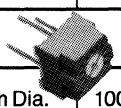
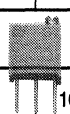
All other intermediate resistance values are available and can be manufactured on normal delivery cycle.
UL and CSA approved.

4410C Ocean Pines ■ Berlin, MD 21811 ■ (301) 641-6844 ■ FAX (301) 641-7413

Beckman Industrial™

Affiliate of Emerson Electric Co.

HELITRIM® Trimming Potentiometers

Model #	Size	Resistance Range, Ω	Resistance Tolerance	CRV	Power Rating, Watts	Seal: 85°C Fluorinert	Adjustment Option Top	Adjustment Option Side	Tape & Reel
Single Turn 									
24	4mm Dia.	100 to 1 Meg	±20%	±2%	0.5 at 70°C	✓	✓	✓	✓
25	1/4" Sq.	10 to 2 Meg	±20%	±1%	0.5 at 70°C	✓	✓	✓	✓
62	1/4" Dia.	10 to 1 Meg	±10%	±1%	0.5 at 70°C	✓	✓		
82	1/4" Dia.	10 to 1 Meg	±10%	±1%	0.5 at 70°C	✓	✓	✓	✓
72	3/8" Sq.	10 to 2 Meg	±10%	±1%	0.5 at 70°C	✓	✓	✓	✓
91	3/8" Dia.	10 to 2 Meg	±20%	±1%	0.5 at 70°C	Dust Cover	✓	✓	
93	1/2" Dia.	20 to 2 Meg	±10%	±1%	1.0 at 70°C	✓	✓		
Multi-Turn 									
64	1/4" Sq.	10 to 1 Meg	±10%	±3%	0.25 at 85°C	✓	✓	✓	✓
66	3/8" Sq.	10 to 2 Meg	±10%	±1%	0.5 at 85°C	✓	✓	✓	✓
67	3/8" Sq.	10 to 2 Meg	±10%	±1%	0.5 at 70°C	✓	✓	✓	✓
68	3/8" Sq.	10 to 2 Meg	±10%	±1%	0.5 at 70°C	✓	✓	✓	
89	3/4" Rect.	10 to 2 Meg	±10%	±3%	0.75 at 70°C	✓		✓	
78	1-1/4" Rect.	10 to 2 Meg	±10%	±1%	1.0 at 70°C	✓		✓	
Surface Mount Single Turn 									
21	4mm Chip	500 to 500K	±30%	±3%	0.1 at 70°C	Dust Cover	✓		✓
23	4mm Dia.	100 to 2 Meg	±20%	±2%	0.25 at 70°C	✓	✓		✓
83	1/4" Dia.	10 to 1 Meg	±10%	±1%	0.5 at 70°C	✓	✓	✓	✓
Surface Mount Multi-Turn 									
84	1/4" Sq.	10 to 1 Meg	±10%	±3%	0.25 at 85°C	✓	✓	✓	✓

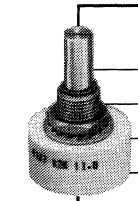
Telephone: (714) 447-2345 / FAX: (714) 447-2500

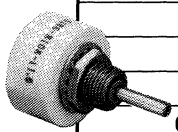
Beckman Industrial™

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HELIPOT® Precision Components

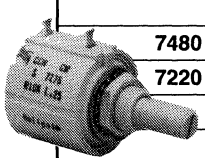
Single Turn Potentiometers





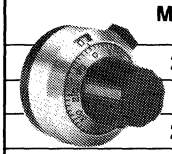
Model	Element Type	Diameter (Inches)	% Standard Linearity	% Resistance Tolerance	Servo Mount	Bushing Mount
6173	CP	7/8	±0.5	±10	✓	
6163	CP	7/8	±1.0	±10	✓	
6180 Series	CP	7/8	±1.0	±10		✓
5100 Series	WW	7/8	±0.5	±5	✓	✓
6273	CP	1-1/16	±0.5	±10	✓	
3371	CP	1-5/16	±0.5	±10		✓
5311	WW	1-5/16	±0.5	±3		✓
6670 Series	CP	2	±0.25	±10	✓	✓
5610 Series	WW	2	±0.50	±5	✓	✓

Multi-Turn Potentiometers



Model	Element Type	# of Turns	Diameter (Inches)	% Standard Linearity	% Resistance Tolerance	Servo Mount	Bushing Mount
7380 Series	WW	3	7/8	±0.25	±5	✓	✓
C	WW	3	1-13/16	±0.50	±3		✓
7480 Series	WW	5	7/8	±0.25	±5	✓	✓
7220 Series	WW	10	7/8	±0.25	±3	✓	✓
7246	WW	10	7/8	±0.25	±5		✓
7276*	WW	10	7/8	±0.25	±5		✓
7280 Series	WW	10	7/8	±0.25	±5	✓	✓
8136*	HYB	10	7/8	±0.25	±10		✓
8140 Series	HYB	10	7/8	±0.25	±10	✓	✓
A	WW	10	1-13/16	±0.25	±3		✓
7600 Series	WW	10	1-13/16	±0.15	±5	✓	✓

Duodial® and Digidial® Turns-Counting Dials



Model	Type	# of Turns	Size	For Bushing Diameter	For Shaft Diameter
2600	Analog	20	7/8″ Dia.	3/8″	1/8″ & 1/4″
RB	Analog	15	1-13/16″ Dia.	1/4″ & 3/8″	1/8″ & 1/4″
2126	Digital	10	1″ Dia.	3/8″	1/4″
2100/2200	Digital	10	1″ x 2″	3/8″	1/4″

*All plastic potentiometer

A full range of high quality precision components are available for standard and custom applications. Please contact the factory for further information.

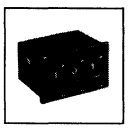
Telephone: (714) 447-2345 / FAX: (714) 447-2500

BOURNS TRIMPOT 1200 COLUMBIA AVENUE RIVERSIDE, CA 92507
(714) 781-5500 FAX (714) 781-5700 TWX 910-332-1252 TLX 676-423

Bourns® Dials; Pushbutton and Knobpot® Potentiometers

PUSH-BUTTON POTENTIOMETERS

3680 Series
Cermet



Decades	Model	Resistance	Resolution
1	3681	50 to 10k ohms	10%
2	3682	500 ohms to 1 megohm	1.0%
3	3683	1k ohms to 1 megohm	0.1%
4	3684	10k ohms to 1 megohm	0.01%
5	3685	100k ohms to 1 megohm	0.001%

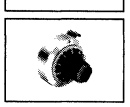
KNOBPOT® POTENTIOMETERS

		Resistance	Power Rating	Dia.
3600 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	3/4"
3610 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	7/8"
3640 Wirewound		100 to 100k ohms	2.5 watts @ 25°C	1 1/4"
3650 Wirewound		100 to 100k ohms	2.5 watts @ 25°C	1 1/4"

DIALS

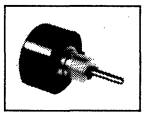
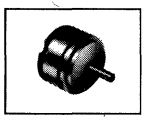
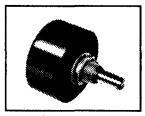
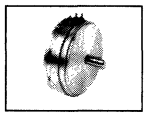
H-507-6 7/8" dia. 

CT23 15/64" dia. 

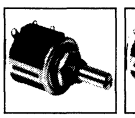
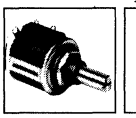
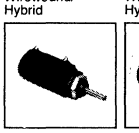
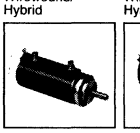
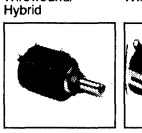
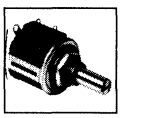
H-490 1" dia. 

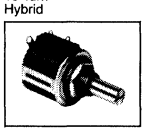
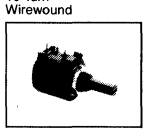
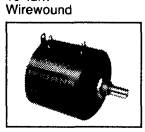
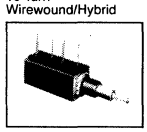
CT26 17/32" dia. 

Bourns® Single-Turn Precision Potentiometers

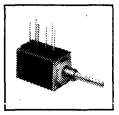
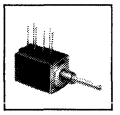
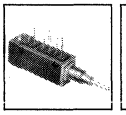
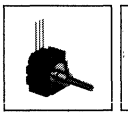
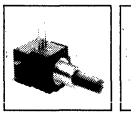
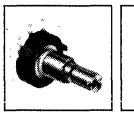
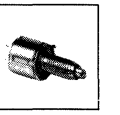
	6534 Conductive Plastic Servo Mount	6637/6638 Conductive Plastic Bushing Mount	6538 Conductive Plastic Servo Mount	6657 Conductive Plastic Bushing Mount	6574 Conductive Plastic Servo Mount
					
Resistance	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms
Power Rating @ 70°C	1.0 watt	1.0 watt	1.0 watt	1.5 watts	2.0 watts
Independent Linearity	±0.5%	±1.0%	±1.0%	±1.0%	±.25%
Rotational Life	25 x 10⁶ revolutions	**6637** 10 x 10⁶ revolutions **6638** 20 x 10⁶ revolutions	20 x 10⁶ revolutions	10 x 10⁶ revolutions	25 x 10⁶ revolutions
Size	7/8" diameter x 15/32"	7/8" diameter x 7/16"	7/8" diameter x 19/32"	15/16" diameter x 5/8"	2" diameter x 19/32"

Bourns® Multiturn Precision Potentiometers

	3543 3-Turn Wirewound	3545 5-Turn Wirewound	3700/3701 10-Turn Wirewound/ Hybrid	3750/3751 10-Turn Wirewound/ Hybrid	3500/3501 10-Turn Wirewound/ Hybrid	3540 10-Turn Wirewound
						
Resistance	20 to 50k ohms	50 to 50k ohms	**3700** 100 to 100k ohms **3701** 1k to 100k ohms	**3750** 100 to 100k ohms **3751** 1k to 50k ohms	**3500** 50 to 200k ohms **3501** 1k to 100k ohms	100 to 100k ohms
Power Rating @ 70°C	1.0 watt	1.5 watts	1.0 watt	1.0 watt	2.0 watts	2.0 watts
Independent Linearity	±0.25%	±0.25%	±0.25%	±0.25%	**3500** ±0.2% **3501** ±0.25%	±0.25%
Rotational Life	0.3 x 10⁶ revolutions	0.5 x 10⁶ revolutions	**3700** 1 x 10⁶ revolutions **3701** 4 x 10⁶ revolutions	**3750** 1 x 10⁶ revolutions **3751** 10 x 10⁶ revolutions	**3500** 2 x 10⁶ revolutions **3501** 4 x 10⁶ revolutions	1 x 10⁶ revolutions
Size	7/8" diameter	7/8" diameter	1/2" diameter	1/2" diameter	7/8" diameter	7/8" diameter

	3541 10-Turn Hybrid	3550/3551 10-Turn Wirewound/Hybrid	3590 10-Turn Wirewound	3400 10-Turn Wirewound	83/84 10-Turn Wirewound/Hybrid
					
Resistance	1k to 100k ohms	**3550** 100 to 200k ohms **3551** 1 k to 100k ohms	200 to 100k ohms	100 to 500k ohms	**Wirewound** 200 to 100k ohms **Hybrid** 1k to 100k ohms
Power Rating @ 70°C	2.0 watts	**3550** 2.5 watts **3551** 2.0 watts	2.0 watts @ 40°C 0 watts @ 125°C	5.0 watts @ 40°C	1.0 watts
Independent Linearity	±0.25%	**3550** ±0.2% **3551** ±0.25%	±0.25%	±0.15%	±0.25%
Rotational Life	5 x 10⁶ revolutions	**3550** 1 x 10⁶ revolutions **3551** 10 x 10⁶ revolutions	1 x 10⁶ revolutions	2 x 10⁶ revolutions	**Wirewound** 1 x 10⁶ revolutions **Hybrid** 4 x 10⁶ revolutions
Size	7/8" diameter x 3/4"	7/8" diameter x 19/16"	7/8" diameter x 3/4"	13/16" diameter x 13/4"	5/8" square x 3/4"

Bourns® Panel Controls

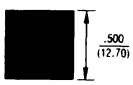
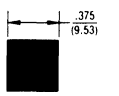
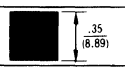
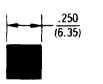
	81/82	87/88	85/86*	91/92/93/ 94/95/96	97/98/99*	3851/3852	3862
							
	5/8" square	5/8" square	5/8" square	5/8" square	5/8" square	3/4" diameter	1/2" diameter
	Modular construction	Modular construction	Modular construction	Modular construction	Modular construction	1/4" depth	Rear terminals
	Single or multiple sections	Single or multiple sections	Multiple sections	Single or dual sections	Dual section	Single section	Single section
	Linear or audio tapers	Semi-precision linear tapers	DPST and DPDT rotary switches*	Linear or audio tapers	DPST and DPDT rotary switches	Linear or audio tapers	Linear taper
	Concentric or single shafts, metal	Concentric or single shafts, metal	Concentric or single shafts, metal	Single shaft, plastic Sealed (96 only)	Single shaft, plastic	Single shaft, metal	Single shaft, metal
	Cermet	Cermet	Cermet	Cermet	Cermet	Cermet	Cermet
	Conductive plastic	Conductive plastic	Conductive plastic	Conductive plastic	Conductive plastic	Conductive plastic	

Specifications are subject to change without notice.

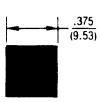
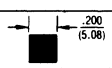
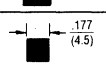
BOURNS TRIMPOT 1200 COLUMBIA AVENUE RIVERSIDE, CA 92507
(714) 781-5500 FAX (714) 781-5700 TWX 910-332-1252 TLX 676-423

Industrial Grade Trimpot® Potentiometers

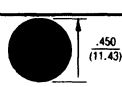
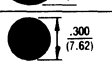
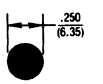
SQUARE, MULTITURN, SEALED

Board Space	Model Number	Element Type	Turns	Pin Styles
 .500 (12.70)	3250	Wirewound	25	L,P,W X (W-66)
	3252	Cermet	25	L,P,W,X
 .375 (9.53)	3290	Wirewound	25	H,P,W
	3292	Cermet	25	L,P,W,X
	3299	Cermet	25	P,W,X,Z,Y
	3296	Cermet	25	P,W,X,Y,Z W,X (T&R)
 .35 (8.89)	3272 (SMD)	Cermet	12	A,C
 .250 (6.35)	3260	Wirewound	11	H,W
	3262	Cermet	12	P,W,X
	3266	Cermet	12	W,X Y,Z (T&R)
	3269 (SMD)	Cermet	12	P,W,X

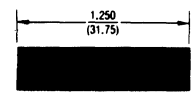
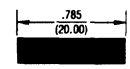
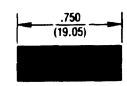
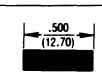
SQUARE, SINGLE-TURN, SEALED

Board Space	Model Number	Element Type	Terminal Styles
 .375 (9.53)	3386	Cermet	H,X,S,B,W,C F,Y,P,R,M,T W (T&R)
	3386 HV2	Cermet	N,U
 .250 (6.35)	3323	Cermet	P,W,X,S,U
	3362	Cermet	H,P,R,W,X M,U (T&R)
 .200 (5.08)	3335 (SMD)	Cermet	A,B,W,X
 .177 (4.5)	3314 (SMD)	Cermet	J,G,H,S

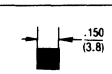
ROUND, SINGLE-TURN, SEALED

 .450 (11.43)	3345	Wirewound	W,P
 .300 (7.62)	3339 (4 Turns)	Cermet	H,P,S,W
 .250 (6.35)	3325 (SMD)	Cermet	P,W,X
	3329	Cermet	H,P,W,X,S M,U (T&R)

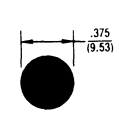
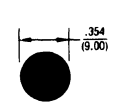
RECTANGULAR, MULTITURN, SEALED

Board Space	Model Number	Element Type	Turns	Pin Styles
 1.250 (31.75)	3057	Wirewound	22	L,P,J,Y
	3059	Cermet	22	L,P,J,Y
 .785 (20.00)	20	Cermet	15	P
 .750 (19.05)	3005	Wirewound	20	P
	3006	Cermet	15	P,W,Y
	3009	Cermet	15	P,Y
	3099 (DIP)	Cermet	20	P
 .500 (12.70)	3082	Cermet	10	P

SQUARE, SINGLE-TURN, OPEN STYLE

Board Space	Model Number	Element Type	Terminal Styles
 .150 (3.8)	3304 (SMD)	Cermet	A,B,C,D W,X

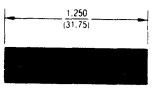
ROUND, SINGLE-TURN, OPEN STYLE

 .375 (9.53)	3352	Cermet	K,H,V,W,E,P,T
	3359	Cermet	P,W
 .354 (9.00)	3309	Cermet	P,W
	3319	Carbon	P,W
 .268 (6.8)	3306	Cermet	F,K,P,W
	3316	Carbon	F,K,P,W

BOURNS TRIMPOT 1200 COLUMBIA AVENUE RIVERSIDE, CA 92507
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Military Grade Trimpot® Potentiometers

RECTANGULAR, MULTITURN, SEALED

Board Space	Model Number	Element Type	Turns	Grade	Pin Styles
	RTR12	Wirewound	22	Hi-Rel Military	L,P,Y
	RT12	Wirewound	22	Military	L,P,Y
	RJR12	Cermet	22	Hi-Rel Military	L,Y
	RJ12	Cermet	22	Military	L,P,Y
	RJR28	Cermet	10	Hi-Rel Military	P

SQUARE, MULTITURN, SEALED

Board Space	Model Number	Element Type	Turns	Grade	Pin Styles
	RTR22	Wirewound	25	Hi-Rel Military	L,P,W,X
	RT22	Wirewound	25	Military	L,P,W,X
	RJ22	Cermet	25	Military	L,P,W,X

SQUARE, MULTITURN, SEALED

Board Space	Model Number	Element Type	Turns	Grade	Pin Styles
	RTR24	Wirewound	25	Hi-Rel Military	P,W,X
	RT24	Wirewound	25	Military	P,W,X
	RJR24	Cermet	22	Hi-Rel Military	P,W,X
	RJ24	Cermet	22	Military	L,P,W,X
	RT26	Wirewound	11	Military	W,X
	RJR26	Cermet	12	Hi-Rel Military	P,W,X
	RJ26	Cermet	12	Military	P,W,X

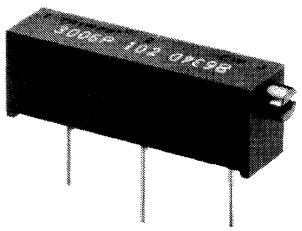
ROUND, SINGLE-TURN, SEALED

	RJR50	Cermet	1	Hi-Rel Military	P
	RJ50	Cermet	1	Military	P

Surface Mounted Trimpot® Potentiometers

		TYPE: SEALED	TYPE: OPEN	CONFIGURATION: LEADLESS CHIP	CONFIGURATION: "J" LEAD	CONFIGURATION: GULL WING	ADJUSTMENT: TOP ADJUST	ADJUSTMENT: SIDE ADJUST	ADJUSTMENT: MULTITURN	ADJUSTMENT: SINGLE-TURN	PKG: EMBOSSED TAPE
Model 3272 .350″ square	• JEDEC package • Exceptional setting stability • Packaged in plastic tube or embossed tape	•				•		•	•		•
Model 3325 1/4″ diameter	• Stable, infinite resolution cermet element • Plastic tube and tray packaging	•				•	•	•		•	
Model 3269 1/4″ square	• Recommended for reflow solder processing • Plastic tube and tray packaging	•				•	•	•	•		
Model 3335 5mm square	• 16mm embossed tape packaging • Auto adjust rotor • Recommended for reflow solder processing only	•			•	•	•			•	•
Model 3374 4mm square	• 5-turn seal life • Low cost chip-style construction • Compatible with all surface mount processes	•		•			•			•	•
Model 3314 4mm square	• Compatible with dual wave, IR,VP • 100 cycle seal design • Small 4mm standard EIA/J size and footprint	•			•	•	•	•		•	•
Model 3314S	• Side-adjust for external and blind calibration • Superior pushover strength (4.4 lbs) • Cross-slot rotor for auto adjustment	•				•		•		•	•
Model 3304 4mm square	• Cross-slot rotor for auto adjustment • Two packaging styles • Supplied in 12mm embossed tape • Two terminal and three terminal styles		•	•			•			•	•
Model 3224 4mm square	• Smallest multiturn SMD trimmer • Pick and place centering design, with flush adjustment • Low CRV — 1%	•			•	•	•	•	•		•
Model 3363 3mm square	• High volume assembly compatible • Wave/Reflow solderable • 8mm embossed tape packaging		•	•			•			•	•
Model 3313 3mm square	• 100 cycle seal life • Compatible with all surface mount processes • Low CRV — 2% max., 1% typical	•			•		•			•	•
SMD Trimmer Design Kit	• Full line of surface mount trimmers • Convenient, easy-to-use packaging • Single-turn, multiturn, sealed, open frame styles • Popular pin styles and ohmic values										

BOURNS TRIMPOT 1200 COLUMBIA AVENUE RIVERSIDE, CA 92507
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Model 3006

Trimpot® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....10 to 5 megohms
(see standard resistance table)
Resistance Tolerance
.....±10% std.
(tighter tolerance available)
Contact Resistance Variation
.....1.0% or 1 ohm max.
(whichever is greater)
Adjustability
Voltage.....±0.01%
Resistance.....±0.05%
Resolution .....Infinite
Adjustment Angle . .15 turns nom.

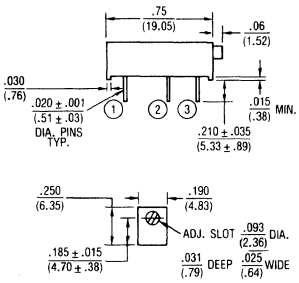
Environmental Characteristics

Power Rating (400 volts max.)
70°C .....0.75 watt
150°C.....0 watt
Temperature Range
.....–55°C to +125°C
Temperature Coefficient
.....±100ppm/°C
Rotational Life .....200 cycles
(3% △TR; 1% or 1 ohm,
whichever is greater, CRV)

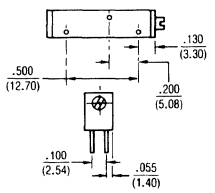
Physical Characteristics

Torque .....5.0 oz-in. max.
Mechanical Stops .....Wiper idles
Terminals .....Solderable pins
External Marking . . .Manufacturer's trademark, resistance code, terminal numbers, date code, manufacturer's model number and style
Standard Packaging
P&Y Style .....25pcs. per tube
W Style .....50 pcs. per tray

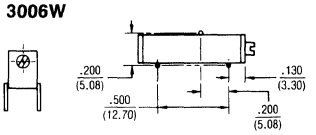
COMMON DIMENSIONS



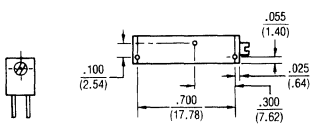
3006P



3006W



3006Y



STANDARD RESISTANCE TABLE

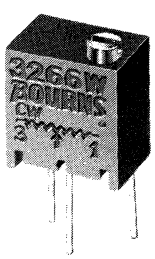
Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205
5,000,000	505

HOW TO ORDER

3006 P - 1 - 103 Z

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
– 7 = Transparent Housing
– 11 = 50% Resistance Tolerance
Resistance Code
Optional Suffix Letter
Z = Panel Mount (Factory Installed)

Consult factory for other available options.



Model 3266

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....10 to 1 megohm
(see standard resistance table)
Resistance Tolerance . . . ±10% std.
Contact Resistance Variation
.....3.0% or 3 ohm max.
(whichever is greater)
Adjustability
Voltage.....±0.02%
Resistance.....±0.05%
Resolution .....Infinite
Effective Travel .....12 turns nom.

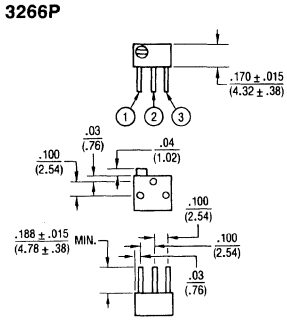
Environmental Characteristics

Power Rating (300 volts max.)
70°C .....0.25 watt
150°C.....0 watt
Temperature Range
.....–55°C to +125°C
Temperature Coefficient
.....±100ppm/°C
Rotational Life .....200 cycles
(4% △TR; 3% or 3 ohms,
whichever is greater, CRV)

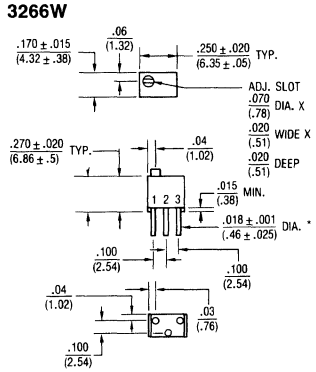
Physical Characteristics

Torque .....3.0 oz-in. max.
Mechanical Stops .....Wiper idles
Terminals .....Solderable pins
External Marking . . .Manufacturer's trademark, resistance code, wiring diagram, date code, manufacturer's model number and style
Standard Packaging . . . .50 pcs. per tube

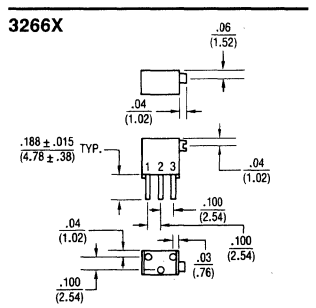
3266P



3266W



3266X



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105

Special resistances available from 10 ohms to 1 megohm.

HOW TO ORDER

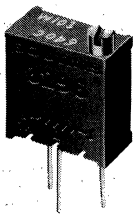
3266 W - 1 - 103

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
Resistance Code

Consult factory for other available options.

Specifications are subject to change without notice.

BOURNS TRIMPOT 1200 COLUMBIA AVENUE RIVERSIDE, CA 92507
(714) 781-5500 FAX (714) 781-5700 TWX 910-332-1252 TLX 676-423



Model 3296

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....10 to 5 megohms
(see standard resistance table)
Resistance Tolerance
.....±10% std.
(tighter tolerance available)
Contact Resistance Variation
.....1.0% or 3 ohm max.
(whichever is greater)
Adjustability
Voltage.....±0.01%
Resistance.....±0.05%
Resolution .....Infinite
Effective Travel ....25 turns nom.

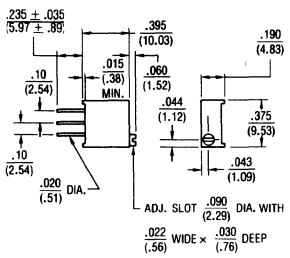
Environmental Characteristics

Power Rating (300 volts max.)
70°C .....0.5 watt
125°C.....0 watt
Temperature Range
.....–55°C to +125°C
Temperature Coefficient
.....±100ppm/°C
Rotational Life .....200 cycles
(4% △TR; 3% or 3 ohms,
whichever is greater, CRV)

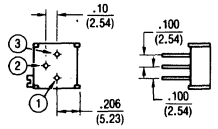
Physical Characteristics

Torque .....3.0 oz-in. max.
Mechanical Stops .....Wiper idles
Terminals .....Solderable pins
External Marking ..Manufacturer's trademark, resistance code, wiring diagram, date code, manufacturer's model number and style
Standard Packaging ....50 pcs. per tube

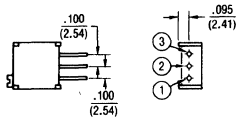
COMMON DIMENSIONS



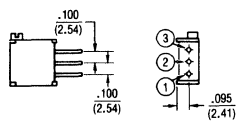
3296P



3296W



3296X



STANDARD RESISTANCE TABLE

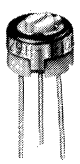
Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205
5,000,000	505

HOW TO ORDER

3296 W - 1 - 103

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
– 11 = 5% Resistance Tolerance
Resistance Code

Consult factory for other available options.



Model 3329

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....10 to 1 megohm
(see standard resistance table)
Resistance Tolerance ...±10% std.
(closer tolerance available)
Contact Resistance Variation
.....3.0% or 3 ohm max.
(whichever is greater)
Adjustability
Voltage.....±0.05%
Resistance.....±0.15%
Resolution .....Infinite
Adjustment Angle .....240° nom.

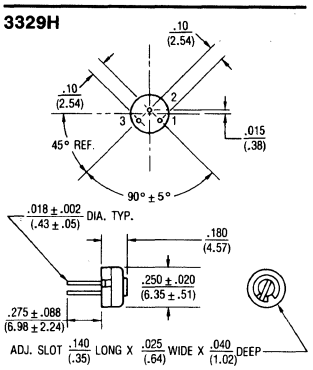
Environmental Characteristics

Power Rating (300 volts max.)
85°C .....0.5 watt
150°C.....0 watt
Temperature Range
.....–55°C to +150°C
Temperature Coefficient
.....±100ppm/°C
Rotational Life .....200 cycles
(4% △TR; 4% CRV)

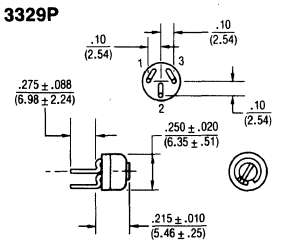
Physical Characteristics

Mechanical Angle .....260° nom.
Torque .....5.0 oz-in. max.
Stop Strength .....5.0 oz-in. min.
Terminals .....Solderable pins
External Marking ...Manufacturer's trademark, resistance code, date code, manufacturer's model number and style
Standard Packaging ....50 pcs. per tube

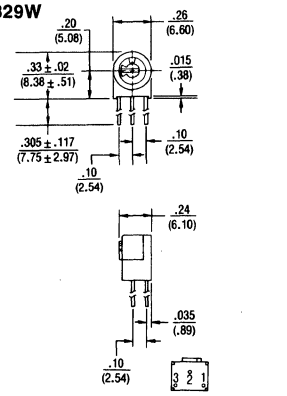
3329H



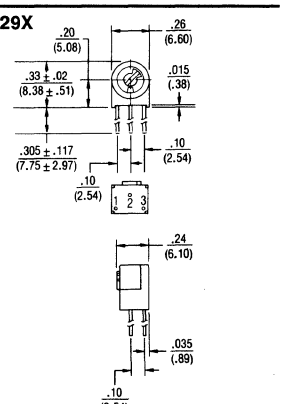
3329P



3329W



3329X



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105

HOW TO ORDER

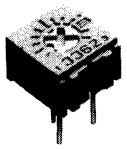
3329 P - 1 - 103

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
– 11 = 5% Resistance Tolerance
– 99 = 5/8″ Length Pins
Resistance Code

Consult factory for other available options.

Specifications are subject to change without notice.

BOURNS TRIMPOT 1200 COLUMBIA AVENUE RIVERSIDE, CA 92507
(714) 781-5500 FAX (714) 781-5700 TWX 910-332-1252 TLX 676-423



Model 3362

B® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....20 to 2 megohms
(see standard resistance table)
Resistance Tolerance
.....±20% std.
(tighter tolerance available)
Contact Resistance Variation
.....1.0% or 3 ohms max.
(whichever is greater)
Adjustability
Voltage.....±0.05%
Resistance.....±0.15%
Resolution .....Infinite
Adjustment Angle.....240° nom.

Environmental Characteristics

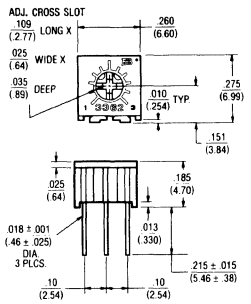
Power Rating (300 volts max.)
70°C .....0.50 watt
125°C.....0 watt
Temperature Range
.....–55°C to +125°C
Temperature Coefficient
.....±100ppm/°C
Rotational Life .....200 cycles
(4% △TR; 3% or 3 ohms,
whichever is greater, CRV)

Physical Characteristics

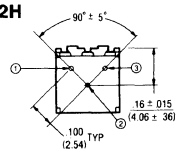
Torque .....3.0 oz-in. max.
Stop Strength .....7.0 oz-in. min.
Terminals .....Solderable pins
External Marking . . .Manufacturer's trademark, resistance code, terminal numbers, manufacturer's model number, style and date code
Standard Packaging . . . .50 pcs. per tube

COMMON DIMENSIONS

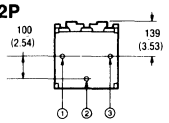
TOP ADJUST



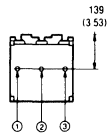
3362H



3362P

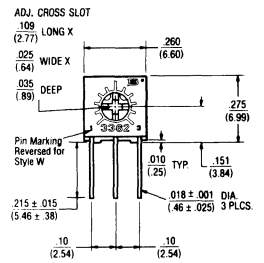


3362U

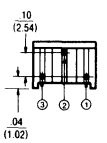


COMMON DIMENSIONS

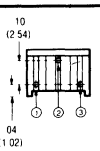
SIDE ADJUST



3362W



3362X



Common dimensions unless otherwise specified.

STANDARD RESISTANCE TABLE

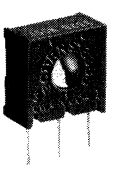
Resistance (Ohms)	Resistance Code
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

HOW TO ORDER

3362 U - 1 - 502

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
– 10 = 10% Resistance Tolerance
Resistance Code

Consult factory for other available options.



Model 3386

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....10 to 2 megohms
(see standard resistance table)
Resistance Tolerance . . . ±10% std.
(tighter tolerance available)
Contact Resistance Variation
.....1% or 1 ohm max.
(whichever is greater)
Adjustability
Voltage.....±0.05%
Resistance.....±0.15%
Resolution .....Infinite
Adjustment Angle .....280° nom.

Environmental Characteristics

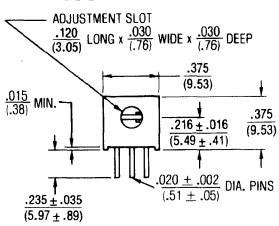
Power Rating (300 volts max.)
85°C .....0.5 watt
125°C.....0 watt
Temperature Range
.....–55°C to +125°C
Temperature Coefficient
.....±100ppm/°C
Rotational Life .....200 cycles
(4% △TR; 1% or 1 ohm,
whichever is greater, CRV)

Physical Characteristics

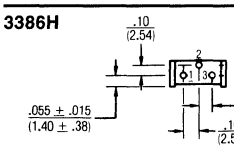
Torque .....5.0 oz-in. max.
Stop Strength .....15.0 oz-in. min
Terminals .....Solderable pins
External Marking . . .Manufacturer's trademark, resistance code, wiring diagram, date code, manufacturer's model number and style
Standard Packaging
Styles B, C, H, S, W, X, U
.....50 pcs. per tube

COMMON DIMENSIONS

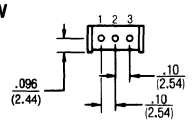
SIDE ADJUST



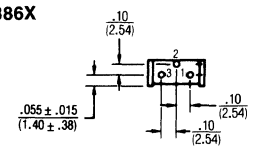
3386H



3386W

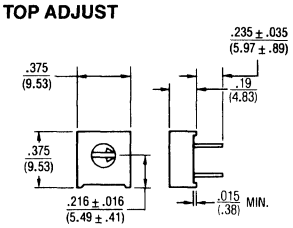


3386X

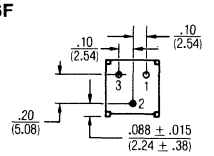


COMMON DIMENSIONS

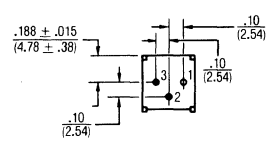
TOP ADJUST



3386F



3386P



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Special resistances available from 10 ohms to 2 megohm.

HOW TO ORDER

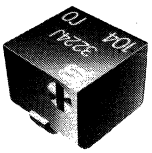
3386 P - 1 - 103 Z

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
– 11 = 5% Resistance Tolerance
– 99 = 5/8" Length Pins
Resistance Code
Optional Suffix Letter
T = Knob

Consult factory for other available options.

Specifications are subject to change without notice.

BOURNS TRIMPOT 1200 COLUMBIA AVENUE RIVERSIDE, CA 92507
(714) 781-5500 FAX (714) 781-5700 TWX 910-332-1252 TLX 676-423



Model 3224

Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
. . . . . .10 to 2 megohms
(see standard resistance table)
Resistance Tolerance . . . ±10% std.
Absolute Minimum Resistance
. . . . . .1% or 2.0 ohms
(whichever is greater)
Contact Resistance Variation
. . . . . .1% or 3 ohms max.
Resolution . . . . . .Infinite
Insulation Resistance . . . . .500 vdc.
100 megohms min.
Dielectric Strength
Sea Level. . . . .600 vac (1 minute)
Adjustment Angle . . . .12 turns nom.

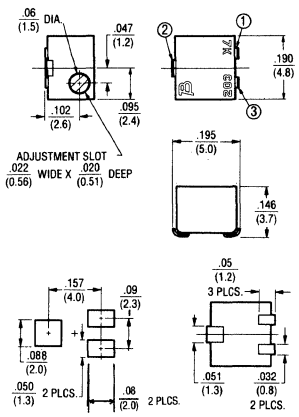
Environmental Characteristics

Soldering Heat
. .260°C, 10 seconds, TRS ±1%
Power Rating (300 volts max.)
85°C . . . . . .0.25 watt
150°C. . . . . .0 watt
Temperature Range
. . . . . –65°C to +150°C
Temperature Coefficient
. . . . . ±100ppm/°C
Humidity. MIL-STD-202
Method 106
TRS ±2%; IR 10 megohms
Vibration 20G TRS ±1%; VRS ±1%
Shock. .100G TRS ±1%; VRS ±1%
Load Life . . . . .@ 85°C rated power
1,000 hours; TRS 3 ohms or 3%
(whichever is greater)
Rotational Cycling . . . . . .200 cycles
TRS 3 ohms or 3%
(whichever is greater)
Thermal Shock. . . . . .5 cycles
TRS ±2%; VRS ±1%

Physical Characteristics

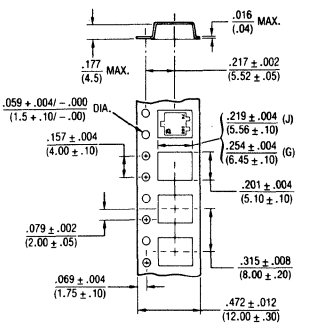
Mechancial Stop . . . . . .Wiper idles
Torque. . . . . .180g-cm max.
Weight . . . . .Approximately 0.01 oz.
Marking. . . . . .Manufacturer's code,
resistance code and date code
Standard Packaging
G. . . . . .500 pieces/7″ reel

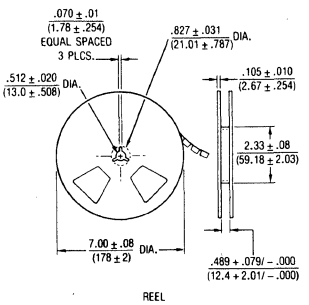
3234J



PACKAGING SPECIFICATIONS

(J & G Styles)





Cover tape peel strength:
Meets EIA 481

Units packaged 500 pieces per reel.

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105
2,000,000	205

Special resistances available.

HOW TO ORDER

3224 J - 1 - 502 E

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
Resistance Code
Embossed Tape Designator

Consult factory for other available options.



Model 3304

Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
. . . . . .10 ohms to 2 megohms
(see standard resistance table)
Resistance Tolerance . . . ±25% std.
End Resistance . . . . . .5% max.
Contact Resistance Variation
(Voltage Divider)
Styles A, B, W & X . . . . .5% max.
Resolution . . . . . .Infinite
Adjustment Angle . . . . . .230° nom.

Environmental Characteristics

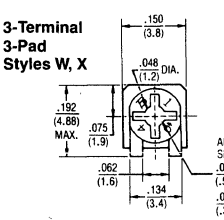
Power Rating (50 volts max.)
70°C . . . . . .0.2 watt
Temperature Range
. . . . . –55°C to +125°C
Temperature Coefficient 10 ohms
to 200 ohms . . . . . ±250ppm/°C
500 ohms & above . ±200ppm/°C
Humidity. MIL-STD-202
Method 103; 500 hours
(5% △TR) Styles A, B, W, & X
SRS ±5% Styles C & D
Vibration . .30G (2% △TR; 2% △VR)
Styles A, B, W & X
SRS ±5% Styles C & D
Shock . .100G (2% △TR; 2% △VR)
Styles A, B, W & X
SRS ±5% Styles C & D
Load Life
. . . .1,000 hours 0.2 watt @ 70°C
(5% △TR) Styles A, B, W & X
SRS ±5% Styles C & D
Rotational Life . . . . . .20 cycles
(15% △TR)

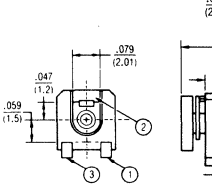
Physical Characteristics

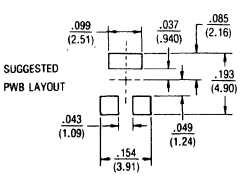
Torque (Operating) . .3.0 oz-in. max.
Mechanical Angle. . . . . .Continuous
Marking. . . . . .Manufacturer's
trademark, resistance code,
Manufacturer's full part number
and date code on packaging
Standard Packaging
. . . . . .750 pieces/7″ reel
Reflow solder processing
recommended

3304 Voltage Divider

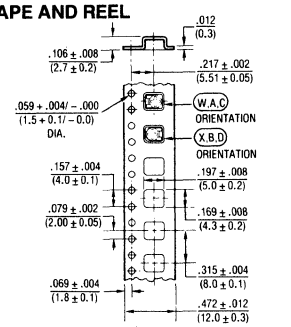
3-Terminal
3-Pad
Styles W, X

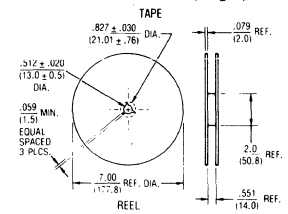






TAPE AND REEL





750 pieces per reel.
Conforms with EIA specification RS-481.
Orientation of parts in tape:
Styles W, A, C: Terminals toward sprocket holes
Styles X, B, D: Terminals away from sprocket holes

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105
2,000,000	205

Special resistances available from 10 ohms to 2 megohms.

HOW TO ORDER

3304 X - 1 - 103 E

Model
Style
Standard Product
Resistance Code
Embossed Tape Designator
E = 750 pcs./7″ reel (standard)
G = 3000 pcs./13″ reel (optional)

Consult factory for other available options.

Specifications are subject to change without notice.

BOURNS TRIMPOT 1200 COLUMBIA AVENUE RIVERSIDE, CA 92507
(714) 781-5500 FAX (714) 781-5700 TWX 910-332-1252 TLX 676-423



Model 3313

® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....10 ohms to 2 megohms
(see standard resistance table)
Resistance Tolerance . . . ±20% std.
End Resistance
.....1% or 3 ohms max.
(whichever is greater)
Contact Resistance Variation
.....2% or 3 ohms max.
(whichever is greater)
Resolution .....Infinite
Insulation Resistance .....500 vdc.
100 megohms min.
Dielectric Strength
Sea Level .....500 vac
70,000 Feet 350VAC
Adjustment Angle .....220° nom.

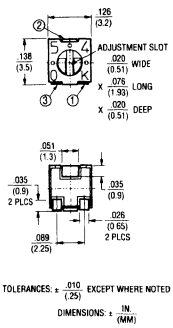
Environmental Characteristics

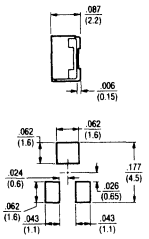
Power Rating (200 volts max.)
70°C .....0.125 watt
125°C .....0 watt
Operating Temperature Range
.....–55°C to +125°C
Temperature Coefficient
.....≤100 ohms ±150ppm/°C
>100 ohms ±100ppm/°C
Seal Test .....85°C Fluorinet*
Humidity .MIL-STD 202, Method 106
.....(no vibration)
TRS ±3%
IR 10 megohms
Vibration 20G
TRS ±1%; VRS ±1%
Shock 100G
TRS ±1%; VRS ±1%
Load Life .....1000 hours
@70°C Rated Power
TRS ±3%
Rotational Life .....100 cycles
TRS ±3%
Thermal Shock .....5 cycles
TRS ±2%; VRS ±1%

Physical Characteristics

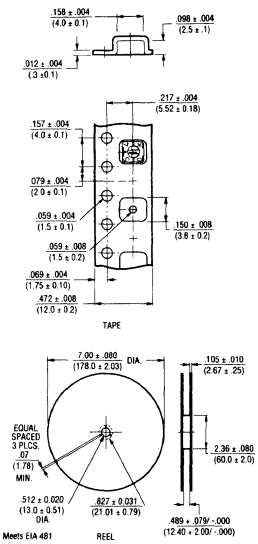
Mechancial Angle .....250° nom.
Torque .....50g-cm max.
Stop Strength .....200g-cm min.
Weight .....Approx. 0.01 oz.
Marking .....Resistance code
and date code
Standard Packaging
.....1000 pieces/7″ reel

3313J





PACKAGING SPECIFICATIONS



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Part Marking Code	Resistance Code
10	A1	100
20	21	200
50	51	500
100	A2	101
200	22	201
500	52	501
1,000	A3	102
2,000	23	202
5,000	53	502
10,000	A4	103
20,000	24	203
50,000	54	503
100,000	A5	104
200,000	25	204
500,000	55	504
1,000,000	A6	105
2,000,000	26	205

Special resistances available.

HOW TO ORDER

3313 J - 1 - 502 E

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
Resistance Code
Embossed Tape
E = 1000 pcs. / 7″ Reed (Standard)
G = 2500 pcs. / 13″ Reel (Optional)
8mm embossed tape packaging avialable



Model 3314

® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....10 ohms to 2 megohms
(see standard resistance table)
Resistance Tolerance . . . ±20% std.
(tighter tolerance available)
End Resistance .1% or 2 ohms max.
(whichever is greater)
Contact Resistance Variation
.....1% or 3 ohms max.
(whichever is greater)
Resolution .....Infinite
Insulation Resistance .....500 vdc.
100 megohms min.
Dielectric Strength
Sea Level .....500 vac (1 minute)
Adjustment Angle .....210° nom.

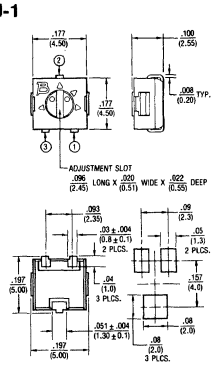
Environmental Characteristics

Soldering Heat .....260°C,
10 seconds, TRS ±1%
Power Rating (300 volts max.)
70°C .....0.25 watt
125°C .....0 watt
Temperature Range
.....–55°C to +125°C
Temperature Coefficient
.....±100ppm/°C
Humidity .....90-98% RH,
10 cycles, 240 hours
TRS ±2%; IR 10 megohms
Rotational Life 100 cycles; TRS ±3%
Thermal Shock .....5 cycles
TRS ±2%; VRS ±1%

Physical Characteristics

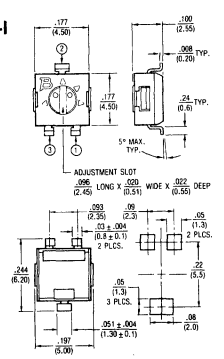
Mechanical Angle .....240° nom.
Torque .....180g-cm typcial
Stop Strength .....300g-cm typical
Pushover Strength (S Style)
. . .2 kilograms (4.4 lbs.) minimum
Weight .....Approximately 0.01 oz.
Marking .....Manufacturer's
code, resistance code
and date code
Standard Packaging
J & G .....500 pcs./7″ reel
S .....200 pcs./7″ reel;
H .....500 pcs./tube

3314J-1



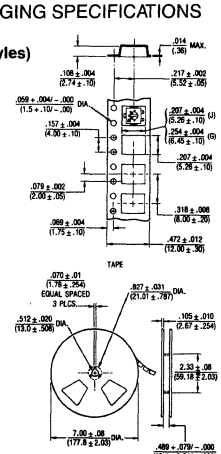
FOR ALL MODELS
ROTOR POSITIONED WITHIN
±11° OF TERMINAL 2

3314G-I



PACKAGING SPECIFICATIONS

(J, G Styles)



Reel

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105
2,000,000	205

Special resistances available from 10 ohms to 2 megohms.

HOW TO ORDER

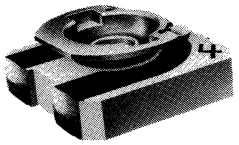
3314 G - 1 - 502 E

Model
Style
Standard or Modified
– 1 = Standard Product
Resistance Code
Embossed Tape Designator
(Applicable to Styles J, G and S only)
Styles J and G
E = 500 pcs./7″ reel (standard)
G = 3000 pcs./13″ reel (optional)
Style S
E = 200 pcs./7″ reel (standard)
G = 1000 pcs./13″ reel (optional)

Consult factory for other available options.

Specifications are subject to change without notice.

BOURNS TRIMPOT 1200 COLUMBIA AVENUE RIVERSIDE, CA 92507
(714) 781-5500 FAX (714) 781-5700 TWX 910-332-1252 TLX 676-423



Model 3363

Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....100 to 1 megohm
(see standard resistance table)
Resistance Tolerance . . . ± 25% std.
Absolute Minimum Resistance
.....2% ro 20 ohms
(whichever is greater)
Contact Resistance Variation
.....5% max.
Resolution .....Infinite
Adjustment Angle.....220° ± 20°

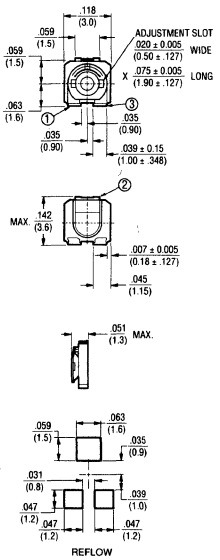
Environmental Characteristics

Resistance to Soldering Heat
260°C, 10 seconds, TRS max. 5%
Power Rating (50 VDC max.)
70°C .....0.1 watt
Temperature Range
.....– 55°C to + 125°C
Temperature Coefficient
.....± 250ppm/°C
Humidity .....95% RH
1,000 hours
TRS max. .....± 5%
Load Life.....@ 70°C rated power;
1,000 hours; TRS ± 5%
Rotational Cycling .....20 turns
TRS ± 15%

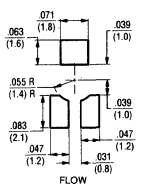
Physical Characteristics

Torque .....20-200g-cm max.
Mechanical Angle.....Continuous
Marking .....Part marking code
Standard Packaging
.....2,000 pcs./7" reel

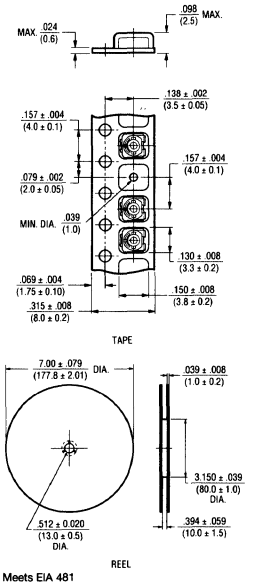
3363



All dimensional tolerances are: ± 0.010 in., ± (0.25 mm.); unless otherwise noted.



PACKAGING SPECIFICATIONS



Meets EIA 481

STANDARD RESISTANCE TABLE

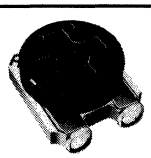
Resistance (Ohms)	Part Marking Code	Resistance Code
100	A2	101
200	22	201
500	52	501
1,000	A3	102
2,000	23	202
5,000	53	502
10,000	A4	103
20,000	24	203
50,000	54	503
100,000	A5	104
200,000	25	204
500,000	55	504
1,000,000	A6	105

HOW TO ORDER

3363 X - 1 - 103 E

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
Resistance Code
Embossed Tape Designator

Consult factory for other available options.



Model 3374

Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
.....10 to 2 megohms
(see standard resistance table)
Resistance Tolerance . . . ± 20% std.
End Resistance .1% or 2 ohms max.
(whichever is greater)
Contact Resistance Variation
.....3.0% or 3 ohm max.
(whichever is greater)
Resolution .....Infinite
Adjustment Angle .....240° nom.
Maximum Voltage.....200V

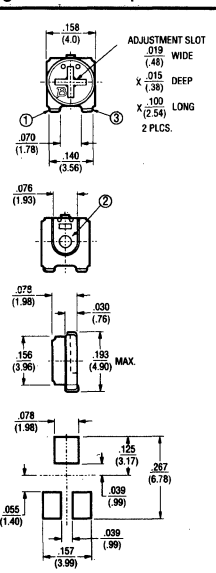
Environmental Characteristics

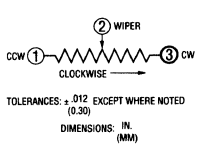
Power Rating
70°C .....0.25 watt
125°C.....0 watt
Operating Temperature Range
.....– 55°C to + 125°C
Temperature Coefficient
<500KΩ.....± 100ppm/°C
>500KΩ.....± 150ppm/°C
Seal .....5 Turns min.
Humidity.....MIL-STD 202
Method 103
TRS ± 2%
Vibration.....20G
TRS ± 1%, VRS ± 1%
Shock 100G
TRS ± 1%, VRS ± 1%
Load Life (@ 70°C Rated Power,
1000 hours) .....TRS ± 3%
Rotational Life .....100 cycles
TRS ± 3%
Thermal Shock.....5 cycles
TRS ± 2%, VRS ± 1%

Physical Characteristics

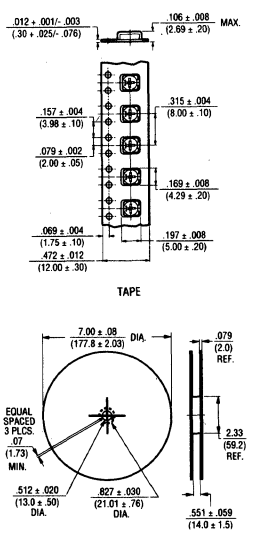
Torque 18-180gm/cm
Mechanical Angle.....Continuous
Marking .Manufacturer's trademark,
and part of marking code
Packaging .....750 pcs./7" reel

3374X





PACKAGING SPECIFICATIONS



Meets EIA 481

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Part Marking Code	Resistance Code
10	A1	100
20	21	200
50	22	500
100	A2	101
200	22	201
500	52	501
1,000	A3	102
2,000	23	202
5,000	53	502
10,000	A4	103
20,000	24	203
50,000	54	503
100,000	A5	104
200,000	25	204
500,000	55	504
1,000,000	A6	105
2,000,000	26	205

Special resistances available from 10 ohms to 2 megohms.

HOW TO ORDER

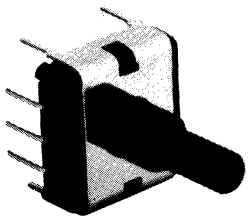
3374 X - 1 - 502 E

Model
Style
Standard or Modified Product Indicator
– 1 = Standard Product
Resistance Code
Embossed Tape

Consult factory for other available options.
E = 750 pcs./7" reel (standard)
G = 3000 pcs./13" reel (optional)

Specifications are subject to change without notice.

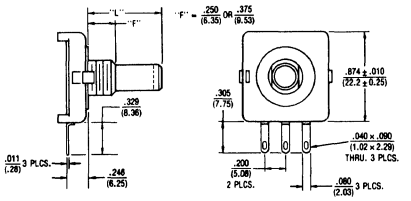
BOURNS SENSORS/CONTROLS, INC. 2533 NORTH 1500 WEST STREET OGDEN, UT 84404
(1 800) 468-6932 FAX (801) 479-0394 TWX 310-378-9499



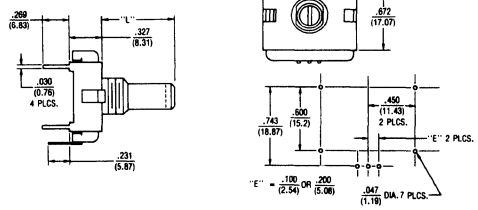
Slimline Potentiometers

Bourns® Slimline Potentiometers

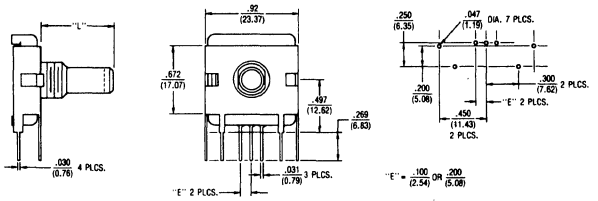
SOLDER LUGS
Dimensions not given are the same as PC pins (Rear Facing)



PC PINS
(Rear Facing)
With Rear Mounting Bracket



PC PINS (Side Exit)
With Side Mounting Bracket



Electrical Characteristics[1]

Standard Resistance Range
- Linear Tapers ..... .500 ohms to 1.5 megohms
- Audio Tapers ..... .1K ohms to 500k ohms
- Resistance Tolerance (All Tapers) ..... ±20%
- Independent Linearity ..... ±5% (linear taper)

Effective Electrical Angle ..... .270° ±5%

Power Rating @ 70°C (Voltage Limited by Power dissipation or 350 VAC, Whichever is Less)
- Linear ..... .75 watt
- Audio ..... .25 watt

Environmental Characteristics[1]

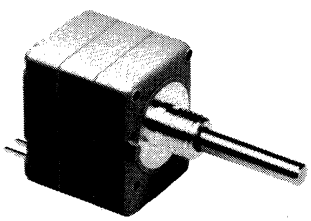
Rotational Life ..... .50,000 cycles

Total Resistance Shift
- Linear ..... ±10 ohms or 12%, whichever is greater
- Audio ..... ±20% maximum

Mechanical Characteristics

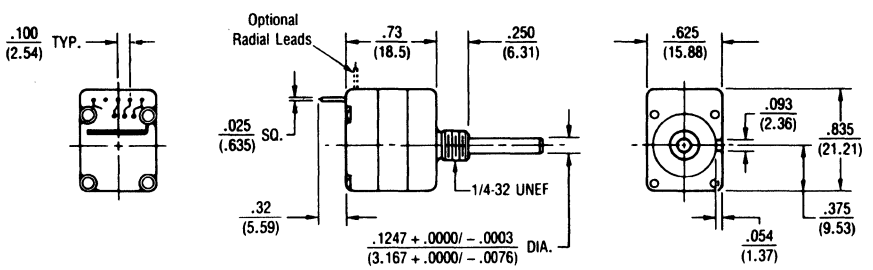
Mechanical Angle ..... .300° ±5°

Detents ..... .Center, 10, 20, 30, none



Rotary Optical Encoders

Bourns® Optical Encoders



Electical Characteristics

Output ..... .2-bit gray code, Channel A leads Channel B by 90° (electrical) wiht clockwise rotation

Supply Voltage ..... .5.0 VDC ±0.25 VDC*

Supply Current ..... .26 mA maximum

Output Voltage
- Low Output ..... .0.8V maximum
- High Output ..... .4V minimum

Output Current
- Low Output ..... .25 mA minimum

Insulation Resistance (500 VDC) ..... .1,000 megohms

Rise/Fall Time ..... .200ns (typical)

Shaft RPM (Ball Bearing) (Resolutions ≤ 128 cycles) ..... .5,000 rpm maximum

Power Consumption ..... .136 mW maximum

Pulse Width (Electrical Degrees, Each Channel) ..... .180° ±45° TYP.

Pulse Width (Index Channel) ..... .360° ±90°

Phase (Electrical Degrees, Channel A to Channel B) ..... .90° ± 45° TYP.

Index Channel Centered on 1-1 State Combination of A and B Channels ..... .0° ±45°

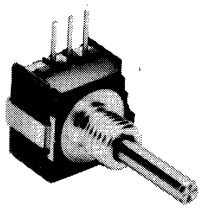
*Consult factory for other voltages up to 15 VDC.

Mechanical Characteristics

Rotational Life
- A & C Bushings (300 rpm maximum) ..... .10,000,000 revolutions
- W, S & T Bushings (5,000 rpm maximum) (Resolutions ≤ 128 cycles) ..... .200,000,000 revolutions

Specifications are subject to change without notice.

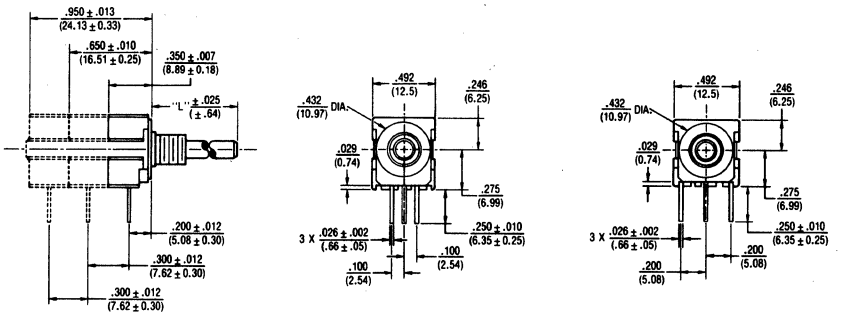
BOURNS SENSORS/CONTROLS, INC. 2533 NORTH 1500 WEST STREET OGDEN, UT 84404
(1 800) 468-6932 FAX (801) 479-0394 TWX 310-378-9499



Model 50 Series

Bourns® Panel Controls

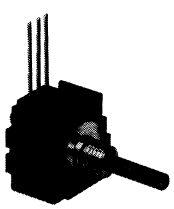
PACKAGE DIMENSIONS



[SINGLE, DUAL AND TRIPLE MODULE SHOWN] [.100" (2.54) TERMINAL SPACING] [.200" (5.08) TERMINAL SPACING]

	Conductive Plastic	Cermet
Electrical Characteristics[1]		
Standard Resistance Range		
Linear	1K ohms to 1 megohm	150 ohms to 1 megohm
Audio	1K ohms to 1 megohm	1K ohms to 1 megohm
Total Resistance Tolerance		
Linear Tapers	±10% OR ±20%	±10% OR ±5%
Audio Tapers	±10% OR ±20%	±10%
Independent Linearity	±5%	±5%
Power Rating At 70°C (Derate To 0 At 125°C) (Voltage Limited By Power Dissipation or 350 VAC, Whichever Is Less)		
Linear Tapers	.5 watt	1.0 watt
Audio Tapers	.25 watt	.5 watt
Tracking (Multiple Sections)	3 db	3 db
Environmental Characteristics[1]		
Rotational Life—No Load (50,000 Cycles)[2]	±10% TRS maximum	±10% TRS maximum
Mechanical Characteristics		
Stop Strength	5 in-lb.	5 in-lb.
Mechanical Angle	295° ±5°	295° ±5°

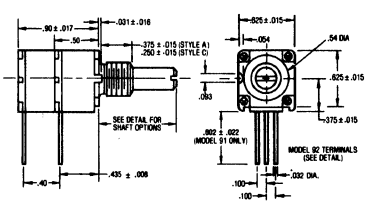
[1]At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.
[2]Conductive plastic, 25,000 cycles for cermet elements.



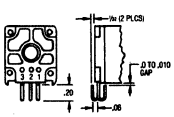
Models 91, 92, 93, 94, 95, 96

Bourns® Panel Controls

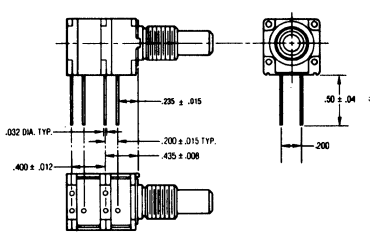
MODEL 91 PC PIN TERMINALS, IN-LINE



MODEL 92 J-HOOKED TERMINALS, IN-LINE



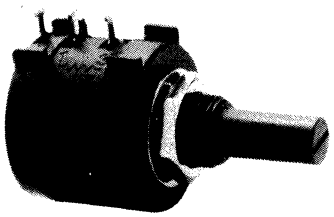
MODEL 93 PC PIN TERMINALS, "L" PATTERN



	Conductive Plastic Element	Cermet Element
Initial Electrical Characteristics[1]		
Standard Resistance Range		
Linear Tapers	150 ohms to 5 megohms	50 ohms to 5 megohms
Audio Tapers	1K ohms to 5.0 megohms	1K ohms to 5.0 megohms
Resistance Tolerance	±20% ~ ±10%	±10% ~ ±5%
Independent Linearity	±5%	±5%
Power Rating (Voltage Limited by Power Dissipation or 350 VAC, Whichever is Less)		
+70°C Single Section Assembly	Linear 1 watt Log 0.5 watt	Linear 2 watts Log 1 watt
+70°C Multiple Section Assembly	Linear 0.5 watt/section Log 0.25 watt/section	1 watt/section 0.5 watt/section
+125°C	0 watt	0 watt
Environmental Characteristics[1]		
Rotational Life (No Load)	100,000 cycles	100,000 cycles
Mechanical Characteristics[1] *		
Mechanical Angle	300° ±5°	

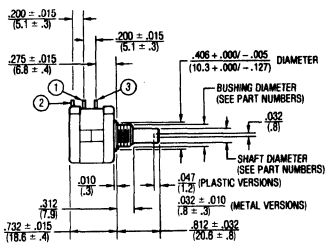
NOTE: All Model 90 performance specifications do not apply to units subjected to printed circuit board cleaning procedures, except for the sealed version (Model 96).
[1]At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.
Specifications are subject to change without notice.

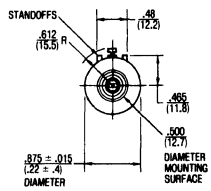
BOURNS SENSORS/CONTROLS, INC. 2533 NORTH 1500 WEST STREET OGDEN, UT 84404
(1 800) 468-6932 FAX (801) 479-0394 TWX 310-378-9499



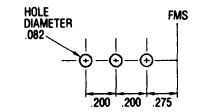
Model 3590

Bourns® Precision Potentiometers



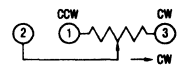


RECOMMENDED PC BOARD MOUNTING HOLE LOCATIONS



DIMENSIONS IN INCHES
PARENTHESES INDICATE MILLIMETERS

TOLERANCES
EXCEPT WHERE NOTED
.xx ± .02 (± .51)
.xxx ± .005 (± .127)
DIMENSIONS: IN. (MM)



Electrical Characteristics[1]

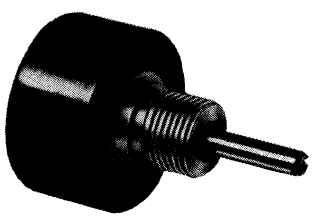
Standard Resistance Range	.200 tp 100KΩ
Resistance Tolerance	±5%
Independent Linearity	±0.25%
Effective Electrical Angle	.3600° +10°, –0°
Power Rating (Voltage Limited By Power Dissipation or 450 VAC, Whichever is Less)	
+40°C	.2 watts
+125°C	.0 watt

Environmental Characteristics[1]

Rotational Life (No Load)	.1,000,000 shaft revolutions

Mechanical Characteristics[1]

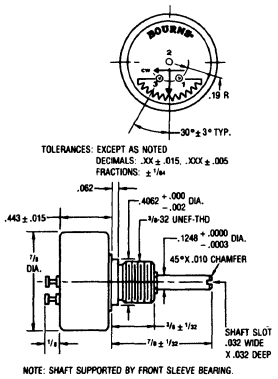
Mechanical Angle	.3600° +10°, –0°



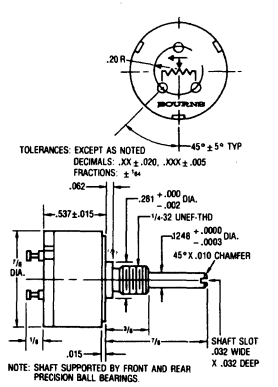
Models 6637/6638

Bourns® Precision Potentiometers

6637 7/8" DIAMETER



6638 7/8" DIAMETER





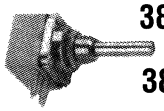
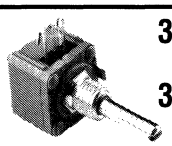
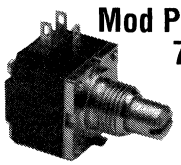
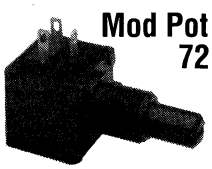
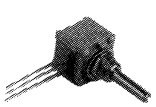
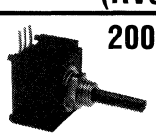
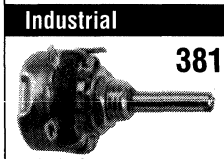
	6637 7/8" Diameter	6638 7/8" Diameter (Ball Bearing)
Electrical Characteristics[1]		
Standard Resistance Range	1KΩ to 100KΩ	1KΩ to 100KΩ
Resistance Tolerance	±10%	±10%
Independent Linearity	±1%	±1%
Effective Electrical Angle	340° ±3%	340° ±3%
End Voltage	0.5% maximum	0.5% maximum
Output Smoothness	0.1% maximum	0.1% maximum
Resolution	Essentially Infinite	Essentially Infinite
Power Rating (Voltage Limited By Power Dissipation, or 300 VAC, Whichever is Less)		
+70°C	1 watt	1 watt
+125°C	0 watt	0 watt
Environmental Characteristics[1]		
Rotational Life (No Load)	10,000,000 shaft revolutions	20,000,000 shaft revolutions
Mechanical Characteristics[1]		
Mechanical Angle	Continuous	Continuous

[1]At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.

Specifications are subject to change without notice.

CLAROSTAT

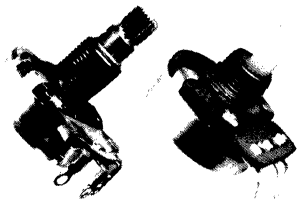
POTENTIOMETERS

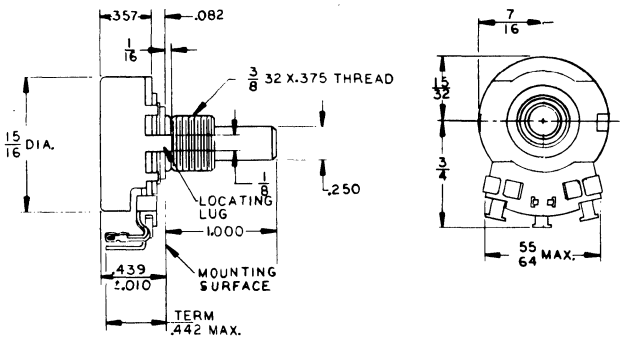
Series	Resistive Element	Power (watts)	Resistance Range (ohms)	Tolerance	Taper	Body Dimensions	Shaft	Bushing	Terminals
Modular									
 **388** **389**	Conductive plastic Cermet	0.5 1.0	100-5 meg	±10%	S Z RZ	1/2" sq.	Slotted Flatted	Plain Locking	Solder hook PC
Note: can be used with AJ, BJ, BJM, CJ, DJ, and shadow switches.									
388/389MP 	Same as 388 and 389 with 1/2" diameter gear motor.								
 **308** **309**	Conductive plastic Cermet	0.5 1.0	100-5 meg	±10%	S Z RZ	1/2" sq.	Slotted Flatted	Plain Locking	Solder hook PC
Note: can be used with AL, BL, BLM and DJ switches									
 **Mod Pot 70**	Cermet Carbon composition Conductive plastic	2.0 1.0 0.5	100-5 meg 50-10 meg 100-1 meg	±5, ±10% ±10, ±20% ±10, ±20%	Linear*	0.625" sq.	Plain Slotted Flatted	Plain Locking	Solder lug PC
Note: available as L and Straight-T attenuator. *Consult factory for other tapers.									
 **Mod Pot 72**	Cermet Carbon composition Conductive plastic	1.0 0.5 0.25	100-5 meg 50-10 meg 100-1 meg	±5, ±10% ±10, ±20% ±10, ±20%	Linear*	0.625" sq.	Plain Slotted Flatted	Plain Locking	Solder lug PC
Note: available as L and Straight-T attenuator. *Consult factory for other tapers.									
Board Washable									
 **408** **409**	Conductive plastic Cermet	0.5 1.0	100-5 meg	±10, ±20%	S Z RZ	1/2" sq.	Slotted Flatted	Plain Locking	Solder hook PC
 **392** **(RV6)** **(RV8)**	Conductive plastic	0.5	100-5 meg	±10, ±20%	S Z RZ	1/2" diameter	Slotted	Plain Split locking	PC Solder lug
 **2000**	Conductive plastic	0.5	250-1 meg	±10, ±20%	Linear*	0.625" sq.	Plain Slotted	Threaded Unthreaded	PC
Note: Available as a Straight-T attenuator. *Consult factory for other tapers									
Industrial									
 **381**	Conductive plastic	2.0	100-5 meg	±10, ±20%	S Z RZ	5/8" dia.	Slotted Flatted	Plain Locking	Solder lug
 **53 (RV4)** **380**	Conductive plastic	2.0	50-10 meg	±10, ±20%	S Z RZ	1" dia.	Slotted Flatted	Plain Locking	Solder lug
Like Series 53, except 100,000 life and stainless steel shaft									
Note: can be used with AE switches									

CRL™ Components, Inc.
Highway 20 West
Fort Dodge, Iowa 50501
Telephone: (515) 573-1300
FAX: (515) 573-1342

POTENTIOMETERS

Series 200



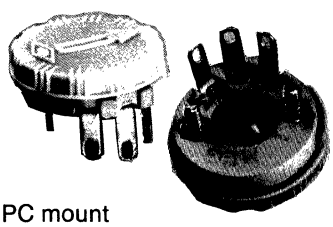


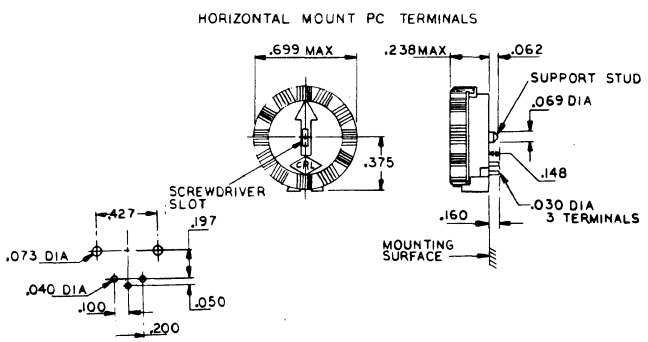
- 15/16″ diameter
- PC, wirewrap or solder lug terminals
- Bushing, twist tab, or PC Terminal Mount
- Numerous metal or plastic shaft options

SPECIFICATIONS

Resistor: Carbon Linear ±20%; Carbon, Non-Linear ±20″
Power Rating: .5 Watt Linear; .2 Watt Non-Linear
Max. Oper. Voltage: 350VDC
Rotational Life: 25,000 cycles
Rotation: 300° ±5°
CRV: <5%
Insulation Resistance: >100 megohm

Series 900



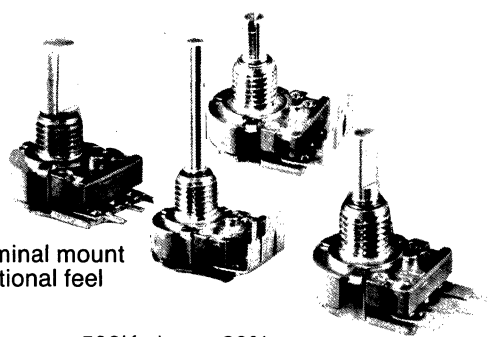


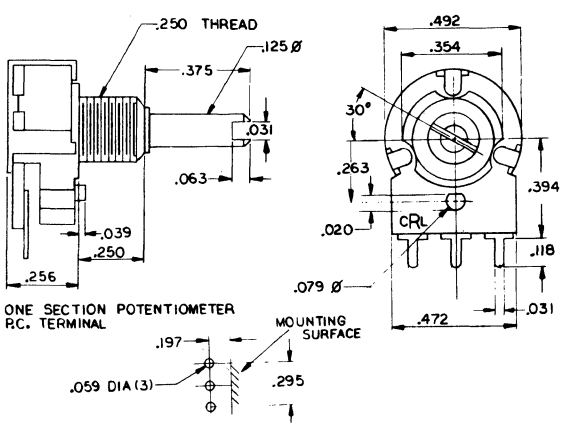
- .699″ diameter
- Stud, bracket or PC mount
- Numerous knob styles and colors available
- Vertical or horizonal mounting styles

SPECIFICATIONS

Resistor: Carbon, Linear ±20%
Power Rating: .2 Watts
Max. Oper. Voltage: 250VDC
Rotational Life: 25,000 cycles
Rotation: 260° ±3°
Contacts: Dual Wiping, Low Noise

Series 1200





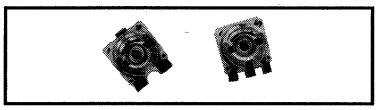
- .492″ diameter
- Low cost
- Bushing or PC terminal mount
- Velvet smooth rotational feel

SPECIFICATIONS

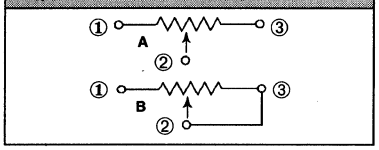
Resistor: Carbon, Linear; <500K ohm ±20%;
>500K ohm ±30%
Power Rating: .16 Watt
Max. Oper. Voltage: 200 Volts (RMS or VDC)
Rotational Life: 25,000 cycles
Rotation: 300° ±10°
CRV, Initial: 2% Nominal
Insulation Resistance: 100 Megohm Min.

MODELS ST22 and ST23
Chip Potentiometers
Surface Mounted, Single Turn
Open Frame, 4mm Square

A COMPANY OF VISHAY DALE®



EQUIVALENT CIRCUIT



FEATURES

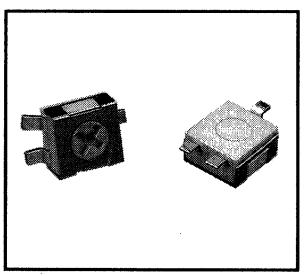
- Designed for efficient, accurate miniaturization
- Can be wave or dip soldered without rotor problems
- Coded marking for easy identification of resistance value
- Models for standard, automatic or reverse adjustment
- 12mm tape and reel packaging

ELECTRICAL SPECIFICATIONS

Resistance Values: 100Ω to 1 MΩ.
Resistance Tolerance: ± 30%.
Rated Power: 0.2 watts at 70°C.
Rated Voltage: 100 VDC.
Rotation Life: 20 rotations.
Torque: 20 to 200 g/cm.
Rotation Angle: 270° ± 20° total.
Operating Temp. Range: - 40°C to + 100°C.
TCR: ± 250PPM/°C.
CRV: 5% maximum.

MODELS ST53YJ and ST53YL
Cermet Trimmers
Surface Mount, Miniature, Single Turn, Fully Sealed

A COMPANY OF VISHAY DALE®



FEATURES

- 0.2 watts at 85°C
- Excellent stability
- Wide ohmic range
- Fully sealed
- Low temperature coefficient
- Low contact resistance variation
- Manual or automatic operations
- Small size for optimum packing density

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW			T. C. - 55°C + 125°C PPM/°C
	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	
10	0.20	1.41	141.0	0 + 200
20	0.20	2.00	100.0	
50	0.20	3.16	63.0	
100	0.20	4.47	45.0	± 100
200	0.20	6.32	32.0	
500	0.20	10.0	20.0	
1k	0.20	14.1	14.0	
2k	0.20	20.0	10.0	
5k	0.20	31.6	6.3	
10k	0.20	44.7	4.5	
20k	0.20	63.2	3.2	
50k	0.20	100.0	2 .0	
100k	0.10	100.0	1.0	
200k	0.05	100.0	0.5	
500k	0.02	100.0	0.2	
1M	0.01	100.0	0.1	

APPLICATIONS

The ST53 trimming potentiometers have been designed for surface mount applications. They offer volumetric efficiency and have dimensions of .197" x .197" x .106" [5.0 x 5.0 x 2.7] with high performance and stability. The ST53 models are suitable for both manual or automatic operation and can with-stand wave, vapor phase and reflow soldering techniques.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 220° ± 15°.
Standard Series: 1-2-5.
Resistance Range: 10Ω to 1MΩ.
Resistance Tolerance: ± 10% standard.
Temperature Coefficient: (- 55°C to + 155°C). ± 100PPM/°C for Rn ≥ 100Ω.
Power Rating: 0.2 watt at + 85°C.
Limiting Element Voltage: 200 V.
Contact Resistance Variation: 1% Rn or 3Ω.
End Resistance Variation: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ.
Specification: In accordance with NFC 83251 or CECC 41100 and VRCI.

ENVIRONMENTAL SPECIFICATIONS

Climatic Category: 55/125/56.
Sealing: Fully Sealed container, solder immersion.
Soldering Cycle (Surface Mounting): 2 minutes at 215°C or 10 seconds at 260°C or 3 seconds at 350°C (according to VRCI). Soldering by wave, reflow and vapor phase.

MECHANICAL SPECIFICATIONS

Mechanical Travel: 270° ± 10°.
Operating Torque: 2.2 ounce inch maximum.
End Stop Torque: 5.0 ounce inch minimum.
Weight: 0.15 grams maximum.

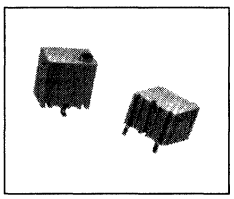
For more information contact:
DALE ELECTRONICS, INC., 1155 W. 23rd Street, Tempe, AZ 85282-1883 • Phone (602) 967-7874 • Fax 602-829-9314

A COMPANY OF VISHAY DALE®

MODELS ST63Y and ST63Z Cermet Trimmers

Surface Mount, Miniature

Industrial Grade, Multiturn, Fully Sealed



FEATURES

- 1/4" square and fully sealed
- 0.25 watts at 85°C
- Tight tolerance
- Very low T. C.
- Low contact resistance variation
- Low end contact resistance
- Tape & Reel or Tube packaging

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW			
	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.25	1.58	158.0	0
20	0.25	2.23	112.0	+ 200
50	0.25	3.53	77.0	
100	0.25	5.00	50.0	
200	0.25	7.07	35.0	
500	0.25	11.2	22.0	
1k	0.25	15.8	15.8	
2k	0.25	22.3	11.2	
5k	0.25	35.3	7.1	
10k	0.25	50.0	5.0	± 100
20k	0.25	70.7	3.5	
50k	0.25	112.0	2.2	
100k	0.25	158.0	1.6	
250k	0.25	250.0	1.0	
500k	0.13	223.0	0.50	
1M	0.06	250.0	0.25	
2M	0.03	250.0	0.12	

APPLICATIONS

The ST63 has dimensions of 6.6 x 6.8 x 4.6mm and is designed for PCB surface mounting. 2 styles are available according to the positioning of the control screw and contact positions. The cermet track gives a high stability performance with an extended ohmic capacity of 10Ω to 2MΩ.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 13 turns ± 2.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard.
Power Rating: 0.25 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 2% Rn or 2Ω, whichever is greater.
End Resistance Variation: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ, 500 VDC.

MECHANICAL SPECIFICATIONS

Mechanical Travel: 15 turns ± 5.
Operating Torque: 2.1 ounce inch maximum.
End Stop Torque: Clutch action.
Weight: 0.5 grams maximum.

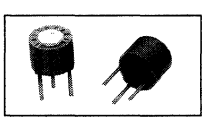
ENVIRONMENTAL SPECIFICATIONS

Climatic Category: 55/125/56.
Soldering Cycle (Surface Mounting): 2 minutes at 215°C or 10 seconds at 260°C or 3 seconds at 350°C (according to VRCI). Soldering by wave, reflow and vapor phase.

A COMPANY OF VISHAY DALE®

MODELS T7YA and T7YB Cermet Trimmers

Miniature, Industrial Grade



FEATURES

- 0.5 watts at 85°C • High stability
- Low T. C. • Wide resistance range
- Easy to read scale

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW			
	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.50	2.2	224.0	0
20	0.50	3.2	158.0	+ 200
50	0.50	5.0	100.0	
100	0.50	7.0	70.0	
200	0.50	10.0	50.0	
500	0.50	15.8	32.0	
1k	0.50	22.4	22.0	
2k	0.50	31.6	16.0	
5k	0.50	50.0	10.0	± 100
10k	0.50	70.7	7.0	
20k	0.50	100.0	5.0	
50k	0.50	158.0	3.2	
100k	0.50	224.0	2.2	
200k	0.31	250.0	1.25	
500k	0.12	250.0	0.50	
1M	0.06	250.0	0.25	

APPLICATIONS

The T7 trimmer is only .275" [7.0] in diameter and fits almost anywhere. A sealed plastic case protecting a quality cermet track guarantees high performance and reliability. Adjustments are made easier by the clear scale readings. Competitively priced, the T7 is ideally suited to all industrial applications.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 270° ± 15°.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard.
Power Rating: 0.5 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 3% or 3Ω, whichever is greater.
End Resistance Variation: 1Ω typical.

MECHANICAL SPECIFICATIONS

Mechanical Travel: 300° ± 15°.
Operating Torque: 3 ounce inch maximum.
End Stop Torque: 5.6 ounce inch minimum.
Weight: 0.02 ounces.

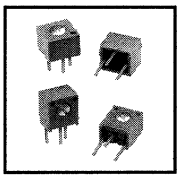
ENVIRONMENTAL SPECIFICATIONS

Climatic Category: 55/100/56.
Sealing: Enables cleaning.

For more information:
DALE ELECTRONICS, INC., 1155 W. 23rd Street, Tempe, AZ 85282-1883 • Phone (602) 967-7874 • Fax 602-829-9314

MODELS TX, TXD, TY (A, D, M, P)
Cermet Trimmers
Miniature, Industrial Grade

A COMPANY OF VISHAY DALE®



FEATURES
- 0.5 watt at 85°C • Easy to read scale
- Typ. contact resistance variation = 1%
- Fully sealed
- Wide temp. range - 55°C to + 125°C
- Excellent stability owing to multi-contact wiper in precious metal

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW MAXIMUM POWER AT 85°C (Watts)	LINEAR LAW MAXIMUM WORKING VOLTAGE (Volts)	LINEAR LAW MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.50	2.2	224.0	0
20	0.50	3.2	158.0	+ 200
50	0.50	5.0	100.0	
100	0.50	7.0	70.0	
200	0.50	10.0	50.0	
500	0.50	15.8	32.0	
1k	0.50	22.4	22.0	
2k	0.50	31.6	16.0	
5k	0.50	50.0	10.0	± 100
10k	0.50	70.7	7.0	
20k	0.50	100.0	5.0	
50k	0.50	158.0	3.2	
100k	0.50	224.0	2.2	
200k	0.31	250.0	1.25	
500k	0.12	250.0	1.50	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.12	

APPLICATIONS
This newly designed trimming potentiometer can be mounted on PCBs as an alternative to most of the current 3/8" [9.53] square trimmers with the advantage of a significantly smaller size 9/32" [7.14].

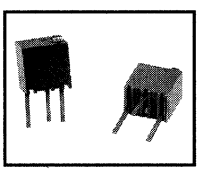
ELECTRICAL SPECIFICATIONS
Electrical Travel: 260° ± 15°.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard. ± 5% available.
Power Rating: 0.5 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 1% or 2Ω (whichever is greater).
End Resistance Variation: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ (500 VDC).

MECHANICAL SPECIFICATIONS
Mechanical Travel: 300° ± 15°.
Operating Torque: 3 ounce inch maximum.
End Stop Torque: 5.7 ounce inch maximum.
Weight: 0.02 ounces maximum.

ENVIRONMENTAL SPECIFICATIONS
Temperature Limits: - 55°C to + 125°C.
Climatic Category: 55/100/56.
Sealing: Fully sealed container.

MODEL T63
Cermet Trimmers
Small Size, 1/4 [6.35], Industrial Grade
Multiturn, Fully Sealed Container

A COMPANY OF VISHAY DALE®



FEATURES
- 0.25 watts at 85°C • Space saving
- Excellent stability & setting accuracy
- Multi-contact wiper in precious metal
- Wide range of ohmic values

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW MAXIMUM POWER AT 85°C (Watts)	LINEAR LAW MAXIMUM WORKING VOLTAGE (Volts)	LINEAR LAW MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.25	1.58	158.0	0
20	0.25	2.23	112.0	+ 200
50	0.25	3.53	70.0	
100	0.25	5.0	50.0	
200	0.25	7.07	35.0	
500	0.25	11.2	22.0	
1k	0.25	15.8	15.8	
2k	0.25	22.3	11.2	
5k	0.25	35.3	7.1	± 100
10k	0.25	50.0	5.0	
20k	0.25	70.7	3.5	
50k	0.25	112.0	2.2	
100k	0.25	158.0	1.6	
200k	0.25	224.0	1.1	
500k	0.13	250.0	0.50	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.13	

APPLICATIONS
Due to their square shape and small size (6.6 x 6.8 x 4.7mm), the T63 trimmers are ideally suited for PCB use, enabling high density board mounting with reduced space requirement between cards. 4 styles are available differing by the top or side position of the adjustment screw and the spacing of the terminals. The use of cermet for the resistive track ensures an excellent stability of the nominal specifications throughout life.

ELECTRICAL SPECIFICATIONS
Electrical Travel: 13 turns ± 2.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard. ± 5% available.
Power Rating: 0.25 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 2% Rn or 2Ω (whichever is greater).
End Resistance: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ (500 VDC).

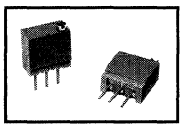
MECHANICAL SPECIFICATIONS
Mechanical Travel: 15 turns ± 5.
Operating Torque: 2.1 ounce inch maximum.
End Stop Torque: Clutch action.
Weight: 0.02 ounces.

ENVIRONMENTAL SPECIFICATIONS
Climatic Category: 55/125/56.

For more information contact:
DALE ELECTRONICS, INC., 1155 W. 23rd Street, Tempe, AZ 85282-1883 • Phone (602) 967-7874 • Fax 602-829-9314

MODEL T93
Cermet Trimmers
Small Size, 3/8 [9.53] Square, Industrial Grade, Multiturn, Fully Sealed

A COMPANY OF VISHAY DALE®



FEATURES
- 0.5 watts at 85°C
- Contact resistance variation < 1%, typ.
- Multi-finger wiper contact in precious metal

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW: MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.50	2.2	224.0	0
20	0.50	3.2	158.0	+ 200
50	0.50	5.0	100.0	
100	0.50	7.0	70.0	
200	0.50	10.0	50.0	
500	0.50	15.8	32.0	
1k	0.50	22.4	22.0	
2k	0.50	31.6	16.0	
5k	0.50	50.0	10.0	
10k	0.50	70.7	7.0	± 100
20k	0.50	100.0	5.0	
50k	0.50	158.0	3.2	
100k	0.50	224.0	2.2	
200k	0.31	250.0	0.50	
500k	0.12	250.0	0.50	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.12	

APPLICATIONS
The T93 is a small size trimmer - 3/8" x 3/8" x 3/16" [9.53 x 9.53 x 4.78] for PC board mounting. 5 styles are available which differ by the position of the control screw in relation to the PC board plane and by the spacing of the terminals. Excellent operational stability is provided by the use of a cermet element. The T93 model is ideally suited for all industrial applications.

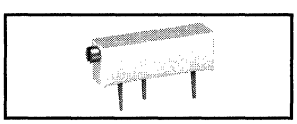
ELECTRICAL SPECIFICATIONS
Electrical Travel: 19 turns ± 2.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard. ± 5% available.
Power Rating: 0.5 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 2% Rn or 2Ω (whichever is greater).
End Resistance : 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ (500 VDC).

MECHANICAL SPECIFICATIONS
Mechanical Travel: 22 turns ± 5.
Operating Torque: 2.1 ounce inch maximum.
End Stop Torque: Clutch action.
Weight: 0.04 ounces.

ENVIRONMENTAL SPECIFICATIONS
Climatic Category: 55/125/56.

MODELS T18 and T18T
Cermet Trimmers
3/4 [19.05] Rectangular, Industrial Grade, Multiturn

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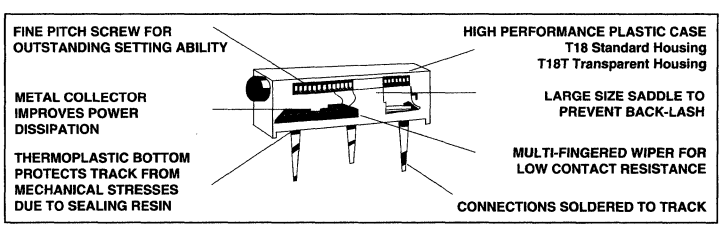


FEATURES
- 3/4" [19.05] rectangular
- T18 normal housing
- T18T transparent housing

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW: MAXIMUM POWER AT 70°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.75	2.7	270.0	0
20	0.75	3.9	195.0	+ 200
50	0.75	6.1	122.0	
100	0.75	8.7	87.0	
200	0.75	12.2	61.0	
500	0.75	19.4	39.0	
1k	0.75	27.4	27.0	
2k	0.75	38.7	19.0	
5k	0.75	61.2	12.0	
10k	0.75	86.6	9.0	± 100
20k	0.75	122.0	6.0	
50k	0.75	194.0	4.0	
100k	0.625	250.0	2.5	
200k	0.31	250.0	1.25	
500k	0.12	250.0	0.50	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.12	

ENVIRONMENTAL SPECIFICATIONS
Climatic Category: 55/100/56.
Sealing: T18-Fully sealed, T18T-Enables cleaning.



ELECTRICAL SPECIFICATIONS
Electrical Travel: 15 turns ± 1.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard.
T. C.: T18 = (- 55°C to + 125°C), ± 100PPM/°C for Rn ≥ 100Ω.
T18T = (- 55°C to + 105°C), ± 100PPM/°C for Rn ≥ 100Ω.
Power Rating: 0.75 watt at + 70°C.
Limiting Element Voltage: 250 volts.
Contact Resistance Variation: 2% or 2Ω, whichever is greater.
End Resistance Variation: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ, 500 VDC.

MECHANICAL SPECIFICATIONS
Mechanical Travel: 18 turns ± 3.
Operating Torque: 2.8 ounce inch maximum.
End Stop Torque: Clutch action.
Weight: .04 ounces maximum.

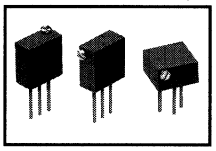
For more information contact:
DALE ELECTRONICS, INC.. 1155 W. 23rd Street, Tempe, AZ 85282-1883 • Phone (602) 967-7874 • Fax 602-829-9314

MODELS RT24 and RTR24 Wirewound Trimmers

Military, MIL-R-27208 Qualified, Type RT

Established Reliability, MIL-R-39015 Qualified, Type RTR

A COMPANY OF VISHAY TECHNO



FEATURES

- Precious metal wiper
- Solderable leads
- Military quality at affordable prices
- Established Reliability to 0.01%/ 1,000 hours, R level

STANDARD RESISTANCE VALUES

3/8 "[9.52] MODELS RT24 and RTR24

RESISTANCE* (Ohms)	NOMINAL RESOLUTION (%)
10	**1.10**
20	**.85**
50	**.65**
100	**.51**
200	**.40**
500	**.45**
1k	**.34**
2k	**.27**
5k	**.20**
10k	**.16**
20k	.13
25k	.12
35k	.11
50k	.10

* Other resistances available upon request.
Bold type indicates MIL approved range.

APPLICATIONS

Wirewound trimmers are particularly useful in applications where any combination of high power, low TCR and/or excellent long term life stability are important design considerations.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 22 ± 4 turns.
Resistance Range: 10Ω to 10kΩ.
Resistance Tolerance: ± 5% standard. Closer tolerances available.
Temperature Coefficient: (- 65°C to + 150°C) ± 50PPM/°C.
Power Rating: 1.0 watt at 85°C derated to 0 watt at 150°C.
End Resistance: 1Ω or 2%, whichever is greater.
Equivalent Noise Resistance (ENR): 100Ω max.
Dielectric (DWV): 1000 VAC at atmospheric pressure.
Insulation Resistance: > 100,000MΩ (500 VDC).

MECHANICAL SPECIFICATIONS

Operating Torque: 5 oz. inch max.
Rotation: Clutch stop, wiper idles.
Weight: 0.935 grams max.
Resistive Element: Nickel chromium.
Rotational Life: 200 cycles min.
Terminal Strength: 2 pounds for 10 seconds.

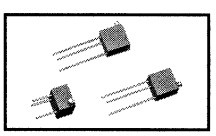
ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 65°C to + 150°C.
Sealing: Fully sealed case (non-hermetic).

MODELS RT26 and RT27 Wirewound Trimmers

Military, MIL-R-27208 Qualified, Type RT

A COMPANY OF VISHAY TECHNO



FEATURES

- Precious metal wipe
- Solderable leads
- Special configurations available
- Milquality at affordable prices

STANDARD RESISTANCE VALUES

1/4" [6.35] MODELS RT26 and RT27

RESISTANCE* (Ohms)	NOMINAL RESOLUTION (%)
10	**1.65**
20	**1.35**
50	**1.13**
100	**.82**
200	**.62**
500	**.62**
1k	**.49**
2k	**.34**
5k	**.27**
10k	.21
20k	.17
25k	.16

* Other resistances available upon request.
Bold type indicates MIL approved range.

APPLICATIONS

Wirewound trimmers are particularly useful in applications where any combination of high power, low TCR and/or excellent long term life stability are important design considerations.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 22 ± 4 turns.
Resistance Range: 10Ω to 5kΩ.
Resistance Tolerance: ± 5% standard. Closer tolerances available.
Temperature Coefficient: (- 65°C to + 150°C) ± 50PPM/°C.
Power Rating: 0.5 watt at 85°C derated to 0 watt at 150°C.
End Resistance: 1Ω or 2%, whichever is greater.
Equivalent Noise Resistance (ENR): 100Ω max.
Dielectric (DWV): 1000 VAC at atmospheric pressure.
Insulation Resistance: > 100,000MΩ (500 VDC).

MECHANICAL SPECIFICATIONS

Operating Torque: 3 oz. inch max., RT26. 5 oz. inch max., RT27.
Rotation: Clutch stop, wiper idles.
Weight: 0.935 grams max.
Resistive Element: Nickel chromium.
Rotational Life: 200 cycles min.
Terminal Strength: 2 pounds for 10 seconds.

ENVIRONMENTAL SPECIFICATIONS

Sealing: Fully sealed case (non-hermetic).

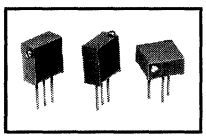
For more information contact:
TECHNO DIVISION, DALE ELECTRONICS, INC., 7803 Lemona Avenue, Van Nuys, CA 91405-1139 • Phone (818) 781-1642 • Fax 818-781-8647

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MODELS RJ24 and RJR24 Cermet Trimmers

Military, MIL-R-22097 Qualified, Type RJ

Established Reliability, MIL-R-39035 Qualified, Type RJR



FEATURES

- Infinite resolution
- Solderable leads, Hot Solder Dipped
- Withstands thermal stress environments
- Board washable and easy adjustability
- The RJ/RJR24 trimmers are continually tested to the most demanding requirements of MIL-R-22097 and MIL-R-39035. Units are qualified from 10Ω to 1MΩ to Characteristic H (± 50PPM/°C) of MIL-R-39035.

STANDARD RESISTANCE VALUES

3/8" [9.52] MODELS RJ24 and RJR24

RESISTANCE (Ohms)	MAXIMUM WORKING VOLTAGE (Volts)
10	2.23
20	3.10
50	5.00
100	7.00
200	10.00
500	15.80
1k	22.30
2k	31.60
5k	50.00
10k	70.70
20k	100.00
25k	111.00
50k	158.00
100k	223.00
250k	300.00
500k	300.00
1M	300.00

ELECTRICAL SPECIFICATIONS

Electrical Travel: 25 ± 2 turns.
Resistance Tolerance: ± 10% standard.
T. C.: (- 55°C to + 150°C) ± 100PPM/°C. ± 50PPM/°C available.
Power Rating: 0.5 watt at 85°C derated to 0 watt at 150°C.
Maximum CRV: 3% of R or 3Ω, whichever is greater, typical 0.5%.
End Resistance: 2% of R or 2Ω, whichever is greater, typical 0.2Ω.
Dielectric Strength: 1000 VAC at ambient temperature.
Insulation Resistance: > 100,000MΩ (500 VDC)

MECHANICAL SPECIFICATIONS

Operating Torque: 5 ounce inch maximum.
Rotation: Clutch stop, wiper idles.
Weight: 1.3 grams maximum.
Resistive Element: Thick film.
Rotational Life: 200 cycles minimum.
Terminal Strength: 2 pounds for 10 seconds.

ENVIRONMENTAL SPECIFICATIONS

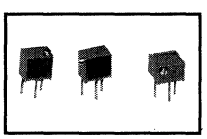
Temperature Limits: - 65°C to + 150°C.
Sealing: Fully sealed case (non-hermetic).

A COMPANY OF VISHAY TECHNO

MODELS RJ26 and RJR26 Cermet Trimmers

Military, MIL-R-22097 Qualified, Type RJ

Established Reliability, MIL-R-39035 Qualified, Type RJR



FEATURES

- Infinite resolution
- Solderable leads, Hot Solder Dipped
- Withstands thermal stress environments
- Board washable and easy adjustability
- The RJ/RJR26 trimmers are continually tested to the most demanding requirements of MIL-R-22097 and MIL-R-39035. Units are qualified from 10Ω to 1MΩ to Characteristic H (± 50PPM/°C) of MIL-R-39035.

STANDARD RESISTANCE VALUES

1/4" [6.35] MODELS RJ26 and RJR26

RESISTANCE (Ohms)	MAXIMUM WORKING VOLTAGE (Volts)
10	1.58
20	2.23
50	3.54
100	5.00
200	7.07
500	11.10
1k	15.80
2k	22.30
5k	35.40
10k	50.00
20k	70.07
25k	79.00
50k	111.00
100k	158.00
250k	200.00
500k	200.00
1M	200.00

ELECTRICAL SPECIFICATIONS

Electrical Travel: 22 ± 2 turns.
Resistance Tolerance: ± 10% standard.
T. C.: (- 55°C to + 150°C) ± 100PPM/°C. ± 50PPM/°C available.
Power Rating: 0.25 watt at 85°C derated to 0 watt at 150°C.
Maximum CRV: 3% of R or 3Ω, whichever is greater, typical 0.5%.
End Resistance: 2% of R or 2Ω, whichever is greater, typical 0.2Ω.
Dielectric Strength: 1000 VAC at ambient temperature.
Insulation Resistance: > 100,000MΩ (500 VDC).

MECHANICAL SPECIFICATIONS

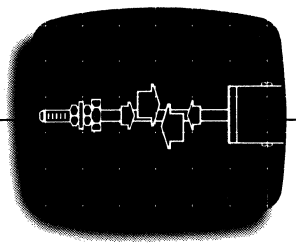
Operating Torque: 3 ounce inch maximum.
Rotation: Clutch stop, wiper idles.
Weight: 0.6 grams maximum.
Resistive Element: Thick film.
Rotational Life: 200 cycles minimum.
Terminal Strength: 2 pounds for 10 seconds.

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 65°C to + 150°C.
Sealing: Fully sealed case (non-hermetic).

For more information contact:
TECHNO DIVISION. DALE ELECTRONICS, INC., 7803 Lemona Avenue, Van Nuys, CA 91405-1139 • Phone (818) 781-1642 • Fax 818-781-8647

DUNCAN ELECTRONICS
A BEI Electronics Company



A complete selection of standard products is available for cost-effective solutions to a wide variety of functions. DUNCAN ELECTRONICS is also prepared to respond to special requirements, and offers a host of new, innovative alternatives to position sensing applications.



PT-100 SERIES

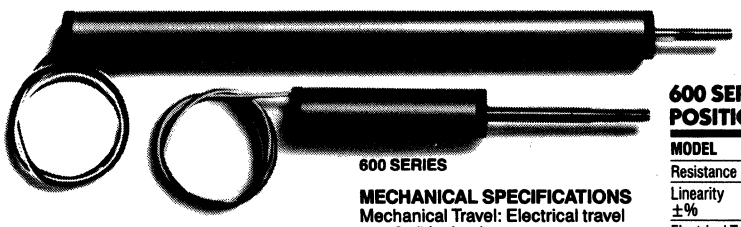
ELECTRICAL SPECIFICATIONS
Resistance: 2.4K–9.6KΩ standard (See table)
Special resistances: contact factory
R_T Tolerance: ±20% standard ±10% and less: special
Accuracy (independent linearity): ±0.07% to 0.05% standard (contact factory for special)
Power Rating: 0.75 watts/inch stroke
Temp Range: −55° to +125°C
Resolution: Infinite (conductive plastic)
Stroke (electrical travel): 6″ (150mm) to 36″ (900mm) (See table)

MECHANICAL SPECIFICATIONS
Mechanical Travel: Electrical travel +0.1″ min. (See table)
Shaft: 0.250″ (6.35mm) diameter; 1/4–28 threaded end adaptor (furnished) M6 threaded adapter available (Metric Model)
Case Size: 1.25″ square x length (See table)
Actuation Force: 1 lb. (maximum)—standard
Repeatability: Within 0.0005″ (.013mm)
Life: 100 x 10^6 (up to 12″ stroke—derated proportionately for longer units)

PT-100 SERIES LINEAR MOTION POSITION TRANSDUCERS

MODEL NO.*	106	109	112	118	124	130	136
Resistance Ω ±20%	5.0K	2.4K	3.2K	4.8K	6.4K	8.0K	9.6K
Linearity (±% standard)	0.07	0.07	0.07	0.05	0.05	0.05	0.05
Electrical Travel inches (mm)	6 (150)	9 (225)	12 (300)	18 (450)	24 (600)	30 (750)	36 (900)
Case Dimensions in inches (mm)							
Housing Length	8.82 (224)	11.82 (300)	14.82 (377)	20.82 (529)	26.82 (681)	32.82 (834)	38.82 (986)
Total Weight (gms)	360	460	580	805	1025	1245	1470
Intertia (gms)	70	90	105	145	180	220	260

*Add prefix M for metric models.



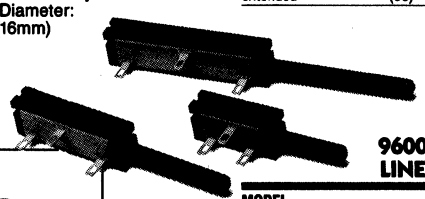
600 SERIES

ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ±20%
Independent Linearity: ±0.70 to 0.08% (See table)
Power Rating at 70° C: 0.25 watts Per inch of electrical travel derated to 0 watts at 125° C
Output Smoothness: 0.1%
Resolution: Infinite
Insulation Resistance at 500 VDC: 1000 megohms
Dielectric Strength: 500 VRMS
Temperature Range: −55 to +125°C

MECHANICAL SPECIFICATIONS
Mechanical Travel: Electrical travel +0.1″ inch min.
Actuation Force: 2 oz. max.
Repeatability: Within .0005 in.
Life: 10 x 10^6 Cycles
Shaft Alignment: Floating shaft design allows for shaft/interface misalignment up to 0.010″ (.25). Shaft rotates freely
Housing Diameter: 0.62″ (16mm)

600 SERIES LINEAR MOTION POSITION SENSOR INFINITE RESOLUTION

MODEL	601	602	603	604	606	610	612
Resistance KΩ	1.0	2.0	3.0	4.0	6.0	10.0	12.0
Linearity ±%	0.70	0.35	0.25	0.15	0.12	0.09	0.08
Electrical Travel inches (mm)	1.00 (25)	2.00 (51)	3.00 (76)	4.00 (102)	6.00 (152)	10.00 (254)	12.00 (305)
Case Dimensions in inches (mm)							
Housing Length	2.50 (57)	3.50 (89)	4.50 (114)	5.50 (140)	7.50 (190)	11.50 (292)	13.50 (343)
Shaft Length extended	2.10 (53)	3.10 (79)	4.10 (104)	5.10 (129)	7.10 (180)	11.10 (282)	13.10 (333)



9800 SERIES THROTTLE POSITION AND INDUSTRIAL CONTROL SENSOR MODULES



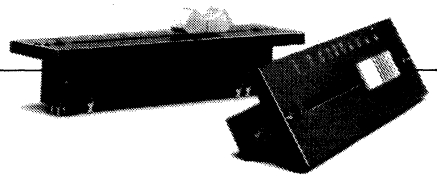
The Duncan 9800 Series Sensor is designed for rugged, continuous under hood environments. Features include high temperature, stable materials; insert molded integral connector/body design to eliminate weak/stress points or leaks during engine wash-down or water exposure.

To meet a variety of mounting area needs and interconnection requirements, fourteen standard models are available. For complete specifications, engineering assistance or special configurations of the 9800 Series to meet specific applications, contact a Duncan representative or the factory.

9600 SERIES MINIATURIZED SPRING RETURN LINEAR/POSITION SENSOR MODULE

MODEL	9605	9610	9615
Total Electric Travel inches (mm)	0.50 (12.7)	1.00 (25.4)	1.50 (38.1)
Total DC Resistance ±25%	1.7K	3.4K	5.1K
Linearity Over Active Electrical Travel	±2%	±2%	±2%
Best Practical Linearity	±1.0%	±0.5%	±0.35%
Power Rating At 70°C, Watts	.25	.50	.75
Mechanical Travel ±.015 (±0.4) inches (mm)	0.56 (14.2)	1.06 (26.9)	1.56 (39.6)
Housing Length ±.015 (±0.4) inches (mm)	1.06 (26.9)	1.56 (39.6)	2.06 (52.3)
Fully Extended Length ±.015 (±0.4) inches (mm)	.810 (20.6)	1.310 (33.3)	1.810 (46.0)
Housing Cross Section (max.) inches (mm)	0.35 H (9.0) X 0.50 W (12.7)	0.35 H (9.0) X 0.50 W (12.7)	0.35 H (9.0) X 0.50 W (12.7)
Mechanical Life	1,000,000 Full Cycles, 5,000,000 Dither Cycles		
Stop Strength oz. (Newtons)	360 (100)		
Actuation Force oz. (Newtons)	14.4 (4.0) Maximum supplied with internal spring to return actuator to extended position.		
Humidity	95% @ 38°C		
Vibration	15G's, 50 to 1,000Hz, 2 hrs. each plane		
Shock	UP to 50G's		
Temperature Limits	−40°C to +135°C		

POSITION SENSING PRODUCTS



PRECISION POTENTIOMETERS

A COMPLETE SELECTION OF WIREWOUND, HYBRID, AND CONDUCTIVE PLASTIC UNITS, INCLUDING COMMERCIAL AND INDUSTRIAL MODELS AND SPECIAL CAPABILITIES.

COMPARISON OF RESISTIVE CHARACTERISTICS

PARAMETER	RESISTIVE TECHNOLOGY		
	Wirewound	Hybrid	Conductive Plastic
Resistance Range	Full Range	Limited Range	Full Range
Std. Resistance Tolerance	±3%	±5%	±10%
Effective Travel Range	Up to 10-Turns	Up To 10-Turns	360° Maximum
Temp. Coefficient of Resistance	±20 PPM°C	±70 PPM°C	−300 PPM°C
Power Dissipation	High	High	Moderate
Resolution	Finite	Infinite	Infinite
Adjustability/Setability	Fair	Good	Excellent
Linearity/Conformity	Very Good	Good	Excellent
Contact resistance	Low	High	Moderately High
Rotational Life (Rev.)	2×10^8	10×10^6	50×10^6
Moisture Stability	Excellent	Good	Fair
Non-Linear Functions	Excellent	Good	Excellent
Rheostat Applications	Excellent	Poor	Fair
AC Circuit Applications	Poor	Fair	Excellent
Relative Cost	Low	Medium	High

SINGLE TURN POTENTIOMETERS

Element Type/ Series No.	Dia.	Resistance Range (Ω)	Linearity (%) Standard	Linearity (%) Best Practical	Max. Power @ 70°C (Watts)	Mounting Style
WIREWOUND						
1200	7/8"	15–75K	±0.5	±0.2	1.25	Servo/Bushing
1230	7/8"	15–50K	±0.5	±0.25	1.25	Bushing
1300	1 1/16"	25–100K	±0.4	±0.15	2.0	Servo/Bushing
1500	1 7/16"	25–125K	±0.3	±0.12	3.0	Servo/Bushing
1600	1¾"	25–150K	±0.25	±0.09	4.0	Servo/Bushing
1630	1¾"	25–100K	±0.3	±0.15	4.0	Bushing
1700	2"	25–200K	±0.2	±0.08	5.0	Servo/Bushing
1800	3"	25–250K	±0.15	±0.05	7.0	Servo/Bushing
CONDUCTIVE						
1220	7/8"	400–75K	±0.5	±0.2	0.5	Servo/Bushing
1320	1 1/16"	500–100K	±0.4	±0.15	0.75	Servo/Bushing
1520	1 7/16"	500–125K	±0.3	±0.10	1.0	Servo/Bushing
1620	1¾"	500–150K	±0.25	±0.075	1.5	Servo/Bushing
1720	2"	600–200K	±0.2	±0.06	2.0	Servo/Bushing
1820	3"	750–300K	±0.15	±0.04	3.0	Servo/Bushing
5251	7/8"	500–100K	±1.0	±0.25	1.0	Servo
5253	7/8"	500–100K	±2.0	±0.25	1.0	Bushing
HYBRID						
2200	7/8"	200–10K	±0.5	±0.25	1.25	Servo/Bushing
2300	1 1/16"	200–15K	±0.4	±0.2	2.0	Servo/Bushing
2500	1 7/16"	500–20K	±0.3	±0.15	3.0	Servo/Bushing
2600	1¾"	500–25K	±0.25	±0.12	4.0	Servo/Bushing
2630	1¾"	500–25K	±0.5	±0.2	4.0	Bushing
2700	2"	500–30K	±0.2	±0.1	5.0	Servo/Bushing
2800	3"	750–50K	±0.15	±0.07	7.0	Servo/Bushing

MULTI-TURN POTENTIOMETERS

Element Type/ Series No.	Dia.	Resistance Range (Ω)	# of Turns	Linearity (%) Standard	Linearity (%) Best Practical	Max. Power @ 70°C (Watts)	Mounting Style
WIREWOUND							
3200	7/8"	3–250K	3/5/10	±0.5/ 0.35/0.25	±0.1/ 0.07/0.05	1.5/2.0/2.5	Servo/Bushing
3233	7/8"	10–200K	10	±0.25	±0.1	2.5	Bushing
3500	1 7/16"	5–500K	3/5/10	±0.25/ 0.2/0.15	±0.5/ 0.04/0.03	3.0/4.0/5.0	Servo
3600		5–600K	3/10	±0.35/0.25	±0.1/0.05	5.0/7.0	Bushing
3700	2"	5–830K	3/10	±0.2/0.1	±0.04/0.02	5.0/7.0	Servo/Bushing
HYBRID							
4200	7/8"	500–100K	3/5/10	±0.5/ 0.35/0.25	±0.15/ 0.1/0.075	1.5/2.0/2.5	Servo/Bushing
4500	1 7/16"	500–200K	3/5/10	±0.25/ 0.2/0.15	±0.075/ 0.06/0.05	3.0/4.0/5.0	Servo
4700	2"	1K–250K	3/10	±0.2/0.1	±0.06/0.03	5.0/7.0	Servo/Bushing

NOTES: 1. All Wirewound models are manufactured to meet or exceed applicable characteristics of MIL-R-12934.
2. All Conductive Plastic and Hybrid models are manufactured to meet or exceed applicable characteristics of MIL-R-39023.

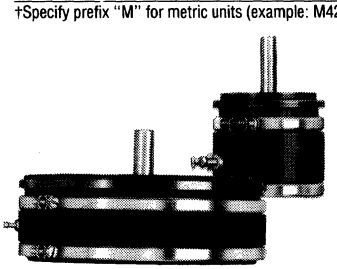
400 SERIES SLIDELINE POTENTIOMETERS

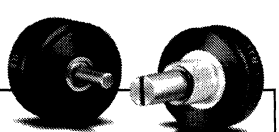
L = Linear A = Audio B = Balance

Electrical		L	A	B
1. Resistance Range (Ohms)		1K to 250K	600 to 25K	1K to 25K
2. Standard Resistance Values*(Ohms)		1K 2K 5K 10K 20K 50K 100K	600 1K 5K 10K	1K 5K 10K
3. Resistance Tolerance**%		±20	±20	±20
4. Linearity Tolerance	Std. (%)	±2.0	NA	NA
	Special (%)	±0.1	NA	NA
5. Taper conformity (dB)		NA	0–20 dB: ±2 >20–50 dB: ±4	NA
6. Tracking (Dual Channel Only) (dB)		2%	0–20 dB:2 >20–50 dB:4	NA
7. End Voltage (%)		0.5	NA	NA
8. Maximum Insertion Loss (dB)		NA	1.0	NA
9. Maximum Attentuation (dB) (Three-Terminal Device)		NA	90	NA
10. Resolution		INFINITE		
11. Power Rating at 70°C (Watts)				
Model 421/422		2.5	.25	.25
Model 441/442		4.0	.40	.40
Mechanical			IN.	MM†
1. Travel (inches MM)	Model 421/422		2¾	70
	Model 441/442		4¼	108
2. Actuating Force, Max.	(Oz. gm.)		3	85
3. Stop Strength	(Lbs. Kg.)		10	4.5
4. Number of Channels			Single or Dual in Identical Case	
5. Terminals	Model 421/441		Solder Type Flat Lugs (Accepts Quick Connect Receptacles)	
	Model 422/442		Printed Circuit Pins	
6. Housing Length	Model 421, 422		2.5	1.08
	Model 441, 442		6.0	1.25
7. Panel Cutout	Model 421, 422		⅛ x 3⅝	3 x 92
	Model 441, 442		⅛ x 5⅛	3 x 130
General				
1. Ambient Temperatures			−55°C to +125°C.	
2. Taps			Center Tap Available on Linear Only	
3. Dual independent wipers			Available in Linear Only	
4. Life	Traverses		5 Million	

*Other values available as special. **Tighter tolerances available as special.

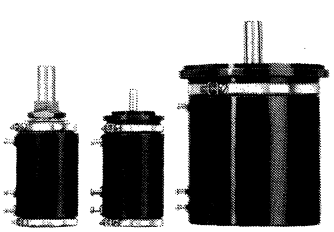
†Specify prefix "M" for metric units (example: M421)





5250 SERIES POTENTIOMETERS

Duncan offers one of industry's most complete selections of quality precision potentiometers, continuing in a tradition of high-performance designs chosen for their reliability. Answering the demand for a reliable yet truly low cost single-turn conductive plastic; 7/8" diameter precision design. Duncan's 5250 Series provides both panel and servo mount styles.

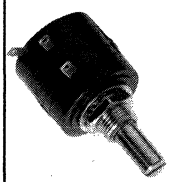
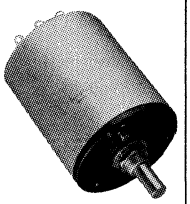


DUNCAN ELECTRONICS
A BEI Electronics Company
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ETI SYSTEMS

PRECISION POTENTIOMETERS

MULTI-TURNS

SPECIFICATIONS SHOWN ARE FOR 10-TURN MODELS.	MW22: 7/8" dia.	MW10: 3/8" dia.	MW20: 3/4" dia.	MW12: 1/2"dia.	MR46: 1-13/16"dia.	MO46: 2-1/2" dia.
						
STANDARD RESISTANCE RANGE	100 to 100k Ω	100 to 20k Ω	100 to 100k Ω	100 to 100K Ω	0.5 to 100k Ω	100 to 100K Ω
LINEARITY TOLERANCE	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.3%
NUMBER OF TURNS	3,5 and 10	3,5, and 10	3,5, and 10	3, 5 & 10	3,5,10,15,20,25 & 30	3,5,10,15, and 20
POWER RATING	2.0 watt	1.0 watt	2.0 watt	1.5 watt	5.0 watt	5.0 watt
ROTATIONAL LIFE	1,000,000	2,000,000	2,000,000	1,000,000	2,000,000	2,000,000
	Economical. General purpose voltage divider.	***World's Smallest*** 10 turn precision wirewound.	***High Rel, Higher Temp Housing.*** Should be used for automation.	***Space Saving Design.*** Bottom or rear terminals available.	***Highest Quality.*** Also avail. with 5 amp snap action limit switches.	***For Harsh and Corrosive Environments.*** Sealed and oil-filled.

OPTIONS: HYBRID ELEMENTS, NON-STD. RES. VALUES, EXTRA TAPS, SHAFT MODIFICATIONS, MULTI-GANGED, NON-STD. TOLERANCES

TURNS COUNTING DIALS

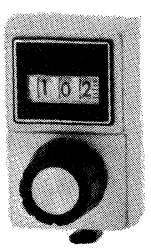
7/8" dia. - Model MG22 ***Lowest Cost***



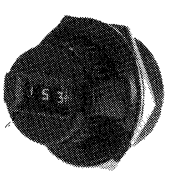
7/8" dia. - Model MF22 ***Highest Quality***



1" w. x 1.75" h. Model DB10, DB100 ***3 or 4 digit read-out***



1-1/16" dia. Model DC27 ***Economical***



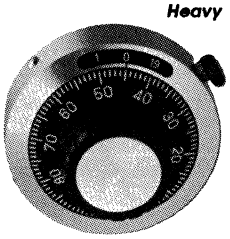
1-3/16" dia. - Model MD30 ***No "flip" action***



1" dia. - Model MB25 ***Large Window***



1-13/16"dia. - Model MF46 ***Heavy Duty***



POT/DIAL COMBINATIONS – *Pre-Asssembled and Calibrated to choice of precision Multi-Turn Potentiometers*

Model DW22 - with MW22 pot. ***Attractive***



COMBO®3

Model DC22 - with MW22 pot. ***Economical***



COMBO®4

NOTE: All dials shown fit 1/4" dia pot shafts as standard.

Options: ALL OPTIONS NOT AVAILABLE ON ALL DIALS. OTHER SHAFT SIZES, OTHER COLORS AVAIL., SOME DIALS AVAILABLE WITHOUT BRAKE, SPECIAL MARKINGS ON FACE PLATE.

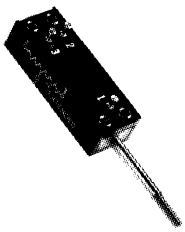
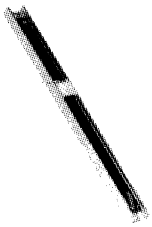
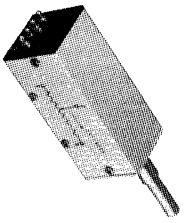
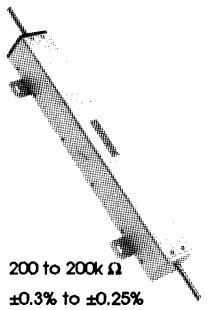
FOR MOTORIZED POTENTIOMETERS, RHEOSTATS, VARIABLE TRANSFORMERS, VALVE POSITIONERS, SEE OUR AD IN EEM, (Motors, Drives & Rotary Components). For SERVO CONTROL CIRCUITRY, see ad in EEM, (Control Systems & Components).

ETI SYSTEMS · 215 Via Del Norte · Oceanside, CA 92054 · TEL: (619) 757-7770 · FAX: (619) 757-2305
Division: Polaris Industrial Enterprises, Inc.

ETI SYSTEMS

PRECISION POTENTIOMETERS

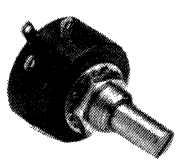
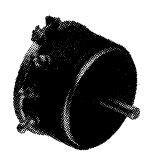
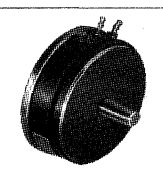
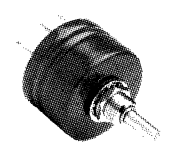
LINEAR MOTION

	Model LCP8 Conductive Plastic	Model LCP12 Conductive Plastic	Model LCPL Conductive Plastic	Model LCP20 Conductive Plastic	Model LW50 Wirewound
					
STANDARD RESISTANCE RANGE	1k to 50k Ω	500 to 20k Ω	2K to 500k Ω	500 to 20k Ω	200 to 200k Ω
LINEARITY TOLERANCE	±2.0%	±1.5% to ±0.5%	±0.5%	±1% to ±0.5%	±0.3% to ±0.25%
ELECTRICAL STROKE	0.433"	1/2", 1", 2", 4"	7.87 to 39.37"	0.590 to 3.937"	11.81 to 39.37"
POWER RATING	0.2 watts	0.2 to 1.2 watt	2 to 6 watts	0.3 to 1.25 watt	5.0 to 10.0 watt
LIFE	20,000,000 strokes	20,000,000 strokes	10,000,000 strokes	20,000,000 strokes	100,000 strokes
	Smallest Linear Motion on the market.	***General Purpose.*** 5 standard shaft types: Avail. wirewound.	***Open Frame*** Construction, high speed tracking	***Precision tolerances,*** increased power rating.Avail.wirewound.	***Heavy Duty*** for industrial machinery.

OPTIONS: (Not all options available on all units)

SPRING RETURNS	NON-STD. TOLERANCES	SPECIAL SHAFTS	HYBRID ELEMENT
OIL FILLED & SEALED	NON-STD. STROKES	NON-STD. RES. VALUES	

SINGLE TURNS

	SP22E -7/8" dia. Conductive Plastic	SP22D - 7/8" dia. Conductive Plastic	SP22 - 7/8" dia. Conductive Plastic	SP50 - 2" dia. Conductive Plastic	SO30 - 1-1/4" dia Oil Filled, Wirewound
					
STANDARD RESISTANCE RANGE	1K to 10k Ω	1K to 10k Ω	1K to 10k Ω	1K to 10k Ω	500 to 10k Ω
LINEARITY TOLERANCE	±1.0%	±1.5%	±1%	±0.5%	±1.0%
ELECTRICAL ANGLE	320° ± 5°	320° ± 5°	320° ± 2°	350° ± 2°	345° ± 5°
MECHANICAL ANGLE	320° ± 5°	320° ± 5°	Continuous	Continuous	Continuous
POWER RATING	1.0 watt	1 watt	1 watt	3 watts	0.75 watt
ROTATIONAL LIFE	10,000,000	10,000,000	50,000,000	50,000,000	200,000
	Lowest Cost. Plug on terminals. Also in wirewound - SW22E	***RearTerminals*** for minimum dia. profile. Also in wirewound - SW22D	***Hi Rel,*** precision quality. Also in wirewound - SW22	***Highest Quality;*** Longest life & highest power avail. Also in wirewound - SW50.	***For Harsh*** and Corrosive Environments. Also in Cond. Plastic - SOP30.

OPTIONS: (Not all options available on all units)

MULTI-GANG	NON-STD.TOLERANCES	REAR SHAFT	SPECIAL ELECT. & MECH. ANGLES
SERVO MOUNT	EXTRA TAPS	NON-STD.SHAFTS	NON-STD. RESISTANCE VALUES

ASK FOR OUR SELECTION GUIDE ON OUR FULL LINE OF POTENTIOMETRIC PRODUCTS

FOR MOTORIZED POTENTIOMETERS, RHEOSTATS, VARIABLE TRANSFORMERS, VALVE POSITIONERS, SEE OUR AD IN EEM, (Motors, Drives & Rotary Components). For SERVO CONTROL CIRCUITRY, see ad in (Control Systems & Components).

ETI SYSTEMS · 215 Via Del Norte · Oceanside, CA 92054 · TEL: (619) 757-7770 · FAX: (619) 757-2305
Division: Polaris Industrial Enterprises, Inc.

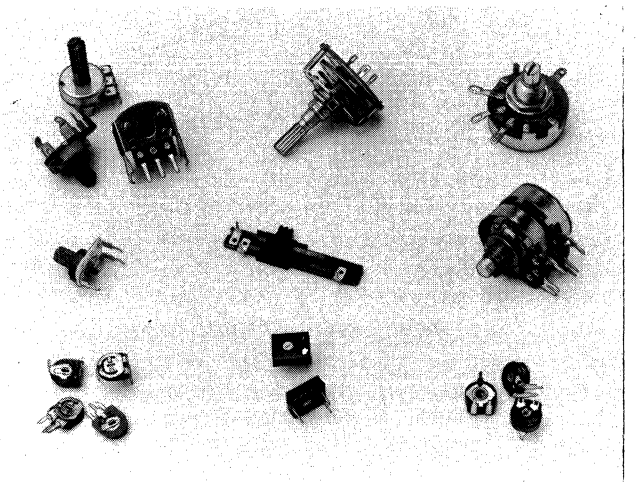
ISL PRODUCTS INTERNATIONAL LTD.

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FAX (516) 937-3840

CAPACITORS / SILICON DIODES / CUSTOM CABLE ASSEMBLIES / LEDS / CUSTOM HYBRID CIRCUITS / TRANSFORMERS / ADAPTORS AND POWER SUPPLIES

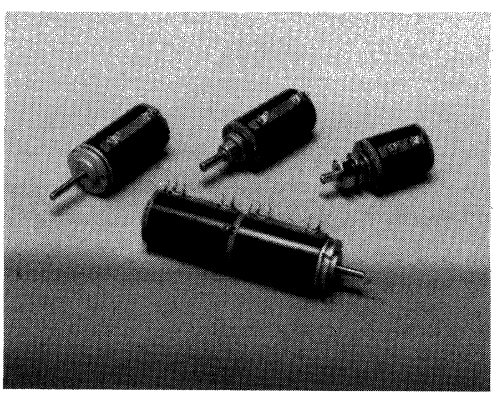
COMMON POTENTIOMETERS

- **Slide Variable Resistors**
  Non Case Slide Pots
  Low Profile Slide Pots
- **Trimmer Potentiometers**
  Carbon Types
  Cermet Types
  SMD Cermet
- **Rotary Variable Potentiometers**
  9mm-17mm
  Insulated Shaft
  Metal Shaft
  Gang Configuration Available
- **Weatherproof Carbon Composition Potentiometers**
  .5w-2w

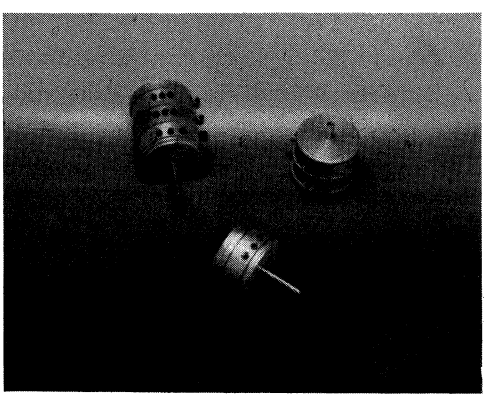


- **Wire Wound Potentiometer** 1W-5W
- **Thumbwheel Pots**
- **Potentiometer Blacks**

PRECISION POTENTIOMETERS



Multiturn Wirewound Pot



Precision Single Twin WW Pot

- **Precision Single Turn Wirewound Pots** .5W-5W
- **Multi-turn Wirewound Pots** 1W-5W
- **Sine-Cosine Wirewound Potentiometer**
- **Linear Motion Wirewound Potentiometer**

SEE OUR PAGES IN SECTIONS 2100,3130, 5600 & 6000

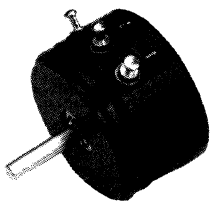
PRECISION CO-MOLDED CONDUCTIVE PLASTIC POTENTIOMETERS & ASSEMBLIES

Super Smooth (low noise) Pots, Wipers and Elements (.02–.03 Output Smoothness Vs MIL R 39023-.1%)

The JDK Co-Molded Conductive Plastic Process

JDK manufactures one type of potentiometer element — co-molded conductive plastic — because, to the designer and builder of systems in critical applications, there is no justification to use less than the best. In the JDK process, the termination and resistance materials are simultaneously molded with the plastic substrate. The result is a flush circuit with a very hard, smooth surface which, when combined with JDK's multifinger precious metal contacts, promotes ultra-long life, as well as excellent electrical performance in all environments. The superiority of the JDK flush circuit over the raised circuit elements (i.e., conductive plastic film, screened conductive plastic, cermet, hybrid, and wirewound) is most evident in its long-term consistent performance and reliability.

SERVO MOUNT MODELS



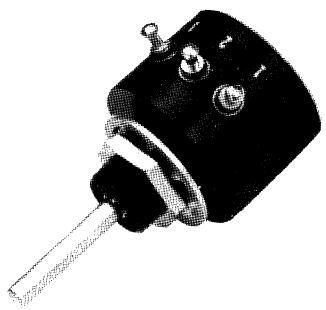
MODEL #	OUTSIDE DIAMETER INCHES	SHAFT DIAMETER INCHES	SHAFT LENGTH	BODY LENGTH MAXIMUM	RESISTANCE RANGE	ELECTRICAL ANGLE	INDEPENDENT LINEARITY	OUTPUT SMOOTHNESS
6005	.500	.1249	.500	.550	1K-50K	325°	1.0%	<0.1%
6008	.750	.1249	.500	.625	1K-50K	340°	.5%	<0.1%
6009	.875	.1249	.500	.625	1K-50K	340°	.5%	<0.1%
6011	1.062	.1249	.500	.625	1K-50K	340°	.5%	<0.1%
6015	1.437	.2498	.625	.750	1K-50K	340°	.5%	<0.1%
6018	1.750	.2498	.625	.750	1K-50K	350°	.5%	<0.1%
6020	2.000	.2498	.625	.750	1K-50K	350°	.5%	<0.1%

Specials available

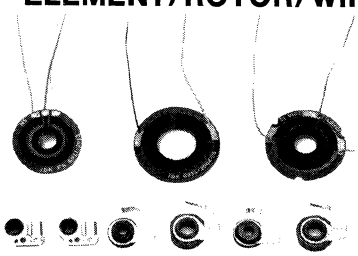
BUSHING MOUNT MODELS

MODEL #	OUTSIDE DIAMETER INCHES	SHAFT DIAMETER INCHES	SHAFT LENGTH	BODY LENGTH MAXIMUM	RESISTANCE RANGE	ELECTRICAL ANGLE	INDEPENDENT LINEARITY	OUTPUT SMOOTHNESS
6205	.500	.1249	.687	.550	1K-50K	325°	1.0%	<0.1%
6208	.750	.1249	.687	.625	1K-50K	340°	.5%	<0.1%
6209	.875	.1249	.687	.625	1K-50K	340°	.5%	<0.1%
6211	1.062	.1249	.687	.625	1K-50K	340°	.5%	<0.1%
6215	1.437	.2498	.875	.750	1K-50K	340°	.5%	<0.1%
6218	1.750	.2498	.875	.750	1K-50K	350°	.5%	<0.1%
6220	2.000	.2498	.875	.750	1K-50K	350°	.5%	<0.1%

Specials available



ELEMENT/ROTOR/WIPER ASSEMBLIES



MODEL	NOMINAL OUTSIDE DIAMETER	NOMINAL INSIDE DIAMETER	NOMINAL THICKNESS	WIRE TERMINATIONS
6909	.702	.186	.072	30 Awg Teflon Coated single conductor 6″ long
6911	.888	.186	.072	30 Awg Teflon Coated single conductor 6″ long
6915	1.252	.435	.072	30 Awg Teflon Coated single conductor 6″ long
6918	1.557	.435	.072	30 Awg Teflon Coated single conductor 6″ long
6920	1.805	.435	.072	30 Awg Teflon Coated single conductor 6″ long

Electrical performance similar to servo and bushing models
Many custom sizes available

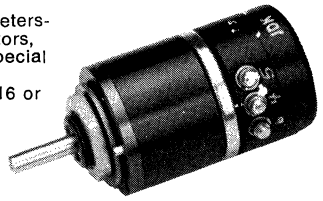
THE JDK DIFFERENCE

Since the JDK process and systems are foremost in the industry, we are able to offer the following features:

- ULTRA-LONG ROTATIONAL LIFE — 50 million cycles minimum for most applications of 6000 & 6200 models
- STATE-OF-THE-ART OUTPUT SMOOTHNESS — always under 0.1%
- NO INTERNAL SOLDER CONNECTIONS — conductive epoxy and welded connections used for greater reliability
- LOW TORQUE — less than 0.1 in oz. available in most single cup 6000 & 6200 models
- 18 MONTH WARRANTY — standard for most applications of 6000 & 6200 models
- OUTSTANDING VALUE = best "price/performance" ratio in the industry
- ALL UNITS DESIGNED, MANUFACTURED, AND TESTED IN ACCORDANCE WITH MIL-R-39023

CUSTOM REQUIREMENTS AND ASSEMBLIES

JDK specializes in custom electrical and/or mechanical requirements for potentiometer in the sizes above as well as the following:
Next Assemblies:
JDK will add to its potentiometers-
Flanges, extra cups, connectors, multiple taps, flying leads, special shafts
Motor and/or Gearheads in 16 or 22mm diameters



JDKontrols, Inc.

WHEN POTENTIOMETER PERFORMANCE IS *CRITICAL*

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- Potter Brumfield
- Waber Electric

CONNECTORS
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- Amphenol
- Cablewave
- E.F. Johnson
- Kulka
- Manhattan
- Paladin
- Panduit
- Pomona
- Superior
- Switchcraft

COUNTERS
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- Kessler-Ellis
- Redington
- Stemco

FIBER OPTICS
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- Amphenol
- Belden Cable
- Madison

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- Curtis
- J.W. Miller
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- Bussmann
- Littelfuse
- U.S.D.

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- Harvey Hubbell
- Kulka Smith
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- Panduit
- Vector

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- Eveready
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- Ledu
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- Waber

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- Bourns
- Clarostat
- Ohmite

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- Dormeyer
- Microtran
- Sola
- Stancor
- Superior
- Triad
- Tripp-lite
- UTC
- Waber

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- Aleph International
- Allied Controls
- American Zettler
- Aromat
- C.P. Clare
- Crydom
- Coto
- Gordos
- Guardian
- ITT
- Line Electric
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- Sigma
- Struthers-Dunn
- Theta-J

RESISTORS & NETWORKS
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- Bourns
- Clarostat
- Mallory
- Ohmite

SEMICONDUCTORS
- Semi Inc.
- Semitronics

SWITCHES
- Arrow Hart
- AMP
- C & K
- Cherry Electric
- G.C.
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- Omron
- Oslo
- Otto
- Switchcraft
- Unimax

TERMINAL BLOCKS
- AMP
- Buchanan
- Curtis
- Electrovert
- Magnum
- RDI
- Siemen
- USD
- Vernitron-Beau
- Weidmuller

TEST EQUIPMENT
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- Simpson Electric
- Triplett

TIMERS
- Agastat
- Amperite
- Industrial Timer
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- SSAC

TOOLS & SOLDER
- AMP
- Blazer
- Ersin
- Kester
- OK Machine & Tool
- Paladin
- Portasol
- Ungar
- Weller
- Xcelite
- Helper Winch

TRANSFORMERS
- Dormeyer
- Jeffersons
- Microtran
- Sola
- Stancor
- Thordarson
- Triad
- U.T.C.

TUBES
- Eimac
- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

WIRE & CABLE
- Alpha
- Belden
- Cablewave
- Carol
- Iboco
- Madison
- Manhattan
- Quabbin

BOURNS



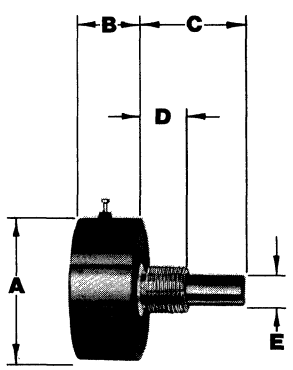
HAWKER CLAROSTAT **CLAROSTAT**

MAUREY INSTRUMENT CORP.

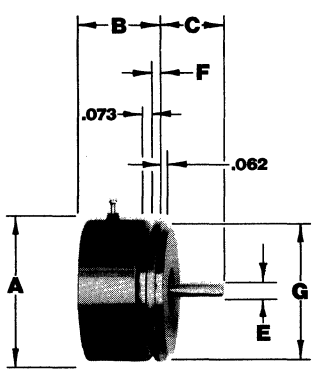
PRECISION WIREWOUND SINGLE TURN POTENTIOMETERS

PST

The wirewound family of precision single turn potentiometers provides a level of quality that has become an industry standard. Designed for applications that require extreme accuracy and high reliability, they meet or exceed most applicable military specifications. They are ideal for laboratory equipment and as standards for test bench applications. The unique design of the wiper assembly provides back-lash free operation.
The housings are machined from aluminum, brass or stainless steel. Shafts are ground and polished 303 stainless steel with either brass sleeve or precision ball bearings.
These combinations provide close linearity tolerances and high repeatability for a relatively moderate environment.



BUSHING



SERVO

	TYPE	A	B	C	D	E	F	G
50-M125	BUSHING	.50	.38	5/8	1/4	.125	—	—
50-M126	SERVO	.50	.56	1/2	—	.125	.062	.437
87-M42	BUSHING	.87	.59	5/8	1/4	.125	—	—
87-M44	SERVO	.87	.68	1/2	—	.125	.062	.750
106-M10	SERVO	1.06	.68	1/2	—	.125	.062	.968
131-M3	BUSHING	1.31	.50	7/8	3/8	.250	—	—
143-M8	SERVO	1.44	.80	3/4	—	.250	.093	1.312
200-M167	SERVO	2.00	.80	3/4	—	.250	.093	1.875
300-M74	SERVO	3.00	.80	3/4	—	.250	.093	2.875

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	50-M125 BUSHING	50-M126 SERVO	87-M42 BUSHING	87-M44 SERVO	106-M10 SERVO	131-M3 BUSHING	143-M8 SERVO	200-M167 SERVO	300-M74 SERVO
Total Resistance (Ohms) ±5%	50Ω - 25K	50Ω - 25K	50Ω - 50K	50Ω - 50K	50Ω - 50K	50Ω - 100K	50Ω - 100K	50Ω - 100K	50Ω - 100K
Independent Linearity ± %	2 to 1	2 to 0.5	1 to 0.5	1 to 0.2	1 to 0.1	0.5	1 to 0.1	1 to 0.1	0.5 to 0.1
Theoretical Electrical Travel (Degrees)	325	354	320	360	353	320	352	356	358
Theoretical Elect. Travel Tol. (Degrees)	3	2	3	2	1	3	3	3	1
Total Mechanical Travel (Degrees)	325	360	330	360	360	330	360	360	360
Power Rating (Wats at 40°C)	1.5	1.5	2	2	2.5	3	3	3	7
Life Expectancy (Rev. at 500RPM)	25,000	1,000,000	25,000	100,000	1,000,000	25,000	1,000,000	1,000,000	1,000,000
Torque (ounce-inches)	.5 to .6	.05 MAX.	.5 to .6	.15 MAX.	.15 MAX.	2 to 8	.6 MAX.	.7 MAX.	1.0 MAX.
Weight (ounces)	.2	.2	.5	.6	.8	1.5	2.5	4	7
Stop Strength (pound-inches)	4	—	4	—	—	6	—	—	—
Bearings	SLEEVE	S. S. BALL	SLEEVE	S. S. BALL	S. S. BALL	SLEEVE	S. S. BALL	S. S. BALL	S. S. BALL

TEMPERATURE COEFFICIENT: 100 PPM°C — OPERATING TEMPERATURE RANGE: −55 to 135°C — DIELECTRIC: 750 VAC

MAUREY INSTRUMENT CORPORATION
4555 W. 60th St., Chicago, IL 60629 • Phone (312) 581-4555 • FAX (312) 581-2576

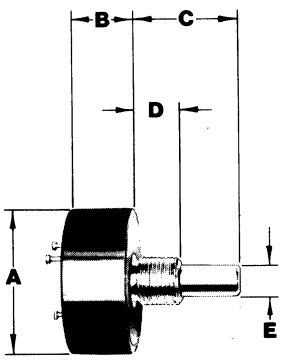
SINCE 1952 - MANUFACTURER OF PRECISION COMPONENTS FOR CONTROL.

MAUREY INSTRUMENT CORP.

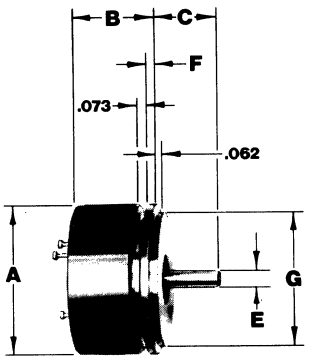
PRECISION CONDUCTIVE-PLASTIC SINGLE TURN POTENTIOMETERS

PST

These conductive plastic potentiometers have been specially designed for severe environmental conditions in mill-factory operations as well as in critical military applications. The molded, raised track maintains itself free from contamination of foreign particles, oil or water. The high gram pressure of the graphite composition contact on the raised track gives excellent resistance to contact bounce under punishing vibration or shock, as well as an exceptional rotational life. Such units are particularly suited for applications where trouble-free maintenance is required.



BUSHING



SERVO

	TYPE	A	B	C	D	E	F	G
87-P82	BUSHING	.87	.53	.87	.38	.250	—	—
87-P83	SERVO	.87	.59	.50	—	.125	.062	.750
106-P249	SERVO	1.06	.57	.50	—	.125	.062	.968
112-P16	BUSHING	1.12	.50	.87	.38	.250	—	—
112-P19	SERVO	1.12	.57	.50	—	.125	.062	1.000
143-P93	SERVO	1.43	.63	.50	—	.250	.093	1.312
200-P445	BUSHING	2.00	.50	.87	.38	.250	—	—
200-P446	SERVO	2.00	.75	.75	—	.250	.093	1.875

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	87-P82 BUSHING	87-P83 SERVO	106-P249 SERVO	112-P16 BUSHING	112-P19 SERVO	143-P SERVO	200-P445 BUSHING	200-P446 SERVO
Total Resistance (Ohms)	500 Ω - 50K	500 Ω - 50K	500 Ω - 100K	500 Ω - 100K	500 Ω - 100K	1K - 100K	1K - 100K	1K - 100K
Total Resistance Tolerance	±20%	±10%	±10%	±20%	±10%	±10%	±20%	±10%
Theoretical Resolution	.001%	.001%	.001%	.001%	.001%	.001%	.001%	.001%
Independent Linearity	±2%	±0.5%	±0.5%	±2%	±0.5%	±0.5%	±2%	±0.5%
Theoretical Electrical Travel (Degrees)	340°	340°	340°	340°	340°	340°	340°	340°
Theoretical Elect. Travel Tolerance (Degrees)	±5°	±3°	±2°	±5°	±2°	±2°	±5°	±2°
Total Mechanical Travel (Degrees)	360°	360°	360°	360°	360°	360°	360°	360°
Temperature Coefficient (PPM/°C)	400	400	400	400	400	400	400	400
Operating Temperature Range (°C)	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C
Power Rating (Watts at 40°C)	1	1	1.5	1.5	1.5	2	3	3
Dielectric Strength (Volts, RMS for 60 Sec)	1000	1000	1000	1000	1000	1000	1000	1000
Terminals, Standard	3	3	3	3	3	3	3	3
Taps, Maximum Available	4	4	6	6	6	9	9	9
Tap Tolerance	±5°	±3°	±2°	±5°	±2°	±2°	±5°	±2°
Life Expectancy (Revolutions at 500RPM)	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000
Moment of Inertia (gm-cm^2)	0.2	0.2	0.2	0.2	0.2	1.5	1.5	1.5
Starting Torque (ounce-inches)	*0.6	0.5	0.5	*0.6	0.5	0.3	*0.6	0.3
Running Torque (ounce-inches)	*0.5	0.4	0.4	*0.5	0.4	0.2	*0.5	0.2
Weight (ounces)	0.5 oz.	0.6 oz.	0.6 oz.	0.6 oz.	0.6 oz.	1.7 oz.	2 oz.	4 oz.
*Stop Strength (pound-inches)	**2 lb.-in.	—	—	*2 lb.-in.	—	—	*3 lb.-in.	—
Bearings	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.

* Add one ounce-inch for O-ring seal

** For units with mechanical stops. Conforms to MIL - R - 39023 A

Standard Resistance Values Within Range Indicated.
500 Ω , 1K, 2K, 5K, 10K, 20K, 50K, 100K

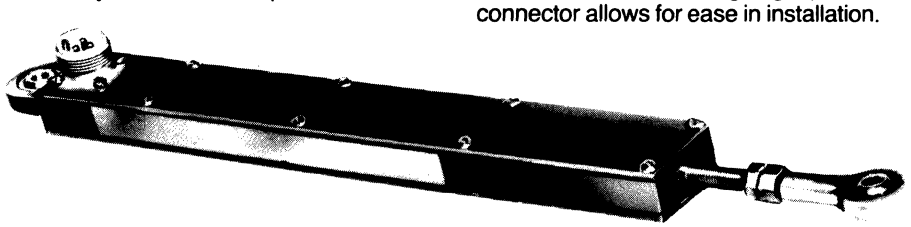
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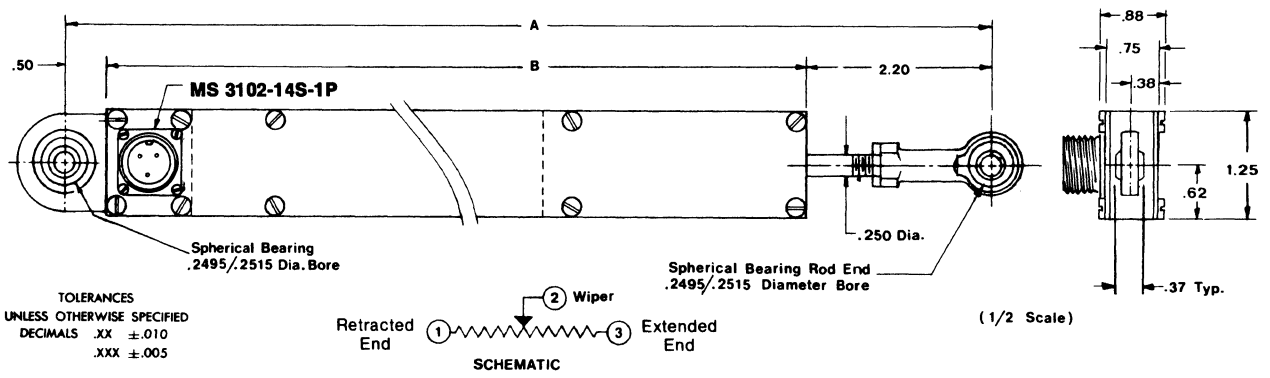
MAUREY INSTRUMENT CORP.

HEAVY DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC **HDL**

WIREWOUND M2028 This transducer combines the inherent accuracy and reliability of a wirewound potentiometer with the physical ruggedness required in industrial applications. They are used with hydraulic and mechanical actuators to measure and control linear motion. The self-aligning spherical ball ends and MS connector simplifies installation. High duty bearings give the ¼ inch shaft stability in the extended position.

CONDUCTIVE PLASTIC P1991 Where severe environmental conditions exist as in mills, factories and power generating plants, this linear motion transducer is practically indestructible. The unit is impervious to dust, oil and moisture. The molded, raised conductive track and graphite composition contacts provide for years of maintenance free service. As with the M2028, the self-aligning spherical ball ends and MS connector allows for ease in installation.





ELECTRICAL AND MECHANICAL CHARACTERISTICS

	M2028 WIREWOUND	P1991 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	See Charts II & III	See Note 5
Total Resistance Tolerance	±5%	±20%
Theoretical Resolution	See Chart III	.001 inch
Independent Linearity	See Note 6	±0.5%
Theoretical Elect. Travel (inches)	See Chart I	See Chart I
Theoretical Elect. Travel Tolerance (inches)	±.010	±.025
Total Mechanical Travel (inches)	See Chart I	See Chart I
Temperature Coefficient	50 PPM/°C	500 PPM/°C
Operating Temperature Range	−55 to 125°C	−55° to 105°C
Power Rating (Watts at 40°C)	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec)	750 volts, RMS	750 volts, RMS
Terminals	3	3
Taps	1/2 inch spacing	1/2 inch spacing
Tap Tolerance (inches)	±.010	±.030
Life Expectancy (Cycles at 60 in./min.)	500,000	50,000,000
Shaft Frictional Force	4 ounces	4 ounces
Weight (ounces)	See Chart I	See Chart I
Bearings	Nylon	Nylon

CHART I					
Dash No.	Elect. Travel	Mech. Travel	A	B	Wt. Ozs.
−1	1.00	1.25	13.20	10.50	10
−2	2.00	2.25	13.20	10.50	10
−3	3.00	3.25	13.20	10.50	10
−4	4.00	4.25	13.20	10.50	10
−5	5.00	5.25	13.20	10.50	10
−6	6.00	6.25	18.50	15.80	15
−7	7.00	7.25	18.50	15.80	15
−8	8.00	8.25	18.50	15.80	15
−9	9.00	9.25	18.50	15.80	15
−10	10.00	10.25	18.50	15.80	15
−11	11.00	11.25	23.70	21.00	20
−12	12.00	12.25	23.70	21.00	20
−13	13.00	13.25	23.70	21.00	20
−14	14.00	14.25	23.70	21.00	20
−15	15.00	15.25	23.70	21.00	20

CHART II	
DASH NO.	TOTAL RESISTANCE
102	1,000
202	2,000
502	5,000
103	10,000
203	20,000
503	50,000
104	100,000

CHART III	
OHMS PER INCH	NUMBER OF TURNS PER INCH
500	270
1,000	370
2,000	415
2,500	450
5,000	550
10,000	660
20,000	1000

PART NUMBER DESIGNATION (EXAMPLE)
M2028-5-502
- M2028 — BASIC TYPE
- 5 — ELECTRICAL TRAVEL (5.00 INCHES)
- 502 — TOTAL RESISTANCE (5000 Ω)

Notes:
1. Mating connector supplied.
2. Stainless steel shaft.
3. Anodized aluminum housing.
4. Terminals available on special request.
5. Ohms per inch for P1991: 500, 1K, 2K, 5K, 10K.
6. With modification, this type is available in strokes greater than 15 inches.
7. Independent linearity for M2028: (100% ÷ Total Turns x 2)

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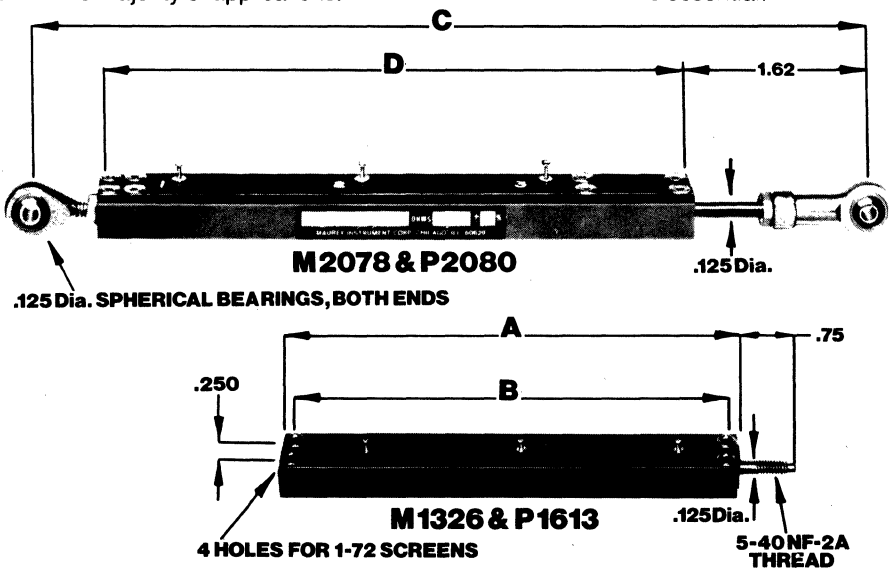
MAUREY INSTRUMENT CORP.

LIGHT DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC

LDL

WIREWOUND (M-Series) These miniature transducers combine the best electrical characteristics in the smallest size at the lowest cost. The units were designed for use in laboratory test equipment, light industrial applications and automation where great accuracy of electrical output is essential. The spherical ball ends add flexibility to mounting. These wirewound, linear motion potentiometers will meet the requirement in the majority of applications.

CONDUCTIVE PLASTIC (P-Series) Where long life in a hostile environment is required, these linear motion transducers with molded, raised tracks and graphite composition contacts have no equal. They are practically impervious to dust, water and oil. The high contact pressure resists the effects of severe vibration and shock. The units are being used in factories and mills where maintenance-free operation is essential.



Stroke (Inches)	M1326 / P1613		M2078 / P2080	
	A	B	C	D
1	2.00	1.800	5.12	3.00
2	3.00	2.800	6.12	4.00
3	4.00	3.800	7.12	5.00
4	5.00	4.800	8.12	6.00
5	6.00	5.800	9.12	7.00
6	7.00	6.800	10.12	8.00
7	8.00	7.800		
8	9.00	8.800		
9	10.00	9.800		
10	11.00	10.800		
11	12.00	11.800		
12	13.00	12.800		

Shaft shown in fully retracted position
Shaft is free to rotate. .
Body: ½ wide on terminal side x ⅜ deep.

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	M1326 WIREWOUND	P1613 CONDUCTIVE PLASTIC	M2078 WIREWOUND	P2080 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	25 Ω to 20K/inch	250 Ω to 10K/inch	25 Ω to 20K/inch	250 Ω to 10K/inch
Total Resistance Tolerance	±5%	±20%	±5%	±20%
Theoretical Resolution (inch)	.006 to .001	.001	.006 to .001	.001
Independent Linearity	±1.2% to ±0.1%	±2% to ±0.5%	±1.2% to ±0.1%	±2% to ±0.5%
Theoretical Electrical Travel (inches)	1.000 to 12.000	1.00 to 5.00	1.000 to 6.000	1.00 to 5.00
Theoretical Elect. Travel Tolerance (inches)	±.010	±.050	±.010	±.050
Total Mechanical Travel (inches)	1.10 to 12.10	1.10 to 5.10	1.10 to 6.11	1.10 to 5.10
Temperature Coefficient (PPM/°C)	50	500	50	500
Operating Temperature Range	−55°to125°C	−55°to105°C	−55°to125°C	−55°to105°C
Power Rating (Watts at 40°C)	1 watt/inch	0.5 watt/inch	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec)	750	750	750	750
Terminals	3	3	3	3
Taps	4 taps/inch	4 taps/inch	4 taps/inch	4 taps/inch
Tap Tolerance (inches)	±.010	±.050	±.010	±.050
Life Expectancy (cycles at 60 in./min.)	500,000	50,000,000	500,000	50,000,000
Shaft Frictional Force (ounces, max.)	4 oz.	4 oz.	4 oz.	4 oz.
Bearings	Nylon	Nylon	Nylon	Nylon

Standard Resistance Values, Ohms / inch: 250Ω, 500Ω, 1K, 2K, 2.5K, 10K, 20K

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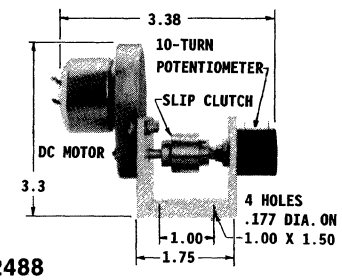
MAUREY INSTRUMENT CORP.

MOTORIZED POTENTIOMETERS AND SWITCHES

MPS

General Description & Applications

A family of single turn and multiturn, motor driven potentiometers and switches has been developed for industrial servo applications. They are used for such applications as variable speed controls on power generating sets, electrical-mechanical remote control, and readouts. They provide excellent accuracy at an economical price. These integrated motor-potentiometers are the result of years of Maurey experience in the manufacture of precision potentiometers and motor assemblies. The potentiometers, gear head, clutch, and motor are precisely matched to perform to exacting specifications. Motor-clutch-pot units are available in a wide range of specifications. A motor of selected speed and voltage may be matched with single, 3, 5, or 10 turn potentiometers, either wirewound or conductive plastic. When multiple voltages are required, single cups may be conveniently ganged with or without clutches. In addition, Maurey engineers can provide multi-tap potentiometers, special shafts and mountings, and a wide range of AC or DC motors to your specification.



H2488

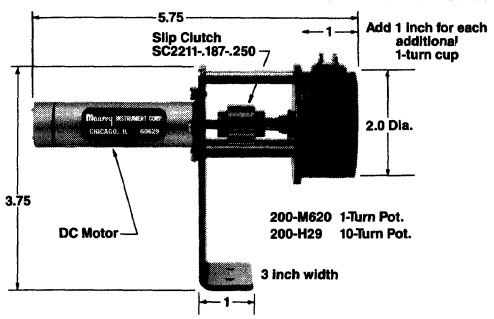
RPM	VOLTS	RPM	VOLTS
16	6	96	28
28	6	120	24
40	12	120	35
60	12	124	28
72	24	148	35

H2488 DC Motorized 10-Turn Potentiometer

This unit utilizes a DC motor, over a wide range of speed and voltages, to operate a precision 10-turn wirewound potentiometer with a ±0.25% linearity.

A slip clutch prevents damage to the potentiometer stops. Unit is suitable for a factory or mill environment.

Potentiometer independent linearity: ±0.25% or better
Power rating: 2.5 watts at 60°C
Resistances available: 500Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K.



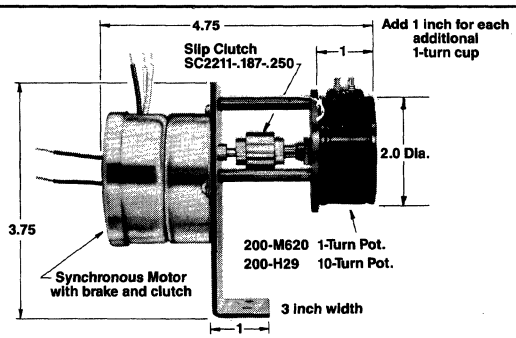
M2391

M2391 DC Motorized Single & 10-Turn Potentiometers

This is a versatile motor-potentiometer assembly. When a single turn wirewound potentiometer is specified, multipole single throw switches may be added. Up to six precision potentiometers with ±0.5% linearity of various resistance values may be ganged. All components are easily assembled or changed. Proven design for factory or mill environment.

A precision 10-Turn high resolution potentiometer with a ±0.25% linearity may be specified. A Slip clutch safeguards the potentiometer stops from being damaged.

Standard resistances available: 250Ω, 500Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K.



M2261

M2261 AC Motorized Single & 10-Turn Potentiometers

This is a compact AC motor driven wirewound potentiometer with mechanical stops. A slip clutch provides positive protection to the potentiometer mechanical stops. For continuous rotation the slip clutch is replaced by a coupling. When operated with single turn potentiometers, single throw switches are available.

1-Turn Potentiometer: ±0.5% linearity, 4 watts power
10-Turn Potentiometer: ±0.25% linearity, 4 watts power

Standard resistances available: 250Ω, 500Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K.

Motor: 115 Volts, A.C. 60 Hz; synchronous continuous duty with positive clutch and instantaneous brake; standard RPM: 1, 2, 4, 6, 10, 12, 30, 60.

Standard DC Motor Data:

Speed: (See chart)
Voltage: (See chart)
Current: (See chart)
Torque at 24 volts: 50 oz-in.
Break away voltage: 10 volts DC
Other requirements on request

M2391

Voltage VDC	ma	Speed RPM
12	49	6.0
24	50	16.0
28	51	21.2
35	53	24.5

Special Requirements

The types shown here are representative of a wide range of motor driven mechanisms manufactured by Maurey. AC or DC motors may be used. Single and multicup carbon, wirewound, or conductive plastic potentiometers may be specified, with or without slip clutches or switches. Write or phone for a solution to your requirement.

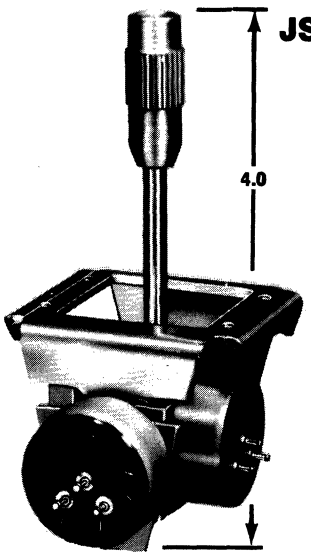
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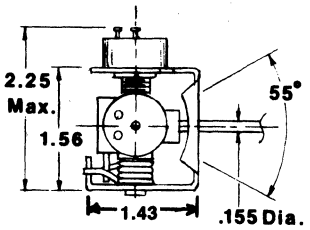
SINCE 1952 - MANUFACTURER OF PRECISION COMPONENTS FOR CONTROL.

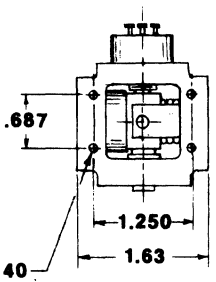
MAUREY INSTRUMENT CORP.

JOYSTICKS JSP/JSE

JSP JOYSTICK CONTROLS WITH POTENTIOMETERS







The Maurey JSP 2302 series precision joystick controls have been proven in a wide variety of applications.

Designed with long life precision potentiometers, the JSP series is available with either single, dual or triple axis control. The compact all metal construction provides a strong, reliable unit.

To better suit your application, the JSP series is available with either internal or external boot, a push button switch in the handle and a variety of knob styles.

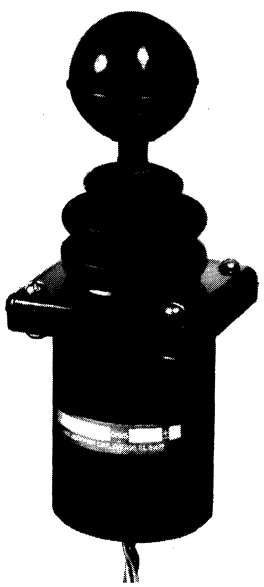
MECHANICAL SPECIFICATIONS

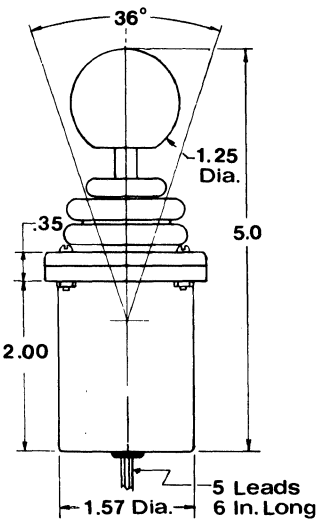
Spring return to center
Knob torque: 12 ounce-inches
Life: 2,000,000 cycles
Limiter Plates available to limit direction of knob.

CONDUCTIVE PLASTIC POTENTIOMETER SPECIFICATIONS

Voltage Repeatability: ±0.2%
Resistance available: (±20%): 1K, 5K, 10K, 20K
Power: 1 Watt at 25°C
Wipers phased at center of resistance.
Temperature Range: —30° to 105°C

JSE INDUCTION TYPE JOYSTICK CONTROL

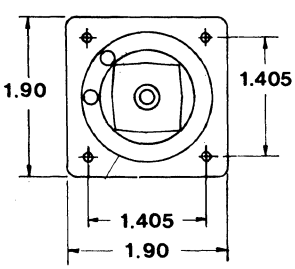


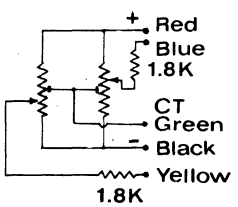


The Maurey JSE 2304 Joystick Control is a non-contacting, inductive device which provides extremely long life, infinite resolution and zero noise. Inherent in the design is a constant output throughout the life of the unit.

A shaft seal boot is supplied on all units to protect the mechanism from moisture and dust.

The electronic circuitry is encapsulated in an anodized aluminum case resulting in an assembly which is compatible to most hostile environments.





Equivalent Circuit

ELECTRICAL SPECIFICATIONS

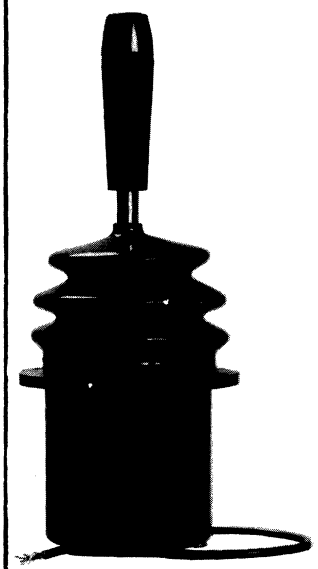
Operating Voltage:	4.5 to 15.0 Volts, D.C.	Center Tap Voltage:	50% of Input Voltage
Current:	15 ma at 10 Volts, D.C.	Resolution:	Infinite
Output Impedance:	1800 ohms (Signals)	Life:	20,000,000 cycles
Center Tap Impedance:	340 ohms	Leads:	6 inch standard length, color coded
Equivalent Noise Resistance:	None		
Temperature Range:	—30° to 105° C	Knob has spring return to center.	

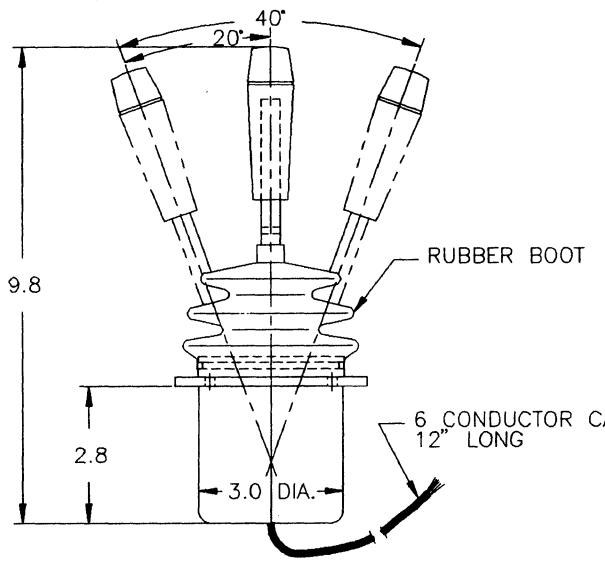
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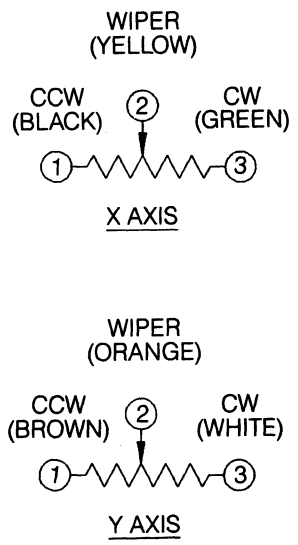
MAUREY INSTRUMENT CORP.

HEAVY DUTY JOYSTICK CONTROL HDJ

The Maurey HDJ series precision industrial joystick fills the need for heavy duty controls. Designed specifically for construction and large industrial equipment, they have been proven in a variety of industries. Overhead crane controls, Marine hoists, Man lifts and Cherry pickers are just a few of the many applications. Constructed of rugged materials, the unit incorporates conductive plastic potentiometers for extremely long life with essentially infinite resolution. A heavy duty shaft boot seals the unit from the environment. Variations are available with single axis control. Special configurations available to your specifications. The HDJ series joystick is ideal for your control requirement and will provide years of trouble free service in a harsh environment.







ELECTRICAL AND MECHANICAL SPECIFICATIONS

MECHANICAL SPECIFICATIONS

Major axis operating angle: 40° Total
Spring return to center
Life: 5,000,000 cycles
Limiter Plates available to limit direction of knob.

MATERIALS

Case: Molded Glass Filled Nylon
Lever: Stainless steel
Trunnions: Anodized aluminum
Bearings: Brass

CONDUCTIVE PLASTIC POTENTIOMETER SPECIFICATIONS

Resistances available: 5K, 10K
Resistance tolerance: ±20%
Voltage Repeatability: ±1%
Wipers phased at center of voltage
Output from center: ±6% of applied voltage
Power: 1 Watt at 25° C
Temperature Range: −30° to 85° C

DASH NO.	RESISTANCE (ohms)
502	5,000
103	10,000

JOYSTICK PART NUMBER DESIGNATION

HDJ2552-2HS-103

- HDJ — Model
- 2 — Axis (2)
- H — Knob Style (Knob H)
- S — Limiter Style (square)
- 103 — Resistance(10,000 Ω)

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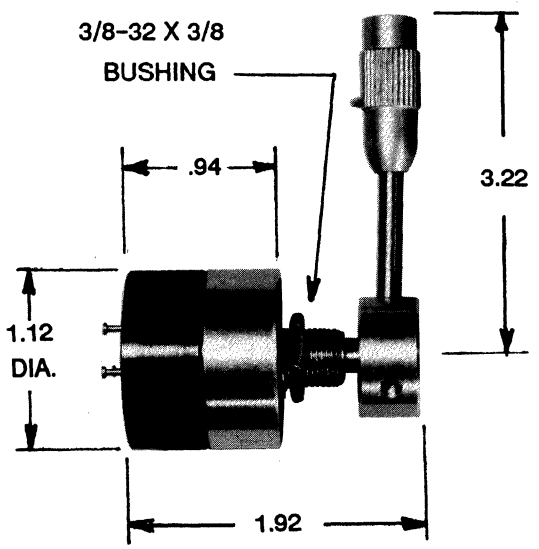
SINGLE AXIS JOYSTICK CONTROLS WITH POTENTIOMETER — SAJ

The type SAJ single axis joystick control is the ideal choice for those industrial applications where a single plane of travel is to be controlled. Such devices are used to control the speed of a single motor, or to determine the back and forth motion of a hydraulic or pneumatic cylinder.

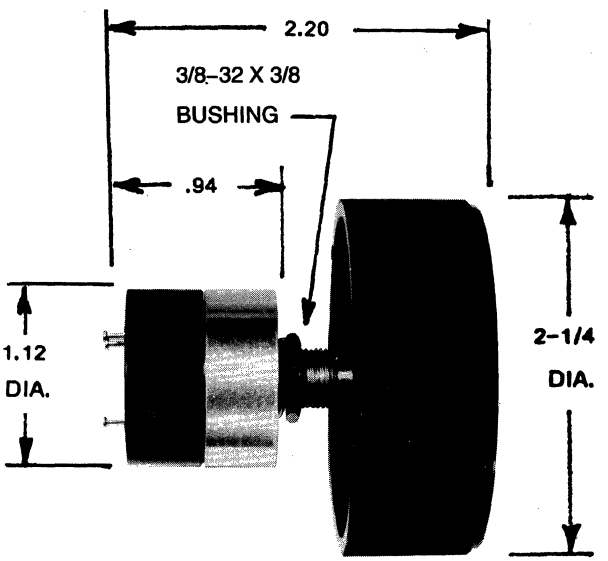
Both units are spring return to center for zero reference. They are available with either lever type or rotary actuator and will adapt to almost any mounting configuration. The bushing type potentiometer facilitates installation.

The precision conductive plastic potentiometer uses the unique Maurey rased molded track, resulting in almost unlimited life. In addition, this design insures that the potentiometer is impervious to moisture, oil, dust and industrial gases.

SAJ 2515-F



SAJ 2515-G



FULL SCALE

MECHANICAL SPECIFICATIONS

Major axis operating angle: ± 70° (140° Total)
Spring return to center tap.
Knob Torque: 12 ounce-inches, nominal
Life: 10,000,000 cycles
Temperature range: -30° to 105° C

CONDUCTIVE PLASTIC POTENTIOMETER SPECIFICATIONS

Standard resistances: 1K, 5K, 10K
Resistance tolerance: ± 20%
Electrical travel: ± 70° (140° Total)
Center tap at center of electrical travel.
Knob phased at center tap.
Linearity: ± 2%
Repeatability: ± 0.2%
Power: 1 watt at 25° C.

DASH NO.	RESISTANCE OHMS
501	500
102	1,000
202	2,000
252	2,500
502	5,000
103	10,000
203	20,000

JOYSTICK PART NUMBER DESIGNATION

SAJ2515 - F - 103
- SAJ2515 — MODEL
- F — KNOB TYPE
- 103 — RESISTANCE (10K)

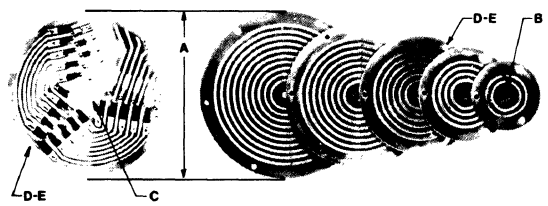
MAUREY INSTRUMENT CORPORATION
4555 W. 60th St., Chicago, IL 60629 • Phone (312) 581-4555 • FAX (312) 581-2576

SINCE 1952 - MANUFACTURER OF PRECISION COMPONENTS FOR CONTROL.

SLIPRINGS

MAUREY INSTRUMENT CORP.

INSTRUMENTATION AND POWER SLIPRINGS



Current Capacity: 500 ma per ring
Noise level: 50 milliohms
Temperature range: −30° to 105°C

Life 10,000,000 revolutions at rated RPM
Stacking width of both slipring and contact holder: .375
Standard leads: AWG22, vinyl insulated, 12 inches long

SR2300 INSTRUMENTATION PANCAKE SLIPRINGS

	NUMBER OF CONDUCTORS	2	4	6	8	10
A	Diameter of Ring & Contact Holder	2.700	3.400	3.900	4.600	5.500
B	Center Hole in Ring		— See Chart Y —			
C	Center Hole in Contact Holder		— See Chart Y —			
D	Number of .156 Dia. Mounting Holes	3	3	3	6	6
E	Bolt Circle of Mounting Holes	2.325	3.025	3.525	4.225	5.125
	Rated RPM	1000	900	800	700	600

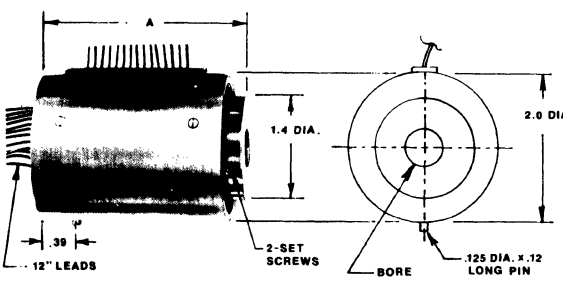
CHART Y

STANDARD BORE SIZES	
1/4	.250
3/8	.375
1/2	.500
5/8	.625

Standard with 2, 4, 6, 8, or 10 conductors. There are 3 sliding contacts per conductor.

The coin silver collector rings and precious metal contacts provide long life and low noise operation for instrumentation use. The collector ring/brush sets can be stacked or "pancaked" for multiple application. These units are particularly useful where there is limited axial width.

With a wide variety of diameter and bore sizes available, the SR2300 is ideal for strain gage and thermocouple measurements where rotating data circuits must be monitored.



SR2066 SIGNAL LEVEL SLIPRINGS

RINGS	A
2-5	1.80
6-10	2.30
11-15	2.80
16-20	3.30
21-25	3.80
26-30	4.30

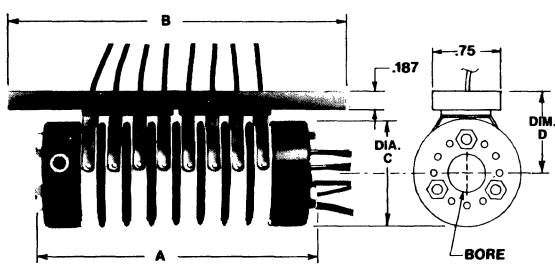
Current capacity per conductor: 250 ma
Dielectic strength: 750 volts, RMS
Temperature range: −55° to 105° C
Leads: Teflon insulated, 12" long.

Maximum speed: 1200 rpm
Life: 25,000,000 Rev.
Noise level: 50 milliohms
Std. bore sizes: 1/2", 5/8", 3/4"

The SR2066 totally enclosed slipring assembly is used for industrial and military applications where low signal noise is essential. Enclosed ball bearings support coin silver rings with gold-platinum alloy brushes.

Aluminum housing with O-ring seals, effectively protects the rings and brushes from the environment.

Manufacturers of industrial equipment requiring signal feedback and low current input rely upon this precision slipring for long life and trouble free service. They are used in laboratory instrumentation, fire control, meteorological circuits and for numerous automation applications.



ROTARY TYPE SLIPRINGS

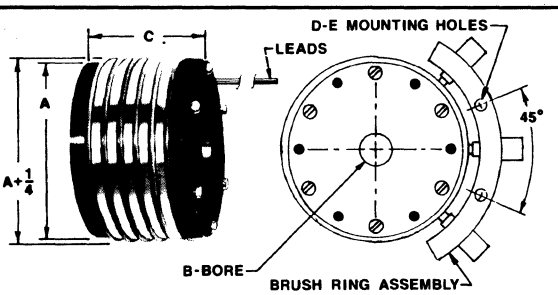
The SR2310, SR2460 and SR2495 standard sliprings fill a need for a low cost yet highly reliable means of medium power and signal transfer to and from a rotating shaft.

Two standard assemblies are used, a rotary slipring with 4 to 12 conductors and a stationary brush block assembly providing 2 contacts per ring. The slipring assembly is mounted on the rotating shaft. The brush assembly is attached to the machine by 4 screws. Long life precious metal contacts and coin silver rings insure low noise signals and conducts 2 amperes. Noise level: 50 millohms, Dielectric Strength: 750 volts RMS for 60 sec., Leads: AWG 22, PVC. 12" long, Contacts per ring: 2.

MODEL NO.	DIA. C	DIM. D	BORE SIZES
SR2310	1.0	.88	1/4, 3/8, 1/2
SR2460	2.0	1.38	5/8, 3/4, 1
SR2495	3.0	1.88	1-1/4, 1-1/2, 2

NO. RINGS	DIM. A	DIM. B
4	1.88	2.50

ADD 1 INCH TO A & B FOR EACH ADDITIONAL 4 RING MULTIPLE



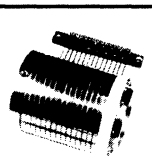
SR2035 POWER SLIPRINGS

A RING O.D.	B BORE MIN. TO MAX. +.002 −.000	BRUSH RING ASSEMBLY PART NO.	D BOLT CIRCLE	E HOLE
8.00	1.00 to 6.50	2035-60-8	9.625	.375
7.00	1.00 to 5.50	2035-60-7	8.625	.375
6.00	1.00 to 4.50	2035-60-6	7.375	.312
5.00	1.00 to 3.50	2035-60-5	6.375	.312
4.00	.75 to 2.50	2035-60-4	5.500	.250
3.00	.50 to 1.50	2035-60-3	4.500	.250
2.50	.50 to 1.00	2035-60-2.5	4.000	.250
2.00	.50	2035-60-2	3.500	.250

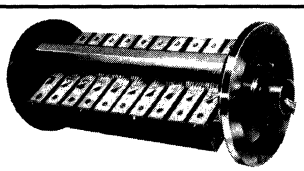
Maurey SR2035 standard power sliprings are designed and built for rugged industrial applications. They are being used in wind power generators, packing machinery, chemical processing equipment and in automated applications.

They are available in eight standard diameters with suitable bores to fit most equipment. The larger units are available with up to 50 rings. All parts are precision machined or molded.

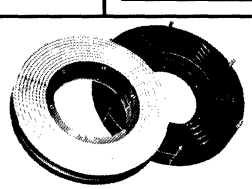
Standard brushes are rated at 7 amps. with a max. of 3 brushes per ring. With 3 heavier brushes and wider rings, current capacity can be increased to 75 amps. per ring. Length (C): 1.25 + .50 per ring.



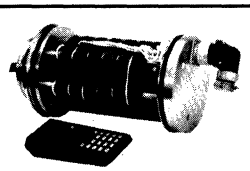
SR1322 15 conductor, 3" diameter: Rotary signal slipring for physiological testing.



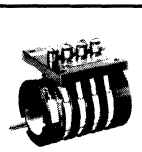
SR1858 84 conductor, 8" instrumentation rotary slipring with integrated ball bearings and universal joint. for NASA wind tunnel testing.



SR2224 27 conductor, 13" diameter, 3 section pancake slipring for windmill blade testing.



SR2036 6 conductor, 6" rotary power slipring. Self contained ball bearings. Sealed unit. Used in paper making machinery.



SR2234 4 conductor, 1.5" diameter, coin silver rings. Rotary signal slipring for high speed camera.

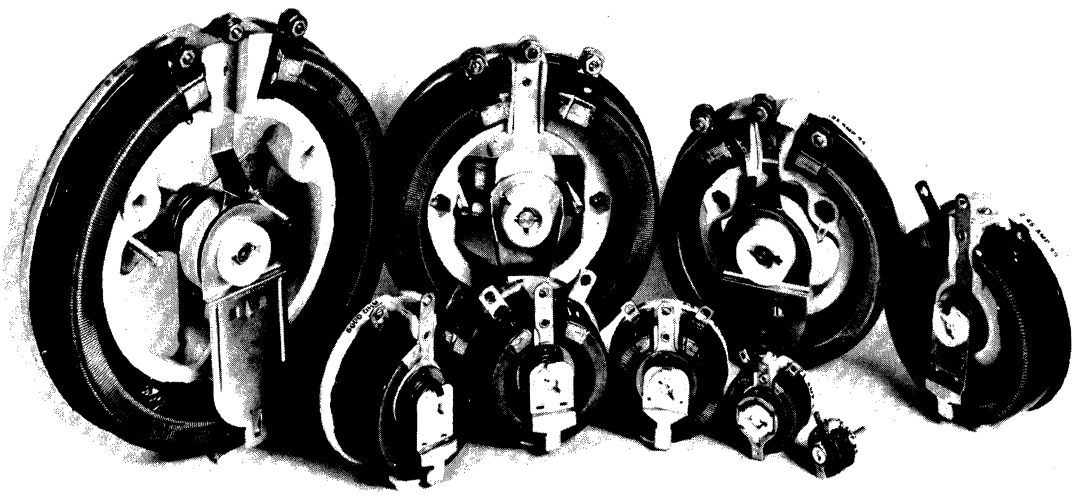
MAUREY INSTRUMENT CORPORATION
4555 W. 60th St., Chicago, IL 60629 • Phone (312) 581-4555 • FAX (312) 581-2576

SINCE 1952 - MANUFACTURER OF PRECISION COMPONENTS FOR CONTROL.

MEMCOR-TRUOHM INC.

POWER RHEOSTATS

MEET THE MEMCOR FAMILY OF HIGH QUALITY WIRE-WOUND POWER RHEOSTATS



All MEMCOR Power Rheostats are vitreous enamel coated. The core and base are bonded together with vitreous enamel, thereby contributing markedly to the heat dissipation.

Standard tolerance: ±10%, ±5% available as a special.

TYPE	POWER (Watts)	RESISTANCE RANGE	DIAMETER	WEIGHT
R12½	12½ Watt	1 - 5000 Ohms	7/8"	.035 Lbs.
R25	25 Watt	1 - 5000 Ohms	1 1/16"	0.23 Lbs.
R50	50 Watt	0.5 - 10,000 Ohms	2 15/16"	0.45 Lbs.
R75	75 Watt	0.5 - 10,000 Ohms	2¾"	0.60 Lbs.
R100	100 Watt	0.5 - 10,000 Ohms	3⅛"	0.72 Lbs.
R150	150 Watt	0.5 - 10,000 Ohms	4"	1.50 Lbs.
R225	225 Watt	1 - 2500 Ohms	5"	2.18 Lbs.
R300	300 Watt	1 - 2500 Ohms	6"	3.0 Lbs.
R500	500 Watt	1 - 2500 Ohms	8"	3.75 Lbs.
R1000	1000 Watt	1 - 2000 Ohms	12"	10.0 Lbs.

Special Rheostats with Tapered Sections, Locking Devices, Off Positions, Tandem Mountings, Special Shafts on Bushing, and many other variations can be supplied.

Write for FREE Catalog.

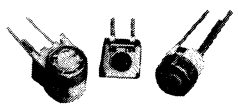
MEMCOR-TRUOHM INC.

DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Fax No. 356-7376
Telephone: (219) 356-4300
ESY LINK 629-38315

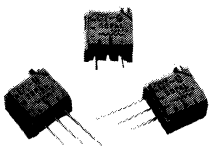
MEPCOPAL

Trimmers & Switches

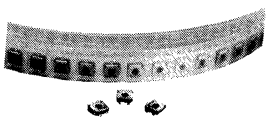
TRIMMER SPECIFICATIONS



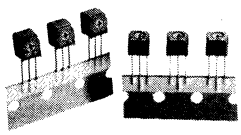
RJ-4/ST-4C TRIMMERS



CT-9 TRIMMERS



ST-4 TRIMMERS



CT-6 TRIMMERS

Element	Style	Shape	Number of Turns (Nominal)	Model	Basic Outline Dimen. Inch	Basic Outline Dimen. MM	Resistance Range (Ω)	Power Rating (°C)	Operating Temperature Range (°C)	Adjustment Pin Configuration: Pin Style: Adj. Mode	To-18	To-5	In-Line	Other	Pkg.: Bulk	Magazine	Tape & Reel
CERMET	SINGLE TURN	ROUND	1	RJ-4	.19	4.9	10-2 Meg	.50W@70°	−55 to +125	TOP	W				•		
										SIDE	WS						
			1	RJ-6	.25	7.0	10-5 Meg	.50W@70°	−55 to +125	TOP	W	P		F	•		
										SIDE		S,X					
			1	RJ-13	.50	12.6	10-5 Meg	.75W@70°	−55 to +125	TOP		P,B,PR			•		
										SIDE		S,SR					
		SQUARE	1	CT-6	.25	7.0	10-2 Meg	.50W@70°	−55 to +125	TOP	W	P,R	V	F	•	•	•
										SIDE		S,X	H				
	MULTI-TURN	ROUND	3	TM-7	.28	7.2	50-2 Meg	.50W@70°	−55 to +125	TOP	W	P			•		
										SIDE		S,X					
		SQUARE	12	8026*	.25	6.4	10-5 Meg	.25W@85°	−65 to +150	TOP		W			•		
										SIDE		P,X					
			25	8024*	.38	9.5	10-5 Meg	.50W@85°	−65 to +150	TOP		Y	W		•		
										SIDE		P	X				
			18	CT-9	.38	9.5	10-5 Meg	.50W@70°	−55 to +125	TOP			W		•		•
										SIDE		P	X				
		REC-TANGLE	15	CT-20	.75	19.0	10-5 Meg	.75W@70°	−55 to +125					P,X	•	•	•
										SIDE							
(CERMET) SURFACE MOUNT	SINGLE TURN	SQUARE	1	ST-4	.18	4.5	10-2 Meg	.25W@70°	−55 to +125	TOP				A,B,C,F	•	•	•
	MULTI-TURN		14	ST-5	.25	6.4	10-2 Meg	.25W@85°	−55 to +125	TOP				P,R,X,W	•	•	•
										SIDE							
WIRE-WOUND	SINGLE TURN	ROUND	1	1106	.25	6.6	10-30K	.37W@70°	−55 to +120	TOP		T,B		F	•		
										SIDE		S					
			1	1113	.50	13.5	10-100K	.75W@70°	−55 to +120	TOP		T,B,T,R		F,FR	•		
										SIDE		S,SR					
	MULTI-TURN	SQUARE	19	1309	.38	9.5	10-50K	.50W@70°	−55 to +120	TOP			W		•		
										SIDE		P	X				
		REC-TANGLE	16	1208	.75	19.0	10-50K	.50W@70°	−55 to +120					P	•		
										SIDE							
			22	1211	1.25	31.8	10-100K	.75W@85°	−55 to +150					P,L,PB, LB	•		
										SIDE							

Notes:
1. Temperature Coefficient of resistance is 100 ppm/°C maximum. This may vary at high and low resistance values. See catalog for details.
2. All models pass immersion at 85°C.

*Available in military RJ & RJR versions.

MEPCOPAL Mepcopal Company, 11468 Sorrento Valley Road, San Diego, California 92121
619/453-0332, FAX: 619/481-1123

MEPCOPAL

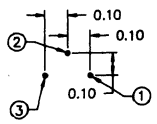
Trimmers and Switches

TRIMMER PIN STYLES

TOP ADJUST
1106B*
1106T
1113B*
1113T
1113TR†
8024Y
8026W

SIDE ADJUST
CT-6X
RJ-6X
TM-7X

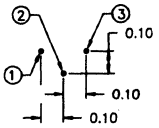
TO-5



TOP ADJUST
CT-6P
RJ-6P
RJ-13B*
RJ-13P
RJ-13PR†
TM-7P

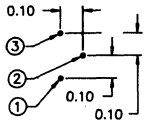
SIDE ADJUST
CT-6S
RJ-6S
RJ-13S
RJ-13SR†
TM-7S
1106S
1113S
1113SR†

TO-5



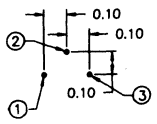
SIDE ADJUST
8026X

TO-5



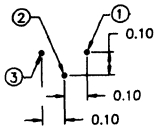
SIDE ADJUST
CT-6N
CT-9P
1309P
8024P
8026P

TO-5



TOP ADJUST
CT-6R

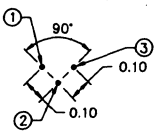
TO-5



TOP ADJUST
CT-6W
RJ-4W
RJ-6W
TM-7W

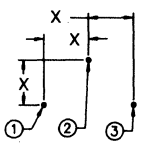
SIDE ADJUST
RJ-4WS

TO-18



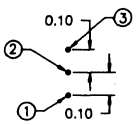
BOTTOM ADJUST

	x dimension
CT-6F	0.17
RJ-6F	0.17
1106F	0.14
1113F	0.30
1113FR†	0.30



IN-LINE

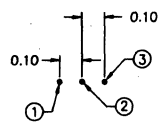
SIDE ADJUST
CT-9X
1309X
8024X



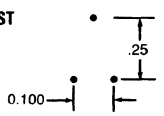
TOP ADJUST
CT-6V
CT-9W
1309W
8024W

SIDE ADJUST
CT-6H

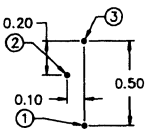
IN-LINE



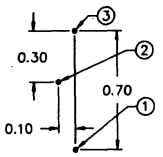
BOTTOM ADJUST
ST-4F



SIDE ADJUST
CT-20P
1208P

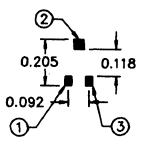


SIDE ADJUST
CT-20X
1211P
1211PB*



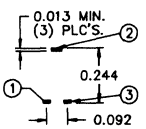
SURFACE MOUNT

TOP ADJUST
ST-4A

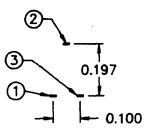


SURFACE MOUNT

TOP ADJUST
ST-4B



TOP ADJUST
ST-4C



SURFACE MOUNT

BOTTOM ADJUST
ST-4D



SURFACE MOUNT

SIDE ADJUST
ST-4G



SURFACE MOUNT

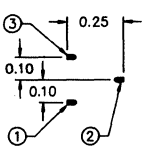
SIDE ADJUST
ST-4H



SURFACE MOUNT

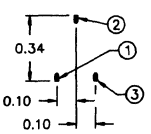
TOP ADJUST
ST-5W

SIDE ADJUST
ST-5X



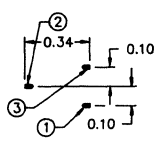
SURFACE MOUNT

SIDE ADJUST
ST-5P



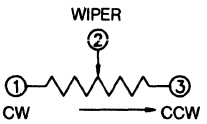
SURFACE MOUNT

SIDE ADJUST
ST-5R



*Bushing

†Knob



- Pin patterns shown are as seen from bottom view of the part.
- For all side adjust pin styles, the shaft points towards the top of the page.
- All dimensions are in inches.

STANDARD RESISTANCE VALUES
(in ohms)

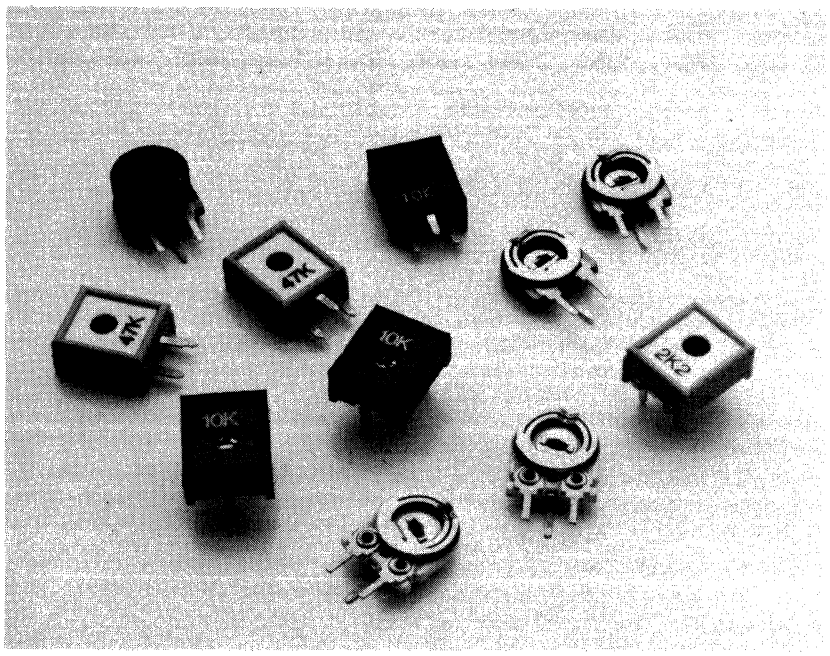
10	1K	100K
20	2K	200K
50	5K	500K
100	10K	1M
200	20K	2M
500	50K	5M

MEPCOPAL Mepcopal Company, 11468 Sorrento Valley Road, San Diego, California 92121
619/453-0332, FAX: 619/481-1123

MEPCOPAL

Trimmers & Switches

TRIMMER SPECIFICATIONS



PHILIPS COMPONENTS' CARBON AND CERMET POTENTIOMETERS

Element	Style	Shape	Number of Turns (Nominal)	Model	Basic Outline Dimen.		Resistance Range (Ω)	Power Rating (°C)	Operating Temperature Range (° C)	Adjustment Pin Configuration					Pkg.	
										Pin Style						
					Inch	MM				Adj. Mode	To-18	To-5	In-Line	Other	Bulk	Anti-Static Rails
CARBON	SINGLE TURN	ROUND	1	410	.40	10	47-4.7 Meg	.1W@40 .05W@70	– 25 to + 70	TOP				●	●	
										SIDE		●				
CARBON	SINGLE TURN	SQUARE	1	483	.40	10	100-4.7 Meg	.05W@70 .1W@40	– 25 to + 85	TOP				●	●	●
										SIDE		●				
CERMET	SINGLE TURN	ROUND	1	482	.40	10	100-10 Meg	.50W@70	– 55 to + 125	TOP				●	●	
										SIDE		●				
CERMET	SINGLE TURN	SQUARE	1	484	.40	10	47-10 Meg	.50W@70	– 55 to + 125	TOP				●	●	●
										SIDE		●				

MEPCOPAL Mepcopal Company, 11468 Sorrento Valley Road, San Diego, California 92121
619/453-0332, FAX: 619/481-1123

chip trimming potentiometers

MURATA ERIE NORTH AMERICA

RVG3A



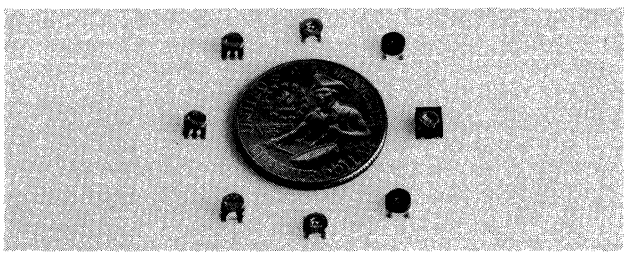
The new SMT RVG3A Series of chip trimming potentiometers features an exceptionally low profile—just 1.5 mm above the PC board—allowing higher component densities than possible before. Its alumina substrate and cermet resistance element provide long term reliability and are designed to withstand the stress of both flow and reflow soldering operations.

SPECIFICATIONS

Resistance Range	200Ω to 2MΩ
Resistance Tolerance	±25%
Taper	Linear
Power Rating	1/10W at 70°C
Maximum Working Voltage	50 VDC
Operating Temperature Range	−55°C to 125°C
Rotational Torque	2.0 to 24.5 mNm
Effective Rotational Angle	270°, ±10°

FEATURES
- Ultra-low profile—just 1.5 mm H.
- Extremely light weight
- Nickel barrier layer terminations for solderability
- Suitable for both flow and reflow soldering
- Offered on 8 mm tape for auto-placement
- Standard screw driver adjustable
- Suitable for auto-tuning (RVG3A08)

RVG4



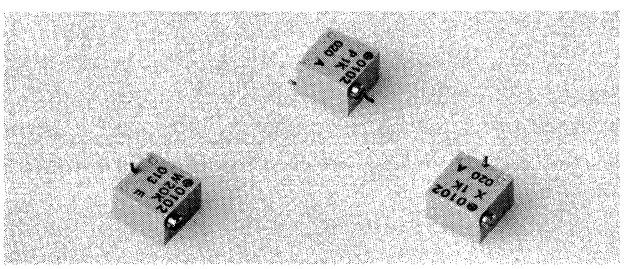
The RVG4 Series has presoldered electrodes to facilitate surface mounted auto-placement and reflow soldering. They are also available with conventional lead type terminals. The wide 200° rotational angle improves performance and resistance range.

SPECIFICATIONS

Resistance Range	100ohms to 2 Megohm
Tolerance	±25%
Temperature Coefficient	±250ppm/°C
Taper	Linear
Power Rating	1/10W (at 70°C) Derated to 0 Watts at 125°C
Max. Working Voltage	50 VDC
Torque	.27 to 2.8 in.-oz.
Effective Rotation	Elec. 200° ±10°

FEATURES
- Miniature size—3.8 × 4.5 × 2.3 mm for close close component spacing
- Easily adjusts with regular screwdriver
- Large, solid axle not affected by vacuum chuck during auto-placement
- Nickel plated, solder coated terminals eliminate solder leaching in reflow soldering operations
- Tape packaging available for auto-placement

POTO102



SPECIFICATIONS

Resistance Range	10 ohms to 1 Megohm
Tolerance	±10%
Temperature Coefficient	±100ppm/°C
Residual Resistance	2 ohms max.
Power Rating	0.25W at 85°C. Derated to 0W at +125°C
Working Voltage	200 VDC max.
Operating Temp. Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max., whichever is greater
Dielectric Strength	600 VAC
Insulation Resistance	1,000 Megohms min. at 500 VDC
Torque	3.0 in.-oz. max.
Effective Electrical Adjust.	12 turns, ±2 turns

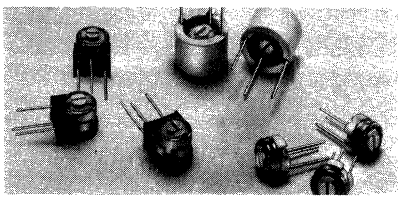
FEATURES:
- Miniature size—.250″ × .250″ × .169″
- 12-turn
- Will withstand industrial cleaning processes
- Cermet resistance element
- For surface mount applications
- Reflow solderable

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

sealed precision cermet trimming potentiometers—±100 ppm/°C

MURATA ERIE NORTH AMERICA

3321 Single Turn, 1/2 Watt



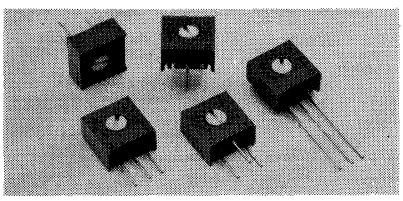
FEATURES

- Flame retardant rotor meets UL94V-0 requirements
- Extremely small size — .260″D. x .181″
- Sealed to withstand wave soldering and immersion cleaning processes
- Can be packaged for auto-insertion

SPECIFICATIONS

Resistance Range	10 ohms to 5 Megohms
Tolerance	±20%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +150°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3104 Single Turn, 1/2 Watt



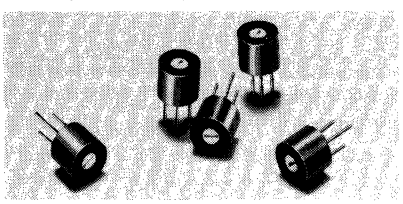
FEATURES

- Low cost
- 3/8″ square

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	2 ohms max.
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	1% or 1 ohm max. whichever is greater

1102, 4-Turn, 1/2 Watt



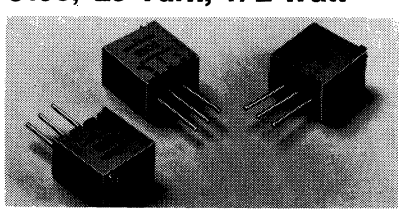
FEATURES

- Unique planetary drive provides the precise setting capability of a multi-turn unit in a small single-turn package
- Just .299″D x .260″
- Sealed to withstand wave soldering and immersion cleaning process

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3106, 25-Turn, 1/2 Watt



FEATURES

- Small size — .374″ x .394″ x .200″
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2103, 15-Turn, 3/4 Watt



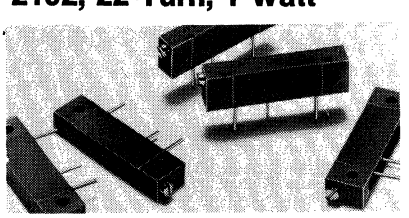
FEATURES

- Small size — .181″ x .252″ x .752″ for close board spacing
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	3% or 1 ohm max. whichever is greater
Power Rating	0.75W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2102, 22-Turn, 1 Watt



FEATURES

- 22-turn mechanism provides extremely fine adjustment capability
- High power dissipation: 1.0W at 70°C
- Sealed to withstand wave soldering and immersion cleaning processes

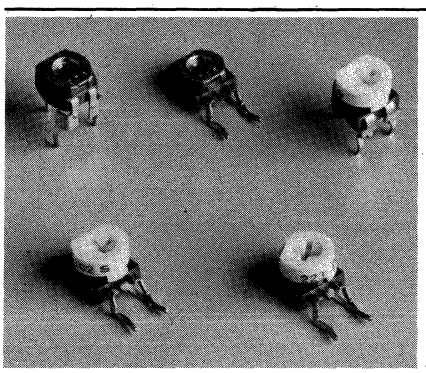
SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	1W at 70°C. Derated to 0W at +150°C
Max. Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-303

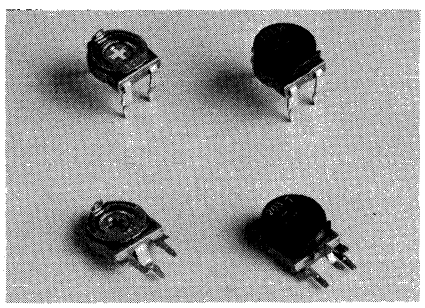
single turn, low cost trimming potentiometers

MURATA ERIE NORTH AMERICA



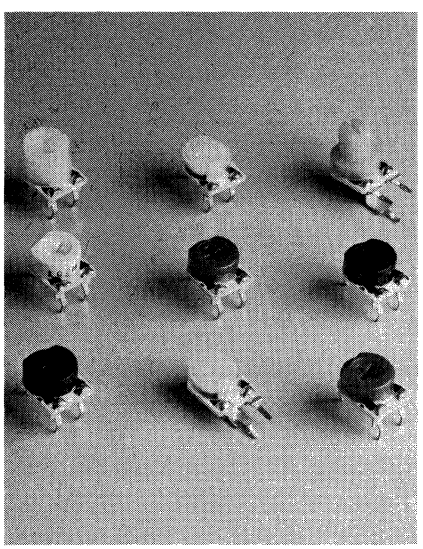
1/10 Watt, Molded Substrate—RVF6

Resistance Range:	200 ohms to 1 Megohm
Tolerance:	±30%
Residual Resistance:	Less than 500Ω, less than 5% of nominal resistance 500Ω and up, less than 3% of nominal resistance.
Taper:	Linear
Power Rating:	0.1W (at 70°C) Derated to 0 watts at 85°C
Max. Working Voltage:	50 VDC
Torque:	.28 to 4.86 in.-oz.
Terminal Strength:	17.64 oz. when the force is applied in the direction of the axes of the terminal.
Effective Rotation:	Elect. 200° Mech. 220° ±10°
Stop Strength:	6.9 in.-oz.



.15 Watt, Carbon—RVF8

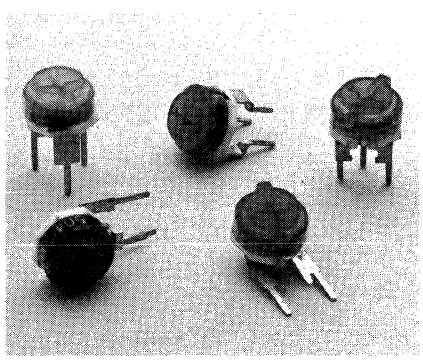
Resistance Range:	100 ohms to 1 Megohm
Tolerance:	±25%
Residual Resistance:	Less than 5% of nominal rated resistance
Taper:	Linear
Power Rating:	0.15W (at 70°C) Derated to 0 watts at 85°C
Max. Working Voltage:	150 VDC
Torque:	.4 to 4.17 in.-oz.
Terminal Strength:	17.64 oz. when the force is applied in the direction of the axes of the terminal
Effective Rotation:	270° ±10°



1/5 to 3/4 Watt, Carbon, Plastic & Cermet—0911

Characteristic	RVX (Carbon)		RVG (Cermet)	
	0911		0911	
Resistance Range:	200 — 5 Megohms*		200 — 1 Megohm	
Tolerance:	±20%			
Residual Resistance:	Less than 500Ω, 5Ω maximum 500Ω and up, less than 1% of nominal rated resistance			
Taper:	Linear			
Power Rating**:	1/5W (70°C)	1/3W (70°C)	1/2W (70°C)	3/4W (70°C)
Max. Working Voltage***:	250 VDC	350 VDC	350 VDC	500 VDC
Torque:	0.56-4.86 in.-oz.	0.83-6.0 in.-oz.	0.56-4.86 in.-oz.	0.83-6.0 in.-oz.
Terminal Strength:	35.27 oz.			
Effective Rotation: Elec.	240°	250°	240°	250°
Mech.	260° ±10°	280° ±10°	260° ±10°	280° ±10°
Stop Strength:	13.9 in.-oz.			

*Derated to 0 watts at 100°C (for Special Carbon), at 125°C (for Cermet)
***Max working V varies with resistance value. Vmax = √ Resistance × Power



1/3 Watt, Cermet—RVG0707

Resistance Range:	100 ohms to 1 Megohm
Tolerance:	±20%
Temperature Coefficient:	± 250ppm/°C
Residual Resistance:	100 to 500 ohms — 5 ohms max. Over 500 ohms — 1% max.
Taper:	Linear
Power Rating:	1/3W (at 70°C) Derated to 0 Watts at 125°C
Max. Working Voltage:	100 VDC
Torque:	.27 to 2.8 in.-oz. (20 to 200 g cm)
Terminal Strength:	12.35 oz. (350 gr) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	200° ±10°

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 26-1301 FAX: 404-436-3030

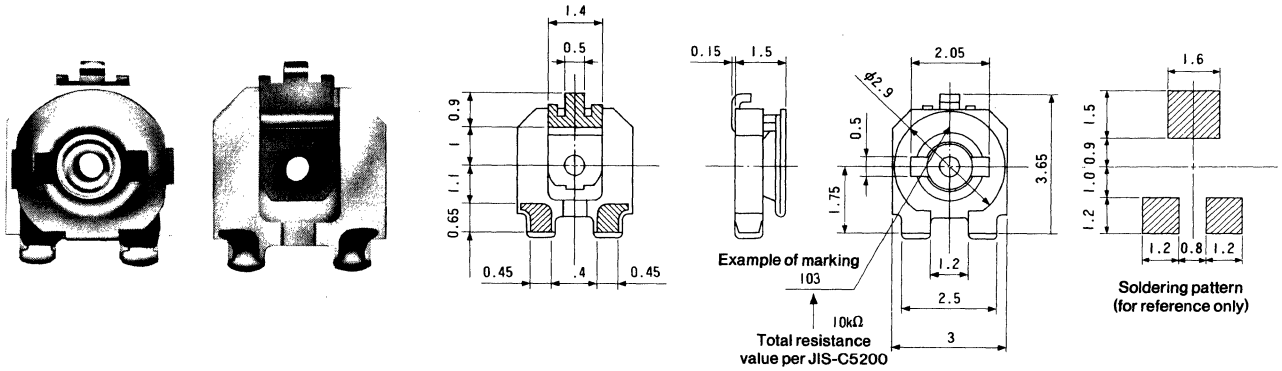
NOBLE®

Surface Mount Trimmer Potentiometers

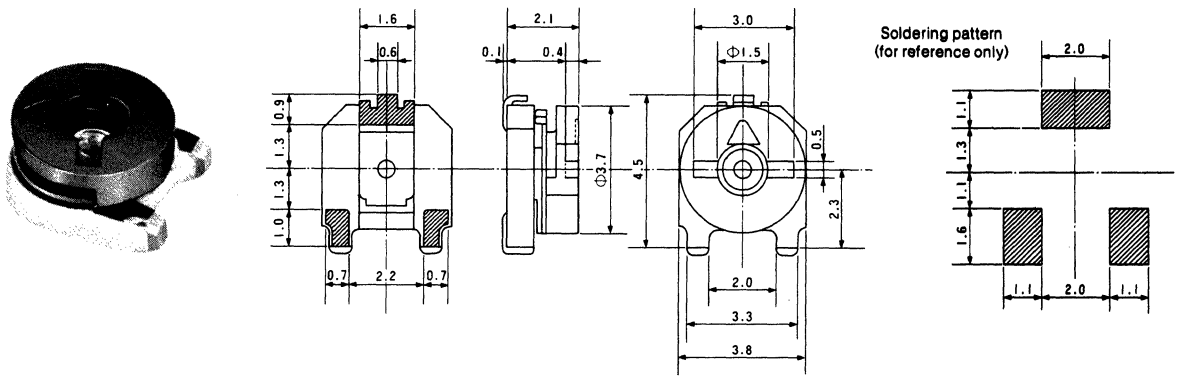
TMC3K, TMC4K

(With Metal-Glaze Element)

External View and Dimensions—TMC3K



External View and Dimensions—TMC4K



Features:

1. Space saving size—TMC3K measures 3.0mm×3.65mm (1.5mm thick); TMC4K measures 3.8mm×4.5mm (2.1mm thick).
2. Designed for reflow soldering.
3. Surface mounting with adhesive.
4. TMC3K supplied in 8mm tape and reel; TMC4K available in 12mm.
5. Metal-glaze element for stability and high-temperature requirements.

Applications:

Hand-held equipment, radar detectors, bar code devices, disk drives, and other consumer and business electronic products.

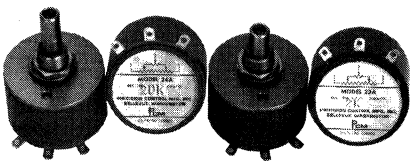
Specifications:

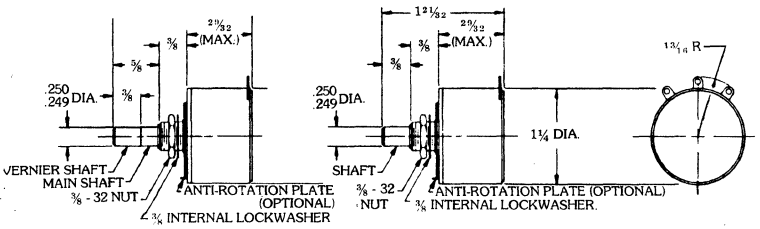
Operating temperature range	−30°C to+125°C
Mechanical Characteristics	
Total rotation angle	Endless
Effective rotation angle	250 ± 20°
Rotation torque	20-200 g-cm (5-35°C)
Electrical Characteristics	
Nominal total resistance range	200 Ω to 1 M Ω ± 25%
Resistance taper	Linear (B)
Residual resistance	Less than 1% of total resistance (300 Ω and below: 3 Ω max.)
Power rating	0.1W (TMC3K), 0.2W (TMC4K)
Voltage rating	20 V AC/DC

NOBLE U.S.A., INC. 5450 Meadowbrook Industrial Court Rolling Meadows, IL 60008 USA
Phone: 708/364-6038 FAX: 708/364-6045

PRECISION CONTROL MFG. INC.
1509 B QUEEN ANNE AVENUE N., SEATTLE WASHINGTON 98109 (206) 281-9380
We Specialize in Precision Controls

HIGH RESOLUTION VERNIER POTENTIOMETERS





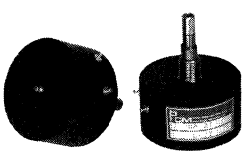
Models 23A and 24A Vernier potentiometers feature high and very high resolution because of their unique design. Coupled both electrically and mechanically, they allow any fixed portion of the coarse element (5% or less) to be expanded over the 270° of shaft rotation on the vernier. Total rotation is 555° (1.5 turns) and a 5% vernier presents a resolution roughly equivalent to a 3600° (10 turn) model; a 2.5% vernier is about equivalent to a 7200° (20 turn) model; a 1% vernier is approximately equivalent to a 18000° (50 turn) model.

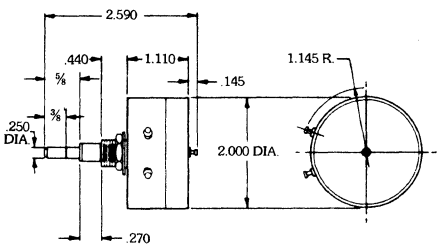
Customized products are available with modified shafts. R_t (total resistance), tolerance, P_v (vernier percentage), and torque. Please consult the factory with your unique requirements.

All PCM potentiometers are wire wound; standard values are from 100 ohms to 100K ohms ±3%.

We sell quality and service and we stand behind what we sell.

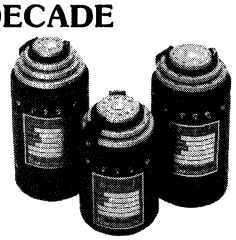
DOUBLE VERNIER POTENTIOMETERS

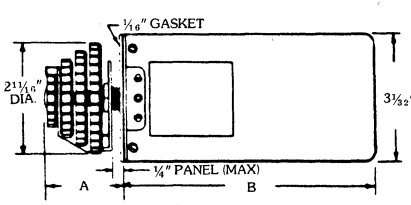




For applications requiring extremely high resolution, the Model 30A Vernier Potentiometer provides 0.002% or better resolution in less than 2½ turns of the shaft. The 30A does not rely on gear ratios to achieve mechanical resolution, but through a unique patented design, provides true electrical resolution which is roughly equivalent to 40 turn potentiometers. The vernier contacts span any 5% of the main winding and expand it over the 280° rotation of the first vernier. Any 5% segment of the first vernier is in turn expanded over the 270° rotation of the second vernier. Thus extreme resolution is possible in only 830° of total shaft rotation.

HIGH ACCURACY DECADE POTENTIOMETERS AND RHEOSTATS





Precision Control Mfg., Inc. (PCM) produces high quality, coaxial dial decade potentiometers and rheostats for high accuracy applications. The basic design features a positive in-line readout and easy, rapid adjustment made possible by a combination of distinct dials and a parallax free indicator. The unique electrical and mechanical design of PCM decades makes a small and accurate package which is very rugged.

Decade potentiometers provide linearities ranging from ±0.005% in the model 50A to ±0.0025% in the model 60A. All PCM rheostats have an accuracy base of ±0.025%.

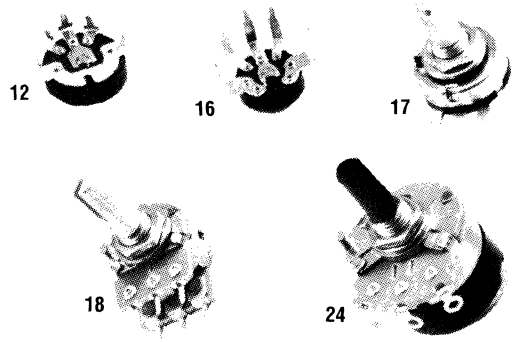
All PCM decades are available in militarized versions which meet or exceed the environmental portions of MIL-E-5272C, Sections 4.2.2, 4.3.1, 4.4, 4.6 through 4.11.2, 4.12, 4.15 and MIL-T-945A, Sections 4.4.1 through 4.6. Resistors used in PCM decades are wound with only premium resistance alloys for low temperature coefficients and are single layer wound, with low inductance making possible precision attenuation over a wide range of frequencies. Switch decks utilize low leakage materials and feature gold plated silver contacts. The case is heavy gauge aluminum to provide shielding and dust protection, shafts are of stainless steel.

RDI ELECTRONICS INCORPORATED

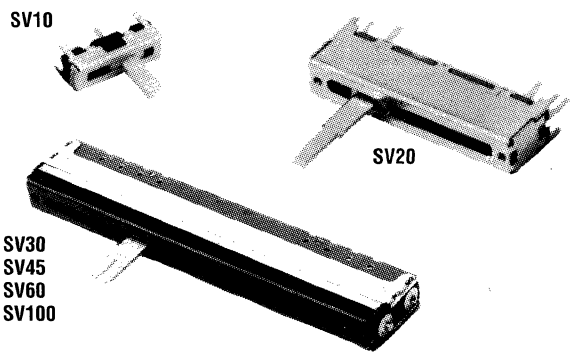
The following information is excerpted from our catalog. Please contact us for your complete guide to the components available from RDI Electronics.

POTENTIOMETERS

RDI Electronics offers both rotary & slide potentiometers in a wide range of sizes and mounting configurations. From our ultra thin low profile rotarys to our 100mm "Easy Glide" slide potentiometer, RDIE can satisfy your requirements. Linear, Log, and Anti-Log resistance tapers available.



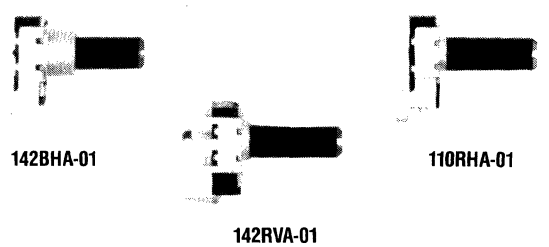
ROTARY TYPE ELECTRICAL SPECIFICATIONS					
	φ12	φ16	φ17	φ18	φ24
Total Resistance	1 to 500KΩ±20%				
Power Rating (Taper B)	0.1W	.2W			0.5W
Power Rating (other)	0.5W	0.1W			0.25W
Operating Volt. Max (B)	DC 200V	DC 250V			DC500V
Operating Volt. (other)	DC 150V	DC 200V			
Sliding Noise	47 mV Max.				
Insulation Resistance	100MΩ Min. at DC 500V				
Withstanding Voltage	1 min. at AC 500V				AC 1,000 V
MECHANICAL SPECIFICATIONS					
Rotation Torque	20 to 200 g.cm		50 to 450 g.cm		
Angle of Rotation	230° ± 10°		260° ± 10°		300° ± 10°
Torque at End Stop	3 Kg.cm		4 Kg.cm		5 Kg.cm
Rotational Life	15,000 cycles Min.				
SWITCH SPECIFICATIONS					
Rating	DC 12V 1A		AC 125V 1A		AC 125V 1A,3A
Operating Force	100 to 400 g.cm				1.5 Kg.cm Max.
Operating Angle	45°Max.				60° Max.
Contact Resistance	Less than 50 mΩ				
Life	5,000 cycles Min.				



SLIDE TYPE ELECTRICAL SPECIFICATIONS	
Total Resistance Range	500Ω to 1MΩ ± 20%
Resistance Taper	Any type taper available.
Power Rating	"B" taper:0.25W, Others:0.125W.
Operating Voltage Max.	DC 350V.
Insulation Resistance	100MΩ Min. at DC 500V.
Withstanding Voltage	1 min. at AC 500V
Sliding Noise	56mV.
MECHANICAL SPECIFICATIONS	
Operating Force	50 to 350g.
Shaft Stop Strength	5kg Min.
Shaft Wobble	2L/20mm Max. (L: Shaft Length, Lever Swing)
Sliding Life	15,000 cycles Min.

11 & 14mm ROTARY TYPE

- Horizontal and vertical PC Mount
- With or without threaded bushing
- Flux resistant



		φ 11 Type	φ 14 Type
ELECTRICAL SPECIFICATION			
Total Resistance Range		5kΩ to 500kΩ±20%	
Resistance Taper		A, B, C, D, W etc	
Power Rating		0.05 W	
Operating Voltage Max.		AC 50V, DC 20V	AC 50V for A.C use only
Residual Resistance		R ≦10 kΩ : 20Ω Max. 10kΩ<R<50 kΩ : 30Ω Max. 50kΩ ≦R ≦500kΩ : 0.1% Max. of R	R ≦30 kΩ : 30Ω Max. 30kΩ<R ≦500kΩ : 0.1% Max. of R
Sliding Noise		Within 47 mV	
Insulation Resistance		100MΩ Min. at DC 500V	100MΩ Min. at DC 250V
Withstanding Voltage		Min. 1 minute at AC 500V	Min. 1 minute at AC 300V
Tracking Error	Volume		Within±3dB, at −40 to 0dB
	Tone		Within±2dB, center position

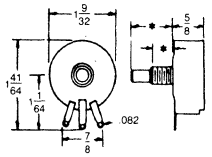
FROM PROTOTYPE TO PRODUCTION, SPECIFY RDI ELECTRONICS FOR QUALITY, SERVICE AND COMPETITIVE PRICING.

RDI Electronics, Inc.,/ Dept. E, 56 Harrison St., New Rochelle, NY 10801 Tel: 914-632-7274/ Fax: 914-632-7464

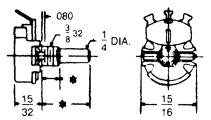
MALLORY *custom wirewound controls*

WIREWOUND POTENTIOMETERS

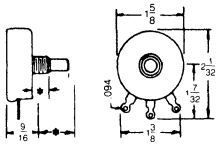
STYLE R AND QR



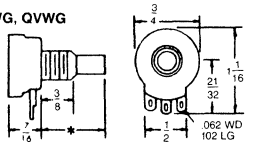
STYLE LW



STYLE M, QM, MG, QMG



STYLE VW, QVW, VWG, QVWG



STYLE SC, QSC, SCG, QSCG
As Above But Smaller Shaft & Bushing Diameter

OTHER WIREWOUND POTENTIOMETER FEATURES AVAILABLE ON SELECTED PRODUCT TYPES:
- nonlinear resistance tapers,
- ±5% resistance tolerance,
- multisection units,
- twist-tab mounting.

MALLORY MANUFACTURES A COMPLETE LINE OF "T", "L", AND "LL" PAD ATTENUATORS.

In addition to the many types of wire-wound controls carried as stock items, Mallory can supply custom made units tailored to your exact requirements. Specifying Mallory for your custom made control will assure exacting quality for either your prototype or production use.

POTENTIOMETER LINE SWITCHES AVAILABLE

Grade Name	Action	Type	Size	Rating	Available On Control	Approval
OAC-1	Rotary	SPST	15/16"	6 A 125VAC 3 A 125VDC	M, R	UL & CSA
OAC-2	Rotary	DPST	15/16"	6 A 125VAC 6 A 125VDC (3 amps/circuit)	M, R	UL & CSA
OAC-3	Rotary	2XSPST	15/16"	3 amps 125VAC	M, R	UL & CSA
OAC-SPC	Rotary	SPST	15/16"	15A 10VDC	M, R	N.R.
OAC-4	Rotary	SPST	15/16"	5 amps 125VAC	M, R	UL & CSA
OAC-8 Auto-SPL	Rotary	SPST	15/16"	20 amps 15VDC	M, R	Automotive
OAC-5	Rotary	SPST	15/16"	5 amps 125VAC	M, R	UL & CSA
OAC-8	Rotary	SPST	15/16"	5 amps 125VAC	M, R	CSA
OAC-8 AUTO	Rotary	SPST	15/16"	15 amps 10V	M, R	UL & CSA
OAC-6	Rotary	SPST	15/16"	5 amps 125VAC		UL & CSA
OAC-8 AUTO	Rotary	SPST	15/16"	15 amps 20VDC 7.5 amps 10VDC	M, R	
OAC-9	Rotary	SPDT	15/16"	5 amps 125VAC	M, R	CSA
OPP-3	Push-Pull	SPST	15/16"	5 amps 125VAC 1 amp 125VDC	LW	UL & CSA
OPP-5	Push-Return	Momentary SPST	15/16"	1 amp 125VAC	LW	UL
PPSI	Push-Pull Side Mount	DPST (OAC-2) SPDT (OAC-3)				
PPS2	Push-Push Side Mount	DPST (OAC-2) SPDT (OAC-3)				
Dual Switches any pr. of OAC		Side Mounted Rotary switches may be used.				
MOAC-1 MOAC-3	Rotary Rotary	SPST SPDT	1/2" 1/2"	3 amps 125VAC 2 amps 125VAC	NO NO	UL UL

Most of the above switches are available separately for mounting on the customer's control, either by welding or tab mounting.

SPECIFICATION TABLE

						Degrees Of Rotation			Resistance ±10%		Locating Lug Radius (3 and/or 9 o'clock)
Watts	Style	Diameter	Depth	Standard Bushing	Standard Shaft Diameter	Mechanical	Electrical W/Switch	Electrical W/O Switch	Min. OHMS	Max. OHMS	Radius
3	R	1 9/32	5/8	3/8-32	1/4	297	260	290	1	50K	17/32
4	M	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	17/32
5	SC	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	15/64
5	VW	3/4	7/16	3/8-32	1/4	305	—	275	1	25K	17/32
5	LW	15/16	15/32	3/8-32	1/4	300	—	280	3	25K	7/16
10	SCT	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	15/64
10	VWG	3/4	7/16	3/8-32	1/4	305	—	275	1	24K	17/32
12 1/2	MG	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	17/32

Style M, MG, R, SC, SCG, VW and VWG also available with "Q" prefix in Military Construction.

Standard Breakdown Voltage test 900 V RMS

The above data is only a guide. This listing of controls does not cover all possible configurations tooled. Please consult Mallory Components Engineering for further details and availability of deviations.

MALLORY CONTROLS, A DIVISION OF EMERSON ELECTRIC CANADA LTD.
P.O. Box 210, 1079 Parkinson Road, Woodstock, Ontario, N4S 7W8, Canada
Phone: (519) 539-4891, Telex: 23:M0Y001, Fax: (519) 539-6684

MALLORY *custom wirewound controls*

WIREWOUND POTENTIOMETERS, ATTENUATORS & SWITCHES

WIREWOUND POTENTIOMETERS

Watts	Style	Diameter	Depth	Standard Bushing	Shaft Diameter	Mechanical Rotation	Resistance Value
3	R	19/32	5/8	3/8-32	1/4	297°	1- 50K
4	M	1 5/8	9/16	3/8-32	1/4	294°	1/2-100K
5	SC	3/4	7/16	1/4-32	1/8	305°	1- 25K
5	VW	3/4	7/16	3/8-32	1/4	305°	1- 25K
5	LW	15/16	15/32	3/8-32	1/4	300°	3- 25K
10	SCG	3/4	7/16	1/4-32	1/8	305°	1- 25K
10	VWG	3/4	7/16	3/8-32	1/4	305°	1- 25K
12.5	MG	1 5/8	9/16	3/8-32	1/4	294°	1/2-100K

ATTENTUATORS

Attenuators available: 10 Watts RR, RL and RT types
15 Watts L, LL and T types
50 Watts MGL, MGLL and MGT types

POTENTIOMETER LINE SWITCHES

Action	Type	Grade Name	Rating	Available on Control
Rotary	SPST	OAC-1	6A 125VAC 3A 125VDC	M, R
		OAC-8	5A 125VAC	M, R
		HD	6A 125VAC (1450W)	M, R
		OAC SPEC.	16A 125VAC (Dimmer)	M, R
	SPDT	OAC-3	3A 125VAC	M, R
		OAC AUTO	15A 10VDC 7.5A 20VDC	M, R
		OAC-9	5A 125VAC	M, R
	DPST	OAC-2	6A 125VAC 2A 125VDC	M, R
Push-Pull	SPST	OPP-2	3A 125VAC 0.5A 125VDC	LW
		OPP-3	5A 125VAC 1A 125VDC	LW
		OPP-4	6A 125VAC 1A 250VDC	LW
Momentary	SPST	OPP-5	1A 125VAC	LW

ROTARY SELECTOR SWITCHES

Circuits	Positions	Terminals	Type
1	2 to 12	2 to 12	Shorting and Non-Shorting
1	2 to 6	4 to 12	
1	2 to 4	6 to 12	
1	2 to 3	8 to 12	

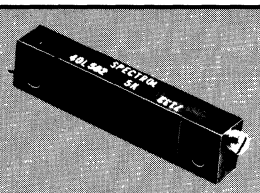
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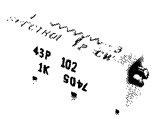
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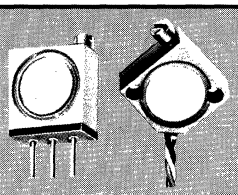
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Spectrol®

TRIMMERS

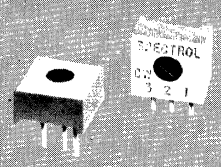


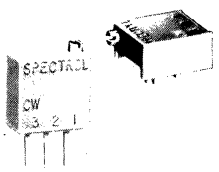


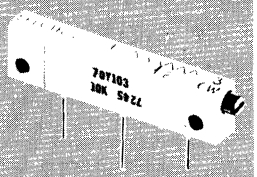


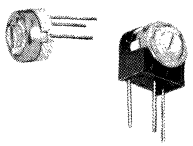


MODEL	40 ✲	43 ✲	50	55
Description	1-1/4" Rectangular Multi-Turn	3/4" Rectangular Multi-Turn	3/8" Square Multi-Turn	1/2" Square Multi-Turn
Element Technology	Wirewound	Cermet	Wirewound	Wirewound
Resistance Range	10Ω to 100KΩ	10Ω to 2MΩ	50Ω to 50KΩ	50Ω to 50KΩ
Resistance Tolerance, %	±5%	±10%	±5%	±5%
Power: Watts at °C	1 W at 70°C	0.75 W at 70°C	0.75 W at 85°C	1.5 W at 70°C
Electrical Travel	22 ±5 Turns	20 Turns, Nominal	23 ±5 Turns	23 ±5 Turns
Operating Temperature	−65°C to +175°C	−55°C to +125°C	−65°C to +150°C	−65°C to +150°C



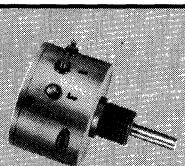


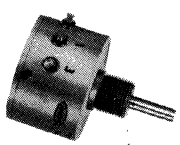


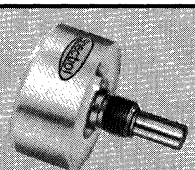


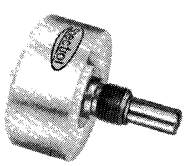
MODEL	63 ✲	64 ✲	70 ✲	75 ✲
Description	3/8" Square Single Turn	3/8" Square Multi-Turn	1-1/4" Rectangular Multi-Turn	1/4" Round or Square Single Turn
Element Technology	Cermet	Cermet	Cermet	Cermet
Resistance Range	10Ω to 2MΩ	10Ω to 2MΩ	10Ω to 2MΩ	10Ω to 2MΩ
Resistance Tolerance, %	±10%	±10%	±10%	±10%
Power: Watts at °C	0.5 W at 70°C	0.5 W at 85°C	1 W at 85°C	.5 W at 70°C
Electrical Travel	270°	25 Turns, Nominal	20 Turns, Nominal	230° ±5°
Operating Temperature	−55°C to +125°C	−55°C to +125°C	−55°C to +150°C	−55°C to +125°C

POTENTIOMETERS









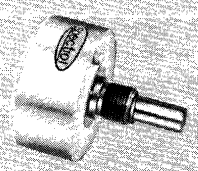
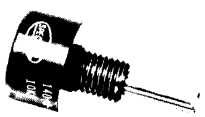
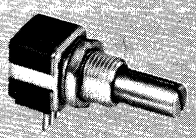
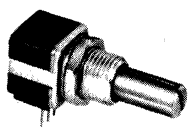
MODEL	122	128	132 ✲	138 ✲
Description	1-1/16" Round 1/8" Shaft	1-1/16" Round 1/8" Shaft	1-5/16" Round 1/4" Shaft	1-5/16" Round 1/4" Shaft
Mounting	Bushing or Servo	Bushing or Servo	Bushing	Bushing
Element Technology	Wirewound	Co-Molded C P	Wirewound	Conductive Plastic
Resistance Range	5Ω to 20KΩ	500Ω to 50KΩ	5Ω to 20KΩ	1KΩ to 50KΩ
Tolerance, %	±3%, 20Ω ≤ Rt ≤ 100KΩ	±10%	±3%, 50Ω ≤ Rt ≤ 35KΩ	±10%
Linearity, %	±0.50%, 200Ω ≤ Rt ≤ 100KΩ	±0.5%	±0.50%, 200Ω ≤ Rt ≤ 35KΩ	±0.5%
Power: Watts at °C	2.3 W at 40°C	1.9 W at 40°C	2.75 W at 40°C	2.0 W at 40°C
Electrical Travel: Continuous	350° ±2°	345° ±4°	352° ±2°	345° ±4°
Stops			336° ±2°	336° ±4°

✲ Standard Distributor Product

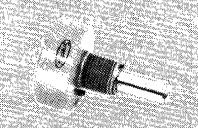
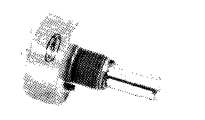
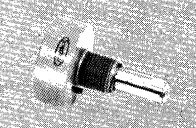
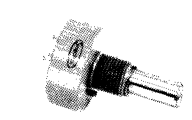
4051 Greystone Dr. ,Ontario, CA, 91761 • (714) 923-3313 • FAX (714) 923-6765

Spectrol®

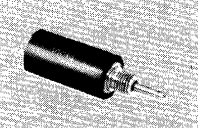
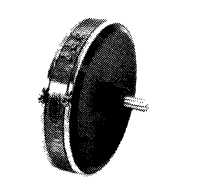
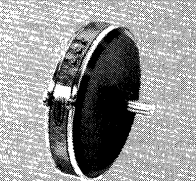
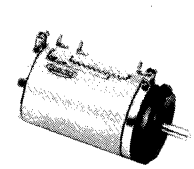
POTENTIOMETERS

MODEL	139	140✲	148	149
Description	1-5/16" Round 1/4" Shaft	1/2" Round 1/8" Shaft	1/2" Square, PCB Pins 1/8" or 1/4" Shaft	1/2" Square, PCB Pins 1/8" or 1/4" Shaft
Mounting	Bushing	Bushing	Bushing	Bushing
Element Technology	Cermet	Wirewound	Conductive Plastic	Cermet
Resistance Range	500Ω to 2MΩ	50Ω to 50KΩ	100Ω to 1MΩ	100Ω to 2MΩ
Tolerance, %	±20%	±5%	±20%	±10%
Linearity, %	±2.0%	±1%	±5%	±5%
Power: Watts at °C	5.0 W at 40°C	2.0 W at 40°C	0.5 W at 70°C	1.0 W at 85°C
Electrical Travel: Continuous	345° ±4°			
Stops	336° ±4°	320° ±5°	265° ±5°	265° ±5°

MODEL	152	157✲	158	159
Description	7/8" Round 1/8" or 1/4" Shaft	7/8" Round 1/8" or 1/4" Shaft	7/8" Round 1/8" or 1/4" Shaft	7/8" Round 1/8" or 1/4" Shaft
Mounting	Bushing or Servo	Bushing or Servo	Bushing or Servo	Bushing or Servo
Element Technology	Wirewound	Conductive Plastic	Co-Molded C P	Cermet
Resistance Range	5Ω to 20KΩ	1KΩ to 50KΩ	500Ω to 50KΩ	500Ω to 2MΩ
Tolerance, %	±3%, 50Ω ≤ Rt ≤ 40KΩ	±20%	±10%	±20%
Linearity, %	±0.5%, 500Ω ≤ Rt < 40KΩ	±2.0%	±0.50%	±2.0%
Power: Watts at °C	2.0 W at 40°C	1.0 W at 40°C	1.0 W at 40°C	3.5 W at 40°C
Electrical Travel	340° ±2°	340° ±4°	340° ±4°	340° ±4°

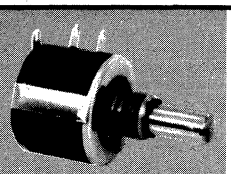
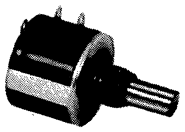
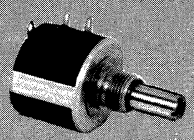
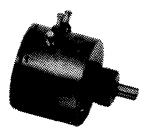
MODEL	162✲	302	308	502
Description	Ten Turn 1/2" Dia., .0935" Shaft	2" Round 1/4" Shaft	2" Round 1/4" Shaft	Ten Turn 7/8" Dia., 1/8" Shaft
Mounting	Bushing	Bushing or Servo	Bushing or Servo	Bushing or Servo
Element Technology	Wirewound	Wirewound	Co-Molded C P	Wirewound
Resistance Range	100Ω to 100KΩ	5Ω to 50KΩ	500Ω to 100KΩ	15Ω to 100KΩ
Tolerance, %	±5%	±3%, 50Ω ≤ Rt ≤ 85KΩ	±10%	±3%, 100Ω ≤ Rt ≤ 150KΩ
Linearity, %	±0.30%	±0.25%, 200Ω ≤ Rt ≤ 85KΩ	±0.25%	±0.25%
Power: Watts at °C	2.0 W at 40°C	6.18 W at 40°C	3.09 W at 40°C	3.09 W at 40°C
Electrical Travel	3,600° +15° −0°	350° ±2°	350° ±2°	3,600° +4° −0°

✲ **Standard Distributor Product**

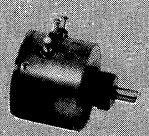
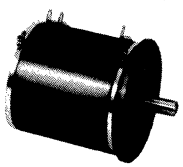
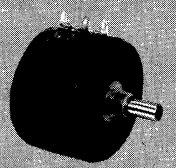
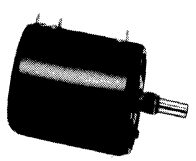
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POTENTIOMETERS

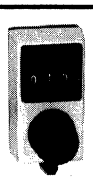





MODEL	533 ✲	534 ✲	535 ✲	702
Description	Three Turn 7/8" Dia., 1/4" Shaft	Ten Turn 7/8" Dia., 1/4" Shaft	Five Turn 7/8" Dia., 1/4" Shaft	7/8" Round 1/8" Shaft
Mounting	Bushing or Servo	Bushing or Servo	Bushing or Servo	Bushing or Servo
Element Technology	Wirewound	Wirewound	Wirewound	Wirewound
Resistance Range	50Ω to 20KΩ	100Ω to 100KΩ	50Ω to 50KΩ	5Ω to 20KΩ
Tolerance, %	±5%	±5%	±5%	±3%, 20Ω ≤ Rt ≤ 100KΩ
Linearity, %	±0.25%	±0.25%	±0.25%	±0.5%, 500Ω ≤ Rt ≤ 100KΩ
Power: Watts at °C	1.55 W at 40°C	3.09 W at 40°C	2.32 W at 40°C	1.25 W at 70°C
Electrical Travel	1,080° +10° −0°	3,600° +10° −0°	1,800° +10° −0°	350° ±2°

MODEL	708	802	830 ✲	860 ✲
Description	7/8" Round 1/8" Shaft	Ten Turn 1-13/16" Dia., 1/4" Shaft	Three Turn 1-13/16" Dia., 1/4" Shaft	Ten Turn 1-13/16" Dia., 1/4" Shaft
Mounting	Bushing or Servo	Bushing or Servo	Bushing	Bushing
Element Technology	Co-Molded C P	Wirewound	Wirewound	Wirewound
Resistance Range	500Ω to 50KΩ	20Ω to 200KΩ	15Ω to 50KΩ	20Ω to 200KΩ
Tolerance, %	±10%	±3%, 200Ω ≤ Rt ≤ 500KΩ	±3%, 200Ω ≤ Rt ≤ 150KΩ	±3%, 200Ω ≤ Rt ≤ 500KΩ
Linearity, %	±0.5%	±0.25%	±0.25%	±0.25%
Power: Watts at °C	1.5 W at 40°C	7.72 W at 40°C	3.0 W at 40°C	8.0 W at 40°C
Electrical Travel	340° ±5°	3,600° +4° −0°	1,080° +4° −0°	3,600° +4° −0°

DIALS



MODEL	11 ✲	15 ✲	16 ✲	21 ✲
Description	Round Vernier Scale	Rectangular Digital Scale	Round Vernier Scale	Round Vernier Scale
Size	1" Dia.	1" Wide	7/8" Dia.	1-13/16" Dia.
Number of Turns	11	15-1 / 10 15-2 / 100	15	15
Minor Scale Division	1/50 Turn	1/500 Turn	1/50 Turn	1/100 Turn
Shaft Bore	0.250"	0.250"	0.250"	0.250"
Finish: Exposed Metal	Satin Chrome Plated	Satin Metal	Brushed Metal	Satin Chrome
Knobs	Black Plastic	Black Plastic	Black Plastic	Black Plastic

✲ Standard Distributor Product

FOR THE JAPANESE, *SHOKAI* MEANS INTRODUCTION

WHAT DOES *SHOKAI* MEAN FOR YOU? (HINT: IT MAKES YOUR IDEAS PROFITABLE)

Let's face it. As a source for electronic and electromechanical components, the quality and pricing of the Far East can't be matched on our side of the ocean. But you can't go to the Far East whenever you need to source a product.

That's why, if up to now, your knowledge of Japanese was limited to "sushi" and "sayonara", we respectfully suggest that you learn another word . . . SHOKAI®. . . Your introduction to the Far East.

SHOKAI® is an American company, with over 30 years experience manufacturing and importing components from the Far East. We were serving American manufacturers long before everybody with a fax machine and a foreign telephone book could claim to be an overseas supplier. And we will be here long after they are gone.

We speak your language. We understand you - your time frames - your requirements - your problems – the quality and personal attention you and your customers demand. As hundreds of "Top 500" companies have learned, let SHOKAI® be your source for components from Japan, Taiwan, Hong Kong and the rest of the Far East.

OUR PRODUCT LINE INCLUDES:

- AC/DC Adaptors
- Antennas
- Battery Holders
- Buzzers
- Cable Assemblies
- Capacitors
- Cassette Mechanisms
- Circuit Breakers
- Connectors
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- LED's
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- Speakers
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And many more. Try us. You can start by requesting a catalog. Let us know what product you're looking for. Or better yet, tell us exactly what you want. You won't be disappointed.

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Telex: 224219 SHFE

Trimming Potentiometers

TOCOSAMERICA

565 West Golf Road, Arlington Heights, Illinois 60005
TELEPHONE: 708-364-7277 FAX: 708-364-7317

Not the largest, but the leader.

Affiliated With COSMOS TOKYO

Single Turn

Series	Description	Adj. Turns	style	Res. Range (Ω) Res. Tol. (%)	Power Rating (W/°C) Working Vol. Max (V) Operating Temp. Range (°C)	Features Available
 GF04 Cermet	Round 4.8mm (0.19″)	1	W U V S UT VT	100Ω~1MΩ ±20%	0.5W/70°C 200V −55°C~+125°C	• Sealed • Flame retardant • Tape & Reel
 GFO6 Cermet	Square 6.8mm (¼″)	1	P P_1 P_2 W U U_1 Y Y_1 X X_1 S S_1 V V_1 UT VT	10Ω~5MΩ ±10%	0.5W/70°C 250V −55°C~+125°C	• Sealed • Space Saving Size • Tape & Reel • Low Cost • Zero-backlash
 G12 Cermet	Round 12.6mm (½″)	1	P X S	10Ω~1MΩ ±20% (±10%)	0.75W/70°C 300V −55°C~+125°C	• Sealed • Excellent Stability • Dial Markings
 GF12 Cermet	Square 12.0mm (½″)	1	P X S R	100Ω~1MΩ ±20% (±10%)	0.75W/70°C 300V −55°C~+125°C	• 5,000 cycles • Sealed • Flame retardant
 GF12 Cermet	Square 12.0mm (½″)	1	P X S R	100Ω~1MΩ ±20% (±10%)	0.75W/70°C 300V −55°C~+125°C	• With Metal Shaft (5S, 10S) & Mold Shaft (8.2S) • 5,000 cycles • Sealed • Flame retardant
 FF-08 Carbon	8mm	1	2V 2VZ2 3V 3VZ2 3H 3HZ2	500Ω~1MΩ ±25%	0.2W/50°C 100V −30°C~+70°C	• Low TCR; ±250ppm/°C • Low Cost • With Dust Proof Cap(Z)
 FF-06 Carbon	6mm	1	30HZ 31VZ 30VZ 20VZ	500Ω~1MΩ ±30%	0.1W/50°C 50V −30°C~+85°C	• Low TCR; ±250ppm/°C • Low Cost

Surface Mount

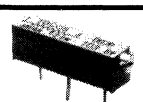
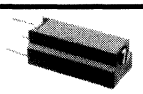
Series	Description	Adj. Turns	style	Res. Range (Ω) Res. Tol. (%)	Power Rating (W/°C) Working Vol. Max (V) Operating Temp. Range (°C)	Features Available
 TRG O4 Cermet	4mm ×4.5mm	1	2S1 3S1 3S4	100Ω~1MΩ ±30%	0.1W/70°C 50V −40°C~+100°C	• Surface Mount • Low Cost • Space Saving Size • Rheostat & voltage divider • Supplied in Embossed Tape • Bottom Side Adjust
 G4 Cermet	Square 4.5mm ×5mm	1	A, B D, E S C, F	50Ω~2MΩ ±20% (±10%)	0.25W/70°C 200V −50°C~+125°C	• Sealed & Surface Mount • Space Saving Size • Side adjust • Supplied in Embossed Tape • 300°C Max. • With Lead C&F

Trimming, Slide and Rotary Potentiometers

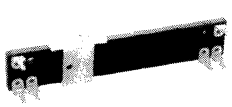
When reliability is critical...

Tocos examines the performance of its products long after their sale, through the widely used FIT, or failure rate in the field methodology. Of the one-hundred million units of our GF06 series produced over a 7-year span, **less than 1ppm failed** for a 0.06 (FIT) failure rate in the field.

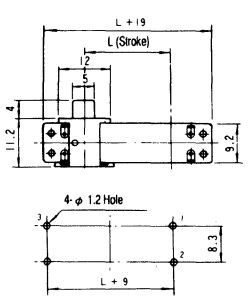
Multi-Turn

Series	Description	Adj. Turns	style	Res. Range (Ω) Res. Tol. (%)	Power Rating (W/°C) Working Vol. Max (V) Operating Temp. Range (°C)	Features Available
 **RJCO97 Cermet**	Rectilinear 19.0mm (¾″ Long)	15	P X	10Ω~2MΩ ±10%	0.75W/70°C 300V −55°C~+125°C	• Sealed • Low Cost • Excellent Stability
 **RJCO97 Cermet**	Rectilinear 19.0mm (¾″ Long)	15	PK PK_2	10Ω~2MΩ ±10%	0.75W/70°C 300V −55°C~+125°C	• With Knob • Sealed • Low Cost • Excellent Stability
 **RJCO7 Cermet**	Rectilinear 17.0mm (⅔″ High)	13	R	100Ω~2MΩ ±20% (±10%)	0.75W/40°C 300V −55°C~+125°C	• Sealed • Excellent Stability & Adjustability
 **GV6 Cermet**	Square 6.8mm (¼″)	2	P S U V UT VT	10Ω~2MΩ ±10%	0.5W/70°C 250V −55°C~+125°C	• Sealed • Space Saving Size • Tape & Reel • Excellent Stability & Adjustability
 **RJC26 Cermet**	Square 6.8mm (¼″)	11	W X	100Ω~2MΩ ±10%	0.25W/70°C 300V −55°C~+125°C	• Sealed to MIL-R-22097 • Flame Retardant-Meets UL-94V-0

Slide Potentiometers

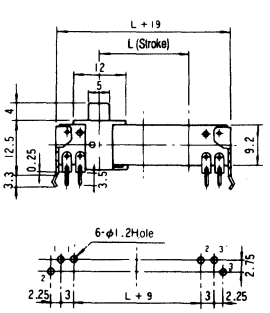


SS002N00A
Horizontal type
10mm, 15mm, 20mm, 30mm Stroke
*Single and Dual units available.





SS002GOOD
Vertical type

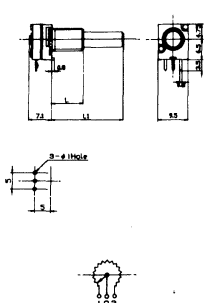


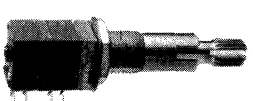
Rotary Potentiometers



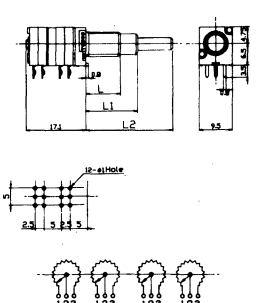
TP96N00
Single unit, single shaft

*With switch available
*Over 100 combinations





TP96H00
Quad unit, dual shaft



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Division of VERNITRON CORPORATION

"TECHNOLOGY IN MOTION"

FILM POTENTIOMETERS

ROTARY SINGLE-TURN POTENTIOMETERS LINEAR-FUNCTIONAL/SINE-COSINE

MULTI-ELEMENT ASSEMBLIES AVAILABLE (GANGED)

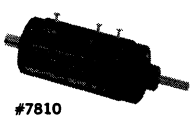


AVAILABLE FROM ½" TO 5" DIAMETERS

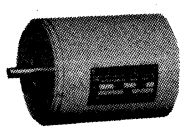
SPECIFICATIONS

	LINEAR	SINE-COSINE
Mechanical Rotation	360° Continuous	
Electrical Function Angle	350° Nominal	360°
Resistance Range	0.5KΩ - 2 MegΩ	500Ω - 50KΩ/Quad
Best Linearity or Conformity	.1% ÷ Inch of Dia.	.3% P-P ÷ Inch of Dia.
Virtual Resolution	1/250,000	
Wattage	Diameter x 2 Watt(s)	
Temperature Range	−55°C to +125°C	
Taps, Maximum No.	Diameter x 6	
Starting Torque (In.-Oz.)	Diameter x .15	Diameter x .2
Guaranteed Life (at 100 RPM)	To 30 Million Cycles Depending on Circuitry	

ROTARY MULTI-TURN POTENTIOMETERS LINEAR-FUNCTIONAL



#7810



#20010

AVAILABLE FROM ½" TO 2" DIAMETERS

SPECIFICATIONS

MODEL	7810†**	7820	7813/7814	20010
Mechanical Rotation	3700° Min.	7200° +100° −0°	3600° +100° −0°	3600° +100° −0°
Electrical Function Angle	3600° ±10°	7200° ±10°	3600 ±5°	3600 ±5°
Resistance Range	250Ω-125KΩ		5KΩ-1.5 MegΩ	5KΩ-3MegΩ
Best Linearity or Conformity	.075%	.05%	0.05%	0.01%
Virtual Resolution (Typ.)	1/200,000		1/400,000	
Wattage at 25°C	1		2	4
Temperature Range	−55°C to +125°C			
Taps Maximum No.*	1	2	1	
Starting Torque (In.-Oz.)	1.5		0.5	1.0
Guaranteed Life (at 100 RPM)	100 x 10^6 Revolutions Depending on Circuitry			
Stop Strength	10 In.-Oz. Max.		50 In.-Oz.	160 In.-Oz.

* For voltage reference, specify 0° width taps. For current carrying, specify zero resistance taps.
† Available in Dual Units, same case dimensions.
** Available to 36,000°

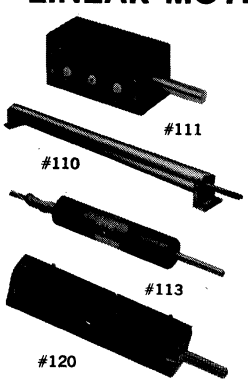
DIMENSIONS

MODEL	7810/ 7820	7813/ 7814	20010
A	.875	.875	2.000
B*	.750	.750	1.875
C	.1875	.125	.250
D*	.750	.800	.750
E	.062	.062	.035
F/G	.062	.062	.060
H	.600	.531	†
J	2.00	1.875	2.625
K	.375	.375	.375

* +.0000 −.0005

† Axial Rear Terminations

LINEAR MOTION POTENTIOMETERS/ TRANSDUCERS



#111

#110

#113

#120

SPECIFICATIONS

MODEL	110*	111*	112	113*	116†	119*	120	121	111V*
Electrical Stroke	To 60"	To 28"	To 12"	To 4"	To 12"	To 10"	To 1"	To 12"	To 28"
Cross Section ¶ Configuration	RD ○	SQ □	REC ▭	RD ○	REC ▭	RD ○	REC ▭	RD ○	SQ □
Resistance Range	250Ω/In. to 200K Ω/In.	150Ω/In. to 200K Ω/In.	150Ω/In. to 200K Ω/In.	500Ω/In. to 250K Ω/In.	150Ω/In. to 125K Ω/In.	350Ω/In. to 250K Ω/In.	500Ω/In. to 125K Ω/In.	500Ω/In. to 250K Ω/In.	150Ω/In. to 200K Ω/In.
Best Linearity	0.2% ÷ Length of Electrical Stroke								
Virtual Resolution	1/400,000								
Wattage	1 Watt per Inch of Stroke								
Temperature Range	−55°C to +125°C								
Taps Maximum No.‡	4	To Suit	To Suit	1	1	1	1	1	To Suit
Starting Force Oz. at 25°C	16	8	4	8	4	8	4	8	8
Life	30 Million Strokes, Depending on Circuitry								
Shaft Misalignment Feature	Available	Available	Available	Not Available	Not Available	Available	Available	Not Available	Available

* Available in Dual Units, same case dimensions.
† Available in Dual Unit providing the resistance and function of both elements is the same.
‡ For Voltage reference, specify zero width taps. For current carrying, specify zero resistance taps.
§ Threaded, ball, spring-return and other shaft endings available.
¶ RD — Round SQ — Square REC — Rectangular

PRESSURE TRANSDUCERS



POTENTIOMETER TYPE

Featuring infinite resolution, long life, and high reliability through the use of conductive film resistance elements, multiple wipers, and direct coupling of pressure sensing element to potentiometer wipers.

Pressure ranges from 0.1 to 10,000 psi in gage, absolute and differential types.

Linearity to ±0.3%. Air speed, altitude and low cost types available.

Refer to sections 2440, 3500, 5500 for additional product listings.

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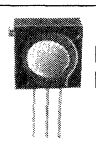
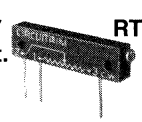
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Quality trimmer and precision potentiometers, attenuators and custom resistive devices.

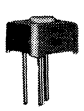
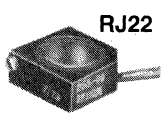
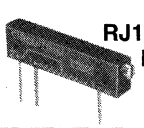
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VRN CIRCUITRIM® MILITARY TRIMMER POTENTIOMETERS

MIL-R-27208/MIL-R-39015* WIREWOUND TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
3/8" Square	 RT24 RTR24	23	10-10K	±5%	.75W	±50	3 PC pin styles, flexible leads (top & side adjust)
1/2" Square	 RT22 RTR22	24	50-20K	±5%	.75W	±50	3 PC pin styles, flexible leads (top & side adjust)
1 1/4" Rect.	 RT12 RTR12	22	10-20K	±5%	.75W	±50	2 PC pin styles, flexible leads (side adjust)

MIL-R-22097/MIL-R-39035** CERMET TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
1/4" Square	 RJ50 RJR50	1	100-500K	±10%	.25W	±100	1 PC pin style (top adjust)
1/4" Square	 RJ26 RJR26	16	10-1M	±10%	.25W	±100	3 PC pin styles (top & side adjust)
3/8" Square	 RJ24 RJR24	24	100-1M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
1/2" Square	 RJ22	24	10-1M	±10%	.5W	±100	3 PC pin styles, flexible leads (top & side adjust)
1 1/4" Rect.	 RJ12 RJR12	22	100-1M	±10%	.75W	±100	2 PC pin styles, flexible leads (side adjust)

*Failure rate: RTR12 & RTR22 approved to P level; RTR24 approved to R level
**Failure rate: Approved to R level
FOR COMMERCIAL EQUIVALENTS, SEE OUR LISTING IN VOL. A, SECTION 4750

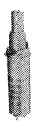
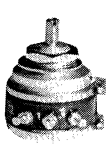
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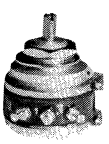
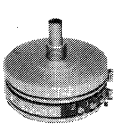
Quality trimmer and precision potentiometers, attenuators and custom resistive devices.

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VRN PRECISION POTENTIOMETERS

VRN manufactures a series of wirewound precision potentiometers with many custom adaptations available. Most single-turn models can be supplied with cermet or conductive plastic elements. Servo-mount is an available option on many models. Call VRN to take the mystery out of problem solving!

MODEL	DESCRIPTION
 **5000**	**½" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 1W (5005) 1.5W (5000) **Standard resistance range:** 100Ω to 100KΩ (5000) 50Ω to 50KΩ (5005) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% std. (closer upon request) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +6° −0 (5000) 1800° +6° −0 (5005) **Electrical rotation:** Same as mechanical
 **5001**	**½" Diameter Single-Turn Wirewound** **Power rating:** 2W @ 40°C **Standard resistance range:** 10Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 320° ±5°
 **7501**	**¾" Diameter Single-Turn Wirewound** **Power rating:** 2.25W @ 40°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±1% **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 125°C **Mechanical rotation:** Continuous **Electrical rotation:** 345° ±5°
 **0871**	**⅞" Diameter Single-Turn Wirewound** **Power rating:** 1.25W @ 70°C **Standard resistance range:** 100Ω to 10KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
 **7400**	**¾" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (7400) 2W (7405) **Standard resistance range:** 100Ω to 100KΩ (7400) 100Ω to 50KΩ (7405) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** .25% (7400) .5% (7405) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +6° −0 (7400) 1800° +6° −0 (7405) **Electrical rotation:** Same as mechanical
 **8400/ 8500**	**⅞" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (8400/8500) @ 40°C 2W (8403-05/8503-05) **Standard resistance range:** 100Ω to 100KΩ (8400/8500) 50Ω to 50KΩ (8403-05/8503-05) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% (8400/8500) ±.5% (8403-05/8503-05) **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 125°C **Mechanical rotation:** 3600° +10° −0 (8400/8500) 1800° +10° −0 (8405-8505); 1080° +10° −0 (8403/8503) **Electrical rotation:** Same as mechanical

MODEL	DESCRIPTION
 **1000/ 1220**	**1" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (1000) 2W (1005) 4W (1215) 5W (1220) **Standard resistance range:** 500Ω to 250KΩ (1000) 250Ω to 100KΩ (1005) 500Ω to 450KΩ (1215) 1KΩ to 600KΩ (1220) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% (1000/1005) ±.1% (1215/1220) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +4° −0 (1000) 1800° +4° −0 (1005) 5400° +4° −0 (1215) 7200° +4° −0 (1220) **Electrical rotation:** Same as mechanical
 **1061**	**1 1/16" Diameter Single-Turn Wirewound** **Power rating:** 1.5W @ 70°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
 **1441**	**1 7/16" Diameter Single-Turn Wirewound** **Power rating:** 1.5W @ 70°C **Standard resistance range:** 100Ω to 40KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
 **151**	**1½" Diameter Single-Turn Wirewound** **Power rating:** 3.5W @ 40°C **Standard resistance range:** 100Ω to 100KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±5°
 **HD150**	**1½" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 5W (HD150) 3W (HD153) 4W (HD155) **Standard resistance range:** 500Ω to 500KΩ (HD150) 200Ω to 250KΩ (HD153) 200Ω to 500KΩ (HD155) **Resistance tolerance:** ±3% (HD150) ±5% (HD153/155) **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% (HD150) ±.5% (HD153/155) **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 100°C **Mechanical rotation:** 3600° +4° −0 (HD150) 1080° +4° −0 (HD153) 1800° +4° −0 (HD155) **Electrical rotation:** Same as mechanical
 **2000/ 3000**	**2" and 3" Diameter Single-Turn Wirewound** **Power rating:** @ 70°C 4W (2000) 6W (3000) **Standard resistance range:** 100Ω to 60KΩ (2000) 200Ω to 100KΩ (3000) **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°

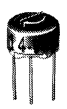
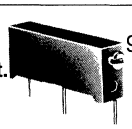
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CERMET TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
1/4" Round 	170	1	10-2M	±10%	.5W	±100 ***	2 PC pin styles (top adjust)
1/4" Square 	180 *	1	10-2M	±10%	.5W	±100 ***	4 PC pin styles (top & side adjust)
1/4" Square 	260 *	16	10-2M	±10%	.5W	±100 ***	3 PC pin styles (top & side adjust)
3/8" Square 	780	1	10-2M	±10%	.5W	±100 ***	15 PC pin styles (top & side adjust)
3/8" Square 	753 *	24	10-2M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
3/4" Rect. 	960	20	10-2M	±10%	.75W	±100 ***	7 PC pin styles (side adjust)

CERMET SURFACE MOUNT TRIMMERS

1/4" Round 	170	1	10-2M	±10%	.5W	±100 ***	Surface mount
1/4" Square 	180	1	10-2M	±10%	.5W	±100 ***	Surface mount
1/4" Square 	260	16	10-2M	±10%	.5W	±100 ***	Surface mount

*Includes military approved versions

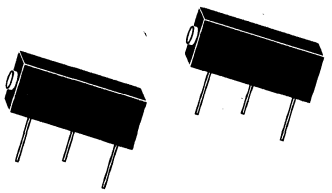
***Tighter specifications available—consult factory

A COMPANY OF VISHAY

Precision Bulk Metal®Foil Trimming Potentiometers

BULK METAL® RESISTORS

VISHAY Precision Trimmers have the Bulk Metal® foil resistive element which possesses a unique inherent temperature and load-life stability. In addition, their advanced, virtually backlash-free adjustment mechanism makes them easy to set quickly and accurately and keeps the setting exactly on target.



Specifications

Model Number	Resistance (Ohms)	Tolerance[1] Available To	Power	No. of Adjustment Turns	Nominal Dimensions Excluding Leads H x L x W Inch (mm) and Termination Styles		TCR (End to End)
1202* (RJ12 Style)	2, 5, 10 20, 50, 100, 200, 250, 500, 1K, 2K, 5K, 10K, 20K	±10%, ±20%, ±5%, ±10%	0.5W @ +85°C	25 ±2	0.325 x 1.250 x 0.195 (8.26) x (31.75) x (4.95) Type P: In-line pins Type Y: Staggered pins Type L: Flexible leads Type LB: Panel-mount with flexible leads	0.5% 2,000 hrs. @ +85°C	-55°C to +25°C +10 ppm/°C +25°C to +150°C -10 ppm/°C
1208 (RJ12 Style)	20, 50, 100 200, 250, 500, 1K, 2K, 5K, 10K	±20% ±10%				0.5% 2,000 hrs. @ +85°C	–55°C to +25°C +20 ppm/°C +25°C to +150°C –20 ppm/°C
1240* (RJ26 Style)	5, 10 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K	±10% ±5%	0.25W @ +85°C	21 ±2	0.250 x 0.250 x 0.175 (6.350) x (6.350) x (4.445) Type X: Edge-mount, side-adjust Type W: Edge-mount, top-adjust 0.175 x 0.250 x 0.250 (4.445) x (6.350) x (6.350) Type P: Edge-mount, side adjust	1.0% 10,000 hrs. @ 85°C	–55°C to +25°C +10 ppm/°C +25°C to +150°C –10 ppm/°C
1242† (RJ26)	50, 100, 200, 500, 1K, 2K, 5K	±10%				1.0% 1,000 hrs. @ +85°C	–55°C to +25°C +10 ppm/°C +25°C to +150°C –10 ppm/°C
1248 (RJ26 Style)	20, 50, 100, 200, 500, 1K, 2K, 5K,	±10%				1.0% 1,000 hrs. @ +85°C	–55°C to +25°C +20 ppm/°C +25°C to +150°C –20 ppm/°C
1260* (RJ24 Style)	5, 10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K	±10% ±5%	0.25W @ +85°C	21 ±2	0.420 x 0.375 x 0.170 (10.67) x (9.53) x (4.32) Type W: Edge-mount, top-adjust Type X: Edge-mount side-adjust	1.0% 10,000 hrs. @ +85°C	–55°C to +25°C +10 ppm/°C +25°C to +150°C –10 ppm/°C
1268 (RJ24 Style)	20, 50, 100, 200, 500, 1K, 2K, 5K	±10%				1.0% 1,000 hrs. @ +85°C	–55°C to +25°C +20 ppm/°C +25°C to +150°C –20 ppm/°C
1280G* (1280)*	10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K	±10%	0.75W @ +25°C	26 ±2	0.270 x 0.750 x 0.190 (6.86) x (19.05) x (4.83) *Panel mount available*	0.5% 2,000 hrs. @ +25°C	–55°C to +25°C +15 ppm/°C +25°C to +125°C –15 ppm/°C
1285G* (1285)*	10 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K	±10% ±5%	0.75W @ +25°C	26 ±2	0.270 x 0.750 x 0.190 (6.86) x (19.05) x (4.83) *Panel mount available*	0.5% 2,000 hrs. @ +25°C	–55°C to +25°C +5 ppm/°C +25°C to +125°C –5 ppm/°C

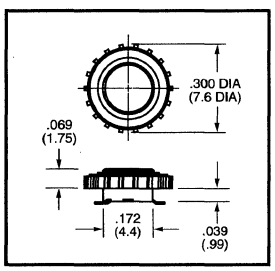
* Screening for low noise (CRV) is available.
† Qualified to MIL-R-22097
1, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

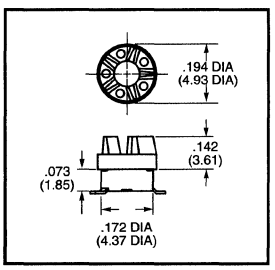
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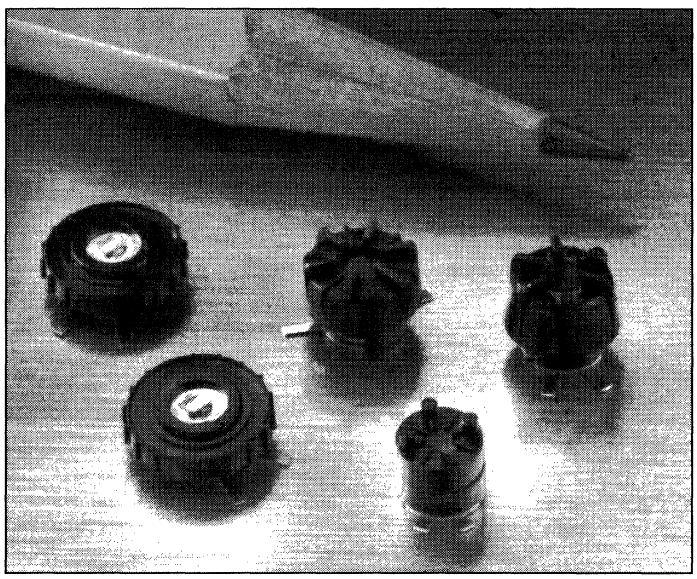
172-VC Ultraminiature Surface Mounted Volume Control

Special Features

- Sealed Unit
- Ultra-miniature size
  - .023 inches^2 surface area
  - .0034 inches^3 volume
- Infinite resolution
- Special tapers available
- Extremely low noise
- Extremely high rotational life (>25,000 cycles)
- Gold plated leads
- Rotors can be color coded as desired





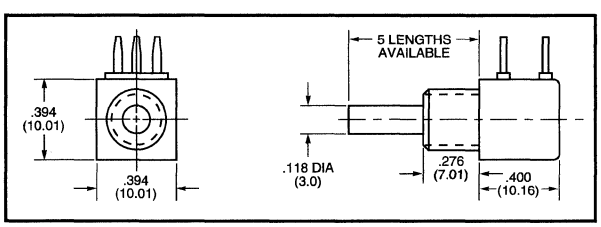


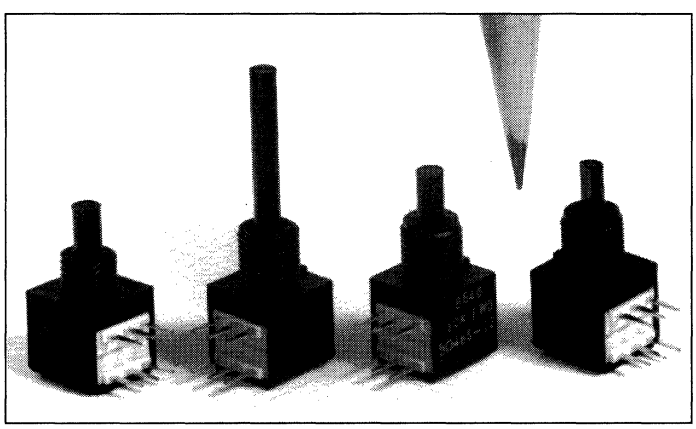
Model 172 Ultraminiature volume control specifically designed for surface mounting.

PA 400 Potentiometer / Switch

Special Features

- Potentiometer and SPDT switch in 10mm^3 size
- English and Metric Versions
- Wave solderable
- Choice of shaft length
- 8 standard electrical tapers (custom tapers also available)
- Flatted or round shafts standard
- Plastic shaft, bushing and case
- Over 750,000 different standard models





Sealed to withstand wave soldering and common printed circuit board cleaning processes, the Model 400 potentiometer/switch will withstand 260°C for 5 seconds. It is corrosion resistant and constructed from non-magnetic materials.

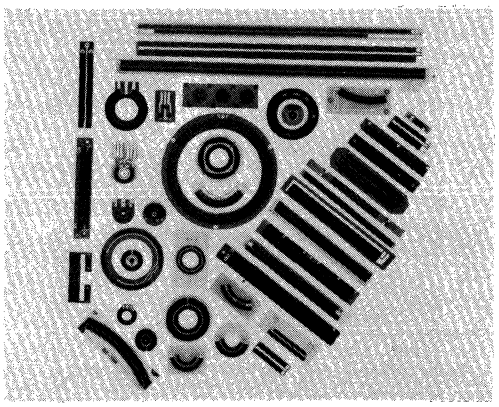
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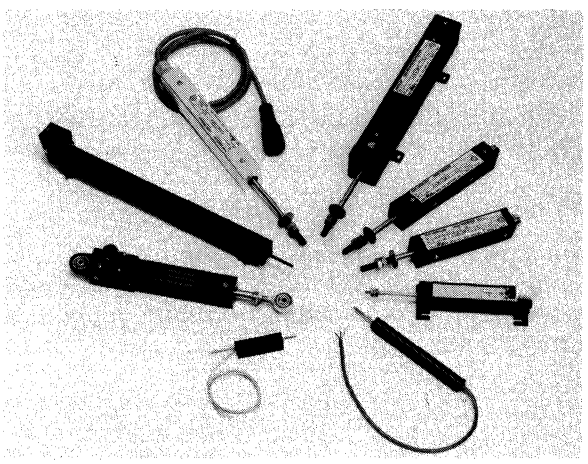


Waters built in servo-feedback elements simplify design and cut costs.

Why box yourself in with "packaged pots"—and linear-to-rotary conversions, and linkages, and costly housings, shafts and bearings you don't really need? Design position or motion feedback *your* way—with our long-lasting, low-noise, custom-made feedback elements.

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If you have the need to measure and control linear position with high accuracy, reliability and millions of operations, Waters offers an extensive range of sizes, linearities, and stroke lengths for applications ranging from heavy industrial equipment to space satellites.

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For the long (70") and short (1"), Waters transducers are the buy of the times.

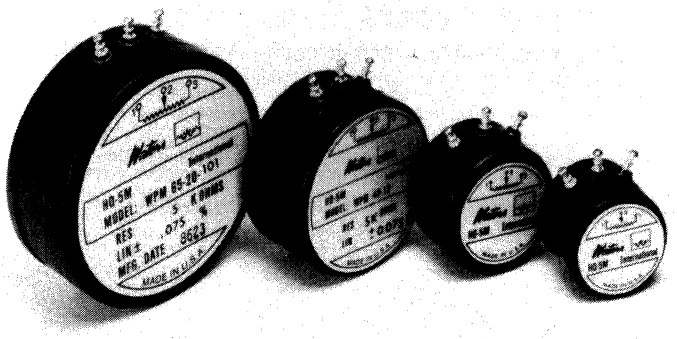
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SERVO POTS

True Positional Output

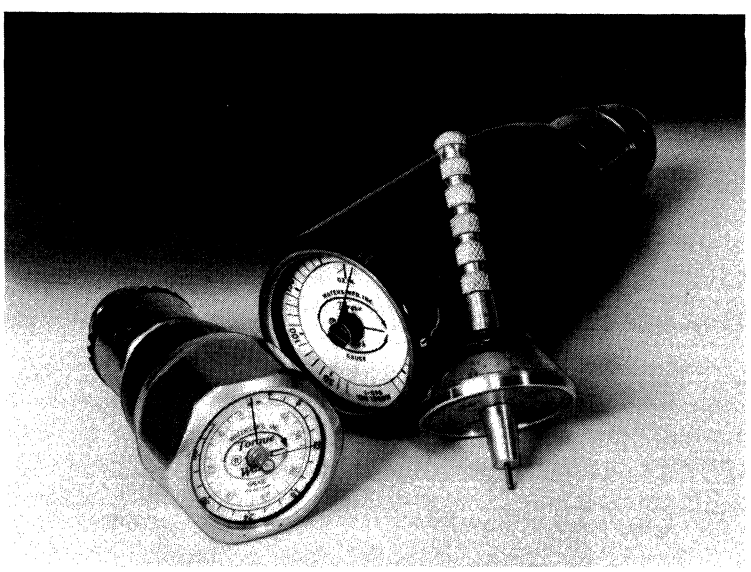


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eem SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

eem SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_O	ampere	A	see current
peak e.m.f.	E_O	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_O}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_0}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

TRANSISTORS

Manufacturer	Starting EEM Page No.	RF (Incl. Microwave)	Power		Switching	UJT	Darlington	Chip	Germanium	Small Signal	IGBT
			Bipolar	FET							
American Micro-Semiconductor	A•2083	√	√§	√	√	√	√	√	√	√§	√
Collmer Semiconductor Inc.	A•2085		√	√	√		√				√
Diodes Inc.	A•2093				√§					√§	√§
ITT Components	A•2096				√§					√§	
Philips Components Discrete Prod. Div.	A•2100	√§		√§	√§		√§			√§	
Philips ECG	A•2118	√	√	√	√	√	√		√	√	
Powerex	A•2117		√	√§	√		√				√
Rohm Elect.	A•2120	√§	§		√§		√§	√§		√§	
§ Surface Mount											

THYRISTORS, RECTIFIERS, & DIODES

Manufacturer	Starting EEM Page No.	Thyristors			Rectifiers			Diodes								
		SCRs	TRIACs	DIACs	Silicon	Germanium	Bridges & Assemblies	Zener	Varactor	Silicon	Suppressor	Avalanche	Tunnel	High Voltage	Schottky	Germanium
American Micro-Semiconductor	A•2083	√	√	√	√§	√	√	√§	√	√	√	√	√	√	√	√
Collmer Semiconductor Inc.	A•2085				√		√			√	√			√	√§	
Crydom	A•2086	√			√		√			√				√		
Diodes Inc.	A•2093				√§		√	√§		√§	√			√§	√§	√
Electronic Devices	A•2094				√§	√§	√§			√§		√§		√§		
Iskra Electronics	A•2095				√		√			√						
ITT Components	A•2096							√§		√§					√§	
Lite-On Inc.	A•2098				√		√			√					√	
Philips Components Prod. Div.	A•2100		√§		√§			√§						√	√§	
Philips ECG	A•2118	√	√	√	√	√	√	√	√	√	√	√		√	√	√
Powerex	A•2117	√§	√§		√		√			√				√		
QMI/NIEC	A•2126				√§					√§				√§		
Rohm Electronics	A•2120				√§			√§	√§	√§				√§	√§	
Teccor Electronics	A•2122	√§	√§	√§	√§					√§	√§					
Voltage Multipliers	A•2127				√§		√§			√§		√§		√§		
World Products Inc.	A•2128							√		√	√	√		√		

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Diodes, Matched Pairs
Diodes, Power, Surface Mount
Diodes, Schottky
Diodes, Silicon
Diodes, Switching
Diodes, Switching, Surface Mount
Diodes, Temperature Compensating
Diodes, Tunnel
Diodes, Varactor
Diodes, Varactor, Surface Mount
Diodes, Zener & Stabistors (Forward Reference Diodes)
Diodes, Zener, Surface Mount

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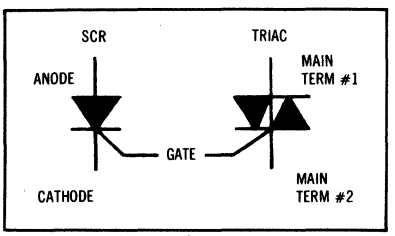
eem MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

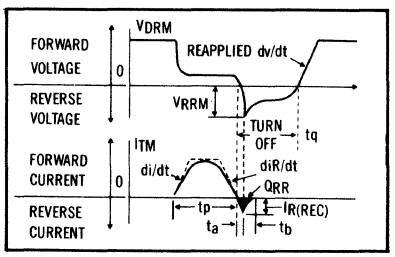


Fig. 1. Concurrent voltage and current waveforms

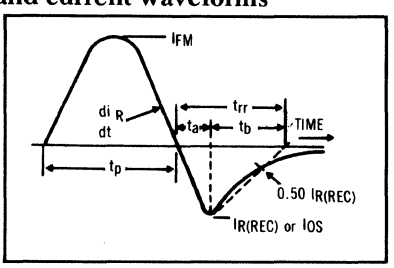


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature*.

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

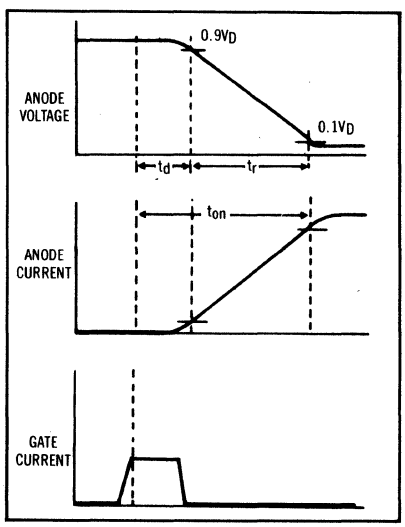


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

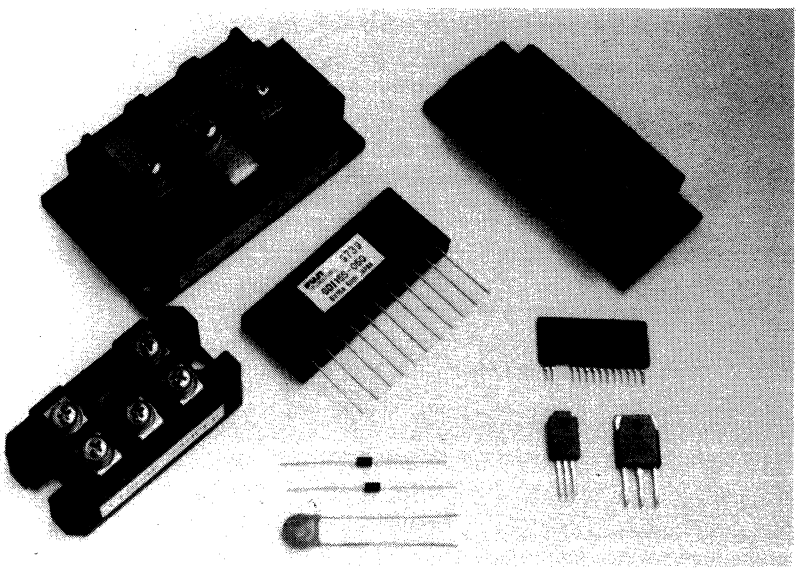
V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

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Brief Highlights

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Reduce system cost
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MOSFET Modules
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Improved control accuracy
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15A to 200A

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CRYDOM COMPANY

POWER MODULES

SERIES L

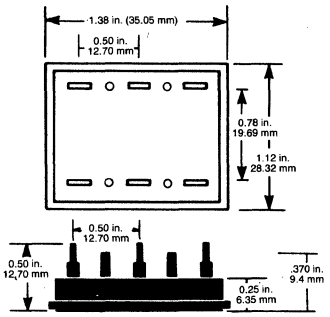
13A-42.5A
SCR/DIODE CIRCUITS

Part Number Identification

1st Digit Series Type	2nd Digit Current	3rd Digit Circuit Type	4th Digit AC Line Voltage	Options
L-Casestyle (Ceramic Base)	3-13 Amp. 4-20 Amp. 5-25 Amp. 6-42.5 Amp*	1-9 (see schematic) diagrams)	1-120 volts 2-240 volts 3-280 volts	F-Free Wheeling Diode Option C-Gate to cathode capacitor option. Consult factory.

* 42.5 AMP Rating only available in circuits 1, 2, 3, & 5.

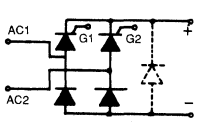
Each part number consists of 4 to 7 digits. Use the table to determine the part that fits your needs.

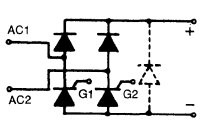


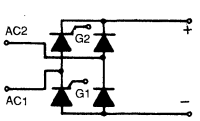
Electrical Specifications

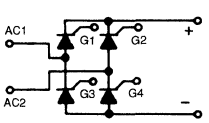
		SERIES			
		L3	L4	L5	L6*
I_d	maximum dc output current @ 85°C = Tc ceramic full bridge (A)	13.0	20	25	42.5
I_T^{RMS}	maximum output current @ 85°C = Tc CKT 5 (A)	15.0	22	27	46
V_{TM}	maximum SCR voltage (V) @ amperes peak	1.8V @13A	2.2V @20A	2.2V @25A	2.2V @40A
I_H	maximum holding current (mA)	100	100	100	200
T_J	operating junction temperature range	−25°C to +125°C			
di/dt	critical rate of rise of on-state current @ T_J = 125°C (A/µS)	100	100	100	100
dv/dt	critical rate of rise of off-state current @ T_J = 125°C (A/µS)	200	200	200	200
V_{RMS}	AC line input voltage	——120 (400PIV)—— ——240 (600PIV)—— ——280 (800PIV)—— ——400 (1200PIV)——			
I_{TSM}	maximum non-repetitive surge current (A)	150	250	300	600
I^2t	maximum 1^2t for fusing t = 8.3 (A^2 sec)	94	260	375	1500
I_{GT}	maximum required gate current to trigger, 25°C (mA)	100	100	100	100
I_{GM}	maximum peak gate current (A)	1.5	3.0	3.0	3.0
V_{GT}	maximum required gate voltage to trigger, 25°C (V)	2.5	2.5	2.5	3.0
V_{GD}	maximum non-triggering gate voltage at Tj = 125°C (V)	0.2	0.2	0.2	0.2
P_{GM}	maximum peak gate power, tp = 10µSec. (W)	5.0	5.0	5.0	5.0
$P_G(AV)$	average gate power (W)	0.5	0.5	0.5	0.5
V_{GM}	maximum peak gate voltage (reverse) (V)	5.0	5.0	5.0	5.0
R_{OCS}	maximum thermal resistance to sink (°C/W)	0.1	0.1	0.1	0.1
RθJC	typical thermal resistance junction to ceramic base per device (°C/W)	0.6	0.5	0.5	0.5

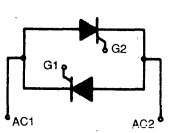
Circuit Configurations for Series L

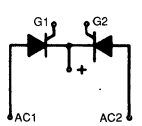
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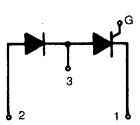
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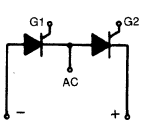
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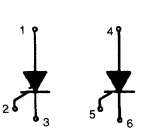
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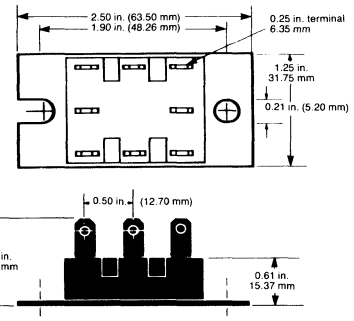
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CRYDOM COMPANY

POWER MODULES

SERIES B-2T

25A-42.5A
SCR/DIODE CIRCUITS



Part Number Identification

1st Digit Series Type	2nd Digit Current	3rd Digit Circuit Type	4th Digit AC Line Voltage	Options		Type Of Terminal
B-Casestyle (Ceramic Base)	5-25 amps. 6-42.5 amps.*	1-9 (see schematic) diagrams)	1-120 volts 2-240 volts 3-280 volts 4-440 volts	F-Free Wheeling Diode Option S-Suppressor Option E-External Mounting of Suppressor	—	2T—.250

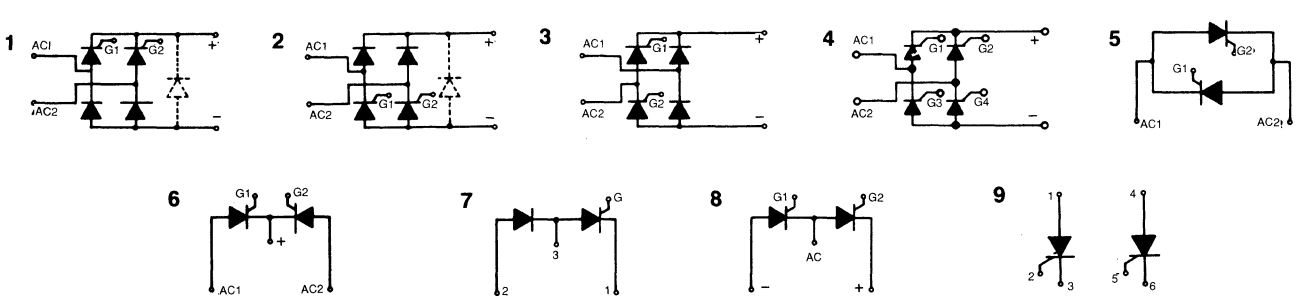
* 42.5 AMP Rating only available in circuits 1, 2, 3, & 5.

Electrical Specifications

		PACKAGE TYPE	
		B5	B6
I_d	maximum dc output current @ 85° C = Tc full bridge (circuits 1-4) (A)	25	42.5
I_T(RMS)	maximum output current @ 85°C ceramic plate CKT5(A)	27	46
V_{TM}	maximum peak on-state voltage	1.8V @25A	1.6V @40A
I_H	maximum holding current	200mA	200mA
T_J	operating junction temperature range	–25°C to 125°C	
di/dt	critical rate of rise of on-state current @ T_J = 125°C (A/μS)	100	100
dv/dt	①critical rate of rise of off-state voltage @ T_J = 125°C (V/μS)	200	200
V_{RMS}	AC line input voltage (PIV)	——120 (400PIV)—— ——240 (600PIV)—— ——280 (800PIV)—— ——440 (1200PIV)——	
I_{TSM}	maximum non-repetitive surge current (A) 60Hz—125°C 50Hz—25°C	 300 325	 600 650
I^2t	maximum I^2t for fusing t = 8.3 MSEC (A^2 sec)	370	1500
I_{GT}	maximum required gate current to trigger, 25°C (mA)	110	150
I_{GT}	typical gate current to trigger	—20mA to 100mA—	
I_{GM}	maximum peak gate current	3.0A	3.0A
V_{GT}	maximum required gate voltage to trigger, 25°C (V)	2.5	3.0
V_{GT}	typical gate voltage to trigger	0.9V	0.9V
V_{GD}	maximum non-triggering gate voltage at T_J = 125°C	0.2V	0.2V
P_{GM}	maximum peak gate power, tp = 10μSec.	5W	5W
P_G(AV)	average gate power	0.5W	0.5W
V_{GM}	maximum peak gate voltage (forward)	10V	10V
V_{GM}	maximum peak gate voltage (reverse)	5.0V	5.0V
$R_{\theta cs}$	①maximum thermal resistance case to sink (°C/W)	0.10	0.10
V_{FM}	maximum peak forward voltage	1.65V @25A	1.50V @40A
$R\theta_{JC}$	typical thermal resistance junction to ceramic base per device	0.6 C/W	0.5°C/W
V_{ISOL}	isolation voltage from terminals to base	—2500 $volts_{RMS}$ min.—	

NOTE: B-2T circuit and pinout same as "T" package on Page A•2092

Circuit Configurations for Series B-2T



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POWER MODULES

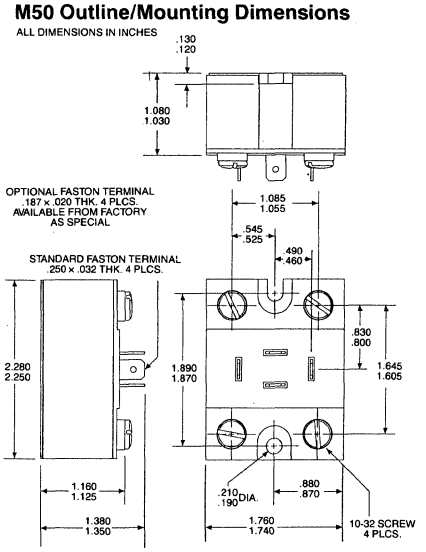
SERIES M50

42.5A-100A
SCR/DIODE CIRCUITS

PARAMETER	SYM.	UNITS	SPECIFICATION LIMITS				CONDITIONS
DC Output Current (Max.)	I_O	A	42.5	50	80	100	T_C = 85°C (Circuits 1, 2, 3 & 6)
One-Cycle Surge Current (Peak)	I_{TSM}	A	600	600	1200	1500	60Hz Sine Wave, Non-Repetitive (Fig. 6)
I^2t for Fusing (Max.)	I^2t	A^2S	1500	1500	6000	9350	60Hz Sine Wave with Full Reapplied Voltage
Rate-of-Rise of On-State Current (Max.)	di/dt	A/µS	100				
Rate-of-Rise of Off-State Voltage (Max.)	dv/dt	V/µS	200				Exponential Rise to 80% V_{VDRM} Gate Open Circuit, T_C = 125°C
Repetitive Peak Off-State and Reverse Blocking Voltage (Max.)	V_{DRM} & V_{RRM}	V	300V for $120V_{RMS}$(-1) 600V for $240V_{RMS}$(-2) 800V for $280V_{RMS}$(-3) 1000V for $440V_{RMS}$(-4) *1200V for $480V_{RMS}$(-5)				T_J = 125°C
Isolation Voltage (Min.)	V_{ISOL}	Vrms	2500				Any Terminal-to-Base
Junction Operating Temp. Range	T_J	°C	– 40 to 125				
Storage Temperature Range	T_{STG}	°C	– 40 to 125				
Thermal Resistance (Case-to-Sink)	$R\theta_{C-S}$	°C/W	.07				With Thermal Grease
Thermal Resistance (Junction-to-Case)	$R\theta_{J-C}$	°C/W	0.56	0.56	0.36	0.36	Per Device
Forward Gate Current (Peak)	I_{FGM}	A	5				See Fig. 7
Forward Gate Voltage (Peak)	V_{FGM}	V	25				
Reverse Gate Voltage (Peak)	V_{RGM}	V	5				
Gate Power (Peak)	P_{GM}	W	20				10 µS Duration
Gate Current Required to Fire all Devices (Max.)	I_{GT}	mA	150				T_C = 25°C
Gate Voltage Required to Fire all Devices (Max.)	V_{GT}	V	3				
Latching Current (Max.)	I_L	mA	300				
Holding Current (Max.)	I_H	mA	150				
Leakage Current	I_{DRM} & I_{DM}	mA	10				T_J = 125°C at Peak Rated Voltage
Case Style			**M50**				**See following page for circuit configurations and outline dimensions**

*Higher values are available. Consult Factory.

M50 Outline/Mounting Dimensions



MOUNTING TORQUE REQUIRED:
(A) Mounting Screws (not included) 20 in.-lb.
(B) Terminal Studs (screws included, unmounted) 30 in.-lb.

Part Number Designation Code

M50 — **CASE STYLE M50**

50 — **DC OUTPUT CURRENT 50, 80, OR 100A (M50 CASE)**

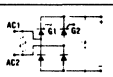
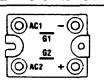
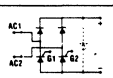
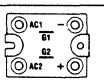
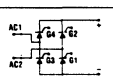
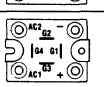
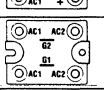
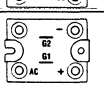
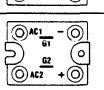
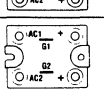
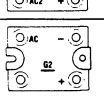
1 — **CIRCUIT DESIGNATION**

2 — ***VOLTS AC (RMS)**
1-120V 4-440V
2-240V 5-480V
3-320V

FV — **F-FREE WHEELING DIODE**
V-VOLTAGE SUPPRESSOR
FV-BOTH

*Consult Factory for higher voltages

CIRCUIT DESIGNATION

M50	CIRCUIT TYPE	CIRCUIT SCHEMATICS	CIRCUIT OPTIONS	TERMINAL LOCATIONS—M-50
1	HYBRID BRIDGE COMMON CATHODE SCRS		F,V	
2	HYBRID BRIDGE COMMON ANODE SCRS		F,V	
3*	FULL SCR BRIDGE		V	
4	AC SWITCH		V	
5	SCR DOUBLER		N/A	
6	HYBRID BRIDGE DOUBLER		V	
7	SCR CENTER TAP COMMON CATHODE		N/A	
8	HYBRID DOUBLER		N/A	

*Not available in 100A Rating.

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POWER MODULES

SERIES F18

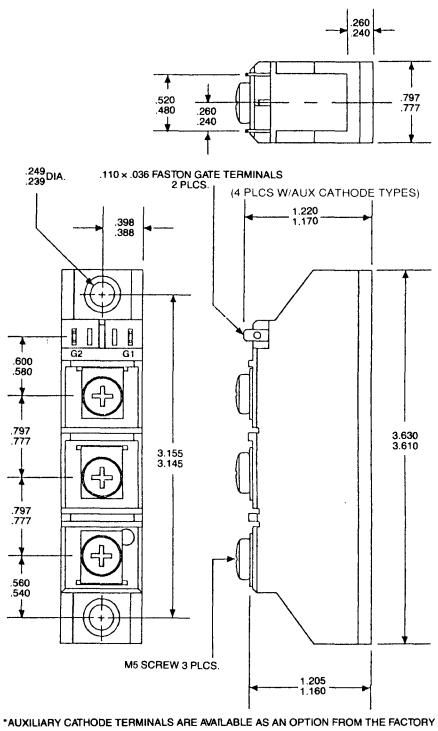
25A - 90A
SCR/DIODE CIRCUITS

Parameter	Sym.	Units	Specification Limits				Conditions*
Average Output Current per Device	I_O	A	25	40	55	90	$T_C = 85°C$
One-Cycle Surge Current (Peak)	I_{TSM}	A	400	1000	1500	1950	$T_C = 125°C$ Non-Repetitive
I^2t for Fusing (Max.)	I^2t	A^2s	670	4150	9340	15,800	
Rate-of-Rise of On-State Current (Max.)	di/dt	A/µS	100				
Rate-of-Rise of Off-State Voltage (Max.)	dv/dt	V/µS	500				Exponential Rise to 80% V_{DRM}, Gate Open Circuit, $T_C = 125°C$
Leakage Current (Max.)	I_{RM}	mA	20				$T_7 = 125°C$ at Rated Voltage
Isolation Voltage (Min.)	V_{ISOL}	Vrms	2500				Any Terminal-to-Base
Junction Operating and Storage Temperature Range	T_J & T_{STG}	C	−40 to +125				
Thermal Resistance (Case-to-Sink)	$R\theta_{C-S}$	°C/W	0.1				With Thermal Grease
Thermal Resistance (Junction-to-Case)	$R\theta_{J-C}$	°C/W	.40	.30	.25	.15	Per Module
Forward Gate Current (Peak)	I_{FGM}	A	10				
Gate Current Required to Fire all Devices (Max.)	I_{GT}	mA	150				$V_D = 6V$
Forward Gate Voltage (Peak)	V_{FGM}	V	30				
Reverse Gate Voltage (Peak)	V_{RGM}	V	5				
Gate Voltage Required to Fire all Devices (Max.)	V_{GT}	V	3				$V_D = 6V$
Latching Current (Max.)	I_L	mA	500				
Holding Current (Max.)	I_H	mA	300				
Gate Power (Peak)	P_{GM}	W	50				10 µs Pulse

*All conditions are at 25°C unless noted otherwise.

Outline/Mounting Dimensions

ALL DIMENSIONS IN INCHES



*AUXILIARY CATHODE TERMINALS ARE AVAILABLE AS AN OPTION FROM THE FACTORY

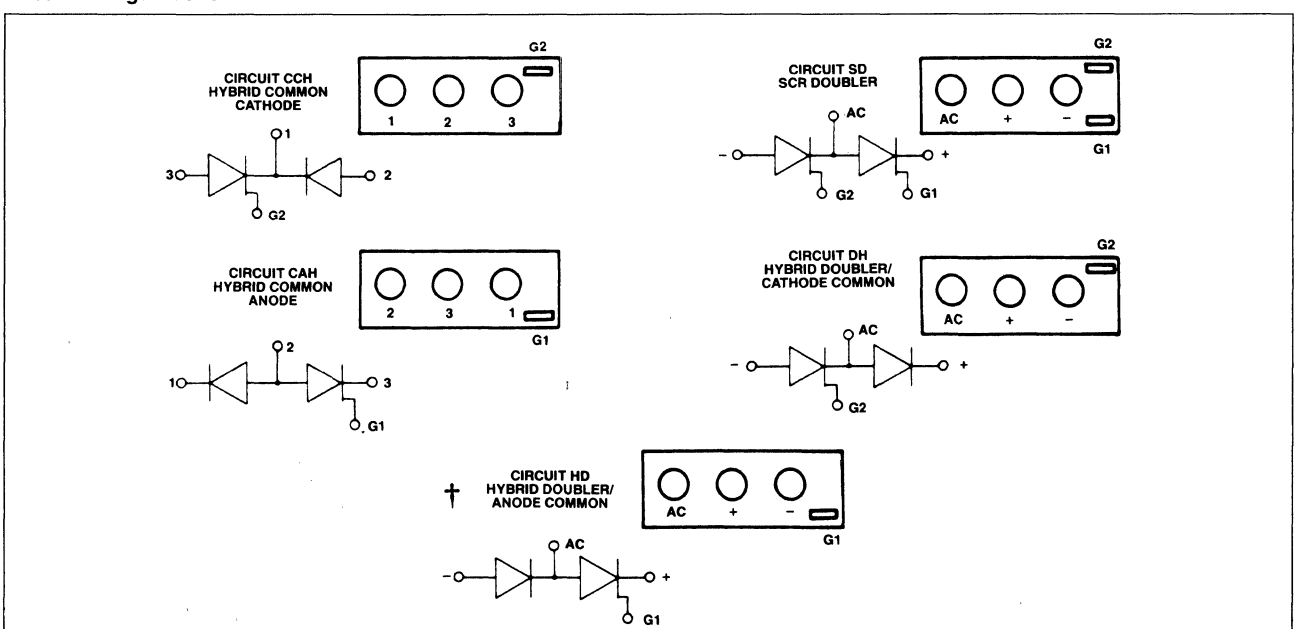
Part Number Designation Code

F18 56 SD 1200

- F18 — CASE STYLE
- 56 — DEVICE AVG. CURRENT RATING
  - 26, 41, 56 or 91 (Isolation Barriers, w/o Aux. Cathodes)
  - 27, 42, 57, or 92 (Isolation Barriers, w/ Aux. Cathodes)
- SD — CIRCUIT CONFIGURATION
- 1200 — VOLTAGE RATING* 600-1400V

*Consult Factory for other voltages.

Circuit Configurations



CRYDOM COMPANY

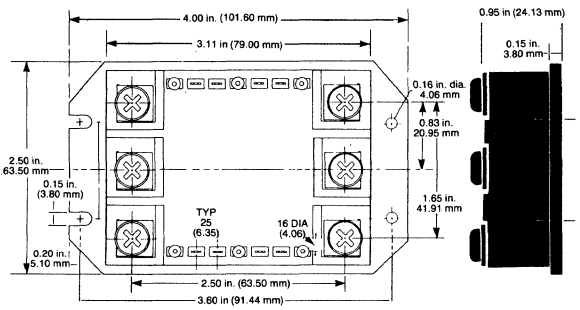
POWER MODULES

SERIES EF

35A-150A
SCR/DIODE CIRCUITS

Part Numbering System Example: **EFE19C-F**

Package Code	Current Code (Amperes)* 1φ 3φ ACSW	Circuit Code	Voltage Code	Option Code
EF (Ceramic Base)	**C** 35 50 40 **D** 50 75 55 **E** 75 100 90 **F** 100 150 110 **G** 125 150 125 *All values are for full conduction: AC Switch values are RMS Amperes	**01** 1φ Com. Cath. **02** 1φ Com. Anode **04** 1φ 4 SCR **05** Single AC Sw. **16** 3φ 6 SCR **17** 3φ 3 SCR **18** 3 AC Sw. **19** 3φ 3 diode/3 SCR **20** 3φ 3 diode/3 SCR ½ control	**U** 100 **A** 200 **B** 400* **C** 600* **D** 800 **E** 1000 **F** 1200* **G** 1400 *For ckts. 1 through 5: B = 120V. Line C = 240V. Line F = 480V Line	**S** Supressor (internal) **SE** Supressor (external) **F** Free Wheel



ELECTRICAL SPECIFICATIONS (all tested @25°C unless otherwise indicated)*
*Values shown are ratings for the individual semiconductor cells used in the module

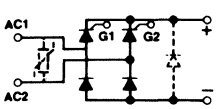
Parameter	Spec. Code:	C	D	E	F	G	Units
Surge (non-rep)	I_{TSM}	300	400	600	1500	1950	Amperes (one cycle; 60 Hz)
Fusing	I^2t	370	650	1500	9340	15,800	A^2 second (<8.3 ms.)
Forward Drop (pk.)	V_{TM}	1.7@50A	1.7@70A	1.8@100A	1.8@150A	1.7@150A	Volts, peak; (pulse)
Leakage current	I_{DRM}; I_{RRM}	8.0	10.0	15.0	20.0	20.0	Milliamperes
Gate trigger	I_{GT}(max)	100	100	100	120	150	Milliamperes
Trigger voltage	V_{GT}(max)	2.5	2.5	3.0	3.0	3.0	Volts
Peak gate power	P_{GM}	5.0	5.0	5.0	7.0	10.0	Watts
Voltage Rate of Rise	dv/dt	100	100	200	200	200	Volts/microsecond① exponential
Current Rate of Rise	di/dt			100			Amps/microsecond②
Max. operating temp.	Tj(max)			125°			Centigrade
Min. operating temp.	Tj(min.)			– 40°			Centigrade
Thermal resistance	$R\Theta_{jc}$	0.5	0.5	0.4	0.25	0.15	°C/W chip to baseplate
Thermal resistance	$R\Theta_{cs}$			0.3			°C/W base to heatsink (with heatsink compound)

Recommended mounting Ms screw
1) Tc = 125°C, exponential to 80% rated VDRM 2) Gate pulse: 20V, 15Ω source, tr = 0.1μs

UL RECOGNIZED

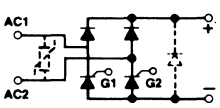
EF Series Available Circuits

CIRCUIT NO. 1



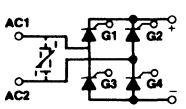
Single phase, common cathode (50 Amperes and above)

CIRCUIT NO. 2



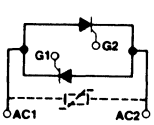
Single phase, common anode (50 Amperes and above)

CIRCUIT NO. 4



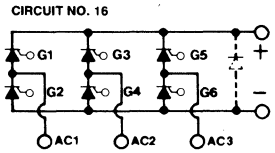
Single phase, quad SCR (50 Amperes and above)

CIRCUIT NO. 5



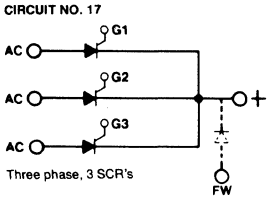
Single phase, AC Switch (50 Amperes and above)

CIRCUIT NO. 16



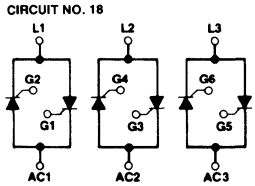
Three phase, full converter, 6 SCR's
*Optional Free Wheel diode on EFC, EFD Series

CIRCUIT NO. 17



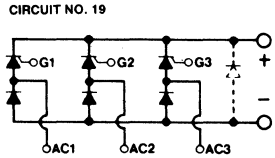
Three phase, 3 SCR's

CIRCUIT NO. 18



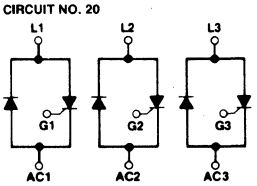
Triple AC, Switch

CIRCUIT NO. 19



Three phase, semi-converter
*Optional Free Wheel diode on EFC, and EFD Series

CIRCUIT NO. 20



Hybrid Triple Switch

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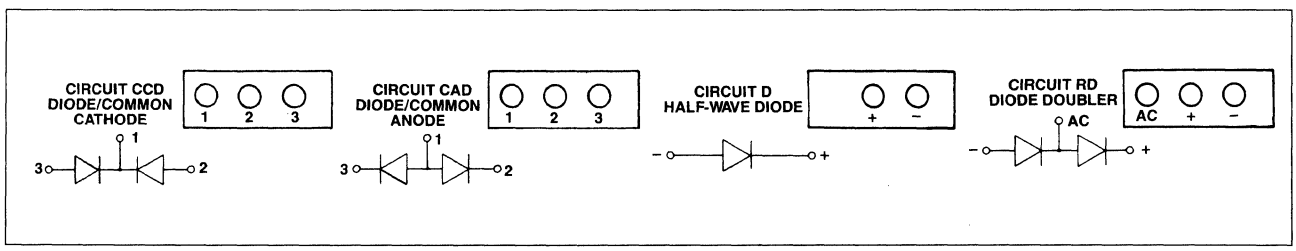
POWER MODULES

SERIES F18

40A-90A
DIODE CIRCUITS

PARAMETER	SYM.	UNITS	SPECIFICATION LIMITS			CONDITIONS
			40	55	90	
Average Output Current per Device	I_O	A				$T_C = 85°C$
One-Cycle Surge Current (Peak)	I_{TSM}	A	1000	1500	1950	$T_C = 125°C$ Non-Repetitive
I^2t for Fusing (Max.)	I^2t	A^2S	4150	9340	15,800	
Leakage Current (Max.)	I_{RM}	mA		20		$T_J = 125°C$ at Rated Voltage
Isolation Voltage (Min.)	V_{ISOL}	Vrms		2500		Any Terminal-to-Base
Junction Operating and Storage Temperature Range	T_J & T_{STG}	°C		−40 to +125		
Thermal Resistance (Case-to-Sink)	$R\theta_{c-s}$	°CW		0.1		With Thermal Grease

Circuit Configurations (See Page A•2089 for Package Outline Dimensions)



SERIES EF

50A-150A
DIODE CIRCUITS

EXAMPLE: **EF** (EF PACKAGE) **G** (CURRENT CODE) **15** (CIRCUIT CODE) **G** (VOLTAGE CODE)

Part Numbering Designation Code

Package Code	Current Code (Amperes)*			Circuit Code		Voltage Code	
	Code	1φ	3φ	Code	Circuit	Code	Voltage
EF (Ceramic Base)	**D**	50	75	**13**	1φ 4 diode	**U**	100
	E	75	100	**14**	3φ 3 diode	**A**	200
	F	100	150	**15**	3φ 6 diode	**B**	400
	G	125	150			**D**	800
						E	1000
						F	1200
						G	1400

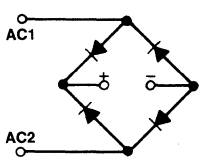
Electrical Specifications (all tested @ 25°C unless otherwise indicated)*

Parameter	Spec. Code:	D	E	F	G	Units
Surge (non-rep)	I_{TSM}	400	800	1000	2000	Amperes (one cycle; 60 Hz)
Fusing	I^2t	650	2600	4100	16,600	A^2 second (<8.3 ms.)
Forward Drop (pk.)	V_{TM}	1.7@70A	1.8@100A	1.8@150A	1.7@150A	Volts, peak; to remain (pulse)
Leakage current	I_{DRM}; I_{RRM}	10.0	15.0	20.0	20.0	Milliamperes
Max. operating temp.	Tj(max)	125°				Centigrade
Min. operating temp.	Tj(min.)	−40°				Centigrade
Thermal resistance	$R\Theta_{jc}$	0.5	0.4	0.25	0.15	°C/W chip to baseplate
Thermal resistance	$R\Theta_{cs}$	.03				°C/W base to heatsink (with heatsink compound)

Recommended mounting Ms screw

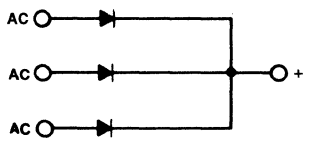
Series EF Circuits Available (See Page A•2090 for Package Outline Dimensions)

CIRCUIT NO. 13



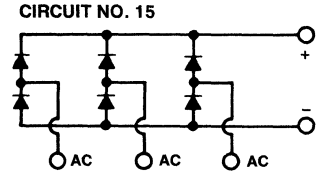
Single phase, quad diode
(50 Amperes and above)

CIRCUIT NO. 14



Three phase, half wave, 3 diodes
(75 Amperes and above)

CIRCUIT NO. 15



Three phase, full wave, 6 diodes
(75 Amperes and above)

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POWER MODULES

SERIES B48-2T; SERIES M50

35A-100A DIODE CIRCUITS

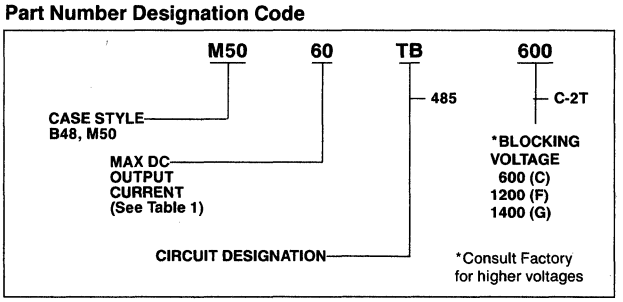
Parameter	Sym.	Units	B48-2	M50 Rating		Conditions
				Single Phase	Three Phase	
			Specification Limits			
DC Output Current, 1ϕ (Max.)	I_O	A	35	60	100	T_C = 100°C Max. (table 1)
DC Output Current, 3ϕ (Max.)	I_O	A	50	60	100	T_C = 100°C, Max. (Table 1)
One-Cycle Surge Current (Peak)	I_{TSM}	A	300	1000	2000	60Hz Sine Wave, Non-Repetitive (Fig. 2)
I^2t for Fusing (Max.)	I^2t	A^2S	376	4150	16,000	60Hz Sine Wave
Reverse Blocking Voltage (Max.)	V_{RRM}	V		200-1600		T_J = 125°C
Leakage Current (Max.)	I_{RRM}	mA	3	5		T_J = 125°C @ V_{RRM}
Forward Voltage Drop (Max.)	V_F	V	1.8 @50A	1.25 @60A	1.4 @100A	T_J = 25°C (Fig. 3)
Isolation Voltage (Min.)	V_{ISOL}	Vrms		2500		Any Terminal-to-Base
Junction Operating Temp. (Range)	T_J	°C		−40 to +150		
Storage Temperature (Range)	T_{STG}	°C		−40 to +150		
Thermal Resistance (case-to-Sink)	$R\theta_{c\text{-}s}$	°C/W	0.1	0.07		With Thermal Grease
Thermal Resistance (Junction-to-Case)	$R\theta_{J\text{-}C}$	°C/W	1.8	1.25	1.0	Per Device (Table 1) See page 55 for terminal derating curves

Table 1
Maximum DC Output Current

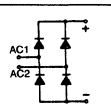
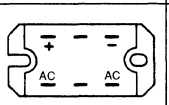
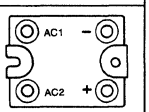
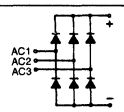
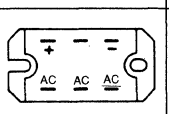
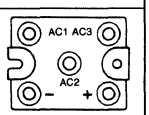
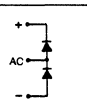
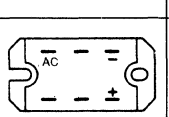
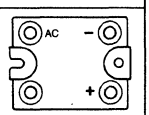
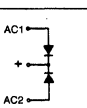
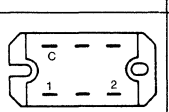
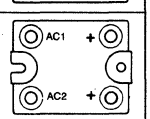
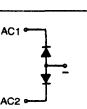
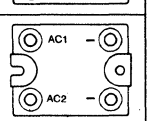
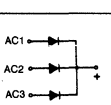
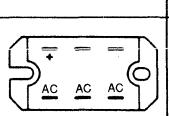
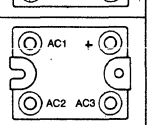
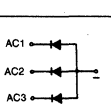
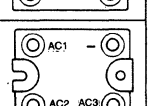
CIRCUIT DESIGNATION		MAX. DC OUTPUT CURRENT (A)		
B48-2T	M50	B48-2T	M5060	M50100
483	SB	35	60	100
485	TB	50	60	100
482	*DD	20	35	50
481	CC	35	60	100
NA	CA	35	60	100
484	THC	50	60	100
NA	THA	50	60	100

*Average current at 180° conduction angle

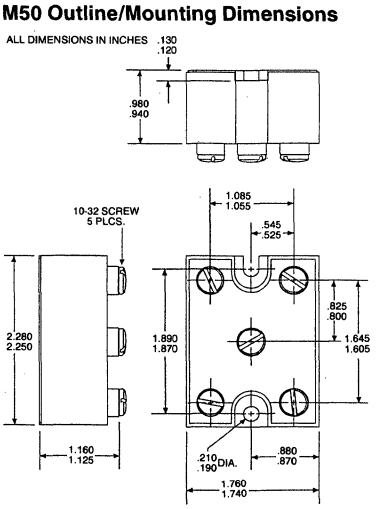
Part Number Designation Code



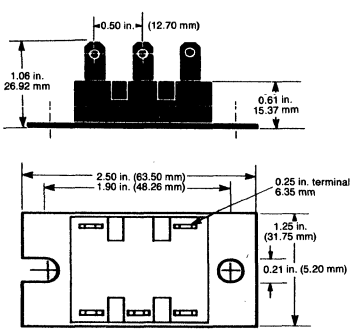
Circuit Configurations

Circuit Type	Circuit Designations M50	Circuit Designations B48-2T	Circuit Schematics	B48-2T	Case M50 Terminal Locations
SINGLE-PHASE BRIDGE	SB	483			
THREE-PHASE BRIDGE	TB	485			
DIODE DOUBLER	DD	482			
CENTER TAP COMMON CATHODE	CC	481			
CENTER TAP COMMON ANODE	CA	N/A			
THREE PHASE COMMON CATHODE HALF WAVE BRIDGE	THC	484			
THREE PHASE COMMON ANODE HALF WAVE BRIDGE	THA	N/A			

M50 Outline/Mounting Dimensions

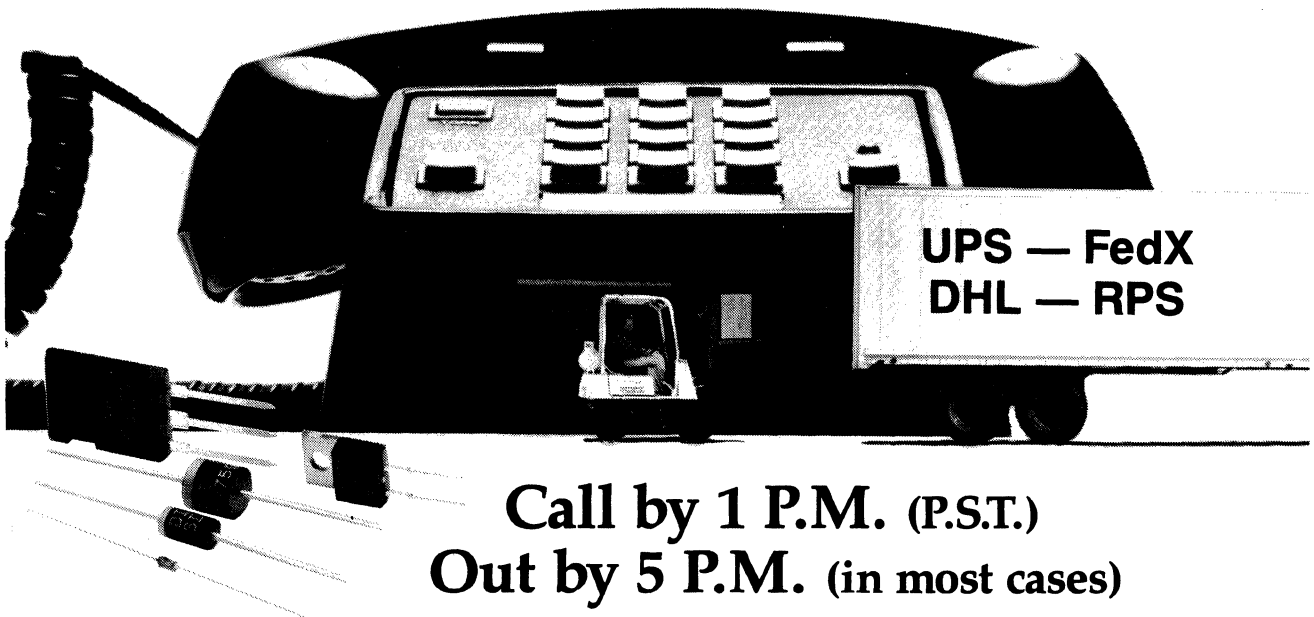


B48-2T Outline/Mounting Dimensions



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- Silicon Transistors
- Surface Mount Devices

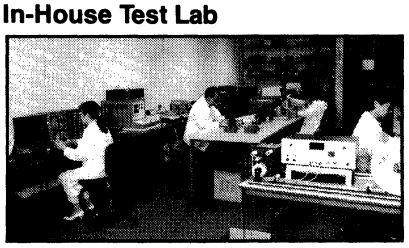
Quality Testing
All incoming devices are carefully lot tested to stringent QA requirements before being placed in inventory.

Over 200 million devices in stock.



A portion of DIODES INC.'s cavernous warehouse.

In-House Test Lab



In addition to normal "Group A" test capability, Diodes, Inc. has on-site equipment necessary to perform product reliability testing. High temperature reverse bias, temperature-humidity, high temperature storage and temperature cycling testing is performed on our products as part of an ongoing quality monitoring process.

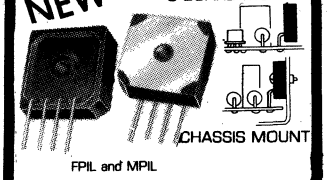
Customer Service
Diodes, Inc. account managers are well qualified to answer inquiries, as well as provide stock checks and quotations. You'll like doing business with Diodes and its people.

Competitive Pricing
Diodes, Inc. has always been highly competitive in its pricing, *regardless of quantity.*

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NEW



40 A IN-LINE RECTIFIERS

Space-saving design
Low thermal impedance
Standard, fast, and ultrafast
UL Recognized

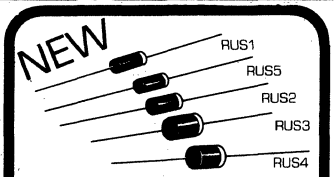
NEW XL10 and XLR10



HV X-RAY DIODES

XL10	9KV	220mA	standard
XLR10	9KV	200mA	175ns
XLU12	11KV	100mA	50ns
XMU10	9KV	300mA	150ns
XMR5	5KV	500mA	150ns

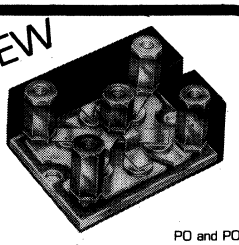
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ULTRA-FAST, 1KV MINIATURE DIODES

PRV to 1KV
Current to 5A.
Low forward characteristic
High surge current
Recoveries to 50 ns

NEW



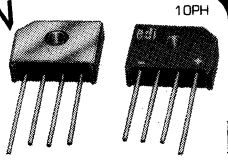
PO and POT

100 A RECTIFIERS

Rugged compact module
Patented "Porcelainized" heat sink
Low thermal impedance
UL Recognized

SPACE SAVING **HIGH VOLT & AMP** **STATE OF ART** **LOWER COSTS**

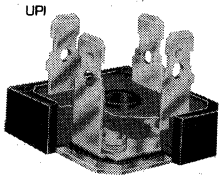
NEW 10PH



10 A IN-LINE RECTIFIERS

PC or chassis mount
Integral heat sink for low thermal impedance
300 A surge
UL Recognized
Standard, fast, and ultrafast

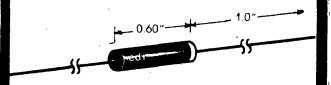
UPI



50 A RECTIFIERS

Integral heat sink
Quick connect or wire leads
1,000A surge
Also available in fast recovery
UL Recognized

NEW CRVT



FAST RECOVERY, 20KV MINIATURE DIODES

15 & 20 KV models
25 mA forward current
Low leakage
Recovery less than 100 ns

CALL US FOR ENGINEERED SOLUTIONS TO YOUR PRODUCT REQUIREMENTS

INNOVATIVE RECTIFIER DESIGNS...

and an extensive line of standard types

bridges

- ☐ 36 different models
- ☐ Broad range of package types
- ☐ 2 to 100 amps
- ☐ PRV to 1,200V

Standard, fast, and ultrafast recovery

diodes

- ☐ General purpose diodes, 11 packages
- ☐ PIV to 250KV
- ☐ Current up to 6A
- ☐ Ultra-miniature packaging

Standard, fast, and ultrafast, recovery

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- ☐ Standard products; blocks, packs, cylinders, night vision, CRT
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- ☐ To 25 amps

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EDI has specialized in rectifier devices for over 40 years. Our fully integrated, manufacturing facilities perform all operations from silicon diffusion to packaging. Stringent testing and quality control is performed at every step to provide customers the most reliable high performance recitifier available today. We will be pleased to provide all the help and technical information you want. Catalogs are available, please give us a call at

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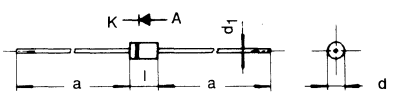
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SILICON RECTIFIER DIODES

- Δ Plastic Rectifiers
- Δ Low Forward Voltage Drop
- Δ High Surge Current Capability
- Δ JEDEC Numbered
- Δ Polarity Indicated By Cathode Band
- Δ Lead: MIL-STD202F

Type	V_{RRM} Repetitive Peak Reverse Voltage (V)	V_{DC} DC Blocking Voltage (V)	I_{FAV} Maximum Average Forward Rectified Current (A)	I_{FSM} Peak Forward Surge Current 1 Cycle (A)	Maximum Forward Voltage at I_{FAV} (V)	Maximum Reverse Current at V_{DC} T_A 25°C (μA)	T_{STG} T_{OP} Storage and Operating Temperature (°C)	Case
1N4001	50	50	1.0	50	1.1	10	-65 to +175	DO-41
1N4002	100	100	1.0	50	1.1	10	-65 to +175	DO-41
1N4003	200	200	1.0	50	1.1	10	-65 to +175	DO-41
1N4004	400	400	1.0	50	1.1	10	-65 to +175	DO-41
1N4005	600	600	1.0	50	1.1	10	-65 to +175	DO-41
1N4006	800	800	1.0	50	1.1	10	-65 to +175	DO-41
1N4007	1000	1000	1.0	50	1.1	10	-65 to +175	DO-41
1N5400	50	50	3.0	200	1.3	20	-40 to +175	DO-27
1N5401	100	100	3.0	200	1.3	20	-40 to +175	DO-27
1N5402	200	200	3.0	200	1.3	20	-40 to +175	DO-27
1N5403	300	300	3.0	200	1.3	20	-40 to +175	DO-27
1N5404	400	400	3.0	200	1.3	20	-40 to +175	DO-27
1N5405	500	500	3.0	200	1.3	20	-40 to +175	DO-27
1N5406	600	600	3.0	200	1.3	20	-40 to +175	DO-27
1N5407	800	800	3.0	200	1.3	20	-40 to +175	DO-27
1N5408	1000	1000	3.0	200	1.3	20	-40 to +175	DO-27

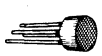
DIMENSIONS: (mm)



	a	d	l	d_1
1N400X	25.4	Max. 3.1	5.1	.86
1N540X	25.4	5	9.5	1.32

BRIDGE RECTIFIERS

0.8 — 1.5 AMPERES RECTIFIER BRIDGES



Series
BxxC 800
BxxC 1000
BxxC 1500

GENERAL PURPOSE

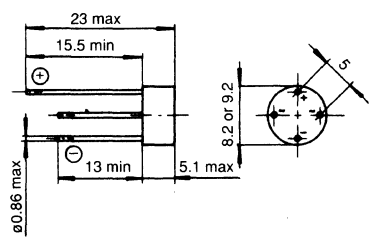
Δ Single-phase full-wave bridges for general purpose low-power applications.

FEATURES:

- Δ High current
- Δ High surge current capability
- Δ Low forward voltage drop
- Δ Economical plastic package

MECHANICAL DATA

Case: Potted epoxy encapsulated
Lead: MIL-STD-202 — method 208C
Dimensions: (mm)



Note: Available in either 8.2 or 9.2mm Diameter. Please specify.

ELECTRICAL CHARACTERISTICS

Characteristics and Conditions	Symbol	Unit	Value
Max. reverse current at U_{RRM} (Øj = 25°C)	I_R	μA	10
Max. reverse current at U_{RRM} (Øj = 100°C)	I_R	μA	50
Max. forward voltage drop at 25°C, 1 A:			
C 800 type			1.3
C 1000 type	U_F	V	1.2
C 1500 type			1.1

Ratings and characteristics hold for every diode in the bridge structure.

Type	Symbol	Unit	C 800						C 1000						C 1500					
			B 40	B 80	B 125	B 250	B 380	B 500	B 40	B 80	B 125	B 250	B 380	B 500	B 40	B 80	B 125	B 250	B 380	B 500
Non-repetitive peak reverse voltage	U_{RSM}	V	120	240	350	720	1000	1200	120	240	350	720	1000	1200	120	240	350	720	1000	1200
Repetitive peak reverse voltage	U_{RRM}	V	100	200	300	600	800	1000	100	200	300	600	800	1000	100	200	300	600	800	1000
Average forward current at 45°C (C load)	I_{FAV}	A				0.8						1.0						1.5		
Surge forward current (1 cycle, 10 ms, sine wave) Øj = 25°C	I_{FSM}	A				50						50						50		
Typical thermal resistance, junction to lead (lead length 5 mm, mounted on infinite heat sink)	Rthjl	K/W				52						45						31		
Operating and storage temperature	Øop	°C				— 40 to +175						— 40 to +175						— 40 to +175		

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SILICON DIODES

General Purpose and Switching Diodes in DO-35 Package and DO-34 Package.
Using the type designations **LL4148, LL4448,** and so on, these Silicon Diodes are available in the MiniMELF package with the same electrical characteristics.

Type	Peak Inv. Voltage PIV	Max. Aver. Rectified Current I_O	Power Dissipation at 25°C	Junction Temperature T	Forward Voltage Drop V_F		Reverse Current I_R		Reverse Recovery Time	
						at I_F		at V_R		
	Volts	mA	max. mW	max. °C	max. V	mA	max. nA	Volts	T_r ns	Conditions
1N914	100	75	500	200	1.0	10	25	20	max. 4.0	$I_F = 10$ mA, $V_R = 6$V, $R_L = 100\Omega$, to $I_R = 1$ mA
1N4148	100	150	500	200	1.0	10	25	20	max. 4.0	$I_F = 10$ mA, $V_R = 6$V, $R_L = 100\Omega$, to $I_R = 1$ mA
1N4150	50	200	500	200	1.0	200	100	50	max. 4.0	$I_F = I_R = 10$ to 200 mA, to 0.1 I_F
1N4152	40	150	400	175	0.55	0.10	50	30	max. 2.0	$I_F = 10$ mA, $V_R = 6$V, $R_L = 100\Omega$, to $I_R = 1$ mA
1N4154	35	150	500	200	1.0	30	100	25	max. 2.0	$I_F = 10$ mA, $V_R = 6$V, $R_L = 100\Omega$, to $I_R = 1$ mA
1N4448	100	150	500	200	1.0	100	25	20	max. 4.0	$I_F = 10$ mA, $V_R = 6$V, $R_L = 100\Omega$, to $I_R = 1$ mA
1N4450	40	150	400	175	0.54	0.50	50	30	max. 4.0	$I_F = I_R = 10$ mA, to $I_R = 1$ mA
1N4454	75	150	400	175	1.0	10	100	50	max. 4.0	$I_F = I_R = 10$ mA, to $I_R = 1$ mA

ZENER DIODES

1N4729 Series 1 Watt Glass Zener Diodes in DO-41 Package ($T_A = 25$°C)
Using the type designations **ZM4729, ZM4730,** and so on, these Zener diodes are available in the MELF package with the same electrical characteristics.

Type	Nominal Zener Voltage V_Z at I_{ZT}*	Test Current I_{ZT}	Maximum Zener Impedance			Maximum Reverse Leakage Current		Max. Surge Current 8.3 ms	Maximum Regulator Current
			Z_{ZT} at I_{ZT}	Z_{ZK} at I_{ZK}	I_{ZK}	I_R	at V_R	I_{ZS}	I_{ZM}
	Volts	mA	Ohms	Ohms	mA	µA	Volts	mA	mA
1N4729A	3.6	69	10	400	1.0	100	1	1260	252
1N4730A	3.9	64	9	400	1.0	100	1	1190	234
1N4731A	4.3	58	9	400	1.0	50	1	1070	217
1N4732A	4.7	53	8	500	1.0	10	1	970	193
1N4733A	5.1	49	7	550	1.0	10	1	890	178
1N4734A	5.6	45	5	600	1.0	10	2	810	162
1N4735A	6.2	41	2	700	1.0	10	3	730	146
1N4736A	6.8	37	3.5	700	1.0	10	4	660	133
1N4737A	7.5	34	4	700	0.5	10	5	605	121
1N4738A	8.2	31	4.5	700	0.5	10	6	550	110
1N4739A	9.1	28	5	700	0.5	10	7	500	100
1N4740A	10	25	7	700	0.25	10	7.6	454	91
1N4741A	11	23	8	700	0.25	5	8.4	414	83
1N4742A	12	21	9	700	0.25	5	9.1	380	76
1N4743A	13	19	10	700	0.25	5	9.9	344	69
1N4744A	15	17	14	700	0.25	5	11.4	304	61
1N4745A	16	15.5	16	700	0.25	5	12.2	285	57
1N4746A	18	14	20	750	0.25	5	13.7	250	50
1N4747A	20	12.5	22	750	0.25	5	15.2	225	45
1N4748A	22	11.5	23	750	0.25	5	16.7	205	41
1N4749A	24	10.5	25	750	0.25	5	18.2	190	38
1N4750A	27	9.5	35	750	0.25	5	20.6	170	34
1N4751A	30	8.5	40	1000	0.25	5	22.8	150	30
1N4752A	33	7.5	45	1000	0.25	5	25.1	135	27
1N4753A	36	7.0	50	1000	0.25	5	27.4	125	25
1N4754A	39	6.5	60	1000	0.25	5	29.7	115	23
1N4755A	43	6.0	70	1500	0.25	5	32.7	110	22
1N4756A	47	5.5	80	1500	0.25	5	35.8	95	19
1N4757A	51	5.0	95	1500	0.25	5	38.8	90	18
1N4758A	56	4.5	110	2000	0.25	5	42.6	80	16
1N4759A	62	4.0	125	2000	0.25	5	47.1	70	14
1N4760A	68	3.7	150	2000	0.25	5	51.7	65	13
1N4761A	75	3.3	175	2000	0.25	5	56.0	60	12
1N4762A	82	3.0	200	3000	0.25	5	62.2	55	11
1N4763A	91	2.8	250	3000	0.25	5	69.2	50	10
1N4764A	100	2.5	350	3000	0.25	5	76.0	45	9.0

Standard Voltage Tolerance is ±5% tolerance. Other Tolerances, Non-Standard and Higher Zener Voltages Upon Request.
*Measured under thermal equilibrium and DC test conditions.

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SCHOTTKY DIODES

Silicon Schottky Barrier Diodes in DO-35 Package for general purpose applications with low forward voltage drop and very fast switching times.
Using the type designations **LL101A, LL103A,** and so on, these Schottky Barrier diodes are available in the MiniMELF package with the same electrical characteristics.

Type	Peak Inv. Voltage PIV	Power Dissipation at 25°C	Junction and Storage Temp.	Forward Voltage Drop V_F at I_F				Reverse Current I_R at V_R		Capacitance at $V_F = V_R = 0$, f = 1 MHz	Reverse Recovery Time t_{rr}	
	Volts	max. mW	max. °C	max. V	at mA	max. V	at mA	max. µA	at V	max. pF	max. ns	Conditions
SD101A*	60	400	200	0.41	1	1.0	15	0.2	50	2.0	1	$I_F = I_R = 5$ mA to 0.1 I_R
SD101B	50	400	200	0.40	1	0.95	15	0.2	40	2.1	1	$I_F = I_R = 5$ mA to 0.1 I_R
SD101C	40	400	200	0.39	1	0.90	15	0.2	30	2.2	1	$I_F = I_R = 5$ mA to 0.1 I_R
SD103A	40	400	125	0.37	20	0.6	200	5.0	30	50	10	$I_F = I_R = 200$ mA to 0.1 I_R
SD103B	30	400	125	0.37	20	0.6	200	5.0	20	50	10	$I_F = I_R = 200$ mA to 0.1 I_R
SD103C	20	400	125	0.37	20	0.6	200	5.0	10	50	10	$I_F = I_R = 200$ mA to 0.1 I_R

ZENER DIODES

1N5225 Series 500 mW Glass Zener Diodes, in DO-35 Package ($T_A = 25°C$) **Replaces 1N746 and IN957 Series (See Note):**
Using the type designations **ZMM5225, ZMM5226,** and so on, these Zener diodes are available in the MiniMELF package with the same electrical characteristics. Also available in DO-34 Package.

Type	Nominal Zener Voltage V_Z at I_{ZT}*	Test Current I_{ZT}	Maximum Zener Impedance Z_{ZT} at I_{ZT}	Maximum Zener Impedance Z_{ZK} at $I_{ZK} = 0.5$ mA	Typical Temperature Coefficient	Maximum Reverse Leakage Current I_R	Maximum Reverse Leakage Current Test-Voltage Suffix B	Maximum Regulator Current I_{ZM}
	Volts	mA	Ohms	Ohms	%/°C	µA	Volts	mA
1N5225 B	3.0	20	29	1600	−0.075	50	1.0	152
1N5226 B	3.3	20	28	1600	−0.070	25	1.0	138
1N5227 B	3.6	20	24	1700	−0.065	15	1.0	126
1N5228 B	3.9	20	23	1900	−0.060	10	1.0	115
1N5229 B	4.3	20	22	2000	−0.055	5	1.0	106
1N5230 B	4.7	20	19	1900	±0.030	5	2.0	97
1N5231 B	5.1	20	17	1600	±0.030	5	2.0	89
1N5232 B	5.6	20	11	1600	+0.038	5	3.0	81
1N5233 B	6.0	20	7	1600	+0.038	5	3.5	76
1N5234 B	6.2	20	7	1000	+0.045	5	4.0	73
1N5235 B	6.8	20	5	750	+0.050	3	5.0	67
1N5236 B	7.5	20	6	500	+0.058	3	6.0	61
1N5237 B	8.2	20	8	500	+0.062	3	6.5	55
1N5238 B	8.7	20	8	600	+0.065	3	6.5	52
1N5239 B	9.1	20	10	600	+0.068	3	7.0	50
1N5240 B	10	20	17	600	+0.075	3	8.0	45
1N5241 B	11	20	22	600	+0.076	2	8.4	41
1N5242 B	12	20	30	600	+0.077	1	9.1	38
1N5243 B	13	9.5	13	600	+0.079	0.5	9.9	35
1N5244 B	14	9.0	15	600	+0.082	0.1	10	32
1N5245 B	15	8.5	16	600	+0.082	0.1	11	30
1N5246 B	16	7.8	17	600	+0.083	0.1	12	28
1N5247 B	17	7.4	19	600	+0.084	0.1	13	27
1N5248 B	18	7.0	21	600	+0.085	0.1	14	25
1N5249 B	19	6.6	23	600	+0.086	0.1	14	24
1N5250 B	20	6.2	25	600	+0.086	0.1	15	23
1N5251 B	22	5.6	29	600	+0.087	0.1	17	21
1N5252 B	24	5.2	33	600	+0.087	0.1	18	19.1
1N5253 B	25	5.0	35	600	+0.089	0.1	19	18.2
1N5254 B	27	4.6	41	600	+0.090	0.1	21	16.8
1N5255 B	28	4.5	44	600	+0.091	0.1	21	16.2
1N5256 B	30	4.2	49	600	+0.091	0.1	23	15.1
1N5257 B	33	3.8	58	700	+0.092	0.1	25	13.8
1N5258 B	36	3.4	70	700	+0.093	0.1	27	12.6
1N5259 B	39	3.2	80	800	+0.094	0.1	30	11.6
1N5260 B	43	3.0	93	900	+0.095	0.1	33	10.6
1N5261 B	47	2.7	105	1000	+0.095	0.1	36	9.7
1N5262 B	51	2.5	125	1100	+0.096	0.1	39	8.9

Standard Voltage Tolerance is ±5%.
*Measured under thermal equilibrium and DC test conditions.

Note: 1N746 and 1N957 Series are 400 mW Glass Zener Diodes.

LITEON

LITE-ON Power Semiconductor Products

SCHOTTKY BARRIER RECTIFIERS

Io, max. average recitified forward current

	1A	3A	5A	8A	16A
					
Vrrm (volts)	DO-41	DO-201-AD			TO-220
15	SD115	SD315			
20	SD120/1N5817	SD320/1N5820	SD520	SD820	SDS1620L
30	SD130/1N5818	SD330/1N5821	SD530	SD830	SDS1635L
40	SD140/1N5819	SD340/1N5822	SD540	SD840	SDS1640L
50	SD150	SD350			
60	SD160	SD360			
70	SD170				
80	SD180	SD380			

LITE-ON produces 1 watt zener diodes with nomimal zener voltage ratings from 110V to 330V in a plastic "DO-41" package.

New products include glass passivated junction 1A, glass passivated 3A, varistors, Bidirectional Diode Thyristors (DIACS), and a "DO-15" size package for both 1.5A and 2A standard plastic silicon rectifiers.

STANDARD PLASTIC SILICON RECTIFIERS

Io, max. average rectified forward current

	1A*	1.5A	3A	4A	6A	10A
						
Vrrm (volts)	DO-41		DO-201-AD			
50	1N4001	1N5391	IN5400	PX4A01	PX6A01	PX10A01
100	1N4002	1N5392	1N5401	PX4A02	PX6A02	PX10A02
200	1N4003	1N5393	1N5402	PX4A03	PX6A03	PX10A03
300		1N5394	1N5403			
400	1N4004	1N5395	1N5404	PX4A04	PX6A04	PX10A04
500		1N5396	1N5405			
600	1N4005	1N5397	1N5406	PX4A05	PX6A05	PX10A05
800	1N4006	1N5398	1N5407	PX4A06	PX6A06	PX10A06
1000	1N4007	1N5399	1N5408	PX4A07	PX6A07	PX10A07

All axial products are available either on tape and reel or in bulk.

FAST RECOVERY RECTIFIERS

Io, max. average rectified forward current

	1A*	1.5A	3A	6A	1A ultrafast	1A efficient	1A soft	3A soft	6A soft
									
Vrrm (volts)	DO-41		DO-201-AD		DO-41			DO-201-AD	
50	PR1001/1N4933	PR1501	PR3001	PR6001	UF1001	ER1001	SR1001	SR3001/SR850	SR6001
100	PR1002/1N4934	PR1502	PR3002	PR6002	UF1002	ER1002	SR1002	SR3002/SR851	SR6002
200	PR1003/1N4935	PR1503	PR3003	PR6003	UF1003	ER1003	SR1003	SR3003/SR852	SR6003
400	PR1004/1N4936	PR1504	PR3004	PR6004	UF1004	ER1004	SR1004	SR3004/SR854	SR6004
600	PR1005/1N4937	PR1505	PR3005	PR6005	UF1005	ER1005	SR1005	SR3005/SR856	SR6005
800	PR1006	PR1506	PR3006	PR6006	UF1006	ER1006	SR1006	SR3006	SR6006
1000	PR1007	PR1507	PR3007	PR6007	UF1007	ER1007	SR1007	SR3007	SR6007
trr(nsec)	150-500/200	150-500	150-500	150-500	50-100	100-150	150-300	150-300	150-300

* 0.6mm LEAD DIAMETER ("L" TYPE) ALSO AVAILABLE

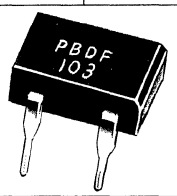
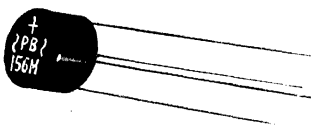
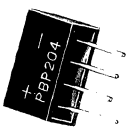
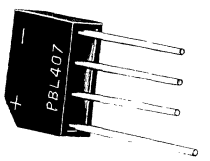
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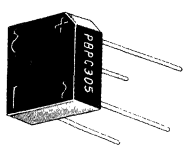
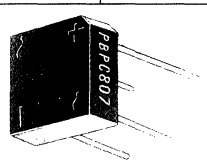
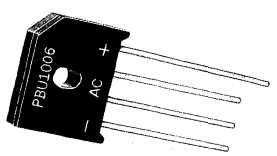
LITE-ON Power Semiconductor Products

BRIDGE RECTIFIERS

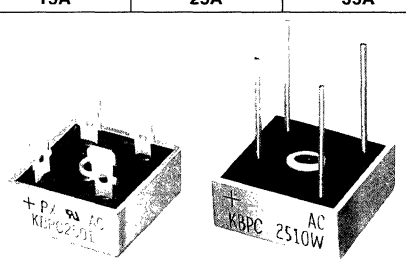
Io, max. average rectified forward current

Vrrm (volts)	1A	1.5A	1A	1.5A	2A	1.5A	2A	3A	4A
									
50	PBDF101	PBDF151	PB101M	PB151M	PB201M	PBP151	PBP201	PBL301	PBL401
100	PBDF102	PBDF152	PB102M	PB152M	PB202M	PBP152	PBP202	PBL302	PBL402
200	PBDF103	PBDF153	PB103M	PB153M	PB203M	PBP153	PBP203	PBL303	PBL403
400	PBDF104	PBDF154	PB104M	PB154M	PB204M	PBP154	PBP204	PBL304	PBL404
600	PBDF105	PBDF155	PB105M	PB155M	PB205M	PBP155	PBP205	PBL305	PBL405
800	PBDF106	PBDF156	PB106M	PB156M	PB206M	PBP156	PBP206	PBL306	PBL406
1000	PBDF107	PBDF157	PB107M	PB157M	PB207M	PBP157	PBP207	PBL307	PBL407

Io, max. average rectified forward current

Vrrm (volts)	3A	6A	8A	10A	4A	6A	8A	10A
								
50	PBPC301	PBPC601	PBPC801	PBPC1001	PBU401	PBU601	PBU801	PBU1001
100	PBPC302	PBPC602	PBPC802	PBPC1002	PBU402	PBU602	PBU802	PBU1002
200	PBPC303	PBPC603	PBPC803	PBPC1003	PBU403	PBU603	PBU803	PBU1003
400	PBPC304	PBPC604	PBPC804	PBPC1004	PBU404	PBU604	PBU804	PBU1004
600	PBPC305	PBPC605	PBPC805	PBPC1005	PBU405	PBU605	PBU805	PBU1005
800	PBPC306	PBPC606	PBPC806	PBPC1006	PBU406	PBU606	PBU806	PBU1006
1000	PBPC307	PBPC607	PBPC807	PBPC1007	PBU407	PBU607	PBU807	PBU1007

Io, max. average rectified forward current

Vrrm (volts)	15A	25A	35A
			
50	KBPC15-005(W)	KBPC25-005(W)	KBPC35-005(W)
100	KBPC15-01(W)	KBPC25-01(W)	KBPC35-01(W)
200	KBPC15-02(W)	KBPC25-02(W)	KBPC35-02(W)
400	KBPC15-04(W)	KBPC25-04(W)	KBPC35-04(W)
600	KBPC15-06(W)	KBPC25-06(W)	KBPC35-06(W)
800	KBPC15-08(W)	KBPC25-08(W)	KBPC35-08(W)
1000	KBPC15-10(W)	KBPC25-10(W)	KBPC35-10(W)

In addition to the many models listed here, LITE-ON also offers a complete line of controlled avalanche ("A" series) bridge rectifiers.

A full line of fast recovery ("R" series) bridge rectifiers is also available with maximum recovery times of 200ns to 500ns.

LITE-ON is known for short lead times, competitive prices, and consistent quality. Our offshore production facility provides custom parts for several customers, and our warehouse in California holds many standard products for your immediate needs.

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PHILIPS POWER SEMICONDUCTORS

RECTIFIERS

See pages A•2118 & A•2119

General Purpose Silicon Rectifiers

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYD11D	SOD-91	0.58	200	1.2 @1
BYD11G			400	
BYD11J			600	
BYD11K			800	
BYD11M			1000	
BYD13D	SOD-81	1.4	200	1.05 @ 1
BYD13G			400	
BYD13J			600	
BYD13K			800	
BYD13M			1000	
BYD14D	SOD-84	2	200	1.5 @ 3
BYD14G			400	
BYD14J			600	
BYD14K			800	
BYD14M			1000	
BY527	SOD-57	2	1250	1.65 @ 10
BY627	SOD-84	2	1250	1.65 @ 10
BYW54	SOD-57	2	600	1.15 @ 2.5
BYW55			800	
BYW56			1000	
IN5059	SOD-57	2	200	1.15 @ 2.5
IN5060			400	
IN5061			600	
IN5062			800	
BYM56A	SOD-64	3.5	200	0.95 @ 3
BYM56B			400	
BYM56C			600	
BYM56D			800	
BYM56E			1000	
BYX38-300	DO-4 (1)	6	300	1.7 @ 20
-600			600	
-1200			1200	
BY249-300	TO-220AC	7	300	1.6 @ 20
-600			600	
-800			800	
BYX98-300	DO-4 (1)	10	300	1.7 @ 20
-600			600	
-1200			1200	
BYX42-300	DO-4 (1)	12	300	1.4 @ 15
-600			600	
-1200			1200	
BYX99-300	DO-4 (1)	15	300	1.55 @ 50
-600			600	
-1200			1200	
BYX96-300	DO-4 (3)	30	300	1.7 @ 100
-600			600	
-1200			1200	
1N4001ID	SOD-81	1A	50V	1.1v @ 1A
1N4002ID			100V	
1N4003ID			200V	
1N4004ID			400V	
1N4005ID			600V	
1N4006ID			800V	
1N4007ID			1000V	
PRLL4001	SOD-87	1.5A	50V	0.8V @ 1A
PRLL4002			100V	0.8V @ 1A
BYD17D			200V	1.05V @ 1A
BYD17G			400V	1.05V @ 1A
BYD17J			600V	1.05V @ 1A
BYD17K			800V	1.05V @ 1A
BYD17M			1000V	1.05V @ 1A

Schottky Rectifiers

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYV10-20	DO-41	1	20	0.4 @ 1
-30			30	
-40			40	
IN5817	SOD-81	1	20	0.45 @ 1
IN5818			30	0.55 @ 1
IN5819			40	0.60 @ 1
PRLL5817	SOD-87	1A	20V	0.45V @ 1A
PRLL5818			30V	0.55V @ 1A
PRLL5819			40V	0.60V @ 1A
PBYR235CT	SOT-223	2A	35V	0.45 @ 1A
PBYR240CT			40V	
PBYR245CT			45V	
PBYR735	TO-220AC	7.5	35	0.57 @ 7.5
PBYR740			40	
PBYR745			45	
PBYR735F	SOT-186	7.5A	35V	0.57V @ 7.5A
PBYR740F			40V	
PBYR745F			45V	
PBYR1035	TO-220AC	10	35	0.57 @ 10
PBYR1040			40	
PBRY1045			45	
PBYR1035F	SOT-186	10A	35V	0.57V @ 10A
PBYR1040F			40V	
PBYR1045F			45V	
BYV118	TO-220AB	10		0.6 @ 5
-35			35	
-40			40	
-45			45	
BYV118F-35	SOT-186	*10A	35V	0.6 @ 5A
-40			40V	
-45			45V	
BYV120	DO-4 (1)	15		0.6 @ 15
-35			35	
-40			40	
-45			45	
PBYR1535CT	TO-220AB	15	35	0.57 @ 7.5
PBYR1540CT			40	
PBYR1545CT			45	
PBRY1535CTF	SOT-186	15A	35V	0.57V @ 7.5A
PBYR1540CTF			40V	

Schottky Rectifiers (Cont.)

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
PBYR1545CTF			45V	
PBYR1635	TO-220AC	16	35	0.57 @ 16
PBYR1640			40	
PBYR1645			45	
PBYR1635F	SOT-186	16A	35V	0.57V @ 16A
PBYR1640F			40V	
PBYR1645F			45V	
PBYR2035CT	TO-220AB	20	35	0.57 @ 10
PBYR2040CT			40	
PBYR2045CT			45	
PBYR2035CTF	SOT-186	20A	35V	0.57V @ 10A
PBYR2040CTF			40V	
PBYR2045CTF			45V	
BYV133-35	TO-220AB	20	35	0.67 @ 7
BYV133-40			40	
BYV133-45			45	
BYV133F-35	SOT-186	20A	35V	0.6V @ 7A
-40			40V	
-45			45V	
BYV121	DO-4 (2)	30		0.6 @ 30
-35			35	
-40			40	
-45			45	
BYV143	TO-220AB	30		0.6 @ 15
-35			35	
-40			40	
-45			45	
BYV143F-35	SOT-186	30A	35V	0.6V @ 15A
-40			40V	
-45			45V	
PBYR2535CT	TO-220AB	30	35	0.73 @ 15
PBYR2540CT			40	
PBYR2545CT			45	
PBYR2535CTF	SOT-186	30A	35V	0.73V @ 15A
PBYR2540CTF			40V	
PBYR2545CTF			45V	
PBYR3035PT	SOT-93	30	35	0.6 @ 20
PBYR3040PT			40	
PBYR3045PT			45	
PBYR3035PTF	SOT-199	30A	35V	0.6V @ 20A
PBYR3040PTF			40V	
PBYR3045PTF			45V	
PBYR12035TV	SOT-227B2	120	35	0.67 @ 60
PBYR12040TV			40	
PBYR12045TV			45	
PBYR16035TV	SOT-227B2	160	35	0.69 @ 160
PBYR16040TV			40	
PBYR16045TV			45	
PBYR30035CT	TO-244	300	35	0.62 @ 150
PBYR30040CT			40	
PBYR30045CT			45	
PBYR40035CT	TO-244	400	35	0.58 @ 200
PBYR40040CT			40	
PBYR40045CT			45	

Ultra-Fast Recovery Epitaxial Rectifiers

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
PHS1001	SOD-57	1	50	0.89 @ 1
PHS1002			100	
PHS1003			150	
BYV26A	SOD-57	1	200	1.3 @ 1
B			400	
C			600	
D			800	
E			1000	
BYV40-100	SOT-223	1.5A	100V	1V at 1.5A
-150			150V	
-200			200V	
BYV36A			200	
B		1.6	300	1.0 @ 1
C	SOD-57		600	
D		1.5	800	1.05 @ 1
E			1000	
BYD73A	SOD-81		50	
B			100	
C		1.75	150	0.74 @ 1
D			200	
F		1.7	300	0.83 @ 1
G		1.7	400	0.83 @ 1
BYD77A	SOD-87	2A	50V	0.95V @ 1A
B		2A	100V	0.95V @ 1A
C		2A	150V	0.95V @ 1A
D		2A	200V	0.95V @ 1A
E		1.85A	250V	1.05V @ 1A
F		1.85A	300V	1.05V @ 1A
G		1.85A	400V	1.05V @ 1A
PHS1101	SOD-57	2	50	0.88 @ 3
PHS1102			100	
PHS1103			150	
BYV27-50	SOD-57		50	0.88 @ 3
-100			100	
-150			150	
-200			200	
BYD74A	SOD-84		50	
B			100	0.72 @ 2
C		2.4	150	
D			200	
F		2.15	300	0.82 @ 2
G			400	
BYV28-50	SOD-64	3.5	50	0.75 @ 3
-100			100	
-150			150	
-200			200	
PHR605CT	TO-220AB	6	50	0.75 @ 3

Ultra-Fast Recovery Epitaxial Rectifiers (Cont.)

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
PHR610CT			100	
PHR615CT			150	
PHR620CT			200	
BYW29-50	TO-220AC	8	50	0.8 @ 8
-100			100	
-150			150	
-200			200	
BYR29-600	TO-220AC	8	600	1.3 @ 10
-800			800	
BYW29F-50	SOT-186	8	50	0.8 @ 8
-100			100	
-150			150	
-200			200	
BYR29F-600	SOT-186	8	600	1.3 @ 10
-800			800	
BYV29F-300	SOT-186	9	300	1.05 @ 5
-400			400	
-500			500	
BYV29-300	TO-220AC	9	300	1.05 @ 5
-400			400	
-500			500	
BYQ28-50	TO-220AB	10	50	0.85 @ 5
-100			100	
-150			150	
-200			200	
BYV30-300	DO-4 (1)	12	300	1.05 @ 12
-400			400	
-500			500	
BYV32F-50	SOT-186	12	50	0.85 @ 5
-100			100	
-150			150	
-200			200	
BYW30-50U	DO-4 (1)	14	50	0.85 @ 10
-100U			100	
-150U			150	
-200U			200	
BYT79-300	TO-220AC	14	300	1.05 @ 10
-400			400	
-500			500	
BYV79-50	TO-220AC	14	50	0.85 @ 10
-100			100	
-150			150	
-200			200	
BYR79-500	TO-220AC	14	500	1.5 @ 15
-600			600	
-700			700	
-800			800	
BYR34-600	TO-220AB	20	600	1.25 @ 10
-700			700	
-800			800	
BYV72F-50	SOT-199	20	50	0.85 @ 10
-100			100	
-150			150	
-200			200	
BYV74F-300	SOT-199	20	300	1.05 @ 15
-400			400	
-500			500	
BYV32-50	TO-220AB	20	50	0.85 @ 5
100			100	
BYV32-150	TO-220AB	20	150	0.85 @ 5
-200			200	
BYV34-300	TO-220AB	20	300	1.1 @ 10
-400			400	
-500			500	
BYW31-50U	DO-4 (2)	28	50	0.85 @ 20
-100U			100	
-150U			150	
-200U			200	
BYV42-50	TO-220AB	30	50	0.85 @ 10
-100			100	
-150			150	
-200			200	
BYV44-300	TO-220AB	30	300	1.1 @ 15
-400			400	
-500			500	
BYV72-50	SOT-93	30	50	0.85 @ 10
-100			100	
-150			150	
-200			200	
BYV74-300	SOT-93	30	300	1.1 @ 15
-400			400	
-500			500	
BYM26A	SOD-64	2.3A	200V	1.34V @ 2A
B			400V	
C			600V	
D			800V	
E			1000V	
BYM36A	SOD-64	3A	200V	1.22V @ 3A
B			400V	
C			600V	
D			800V	
E			1000V	1.28V @ 3A
*BYT28-300	TO-220AB	*10A	300V	1.05V @ 5A
-400			400V	
-500			500V	
BYR30-600U	DO-4 (1)	14A	600V	1.25V @ 15A
-700U			700V	
BYV31-300	DO-4 (2)	28A	300V	1.05V @ 30A
-400			400V	
-500			500V	
*BYT230PIV-200	SOT-227B2	*60A	200V	1.4V @ 30A
-300			300V	
-400			400V	
-600			600V	
-800			800V	1.8V @ 30A
-1000			1000V	

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PHILIPS POWER SEMICONDUCTORS

RECTIFIERS, ZENERS, THYRISTORS

See pages A•2118 & A•2119

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
Ultra-Fast Recovery Epitaxial Rectifiers (Cont.)				
*BYV54V-50	SOT-227B2	*100A	50V	0.8V @ 50A
-100			100V	
-150			150V	
-200			200V	
BYV492-400	TO-244	160A	400V	1.1V @ 80A
BYV493-400	TO-244	240A	400V	1.1V @ 120A
BYW493-150	TO-244	240A	150V	0.8V @ 120A
-200			200V	
Fast Recovery Rectifiers—Double Diffused Very Fast Types				
BYD31D	SOD-91	0.5A	200V	1.6V @ 1A
G			400V	
J			600V	
BYD33D	SOD-81	1.3	200	1.3 @ 1
G			400	
J			600	
K			800	
M			1000	
BYD37D	SOD-87	1.5A	200V	1.3V @ 1A
G			400V	
J			600V	
K			800V	
M			1000V	
BYV95A	SOD-57	1.5	200	1.6 @ 3
B			400	
C			600	
BYV96D	SOD-57	1.5	800	1.6 @ 3
E			1000	
BYD34D	SOD-84	1.8	200	1.2 @ 3
G			400	
J			600	
K			800	
M			1000	
BYW95A	SOD-64	3	200	1.5 @ 3
B			400	
C			600	
BYW96D	SOD-64	3	800	1.5 @ 3
E			1000	
IN3879	DO-4 (1)	6	50	1.4 @ 6
IN3880			100	
IN3881			200	
IN3882			300	
IN3883			400	
IN3889	DO-4 (1)	12	50	1.4 @ 12
IN3890			100	
IN3981			200	
IN3982			300	
IN3893			400	
BYX30-200	DO-4 (2)	14	200	2.1 @ 14
-300			300	
-400			400	
-500			500	
-600			600	
BYX46-200	DO-4 (2)	22	200	2 @ 50
-200			300	
-400			400	
-500			500	
-600			600	
IN4933	SOD-84	1A	50	0.95 @ 1
IN4934			100	
IN4935			200	
IN4936			400	
IN4937			600	
†BY229-200	TO-220AC	7A	200	1.85 @ 20
-400			400	
-600			600	
-800			800	
-1000			1000	
BY329-1000	TO-220AC	8A	1000	1.85 @ 20
-1200			1200	
Fast Types				
BY458	SOD-57	4	1200	1.6 @ 3
BY448			1500	
BY438	SOD-64	5	1200	1.5 @ 5
BY228			1500	
BYV24-800U	DO-4 (1)	14	800	1.7 @ 20
-1000U			1000	
BY328	SOD-64	4.5A (I_{FWM}max.)	1400	1.4 @ 5
High Voltage Rectifier Diodes				
BY584	SOD-61	85mA	1800	
BY614	SOD-61H	50mA	2200	
BY505	SOD-61	85mA	2200	
BY705	SOD-61	20mA	5000	
BY715	SOD-61	20mA	5000	
BY706	SOD-61	20mA	6000	
BY716	SOD-61	20mA	6000	
BYX90G	SOD-83	550mA	7500	
BY707	SOD-61	3mA	9000	
BY717	SOD-61	4mA	10000	
BY718	SOD-61	4mA	12000	
BY708	SOD-61	3mA	12000	
BY709	SOD-61	3mA	14000	
BY719	SOD-61	4mA	14000	
BY609	SOD-61	4mA	15000	
BY619	SOD-61	4mA	15000	
BY610	SOD-61	4mA	17000	
BY620	SOD-61	4mA	17000	
BY710	SOD-61	3mA	17000	
BY720	SOD-61	3mA	17000	

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
High Voltage Rectifier Diodes (Cont.)				
BY721	SOD-61	3mA	19000	
BY711	SOD-61	3mA	19000	
BY712	SOD-61	3mA	22000	
BY722	SOD-61	3mA	22000	
BY723	SOD-61	3mA	24000	
BY713	SOD-61	3mA	24000	
BY714	SOD-61	3mA	30000	
BY724	SOD-61	3mA	30000	

Type No.	Package Outline	Breakover Voltage ±12%	I_{TRM} 8/20µs	I_{TRM} 10/700µs	V_T
Breakover Diodes/Single					
BR210-120	TO-220AC	120V	150A	40A	2.5 @ 10
-140		140V			
-160		160V			
-240		240V			
-260		260V			
-280		280V			
BR211-100	SOD-84	100V	150A	40A	2.5V @ 2A
-120		120V			
-140		140V			
-160		160V			
-180		180V			
-200		200V			
-220		220V			
-240		240V			
-260		260V			
-280		280V			
Dual Bi-Directional					
BR220-120	TO-220AB	120V	150A	40A	2.5 @ 10
-140		140V			
-160		160V			
-240		240V			
-260		260V			
-280		280V			
BR213-120	TO-220AB	120V	150A	40A	2.5 @ 5
-140		140V			
-160		160V			
-240		240V			
-260		260V			
-280		280V			
Dual Uni-Directional					
*BR216-78	TO-220AB	65V	150A	40A	3 @ 5

Type	Pkg	Polarity	P_{TOT} Max W	Reg V V_Z
Power Zeners (Voltage Regulator)				
BZD23	SOD-81	Norm	2.5W	7.5 to 270
BZT03	SOD-57	Norm	3.25W	7.5 to 510
BZW03	SOD-64	Norm	6W	7.5 to 510
BZY93	DO-4 (1)	Both	20W	7.5 to 75

Type	Pkg	Polarity	P_{RSM} Max W	Stand off VR
Power Zeners (Transient Suppressor)				
BZD23	SOD-81	Norm	300W	3.0 to 220
BZT03	SOD-57	Norm	600W	5.6 to 220
BZW03	SOD-64	Norm	1000W	6.2 to 220
BZY93	DO-4 (1)	Both	700W	5.6 to 56

Type	Pkg	$I_{T(AV)}$ Max A	V_{RRM} Max V	V_{GT} Min V	I_{GT} Min A
General Purpose Thyristors					
2N5064	TO-92	0.5	200	0.8	0.2mA
BT169B	TO-92	0.5	200	0.8	0.2mA
D			400		
E			500		
G			600		
BT148W-400R	SOT-223	0.6A	400V	1.5V	200µA
-500R			500V		
-600R			600V		
BT148-400R	SOT-82	2.5	400	1.5	0.2mA
-500R			500		
-600R			600		
BT151F-500	SOT-186	5.7	500	1.5	15mA
-650			650		
-800			800		
BT151-500R	TO-220AB	7.5	500	1.5	15mA
-650R			650		
-800R			800		
BTW38-600RU	TO-64	10	600	1.5	50mA
-1000RU			1000		
BTW42-600RU	TO-64	10	600	1.5	50mA
-1000RU			1000		
BT152-400R	TO-220AB	13	400	1.5	32mA
-600R			600		
-800R			800		
BT145-500R	TO-220AB	16	500	1.5	35mA
-600R			600		
-800R			800		
BTW40-400RU	TO-48	20	400	1.5	75mA
-800RU			800		

Type	Pkg	$I_{T(RMS)}$ Max A	V_{DRM} Max V	V_{GT} Min V
TRIACs				
BT134W-500	SOT-223	1A	500V	1.5V
-600			600V	
-700			700V	
-800			800V	
BT134-500	SOT-82	4A	500V	1.5V
-600			600V	
-800			800V	
BT136-500	TO-220AB	4	500	1.5
-600			600	
-800			800	
BT136-500D	TO-220AB	4	500	1.5
BT136-500E	TO-220AB	4	500	1.5
-600E			600	
-800E			800	
BT136-500F	TO-220AB	4	500	1.5
-600F			600	
-800F			800	
BT136-500G	TO-220AB	4	500	1.5
BT136-600G			600	
-800G			800	
BT136F-500	SOT-186	4	500	1.5
-600			600	
-800			800	
BT136F-500D	SOT-186	4	500	1.5
BT136F-500E	SOT-186	4	500	1.5
-600E			600	
BT137-500	TO-220AB	8	500	1.5
-600			600	
-800			800	
BT137-500D	TO-220AB	8	500	1.5
BT137-500E	TO-220AB	8	500	1.5
-600E			600	
-800E			800	
BT137-500F	TO-220AB	8	500	1.5
-600F			600	
-800F			800	
BT137-500G	TO-220AB	8	500	1.5
-600G			600	
-800G			800	
BT137F-500	SOT-186	8	500	1.5
BT137F-500D	SOT-186	8	500	1.5
BT137F-500E	SOT-186	8	500	1.5
BT137F-500F	SOT-186	8	500	1.5
BT138-500	TO-220AB	12	500	1.5
-600			600	
-800			800	
BT138-500E	TO-220AB	12	500	1.5
-600E			600	
-800E			800	
BT138-500F	TO-220AB	12	500	1.5
-600F			600	
-800F			800	
BT138-500G	TO-220AB	12	500	1.5
-600G			600	
-800G			800	
BT138F-500	SOT-186	12	500	1.5
-600			600	
-800			800	
BTW43-600G	TO-64	12	600	2.5
-1000G			1000	(5V with
-1200G			1200	T-, G+)
BTW43-600H	TO-64	12	600	2.5
-1000H			1000	(5V with
-1200H			1200	T-, G+)
BT139-500	TO-220AB	16	500	1.5
-600			600	
-800			800	
BT139-500E	TO-220AB	16	500	1.5
-600E			600	
-800E			800	
BT139-500F	TO-220AB	16	500	1.5
-600F			600	
-800F			800	
BT139-500G	TO-220AB	16	500	1.5
-600G			600	
-800G			800	
BT139F-500	SOT-186	16	500	1.5
-600			600	
-800			800	
BTA140-500	TO-220AB	25	500	1.5
-600			600	
-800			800	

V_{DS} MAX (V)	TYPE NO.	PACKAGE OUTLINE	I_D MAX (A)	P_{TOT} MAX (W)	R_{DS} ON MAX (Ω)
Power Mosfet Transistors General Purpose (in order of Voltage/R_{DS} on)					
50V	BUZ71	TO-220AB	20	75	0.10
50V	BUZ11	TO-220AB	40	125	0.04
60	MTP3055E	TO-220AB	12	60	0.16
60	BUK452-60A	TO-220AB	15	60	0.13
60	BUK452-60B	TO-220AB	14	60	0.15
60	BUK453-60B	TO-220AB	20	75	0.10
60	BUK443-60B	SOT-186*	12	25	0.1
60	BUK453-60A	TO-220AB	22	75	0.08
60	BUK443-60A	SOT-186*	13	25	0.08
60	BUK455-60B	TO-220AB	38	125	0.045
60	BUK445-60B	SOT-186*	20	30	0.045
60	BUK455-60A	TO-220AB	41	125	0.038
60	BUK445-60A	SOT-186*	21	30	0.038
60	BUK436-60B	SOT-93	46	125	0.033
60	BUK456-60B	TO-220AB	51	150	0.03

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Power Mosfet Transistors General Purpose (in order of Voltage/R_{DS} on) (Cont.)

V_{DS} MAX (V)	TYPE NO.	PACKAGE OUTLINE	I_D MAX (A)	P_{TOT} MAX (W)	R_{DS} ON MAX (Ω)
60	BUK426-60B	SOT-199*	30	45	0.03
60	BUK456-60A	TO-220AB	52	150	0.028
60	BUK436-60A	SOT-93	50	125	0.028
60	BUK426-60A	SOT-199*	30	45	0.028
100	BUK451-100B	TO-220AB	3.0	40	1.1
100	BUK441-100B	SOT-186*	2.8	20	1.1
100	BUK451-100A	TO-220AB	3.0	40	0.85
100	BUK441-100A	SOT-186*	3.0	20	0.85
100	BUK452-100B	TO-220AB	10	60	0.3
100	BUK452-100A	TO-220AB	11	60	0.25
100	BUK453-100B	TO-220AB	13	75	0.20
100	BUK443-100B	SOT-186*	8	25	0.2
100	BUK453-100A	TO-220AB	14	75	0.16
100	PRF530	TO-220AB	14	75	0.16
100	BUK443-100A	SOT-186*	9	25	0.16
100	BUK455-100B	TO-220AB	23	125	0.1
100	BUK445-100B	SOT-186*	12	30	0.1
100	BUK455-100A	TO-220AB	26	125	0.08
100	BUK445-100A	SOT-186*	14	30	0.08
100	PRF540	TO-220AB	28	125	0.077
100	BUK456-100B	TO-220AB	32	150	0.065
100	BUK436-100B	SOT-93	31	125	0.065
100	BUK426-100B	SOT-199*	19	45	0.065
100	BUK456-100A	TO-220AB	34	150	0.057
100	BUK436-100A	SOT-93	33	125	0.057
100	BUK426-100A	SOT-199*	20	45	0.057
100	BUK416-100BE	ISOTOP	100	310	0.016
100	BUK416-100AE	ISOTOP	110	310	0.013
200	BUK454-200B	TO-220AB	8.2	90	0.5
200	BUK444-200B	SOT-186*	4.7	25	0.5
200	BUK454-200A	TO-220AB	9.2	90	0.4
200	BUK444-200A	SOT-186*	5.3	25	0.4
200	BUK455-200B	TO-220AB	13	125	0.28
200	BUK445-200B	SOT-186*	7	30	0.28
200	BUK455-200A	TO-220AB	14	125	0.23
200	BUK445-200A	SOT-186*	7.6	30	0.23
200	BUK456-200B	TO-220AB	17	150	0.2
200	BUK436-200B	SOT-93	17	125	0.2
200	BUK426-200B	SOT-199*	10	45	0.2
200	PRF640	TO-220AB	18	150	0.18
200	BUK456-200A	TO-220AB	19	150	0.16
200	BUK436-200A	SOT-93	19	125	0.16
200	MTH15N20	SOT-93	15	125	0.16
200	BUK426-200A	SOT-199*	11	45	0.16
200	BUK416-200BE	ISOTOP	63	310	0.045
200	BUK416-200AE	ISOTOP	63	310	0.035
400	BUK454-400B	TO-220AB	4.2	75	1.8
400	BUK444-400B	SOT-186*	2.4	25	1.8
400	BUK454-400A	TO-220AB	4.6	75	1.5
400	BUK444-400A	SOT-186*	2.7	25	1.5
400	BUK455-400B	TO-220AB	6.5	100	1.0
400	BUK445-400B	SOT-186*	3.8	30	1
400	PRF730	TO-220AB	6.5	100	1.0
400	MTP5N40	TO-220AB	5.0	100	1.0
400	BUK455-400A	TO-220AB	7.3	100	0.8
400	BUK445-400A	SOT-186*	4	30	0.8
400	BUK457-400B	TO-220AB	11	150	0.5
400	PRF740	TO-220AB	11	150	0.5
400	BUK437-400B	SOT-93	12	180	0.5
400	BUK427-400B	SOT-199*	6.2	45	0.5
400	BUK437-400A	SOT-93	14	180	0.4
400	BUK427-400A	SOT-199*	6.9	45	0.4
500	BUK454-500B	TO-220AB	3.3	75	2.8
500	BUK444-500B	SOT-186*	1.9	25	2.8
500	BUK454-500A	TO-220AB	3.7	75	2.3
500	BUK444-500A	SOT-186*	2.1	25	2.3
500	BUK455-500B	TO-220AB	5.3	100	1.5
500	MTP4N50	TO-220AB	4.0	100	1.5
500	BUK445-500B	SOT-186*	2.9	30	1.5
500	BUK455-500A	TO-220AB	5.7	100	1.3
500	BUK445-500A	SOT-186*	3.1	30	1.3
500	BUK457-500B	TO-220AB	9	150	0.8
500	BUK437-500B	SOT-93	10	180	0.8
500	BUK427-500B	SOT-199*	4.8	45	0.8
500	MTH7N50	SOT-93	7.0	180	0.8
500	PRF840	TO-220AB	9.0	150	0.8
500	BUK437-500A	SOT-93	11	180	0.6
500	BUK427-500A	SOT-199*	5.6	45	0.6
500	BUK438-500B	SOT-93	13.5	220	0.5
500	BUK428-500B	SOT-199*	6.1	45	0.5
500	BUK438-500A	SOT-93	15	220	0.4
500	BUK428-500A	SOT-199*	6.8	45	0.4
500	BUK417-500BE	ISOTOP	28	310	0.16
500	BUK417-500AE	ISOTOP	32	310	0.13
600	BUK454-600B	TO-220AB	2.6	75	4.5
600	BUK444-600B	SOT-186*	1.5	25	4.5
600	BUK454-600A	TO-200AB	2.8	75	4.0
600	BUK444-600A	SOT-186*	1.6	25	4
600	BUK455-600B	TO-220AB	4.0	100	2.5
600	BUK445-600B	SOT-186*	2.2	30	2.5
600	BUK455-600A	TO-220AB	4.5	100	2.0
600	BUK445-600A	SOT-186*	2.5	30	2
600	BUK457-600B	TO-220AB	7.1	150	1.2
600	BUK437-600B	SOT-93	7.8	180	1.2
600	BUK427-600B	SOT-199*	3.9	45	1.2
600	BUK437-600A	SOT-93	9	180	1
600	BUK427-600A	SOT-199*	4.3	45	1

Power Mosfet Transistors General Purpose (in order of Voltage/R_{DS} on) (Cont.)

V_{DS} MAX (V)	TYPE NO.	PACKAGE OUTLINE	I_D MAX (A)	P_{TOT} MAX (W)	R_{DS} ON MAX (Ω)
800	BUK454-800B	TO-220AB	2.0	85	8
800	BUK444-800B	SOT-186*	1.2	30	8
800	BUK454-800A	TO-220AB	2.4	85	6
800	BUK444-800A	SOT-186*	1.4	30	6
800	BUK456-800B	TO-220AB	3.5	125	4
800	BUK436-800B	SOT-93	3.5	125	4
800	BUK426-800B	SOT-199*	2.1	45	4
800	BUK446-800B	SOT-186*	1.7	30	4
800	BUK456-800A	TO-220AB	4	125	3
800	BUK436-800A	SOT-93	4	125	3
800	BUK426-800A	SOT-199*	2.4	45	3
800	BUK446-800A	SOT-186*	2	30	3
800	BUK438-800B	SOT-93	6.6	220	2.0
800	BUK428-800B	SOT-199*	3.0	45	2.0
800	BUK438-800A	SOT-93	7.6	220	1.5
800	BUK428-800A	SOT-199*	3.4	45	1.5
1000	BUK456-1000B	TO-220AB	3.1	125	5
1000	BUK436-1000B	SOT-93	3.1	125	5
1000	BUK426-1000B	SOT-199*	1.9	45	5
1000	BUK446-1000B	SOT-186*	1.5	30	5
1000	BUK456-1000A	TO-220AB	3.5	125	4
1000	BUK436-1000A	SOT-93	3.5	125	4
1000	BUK426-1000A	SOT-199*	2.1	45	4
1000	BUK446-1000A	SOT-186*	1.7	30	4
1000	BUK438-1000B	SOT-93	5.7	220	2.6
1000	BUK428-1000B	SOT-199*	2.6	45	2.6
1000	BUK438-1000A	SOT-93	6.5	220	2
1000	BUK428-1000A	SOT-199*	2.9	0.45	2.0

Power Mosfet Transistors Logic Level FET's (in order of Voltage/R_{DS} on)

60	BUK552-60B	TO-220AB	13	60	0.18
60	BUK552-60A	TO-220AB	14	60	0.15
60	BUK553-60B	TO-220AB	20	75	0.10
60	BUK543-60B	SOT-186*	12	25	0.1
60	BUK553-60A	TO-220AB	21	75	0.085
60	BUK543-60A	SOT-186*	13	25	0.085
60	BUK555-60B	TO-220AB	35	125	0.055
60	BUK545-60B	SOT-186*	18	30	0.055
60	BUK555-60A	TO-220AB	39	125	0.042
60	BUK545-60A	SOT-186*	20	30	0.042
100	BUK551-100B	TO-220AB	3.0	40	1.1
100	BUK541-100B	SOT-186*	2.8	20	1.1
100	BUK551-100A	TO-220AB	3.0	40	0.85
100	BUK541-100A	SOT-186*	3.0	20	0.85
100	BUK552-100B	TO-220AB	8.5	60	0.35
100	BUK542-100B	SOT-186*	5.6	22	0.35
100	BUK542-100A	SOT-186*	6.3	22	0.28
100	BUK552-100A	TO-220AB	10	60	0.28
100	BUK553-100B	TO-220AB	12	75	0.22
100	BUK543-100B	SOT-186*	7.5	25	0.22
100	BUK553-100A	TO-220AB	13	75	0.18
100	BUK543-100A	SOT-186*	8.3	25	0.18
100	BUK555-100B	TO-220AB	22	125	0.11
100	BUK545-100B	SOT-186*	12	30	0.11
100	BUK555-100A	TO-220AB	25	125	0.085
100	BUK545-100A	SOT-186*	13	30	0.085
200	BUK554-200B	TO-220AB	8.2	90	0.5
200	BUK554-200A	TO-220AB	9.2	90	0.4
200	BUK555-200B	TO-220AB	13	125	0.28
200	BUK545-200B	SOT-186*	7	30	0.28
200	BUK555-200A	TO-220AB	14	125	0.23
200	BUK545-200A	SOT-186*	7.6	30	0.23

Power Mosfet Transistors Fast Recovery Epitaxial Diode FET's (in order of Voltage/R_{DS} on)

400	BUK637-400B	SOT-93	12	180	0.6
400	BUK657-400B	TO-220AB	11	150	0.6
400	BUK657-400A	TO-220AB	13	150	0.5
400	BUK637-400A	SOT-93	14	180	0.5
500	BUK655-500C	TO-220AB	5.0	100	1.7
500	BUK655-500B	TO-220AB	5.3	100	1.5
500	BUK657-500C	TO-220AB	8.5	150	0.9
500	BUK637-500C	SOT-93	9.5	180	0.9
500	BUK627-500C	SOT-199*	4.5	45	0.9
500	BUK657-500B	TO-220AB	9	150	0.8
500	BUK637-500B	SOT-93	10	180	0.8
500	BUK627-500B	SOT-199*	4.8	45	0.8
500	BUK638-500B	SOT-93	12.5	220	0.6
500	BUK638-500A	SOT-93	14	220	0.48
500	BUK617-500B	ISOTOP	27	310	0.18
500	BUK617-500A	ISOTOP	29	310	0.15
800	BUK638-800B	SOT-93	6.3	220	2.4
800	BUK638-800A	SOT-93	7.3	220	1.8
1000	BUK638-1000B	SOT-93	5.6	220	3.0
1000	BUK638-1000A	SOT-93	6.2	220	2.4

Power Mosfet Transistors Current Sensing FET's (in order of Voltage/R_{DS} on)

60	BUK793-60	SOT-263	20	75	0.1
60	BUK795-60	SOT-263	38	125	0.045

Power Mosfet Transistors Logic Level Current Sensing FET's (in order of Voltage/R_{DS} on)

60	BUK993-60	SOT-263	20	75	0.1
60	BUK995-60	SOT-263	38	125	0.045

Power Mosfet Transistors Insulated Gate Bi-Polar FET's (IGBT) (in order of Voltage/R_{DS} on)

V_{DS} MAX (V)	TYPE NO.	PACKAGE OUTLINE	I_D MAX (A)	P_{TOT} MAX (W)	R_{DS} ON MAX (Ω)
800	BUK854-800A	TO-220AB	12	85	3.5
800	BUK856-800A	TO-220AB	38	125	3.5

Type NPN	PNP	Pkg	I_C (DC) Max A	V_{CEO} V	h_{FE} @ I_C Min
General Purpose Darlingtons, Low Voltage					
TIP110	TIP115	TO-220AB	2	60	100 @ 1A
TIP111	TIP116			80	and
TIP112	TIP117			100	500 @ 2A
BD675	BD676	TO-126	4	45	750 @ 1.5A
BD677	BD678			60	
BD679	BD680			80	
BD681	BD682			100	
BD683	BD684			120	
BDT61	BDT60	TO-220AB	4	60	750 @ 1.5A
BDT61A	BDT60A			80	
BDT61B	BDT60B			100	
BDT61C	BDT60C			120	
TIP120	TIP125	TO-220AB	5	60	1000 @ 3A
TIP121	TIP126			80	
TIP122	TIP127			100	
BD645	BD646	TO-220AB	8	60	750 @ 3A
BD647	BD648			80	
BD649	BD650			100	
BD651	BD652			120	
BD645F	BD646F	SOT-186	8	60	750 @ 3A
BD647F	BD648F			80	
BD649F	BD650F			100	
BD651F	BD652F			120	
BU806		TO-220AB	8	200	—
BU807				150	
BU806F		SOT-186	8	200	—
BU807F				150	
TIP130	TIP135	TO-220AB	8	60	500 @ 1A
TIP131	TIP136			80	and
TIP132	TIP137			100	1000 @ 4A
BDT63	BDT62	TO-220AB	10	60	1000 @ 3A
BDT63A	BDT62A			80	
BDT63B	BDT62B			100	
BDT63C	BDT62C			120	
BDT63F	BDT62F	SOT-186	10A	60V	1000 @ 3A
BDT63AF	BDT62AF			80V	
BDT63BF	BDT62BF			100V	
BDT63CF	BDT62CF			120V	
TIP140	TIP145	SOT-93	10	60	1000 @ 5A
TIP141	TIP146			80	and
TIP142	TIP147			100	500 @ 10A
BDV65	BDV64	SOT-93	12	60	1000 @ 5A
BDV65A	BDV64A			80	
BDV65B	BDV64B			100	
BDV65C	BDV64C			120	
BDT65	BDT64	TO-220AB	12	60	1000 @ 5A
BDT65A	BDT64A			80	
BDT65B	BDT64B			100	
BDT65C	BDT64C			120	
BDT65F	BDT64F	SOT-186	12A	60V	1000 @ 5A
BDT65AF	BDT64AF			80V	
BDT65BF	BDT64BF			100V	
BDT65CF	BDT64CF			120V	
BDV67A	BDV66A	SOT-93	16	80	1000 @ 10A
BDV67B	BDV66B			100	
BDV67C	BDV66C			120	
General Purpose Transistors, Low Voltage					
TIP29	TIP30	TO-220AB	1	40	40 @ 200mA
TIP29A	TIP30A			60	and
TIP29B	TIP30B			80	15 @ 1A
TIP29C	TIP30C			100	
BD233	BD234	TO-126	2	45	25 @ 1A
BD235	BD236			60	
BD237	BD238			80	
BDT31F	BDT32F	SOT-186	3	40	25 @ 1A
BDT31AF	BDT32AF			60	
BDT31BF	BDT32BF			80	
BDT31CF	BDT32CF			100	
TIP31	TIP32	TO-220AB	3	40	25 @ 1A
TIP31A	TIP32A			60	and
TIP31B	TIP32B			80	10 @ 3A
TIP31C	TIP32C			100	
BD933F	BD934F	SOT-186	3	45	25 @ 1A
BD935F	BD936F			60	
BD937F	BD938F			80	
BD939F	BD940F			100	
BD941F	BD942F			120	
TIP41	TIP42	TO-220AB	6	40	30 @ 300mA
TIP41A	TIP42A			60	and
TIP41B	TIP42B			80	15 @ 3A
TIP41C	TIP42C			100	
BD201	BD202	TO-220AB	8	45	30 @ 3A
BD203	BD204			60	30 @ 2A
BDX77	BDX78			80	30 @ 2A
BD201F	BD202F	SOT-186	8	45	30 @ 3A
BD203F	BD204F			60	30 @ 2A
BDX77F	BDX78F			80	30 @ 2A
BDV91	BDV92	SOT-93	10	60	20 @ 4A
BDV93	BDV94			80	
BDV95	BDV96			100	
TIP33	TIP34	SOT-93	10	40	20 @ 3A
TIP33A	TIP34A			60	
TIP33B	TIP34B			80	
TIP33C	TIP34C			100	

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PHILIPS POWER SEMICONDUCTORS

TRANSISTORS, DIODES, DARLINGTONS

See pages A•2118 & A•2119

Type NPN	PNP	Pkg	I_C (DC) Max A	V_{CEO} V	h_{FE} @ I_C Min
General Purpose Transistors, Low Voltage (Cont.)					
BDT91	BDT92	TO-220AB	10	60	20 @ 4A
BDT91F	BDT92F	SOT-186	10A	60V	20 @ 4A
BDT93F	BDT94F			80V	
BDT95F	BDT96F			100V	
BDT93	BDT94			80	
BDT95	BDT96			100	
BDT81	BDT82	TO-220AB	15	60	50 @ 5A
BDT81F	BDT82F	SOT-186	15A	6V	50 @ 5A
BDT83F	BDT84F			80V	
BDT85F	BDT86F			100V	
BDT87F	BDT88F			120V	
BDT83	BDT84			80	
BDT85	BDT86			100	
BDT87	BDT88			120	
TIP3055	TIP2955	SOT-93	15	60	20 @ 4A
High Speed, Low Voltage Darlingtons					
BDX42	BDX45	TO-126	1	45	2000 @ 0.5A
BDX43	BDX46			60	
BDX44	BDX47			80	
High Speed, Low Voltage Transistors					
BD135	BD136	TO-126	1	45	25 @ 0.5A
BD137	BD138			60	
BD139	BD140			80	
BD226	BD227	TO-126	1.5	45	25 @ 1A
BD228	BD229			60	
BD230	BD231			80	
BDX35		TO-126	5	60	45 @ 0.5A
BDX36				60	
BDX37				80	

Type	Pkg	I_C (DC) Max A	V_{CEO}	V_{CE} (Sat) Max I_C/I_B R/R
High Speed, High Voltage Transistors				
BUX86	TO-126	0.5	400	1.5@0.1
BUX87			450	
TIP47			250	
TIP48			300	
TIP49	TO-220AB	1.0	350	1.0@2
TIP50			400	
BUX99	TO-126	1.5	300	1@0.2
BUX84	TO-220A	2	400	1@1/0.2
BUX85			450	
BUX84F	SOT-186	2	400	1@1/0.2
BUX85F			450	
BUT11	TO-220AB	5	400	1.5@3/0.6
BUT11A			450	1.5@2.5/0.5
BUT11F	SOT-186	5	400	1.5@3/0.6
BUT11AF			450	1.5@2.5/0.5
BUW11	SOT-93	5	400	1.5@3/0.6
BUW11A			450	1.5@2.5/0.5
BUT18	TO-220AB	6	400	1.5@4/0.8
BUT18A			450	
BUT18F	SOT-186	6	400	1.5@4/0.8
BUT18AF			450	
BUT12	TO-220AB	8	400	1.5@6/1.2
BUT12A			450	1.5@5/1
BUW12	SOT-93	8	400	1.5@6/1.2
BUW12A			450	1.5@5/1
BUW13	SOT-93	15	400	1.5@10/2
BUW13A			450	1.5@8/1.5
BUV98V	SOT-227B1	30	450	1.5@20A/4A
BUV98AV			450	1.5V@16A/3.2A
BUV298A	SOT-227B1	96	450	1.2@32A/6.4A
BUV298V		120	450	1.2@40A/8A
High Speed, High Voltage Darlingtons				
BU826	SOT-93	6	375	2@2.5
BU826A			400	
BU931RP	SOT-93	15A	400V	1.6V @ 7A
ESM3045AV	SOT-227B2	24	450	2@15A
ESM3045DV				
ESM4045AV	SOT-227B2	42	450	2@25A
ESM4045DV				
ESM5045DV	SOT-227B2	60A	450	2@35A
ESM6045AV	SOT-227B2	84	1000	2@50A
ESM6045DV				
High Speed, Medium Voltage Transistors				
BU406	TO-220AB	7	200	1@5
BU407			100	
BUV28	TO-220AB	12	200	1.5@6
BUV28A			225	1.5@4
BUV27	TO-220AB	13	120	1.5@8
BUV27A			150	1@7
BUV26	TO-220AB	14	90	1.5@12
BUV26A			100	1@10
Very High Voltage Transistors				
BU505	TO-220AB	2.5	700	5@2
BU506	TO-220AB	3.0	700	5@3
BU506D	TO-220AB	3.0	700	5@3
BUF706	SOT-93A	3.0	700	5@3
BU706D	SOT-93A	3.0	700	5@3
BUV89	SOT-93A	8.0	800	1@4.5
BU508A	SOT-93	8	700	1@4.5
BU508AF	SOT-199	8	1500	1@4.5A
BU508D	SOT-93A	8.0	700	1@4.5
BU508DF	SOT-199	8	1500	1@4.5A

Type	Pkg	I_C (DC) Max A	V_{CEO}	V_{CE} (Sat) Max I_C/I_B R/R
Very High Voltage Transistors (Cont.)				
BUX88	TO-3	12	800	1@9
BU603	TO-220AB	5	550	2@2A
BU903	SOT-93	6	550	2@3.2A
BU2508A	SOT-93	8A	700V	1V@4.5A

Type NPN	PNP	Pkg	I_C (DC) Max A	V_{CEO} V	h_{FE} @ I_C Min mA	V_{CE} (Sat) Max I_C/I_B A/mA	f_T MHz
High Frequency, Video, Transistors							
BF469	BF470	TO-126	0.1	250	50@25	—	60
BF471	BF472			300			
BF869	BF870	TO-202	0.1	250	50@25	—	60
BF871	BF872			300			
BF591		TO-202	0.15	170	30@100	—	—
BF593				210			
BF419	—	TO-126	0.3	250	45@20	11@ 0.2/ 20mA	90
BF457	—	TO-126	0.3	160	26@30	1@ 0.03/ 6mA	90
BF458				250			
BF459				300			
BF819	—	TO-202	0.3	250	45@20	11@ 0.2/ 20mA	90
BF857	—	TO-202	0.3	160	26@30	1@ 0.03/ 6mA	90
BF858				250			
BF859				300			

Type	Pkg	V_R V	I_F mA	V_F @ I_F V	mA	t_{RR}
Switching Diodes						
1N914	DO-35	75	75	1.00	10	4
1N914A	DO-35	75	75	1.00	20	4
1N914B	DO-35	75	75	0.72	5	4
1N916	DO-35	75	75	1.00	10	4
1N9164B	DO-35	75	75	0.73	5	4
1N4148	DO-35	75	200	1.00	10	4
1N4149	DO-35	75	200	1.00	10	4
1N4150	DO-35	50	200	0.74	10	4
1N4151	DO-35	75	200	1.00	50	2
1N4153	DO-35	75	200	0.88	20	2
1N4446	DO-35	75	200	1.00	20	4
1N4448	DO-35	75	200	0.72	5	4
1N4449	DO-35	75	200	0.73	5	4
1N4531	DO-34	75	200	1.00	10	4
1N4532	DO-34	75	200	1.00	10	2
BAS11	DO-35	300	350	1.10	300	1000
BAV10	DO-35	60	300	1.00	200	6
BAV18	DO-35	50	250	1.00	100	50
BAV19	DO-35	100	250	1.00	100	50
BAV20	DO-35	150	250	1.00	100	50
BAV21	DO-35	200	250	1.00	100	50

Type	Pkg	V_R V	I_F mA	C_D @ V_R pF	V
Bandswitch Diodes					
BA223	DO-34	20	50	3.5	6
BA423	DO-34	20	50	2.5	3
BA482	DO-34	35	100	1.2	3
BA483	DO-34	35	100	1.0	3
BA484	DO-34	35	100	1.6	3

Type	Pkg	V_R V	I_F mA	V_F @ I_F V	mA
Schottky Barrier Diodes					
BA480	DO-34	4	30	280	1
BA481	DO-34	4	30	450	1
BAT81	DO-34	40	30	410	1
BAT82	DO-34	50	30	410	1
BAT83	DO-34	60	30	410	1
BAT85	DO-34	30	200	320	1
BAT86	DO-34	50	200	380	1
BYV10-20	DO-41	20	1000	550	1000
BYV10-30	DO-41	30	1000	550	1000
BYV10-40	DO-41	40	1000	550	1000

Type	Pkg	V_R V	I_F mA	C_D @ V_R pF	@ f V	MHz
Variable Capacitance Diodes						
BB119	DO-35	15	200	20-25	4.0	1.0
BB417	DO-34	20	20	8-11	4.0	0.5
BB112	SOD-69	12	50	440-540	1.0	1.0
BB130	SOD-69	30	50	450-550	1.0	1.0
BB212	TO-92	12	100	500-620	0.5	1.0
BB204B	TO-92	30	100	37-42	3.0	1.0
BB204G	TO-92	30	100	34-39	3.0	1.0
BB405B	DO-34	30	20	18 MAX	1.0	0.5
BB809	DO-34	28	20	39-46	1.0	0.5
BB909A	DO-34	30	20	31 MIN	1.0	0.5
BB909B	DO-34	30	20	33.5 MIN	1.0	0.5
BB910	DO-34	28	20	28 MIN	0.5	1.0
BB911	DO-34	30	20	63 MIN	0.5	1.0

Type	V_Z @ I_{ZT} V	Z_{ZT} @ I_{ZT} Ω	I_{ZT} mA
Zener Diodes–400mW, 5%, DO-35			
1N746A	3.3	18	20
1N747A	3.6	24	20
1N748A	3.9	23	20
1N749A	4.3	22	20
1N750A	4.7	19	20
1N751A	5.1	17	20
1N752A	5.6	11	20
1N753A	6.2	7	20
1N754A	6.8	5	20
1N755A	7.5	6	20
1N756A	8.2	8	20
1N757A	9.1	10	20
1N758A	10.0	17	20
1N759A	12.0	30	20
1N957B	6.8	4.5	18.5
1N958B	7.5	5.5	16.5
1N959B	8.2	6.5	15.0
1N960B	9.1	7.4	14.0
1N961B	10	8.5	12.5
1N962B	11	9.5	11.5
1N963B	12	11.5	10.5
1N964B	13	13	9.5
1N965B	15	16	8.5
1N966B	16	17	7.8
1N967B	18	21	7.0
1N968B	20	25	6.2
1N969B	22	29	5.6
1N970B	24	33	5.2
1N971B	27	41	4.6
1N972B	30	49	4.2
1N973B	33	58	3.8
Zener Diodes–500mW, 5%, DO-35			
1N5225B	3.0	29	20
1N5226B	3.3	28	20
1N5227B	3.6	24	20
1N5228B	3.9	23	20
1N5229B	4.3	22	20
1N5230B	4.7	19	20
1N5231B	5.1	17	20
1N5232B	5.6	11	20
1N5233B	6.0	7	20
1N5234B	6.2	7	20
1N5235B	6.8	5	20
1N5236B	7.5	6	20
1N5237B	8.2	8	20
1N5238B	8.7	8	20
1N5239B	9.1	10	20
1N5240B	10	17	20
1N5241B	11	22	20
1N5242B	12	20	20
1N5243B	13	13	9.5
1N5244B	14	15	9.0
1N5245B	15	16	8.5
1N5246B	16	17	7.8
1N5247B	17	19	7.4
1N5248B	18	21	7.0
1N5249B	19	23	6.6
1N5250B	20	25	6.2
1N5251B	22	29	5.6
1N5252B	24	33	5.2
1N5253B	25	35	5.0
1N5254B	27	41	4.6
1N5255B	28	44	4.5
1N5256B	30	49	4.2
1N5257B	32	58	3.8
1N5258B	36	70	3.4
1N5259B	39	80	3.2
1N5260B	43	93	3.0
1N5261B	47	105	2.7
1N5262B	51	125	2.5
1N5263B	56	150	2.2
1N5264B	60	170	2.1
1N5265B	62	185	2.0
1N5266B	68	230	1.8
1N5267B	75	270	1.7
Zener Diodes–1.0W, 5%, DO-41			
1N4728A	3.3	10	76
1N4729A	3.6	10	69
1N4730A	3.9	9.0	64
1N4731A	4.3	9.0	58
1N4732A	4.7	8.0	53
1N4733A	5.1	7.0	45
1N4734A	5.6	5.0	45
1N4735A	6.2	2.0	41
1N4736A	6.8	3.5	37
1N4737A	7.5	4.0	34
1N4738A	8.2	4.5	31
1N4739A	9.1	5.0	28
1N4740A	10	7.0	25
1N4741A	11	8.0	23
1N4742A	12	9.0	21
1N4743A	13	10	19
1N4744A	15	14	17
1N4745A	16	16	15.5
1N4746A	18	20	14
1N4747A	20	22	12.5

Type	Pkg	V_R V	I_F mA	I_R @ V_R A	V	V_R @ I_F V	mA
Low Leakage Diodes							
BAV45A	TO-18	20	50	5pA	5	1.00	10
BAS45	DO-34	125	225	1nA	125	0.80	5

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PHILIPS SMALL SIGNAL LEADED SEMICONDUCTORS

TRANSISTORS, DIODES, DARLINGTONS

See pages A•2118 & A•2119

Type	Pkg	Ref. V	△V ref mV	T_c %/°C	r_{DIFF} Ω
Temp. Compensated Ref. Diodes					
1N821	DO-34	6.2	96	0.01	15
1N823	DO-34	6.2	48	0.005	15
1N825	DO-34	6.2	19	0.002	15
1N827	DO-34	6.2	9	0.001	15
1N829	DO-34	6.2	5	0.0005	15
1N821A	DO-34	6.2	96	0.01	10
1N823A	DO-34	6.2	48	0.005	10
1N825A	DO-34	6.2	19	0.002	10
1N827A	DO-34	6.2	9	0.001	10
1N829A	DO-34	6.2	5	0.0005	10

Type	Pkg	BV_{CES} V	I_C mA	h_{FE} @ I_C mA		V_{CE}(Sat) @ I_C @ I_B V	mA	mA	f_T @ I_C MHz	mA
Darlington Transistors–NPN										
MPSA12	TO-92	20	300	20,000	10	1.0	10	0.01	—	—
MPSA13	TO-92	30	500	10,000	100	1.5	100	0.10	125	10
MPSA14	TO-92	30	500	20,000	100	1.5	100	0.10	125	10
MPSA25	TO-92	40	500	10,000	100	1.5	100	0.10	125	10
MPSA26	TO-92	50	500	10,000	100	1.5	100	0.10	125	10
MPSA27	TO-92	60	600	10,000	100	1.5	100	0.10	—	—
MPSA28	TO-92	80	500	10,000	100	1.5	100	0.10	125	10
MPSA29	TO-92	100	500	10,000	100	1.5	100	0.10	125	10
—PNP										
MPSA62	TO-92	20	500	20,000	10	1.0	10	0.01	—	—
MPSA63	TO-92	30	500	10,000	100	1.5	100	0.10	125	10
MPSA64	TO-92	30	500	20,000	100	1.5	100	0.10	125	10
MPSA75	TO-92	40	500	10,000	100	1.5	100	0.10	125	10
MPSA76	TO-92	50	500	10,000	100	1.5	100	0.10	125	10
MPSA77	TO-92	60	500	10,000	100	1.5	100	0.10	—	—

Type	Pkg	BV_{CBO} V	I_C mA	h_{FE} @ I_C min	max	mA	f_T @ I_C MHz	mA
General Purpose & Switching Transistors–NPN								
2N1613	TO-39	50	500	40	120	150	60	50
2N1711	TO-39	50	1000	100	300	150	70	50
2N1893	TO-39	80	500	40	120	150	—	—
2N2218	TO-39	30	800	40	120	150	250	20
2N2219	TO-39	60	800	100	300	150	250	20
2N2219A	TO-39	75	800	100	200	150	300	20
2N2222	TO-18	30	800	100	300	150	250	20
2N2222A	TO-18	40	800	100	300	150	300	20
2N2297	TO-39	35	1000	40	120	150	60	50
2N2368	TO-18	15	200	20	60	10	400	10
2N2369	TO-18	15	200	40	120	10	500	10
2N2369A	TO-18	15	200	40	120	10	500	10
2N2483	TO-18	60	50	40	120	.01	60	.5
2N2484	TO-18	60	50	100	500	.01	60	.5
2N3019	TO-39	80	1000	100	200	150	100	50
2N3020	TO-39	80	1000	40	120	150	80	50
2N3053	TO-39	40	700	50	250	150	80	50
2N3903	TO-92	40	200	50	150	10	300	10
2N3904	TO-92	40	200	100	300	10	250	10
2N4123	TO-92	30	200	50	150	2	250	10
2N4124	TO-92	25	200	120	360	2	300	10
2N4400	TO-92	40	600	50	150	150	200	20
2N4401	TO-92	40	600	100	300	150	250	20
2N5088	TO-92	30	50	300	900	0.1	50	.5
2N5089	TO-92	25	50	400	1200	0.1	50	.5
2N6428	TO-92	50	200	250	650	0.1	100	1
2N6428A	TO-92	50	200	250	650	0.1	100	1
2PC945	TO-92	60	100	200	—	1.0	250	1
2PC1815	TO-92	60	150	250	—	1.0	8	1
2PC1815L	TO-92	60	150	140	—	1.0	8	1
JC337	TO-92	45	500	100	600	100	100	10
JC500	TO-92	25	100	90	600	1	130	10
JC501	TO-92	45	90	—	—	1.0	150	1
JC546	TO-92	65	100	110	450	2	300	10
JC547	TO-92	45	100	110	800	2	300	10
JC548	TO-92	30	100	110	800	2	300	10
MPS3646	TO-92	15	300	30	120	30	350	30
MPS3704	TO-92	30	600	100	300	50	100	50
MPS3705	TO-92	30	600	50	150	50	100	50
MPS3706	TO-92	20	600	30	600	50	100	50
MPS3904	TO-92	60	200	100	300	10	300	10
MPS5172	TO-92	25	100	100	500	10	120	2
MPS6512	TO-92	30	100	50	100	2	—	—
MPS6513	TO-92	30	100	90	180	2	(330)	10
MPS6514	TO-92	25	100	150	300	2	(480)	10
MPS6515	TO-92	25	100	250	500	2	(480)	10
MPS6520	TO-92	25	100	200	600	2	(390)	2
MPS6521	TO-92	25	100	300	—	2	(390)	2
MPS6530	TO-92	40	600	40	120	100	—	—
MPS6531	TO-92	40	600	90	270	200	(390)	50
MPS6532	TO-92	30	600	30	—	100	—	—
MPS6560	TO-92	25	500	50	200	500	60	10
MPS6601	TO-92	25	1000	50	—	500	100	50
MPS6602	TO-92	40	1000	50	—	500	100	50
MPS8098	TO-92	60	500	100	300	1.0	150	10
MPSA05	TO-92	60	500	50	—	100	100	10
MPSA06	TO-92	80	500	50	—	100	100	10
PN2222	TO-92	30	800	100	300	150	250	20
PN2222A	TO-92	40	800	100	300	150	300	20
PN2369	TO-92	15	500	40	120	10	500	10
PN2369A	TO-92	15	600	40	120	10	500	10

Type	Pkg	BV_{CBO} V	I_C mA	h_{FE} @ I_C min	max	mA	f_T @ I_C MHz	mA
General Purpose & Switching Transistors–PNP								
2N2904A	TO-39	60	600	40	120	150	200	50
2N2905	TO-39	40	600	100	300	150	200	50
2N2905A	TO-39	60	600	100	300	150	200	50
2N2906	TO-18	60	600	35	—	10	200	50
2N2906A	TO-18	60	600	40	120	150	200	50
2N2907	TO-18	40	600	100	300	150	200	50
2N2907A	TO-18	60	600	100	300	150	200	50
2N3905	TO-92	40	200	50	150	10	300	10
2N3906	TO-92	40	200	100	300	10	300	10
2N4030	TO-39	60	1000	40	120	100	100	50
2N4031	TO-39	80	1000	40	120	100	100	50
2N4032	TO-39	60	1000	100	300	100	150	50
2N4033	TO-39	80	1000	100	300	100	150	50
2N4125	TO-92	30	200	50	150	2	200	10
2N4126	TO-92	25	200	120	360	2	250	10
2N4402	TO-92	40	600	50	150	150	150	20
2N4403	TO-92	40	600	100	300	150	200	20
2N5086	TO-92	50	50	150	500	0.1	40	.5
2N5087	TO-92	50	50	250	800	0.1	40	.5
2PA733	TO-92	50	100	205	—	1	180	—
2PA1015	TO-92	50	150	70	—	2	80	—
2PA1015L	TO-92	50	150	140	—	2	80	—
JA100	TO-92	25	100	90	600	1	130	10
JA101	TO-92	45	100	90	600	1	130	10
JC327	TO-92	45	500	100	600	100	100	10
JC328	TO-92	25	500	100	600	100	100	10
JC556	TO-92	65	100	75	475	2	200	10
JC557	TO-92	45	100	75	800	2	200	10
JC558	TO-92	30	100	75	800	2	200	10
MPS3640	TO-92	12	80	30	120	10	500	10
MPS3702	TO-92	40	600	60	300	50	100	50
MPS3703	TO-92	50	600	30	150	50	100	50
MPS3906	TO-92	40	200	100	300	10	250	10
MPS6516	TO-92	40	100	50	100	2	—	—
MPS6517	TO-92	40	100	90	180	2	(330)	10
MPS6518	TO-92	40	100	150	300	2	(480)	10
MPS6519	TO-92	25	100	250	500	2	(480)	10
MPS6522	TO-92	25	100	200	600	2	(340)	2
MPS6523	TO-92	25	100	300	—	2	(340)	2
MPS6533	TO-92	40	600	40	120	100	—	—
MPS6534	TO-92	40	600	90	270	100	(390)	50
MPS6535	TO-92	30	600	30	—	100	—	—
MPS6562	TO-92	25	500	50	200	500	60	10
MPS6651	TO-92	40	1000	50	—	500	100	50
MPS8598	TO-92	60	500	100	300	1	150	10
MPS8599	TO-92	80	500	100	300	1	150	10
MPSA55	TO-92	60	500	50	—	150	50	100
MPSA56	TO-92	80	500	50	—	150	50	100
PN2907	TO-92	40	600	100	300	150	200	50
PN2907A	TO-92	60	600	100	300	100	200	50

Type	Pkg	BV_{CEO} V	I_C mA	h_{FE} @ I_C min	mA	V_{CE} (Sat) @ I_C V	mA	f_T @ I_C MHz	mA
High Voltage Transistors–NPN									
2N3439	TO-39	350	1000	40	20	0.50	50	4	10
2N3440	TO-39	250	1000	40	20	0.50	50	4	10
2N5550	TO-92	140	600	80	10	0.25	50	100	10
2N5551	TO-92	160	600	80	10	0.20	50	10	10
MPSA42	TO-92	300	500	40	10	0.50	20	50	10
MPSA43	TO-92	200	500	40	10	0.50	20	50	10
PN3439	TO-92	350	1000	40	20	0.50	50	4	10
PN3440	TO-92	250	1000	40	20	0.50	50	4	10

Type	Pkg	BV_{CEO} V	I_C mA	h_{FE} @ I_C min	mA	V_{CE} (Sat) @ I_C V	mA	f_T @ I_C MHz	mA
—PNP									
2N5400	TO-92	120	600	40	10	0.50	50	100	10
2N5401	TO-92	150	600	60	10	0.50	50	100	10
2N5415	TO-39	200	1000	30	50	2.50	50	15	10
2N5416	TO-39	350	1000	30	50	2.00	50	15	10
MPSA92	TO-92	300	500	40	10	0.50	20	50	10
MPSA93	TO-92	200	500	40	10	0.50	20	50	10
PN5415	TO-92	200	1000	30	50	2.50	50	15	10
PN5416	TO-92	350	1000	30	50	2.50	50	15	10

Type	Pkg	Mode	V_{DS} V	I_D mA	r_{DS}on Ω	yfs mA/V	V_{GS}(th) V
Field Effect Transistors, D-MOS, FET, N-Channel							
2N6659	TO-39	ENH	35	1140	0.9	>170	0.8-2.0
2N6660	TO-39	ENH	60	1100	1.4	>170	0.8-2.0
2N6661	TO-39	ENH	90	900	1.9	>170	0.8-2.0
2N7000	TO-92	ENH	60	500	2.5	200	1-2.5
BS107	TO-92	ENH	200	120	15	—	—
BS170	TO-92	ENH	60	500	3.5	200	0.8-3.0
BSD10	TO-72	DPL	10	50	15	15	<2.0
BSD12	TO-72	DPL	20	50	15	15	<2.0
BSD212	TO-72	ENH	10	50	25	15	0.1-2.0
BSD213	TO-72	ENH	10	50	25	15	0.1-2.0
BSD214	TO-72	ENH	20	50	25	15	0.1-2.0
BSD215	TO-72	ENH	20	50	25	15	0.1-2.0
BST70A	TO-92	ENH	80	500	2	300	1.5-3.5
BST72A	TO-92	ENH	80	300	7	150	1.5-3.5
BST74A	TO-92	ENH	200	250	6	250	0.8-2.8

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Philips Components
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PHILIPS SMALL SIGNAL LEADED SEMICONDUCTORS

TRANSISTORS, FETs

See pages A•2118 & A•2119

Type	Pkg	Mode	V_{DS} V	I_D mA	r_{DS}on Ω	yfs mA/V	V_{GS}(th) V
Field Effect Transistors, D-MOS, FET, N-Channel (Cont.)							
BST76A	TO-92	ENH	180	300	6	250	0.7-2.7
BST78	TO-126	ENH	450	750	10	400	2.0-4.0
BST90	TO-39	ENH	80	500	2.0	300	1.5-3.5
BST97	TO-18	ENH	180	300	6	250	0.7-2.7
PH6659	TO-92	ENH	35	750	0.9	>170	0.8-2
PH6660	TO-92	ENH	60	500	1.4	>170	0.8-2
PH6661	TO-92	ENH	90	500	1.9	>170	0.8-2

Type	Pkg	Mode	V_{DS} V	I_D mA	r_{DS}on Ω	yfs mA/V	V_{GS}(th) V
P-Channel							
BST100	TO-92	ENH	60	300	4.5	200	1.5-3.5
BST110	TO-92	ENH	50	250	7.5	125	1.5-3.5
BST250	TO-92	ENH	45	250	9.0	125	1.0-3.5

Type	Pkg	$\pm V_{DS}$ V	I_{DSS} mA	$-V_{(P)GS}$ V	r_{DS}on Ω	C_{RS} @ V_{GS} pF	V
J-FET							
2N3822	TO-72	50	2-10	<6	—	3.0	0
2N3823	TO-72	30	4-20	<8	—	2.0	0
2N3966	TO-72	30	>2	4-6	220	1.5	7
2N4091	TO-18	40	>30	5-10	30	5.0	20
2N4092	TO-18	40	>15	2-7	50	5.0	20
2N4093	TO-18	40	>8	1-5	80	5.0	20
2N4391	TO-18	40	50-150	4-10	30	3.5	12
2N4392	TO-18	40	25-75	2-5	60	3.5	7
2N4393	TO-18	40	5-30	0.5-3	100	3.5	5
2N4856	TO-18	40	>50	4-10	25	8.0	10
2N4857	TO-18	40	25-100	2-6	40	8.0	10
2N4858	TO-18	40	8-80	0.8-4	60	8.0	10
2N4859	TO-18	30	>50	4-10	25	8.0	10
2N4860	TO-18	30	25-100	2-6	40	8.0	10
2N4861	TO-18	30	8-80	0.8-4	60	8.0	10
BF245A/0	TO-92	30	0.5-2.1	<8	—	1.1typ	1
BF245A	TO-92	30	2-6.5	<8	—	1.1typ	1
BF245B	TO-92	30	6-15	<8	—	1.1typ	1
BF245C	TO-92	30	12-25	<8	—	1.1typ	1
BF247A	TO-92	25	30-80	<14.5	—	3.5typ	—
BF247B	TO-92	25	60-140	<14.5	—	3.5typ	—
BF247C	TO-92	25	110-250	<14.5	—	3.5typ	—
BF256A	TO-92	30	3-7	—	—	0.7typ	0
BF256B	TO-92	30	6-13	—	—	0.7typ	0
BF256C	TO-92	30	11-18	—	—	0.7typ	0
BF410A	TO-92	20	0.7-3	0.8	—	0.5	0
BF410B	TO-92	20	2.5-7	1.5	—	0.4	0
BF410C	TO-92	20	6-12	2.2	—	0.4	—
BF410D	TO-92	20	10-18	3	—	0.4	—
BFU308	TO-92	25	12-60	—	—	2.5typ	—
BFU309	TO-92	25	12-30	—	—	2.5typ	—
BFU310	TO-92	25	24-60	—	—	2.5typ	—
BFW10	TO-72	30	8-20	<8	—	0.8	0
BFW11	TO-72	30	4-10	<6	—	0.8	0
BFW12	TO-72	30	1-5	<2.5	—	0.8	0
BFW13	TO-72	30	0.2-1.5	<1.2	—	0.8	0
J108	TO-92	25	>80	3-10	8	15	10
J109	TO-92	25	>40	2-6	12	15	10
J110	TO-92	25	>10	0.5-4	18	15	10
J111	TO-92	35	20	3-10	30	5.0	10
J112	TO-92	35	5	1-5	50	5.0	10
J113	TO-92	35	2	0.5-3	100	5.0	10
J174	TO-92	30	20-135	5-10	85	4.0	10
J175	TO-92	30	7-70	3-6	125	4.0	10
J176	TO-92	30	2-35	1-4	250	4.0	10
J177	TO-92	30	1.5-20	0.8-2.25	300	4.0	10
J308	TO-92	25	12-60	—	—	2.5typ	—
J309	TO-92	25	12-60	—	—	2.5typ	—
J310	TO-92	25	24-60	—	—	2.5typ	—
PN4391	TO-92	40	50-150	4-10	30	3.5	12
PN4392	TO-92	40	25-75	2-5	60	3.5	7
PN4393	TO-92	40	5-30	0.5-3	100	3.5	5
PN4416	TO-92	30	5-15	—	—	0.8typ	—

Type	Pkg	$\pm V_{DS}$ V	I_{DSS} mA	$-V_{(P)G1-S}$ V	y_{fs} mA/V	N_F & G_p @ f dB	f MHz	C_{rss} fF
Dual Gate MOSFET								
BF960	SOT-103	20	2-20	3.5	12	2.8	16.5	800	25
BF964	SOT-103	20	2-20	2.5	17	1.5	25	200	25
BP964S	SOT-103	20	4-20	2.5	18	1.0	25	200	25
BF965	SOT-103	20	2-20	2.5	18min.	1	25	200	25
BF966	SOT-103	20	2-20	2.5	17	2.8	18	800	25
BF966S	SOT-103	20	4-20	2.5	18	1.8	18	800	25
BF980	SOT-103	18	—	1.3	19	2.8	—	800	25
BF980A	SOT-103	18	—	20	19	2	—	800	25
BF981	SOT-103	20	4-25	2.5	14	1.0	26	200	25
BF982	SOT-103	20	—	1.3	25	1.2	—	200	30
BF988	SOT-103	12	2-18	2.5	24	1	—	—	—

Type	Pkg	BV_{CEO} V	I_C mA	f_T @ I_C GHz	mA	dB	N_F @ f @ I_C MHz	mA
High Frequency Transistors–NPN								
2N2857	TO-72	15	40	>1	2	<4.5	450	1.5
2N5053	TO-72	15	25	1.2	2	<3.5	200	2
2N5054	TO-72	15	25	1.5	2	<3.5	200	2
2N6595	TO-72	15	25	>3.5	14	<3.2	200	2
2N6596	TO-72	15	25	>4	14	<2	200	2
2N6597	TO-72	12	35	>3.5	30	<3.2	200	2
2N6598	TO-72	12	35	>4	30	<2	200	2
2N6599	TO-72	15	75	>3.5	50	<4	200	5

Type	Pkg	BV_{CEO} V	I_C mA	f_T @ I_C GHz	mA	dB	N_F @ f @ I_C MHz	mA
High Frequency Transistors–NPN (Cont.)								
2N6600	TO-72	15	75	>3.5	50	4	200	50
2N6601	TO-72	10	50	1.8	30	<4	200	2
BF498	TO-92	20	20	0.55	—	2.5	200	—
BF748	TO-92	20	50	1.2	—	4.5	200	—
MPSH10	TO-92	25	40	>0.65	4	—	100	—
BF506	TO-92	20	25	0.35	—	5	—	—
BF926	TO-92	20	25	0.35	1	5	800	1
BF970N	SOT-37	35	30	0.9	3	4.5	200	3
BF979	SOT-37	20	30	1.35	10	4.5	800	10
MPSH81	TO-92	20	—	>0.6	—	—	800	—
							—	

WIDEBAND TRANSISTORS

Type	Package	V_{CEO} V	I_C mA	h_{FE} min./max. at I_C/V_{CE} mA/V		NF typ. at I_C dB	mA	f_T typ. GHz
NPN								
BF689K	TO-92	15	25	35/70	20/5	3	2	1.8
BF763	TO-92	15	25	25/250	5/10	5	5	1.8
BFG34	SOT-103	18	150	25/-	10/10	2.3	20	3.7
BFG65	SOT-103	10	50	60/-	15/5	3	15	7.5
BFG90A	SOT-103	15	25	40/-	14/10	2.4	14	5
BFG91A	SOT-103	12	35	40/-	30/5	2.3	30	6
BFG96	SOT-103	15	75	25/-	50/10	4	70	5
BFG134	SOT-103	15	150	80/-	100/10	—	—	7
BFG195	SOT-103	10	100	40/-	50/5	1.4	15	7.5
BFP90A	SOT-173	15	30	40/-	14/10	1.7	4	5
BFP91A	SOT-173	12	50	40/-	30/5	1.6	4	6
BFP96	SOT-173	15	100	25/-	50/10	3.7	50	5
BFQ22S	TO-72	12	35	50/150	10/5	1.9	2	5
BFQ33C	SOT-173	7	20	50/-	14/5	3	5	12
BFQ34	SOT-122	18	150	25/-	75/15	8	120	3.5
BFQ34T	SOT-37	18	150	25/-	100/10	—	—	3.7
BFQ53	TO-72	15	25	25/-	14/10	2.4	2	5
BFQ63	TO-72	15	75	50/150	20/5	3	10	4.5
BFQ65	SOT-37	10	50	60/-	15/5	3	15	7.5
BFQ66	SOT-173	10	50	60/-	15/5	2.5	5	7.5
BFQ68	SOT-122	18	300	25/-	240/15	—	—	4
BFQ135	SOT-172A2	19	150	55/-	120/18	—	—	6.5
BFQ136	SOT-122	18	600	25/-	500/15	—	—	4
BFQ161	TO-92	20	10	25/-	—	—	—	1
BFQ162	TO-126	10	500	25/-	300/5	—	—	>1
BFQ163	TO-39	10	500	25/-	300/5	—	—	>1
BFQ231	TO-92	65	300	20/-	—	—	—	>1
BFQ231A	TO-92	95	300	20/-	—	—	—	>0.8
BFQ232	TO-126	65	300	20/-	50/10	—	—	1.4
BFQ232A	TO-126	95	300	20/-	—	—	—	>0.8
BFQ233	TO-39	65	300	20/-	50/10	—	—	1.4
BFQ233A	TO-39	95	300	20/-	—	—	—	>0.8
BFQ234	SOT-172A1	65	300	20/-	50/10	—	—	1.4
BFQ235	SOT-128B	65	300	20/-	50/10	—	—	1
BFQ235A	SOT-128	95	300	20/-	—	—	—	>0.8
BFQ262	TO-126	65	100	400	15/-	100/10	—	—
BFQ262A	TO-126	95	115	400	15/-	—	—	—
BFQ263	TO-39	65	100	400	15/-	100/10	—	—
BFQ263A	TO-39	95	115	400	15/-	—	—	—
BFQ265	SOT-128B	65	100	400	15/-	100/10	—	—
BFQ265A	SOT-128	95	115	400	15/-	—	—	—
BFQ268	SOT-172A1	65	100	400	15/-	100/10	—	—
BFQ270	SOT-172	18	—	270	—	—	—	—
BFR90A	SOT-37	15	20	25	40/-	14/10	2.4	2
BFR91A	SOT-37	12	15	35	40/-	30/5	1.6	4
BFR95	TO-39	25	30	150	30/-	50/20	9	80
BFR96S	SOT-37	15	20	100	25/-	70/10	4	70
BFR134	SOT-37	18	25	150	80/-	100/10	—	—
BFT24	SOT-37	5	8	2.5	20/-	1/1	3.8	1
BFW16A	TO-39	25	40	150	25/-	50/5	<6	30
BFW17A	TO-39	25	40	150	25/-	50/5	—	—
BFW30	TO-72	10	20	50	25/-	25/5	<5	2
BFW92	SOT-37	15	25	25	20/150	2/1	4	2
BFW92A	SOT-37	15	25	25	20/150	2/1	2.5	2
BFW93	SOT-37	10	18	50	25/-	25/5	<5	2
BFX89	TO-72	15	30	25	20/150	2/1	<6.5	2
BFY90	TO-72	15	30	25	25/150	2/1	<3.5	2
PNP								
BFG23	SOT-103	12	15	35	20/-	30/5	3.7	30
BFG32	SOT-103	15	20	75	20/-	50/10	4.3	50
BFG51	SOT-103	15	20	25	20/-	14/10	3.4	14
BFG54	SOT-103	18	—	150	—	—	—	—
BFQ23	SOT-37	12	15	35	20/-	30/5	2.4	2
BFQ23C	SOT-173	12	15	50	20/-	30/5	2.3	4
BFQ24	TO-72	12	15	35	20/-	30/5	2.4	2
BFQ32	SOT-37	15	20	75	20/-	50/10	—	—
BFQ32C	SOT-173	15	20	100	20/-	50/10	4.3	50
BFQ32M	TO-72	15	20	75	20/-	20/5	1.9	10
BFQ32S	SOT-37	15	20	100	20/-	70/10	4.3	50
BFQ51	SOT-37	15	20	25	20/-	14/10	2.4	4
BFQ51C	SOT-173	15	20	30	20/-	14/10	2.5	4
BFQ52	TO-72	15	20	25	20/-	14/10	2.7	2
BFQ54	SOT-122	18	25	150	25/-	150/15	—	—
BFQ54T	SOT-37	18	25	150	25/-	100/10	—	—
BFQ251	TO-92	65	100	300	20/-	—	—	—
BFQ251A	TO-92	95	115	300	20/-	—	—	—
BFQ252	TO-126	65	100	300	20/-	50/10	—	—
BFQ252A	TO-126	95	115	300	20/-	50/10	—	—
BFQ253	TO-39	65	100	300	20/-	50/10	—	—
BFQ253A	TO-39	95	115	300	20/-	—	—	—
BFQ254	SOT-172A1	65	100	300	20/-	50/10	—	—
BFQ255	SOT-128B	65	100	300	20/-	50/10	—	—
BFQ255A	SOT-128	95	115	300	20/-	—	—	—

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PHILIPS SMALL SIGNAL SEMICONDUCTORS

SURFACE MOUNT SEMICONDUCTORS

See pages A•2118 & A•2119

SURFACE MOUNT SEMICONDUCTORS

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	$t_{(MAX)}$ on/off @ I_C/I_S ns	mA
Switching Transistors–NPN							
BSR13	SOT-23	30	800	100/300	150/10	35/285	150/—
BSR14	SOT-23	40					
BSR17	SOT-23	40	200	50/150	10/1	70/225	10/1
BSR17A	SOT-23	40	200	100/300	10/1	70/250	10/1
BSR40	SOT-89	60	1000	40/120	100/5	250/1000	100/5
BSR41	SOT-89			100/300			
BSR42	SOT-89	80	1000	40/120	100/5	250/1000	100/5
BSR43	SOT-89			100/300			
BSS64	SOT-23	80	100	20/80	10/1	/1000	15/1
BSV52	SOT-23	12	100	40/120	10/1	12/18	10/3
PMBT2369	SOT-23	15	500	40/120	10/1	12/18	10/3
PMBT2222	SOT-23	40	600	100/300	150/10	35/285	150/15
PMBT2222A	SOT-23	40	600	100/300	150/10	35/285	150/15
PMBT4401	SOT-23	40	600	100/300	150/1	35/255	150/15
PXT2222A	SOT-89	40	600	100/300	150/10	35/285	150/15
PXT4401	SOT-89	40	600	100/300	150/1	35/255	150/15
PZT2222A	SOT-223	40	600	100/300	150/10	35/285	150/15
BSP40	SOT-223	60	1000	40/120	100/5	250/1000	100/5
BSP41	SOT-223	60	1000	100/300	100/5	250/1000	100/5
BSP42	SOT-223	80	1000	40/120	100/5	250/1000	100/5
BSP43	SOT-223	80	1000	100/300	100/5	250/1000	100/5

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	$t_{(MAX)}$ on/off @ I_C/I_S ns	mA
–PNP							
PMBT3640	SOT-23	12	80	20/—	50/1	25/35	10/5
BSR12	SOT-23	15	100	30/120	50/1	20/30	30/3
BSR15	SOT-23	40	600	100/300	150/10	45/100	150/15
BSR16	SOT-23	60	600	100/300	150/10	45/100	150/15
BSR18	SOT-23	40	200	50/150	10/1	70/250	10/1
BSR18A	SOT-23	40	200	100/300	10/1	70/300	10/1
PMBT4403	SOT-23	40	600	100/300	150/2	35/225	150/15
PXT4403	SOT-89	40	600	100/300	150/2	35/225	150/15
BSR30	SOT-89	60	1000	40/120	100/5	500/650	100/5
BSR31	SOT-89	60		100/300			
BSR32	SOT-89	80		40/120			
BSR33	SOT-89	80		100/300			
BSS63	SOT-23	100	100	30/—	25/1	—	—
PMBT2907	SOT-23	40	600	100/300	150/10	45/100	150/15
PMBT2907A	SOT-23	60	600	100/300	150/10	45/100	150/15
PXT2907A	SOT-89	60	600	100/300	150/10	45/100	150/15
PZT2907A	SOT-223	80	1000	40/120	100/5	500/650	100/5
BSP30	SOT-223	60	1000	40/120	100/5	500/650	100/5
BSP31	SOT-223	60	1000	100/300	100/5	500/650	100/5
BSP32	SOT-223	80	1000	40/120	100/5	500/650	100/5
BSP33	SOT-223	80	1000	100/300	100/5	500/650	100/5

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	f_t MHz
General Purpose Transistors, NPN						
BC817	SOT-23	45	500	100/600	100/1	100
BC818	SOT-23	25	500	100/600	100/1	100
BC846	SOT-23	65	200	110/450	2/5	300
BC847	SOT-23	45	200	110/800	2/5	300
BC848	SOT-23	30	200	110/800	2/5	300
BC868	SOT-89	20	1000	85/375	500/1	60
BCP68	SOT-223	20	1000	85/375	500/1	60
BCV61	SOT-143	30	100	100/800	2/5	300
PMBT2222	SOT-23	30	600	100/300	150/10	>250
BCV71	SOT-23	60	100	110/220	2/5	300
BCV72	SOT-23	60	100	200/450	2/5	300
BCW31	SOT-23	32	100	110/220	2/5	300
BCW32	SOT-23	32	100	220/450	2/5	300
BCW33	SOT-23	32	100	420/800	2/5	300
BCW60A	SOT-23	32	200	120/220	2/5	250
BCW60B	SOT-23	32	200	180/310	2/5	250
BCW60C	SOT-23	32	200	250/460	2/5	250
BCW60D	SOT-23	32	200	380/630	2/5	250
PMBTA20	SOT-23	40	100	40/400	5/10	>125
BCW71	SOT-23	45	100	110/220	2/5	300
BCW72	SOT-23	45	100	200/450	2/5	300
BCW81	SOT-23	45	100	420/800	2/5	300
BCX19	SOT-23	45	500	100/600	100/1	200
BCX20	SOT-23	25	500	100/600	100/1	200
BCX54	SOT-89	45	1000	40/250	150/2	130
BCX55	SOT-89	60	1000	40/250	150/2	130
BCX56	SOT-89	80	1000	40/250	150/2	130
BCX70G	SOT-23	45	200	120/220	2/5	250
BCX70H	SOT-23	45	200	180/310	2/5	250
BCX70J	SOT-23	45	200	250/460	2/5	250
BCX70K	SOT-23	45	200	380/630	2/5	250
PMBTA05	SOT-23	60	500	50/	100/1	>100
PMBTA06	SOT-23	80	500	50/	100/1	>100
PMBT3903	SOT-23	40	200	50/150	10/1	>250
PMBT3904	SOT-23	40	200	100/300	10/1	>300
PXT3904	SOT-89	40	200	100/300	10/1	>300
PXT4401	SOT-89	40	600	100/300	150/1	>250
PMBT2222A	SOT-23	40	600	100/300	150/10	>300
PXT2222A	SOT-89	40	600	100/300	150/10	>300
PZT2222A	SOT-223	40	600	100/300	150/10	>300
PZT3904	SOT-223	40	200	100/300	10/1	>300
PZT4401	SOT-223	40	600	100/300	150/1	250
BCP54	SOT-223	45	1000	40/250	150/2	130
BCP55	SOT-223	60	1000	40/250	150/2	130
BCP56	SOT-223	80	1000	40/250	150/2	130

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	f_t MHz
–PNP						
BC807	SOT-23	45	500	100/600	100/1	100
BC808	SOT-23	25	500	100/600	100/1	100
BC856	SOT-23	65	100	75/475	2/5	150
BC857	SOT-23	45	100	75/475	2/5	150
BC858	SOT-23	30	100	75/800	2/5	150
BC869	SOT-89	20	1000	85/375	500/1	60
BCP69	SOT-223	20	1000	85/375	500/1	60
BCV62	SOT-143	30	100	100/800	2/5	150
BCW29	SOT-23	32	100	120/260	2/5	150
BCW30	SOT-23	32	100	215/500	2/5	150
BCW61A	SOT-23	32	200	120/220	2/5	180
BCW61B	SOT-23	32	200	180/310	2/5	180
BCW61C	SOT-23	32	200	250/460	2/5	180
BCW61D	SOT-23	32	200	380/630	2/5	180
PMBTA70	SOT-23	40	100	40/100	5/10	>125
BCW69	SOT-23	45	100	120/260	2/5	150
BCW70	SOT-23	45	100	215/500	2/5	150
BCW89	SOT-23	60	100	120/260	2/5	150
BCX17	SOT-23	45	500	100/600	100/1	100
BCX18	SOT-23	25	500	100/600	100/1	100
BCX51	SOT-89	45	1000	40/250	150/2	50
BCX52	SOT-89	60	1000	40/250	150/2	50
BCX53	SOT-89	80	1000	40/250	150/2	50
BCX71G	SOT-23	45	200	120/220	2/5	180
BCX71H	SOT-23	45	200	180/310	2/5	180
BCX71J	SOT-23	45	200	250/460	2/5	180
BCX71K	SOT-23	45	200	380/630	2/5	180
PMBTA55	SOT-23	60	500	50/	100/1	>50
PMBT2907A	SOT-23	60	600	100/300	150/10	>200
PXT2907A	SOT-89	60	600	100/300	150/10	>200
PZT2907A	SOT-223	60	600	100/300	150/10	>200
PZT3906	SOT-223	40	200	100/300	10/1	>250
PZT4403	SOT-223	40	600	100/300	150/2	200
PMBTA56	SOT-23	80	500	50/	100/1	>50
BCP53	SOT-223	80	1000	40/250	150/2	50
PMBT3906	SOT-23	40	200	100/300	10/1	>250
PMBT4403	SOT-23	40	600	100/300	150/2	>200
PXT3906	SOT-89	40	200	100/300	10/1	>250
PXT4403	SOT-89	40	600	100/300	150/2	>200
PMBT2907	SOT-23	40	600	100/300	150/10	200
BCP51	SOT-223	45	1000	40/250	150/2	50
BCP52	SOT-223	60	1000	40/250	150/2	50

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_t MHz
High Freq. Transistors–NPN								
BFS18	SOT-23	10	30	35/125	1/10	4	1	200
BFS19	SOT-23	20	30	65/225	1/10	4	1	260
BFS20	SOT-23	20	25	40/—	7/10	—	—	450
BF840	SOT-23	40	25	—	—	1.5	1	380
BF841	SOT-23	40	25	—	—	2.0	1	380

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_t MHz
–PNP								
BF536	SOT-23	30	25	25/—	1/10	5	1	350
BF550	SOT-23	40	25	50/—	1/10	1	.1	325
BF569N	SOT-23	35	30	25/—	3/10	4.5	3	900
BF579	SOT-23	20	25	20/—	10/10	4.5	10	1350
BF660	SOT-23	30	25	30/—	3/10	—	—	650
BF767	SOT-23	30	20	15/—	3/10	4	3	900
BF824	SOT-23	30	25	—	—	3	2	440

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_t GHz
Broadband Transistors–NPN								
BFQ17	SOT-89	25	150	25/—	150/5	—	—	1.2
BFQ18A	SOT-89	15	150	25/—	10/10	—	—	3.6
BFQ19	SOT-89	15	75	25/—	75/10	3.3	50	5.0
BFR53	SOT-23	10	50	25/—	50/5	5.0	2	2.0
BFG67	SOT-143	10	50	60/—	15/5	2.5	5	7.5
BFG97	SOT-223	10	100	25/90	70/10	—	—	5.5
BFG198	SOT-223	10	100	40/100	50/5	—	—	8.0
BFQ67	SOT-23	10	50	100typ	15/5	2.5	5	7.5
BFG135	SOT-223	15	150	80/120	100/10	—	—	7.0
BFS17A	SOT-23	15	35	20/—	2/1	2.5	2	2.8
BFG17A	SOT-143	15	25	20/150	2/1	2.5	2	2.8
BFG25AX	SOT-143	5	6.5	—	—	1.8	—	5
BFG35	SOT-223	18	150	25/140	100/10	—	—	4.0
BFG94	SOT-223	12	60	—	—	—	—	1.8
BFG16A	SOT-223	25	300	25/—	150/5	<6	30	1.2
BFG33	SOT-143	7	20	25/—	14/5	2.5	5	12
BFG92A	SOT-143	15	25	40/—	14/10	—	—	5
BFG93A	SOT-143	12	35	40/—	30/5	—	—	6
BFG197	SOT-143	10	100	40/—	50/5	—	—	8
BFR106	SOT-23	15	100	25/—	20/8	—	—	3.3
BFR92	SOT-23	15	25	25/—	14/10	2.4	2	5.0
BFR92A	SOT-23	15	25	40/—	14/10	1.8	4	5.0
BFR93	SOT-23	12	35	25/—	30/5	1.9	2	5.0
BFR93A	SOT-23	12	35	40/—	30/5	1.6	4	5.0
BFS17	SOT-23	15	25	20/150	2/1	4.5	2	1.3
BFT25	SOT-23	5	6.5	20/—	1/1	3.8	1	2.3
PMBTH10	SOT-23	25	—	—	—	—	—	0.65
PMBTH81	SOT-23	20	—	—	—	—	—	0.6

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_t MHz
–PNP								
BFG31	SOT-223	15	100	25/—	70/10	—	—	5
BFG55	SOT-223	18	150	25typ.	100/10	—	—	4

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See pages A•2118 & A•2119

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_T MHz
-PNP (Cont.)								
BFQ149	SOT-89	15	75	20/—	50/10	3.75	50	4.4
BFT92	SOT-23	15	25	20/—	14/10	2.7	2	5
BFT93	SOT-23	12	25	20/—	30/5	2.4	2	5

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_T MHz
Low Noise Transistors–NPN							µA	MH_z
PMBT5089	SOT-23	25	50	1.2	100	400/—	10/5	100
PMBT5088	SOT-23	30	50	1.0	100	300/—	10/5	100
PMBT6429	SOT-23	45	200	0.5	100	250/—	10/5	100
PMBT6428	SOT-23	50	200	0.5	100	250/—	10/5	100
BC849	SOT-23	30	200	200/900	2/5	1.2	200	300
BC850	SOT-23	45	200	200/900	2/5	1.0	200	300
BCF32	SOT-23	32	100	200/450	2/5	1.2	200	300
BCF33	SOT-23	32	100	420/800	2/5	1.2	200	300
BCF81	SOT-23	45	100	420/800	2/5	1.2	200	300

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_T MHz
-PNP								
BC859	SOT-23	30	100	125/800	2/5	1.0	200	150
BC860	SOT-23	45	100	125/800	2/5	1.0	200	150
BCF29	SOT-23	32	100	120/260	2/5	1.0	200	150
BCF30	SOT-23	32	100	215/500	2/5	1.0	200	150
BCF70	SOT-23	45	100	215/500	2/5	1.0	200	150
PMBT5086	SOT-23	50	50	1.2	100	150/—	10/5	100
PMBT5087	SOT-23	50	50	1.0	100	250/—	10/5	100

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_T MHz
High Voltage Transistors–NPN								
BSR19	SOT-23	140	600	60/250	10/5	—	—	100
PMBT5550	SOT-23	140	600	60/250	10/5	—	—	200
BSR19A	SOT-23	160	600	80/250	10/5	—	—	100
PMBT5551	SOT-23	160	600	80/250	10/5	—	—	200
PMBTA43	SOT-23	200	500	40/—	30/10	—	—	50
PZTA43	SOT-223	200	500	40/—	30/10	—	—	50
BF622	SOT-89	250	20	50/—	25/20			60
BF722	SOT-223	250	50	50/—	25/20			60
BF822	SOT-23	250	50	50/—	25/20			
BSP20	SOT-223	250	1000	40/160	30/10			50
BST39	SOT-89	350	1000	40/160	20/10	15		
PXTA42	SOT-89	300	500	40/1	30/10	50		
BST40	SOT-89	250	1000	40/160	20/10	15		
PMBTA42	SOT-23	300	500	40/—	30/10	50		
PZTA42	SOT-223	300	500	40/—	30/10	50		
BSP19	SOT-223	350	1000	40/160	20/10	15		
BF620	SOT-89	—	20	50/—	25/20	—	—	60
BF720	SOT-223	—	50	50/—	25/20	—	—	60
BF820	SOT-23	—	50	50/—	25/20	—	—	60

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_T MHz
-PNP								
BF621	SOT-89	—	20	50/—	25/20	60		
BF721	SOT-223	—	50	50/—	25/20	60		
BF623	SOT-89	250	20	50/—	25/20	60		
BF821	SOT-23	—	50	50/—	25/20	60		
BF823	SOT-23	250	50	50/—	25/20	60		
BSP16	SOT-223	300	1000	30/120	50/10	—	—	15
BSR20	SOT-23	120	600	40/180	10/5	100		
BSR20A	SOT-23	150	600	60/240	10/5	100		
BST15	SOT-89	200	1000	30/150	50/10	15		
BST16	SOT-89	300	1000	30/120	50/10	15		
PMBTA92	SOT-23	300	500	25/—	30/10	50		
PXTA92	SOT-89	300	500	25/—	30/10	50		
PZTA92	SOT-223	300	500	25/—	30/10	50		
PZTA93	SOT-223	200	500	25/—	30/10	—	—	50
PMBTA93	SOT-23	200	500	25/—	30/10	50		
PMBT5401	SOT-23	150	600	60/240	10/5	200		
BF723	SOT-223	200	50	50/—	25/20	60		
BSP15	SOT-223	200	1000	30/150	50/10	15		

Type	Pkg	$\pm V_{DS}$ V	$-V_{GSO}$ V	I_D mA	I_{DSS} nA	I_{DSS}mA min/max	$-V_{(P)GS}$ V	Y_{fs} mA/V	C_{rs} pF	V_N µV
Field Effect Transistors, J-FETs										
BF510	SOT-23	20	—	30	10	0.7/3.0	0.8	2.5	0.4	—
BF511	SOT-23	20	—	30	10	2.5/7.0	1.5	4	0.4	—
BF512	SOT-23	20	—	30	10	6/12	2.2	6	0.4	—
BF513	SOT-23	20	—	30	10	10/18	3	7	0.4	—
BF545A/0	SOT-23	30	—	—	—	0.5/2.1	—	—	1.1 typ	—
BF545A	SOT-23	30	—	—	—	2/6.5	—	—	1.1 typ	—
BF545B	SOT-23	30	—	—	—	6/15	—	—	1.1 typ	—
BF545C	SOT-23	30	—	—	—	12/25	—	—	1.1 typ	—
BFR30	SOT-23	25	25	10	0.2	4/10	5	1	1.5	0.5
BFR31	SOT-23	25	25	20	0.2	1/5	2.5	1.5	1.5	0.5
BFR101A	SOT-143	30	30	10	5	0.2/1.5	1.0	1.2	—	—
BFR101B	SOT-143	30	30	10	5	1/5	2.5	2.5	—	—
BFT46	SOT-23	25	25	10	0.2	0.2/1.5	1.0	1.0	1.5	0.5
BSR56	SOT-23	40	40	—	1	50/—	10	—	5	—
BSR57	SOT-23	40	40	—	1	20/100	6	—	5	—
BSR58	SOT-23	40	40	—	1	8/80	4	—	5	—
PMBF4391	SOT-23	40	40	—	1	50/150	4-10	—	3.5	—
PMBF4392	SOT-23	40	40	—	1	25/75	2-5	—	3.5	—
PMBF4393	SOT-23	40	40	—	1	5/30	0.53	—	3.5	—
PMBFJ108	SOT-23	25	25	—	—	8/—	10	—	15	—
PMBFJ109	SOT-23	25	25	—	—	40/—	6	—	15	
PMBFJ110	SOT-23	25	25	—	—	10/—	4	—	15	—

Type	Pkg	$\pm V_{DS}$ V	$-V_{GSO}$ V	I_D mA	I_{DSS} nA	I_{DSS}mA min/max	$-V_{(P)GS}$ V	Y_{fs} mA/V	C_{rs} pF	V_N µV
Field Effect Transistors, J-FETs (Cont.)										
PMBFJ111	SOT-23	40	40	—	—	20/—	10	—	3	—
PMBFJ112	SOT-23	40	40	—	—	5/—	5	—	3	—
PMBFJ113	SOT-23	40	40	—	—	2/—	3	—	3	—
PMBFJ174	SOT-23	—	30			20/135	10	—		
PMBFJ175	SOT-23	—	30			7/70	6	—		
PMBFJ176	SOT-23	—	30			2/35	4	—		
PMBFJ177	SOT-23	—	30			1.5/20	2.25	—		
PZFJ108	SOT-223	25	25	—	—	80/—	10	—	15	—
PZFJ109	SOT-223	25	25	—	—	40/—	6	—	15	—
PZFJ110	SOT-223	25	25	—	—	10/—	4	—	15	—
PMBFJ308	SOT-23	25	—	—	—	12/60	—	—	2.5 typ	—
PMBFJ309	SOT-23	25	—	—	—	12/30	—	—	2.5 typ	—
PMBFJ310	SOT-23	25	—	—	—	24/60	—	—	2.5 typ	—
PMBF4416	SOT-23	30	—	—	—	5/15	—	—	0.8 typ	—

Type	Pkg	Polarity	V_{DS} V	V_{GS} V	I_D mA	Y_{FS} mA/V	V_{GS}(th) V	R_{DS}on Ω	mA/V
Vertical D-MOS FETs									
BSP103	SOT-223	N	35	20	750	170	0.8-2.0	5	300/5
BSN20	SOT-23	N	50	20	100	60	2.0	15	100/10
BSP105	SOT-223	N	60	20	500	170	0.8-2.0	5	300/5
BSP106	SOT-223	N	60	15	500	200	0.8-3.0	5	200/10
BSP108	SOT-223	N	80	20	500	300	1.5-3.5	3	500/10
BSP109	SOT-223	N	90	20	500	170	0.8-2.0	5.3	300/5
BSP110	SOT-223	N	80	20	325	150	0.8-2.8	7	200/10
BSP120	SOT-223	N	200	20	250	250	0.8-2.8	12	250/10
BSP121	SOT-223	N	200	20	300	350	0.8-2.8	6	400/10
BSP126	SOT-223	N	250	20	300	400	0.8-2.0	6	300/10
BSP205	SOT-223	P	50	20	250	150	1.5-3.5	10	200/10
BSP206	SOT-223	P	60	20	300	200	1.5-3.5	6	200/10
BSP220	SOT-223	P	200	20	250	200	0.8-2.24	12	200/10
BSP225	SOT-223	P	250	20	250	200	0.8-2.8	15	200/10
BSS192	SOT-89	P	200	20	150	200	0.8-2.8	20	200/10
BST80	SOT-89	N	80	20	500	300	1.5-3.5	4	500/10
BST82	SOT-23	N	80	20	175	150	1.6-3.5	10	150/5
BST84	SOT-89	N	200	20	250	250	0.8-2.8	12	250/10
BSP107	SOT-223	N	200	20	200	180	0.8-2.4	28	20/2.6
BSP128	SOT-223	N	200	20	350	400	0.4-1.8	8	100/2.8
BST86	SOT-89	N	180	20	300	250	0.7-2.7	10	15/3
BST120	SOT-89	P	60	20	300	200	1.5-3.5	10	200/10
BST122	SOT-89	P	50	20	250	125	1.5-3.5	6	200/10

Type	Pkg	Mode	V_{DS} V	I_D mA	g_{FS} mA/V	$V_{(P)GS}$ V	R_{DS}on Ω	mA
N-Channel MOSFET Switching Transistors								
BSD20	SOT-143	Dpl	10	50	15	-2.0	30	1/10
BSD22	SOT-143	Dpl	20	50	15	-2.0	30	1/10
BSS83	SOT-143	Enh	10	50	15	2.0	45	0.1/10

Type	Package	V_{DS} V	I_D mA	NF typ dB	$-I_{GSS}$ max. nA	I_{DSS} min./max. mA	$-V_{(P)GS}$ max. V	Y_{fs} min. mS	C_{rs} typ pF
N-Channel Dual Gate MOSFET's									
BF998	SOT-143	12	30	0.6	50	4/20	2.0	21	.025
BF990	SOT-143	18	30	2.8	—	—	1.3	17	0.25
BF990A	SOT-143	18	—	2	—	—	1.3	18 min.	25
BF991	SOT-143	20	20	0.7	50	4/25	2.5	10	0.20
BF989	SOT-143	20	30	2.8	50	2/20	2.7	9.5	0.25
BF992	SOT-143	20	40	1.2	25	—	1.3	20	.04
BF994S	SOT-143	20	40	1.2	25	—	1.3	20	.04
BF996S	SOT-143	20	40	1.2	25	—	1.3	20	.04
BF997	SOT-143	20	30	1.0	50	2/20	2.0	15	.025

Type	Pkg	V_{CBO} V	V_{CER} V	I_C mA	h_{FE} @ I_C/V_{CE} min	mA/V	V_{CE}(Sat) @ I_C/I_B V	mA	f_T MHz
Darlington Transistors–NPN									
BST50	SOT-89	60	45	500	2000	500/10	1.3	500/0.5	—
BST51	SOT-89	80	60	500	2000	500/10	1.3	500/0.5	—
BSP52	SOT-223	90	80	500	2,000	500/5	1.3	500/0.5	—
BST52	SOT-89	90	80	500	2000	500/10	1.3	500/0.5	—
PMBTA13	SOT-23	30	30	500	10,000	100/5	1.5	100/0.1	125
PZTA13	SOT-223	20	30	300	10,000	100/5	1.5	100/0.1	125
PMBTA14	SOT-23	30	30	500	20,000	100/5	1.5	100/0.1	125
PXTA14	SOT-89	30	30	300	20,000	100/5	1.5	100/0.1	125
PZTA14	SOT-223	30	30	300	20,000	100/5	1.5	100/0.1	125
BCV27	SOT-23	30	40	300	20,000	100/5	1.0	100/0.1	100
PMBT6427	SOT-23	40	40	500	14,000	500/5	1.5	500/0.5	—
BSP50	SOT-223	60	45	500	2,000	500/10	1.3	500/0.5	—

Type	Pkg	V_{CBO} V	V_{CER} V	I_C mA	h_{FE} @ I_C/V_{CE} min	mA/V	V_{CE}(Sat) @ I_C/I_B V	mA	f_T MHz
-PNP									
BST60	SOT-89	60	45	500	2000	500/10	1.3	500/0.5	—
BSP61	SOT-223	80	60	500	2,000	500/10	1.3	500/0.5	—
BST61	SOT-89	80	60	500	2000	500/10	1.3	500/0.5	—
BSP62	SOT-223	90	80	500	2,000	500/10	1.3	500/0.5	—
BST62	SOT-89	90	80	500	2000	500/10	1.3	500/0.5	—
PMBTA63	SOT-23	30	30	500	10,000	100/5	1.3	100/0.1	125
PMBTA64	SOT-23	30	30	500	20,000	100/5	1.5	100/0.1	125
PXTA64	SOT-89	30	30	300	20,000	100/5	1.5	100/0.1	125
PZTA63	SOT-223	30	30	300	10,000	100/5	1.5	100/0.1	
PZTA64	SOT-223	30	30	300	20,000	100/5	1.5	100/0.1	
BCV26	SOT-23	30	40	300	20,000	100/5	1.0	100/0.1	100
BSP60	SOT-223	60	45	500	2,000	500/10	1.3	500/0.5	—

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PHILIPS SMALL SIGNAL SEMICONDUCTORS

SURFACE MOUNT SEMICONDUCTORS

See pages A•2118 & A•2119

Type	Pkg	V_{BA} V	I_A mA	I_P µA	I_V µA
Triggers, PNPN					
BRY61	SOT-23	70	175	5/1	30/50
BRY62	SOT-143	70	175	—	—

Type	Pkg	V_R V	I_F mA	t_{RR} nS	V_F mV @ I_F 10/100/150/200 mA
General Purpose Diodes					
BA582	SOD-123	35	100	—	—
BA682	SOD-80	35	100	—	—
BA683	SOD-80	35	100	—	—
BAS16	SOT-23	75	250	6	855/—/1250/—
BAS17	SOT-23	—	—		830/960/—/—
BAS19	SOT-23	100	200	50	—/1000/—/—
BAS20	SOT-23	150	200	50	—/1000/—/—
BAS21	SOT-23	200	200	50	—/1000/—/—
BAS28	SOT-143	75	250	6	855/—/1250/—
BAS29	SOT-23	90	250	50	—/900/—/1000
BAS31	SOT-23	90	250	50	—/900/—/1000
BAS32L	SOD-80	75	200	4	—
BAS35	SOT-23	90	250	50	—/900/—/1000
BAS56	SOT-143	60	200	6	—/—/—/1000
BAS86	SOD-80	50	200	—	—
BAT17	SOT-23	4	30	—	600/—/—/—
BAT18	SOT-23	35	100	—	—/1200/—/—
BAT54	SOT-23	30	200	5	400/1000/—/—
BAT54A	SOT-23	30	200	—	—
BAT54C	SOT-23	30	200	—	—
BAT54S	SOT-23	30	200	—	—
PBYR235CT	SOT-223	35	2000	—	—
PBYR240CT	SOT-223	40	2000	—	—
PBYR245CT	SOT-223	45	2000	—	—
BAT74	SOT-143	30	300	5	400/1000/—/—
BAV23	SOT-143	200	200	50	—/1000/—/1250
BAV23S	SOT-223	200	200	50	—/1000/—/—
BAV70	SOT-23	70	250	6	855/—/1250/—
BAV74	SOT-23	50	200	4	—/1000/—/—
BAV99	SOT-23	70	250	6	855/—/1250/—
BAV100	SOD-80	50	250	50	—
BAV101	SOD-80	100	250	50	—
BAV102	SOD-80	150	250	50	—
BAV103	SOD-80	200	250	50	—
BAV105	SOD-80	60	600	1000	200 6
BAW56	SOT-23	70	250	6	855/—/1250/—
PMBD914	SOT-23	100	200	1000	10 15
PMBD353	SOT-23	4	10	—	600/—/—/—
PMBD2835*	SOT-23	35	100	1200	100 15
PMBD2836*	SOT-23	75	100	1200	100 15
PMBD2837*	SOT-23	35	100	1200	100 15
PMBD2838*	SOT-23	75	100	1200	100 15
PMBD6050	SOT-23	70	200	1100	100 15
PMBD6100*	SOT-23	70	200	1100	100 15
PMBD7000*	SOT-23	100	200	1100	100 15
PMLL4148	SOD-80	75	200	1000	100 4
PMLL4150	SOD-80	50	300	920	100 4
PMLL4151	SOD-80	75	200	1000	50 2
PMLL4153	SOD-80	75	200	880	20 2
PMLL4446	SOD-80	75	200	1000	100 4
PMLL4448	SOD-80	75	200	1000	100 4
BA423L	SOD-80	20	50		
PMBD101	SOT-23	4	10		600 10
PMBD352*	SOT-23	4	10		600 10
PRLL5817	SOD-87	20	1000	—	—
PRLL5818	SOD-87	30	1000	—	—
PRLL5819	SOD-87	40	1000	—	—
BAS85	SOD-80	30	200		400 10
BA314L	SOD-80	0.85-0.94	100		
BZV80	SOD-80	5.89-6.51	7.5		
BZV81	SOD-80	5.89-6.51	7.5		

Type	Pkg	V_R V	I_F mA	Cd @ V_R pF	V
Variable Capacitance Diodes					
BB215	SOD-80	30	20	18 min	1
BB219	SOD-80	30	20	31 min.	1
BB240	SOD-80	—	—	2.3-2.7	28
BB241	SOD-80	—	—	2.6-3.0	28
BB249	SOD-80	—	—	4.0-5.0	28
BB515	SOD-123	—	—	1.85-2.25	28
BB619	SOD-123	—	—	2.4-2.9	28
BB620	SOD-123	—	—	2.9-3.4	28
BB804	SOT-23	18	50	44.5 typ.	2
BB811	SOD-123	—	—	0.85-1.2	28
BBY31	SOT-23	28	20	1.8-2.8	25
BBY39*	SOT-23	30	20	1.8-2.0	28
BBY40	SOT-23	28	20	4.3-6	25
BBY42	SOT-23	32	50	31 min.	1
BBY62	SOT-143	30	50	17.5 typ.	1

Type	Pkg	$I_{F(AV)}$ (MAX) (A)	V_{RRM} (V)	V_F (MAX) (V)	@ I_F (A)	t_{rr} (MAX) (ns)
Rectifier Diodes General Purpose						
BYD17D	SOD-87	1.5	200	1.05	1	—
BYD17G	SOD-87	1.5	400	1.05	1	—
BYD17J	SOD-87	1.6	600	1.05	1	—
BYD17K	SOD-87	1.5	800	1.05	1	—
BYD17M	SOD-87	1.5	1000	1.05	1	—
PRLL4001	SOD-87	1.5	50	0.8	1	—
PRLL4002	SOD-87	1.5	100	0.8	1	—
Fast Recovery						
BYD37D	SOD-87	1.5	200	1.3	1	250
BYD37G	SOD-87	1.5	400	1.3	1	250

Type	Pkg	$I_{F(AV)}$ (MAX) (A)	V_{RRM} (V)	V_F (MAX) (V)	@ I_F (A)	t_{rr} (MAX) (ns)
Fast Recovery (Cont.)						
BYD37J	SOD-87	1.5	600	1.3	1	250
BYD37K	SOD-87	1.5	800	1.3	1	300
BYD37M	SOD-87	1.5	1000	1.3	1	300
Very Fast Recovery						
BYD77A	SOD-87	2	50	0.95	1	25
BYD77B	SOD-87	2	100	0.95	1	25
BYD77C	SOD-87	2	150	0.95	1	25
BYD77D	SOD-87	2	200	0.95	1	25
BYD77E	SOD-87	1.85	250	1.05	1	50
BYD77F	SOD-87	1.85	300	1.05	1	50
BYD77G	SOD-87	1.85	400	1.05	1	50
BYV40-100	SOT-223	1.5	100	1	1.5	50
BYV40-150	SOT-223	1.5	150	1	1.5	50
BYV40-200	SOT-223	1.5	200	1	1.5	50

Type SOT-23	Type SOD-80	Suffix	V_Z @ I_Z ±5%	mA	R_{DIFF} @ I_Z Ω	S_Z @ I_Z mV/°C	I_R @ V_R µA	V
Zener Diodes								
BZX84	BZV55	C2V4	2.4	5	100	0	50	1
BZX84	BZV55	C2V7	2.7	5	100	0	20	1
BZX84	BZV55	C3V0	3.0	5	95	0	10	1
BZX84	BZV55	C3V3	3.3	5	95	0	5	1
BZX84	BZV55	C3V6	3.6	5	90	0	5	1
BZX84	BZV55	C3V9	3.9	5	90	0	3	1
BZX84	BZV55	C4V3	4.3	5	90	0	3	1
BZX84	BZV55	C4V7	4.7	5	80	.2	3	2
BZX84	BZV55	C5V1	5.1	5	60	1.2	2	2
BZX84	BZV55	C5V6	5.6	5	40	2.5	1	2
BZX84	BZV55	C6V2	6.2	5	10	3.7	3	4
BZX84	BZV55	C6V8	6.8	5	15	4.5	2	4
BZX84	BZV55	C7V5	7.5	5	15	5.3	1	5
BZX84	BZV55	C8V2	8.2	5	15	6.2	.7	5
BZX84	BZV55	C9V1	9.1	5	15	7.0	.5	6
BZX84	BZV55	C10	10.0	5	20	8.0	.2	7
BZX84	BZV55	C11	11	5	20	9.0	.1	8
BZX84	BZV55	C12	12	5	25	10.0	.1	8
BZX84	BZV55	C13	13	5	30	11.0	.1	8
BZX84	BZV55	C15	15	5	30	13.0	.05	
BZX84	BZV55	C16	16	5	40	14.0	.05	
BZX84	BZV55	C18	18	5	45	16.0	.05	
BZX84	BZV55	C20	20	5	55	18.0	.05	
BZX84	BZV55	C22	22	5	55	20.0	.05	
BZX84	BZV55	C24	24	5	70	22.0	.05	
BZX84	BZV55	C27	27	2	80	25.3	.05	
BZX84	BZV55	C30	30	2	80	29.4	.05	
BZX84	BZV55	C33	33	2	80	33.4	.05	
BZX84	BZV55	C36	36	2	90	37.4	.05	
BZX84	BZV55	C39	39	2	130	41.2	.05	
BZX84	BZV55	C43	43	2	150	46.6	.05	
BZX84	BZV55	C47	47	2	170	51.8	.05	
BZX84	BZV55	C51	51	2	180	57.2	.05	
BZX84	BZV55	C56	56	2	200	63.8	.05	
BZX84	BZV55	C62	62	2	215	71.6	.05	
BZX84	BZV55	C68	68	2	240	79.8	.05	
BZX84	BZV55	C75	75	2	255	88.6	.05	

Type	V_Z at I_{ZT} ±5%	mA	Ω	Z_{ZK} @ I_{ZK} =0.25mA Ω	Θvz %/°C	I_R at V_R µA	V
Zener Diodes, SOD-80 (MELF)							
PMLL5225B	3.0	20	29	1600	−0.75	50	1.0
PMLL5226B	3.3	20	28	1600	−0.70	25	1.0
PMLL5227B	3.6	20	24	1700	−0.65	15	1.0
PMLL5228B	3.9	20	23	1900	−0.60	10	1.0
PMLL5229B	4.3	20	22	2000	±.055	5.0	1.0
PMLL5230B	4.7	20	19	1900	±.030	5.0	2.0
PMLL5231B	5.1	20	17	1600	±.030	5.0	2.0
PMLL5232B	5.6	20	11	1600	+.038	5.0	3.0
PMLL5233B	6.0	20	7.0	1600	+.038	5.0	3.5
PMLL5234B	6.2	20	7.0	1000	+.045	5.0	4.0
PMLL5235B	6.8	20	5.0	750	+.050	3.0	5.0
PMLL5236B	7.5	20	6.0	500	+.058	3.0	6.0
PMLL5237B	8.2	20	8.0	500	+.062	3.0	6.5
PMLL5238B	8.7	20	8.0	600	+.065	3.0	6.5
PMLL5239B	9.1	20	10	600	+.068	3.0	7.0
PMLL5240B	10	20	17	600	+.075	3.0	8.0
PMLL5241B	11	20	22	600	+.076	2.0	8.4
PMLL5242B	12	30	30	600	+.077	1.0	9.1
PMLL5243B	13	9.5	13	600	+.079	0.5	9.9
PMLL5244B	14	9.0	15	600	+.082	0.1	10
PMLL5245B	15	8.5	16	600	+.082	0.1	11
PMLL5246B	16	7.8	17	600	+.083	0.1	12
PMLL5247B	17	7.4	19	600	+.084	0.1	13
PMLL5248B	18	7.0	21	600	+.085	0.1	14
PMLL5249B	19	6.6	23	600	+.086	0.1	14
PMLL5250B	20	6.2	25	600	+.086	0.1	15
PMLL5251B	22	5.6	29	600	+.087	0.1	17
PMLL5252B	24	5.2	33	600	+.088	0.1	18
PMLL5253B	25	5.0	35	600	+.089	0.1	19
PMLL5254B	27	4.6	41	600	+.090	0.1	21
PMLL5255B	28	4.5	44	600	+.091	0.1	21
PMLL5256B	30	4.2	49	600	+.091	0.1	23
PMLL5257B	33	3.8	58	700	+.092	0.1	25
PMLL5258B	36	3.4	70	700	+.093	0.1	27
PMLL5259B	39	3.2	80	800	+.094	0.1	30
PMLL5260B	43	3.0	93	900	+.095	0.1	33
PMLL5261B	47	2.7	105	1000	+.095	0.1	36
PMLL5262B	51	2.5	125	1100	+.096	0.1	39
PMLL5263B	56	2.2	150	1300	+.096	0.1	43
PMLL5264B	60	2.1	170	1400	+.097	0.1	46

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PHILIPS DISCRETE SEMICONDUCTORS

SURFACE MOUNT SEMICONDUCTORS

Type	V_Z at I_{ZT} ±5%	mA	Ω	Z_{ZK} @ I_{ZK} =0.25mA Ω	ϴvz %/°C	I_R at V_R µA	V
Zener Diodes, SOD-80 (MELF) (Cont.)							
PMLL5265B	62	2.0	185	1400	+.097	0.1	47
PMLL5266B	68	1.8	230	1600	+.097	0.1	52
PMLL5267B	75	1.7	270	1700	+.098	0.1	56

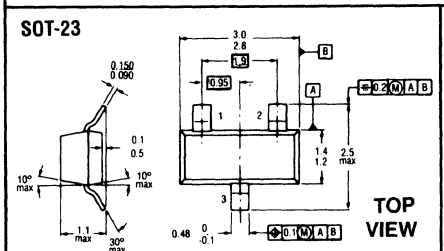
Type		V_Z (V) Min	Max	(mA)	r_{diff} @ I_Z (Ω)	(mA)	S_Z @ I_Z (%/°C)	(mA)	I_R @ V_R (µ)	(V)
Zener Diodes, SOD-87 (2.3W)										
BZD27	C7V5	7.0	7.9	100	2	100	0.07	100	50	3
BZD27	C8V2	7.7	8.7	100	2	100	0.08	100	10	3
BZD27	C9V1	8.5	9.6	50	4	50	0.08	50	5	5
BZD27	C10	9.4	10.6	50	4	50	0.09	50	7	7.5
BZD27	C11	10.4	11.6	50	7	50	0.10	50	3	8.2
BZD27	C12	11.4	12.7	50	7	50	0.10	50	2	9.1
BZD27	C13	12.4	14.1	50	10	50	0.10	50	2	10
BZD27	C15	13.8	15.6	50	10	50	0.10	50	1	11
BZD27	C16	15.3	17.1	25	15	25	0.11	25	1	12
BZD27	C18	16.8	19.1	25	15	25	0.11	25	1	13
BZD27	C20	18.8	21.2	25	15	25	0.11	25	1	15
BZD27	C22	20.8	23.3	25	15	25	0.11	25	1	16
BZD27	C24	22.8	25.6	25	15	25	0.11	25	1	18
BZD27	C27	25.1	28.9	25	15	25	0.11	25	1	20
BZD27	C30	28	32	25	15	25	0.11	25	1	22
BZD27	C33	31	35	25	15	25	0.11	25	1	24
BZD27	C36	34	38	10	40	10	0.11	10	1	27
BZD27	C39	37	41	10	40	10	0.11	10	1	30
BZD27	C43	40	46	10	45	10	0.12	10	1	33
BZD27	C47	44	50	10	45	10	0.12	10	1	36
BZD27	C51	48	54	10	60	10	0.12	10	1	39
BZD27	C56	52	60	10	60	10	0.12	10	1	43
BZD27	C62	58	66	10	80	10	0.13	10	1	47
BZD27	C68	64	72	10	80	10	0.13	10	1	51
BZD27	C75	70	79	10	100	10	0.13	10	1	56
BZD27	C82	77	87	10	100	10	0.13	10	1	62
BZD27	C91	85	96	5	200	5	0.13	5	1	68
BZD27	C100	94	106	5	200	5	0.13	5	1	75
BZD27	C110	104	116	5	250	5	0.13	5	1	82
BZD27	C120	114	127	5	250	5	0.13	5	1	91
BZD27	C130	124	141	5	300	5	0.13	5	1	100
BZD27	C150	138	156	5	300	5	0.13	5	1	110
BZD27	C160	153	171	5	350	5	0.13	5	1	120
BZD27	C180	168	191	5	400	5	0.13	5	1	130
BZD27	C200	188	212	5	500	5	0.13	5	1	150
BZD27	C220	208	233	2	750	2	0.13	2	1	160
BZD27	C240	228	256	2	850	2	0.13	2	1	180
BZD27	C270	251	289	2	1000	2	0.13	2	1	200

Type	V_Z(V) at I_{Ztest}=5 mA min.	max.	Differential Resistance $r_{diff\ (.op)}$ at I_{Ztest}=5 mA typ.	max.	Temperature Coefficient S_Z(mV/K) at I_{Ztest}=5 mA min.	typ.	max.	Diode Capacitance C_d(pF); f=1 MHz V_R=0 typ.	max.
Zener Diodes, SOT-223 (1.3W)									
BZV90C2V4	2.2	2.6	70	100	-3.5	-1.6	0	375	450
BZV90C2V7	2.5	2.9	75	100	-3.5	-2.0	0	350	450
BZV90C3V0	2.8	3.2	80	95	-3.5	-2.1	0	350	450
BZV90C3V3	3.1	3.5	85	95	-3.5	-2.4	0	325	450
BZV90C3V6	3.4	3.8	85	90	-3.5	-2.4	0	300	450
BZV90C3V9	3.7	4.1	85	90	-3.5	-2.5	0	300	450
BZV90C4V3	4.0	4.6	80	90	-3.5	-2.5	0	275	450
BZV90C4V7	4.4	5.0	50	80	-3.5	-1.4	0.2	130	180
BZV90C5V1	4.8	5.4	40	60	-2.7	-0.8	1.2	110	160
BZV90C5V6	5.2	6.0	15	40	-2.0	1.2	2.5	95	140
BZV90C6V2	5.8	6.6	6	10	0.4	2.3	3.7	90	130
BZV90C6V8	6.4	7.2	6	15	1.2	3.0	4.5	85	110

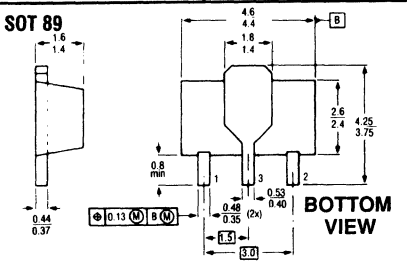
Type	V_Z(V) at I_{Ztest}=5 mA min.	max.	Differential Resistance $r_{diff\ (.op)}$ at I_{Ztest}=5 mA typ.	max.	Temperature Coefficient S_Z(mV/K) at I_{Ztest}=5 mA min.	typ.	max.	Diode Capacitance C_d(pF); f=1 MHz V_R=0 typ.	max.
Zener Diodes, SOT-223 (1.3W) (Cont.)									
BZV90C7V5	7.0	7.9	6	15	2.5	4.0	5.3	80	100
BZV90C8V2	7.7	8.7	6	15	3.2	4.6	6.2	75	95
BZV90C9V1	8.5	9.6	6	15	3.8	5.5	7.0	70	90
BZV90C10	9.4	10.6	8	20	4.5	6.4	8.0	70	90
BZV90C11	10.4	11.6	10	20	5.4	7.4	9.0	65	85
BZV90C12	11.4	12.7	10	25	6.0	8.4	10.0	65	85
BZV90C13	12.4	14.1	10	30	7.0	9.4	11.0	60	80
BZV90C15	13.8	15.6	10	30	9.2	11.4	13.0	55	75
BZV90C16	15.3	17.1	10	40	10.4	12.4	14.0	52	75
BZV90C18	16.8	19.1	10	45	12.4	14.4	16.0	47	70
BZV90C20	18.8	21.2	15	55	14.4	16.4	18.0	36	60
BZV90C22	20.8	23.3	20	55	16.4	18.4	20.0	34	60
BZV90C24	22.8	25.6	25	70	18.4	20.4	22.0	33	55
	at I_{Ztest}=2 mA		at I_{Ztest}=2 mA			at I_{Ztest}=2 mA			
BZV90C27	25.1	28.9	25	80	21.4	23.4	25.3	30	50
BZV90C30	28.0	32.0	30	80	24.4	26.6	29.4	27	50
BZV90C33	31.0	35.0	35	80	27.4	29.7	33.4	25	45
BZV90C36	34.0	38.0	35	90	30.4	33.0	37.4	23	45
BZV90C39	37.0	41.0	40	130	33.4	36.4	41.2	21	45
BZV90C43	40.0	46.0	45	150	37.6	41.2	46.6	21	40
BZV90C47	44.0	50.0	50	170	42.0	46.1	51.8	19	40
BZV90C51	48.0	54.0	60	180	46.6	51.0	57.2	19	40
BZV90C56	52.0	60.0	70	200	52.2	57.0	63.8	18	40
BZV90C62	58.0	66.0	80	215	58.8	64.4	71.6	17	35
BZV90C68	64.0	72.0	90	240	65.6	71.7	79.8	17	35
BZV90C75	70.0	79.0	95	255	73.4	80.2	88.6	16.5	35

Type	V_Z (V)	@ I_Z (mA)	Z_{zt} (MAX) µ	@ I_{ZT} (mA)	I_R (MAX) (µA)	@ V_R (V)
Zener Diodes, SOT-23 (350mW), Pinout H						
PMBZ5226B	3.3	20	28	20	25	1.0
PMBZ5227B	3.6	20	24	20	15	1.0
PMBZ5228B	3.9	20	23	20	10	1.0
PMBZ5229B	4.3	20	22	20	5.0	1.0
PMBZ5230B	4.7	20	19	20	5.0	2.0
PMBZ5231B	5.1	20	17	20	5.0	2.0
PMBZ5232B	5.6	20	11	20	5.0	3.0
PMBZ5233B	6.0	20	7	20	5.0	3.5
PMBZ5234B	6.2	20	7	20	5.0	4.0
PMBZ5235B	6.8	20	5	20	3.0	5.0
PMBZ5236B	7.5	20	6	20	3.0	6.0
PMBZ5237B	8.2	20	8	20	3.0	6.5
PMBZ5238B	8.7	20	8	20	3.0	6.5
PMBZ5239B	9.1	20	10	20	3.0	7.0
PMBZ5240B	10	20	17	20	3.0	8.0
PMBZ5241B	11	20	22	20	2.0	8.4
PMBZ5242B	12	20	30	20	1.0	9.1
PMBZ5243B	13	9.5	13	9.5	0.5	9.9
PMBZ5244B	14	9.0	15	9.0	0.1	10
PMBZ5245B	15	8.5	16	8.5	0.1	11
PMBZ5246B	16	7.8	17	7.8	0.1	12
PMBZ5247B	17	7.4	19	7.4	0.1	13
PMBZ5248B	18	7.0	21	7.0	0.1	14
PMBZ5249B	19	6.6	23	6.6	0.1	14
PMBZ5250B	20	6.2	25	6.2	0.1	15
PMBZ5251B	22	5.6	29	5.6	0.1	17
PMBZ5252B	24	5.2	33	5.2	0.1	18
PMBZ5253B	25	5.0	35	5.0	0.1	19
PMBZ5254B	27	4.6	41	4.6	0.1	21
PMBZ5255B	28	4.5	44	4.5	0.1	21
PMBZ5256B	30	4.2	49	4.2	0.1	23
PMBZ5257B	33	3.8	58	3.8	0.1	25

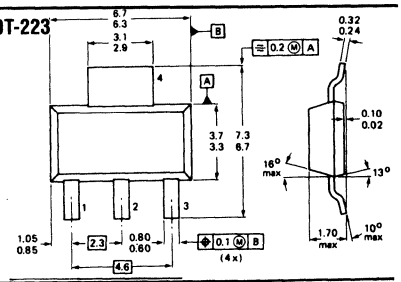
SOT-23



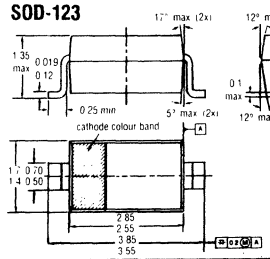
SOT 89



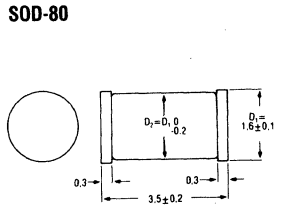
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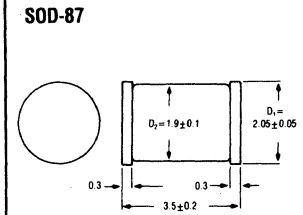
SOD-123



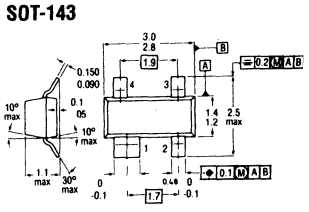
SOD-80



SOD-87



SOT-143

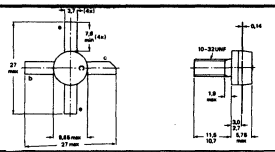


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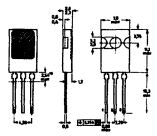
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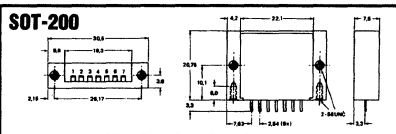
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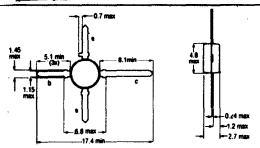
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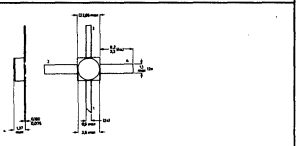
SOT-200



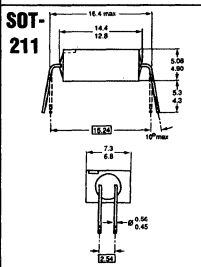
SOT-103



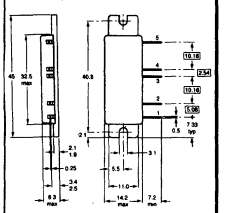
SOT-100



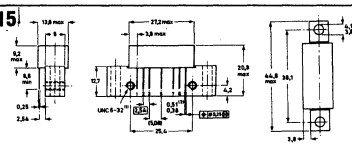
SOT-211



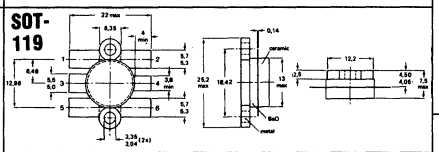
SOT-246



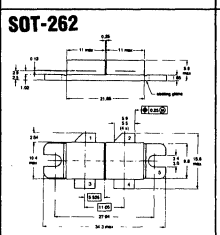
SOT-115



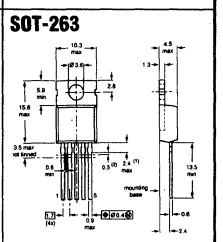
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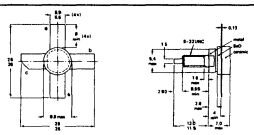
SOT-262



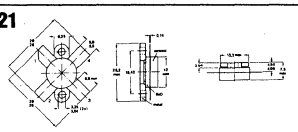
SOT-263



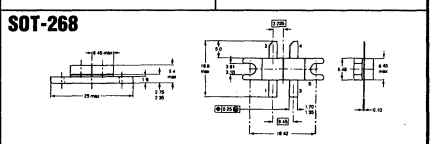
SOT-120



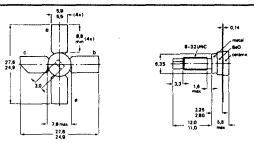
SOT-121



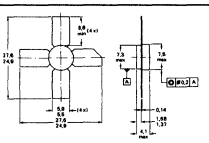
SOT-268



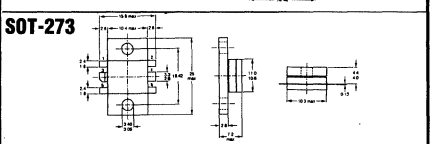
SOT-122



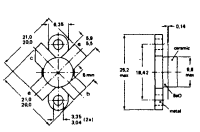
SOT-122D



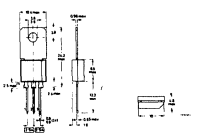
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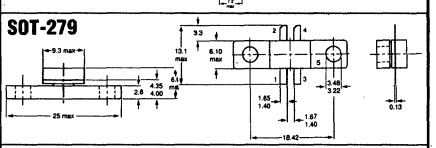
SOT-123



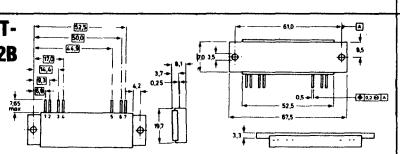
SOT-128B



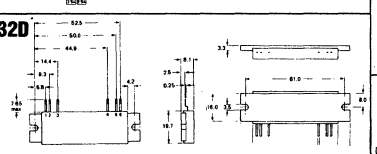
SOT-279



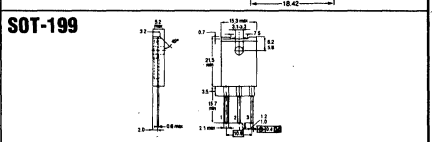
SOT-132B



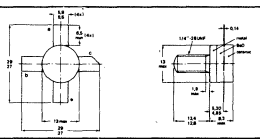
SOT-132D



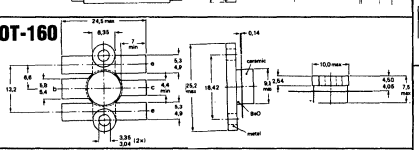
SOT-199



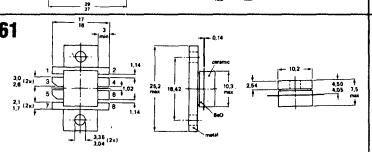
SOT-147



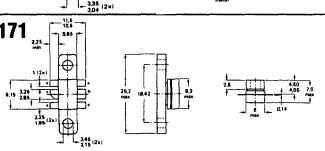
SOT-160



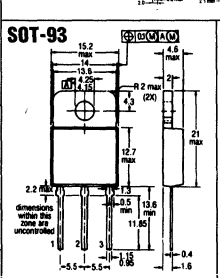
SOT-161



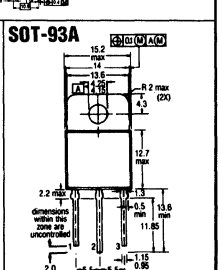
SOT-171



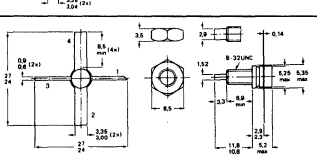
SOT-93



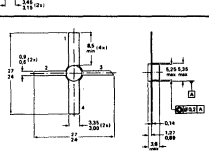
SOT-93A



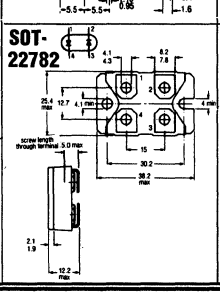
SOT-172



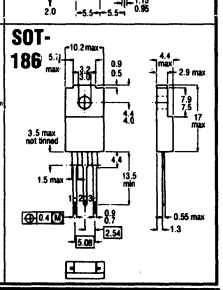
SOT-172D



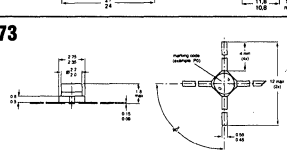
SOT-22782



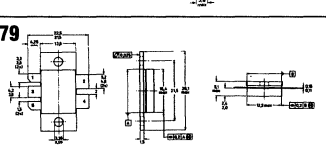
SOT-186



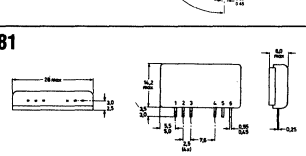
SOT-173



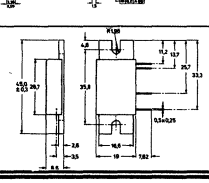
SOT-179



SOT-181



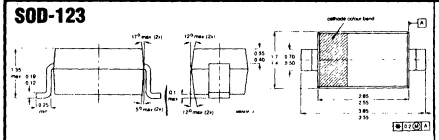
SOT-183



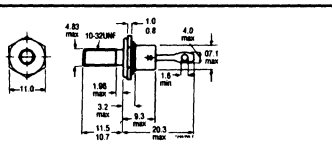
Philips Components
Discrete Products Division
A North American Philips Company

PHILIPS DISCRETE SEMICONDUCTORS

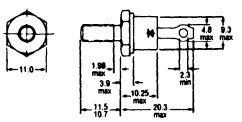
SOD-123



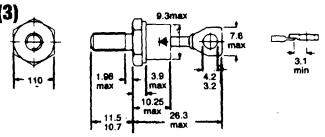
DO-4(1)



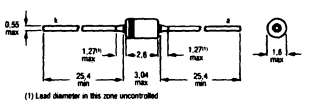
DO-4(2)



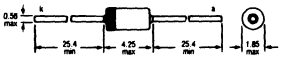
DO-4(3)



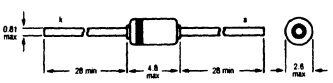
DO-34



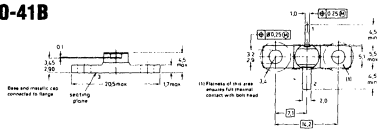
DO-35



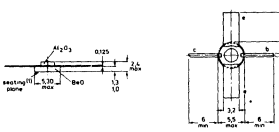
DO-41



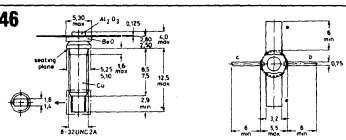
FO-41B



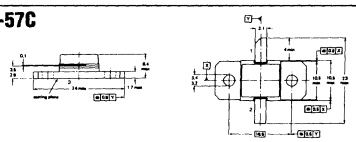
FO-45



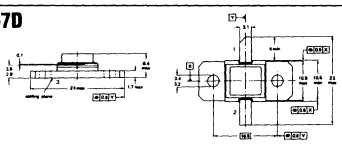
FO-46



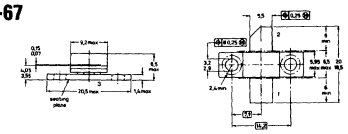
FO-57C



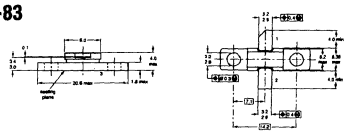
FO-57D



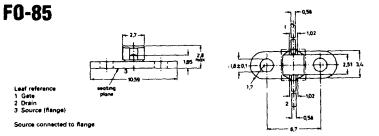
FO-67



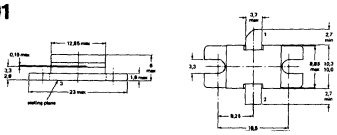
FO-83



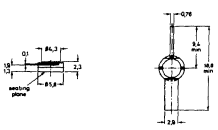
FO-85



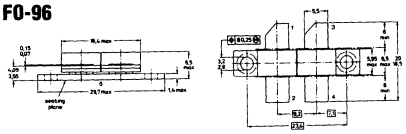
FO-91



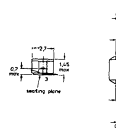
FO-93



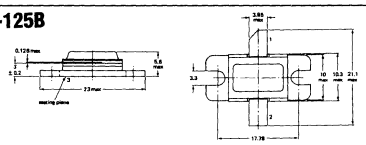
FO-96



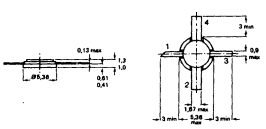
FO-102



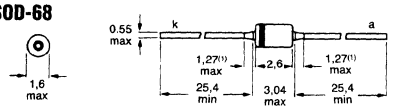
FO-125B



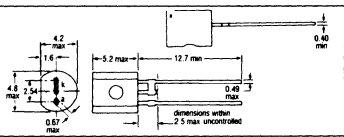
FO-163



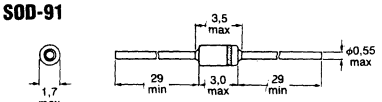
SOD-68



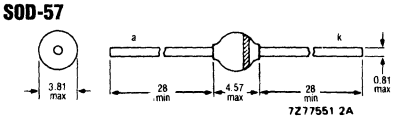
SOD-69



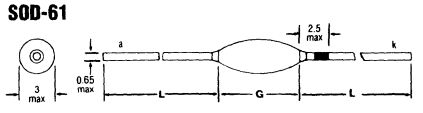
SOD-91



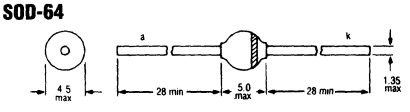
SOD-57



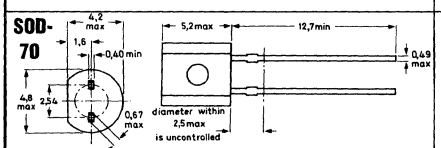
SOD-61



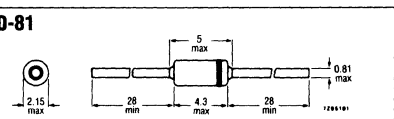
SOD-64



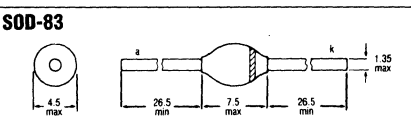
SOD-70



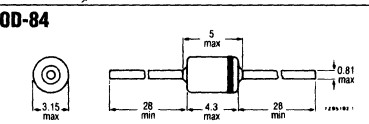
SOD-81



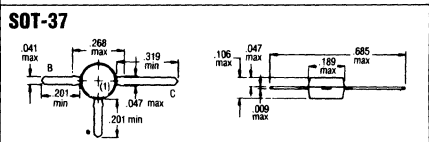
SOD-83



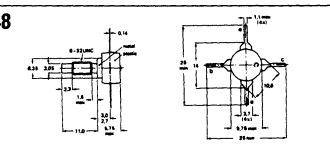
SOD-84



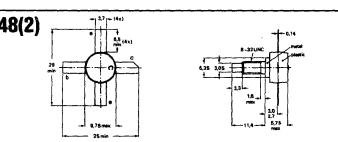
SOT-37



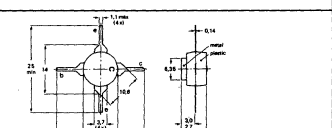
SOT-48



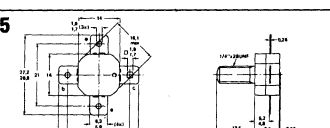
SOT-48(2)



SOT-48(3)

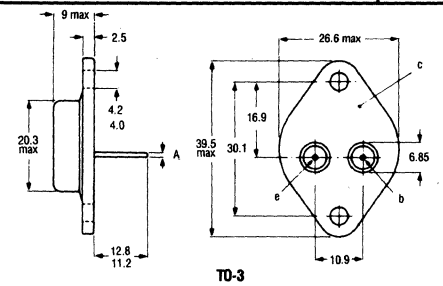


SOT-55

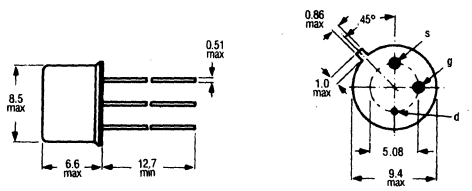


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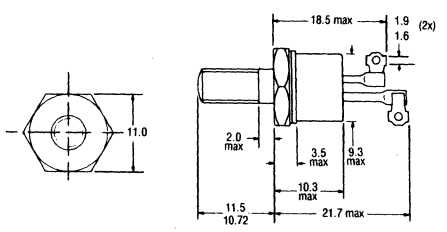
PHILIPS DISCRETE SEMICONDUCTORS



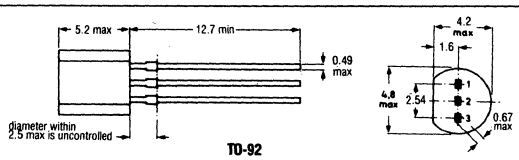
TO-3



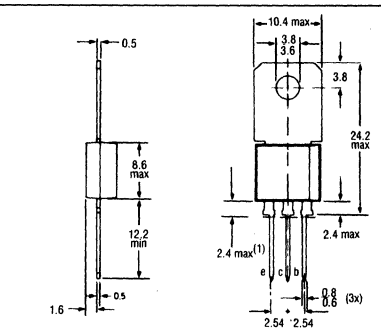
TO-39



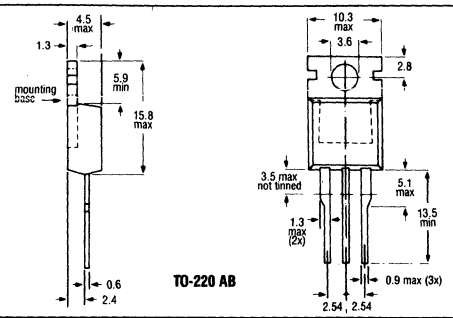
TO-64



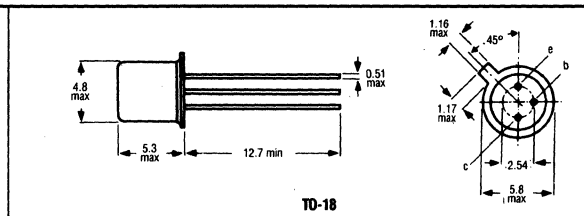
TO-92



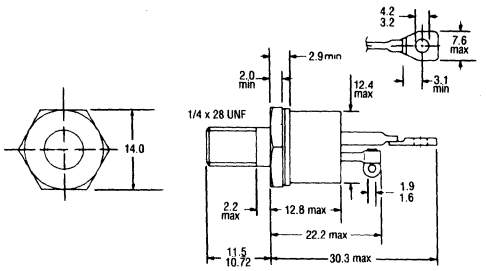
TO-202



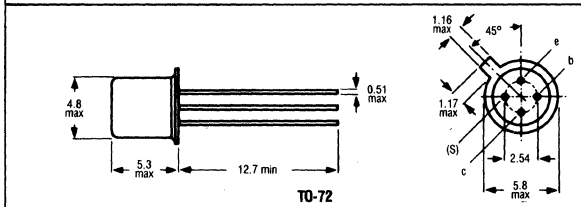
TO-220 AB



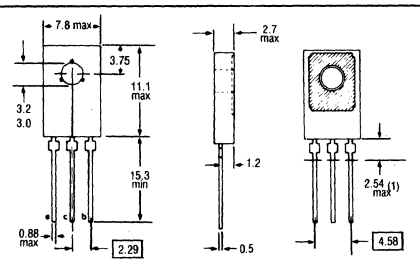
TO-18



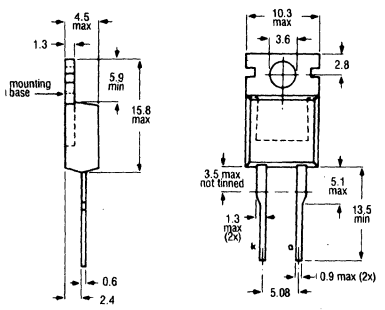
TO-48



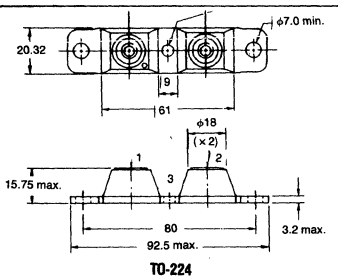
TO-72



TO-126



TO-220 AC



TO-224

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RF/MICROWAVE DEVICES

See pages A•2118 & A•2119

RF DIODES VARIABLE CAPACITANCE DIODES

Type	Package Outline	C_d (pF)	@ V_R (V)	tuning range C_d over ratio	voltage range V_1 to V_2 (V)	r_s max (Ω)	matched sets $\Delta \frac{Cmax}{Cmin} < 3\%$
Automatic Frequency Control							
BB119	DO-35	15.3-19.0	10	>1.3	4 to 10	1.5	no
BB417	DO-34	2.2-2.4	15	2-5	4 to 15	1.2	no
AM Radio Tuning							
BB112	SOD-69	17-29	8.5	>18	1 to 8.5	1.5	yes
BB130	SOD-69	12-21	28	>23	1 to 28	2	yes
BB212[1]	TO-92	<22	8.0	>22.5	0.5 to 8	2.5	no
FM Radio Tuning							
BB204B[1]	TO-92	typ. 14.0	30	2.5-2.8	3 to 30	0.4	no
BB804[1]	SOT-23	42-47.5	8	1.65-1.75	2 to 8	typ. 0.25	no
VHF Tuning							
BB219	SOD-80	2.6-3.2	28	12-15	1 to 28	0.9	yes
BB240	SOD-80	2.3-2.7	28	>14	0.5 to 28	1.0	yes
BB241	SOD-80	2.6-3.0	28	>21	0.5 to 28	2.0	yes
BB249	SOD-80	4.0-5.0	28	8-10	1 to 28	0.6	yes
BB619	SOD-123	2.4-2.9	28	>12.5	1 to 28	typ. 0.7	yes
BB620	SOD-123	2.9-3.4	28	19.5-25	1 to 28	typ. 1.3	yes
BB809	DO-34	4.0-5.0	28	8-10	1 to 28	0.6	yes
BB909A	DO-34	2.6-3.0	28	12-15	1 to 28	0.9	yes
BB909B	DO-34	2.8-3.2	28	12-15	1 to 28	0.9	yes
BB910	DO-34	2.3-2.7	28	>14	0.5 to 28	1.0	yes
BB911	DO-34	2.6-3.0	28	>21	0.5 to 28	2.0	yes
BBY40	SOT-23	3.8-4.8	28	8-12	1 to 28	0.7	no
BBY42	SOT-23	2.4-3.0	28	12-16	1 to 28	1.0	no
UHF Tuning							
BB215	SOD-80	1.8-2.2	28	>7.6	1 to 28	typ. 0.63	yes
BB405B	DO-34	1.8-2.2	28	>7.6	1 to 28	0.75	yes
BBY31	SOT-23	1.8-2.8	25	typ. 9.7	1 to 28	1.2	no
BBY62[1]	SOT-143	1.8-2.8	28	9.7	1 to 28	1.2	no
BB515	SOD-123	1.85-2.25	28	8-9.6	1 to 28	typ. 0.5	yes
SHF/SAT-TV Tuning							
BBY39[2]	SOT-23	1.6-2.0	28	>8.0	1 to 28	1.2	no
BB811	SOD-123	0.85-1.2	28	7.8-9.5	1 to 28	typ. 1.0	yes

1) double diode 2) common cathode double diode

SCHOTTKY-BARRIER DIODES

Type	Package Outline	V_R @ (mV)	I_F (mA)	r_s @ (Ω)	I_F and (mA)	f (kHz)	C_d @ V_R (pF) (V)	max V_R (V)	max I_F (mA)
BA480	DO-34	280	1	15	5	1	1.2 0.2	4	30
BA481	DO-34	450	1	13	5	1	1.1 0	4	30

RF BAND-SWITCHING DIODES

Type	Package Outline	r_s (Ω)	@ I_F (mA)	and f (MHz)	C_d @ (pF)	V_R and (V)	f (MHz)	max V_R (V)	max I_F (mA)
AM Radio									
BA223	DO-34	1.5	10	1	3.5	6	1	20	50
BA423	DO-34	1.2	10	1	2.5	3	1	20	50
BA423L	SOD-80	1.2	10	1	2.5	3	1	20	50
VHF Applications									
BA482	DO-35	0.7	3	200	1.2	3	100	35	100
BA483	DO-35	1.2	3	200	1.0	3	100	35	100
BA484	DO-35	1.2	3	200	1.6	3	100	35	100
BA582	SOD-123	0.55	3	200	0.85	3	100	35	100
BA682	SOD-80	0.7	3	200	1.5	3	1	35	100
BA683	SOD-80	1.2	3	200	1.2	3	1	35	100
BAT18	SOT-23	0.7	5	200	1.0	20	1	35	100

DETECTION DIODE

Type	Package Outline	V_F (mV)	@ I_F (μA)	C_d @ (pF)	V_R and (V)	f (MHz)	max V_R (V)	max I_F (mA)
BA231	DO-35	360-420	10	1.2	0	1	50	200

SMALL SIGNAL FIELD-EFFECT TRANSISTORS JUNCTION FET'S

Type	Package Outline	Ratings V_{DSS} max (V)	Ratings I_G max (mA)	I_{DSS} min (mA)	I_{DSS} max (mA)	Characteristics g_{os} typ @1 kHz (μS)	Characteristics y_{fs} min @1 kHz (mS)	Characteristics C_{rss} typ (pF)	Characteristics C_{iss} typ (pF)	Characteristics F typ (dB)	Remarks
N-Channel Junction Field-Effect Transistors											
BF245A/0	TO-92	30	10	0.5	2.1	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF245A	TO-92	30	10	2	6.5	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF245B	TO-92	30	10	6	15	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF245C	TO-92	30	10	12	25	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF247A	TO-92	25	10	30	80		8.0	3.5	11		VHF and UHF appl.
BF247B	TO-92	25	10	60	140		8.0	3.5	11		VHF and UHF appl.
BF247C	TO-92	25	10	110	250		8.0	3.5	11		audio switching
BF256A	TO-92	30	10	3	7	25	4.5	0.7	2	7.5	VHF and UHF appl.
BF256B	TO-92	30	10	6	13	25	4.5	0.7	2	7.5	VHF and UHF appl.
BF256C	TO-92	30	10	11	18	25	4.5	0.7	2	7.5	VHF and UHF appl.
BF410A	TO-92	20	10	0.7	3	60[1]	2.5	0.4[1]	5[1]	1.5	RF stages FM portables
BF410B	TO-92	20	10	2.5	7	80[1]	4.0	0.4[1]	5[1]	1.5	RF stages car radios
BF410C	TO-92	20	10	6	12	100[1]	6.0	0.4[1]	5[1]	1.5	RF stages mains radios
BF410D	TO-92	20	10	10	18	120[1]	7.0	0.4[1]	5[1]	1.5	mixer stages
N-Channel Junction Field-Effect Transistors (Cont.)											
BF510	SOT-23	20	10	0.7	3	60[1]	2.5	0.4	5	1.5	RF stages FM portables
BF511	SOT-23	20	10	2.5	7	80[1]	4.0	0.4	5	1.5	RF stages car radios
BF512	SOT-23	20	10	6	12	100[1]	6.0	0.4	5	1.5	RF stages mains radios
BF513	SOT-23	20	10	10	18	120[1]	7.0	0.4	5	1.5	mixer stages
BF545A/0	SOT-23	30	10	0.5	2.1	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF545A	SOT-23	30	10	2	6.5	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF545B	SOT-23	30	10	6	15	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF545C	SOT-23	30	10	12	25	25	3.0	1.1	4	1.5	DC, LF and HF appl.
J308	TO-92	25	10	12	60	200[1]	8	2.5	5	1.5	VHF/UHF amplifiers
J309	TO-92	25	10	12	60	150[1]	10	2.5	5	1.5	VHF/UHF amplifiers
J310	TO-92	25	10	24	60	200[1]	8	2.5	5	1.5	VHF/UHF amplifiers
PMBFJ308	SOT-23	25	10	12	60	200[1]	8	2.5	5	1.5	VHF/UHF amplifiers
PMBFJ309	SOT-23	25	10	12	30	150[1]	10	2.5	5	1.5	VHF/UHF amplifiers
PMBFJ310	SOT-23	25	10	24	60	200[1]	10	2.5	5	1.5	VHF/UHF amplifiers
BFW10	TO-72	30	10	8	20	85[1]	3.5	0.8	5	2.5	broad band up to
BFW11	TO-72	30	10	4	10	50[1]	3.0	0.8	5	2.5	300 MHz and
BFW12	TO-72	30	10	1	5	30[1]	2.0	0.8	5		differential
BFW13	TO-72	30	10	0.2	1.5	10[1]	1.0	0.8	5		amplifiers
2N3822	TO-72	50	10	2	10		3.0	3.0	6	5	general purpose VHF appl.
2N3823	TO-72	30	10	4	20		3.2	2.0	6	2.5	industrial IF/RF VHF appl.
BRF30	SOT-23	25	5	4	10	40[1]	1.0	1.5[1]	4		low-level general
BFR31	SOT-23	25	5	1	5	20[1]	1.5	1.5[1]	4		purpose amplifiers
BFT46	SOT-23	25	5	0.2	1.5	10[1]	1.0	1.5[1]	4		general purpose amplifiers
BFU308	TO-18	25	10	12	60	200[1]	8	2.5	5	1.5	VHF/UHF amplifiers
BFU309	TO-18	25	10	12	30	150[1]	10	2.5	5	1.5	VHF/UHF amplifiers
BFU310	TO-18	25	10	24	60	200[1]	10	2.5	5	1.5	VHF/UHF amplifiers
2N4416	TO-72	30	10	5	15	50[1]	4.5	0.8	4	2	VHF/UHF amplifiers
PMBF4416	SOT-23	30	10	5	15	50[1]	4.5	0.8	4	2	VHF/UHF amplifiers
PN4416	TO-92	30	10	5	15	50[1]	4.5	0.8	4	2	VHF/UHF amplifiers

1) max value

SMALL SIGNAL FIELD-EFFECT TRANSISTORS MOSFETS

Type Number	Package Outline	Ratings V_{DS} (V)	Ratings I_D (mA)	I_{DSS} min (mA)	I_{DSS} max (mA)	$-V_{(P)G1-S}$ max (V)	y_{fs} @1 kHz min (mS)	C_{is} typ (pF)	C_{os} typ (pF)	F typ (dB)	Remarks
DUAL-GATE N-CHANNEL MOSFETS											
BF960	SOT-103	20	20	2	20	2.7	9.5	1.8	0.9	2.8	UHF
BF964S	SOT-103	20	30	4	20	2.5	15	2.5	1.0	1.0	VHF
BF965	SOT-103	20	30	2	20	2.5	15	2.5	1.0	1.0	VHF
BF966S	SOT-103	20	30	4	20	2.5	15	2.3	0.8	1.8	UHF
BF980A	SOT-103	18	30	—	—	1.3	18	2.6	1.1	2.0	UHF
BF981	SOT-103	20	20	4	25	2.5	10	2.1	1.1	1.0	VHF
BF982	SOT-103	20	40	—	—	1.3	20	4.0	2.0	1.2	VHF
BF988	SOT-103	12	30	2	18	2.5	24[1]	2.1	1.05	1.0	VHF/UHF
BF989	SOT-143	20	20	2	20	2.7	9.5	1.8	0.9	2.8	UHF
BF990A	SOT-143	18	30	—	—	1.3	18	2.6	1.1	2.0	UHF
BF991	SOT-143	20	20	4	25	2.5	10	2.1	1.1	0.7	VHF
BF992	SOT-143	20	40	—	—	1.3	20	4.0	2.0	1.2	VHF
BF994S	SOT-143	20	30	4	20	2.5	15	2.5	1.0	1.0	VHF
BF996S	SOT-143	20	30	4	20	2.5	15	2.3	0.8	1.8	UHF
BF997	SOT-143	20	30	2	20	2.5	15	2.5	1.0	1.0	VHF
BF998	SOT-143	12	30	2	18	2.5	24[1]	2.1	1.05	1.0	VHF/UHF

1) typical value

TUNER TRANSISTORS

Type No.	Pkg.	Ratings V_{CEO} (V)	Ratings I_C (mA)	Ratings P_{tot} (mW)	Characteristics f_T (MHz)	Characteristics F @ (dB)	Characteristics f (MHz)	Characteristics G_{UM} @ (dB)	Characteristics f (MHz)
NPN									
BF498	TO-92	20	20	300	550	2.5	200	30	100
BF747	SOT-23	20	50	150	1200	4.5	100	20	100
BF748	TO-92	20	50	500	1200	4.5	100	20	100
PNP									
BF506	TO-92	20	25	250	350	5	200	17.5	200
BF569N	SOT-23	35	30	250	900	4.5	800	16.7	800
BF579	SOT-23	20	25	300	1350	4.5	800	16	800
BF660	SOT-23	30	25	300	650	—	—	—	—
BF926	TO-92	20	25	250	350	5	200	17.5	200
BF970N	SOT-37	35	30	—	900	4.5	800	16.7	800
BF979	SOT-37	20	30	140	1350	4.5	800	16	800

WIDEBAND TRANSISTORS

Type No.	Pkg.	Ratings V_{CEO} (V)	Ratings I_C (mA)	Ratings P_{tot} (mW)	Characteristics f_T (GHz)	Characteristics F @ (dB)	Characteristics f (MHz)	Characteristics G_{UM} @ (dB)	Characteristics f (MHz)
General, NPN									
BF698K	TO-92	15	25	360	1.8	3	200	16	200
BF763	TO-92	15	25	500	1.8	5	800	—	—
BFG16A	SOT-223	25	150	1000	1.5	—	—	10	500
BFG17A	SOT-143	15	25	300	2.8	2.5	800	15.5	800
BFG25AX	SOT-143	5	6.5	50	5	1.8	800	—	—
BFG33(X)	SOT-143	7	20	140	12	3	2000	12	2000
BFG34	SOT-103	18	150	1000	4	2.3	800	14.5	800
BFG35	SOT-223	18	150	1000	4	—	—	12	800
BFG65	SOT-103	10	50	300	7.5	3	2000	10.5	2000

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RF/MICROWAVE DEVICES

See pages A•2118 & A•2119

Type No.	Pkg.	Ratings V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	Characteristics f_T (MHz)	F @ f (dB) (MHz)	G_{UM} @ f (dB) (MHz)
General, NPN (Cont.)							
BFG92A(X)	SOT-143	15	25	300	5	2.4	800	17.5	800
BFG93A(X)	SOT-143	12	35	300	6	2.3	800	17	800
BFG94	SOT-223	12	60	700	6	2.3	800	15	800
BFG67(X)	SOT-143	10	50	300	7.5	2.5	2000	11	2000
BFG90A	SOT-103	15	25	180	5	2.4	800	19	800
BFG91A	SOT-103	12	35	300	6	2.3	800	17.5	800
BFG92A(X)	SOT-143	15	25	300	5	2.4	800	17.5	800
BFG93A(X)	SOT-143	12	35	300	6	2.3	800	17	800
BFG94	SOT-223	12	60	700	6	2.3	800	15	800
BFG96	SOT-103	15	150	700	5	3.7	800	15	800
BFG97	SOT-223	15	150	700	5	3.7	800	12	800
BFG134	SOT-103	18	150	1000	7.5	—	—	8	2000
BFG135	SOT-223	18	150	1000	7.5	—	—	12	800
BFG195	SOT-103	10	100	700	7.5	1.4	800	11	2000
BFG197(X)	SOT-143	10	100	300	7.5	1.4	800	11	2000
BFG198	SOT-223	10	100	700	7.5	—	—	15	800
BFP90A	SOT-173	15	30	250	5	2.4	800	19.5	800
BFP91A	SOT-173	12	50	350	6	2.3	800	18.5	800
BFP96	SOT-173	15	100	500	5	3.7	800	15	800
BFQ17	SOT-89	25	150	1000	1.2	—	—	6.5	800
BFQ18A	SOT-89	15	150	1000	3.6	—	—	—	—
BFQ19	SOT-89	15	75	500	5	3.3	500	11.5	500
BFQ22S	TO-72	12	35	150	5	1.9	500	16	500
BFQ33C	SOT-173	7	20	140	12	3	2000	12.5	2000
BFQ34	SOT-122	18	150	2250	4	8	500	16.5	500
BFQ34T	SOT-37	18	150	1000	3.7	—	—	19.5	300
BFQ53	TO-72	15	25	150	5	2.4	500	18	500
BFQ63	TO-72	15	75	250	4.5	2.3	500	11.5	500
BFQ65	SOT-37	10	50	300	7.5	3	2000	8	2000
BFQ66	SOT-173	10	50	350	7.5	3	2000	11.5	2000
BFQ67	SOT-23	10	50	300	7.5	3	2000	8	2000
BFQ68	SOT-122	18	300	4500	4	—	—	13	800
BFQ135	SOT-172	18	150	2250	7.5	—	—	14	800
BFQ136	SOT-122	18	600	9000	4	—	—	12.5	800
BFQ270	SOT-172	18	270	5400	6	—	—	—	—
BFR53	SOT-23	10	50	250	2	5	500	10.5	800
BFR64	SOT-48	25	200	3500	1.2	6	200	—	—
BFR65	SOT-48	25	400	5000	1.2	—	—	—	—
BFR90A	SOT-37	15	25	180	5	2.4	800	15	800
BFR91A	SOT-37	12	35	300	6	2.3	800	14	800
BFR92A	SOT-23	15	25	200	5	2.4	800	15	800
BFR93A	SOT-23	12	35	250	5	2.3	800	14	800
BFR94	SOT-48	25	150	3500	3.5	5	500	13.5	500
BFR95	TO-39	25	150	1500	3.5	9	200	13.5	500
BFR96S	SOT-37	15	100	700	5	4	800	11.5	800
BFR106	SOT-23	15	100	350	4	3.6	800	11.5	800
BFR134	SOT-37	18	150	7.5	—	—	14	800	
BFS17	SOT-23	15	25	250	1.3	4.5	500	—	—
BFS17A	SOT-23	15	25	300	2.8	2.5	800	13.5	800
BFT24	SOT-37	5	2.5	30	2.3	3.8	500	17	500
BFT25	SOT-23	5	6.5	50	2.3	3.8	500	18	500
BFT24A	SOT-23	5	6.5	50	5	1.8	800	—	—
BFW16A	TO-39	25	150	1500	1.2	<6	200	—	—
BFW17A	TO-39	25	50	1500	1.1	—	—	—	—
BFW30	TO-72	10	50	250	1.6	<5	500	7.5	800
BFW92	SOT-37	15	25	190	1.6	4	500	—	—
BFW92A	SOT-37	15	25	200	2.8	2.5	800	13	800
BFW93	SOT-37	10	50	190	1.7	<5	500	10.5	800
BFY90	TO-72	15	25	200	1.4	2.5	200	—	—
MPSH10	TO-92	25	—	350	>0.65	—	—	—	—
MPSH81	TO-92	20	—	350	>0.6	—	—	—	—
PMBTH10	SOT-23	25	—	300	>0.65	—	—	—	—
PMBTH81	SOT-23	20	—	300	>0.6	—	—	—	—
GENERAL, PNP							
BFG23	SOT-103	12	35	180	5	3.7	800	14.5	800
BFG31	SOT-223	15	100	1000	5	—	—	12	800
BFG32	SOT-103	15	75	700	4.5	4.3	800	13.5	800
BFG51	SOT-103	15	25	180	5	3.4	800	16.5	800
BFG54	SOT-103	18	150	1000	4	—	—	—	—
BFG55	SOT-223	18	150	1000	4	—	—	11	800
BFQ23	SOT-37	12	35	180	5	2.4	500	16.5	500
BFQ23C	SOT-173	12	50	350	5	3.7	800	15	800
BFQ24	TO-72	12	35	150	5	2.4	500	15	500
BFQ32	SOT-37	15	75	500	4.2	3.8	500	14	500
BFQ32C	SOT-173	15	100	500	4.5	4.3	800	13	800
BFQ32M	TO-72	15	75	250	4.5	2.3	500	11	500
BFQ32S	SOT-37	15	100	700	4.5	4.3	800	10	800
BFQ51	SOT-37	15	25	180	5	2.4	800	18	500
BFQ51C	SOT-173	15	30	250	5	2.5	800	16.5	800
BFQ52	TO-72	15	25	150	5	2.7	500	17	500
BFQ54	SOT-122	18	150	2250	4	—	—	16.5	500
BFQ54T	SOT-37	18	150	1000	4	—	—	18	300
BFQ149	SOT-89	15	75	500	5	3.75	500	12	500
BFT92	SOT-23	15	25	200	5	2.7	500	18	500
BFT93	SOT-23	12	35	200	5	2.4	500	16.5	500

CRT DRIVER TRANSISTORS

Type. No.	Pkg.	Ratings $-V_{CBO}$ max (V)	$-V_{CEO}$ max (V)	I_C max (mA)	Characteristics h_{FE} min	C_{CB} max (pF)	T_J (°C)	f_T min (MHz)
CRT DRIVERS, NPN								
BFQ161	TO-92	20	10	500	25	4	175	1000
BFQ162	TO-126	20	10	500	25	4.2	175	1000
BFQ163	TO-39	20	10	500	25	4.5	200	1000
BFQ231	TO-92	100	65	300	20	1.7	175	1000
BFQ231A	TO-92	115	95	300	20	2	175	800
BFQ232	TO-126	100	65	300	20	2	175	1000
BFQ232A	TO-126	115	95	300	20	2	175	800
BFQ233	TO-39	100	65	300	20	2	200	1000
BFQ233A	TO-39	115	95	300	20	2	200	800
BFQ234	SOT-172A1	100	65	300	20	2	200	1000
BFQ235	SOT-128	100	65	300	20	2	175	800
BFQ235A	SOT-128	115	95	300	20	2	175	800
BFQ262	TO-126	100	65	400	15	2	175	1000
BFQ262A	TO-126	115	95	400	15	2	175	800
BFQ263	TO-39	100	65	400	15	2	200	1000
BFQ263A	TO-39	115	95	400	15	2	200	800
BFQ265	SOT-128	100	65	400	15	2.5	175	800
BFQ265A	SOT-128	115	95	400	15	2.5	175	800
BFQ268	SOT-172A1	100	65	400	15	2	200	1000
CRT DRIVERS, PNP								
BFQ251	TO-92	100	65	300	20	1.7	175	1000
BFQ251A	TO-92	115	95	300	20	1.7	175	800
BFQ252	TO-126	100	65	300	20	2.5	175	1000
BFQ252A	TO-126	115	95	300	20	2.5	175	800
BFQ253	TO-39	100	65	300	20	2.5	200	1000
BFQ253A	TO-39	115	95	300	20	2.5	200	800
BFQ254	SOT-172A1	100	65	300	20	2.5	200	1000
BFQ255	SOT-128	100	65	300	20	2	175	800
BFQ255A	SOT-128	115	95	300	20	2	175	800

BIPOLAR RF TRANSMITTING TRANSISTORS HF SINGLE SIDEBAND 1.6-30MHz

Type No.	Package Outline	Load Power Pep (w)	Power Gain (dB)	Supply Voltage (v)
Class A, intermodulation distortion: d_3, d_5 < −40 dB				
BLV10	SOT-123	1	18	12
BLY87A	SOT-48/2	1	18	12
BLY87C	SOT-120	1	18	12
BLV20	SOT-123	1.3	20	26
BLY91A	SOT-48/2	1.3	20	26
BLY91C	SOT-120	1.3	20	26
BLV11	SOT-123	2	18	12
BLY88A	SOT-48/2	2	18	12
BLY88C	SOT-120	2	18	12
BLV21	SOT-123	2.5	20	26
BLY92A	SOT-48/2	2.5	20	26
BLW87	SOT-123	6	18	12
BLY89A	SOT-56	6	18	12
BLY89C	SOT-120	6	18	12
BLX13	SOT-56	8	18	26
BLX13C	SOT-120	8	20	26
BLW83	SOT-123	10	20	26
BLX39	SOT-120	15	20	26
BLW50F	SOT-123	16	19.5	45
BLW86	SOT-123	17	22	26
BLW78	SOT-121	35	19.5	26
BLW96	SOT-121	50	19	40
Class AB, intermodulation distortion: d_3, d_5 < −30 dB				
BLV11	SOT-123	10	18	13.5
BLY88A	SOT-48/2	10	18	13.5
BLY88C	SOT-120	10	18	13.5
BLV21	SOT-123	10	20	28
BLY92A	SOT-48/2	10	20	28
BLY92C	SOT-120	10	20	28
BLW87	SOT-123	15	18	13.5
BLY89A	SOT-56	15	18	13.5
BLY89C	SOT-120	15	18	13.5
BLW83	SOT-123	25	20	28
BLX13	SOT-56	25	18	28
BLX13C	SOT-120	25	20	28
BLW85	SOT-123	30	19.5	12.5
BLW60	SOT-56	30	19.5	12.5
BLW60C	SOT-120	30	19.5	12.5
BLX39	SOT-120	37.5	19	28
BLW86	SOT-123	42.5	19	28
BLX14	SOT-55	50	13	28
BLW50F	SOT-123	65	18	50
BLW99	SOT-121	80	12.5	12.5
BLW76	SOT-121	80	13	28
BLW78	SOT-121	100	19	28
BLW77	SOT-121	130	12	28
BLX15	SOT-55	150	14	50
BLW95	SOT-121	160	14	50
BLW97	SOT-121	175	11.5	28
BLW96	SOT-121	200	13.5	50

BIOPOLAR RF TRANSMITTING TRANSISTORS VHF 25-175MHz

Type No.	Package Outline	Load Power Pep (W) @ 175MHz	Power Gain (dB) @ 175MHz	Supply Voltage (V)
Class B, 7.5-9.6V Supply Voltage (Portable Mobile)				
2N4427	TO-39	0.7	8	7.5
BFQ42	TO-39	1.5	8.4	7.5
BFQ43	TO-39	3	9.4	7.5
BLW29	SOT-120	9	7.4	7.5
Class B, 12.5-13.5V Supply Voltage (Car Mobile)				
2N4427	TO-39	1	10	12.5
BFQ42	TO-39	2	11	13.5
BLW79	SOT-122	2	13.5	12.5
BFQ43	TO-39	4	12	13.5
BFS22A	TO-39	4	8	13.5
BLW80	SOT-122	4	25	12.5

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Philips Components
Discrete Products Division
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PHILIPS RF/MICROWAVE SEMICONDUCTORS

RF MICROWAVE DEVICES

Type No.	Package Outline	Load Power Pep (W) @ 175MHz	Power Gain (dB) @ 175MHz	Supply Voltage (V)
Class B, 12.5-13.5V Supply Voltage (Car Mobile) (Cont.)				
BLV10	SOT-123	8	9	13.5
BLY87A	SOT-48/2	8	9	13.5
BLY87C	SOT-120	8	12	13.5
BLW81	SOT-122	10	13.5	12.5
BLV11	SOT-123	15	8	13.5
BLW29	SOT-120	15	10	13.5
BLY88A	SOT-48/2	15	8.0	13.5
BLY88C	SOT-120	15	8	13.5
BLW87	SOT-123	25	6	13.5
BLY89A	SOT-56	25	6	13.5
BLY89C	SOT-120	25	6	13.5
BLW31	SOT-120	28	9	13.5
BLV30/12	SOT-119	30	8.2	13.5
BLW30	SOT-120	30	10	12.5
BLV12	SOT-123	30	9	12.5
BLW60	SOT-56	45	5	12.5
BLW60C	SOT-120	45	5	12.5
BLW85	SOT-123	45	4.5	12.5
BLV45/12	SOT-119	45	6.5	12.5
BLV75/12	SOT-119	75	6.5	12.5
Class B, 28V Base Stations				
2N3866	TO-39	1	10	28
2N3553	TO-39	2.5	10	28
BFS23A	TO-39	4	10	28
BLV20	SOT-123	8	12	28
BLY91A	SOT-48/2	8	12	28
BLY91C	SOT-120	8	12	28
BLV21	SOT-123	15	10	28
BLY92A	SOT-48/2	15	10	28
BLY92C	SOT-120	15	10	28
BLW84	SOT-123	25	9	28
BLY93A	SOT-56	25	9	28
BLY93C	SOT-120	25	9	28
BLW86	SOT-123	45	7.5	28
BLX39	SOT-120	45	7.5	28
BLY94	SOT-55	50	7	28
BLV80/28	SOT-121	80	6.5	28
BLW78[1]	SOT-121	100	6	28
BLW77[2]	SOT-121	130	7.5	28

1) Load power and power gain measured at 150 MHz.
2) Load power and power gain measured at 87.5 MHz.

BIPOLAR RF TRANSMITTING TRANSISTORS VHF/UHF 100-400MHz (Air Communication)

Type No.	Package Outline	Load Power (W) @ 470MHz	Power Gain (dB) @ 470MHz	Supply Voltage (V)
BLU50	SOT-161	30	10	28
BLU51	SOT-161	45	9	28
BLU52	SOT-161	60	9	28
BLU53	SOT-161	100	7	28

BIPOLAR RF TRANSMITTING TRANSISTORS UHF 400-512MHz

Type No.	Package Outline	Load Power (W) @ 400MHz	Power Gain (dB) @ 400MHz	Supply Voltage (V)
Class B 7.5V Supply Voltage (Portable Mobile)				
BLT50	SOT-223	1.2	10.5	7.5
Class B, 12.5V Supply (Car Mobile)				
2N4427	TO-39	0.4	10	12.5
BLU56	SOT-223	1	12	12.5
BLX65	TO-39	2	6	12.5
BLX65E	TO-39	2	9	12.5
BLX65ES	TO-39/3	2	6	12.5
BLW79	SOT-122	2	9	12.5
BLX67	SOT-48/3	2.5	8.5	12.5
BLU11/SL	SOT-122D	2.5	10	12.5
BLW80	SOT-122	4	8	12.5
BLU99	SOT-122	5	10.5	12.5
BLU97	SOT-122	7	9	12.5
BLX68	SOT-48/3	7	5	12.5
BLW81	SOT-122	10	6	12.5
BLU15/12	SOT-122	15	7.8	12.5
BLU20/12	SOT-119	20	6.5	12.5
BLX69A	SOT-48/2	20	4	12.5
BLU30/12	SOT-119	30	5.7	12.5
BLU45/12	SOT-119	45	4.8	12.5
BLU60/12	SOT-119	60	4.4	12.5
Class B, 28V (Base Stations)				
2N3866	TO-39	1	10	28
BLX91A	SOT-48/3	1	11	28
BLW89	SOT-122	2	12	28
BLX92A	SOT-48/3	2.5	11	28
BLW90	SOT-122	4	11	28
BLX93A	SOT-48/3	7	8.5	28
BLW91	SOT-122	10	9	28
BLX94A	SOT-48/2	25	6	28
BLX94C	SOT-122	25	6.5	28
BLU30/28	SOT-119	30	8	28
BLX95	SOT-56	40	4.5	28
BLU60/28	SOT-119	60	7	28

BIPOLAR RF TRANSMITTING TRANSISTORS SHF 900 MHz

Type No.	Package Outline	Load Power (W) @ 900MHz	Power Gain (dB) @ 900MHz	Supply Voltage (V)
Class B, 7.5-9.6 Supply (portable mobile)				
BRF90A	SOT-37	0.075	7.5	7.5
BFG90A	SOT-103	0.075	9.5	7.5
BFR91A	SOT-37	0.16	7	7.5
BFG91A	SOT-103	0.16	9	7.5
BLU98	SOT-103	0.4	6.8	7.5
BLV90	SOT-172	0.75	5.3	7.5
BLT80	SOT-223	0.8	6	7.5
BLV90/SL	SOT-172D	1	7	9.6
BLV91/SL	SOT-172D	1.5	7	9.6
BLV91	SOT-172	1.5	4.3	7.5
BLV92	SOT-171	3	5.8	7.5
BLT90/SL	SOT-172	0.75	7	7.5
BLT91/SL	SOT-172	1.5	7.5	7.5
BLT92/SL	SOT-122D	3	7	7.5
BLT93/SL	SOT-122D	6	5.5	7.5
Class B, 12.5V (car mobile)				
BLU98	SOT-103	0.5	8.5	12.5
BLU86	SOT-223	1	7	12.5
BLV90	SOT-172	1	7.5	12.5
BLV90/SL	SOT-172D	1	7.5	12.5
BLV91	SOT-172	2	6.5	12.5
BLV91/SL	SOT-172D	2	6.5	12.5
BLU99	SOT-122	4	7	12.5
BLU99/SL	SOT-122D	4	7	12.5
BLV92	SOT-171	4	7.5	12.5
BLV93	SOT-171	8	6.5	12.5
BLV94	SOT-171	15	6	12.5
BLV95	SOT-171	22	5.5	12.5
Class B, 24V (base stations)				
BLV99	SOT-172	2	9	24
BLV100	SOT-171	8	8	24
BLV98	SOT-171	14	8.5	24
BLV98CE	SOT-171	15	7.5	24
BLV97	SOT-171	30	7	24
BLV97CE	SOT-171	35	7	24
BLV101A	SOT-273	50	8.5	26
BLV101B	SOT-273	50	8.1	26
BLV102	SOT-262	100	7	26

BIPOLAR RF TRANSMITTING TRANSISTORS FM BROADCAST 87-108MHz

Type No.	Package Outline	Load Power (W) @ 108MHz	Power Gain (dB) @ 108MHz	Supply Voltage (V)
Class B				
2N3866	TO-39	1.8	10	28
BLW90	SOT-122	4	20	28
BLV21	SOT-123	15	10	28
BLW86[1]	SOT-123	45	7.5	28
BLX39	SOT-120	45	7.5	28
BLV80/28	SOT-121	80	10	28
BLW76	SOT-121	80	8	28
BLW78	SOT-121	100	8	28
BLV25	SOT-119	175	10	28
BLV37	SOT-179	250	10.5	28

1) Load power and power gain measured at 175 MHz

BIPOLAR RF TRANSMITTING TRANSISTORS TV TRANSPOSERS/TRANSMITTERS

Type No.	Package Outline	Output Power @ d_{im} SYNC (W)	(dB)	Output Power P_o-1dB (W)	Power Gain (dB)	Supply Voltage (V)
CLASS A, BANDS I (41-68 MHz) and III (174-230 MHz)						
BLV30	SOT-122	1.5	−60	—	18	25
BLV31	SOT-122	5	−58	—	15	25
BLV32F	SOT-160	10	−55	—	16	25
BLV33F	SOT-119	16	−55	—	13.5	25
BLV33	SOT-147	19	−55	—	9	25
CLASS AB, BANDS I (41-68 MHz) and III (174-230 MHz)						
BLV30	SOT-122	—	—	10	15	28
BLV31	SOT-122	—	—	20	12	28
BLV32F	SOT-160	—	—	30	13	28
BLV33F	SOT-119	—	—	85	10.5	28
BLV33	SOT-147	—	—	90	6.5	28
BLV36	SOT-161	—	—	115	11	28
BLV38	SOT-179	—	—	225	9.0	35
CLASS A, BANDS IV and V (470-860 MHz)						
BFR96S	SOT-37	0.12	−60	—	10	25
BFQ34	SOT-122	0.3	−60	—	11	25
BLW32	SOT-122	0.5	−60	—	11	25
BLX96	SOT-48	0.5	−60	—	6	25
BFQ68	SOT-122	0.7	−60	—	10	25
BLW33	SOT-122	1	−60	—	10	25
BLX97	SOT-48	1	−60	—	5.5	25
BLW34	SOT-122	1.8	−60	—	9	25
BLW98	SOT-122	3.5	−60	—	6.5	25
BLX98	SOT-48/2	3.5	−60	—	5	25
BLV57	SOT-161	6	−60	—	8	25

Type No.	Package Outline	Output Power @ d_{im} SYNC (W)	(dB)	Output Power P_o-1dB (W)	Power Gain (dB)	Supply Voltage (V)
CLASS AB, BANDS IV and V (470-860 MHz)						
BLV59	SOT-171	—	—	30	7	25
BLV57	SOT-161	—	—	38	6.5	25

RF POWER MOS TRANSISTORS

Type No.	Package Outline	Load Power (W)	V_{DS} (V)	Source Gain (dB)
HF SSB CLASS AB (f = 28 MHz, d3/d5 < −30 dB)				
BLF145	SOT-123	30	28	20 typ
BLF175	SOT-121	30	50	23
BLF246	SOT-121	80	28	20 typ
BLF147	SOT-121	150	28	17
BLF177	SOT-121	150	50	20
HF SSB CLASS A (f = 1.5-30 MHz, d3/d5 < −40 dB)				
BLF242	SOT-123	2	28	23 typ
BLF244	SOT-123	4	28	23 typ
BLF145	SOT-123	8	28	24
BLF175	SOT-123	8	50	24
BLF246	SOT-121	20	28	23 typ

RF POWER MOS TRANSISTORS

Type No.	Package Outline	Load Power (W)	V_{DS} (V)	f (MHz)	Source Gain (dB)
VHF BASE STATIONS (f = 25-175 MHz, Class B Operation)					
BLF241	SOT-5/11	3	28	175	14 typ
BLF242	SOT-123	5	28	175	13
BLF244	SOT-123	15	28	175	13
BLF245	SOT-123	30	28	175	13
BLF245B	SOT-279	30	28	175	14
BLF175	SOT-121	30	50	108	19 typ
BLF246B	SOT-161	60	28	175	14
BLF246	SOT-121	80	28	108	16
BLF147	SOT-121	150	28	108	13 typ
BLF177	SOT-121	150	50	108	20 typ
BLF277	SOT-119	150	50	108	20 typ
BLF248	SOT-262	300	28	175	15 typ
BLF278	SOT-262	300	50	108	20
VHF MOBILE TRANSMITTERS (f = 25-175 MHz, Class B Operation)					
BLF221	TO-39/3	2	12.5	175	10
BLF241	SOT-5/11	2	12.5	175	10
BLF244	SOT-123	6	12.5	175	15 typ
BLF245	SOT-123	12	12.5	175	12 typ
BLF225	SOT-123	30	12.5	175	8.5
UHF BASE STATIONS (f = 100-500 MHz, Class B Operation)					
BLF521	SOT-172D	2	12.5	500	10
BLF522	SOT-171	5	12.5	500	10
BLF543	SOT-171	10	28	500	12
BLF544	SOT-171	20	28	500	11
BLF544B	SOT-268	20	28	500	11
BLF545	SOT-268	40	28	500	11
BLF546	SOT-268	80	28	500	11
BLF548	SOT-262	150	28	500	9
UHF BASE STATIONS (f = 225-400 MHz, Class B Operation)					
BLF242	SOT-123	5	28	400	13 typ
BLF244	SOT-123	15	28	400	11 typ
BLF245	SOT-123	30	28	400	10 typ
UHF BASE STATIONS (f = 860-960 MHz, Class B Operation)					
BLF543	SOT-171	10	28	960	8 typ
BLF544	SOT-171	20	28	960	7 typ

RF POWER MOS TRANSISTORS

Type No.	Package Outline	Output Power Sync (W)	V_{DS} (V)	f (MHz)	Power Gain (dB)	d_{im} (dB)	I_D (mA)
TV TRANSPOSERS (band 3, f = 174-230 MHz, Class A Operation)							
BLF346	SOT-119	27	28	225	13	−52	3000
BLF348	SOT-262	67	28	225	11	−52	2×4600
TV TRANSMITTERS (band 3, f = 174-230 MHz, Class AB Operation)							
BLF368	SOT-262	300	32	225	12	—	2×250
BLF378	SOT-262	250	50	225	14	—	2×500

RF POWER AMPLIFIER MODULES

Type No.	Package Outline	Frequency Band (MHz)	Output Power (W)	Power Gain (dB)	Supply Voltage (V)
VHF (portable)					
BGY112A	—	68-88	7	38.5	7.2
BGY112B	—	132-156	7	38.5	7.2
BGY112C	—	146-174	7	38.5	7.2
BGY112D	—	174-210	7	38.5	7.2
VHF (car mobile)					
BGY43	SOT-132B	148-174	13	19.4	12.5
BGY32	SOT-132B	68-88	18	22.6	12.5
BGY33	SOT-132B	80-108	18	22.6	12.5
BGY35	SOT-132B	132-156	18	20.8	12.5
BGY36	SOT-132B	148-174	18	20.8	12.5

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PHILIPS RF/MICROWAVE SEMICONDUCTORS

RF MICROWAVE DEVICES

Type No.	Package Outline	Frequency Band (MHz)	Output Power (W)	Power Gain (dB)	Supply Voltage (V)
VHF (car mobile) (Cont.)					
BGY145C	SOT-183	174-200	27	19.5	12.5
BGY145B	SOT-183	146-174	28	19.7	12.5
BGY145A	SOT-183	68-88	29	22.0	12.5
UHF (portable)					
BGY46A	SOT-181	400-440	1.4	15.0	9.6
BGY46B	SOT-181	430-470	1.4	15.0	9.6
BGY47A	SOT-181	400-470	2	16.0	7.5
BGY47A	SOT-181	400-470	3.2	18.0	9.6
BGY113A	—	400-440	7	38.5	7.5
BGY113B	—	430-470	7	38.5	7.5
BGY113C	—	460-512	7	38.5	7.5
UHF (car mobile)					
BGY49A	SOT-132D	400-440	20	21.2	12.5
BGY49B	SOT-132D	440-470	20	21.2	12.5
SHF (portable)					
BGY110A	SOT-246	824-849	1.2	30.8	6.0
BGY110B	SOT-246	872-905	1.2	30.8	6.0
BGY110D	SOT-246	824-849	1.7	32.3	7.2
BGY110E	SOT-246	872-905	1.7	32.3	7.2
BGY110F	SOT-246	890-915	1.7	32.3	7.2
BGY95A	SOT-200	824-849	2.2	20.4	7.5
BGY95B	SOT-200	890-915	2.2	20.4	7.5
BGY96A	SOT-200	824-849	2.5	21.0	9.6
BGY96B	SOT-200	890-915	2.5	21.0	9.6
SHF (car mobile)					
BGY91A	SOT-223	806-890	6	23.0	12.5
BGY91B	SOT-223	890-950	6	23.0	12.5
BGY92C	SOT-223	890-915	10	20.0	12.5

*consult data sheet

MICROWAVE TRANSISTORS, PULSED POWER

Type No.	Package Outline	f (GHz)	V_{CC} (V)	t_p @ (µs)	Duty Cycle (%)	P_L (W)	G_p (dB)	η_C (%)
RADAR PULSED, L-BAND								
RZ1214B35Y	FO-57C	1.2-1.4	50	150	5	35	7	30
		1.2-1.4	50	300	10	40	7	35
RZ1214B65Y	FO-57C	1.2-1.4	50	150	5	70	7	35
		1.2-1.4	50	300	10	80	7	30
RX1214B130Y	FO-91	1.2-1.4	50	150	5	130	7	40
RX1214B170Y	FO-91	1.2-1.4	50	150	5	190	6.7	42
RX1214B150W	FO-91	1.2-1.4	50	1000	10	135	6.5	35
		1.2-1.4	50	150	5	220	8	45
RX1214B300Y	FO-91	1.2-1.4	50	300	10	300	7.5	35
		1.2-1.4	50	150	5	250	7	35
RADAR PULSED, S-BAND								
RZ2731B16W	FO-57D	2.7-3.1	40	100	10	15	6	32
RZ3135B14W	FO-57D	3.1-3.5	40	100	10	13	5.5	30
RZ2731B32W	FO-57D	2.7-3.1	40	100	10	30	6	32
RADAR PULSED, S-BAND (Cont.)								
RZ3135B28W	FO-57D	3.1-3.5	40	100	10	27	5.5	30
RZ2731B48W	FO-57D	2.7-3.1	40	100	10	45	6	32
RZ3135B42W	FO-57D	3.1-3.5	40	100	10	40	5.5	30
RZ2731B60W	FO-57D	2.7-3.1	40	100	10	60	6	35
RZ3135B50W	FO-57D	3.1-3.5	40	100	10	50	5.2	30
RV3135B5X	FO-83	3.1-3.5	24	100	10	4	4.3	30
RX2731B90W	FO-125A	2.7-3.1	40	100	10	90	6	35
RX3034B70W	FO-125A	3.0-3.4	40	100	10	70	5.4	30
AVIONICS PULSED								
MRB11175Y	FO-67	1.09	50	10	1	175	7.5	35
MRB11350Y	FO-67	1.09	50	10	1	350	7	30
MSB11900Y	FO-96	1.09	50	10	1	800	7	30
RZB12050Y	FO-57C	1.09	50	100	10	35	7	30
RZB12100Y	FO-57C	1.09	50	100	10	80	7	30
RZB12250Y	FO-57C	1.09	50	100	10	200	7	30
RXB12350Y	FO-91	1.09	50	100	10	300	7	30
MZ0912B50Y	FO-91	0.96-1.215	50	10	10	50	7	42
MZ0912B100Y	FO-91	0.96-1.215	50	10	10	100	7	42
MX0912B250Y	FO-91	0.96-1.215	50	10	10	235	7	42
MX0912B350Y	FO-91	0.96-1.215	50	10	10	325	7	40

*May also be used for 2.6-3.1 GHz.

MICROWAVE, TRANSISTORS, CONTINUOUS POWER LINEAR POWER TRANSISTORS

Type No.	Package Outline	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{PO}[2] (dB)
CLASS A, MEDIUM POWER						
LEE1015T	SOT-122	1	20	200	1.5 typ	14 typ
LEE1015T	FO-41B	1	20	200	1.5 typ	14 typ
LBE2003S	FO-45	2.0	18	30	.200	—
LCE2003S	FO-46	2.0	18	30	.200	—
LBE2009S	FO-45	2.0	18	110	.700	9.8
LCE2009S	FO-46	2.0	18	110	.700	9.8
LUE2003S	FO-163	2.0	18	30	.200	11
LUE2009S	FO-163	2.0	18	110	.700	9.8
LTE21009R	FO-41B	2.1	16	150	1 typ	8.5
LTE21015R	FO-41B	2.1	16	250	1.5	8.1
LTE21025R	FO-41B	2.1	16	400	2.0	8.8
LWE2015R	FO-93	2.3	16	250	1.2	8.1
LWE2025R	FO-93	2.3	16	400	2.0	7.8
LAE4001R	SOT-100	4.0	15	25	.085	9.5
LAE4002S	SOT-100	4.0	18	30	.126	8
LTE4002S	FO-41B	4.0	18	30	.200 typ	8
LTE42005S	FO-41B	4.2	18	110	.550	7.2
LTE42008R	FO-41B	4.2	16	250	.940	7.5
LTE42012R	FO-41B	4.2	16	400	1.250	7
CLASS A, HIGH POWER (Wideband)						
LZ1418E100R	FO-57C	1.4-1.8	16	2	9	10
LZE18100R	FO-57C	1.8	16	2	10 typ	11 typ
LV1721E50R	FO-83	1.7-2.1	16	1.1	5	7
LV2024E45R	FO-83	2.0-2.4	16	1.1	4	6
LVE21050R	FO-83	2.1	16	1.1	5.5 typ	8 typ
CLASS A, HIGH POWER (Wideband) (Cont.)						
LV2327E40R	FO-83	2.3-2.7	16	1	4	7
LV2931E50S	FO-83	2.9-3.1	18	1	4.5	6

(1) Load power for 1 dB compressed power gain.
(2) Low-level power gain associated with P_{L1}.

CW POWER TRANSISTORS

Type No.	Package Outline	f (GHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
CLASS C, MEDIUM POWER						
PTB23001X	FO-41B	2	24	1	7	45
PTB23003X	FO-41B	2	24	3	8.75	45
PTB23005X	FO-41B	2	24	5	9.2	50
PTB32001X	FO-41B	3	24	1.3	8	35
PTB32003X	FO-41B	3	24	2.5	8	35
PTB32005X	FO-41B	3	24	4.5	8	35
PTB42001X	FO-41B	4.2	24	0.8	5	28
PTB42002X	FO-41B	4.2	24	1.6	5	28
PTB842003X	FO-41B	4.2	24	2.5	5	28
PVB42004X	FO-83	1	24	13	11	60
		2	24	10	10	48
		3	24	7.5	8.8	30
		4	24	4	6	25
CLASS C, HIGH POWER						
PZ1418B15U	FO-57C	1.4-1.8	28	12.5	7	38
PZ1418B30U	FO-57C	1.4-1.8	28	27	7.3	38
PZB16035U	FO-57C	1.6	28	35	8	45
PXB16050U	FO-91	1.6	28	45	8.5	45
PZ1721B12U	FO-57C	1.7-2.1	28	12	6.8	35
PZ1721B25U	FO-57C	1.7-2.1	28	25	7	35
PZ2025B10U	FO-57C	2.0-2.4	28	9	5.6	35
PZ2024B20U	FO-57C	2.0-2.4	28	20	6	35
PZ2327B15U	FO-57C	2.3-2.7	28	15	7	40

OSCILLATOR POWER TRANSISTORS

Type No.	Package Outline	f (GHz)	V_{CE} (V)	I_C (mA)	P_L (mW)
PPC50011	FO-102	5	20	200	450
PQC50011	FO-85	5	20	200	450

MICROWAVE TRANSISTOR CHIPS*

Type No.	Dimensions (mm)	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (mW)	G_{PO} (dB)
OP186	0.37×0.37	4	18	30	250	11
OP213	0.32×0.32	4	15	25	110	9.5
OP214	0.37×0.47	4.2	16	125	470	7.5
OP221	0.37×0.37	2	18	110	900	9.8
OP222	0.65×2.6	2	16	1100	5000	8
OP238	0.47×0.47	3	18	330	1700	6.5
OP255	0.32×0.32	2	8	5	—	10

*Packaging Anti-static waffle-type carrier. Thickness 180 µm. Back Metallization: Gold (collector) Top Metallization: Gold (emitter, base).

CATV AMPLIFIER MODULES

Type	Package Outline	Frequency Range MHz	Power Gain at f=50 MHz dB	Slope Cable Equivalent dB	Application
BGD102	SOT-115	40-450	18.5±0.5	0.5 to 2.5	power doubler
BGD102E	SOT-115	40-450	18.5±0.5	0.5 to 2.0	power doubler
BGD104	SOT-115	40-450	20.0±0.5	0.5 to 2.5	power doubler
BGD104E	SOT-115	40-450	20.0±0.5	0.5 to 2.0	power doubler
BGD106	SOT-115	40-450	22±0.5	0 to 2.0	power doubler
BGD108	SOT-115	40-450	36±0.1	0.5 to 2.0	power doubler
BGD502	SOT-115	40-550	18.5±0.5	0.2 to 2.2	power doubler
BGD504	SOT-115	40-550	20.0±0.5	0 to 2.0	power doubler
BGD506	SOT-115	40-550	22±0.5	0 to 2.0	power doubler
BGD508	SOT-115	40-550	36±0.1	0.5 to 2.5	power doubler
BGD885	SOT-115	40-860	17.3±1	0.2 to 1.6	power doubler
BGE85A	SOT-115	40-450	18.4±1.0	0.3 to 1.5	post amplifier
BGE88	SOT-115	40-450	34.5±1.5	0.5 to 2.5	post amplifier
BGE885	SOT-115	40-860	17.0±0.5	0.2 to 1.2	
BGE887	SOT-115	470-860	23.0±1	−0.5 to 0.5	
BGX885	SOT-115	40-860	17.0±0.5	0.2 to 1.2	40-860 MHz amplifier
BGY50	SOT-115	40-300	12.5±0.4	0.2 to 0.8	preamplifier
BGY51	SOT-115	40-300	12.5±0.4	0.2 to 0.8	post amplifier
BGY52	SOT-115	40-300	16.4±0.4	0 to 1.0	preamplifier
BGY53	SOT-115	40-300	16.4±0.4	0 to 1.0	post amplifier
BGY54	SOT-115	40-300	17.0±0.4	0 to 1.0	preamplifier
BGY55	SOT-115	40-300	17.0±0.4	0 to 1.0	post amplifier
BGY56	SOT-115	40-300	22.0±0.6	0 to 1.0	preamplifier
BGY57	SOT-115	40-300	22.0±0.6	0 to 1.0	post amplifier
BGY58	SOT-115	40-300	33.0±1.0	0.5 to 1.5	line extender
BGY58A	SOT-115	40-300	34.0±1.0	0.5 to 1.5	line extender
BGY59	SOT-115	40-300	38.5±1.0	0 to 1.5	line extender
BGY60	SOT-115	40-300	33.5±1.0	0.5 to 1.5	interstage amplifier (2×17 dB)
BGY61	SOT-115	5-200	13.0±0.5	−0.2 to 0.5	reverse amplifier

CATV AMPLIFIER MODULES (Cont.)

Type	Package Outline	Frequency Range MHz	Power Gain at f=50 MHz dB	Slope Cable Equivalent dB	Application
BGY65	SOT-115	5-200	18.5±0.5	−0.2 to 0.5	reverse amplifier
BGY67	SOT-115	5-200	22.0±0.5	−0.2 to 0.5	reverse amplifier
BGY67A	SOT-115	5-200	24.0±0.5	−0.2 to 0.5	reverse amplifier
BGY80	SOT-115	40-450	12.5±0.5	−0.2 to 1.5	preamplifier
BGY81	SOT-115	40-450	12.5±0.5	0.2 to 1.5	post amplifier
BGY82	SOT-115	40-450	15±0.5	0.2 to 1.5	
BGY83	SOT-115	40-450	14±0.5	0.2 to 1.5	
BGY84	SOT-115	40-450	17.0±0.5	0.5 to 1.5	preamplifier
BGY84A	SOT-115	40-450	18.4±0.4	0.3 to 1.5	preamplifier
BGY84H	SOT-115	40-450	15.4±0.9	4.7 to 5.5	preamplifier
BGY85	SOT-115	40-450	17.0±0.5	0.5 to 1.5	post amplifier
BGY85A	SOT-115	40-450	18.4±0.4	0.3 to 1.5	post amplifier
BGY85H	SOT-115	40-450	15.4±0.9	4.7 to 5.5	post amplifier
BGY86	SOT-115	40-450	22.0±0.5	0.2 to 1.5	preamplifier
BGY87	SOT-115	40-450	22.0±0.5	0.2 to 1.5	post amplifier
BGY87B	SOT-115	40-450	27±0.8	0.5 to 2.5	
BGY88	SOT-115	40-450	34.5±1.0	0.5 to 2.5	line extender
BGY89	SOT-115	40-450	38±0.1	0 to 2.5	line extender
BGY580	SOT-115	40-550	12.5±0.5	0.5 to 2.0	preamplifier
BGY581	SOT-115	40-550	12.5±0.5	0.5 to 2.0	post amplifier
BGY582	SOT-115	40-550	14±0.5	0.2 to 1.5	
BGY583	SOT-115	40-550	14±0.5	0.2 to 1.5	
BGY584	SOT-115	40-550	17.2±0.5	0.5 to 2.0	preamplifier
BGY584A	SOT-115	40-550	18.2±0.5	0.5 to 2.0	preamplifier
BGY585	SOT-115	40-550	17.2±0.5	0.5 to 2.0	post amplifier
BGY585A	SOT-115	40-550	18.2±0.5	0.5 to 2.0	post amplifier
BGY586	SOT-115	40-550	22.0±0.5	0.5 to 2.0	preamplifier
BGY587	SOT-115	40-550	22.0±0.5	0.5 to 2.0	post amplifier
BGY587B	SOT-115	40-550	27±0.8	0.5 to 2.5	
BGY588	SOT-115	40-550	34.5±1.0	0.5 to 2.5	post amplifier

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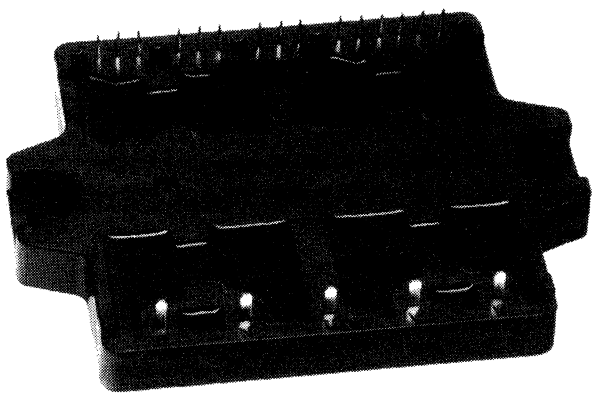
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Infrared Emitting Diodes .....
Phototransistor Detectors .....
Optoisolators .....
Opto Interruptors .....
Bar Graph & LED Arrays .....

Red, orange, green, yellow and IR, in both narrow and wide angle. Photo-transistors to cover the IR and visible spectrum. Optoisolators with transistor, Darlington, SCR or TRIAC outputs. Both 1 and 2 digit numeric displays.

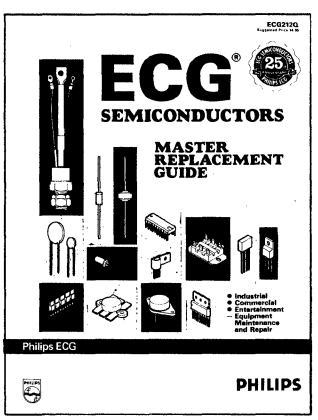
INTERFACE INTEGRATED CIRCUITS .....
Display Driver Circuits .....

Analog and digital IC's for both decoding and driving from both CMOS and TTL logic.

DIGITAL INTEGRATED CIRCUITS .....
CMOS .....
TTL (Including 74C CMOS Series) .....

4000, 4500 series and 40000 series.
74C, 74H, 74HC, 74HCT, 74L, 74LS, 74S and 7400 series.

DTL .....
HTL .....
RTL .....
HLL .....



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4000 ECG types replace over
260,000 industry numbers

SPECIAL PURPOSE DEVICES .....
Silicon Unijunction Transistors (UJT) .....
Programmable Unijunction Transistor (PUT) .....
Silicon Bilateral Switch (SBS) .....
Silicon Unilateral Switch (SUS) .....
Silicon Asymmetrical Switch (SAS .....
Silicon Controlled Switch (SCS) .....
Bilateral Trigger Diodes (DIACs) .....

TRANSIENT SUPPRESSORS
Metal Oxide Varistors (MOV) .....
Surge Clamping Diodes .....
Direct Plug-In Transient Surge Suppressors .....

IC PROTECTORS .....

Protects IC's and all types of electronic equipment from overload

THERMAL CUTOFFS .....

Small appliance (motor driven) thermal protection devices

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Maintenance — Routine Preventative Maintenance
Repair — Repair of Equipment Failures
Operations — Plant/Equipment Renovations

TRANSISTORS	79 case styles to fit almost every application
Bi-Polar Types	Both Silicon and Germanium
Complementary Pairs	Up to 250 watts, up to 1500 volts
Bi-Polar Selector Guide (Silicon & Germanium)	
RF Selector Guide	Covering RF Power devices to 870 MHz
Field Effect Transistors (FET)	Both single and dual gate devices. Suitable from audio through UHF
Power MOSFET Transistors	Up to 800 volts, I_D to 32A
Darlington Power Transistors	Gain up to 90K, power up to 300W, IC to 50A
DIODES AND RECTIFIERS	55 case styles for most applications
General Purpose	Both Silicon and Germanium
PIN Diodes	For fast switching
HV Rectifiers	Voltages to 45,000 volts
Varistors (Temperature Compensating Diodes)	Biasing diodes to achieve stability
Varistors (Voltage Compensating Diodes)	
Varactors (Variable Capacitance Diodes)	For tuning, AFC
Bridge Rectifiers	1 Amp to 100 Amps, up to 1000 volts
HV Rectifiers (Avalanche Silicon)	High voltage and high current
ZENER DIODES	From ½ to 50 watts, from 2.4 to 200 volts, axial and stud cases
INDUSTRIAL RECTIFIERS	From 3 to 2200 Amps up to 1600 volts, Schottky and Ultra-Fast types
SILICON CONTROL RECTIFIERS (SCR)	
Phase Control	0.6 to 1880 Amps, voltage to 1200 volts
Switching	Frequencies to 16 kHz
TRIACS	0.8 to 45 amperes, with voltages up to 1000 volts in a variety of case styles to accommodate most applications
MICROPROCESSORS/RAM's	Seven popular microprocessors and their peripherals, SRAM, DRAM & PROMs in various size configurations
MECHANICAL ACCESSORIES	
IC Sockets	Standard low profile, wire wrap and shrink type (.070 ctrs)
Insulator (Mica/Rubber)	
Transistor Sockets	
Heat Sinks/Clamps	
Transistor Mounting Kits	

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ROHM Electronics Division
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Transistors
DC to 12 GHz

Innovative Transistor Packages

In the past decade, ROHM has pioneered the development of several surface mount and through-hole transistor packages.

Innovations include the development of the digital transistor, a space-saving device that includes two resistors and one transistor in a single surface mount package.

To enhance the possibilities inherent within the industry-standard SOT-23 package outline, ROHM has developed the SOT-25 with five leads and the SOT-36 with six. This design allows a dual digital transistor arrangement, including both resistors and transistors in a single package.

We offer single and dual digital transistors in several device configurations and resistance values. Please call for complete specifications.

ROHM's also has developed the SOT-89 and DPAK packages incorporating an exclusive lock-in mechanism for the power tab that prevents separation from the base. The locking feature eliminates the incursion of moisture, which is otherwise a threat to reliability.

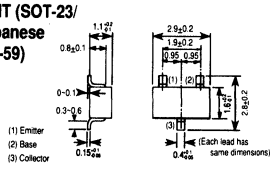
ROHM pioneered the development of thermally isolated TO-126 and TO-220 packages. This electrically isolated, thermally conductive solution eliminates microwashers and thermal grease, and also allows more efficient heat sink mounting of power transistors.

In addition, we have developed semiconductor package innovations which improve automated handling of these devices. Both the FTR and ATR packages have flat corners, which accommodate automatic insertion without taping.

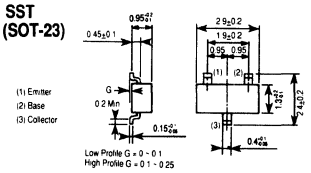
Call us for all your discrete semiconductor requirements, including surface mount, leaded, digital and dual digital transistors, transistor arrays, and dual digital transistor arrays.

Surface Mounted

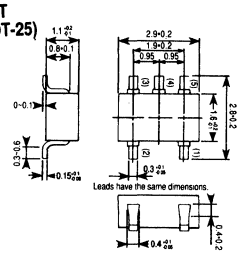
SMT (SOT-23/ Japanese SC-59)



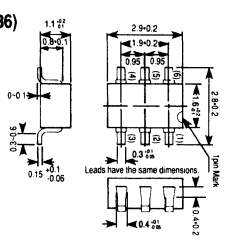
SST (SOT-23)



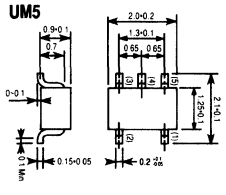
FMT (SOT-25)



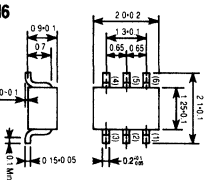
IMD (SOT-36)



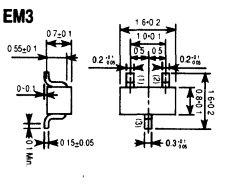
UM5



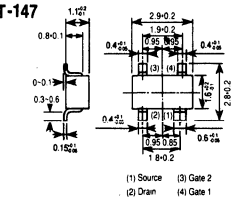
UM6



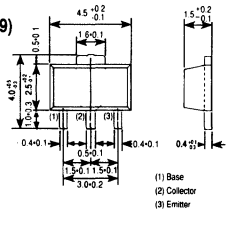
EM3



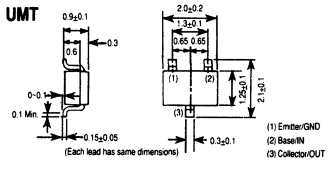
SOT-147



MPT (SOT-89)



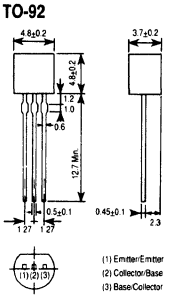
UMT



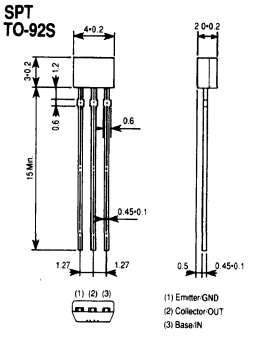
Call for Complete Specs on 1000s of Components!

Leaded

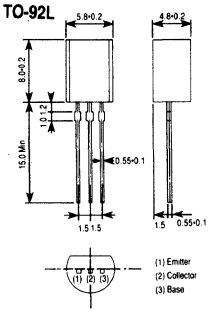
TO-92



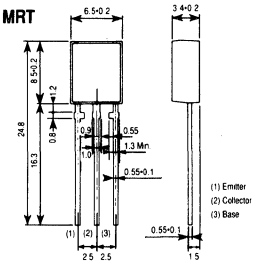
SPT TO-92S



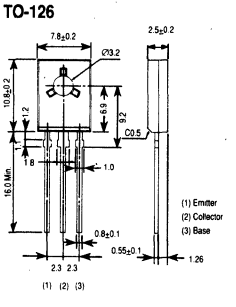
TO-92L



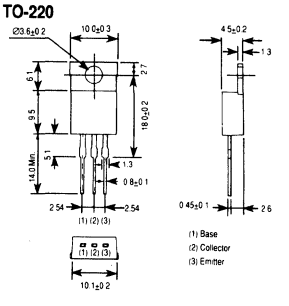
MRT



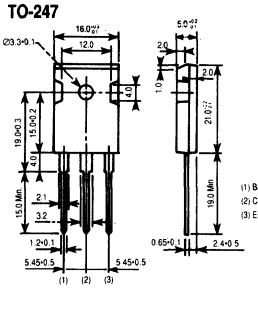
TO-126



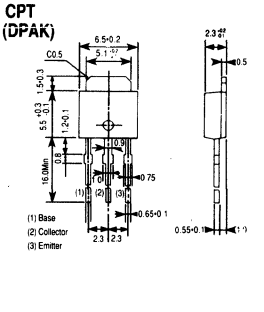
TO-220



TO-247



CPT (DPAK)



ROHM CORPORATION
ROHM Electronics Division
3064 Owen Drive, Antioch, TN 37013
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Diodes

A Reputation for Reliability

Over the past 20 years, ROHM often has set the industry's standards for quality and reliability in discrete semiconductors.

Quality is our passion. We breathe it. We live it. And we believe that rigorous, uncompromising product quality results in the greatest possible economy for you.

ROHM also has earned a reputation as an innovative packaging company. We were among the first to put leadless diodes into production. Today, our leadless diode product line is among the world's most extensive.

When rectifier users encountered excessive wear on lead-forming equipment, ROHM responded by supplying easier-to-bend 0.6mm leads on DO-41 products.

Similarly, to allow mounting of diodes on 5mm centers flush with PC boards, ROHM provided the solution with preformed axial/radial tape-and-reel DO-34 diodes.

So in discrete semiconductors, when quality and innovation are the questions, ROHM is the answer.

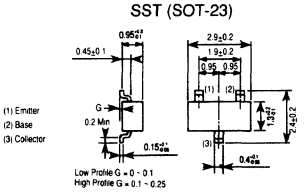
New SST Package

If you're now using SC-59 diodes, you should consider ROHM's new super-slim SST package. It has a smaller overall size, and allows you to increase board density.

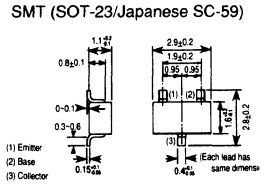
The SST's dimensions match those of many popular European part numbers. It fits the pad layout of existing boards using these components.

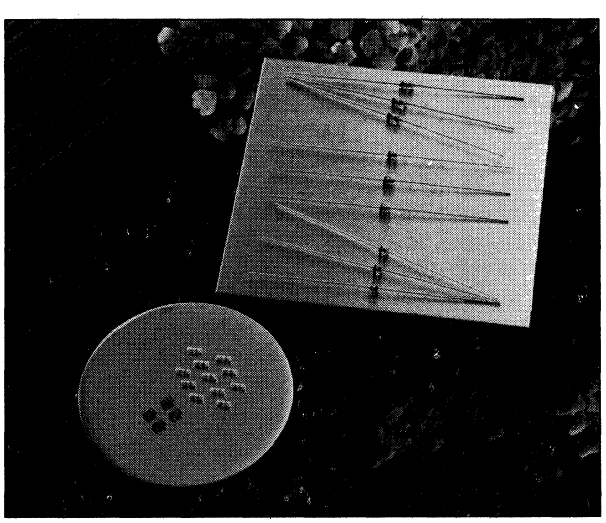
DAN202KR (SC-59)
DAN202CR (SST)
DAP202KR (SC-59)
DAP202CR (SST)
DAN212KR (SC-59)
DAN212CR (SST)
DAN217KR (SC-59)
DAN217CR (SST)

SST (SOT-23)



SMT (SOT-23/Japanese SC-59)





Call for information on 1 watt zeners

Switching Diodes (JEDEC Standard)

Absolute maximum ratings (Ta=25°C)

DO-35		LL-34	DO-34
1N4148	1N914	RLS4148	1N4531
1N4149	1N916	RLS4149	1N4532
1N4150	1N3600	RLS4150	1N4533
1N4151	1N3604	RLS4151	1N4534
1N4152	1N3605	RLS4152	1N4536
1N4153	1N3606	RLS4153	
1N4154		RLS4154	
1N4446	1N914A	RLS4446	
1N4447	1N916A	RLS4447	
1N4448	1N914B	RLS4448	
1N4449	1N916B	RLS4449	
1N4450		RLS4450	
1N4454	1N3064	RLS4454	
1N4606		RLS4606	

General Purpose Rectifying Diodes

1N4000 Series: Surface mount & leaded available in both glass & plastic packages.

1SR35-100A	1SR139-100	1N4001A	RLR4001
1SR35-200A	1SR139-200	1N4002A	RLR4002
1SR35-400A	1SR139-400	1N4003A	RLR4003
	1SR139-600	1N4004A	RLR4004

High-Speed Rectifier Diodes

1SR124-100A	1SR124-400A	1SR153-200	1SR153-400
1SR124-200A	1SR153-100		

Schottky Barrier Diodes (Rectify)

RB100A	RB411D	RB425D	RB451F
RB110C	RB420D	RB435C	RB471E
RB400D	RB421D	RB441Q	

1N5230 - 1N5257 (Pd = 500mW; Package: DO-35)

1N5230B	1N5237B	1N5244B	1N5251B
1N5231B	1N5238B	1N5245B	1N5252B
1N5232B	1N5239B	1N5246B	1N5253B
1N5233B	1N5240B	1N5247B	1N5254B
1N5234B	1N5241B	1N5248B	1N5255B
1N5235B	1N5242B	1N5249B	1N5256B
1N5236B	1N5243B	1N5250B	1N5257B

High-Speed Switching Diode Arrays

DAN202U	DAN601	DAP202U	DAP401
DAN202K	DAN801	DAP202K	DAP601
DAN201	DAN803	DAP201	DAP801
DAN209	FMN1	DAP209	DAP803
DAN209S	IMN10	DAP209S	FMP1
DAN215	IMN11	DAP215	IMP11
DAN401			

Rectifying Diode Arrays

DAN208	DAN213	DAP208	DAP213

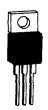
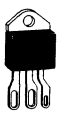
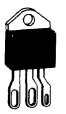
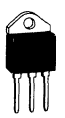
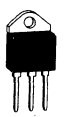
Special Diode Arrays

DA106U	DAN212K	DA204U	DA210S
DA106K	DA112	DA204K	DA216
DA115	DA116	DAN217	DA218S
DA119	DA113	DA203	DAN403
DA114	DA118		

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- TRIACS
- SCRs
- DIACS
- QUADRAC
- ALTERNISTORS
- SIDACS
- POWER RECTIFIERS
- SIDACTORS

 DO-35	 TO-92	 TO-202 AB	 TO-220 AB ISOLATED	 TO-220 AB NON-ISOLATED	 FASTPAC	 TO-218X NON-ISOLATED	 TO-218X ISOLATED	 TO-218 ISOLATED	 TO-218 NON-ISOLATED	 MODIFIED TO-220AB ISOLATED	 SURFACE MOUNT SOT-89 TO-243
HT/HS	E	F	L	R	P	W	M	J	K	A	U

LOGIC TRIACS

IT(RMS)	PART NUMBER	VDRM	*IGT(mA)	PKG. TYPE
0.8 AMPS	L200U5	200	5	U
	L400U5	400	5	
	L600U5	600	5	
	L200U7	200	10	
	L400U7	400	10	
	L600U7	600	10	
	L200U9	200	25	
	L400U9	400	25	
	L600U9	600	25	
1.0 AMP	L201E3	200	3	E
	L401E3	400	3	
	L601E3	600	3	
	L201E5	200	5	
	L401E5	400	5	
	L601E5	600	5	
	L201E7	200	10	
	L401E7	400	10	
	L601E7	600	10	
	L201E9	200	25	
	L401E9	400	25	
	L601E9	600	25	
4.0 AMPS	L2004L3	200	3	L
	L4004L3	400	3	
	L6004L3	600	3	
	L2004L5	200	5	
	L4004L5	400	5	
	L6004L5	600	5	
	L2004L7	200	10	
	L4004L7	400	10	
	L6004L7	600	10	
	L2004L9	200	25	
	L4004L9	400	25	
	L6004L9	600	25	
	L2004F31	200	3	F
	L4004F31	400	3	
	L6004F31	600	3	
	L2004F51	200	5	
	L4004F51	400	5	
	L6004F51	600	5	
	L2004F71	200	10	
	L4004F71	400	10	
	L6004F71	600	10	
	L2004F91	200	25	
	L4004F91	400	25	
	L6004F91	600	25	
6.0 AMPS	L2006L6	200	5	L
	L4006L6	400	5	
	L6006L6	600	5	
	L2006L7	200	10	
	L4006L7	400	10	

*IGT *in Quadrants I, II, III & IV*

LOGIC TRIACS (cont'd)

IT(RMS)	PART NUMBER	VDRM	IGTmA	PKG. TYPE
6.0 AMPS	L6006L7	600	10	L
	L2006L9	200	25	
	L4006L9	400	25	
	L6006L9	600	25	
8.0 AMPS	L2008L6	200	5	L
	L4008L6	400	5	
	L6008L6	600	5	
	L2008L7	200	10	
	L4008L7	400	10	
	L6008L7	600	10	
	L2008L9	200	25	
	L4008L9	400	25	
	L6008L9	600	25	

GATED TRIACS

1.0 AMP	Q201U3	200	10	U
	Q401U3	400	10	
	Q501U3	500	10	
	Q601U3	600	10	
	Q201U4	200	25	
	Q401U4	400	25	
	Q501U4	500	25	
	Q601U4	600	25	
	Q201E3	200	10	E
	Q401E3	400	10	
	Q501E3	500	10	
	Q601E3	600	10	
	Q201E4	200	25	
	Q401E4	400	25	
	Q501E4	500	25	
	Q601E4	600	25	
4.0 AMPS	Q2004L3	200	10	L
	Q4004L3	400	10	
	Q5004L3	500	10	
	Q6004L3	600	10	
	Q2004L4	200	25	
	Q4004L4	400	25	
	Q5004L4	500	25	
	Q6004L4	600	25	
	Q7004L4	700	25	
	Q8004L4	800	25	
	Q2004F31	200	10	F
	Q4004F31	400	10	
	Q5004F31	500	10	
	Q6004F31	600	10	
	Q2004F41	200	25	

GATED TRIACS (cont'd.)

IT(RMS)	PART NUMBER	VDRM	IGT(mA)	PKG. TYPE
4.0 AMPS	Q4004F41	400	25	F
	Q5004F41	500	25	
	Q6004F41	600	25	
6.0 AMPS	Q2006L4	200	25	L
	Q4006L4	400	25	
	Q5006L4	500	25	
	Q6006L5	600	50	
	Q7006L5	700	50	
	Q8006L5	800	50	
	Q2006F41	200	25	F
	Q4006F41	400	25	
	Q5006F41	500	25	
	Q6006F51	600	50	
	Q2006R4	200	25	R
	Q4006R4	400	25	
	Q5006R4	500	25	
	Q6006R5	600	50	
	Q7006R5	700	50	
	Q8006R5	800	50	
	SC141B	200	50	
	SC141D	400	50	
	SC141E	500	50	
	SC141M	600	50	
	SC141N	800	50	
8.0 AMPS	Q2008L4	200	25	L
	Q4008L4	400	25	
	Q5008L4	500	25	
	Q6008L5	600	50	
	Q7008L5	700	50	
	Q8008L5	800	50	
	Q2008F41	200	25	F
	Q4008F41	400	25	
	Q5008F41	500	25	
	Q6008F51	600	50	
	Q2008R4	200	25	R
	Q4008R4	400	25	
	Q5008R4	500	25	
	Q6008R5	600	50	
	Q7008R5	700	50	
	Q8008R5	800	50	
	SC143B	200	50	
	SC143D	400	50	
	SC143E	500	50	
	SC143M	600	50	

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GATED TRIACS (cont'd.)

IT(RMS)	PART NUMBER	VDRM	IGT(mA)	PKG. TYPE
10.0 AMPS	Q2010L5	200	50	L
	Q4010L5	400	50	
	Q5010L5	500	50	
	Q6010L5	600	50	
	Q7010L5	700	50	
	Q8010L5	800	50	
	Q2010F51	200	50	F
	Q4010F51	400	50	
	Q5010F51	500	50	
	Q6010F51	600	50	
	Q2010R5	200	50	R
	Q4010R5	400	50	
	Q5010R5	500	50	
	Q6010R5	600	50	
	Q7010R5	700	50	
	Q8010R5	800	50	
	SC146B	200	50	
	SC146D	400	50	
	SC146E	500	50	
	SC146M	600	50	
	SC146N	800	50	
15.0 AMPS	Q2015L5	200	50	L
	Q4015L5	400	50	
	Q5015L5	500	50	
	Q6015L5	600	50	
	Q7015L5	700	50	
	Q8015L5	800	100	
	Q2015R5	200	50	R
	Q4015R5	400	50	
	Q5015R5	500	50	
	Q6015R5	600	50	
	Q7015R5	700	50	
	Q8015R5	800	100	
	SC151B	200	50	
	SC151D	400	50	
	SC151E	500	50	
	SC151M	600	50	
25.0 AMPS	Q2025L6	200	80	L
	Q4025L6	400	80	
	Q5025L6	500	80	
	Q6025L6	600	80	
	Q7025L6	700	80	
	Q8025L6	800	100	
	Q2025P	200	80	P
	Q4025P	400	80	
	Q5025P	500	80	
	Q6025P	600	80	
	Q7025P	700	80	
	Q8025P	800	80	
	Q2025R6	200	80	R
	Q4025R6	400	80	
	Q5025R6	500	80	
	Q6025R6	600	80	
	Q7025R6	700	80	
	Q8025R6	800	100	
	SC129B	200	50	
	SC129D	400	50	
	SC129E	500	50	
	SC129M	600	50	
	Q2025J6	200	80	J
	Q4025J6	400	80	
	Q5025J6	500	80	
	Q6025J6	600	80	
	Q7025J6	700	80	
	Q8025J6	800	80	

GATED TRIACS (cont'd.)

IT(RMS)	PART NUMBER	VDRM	IGT(mA)	PKG. TYPE
25.0 AMPS	Q2025K6	200	80	K
	Q4025K6	400	80	
	Q5025K6	500	80	
	Q6025K6	600	80	
	Q7025K6	700	80	
	Q8025K6	800	80	
40.0 AMPS	Q2040P	200	100	P
	Q4040P	400	100	
	Q5040P	500	100	
	Q6040P	600	100	
	Q7040P	700	100	
	Q2040J7	200	100	J
	Q4040J7	400	100	
	Q5040J7	500	100	
	Q6040J7	600	100	
	Q7040J7	700	100	
	Q8040J7	800	100	
	Q2040K7	200	100	K
	Q4040K7	400	100	
	Q5040K7	500	100	
	Q6040K7	600	100	
	Q7040K7	700	100	
	Q8040K7	800	100	
	Q2040W7	200	100	W
	Q4040W7	400	100	
	Q5040W7	500	100	
	Q6040W7	600	100	
	Q7040W7	700	100	
	Q8040W7	800	100	

*IGT in Quadrants I, II & III

QUADRAC's

IT(RMS)	PART NUMBER	VDRM	VOLTS	PKG. TYPE
4.0 AMPS	Q2004LT	200	30-45	L
	Q4004LT	400	30-45	
	Q5004LT	500	30-45	
	Q6004LT	600	30-45	
6.0 AMPS	Q2006LT	200	30-45	L
	Q4006LT	400	30-45	
	Q5006LT	500	30-45	
	Q6006LT	600	30-45	
8.0 AMPS	Q2008LT	200	30-45	L
	Q4008LT	400	30-45	
	Q5008LT	500	30-45	
	Q6008LT	600	30-45	
10.0 AMPS	Q2010LT	200	30-45	L
	Q4010LT	400	30-45	
	Q5010LT	500	30-45	
	Q6010LT	600	30-45	
15.0 AMPS	Q2015LT	200	30-45	L
	Q4015LT	400	30-45	
	Q5015LT	500	30-45	
	Q6015LT	600	30-45	

ALTERNISTORS

TYPE	PART NUMBER	VDRM & VRRM	IGT(μA)	PKG. TYPE
15.0 AMPS	Q2015L9	200	125	L
	Q4015L9	400	125	
	Q5015L9	500	125	
	Q6015L9	600	125	
	Q7015L9	700	125	
	Q8015L9	800	125	
	Q2015R9	200	125	R
	Q4015R9	400	125	
	Q5015R9	500	125	
	Q6015R9	600	125	
	Q7015R9	700	125	
	Q8015R9	800	125	
25.0 AMPS	Q2025L9	200	125	L
	Q4025L9	400	125	
	Q5025L9	500	125	
	Q6025L9	600	125	
	Q7025L9	700	125	
	Q8025L9	800	125	
	Q2025R9	200	125	R
	Q4025R9	400	125	
	Q5025R9	500	125	
	Q6025R9	600	125	
	Q7025R9	700	125	
	Q8025R9	800	125	
40.0 AMPS	Q2040K9	200	125	K
	Q4040K9	400	125	
	Q5040K9	500	125	
	Q6040K9	600	125	
	Q7040K9	700	125	
	Q8040K9	800	125	
	Q2040J9	200	125	J
	Q4040J9	400	125	
	Q5040J9	500	125	
	Q6040J9	600	125	
	Q7040J9	700	125	
	Q8040J9	800	125	
	Q2040M9	200	125	M
	Q4040M9	400	125	
	Q5040M9	500	125	
	Q6040M9	600	125	
	Q7040M9	700	125	
	Q8040M9	800	125	
	Q2040W9	200	125	W
	Q4040W9	400	125	
	Q5040W9	500	125	
	Q6040W9	600	125	
	Q7040W9	700	125	
	Q8040W9	800	125	

SENSITIVE SCR's

IT(RMS)	PART NUMBER	VDRM	IGT(μA)	PKG. TYPE
0.8 AMPS	EC103A	100	200	E
	EC103B	200	200	
	EC103C	300	200	
	EC103D	400	200	
	EC103E	500	200	
	EC103M	600	200	
	EC103A1	100	12	
	EC103B1	200	12	
	EC103C1	300	12	
	EC103D1	400	12	
	EC103E1	500	12	

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SEN. SCR's (cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}(μA)	PKG. TYPE
0.8 AMPS	EC103M1	600	12	E
	EC103A2	100	50	
	EC103B2	200	50	
	EC103C2	300	50	
	EC103D2	400	50	
	EC103E2	500	50	
	EC103M2	600	50	
	EC103A3	100	500	
	EC103B3	200	500	
	EC103C3	300	500	
	EC103D3	400	500	
	EC103E3	500	500	
	EC103M3	600	500	
	2N5060	30	200	
	2N5061	60	200	
	2N5062	100	200	
	2N5063	150	200	
	2N5064	200	200	
	2N6564	300	200	
	2N6565	400	200	
1.2 AMPS	S100US1	100	50	U
	S200US1	200	50	
	S300US1	300	50	
	S400US1	400	50	
	S500US1	500	50	
	S600US1	600	50	
	S100US2	100	200	
	S200US2	200	200	
	S300US2	300	200	
	S400US2	400	200	
	S500US2	500	200	
	S600US2	600	200	
1.5 AMPS	TCR22-2	50	200	E
	TCR22-3	100	200	
	TCR22-4	200	200	
	TCR22-6	400	200	
	TCR22-8	600	200	
3.0 AMPS	S0503LS1	50	50	L
	S0503LS2	50	200	
	S0503LS3	50	500	
	S1003LS1	100	50	
	S1003LS2	100	200	
	S1003LS3	100	500	
	S2003LS1	200	50	
	S2003LS2	200	200	
	S2003LS3	200	500	
	S4003LS1	400	50	
	S4003LS2	400	200	
	S4003LS3	400	500	
	S6003LS1	600	50	
	S6003LS2	600	200	
	S6003LS3	600	500	
4.0 AMPS	T106F1	50	200	F
	T106A1	100	200	
	T106B1	200	200	
	T106C1	300	200	
	T106D1	400	200	
	T106E1	500	200	
	T106M1	600	200	
	T107F1	50	500	
	T107A1	100	500	
	T107B1	200	500	
	T107C1	300	500	
	T107D1	400	500	
	T107E1	500	500	
	T107M1	600	500	

SEN. SCR's (cont'd.)

TYPE	PART NUMBER	V_{DRM} & V_{RRM}	I_{GT}(μA)	PKG. TYPE
6.0 AMPS	S0506LS2	50	200	L
	S0506LS3	50	500	
	S1006LS2	100	200	
	S1006LS3	100	500	
	S2006LS2	200	200	
	S2006LS3	200	500	
	S4006LS2	400	200	
	S4006LS3	400	500	
	S6006LS2	600	200	
	S6006LS3	600	500	
	S0506FS21	50	200	F
	S0506FS31	50	500	
	S1006FS21	100	200	
	S1006FS31	100	500	
	S2006FS21	200	200	
	S2006FS31	200	500	
	S4006FS21	400	200	
	S4006FS31	400	500	
	S6006FS21	600	200	
	S6006FS31	600	500	
8.0 AMPS	S0508LS2	50	200	L
	S0508LS3	50	500	
	S1008LS2	100	200	
	S1008LS3	100	500	
	S2008LS2	200	200	
	S2008LS3	200	500	
	S4008LS2	400	200	
	S4008LS3	400	500	
	S6008LS2	600	200	
	S6008LS3	600	500	
	S0508FS21	50	200	F
	S0508FS31	50	500	
	S1008FS21	100	200	
	S1008FS31	100	500	
	S2008FS21	200	200	
	S2008FS31	200	500	
	S4008FS21	400	200	
	S4008FS31	400	500	
	S6008FS21	600	200	
	S6008FS31	600	500	
10.0 AMPS	S0510LS2	50	200	L
	S0510LS3	50	500	
	S1010LS2	100	200	
	S1010LS3	100	500	
	S2010LS2	200	200	
	S2010LS3	200	500	
	S4010LS2	400	200	
	S4010LS3	400	500	
	S6010LS2	600	200	
	S6010LS3	600	500	
	S0510FS21	50	200	F
	S0510FS31	50	500	
	S1010FS21	100	200	
	S1010FS31	100	500	
	S2010FS21	200	200	
	S2010FS31	200	500	
	S4010FS21	400	200	
	S4010FS31	400	500	
	S6010FS21	600	200	
	S6010FS31	600	500	

SCR's

TYPE	PART NUMER	V_{DRM} & V_{RRM}	I_{GT}(mA)	PKG. TYPE
1.0 AMP	S031E	30	10	E
	S051E	50	10	
	S101E	100	10	
	S201E	200	10	
	S401E	400	10	
	S601E	600	10	
4.0 AMPS	S0304F1	30	10	F
	S0504F1	50	10	
	S1004F1	100	10	
	S2004F1	200	10	
	S4004F1	400	10	
	S6004F1	600	10	
6.0 AMPS	S0306L	30	15	L
	S0506L	50	15	
	S1006L	100	15	
	S2006L	200	15	
	S4006L	400	15	
	S6006L	600	15	
	S8006L	800	15	
	S0306F1	30	15	F
	S0506F1	50	15	
	S1006F1	100	15	
	S2006F1	200	15	
	S4006F1	400	15	
	S6006F1	600	15	
8.0 AMPS	S0308L	30	15	L
	S0508L	50	15	
	S1008L	100	15	
	S2008L	200	15	
	S4008L	400	15	
	S6008L	600	15	
	S8008L	800	15	
	S0308F1	30	15	F
	S0508F1	50	15	
	S1008F1	100	15	
	S2008F1	200	15	
	S4008F1	400	15	
	S6008F1	600	15	
	S0308R	30	15	R
	S0508R	50	15	
	S1008R	100	15	
	S2008R	200	15	
	S4008R	400	15	
	S6008R	600	15	
	S8008R	800	15	
10.0 AMPS	S0310L	30	15	L
	S0510L	50	15	
	S1010L	100	15	
	S2010L	200	15	
	S4010L	400	15	
	S6010L	600	15	
	S8010L	800	15	
	S0310F1	30	15	F
	S0510F1	50	15	
	S1010F1	100	15	
	S2010F1	200	15	
	S4010F1	400	15	
	S6010F1	600	15	

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SCR's (cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}(mA)	PKG. TYPE
10.0 AMPS	S2800F	50	15	R
	S2800A	100	15	
	S2800B	200	15	
	S2800C	300	15	
	S2800D	400	15	
	S2800E	500	15	
	S2800M	600	15	
	S2800N	800	15	
12.0 AMPS	S0312R	30	20	R
	S0512R	50	20	
	S1012R	100	20	
	S2012R	200	20	
	S4012R	400	20	
	S6012R	600	20	
	S8012R	800	20	
15.0 AMPS	S0315L	30	30	L
	S0515L	50	30	
	S1015L	100	30	
	S2015L	200	30	
	S4015L	400	30	
	S6015L	600	30	
	S8015L	800	30	
16.0 AMPS	S0316R	30	30	R
	S0516R	50	30	
	S1016R	100	30	
	S2016R	200	30	
	S4016R	400	30	
	S6016R	600	30	
	S8016R	800	30	
20.0 AMPS	S0320L	30	30	L
	S0520L	50	30	
	S1020L	100	30	
	S2020L	200	30	
	S4020L	400	30	
	S6020L	600	30	
	S8020L	800	30	
25.0 AMPS	S0325L	30	30	L
	S0525L	50	30	
	S1025L	100	30	
	S2025L	200	30	
	S4025L	400	30	
	S6025L	600	30	
	S8025L	800	30	
	S0325R	30	30	R
	S0525R	50	30	
	S1025R	100	30	
	S2025R	200	30	
	S4025R	400	30	
	S6025R	600	30	
	S8025R	800	30	
35.0 AMPS	S0335J	30	40	J
	S0535J	50	40	
	S1035J	100	40	
	S2035J	200	40	
	S4035J	400	40	
	S6035J	600	40	
	S8035J	800	40	
	S0335K	30	40	K
	S0535K	50	40	
	S1035K	100	40	
	S2035K	200	40	
	S4035K	400	40	
	S6035K	600	40	
	S8035K	800	40	

SCR's (cont'd.)

TYPE	PART NUMBER	V_{DRM} & V_{RRM}	I_{GT}(mA)	PKG. TYPE
35.0 AMPS	S0335W	30	40	W
	S0535W	50	40	
	S1035W	100	40	
	S2035W	200	40	
	S4035W	400	40	
	S6035W	600	40	
	S8035W	800	40	
55.0 AMPS	S0555M	50	40	M
	S1055M	100	40	
	S2055M	200	40	
	S4055M	400	40	
	S6055M	600	40	
	S8055M	800	40	
	S0555W	50	40	W
	S1055W	100	40	
	S2055W	200	40	
	S4055W	400	40	
	S6055W	600	40	
	S8055W	800	40	
65.0 AMPS	S0565J	50	50	J
	S1065J	100	50	
	S2065J	200	50	
	S4065J	400	50	
	S6065J	600	50	
	S8065J	800	50	
	S0565K	50	50	K
	S1065K	100	50	
	S2065K	200	50	
	S4065K	400	50	
	S6065K	600	50	
	S8065K	800	50	
70.0 AMPS	S0570W	50	50	W
	S1070W	100	50	
	S2070W	200	50	
	S4070W	400	50	
	S6070W	600	50	
	S8070W	800	50	

DIACS/STS

PART NUMBER	V_{BO}	PKG. TYPE
HT-32	32	DO-35
HT-35	35	
HT-40	40	
HT-60	63	
HT-5761	32	
HT-5761A	32	
HT-5762	36	
HS-10	10	
HS-20	21	

SIDACS

K1050U	95-113	U
K1100U	104-118	
K1200U	110-125	
K1300U	120-138	
K1400U	130-146	
K1500U	140-170	
K1050E	95-113	E
K1100E	104-118	

SIDACS (cont'd.)

PART NUMBER	V_{BO}	PKG. TYPE
K1200E	110-125	E
K1300E	120-138	
K1400E	130-146	
K1500E	140-170	
K2000F1	190-215	F
K2200F1	205-230	
K2400F1	220-250	
K2500F1	240-280	
K3000F1	270-330	

POWER RECTIFIER

TYPE	PART NUMBER	V_{RRM}	I_{RM} (mAmps)	I_T (RMS)	PKG. TYPE
15.0 AMPS	D0515L	50	.05	15	L
	D2015L	200	.05	15	
	D4015L	400	.05	15	
	D6015L	600	.05	15	
	D8015L	800	.05	15	
20.0 AMPS	D0520L	50	.05	20	L
	D2020L	200	.05	20	
	D4020L	400	.05	20	
	D6020L	600	.05	20	
	D8020L	800	.05	20	

SIDACTOR's
TRANSIENT SURGE PROTECTOR

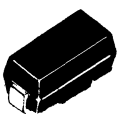
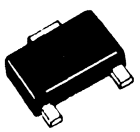
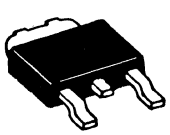
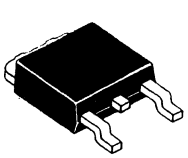
PART NUMBER	V_{BO} (Clamping Voltage)	I_H (μAmps)	I_{PP} (Peak Pulse Current)	PKG. TYPE
P0800EA70	60- 95	150	75	E
P1100EA70	90-125	150	50	
P1300EA70	120-145	150	50	
P1500EA70	135-165	150	50	
P2000AA61	190-215	150	50	A
P2200AA61	205-230	150	50	
P2400AA61	220-250	150	50	
P2500AA61	240-280	150	50	
P3000AA61	270-330	150	50	
P3300AA61	300-360	150	50	
P1602AA	120-190	150	150*	
P2202AA	190-250	150	100*	
P2702AA	240-300	150	100*	
P3002AA	280-320	150	100*	
P1602AB	120-200	260	200*	
P2202AB	190-250	260	200*	
P2702AB	240-300	260	200*	
P3002AB	280-320	260	200*	
P4802AB	440-520	260	200*	
P6002AB	540-660	260	200*	
P1553AA	140-170	150	150*	
P2103AA	180-240	150	100*	
P2353AA	210-265	150	100*	
P2703AA	240-300	150	100*	
P1553AB	140-170	260	200*	
P2103AB	180-240	260	200*	
P2353AB	210-265	260	200*	
P2703AB	240-300	260	200*	
P3403AB	300-380	260	200*	

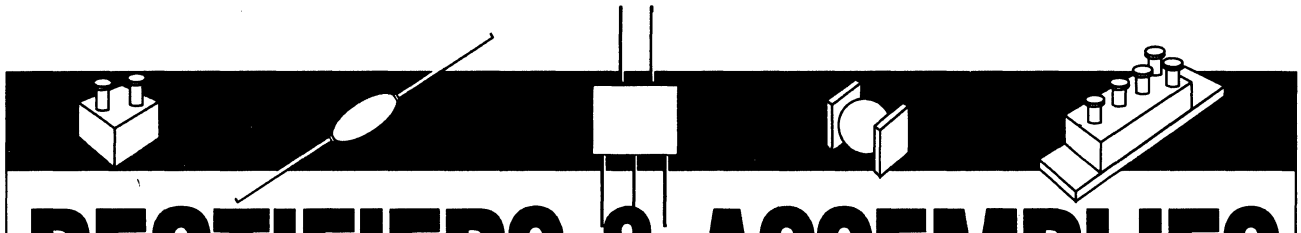
*Surge rating based on two circuit operations.
(Additional info available on request.)

Nihon Inter Electronics Corporation

AUTHORIZED AGENT QUANTUM MARKETING INTERNATIONAL QMI™

12900 Rolling Oaks Rd.
Twin Oaks, CA 93518
TEL: (805) 867-2555
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Case Style	Type	Circuit	Type No.	Io (A)	V_{FM} (V)	V_{RRM} (V) 20	30	40	50	60	90	100	200	300	400	600
D-64 	Rectifier Diode	Single Chip	EC10DS1	1.0	1.1							•				
			EC10DS2										•			
			EC10DS4												•	
			EC10DS6													•
	Schottky Barrier Diode (S.B.D.)		EC10QS03		.55		•									
			EC10QS04					•								
			EC10QS05		.58				•							
			EC10QS06	1.0						•						
			EC10QS09		.85						•					
			EC10QS10									•				
			EC10QS02L		.30	•										
			EC15QS03	1.5	.55		•									
			EC15QS04					•								
	Fast Recovery Diode (F.R.D.)		EC11FS1	1.0	.98							•				
			EC11FS2										•			
			EC10FS3		1.3									•		
			EC10FS4												•	
			EC8FS6	.8												•
SOT-89 	Rectifier Diode	Single Chip	E10DS1	1.0	1.0							•				
			E10DS2										•			
			E10DS4												•	
	Schottky Barrier Diode (S.B.D.)		E10QS03	1.0	.55		•									
			E10QS04					•								
			E10QS05		.58				•							
			E10QS06							•						
			E10QS09		.85						•					
			E10QS10									•				
	Fast Recovery Diode (F.R.D.)		E11FS1	1.0	.98							•				
			E11FS2										•			
			E11FS3		1.2									•		
			E11FS4												•	
TO-252AA 	Schottky Barrier Diode (S.B.D.)	Single Chip	30VQ03(F)	3.0	.62		•									
			30VQ04(F)					•								
			30VQ05(F)		.71				•							
			30VQ06(F)							•						
			30VQ09(F)		.92						•					
			30VQ10(F)									•				
			50VQ03(F)	5.0	.67		•									
			50VQ04(F)					•								
			50VQ05(F)		.72				•							
			50VQ06(F)							•						
			50VQ09(F)		.95						•					
			50VQ10(F)									•				
		Center Tap	4VQ03CT(F)	4.0	.55		•									
			4VQ04CT(F)					•								
			4VQ05CT(F)		.60				•							
			4VQ06CT(F)							•						
			4VQ09CT(F)		.85						•					
			4VQ10CT(F)									•				
			6VQ03CT(F)	6.0	.55		•									
			6VQ04CT(F)					•								
			6VQ05CT(F)		.60				•							
			6VQ06CT(F)							•						
			6VQ09CT(F)		.85						•					
			6VQ10CT(F)									•				
SQUARE-PAK TO-263AB 	Schottky Barrier Diode (S.B.D.)	Center Tap	C10T04Q	10	.55			•								
			C10T06Q		.58					•						
			C10T10Q		.85							•				
			C16T06Q	16	.62					•						
			C25T04Q	25	.55			•								
			C25T06Q		.62					•						
			C25T10Q		.85							•				
	Fast Recovery Diode (F.R.D.)		C10T10F	10	.98							•				
			C10T20F										•			
			C10T30F		1.2									•		
			C10T40F												•	
			C16T10F	16	.98							•				
			C16T20F										•			
			C16T30F		1.2									•		
			C16T40F												•	



RECTIFIERS & ASSEMBLIES

LOW VOLTAGE AND HIGH VOLTAGE

Discretes

Part #	Vrwm volts	Io (55°C)* amps	trr nS
1N5415	50	5.00	150
1N5416	100	5.00	150
1N5615	200	1.50	150
1N5614	200	1.50	2,000
1N5417	200	5.00	150
1N5550	200	5.00	2,000
Z02SL	200	15.0	note 3
1N6612	400	1.00	70
X04FG	400	1.00	note 3
1N5617	400	1.50	150
1N5616	400	1.50	2,000
1N6616	400	3.00	70
Z04FG	400	3.00	note 3
1N5418	400	5.00	150
1N5551	400	5.00	2,000
Z04SL	400	15.0	note 1
1N5419	500	5.00	250
1N6613	600	1.00	70
X06FG	600	1.00	note 3
1N5619	600	1.50	250
1N5618	600	1.50	2,000
1N6617	600	3.00	70
Z06FG	600	3.00	note 3
1N5420	600	5.00	400
1N5552	600	5.00	2,000
Z06SL	600	15.0	note 1
1N6614	800	1.00	70
X08FG	800	1.00	note 3
1N5621	800	1.50	300
1N5620	800	1.50	2,000
1N6618	800	3.00	70
Z08FG	800	3.00	note 3
1N5553	800	5.00	2,000
Z08SL	800	15.0	note 1
1N6615	1,000	1.00	70
X10FG	1,000	1.00	note 3
1N5623	1,000	1.50	500
1N5622	1,000	1.50	2,000
1N6619	1,000	3.00	70
Z10FG	1,000	3.00	note 3
1N5554	1,000	5.00	2,000
Z10SL	1,000	15.0	note 1
M15SG	1,500	0.10	note 2
1N6528	1,500	0.25	70
X15SG	1,500	0.25	note 2
1N6520	1,500	0.50	70
Z15SG	1,500	1.50	note 2
1N6512	1,500	2.00	70
Z15S	1,500	2.00	note 2
K15S	1,500	3.00	note 2
M20SG	2,000	0.10	note 2
1N6529	2,000	0.25	70
X20SG	2,000	0.25	note 2
1N6521	2,000	0.50	70
Z20SG	2,000	1.50	note 2
1N6513	2,000	2.00	70
Z20S	2,000	2.00	note 2
K20S	2,000	3.00	note 2
1N6530	2,500	0.10	70
M25SG	2,500	0.10	note 2
1N6522	2,500	0.25	70
X25SG	2,500	0.25	note 2
1N6514	2,500	1.50	70
Z25SG	2,500	1.50	note 2
Z25S	2,500	2.00	note 2
K25S	2,500	3.00	note 2
M30SG	3,000	0.05	note 2
1N6531	3,000	0.10	70
X30SG	3,000	0.15	note 2
1N6523	3,000	0.25	70
Z30S	3,000	1.00	note 2

Discretes

Part #	Vrwm volts	Io (55°C)* amps	trr nS
Z30SG	3,000	1.00	note 2
1N6515	3,000	1.50	70
K30S	3,000	2.20	note 2
1N6532	4,000	0.05	70
M40SG	4,000	0.05	note 2
1N6524	4,000	0.15	70
X40SG	4,000	0.15	note 2
1N6516	4,000	1.00	70
Z40S	4,000	1.00	note 2
Z40SG	4,000	1.00	note 2
K40S	4,000	2.20	note 2
1N6533	5,000	0.05	70
M50SG	5,000	0.05	note 2
1N6525	5,000	0.15	70
X50SG	5,000	0.15	note 2
1N6517	5,000	1.00	70
Z50SG	5,000	1.00	note 2
Z50S	5,000	1.00	note 2
K50S	5,000	2.20	note 2
M60SG	6,000	0.025	note 2
X60SG	6,000	0.10	note 2
Z60SG	6,000	0.50	note 2
Z60S	6,000	0.60	note 2
K60S	6,000	1.50	note 2
1N6534	7,500	0.025	70
1N6526	7,500	0.10	70
1N6518	7,500	0.50	70
M80SG	8,000	0.025	note 2
X80SG	8,000	0.10	note 2
Z80SG	8,000	0.50	note 2
Z80S	8,000	0.60	note 2
K80S	8,000	1.50	note 2
1N6535	10,000	0.025	70
M100SG	10,000	0.025	note 2
1N6527	10,000	0.10	70
X100SG	10,000	0.10	note 2
1N6519	10,000	0.50	70
Z100SG	10,000	0.50	note 2
Z100S	10,000	0.60	note 2
K100S	10,000	1.50	note 2
X120SG	12,000	0.05	note 2
X150SG	15,000	0.05	note 2

Half Wave Assemblies

Part #	Vrwm volts	Io (55 C)* amps	trr nS
LTI 102	200	15.0	note 4
LTI 104	400	15.0	note 4
LTI 106	600	15.0	note 4
LTI 108	800	15.0	note 4
LTI 110	1,000	15.0	note 4
FP25S	2,500	2.20	note 5
FP50S	5,000	2.20	note 5
SP50S	5,000	0.50	note 5
FP75S	7,500	2.20	note 5
SP75S	7,500	0.50	note 5
FP100S	10,000	2.20	note 5
SP100S	10,000	0.50	note 5
FP125S	12,500	2.20	note 5
SP125S	12,500	0.50	note 5
FP150S	15,000	2.20	note 5
SP150S	15,000	0.50	note 5
FP175S	17,500	2.20	note 5
FP200S	20,000	2.20	note 5
SP200S	20,000	0.50	note 5
SP250S	25,000	0.50	note 5

1 Phase FWB Assemblies

Part #	Vrwm volts	Io (55°C)* amps	trr nS
1102	200	1.50	note 6
1104	400	1.50	note 6
1106	600	1.50	note 6
1108	800	1.50	note 6
1110	1,000	1.50	note 6
1201	200	3.00	note 6
1204	400	3.00	note 6
1206	600	3.00	note 6
1208	800	3.00	note 6
1210	1,000	3.00	note 6
1302	200	5.00	note 6
1304	400	5.00	note 6
1306	600	5.00	note 6
1308	800	5.00	note 6
1310	1,000	5.00	note 6
1402	200	12.0	note 6
1404	400	12.0	note 6
1406	600	12.0	note 6
1408	800	12.0	note 6
1410	1,000	12.0	note 6
1502	200	20.0	note 6
1504	400	20.0	note 6
1506	600	20.0	note 6
1508	800	20.0	note 6
1510	1,000	20.0	note 6
LTI 402	200	30.0	note 4
LTI 404	400	30.0	note 4
LTI 406	600	30.0	note 4
LTI 408	800	30.0	note 4
LTI 410	1,000	30.0	note 4

1 Phase Center Tap & Doubler Assemblies

Part #	Vrwm volts	Io (55 C)* amps	trr nS
1202	200	25.0	note 4
1204	400	25.0	note 4
1206	600	25.0	note 4
1208	800	25.0	note 4
1210	1,000	25.0	note 4
LTI 202	200	30.0	note 4
LTI 204	400	30.0	note 4
LTI 206	600	30.0	note 4
LTI 208	800	30.0	note 4
LTI 210	1,000	30.0	note 4

Notes:

Note 1: 3000nS, replace S with F for 150nS, UF for 70nS parts

Note 2: 3000nS, replace S with F for 200nS, UF for 100nS parts

Note 3: 150nS, replace F with UF for 70nS part

Note 4: 3000nS, add suffix F for 150nS, UF for 70nS

Note 5: 3000nS, replace S with F for 150nS part

Note 6: 2000nS, add suffix F for 150nS part, UF for 70nS part

* 70nS assemblies have lower ratings.

3 Phase FWB Assemblies

Part #	Vrwm volts	Io (55 C)* amps	trr nS
3102	200	2.0	note 6
3104	400	2.0	note 6
3106	600	2.0	note 6
3108	800	2.0	note 6
3110	1,000	2.0	note 6
3202	200	5.0	note 6
3204	400	5.0	note 6
3206	600	5.0	note 6
3208	800	5.0	note 6
3210	1,000	5.0	note 6
3302	200	10.0	note 6
3304	400	10.0	note 6
3306	600	10.0	note 6
3308	800	10.0	note 6
3310	1,000	10.0	note 6
3402	200	20.0	note 6
3404	400	20.0	note 6
3406	600	20.0	note 6
3408	800	20.0	note 6
3410	1,000	20.0	note 6
3502	200	50.0	note 6
3504	400	50.0	note 6
3506	600	50.0	note 6
3508	800	50.0	note 6
3510	1,000	50.0	note 6
LTI 602	200	45.0	note 4
LTI 604	400	45.0	note 4
LTI 606	600	45.0	note 4
LTI 608	800	45.0	note 4
LTI 610	1,000	45.0	note 4

Rectifiers & Assemblies

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W O R L D P R O D U C T S

TRANSIENT VOLTAGE SUPPRESSION DIODES

LOW CLAMPING VOLTAGE SERIES

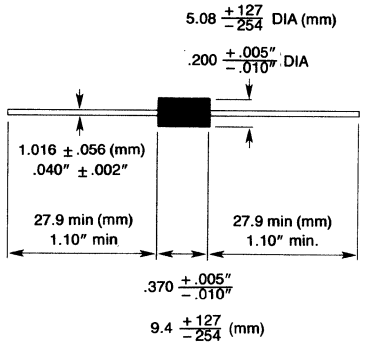
1N5908, 1N6373 –1N6389 ICTE-5 – ICTE-45C

ELECTRICAL CHARACTERISTICS @ 25°C

Part Number*	JEDEC Part Number	Rated Stand-off Voltage V_{WM} (Volts)	Minimum Breakdown Voltage @ 1mA V_{BR} (Volts)	Maximum Stand-By Current @ V_{WM} I_D (uA)	Maximum Clamping Voltage @ I_{PP1} V_C (Volts)	Peak Pulse Current I_{PP1} (Amps)	Maximum Clamping Voltage @ I_{PPM2} V_C (Volts)	Peak Pulse Current I_{PP2} (Amps)	Peak Pulse Current I_{PPM} (Amps)
	1N5908 (1)	5.0	6.0	300	7.6	30	8.0	60	160
ICTE-5	1N6373	5.0	6.0	300	7.1	1	7.5	10	160
ICTE-8	1N6374	8.0	9.4	25	11.3	1	11.5	10	100
ICTE-10	1N6375	10	11.7	2	13.7	1	14.1	10	90
ICTE-12	1N6376	20	14.1	2	16.1	1	16.5	10	70
ICTE-15	1N6377	15	17.6	2	20.1	1	20.6	10	60
ICTE-18	1N6378	18	21.2	2	24.2	1	25.2	10	50
ICTE-22	1N6379	22	25.9	2	29.8	1	32.0	10	40
ICTE-36	1N6380	36	42.4	2	50.6	1	54.3	10	23
ICTE-45	1N6381	45	52.9	2	63.3	1	70.0	10	19
ICTE-5C		5.0	6.0	600	7.2	1	7.6	10	160
ICTE-8C	1N6382	8.0	9.4	50	11.4	1	11.6	10	100
ICTE-10C	1N6383	10	11.7	2	14.1	1	14.5	10	90
ICTE-12C	1N6384	12	14.0	2	16.7	1	17.1	10	70
ICTE-15C	1N6385	15	17.6	2	20.8	1	21.4	10	60
ICTE-18C	1N6386	18	21.2	2	24.8	1	25.5	10	50
ICTE-22C	1N6387	22	25.9	2	30.8	1	32.0	10	40
ICTE-36C	1N6388	36	42.4	2	50.6	1	54.3	10	23
ICTE-45C	1N6389	45	52.9	2	63.3	1	70.0	10	19

* "C" suffix indicates bidirectional device. Notes: (1) V_C = 8.5 volts @ I_{PP} = 120 amps (Figure 1).

MECHANICAL DIMENSIONS



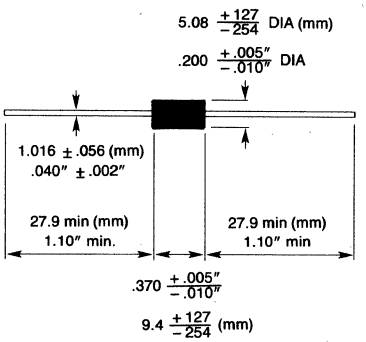
1.5KE 6.8 — 1.5KE 440A
1N6267 — 1N6303A

ELECTRICAL CHARACTERISTICS @ 25°C

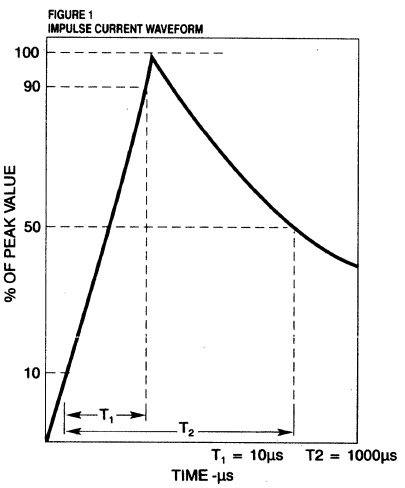
Part Number*	JEDEC Part Number	Rated Stand-off Voltage V_{WM} (Volts)	Breakdown Voltage V_{BR} (Volts) min	Breakdown Voltage V_{BR} (Volts) max	@ I_T (mA)	Maximum Stand-By Current @ V_{WM}** I_D (uA)	Maximum ClampingVoltage @ I_{PPM} (Fig. 3) V_C max (Volts)	Rated Peak Impulse Current (Fig. 3) I_{PPM} (Amperes)	Temperature Coefficient of V_{BR} ΦVBR max (mV/Deg C)
1.5KE6.8	1N6267	5.5	6.12	7.48	10	1000	10.8	139	5
1.5KE6.8A	1N6267A	5.8	6.45	7.14	10	1000	10.5	143	5
1.5KE7.5	1N6268	6.05	6.15	8.25	10	500	11.7	128	5
1.5KE7.5A	1N6268A	6.4	7.13	7.88	10	500	11.3	132	5
1.5KE8.2	1N6269	6.63	7.38	9.02	10	200	12.5	120	6
1.5KE8.2A	1N6269A	7.02	7.79	8.61	10	200	12.1	124	6
1.5KE9.1	1N6270	7.27	8.19	10	1	50	13.8	109	7
1.5KE9.1A	1N6270A	7.78	8.65	9.55	1	50	13.4	112	7
1.5KE10	1N6271	8.1	9	11	1	10	15.0	100	8
1.5KE10A	1N6271A	8.55	9.5	10.5	1	10	14.5	103	8
1.5KE12	1N6273	9.72	10.8	13.2	1	5	17.3	87	10
1.5KE12A	1N6273A	10.2	11.4	12.6	1	5	16.7	90	10
1.5KE15	1N6275	12.1	13.5	16.5	1	5	22.0	68	13
1.5KE15A	1N6275A	12.8	14.3	15.8	1	5	21.2	71	12
1.5KE18	1N6277	14.5	16.2	19.8	1	5	26.5	56.5	17
1.5KE18A	1N6277A	15.8	17.1	18.9	1	5	25.2	59.5	19
1.5KE20	1N6278	16.2	18	22	1	5	29.1	51.3	19
1.5KE20A	1N6278A	17.1	19	21	1	5	27.7	54	19
1.5KE22	1N6279	17.8	19.8	24.2	1	5	31.9	47	21
1.5KE22A	1N6279A	18.8	20.9	23.1	1	5	30.6	49	20
1.5KE24	1N6280	19.4	21.6	26.4	1	5	34.7	43	25
1.5KE24A	1N6280A	20.5	22.8	25.2	1	5	33.2	45	22
1.5KE27	1N6281	21.8	24.3	29.7	1	5	39.1	38.5	28
1.5KE27A	1N6281A	23.1	25.7	28.4	1	5	37.5	40	25
1.5KE30	1N6282	24.7	27	31	1	5	43.5	34.5	24
1.5KE30A	1N6282A	25.6	28.5	31.5	1	5	41.4	36	28
1.5KE33	1N6283	26.8	29.7	36.3	1	5	47.7	31.5	31
1.5KE33A	1N6283A	28.2	31.4	34.7	1	5	45.7	33	30
1.5KE39	1N6285	31.6	35.1	42.9	1	5	56.4	26.5	39
1.5KE39A	1N6285A	33.3	37.1	41	1	5	53.9	28	36
1.5KE47	1N6287	38.1	42.3	51.7	1	5	67.8	22.2	50
1.5KE47A	1N6287A	40.2	44.7	49.4	1	5	64.8	23.2	48
1.5KE56	1N6289	45.5	50.4	61.6	1	5	80.5	18.6	58
1.5KE56A	1N6289A	47.8	53.2	58.8	1	5	77.0	19.5	56
1.5KE68	1N6291	55.1	61.2	74.8	1	5	98.0	15.3	71
1.5KE68A	1N6291A	58.1	64.6	71.4	1	5	92.0	16.3	69
1.5KE82	1N6293	66.4	73.8	90.2	1	5	118.0	12.7	90
1.5KE82A	1N6293A	70.1	77.9	86.1	1	5	113.0	13.3	86
1.5KE100	1N6295	81	90	110	1	5	144.0	10.4	109
1.5KE100A	1N6295A	85.5	95	105	1	5	137.0	11	104
1.5KE120	1N6297	97.2	108	132	1	5	173.0	8.7	131
1.5KE120A	1N6297A	102	114	126	1	5	165.0	9.1	125
1.5KE130	1N6298	105	117	143	1	5	187.0	8	250
1.5KE130A	1N6298A	111	124	127	1	5	179.0	8.4	136
1.5KE150	1N6300	121	135	165	1	5	215.0	7	164
1.5KE150A	1N6300A	128	143	158	1	5	207.0	7.2	157
1.5KE180	1N6302	146	162	198	1	5	258.0	5.8	197
1.5KE180A	1N6302A	154	171	189	1	5	246.0	6.1	188
1.5KE200	1N6303	162	180	220	1	5	287.0	5.2	219
1.5KE200A	1N6303A	171	190	210	1	5	274.0	5.5	209
1.5KE220		175	198	242	1	5	344.0	4.3	240
1.5KE220A		185	209	231	1	5	328.0	4.6	230
1.5KE250		202	225	275	1	5	360.0	5	270
1.5KE250A		214	237	263	1	5	344.0	5	260
1.5KE300		243	270	330	1	5	430.0	5	320
1.5KE300A		256	285	325	1	5	414.0	5	325
1.5KE350		284	315	385	1	5	504.0	4	385
1.5KE350A		300	332	368	1	5	504.0	4	385
1.5KE400		324	360	440	1	5	574.0	4	440
1.5KE400A		342	380	420	1	5	548.0	4	420
1.5KE440		356	396	484	1	5	631.0	4	420
1.5KE440A		376	418	462	1	5	600.0	4	420

* Add C or CA suffix for bidirectional device types. **For bidirectional types having V_{WM} of 10 volts and under, their I_D limit is doubled.

MECHANICAL DIMENSIONS



IMPULSE CURRENT WAVEFORM

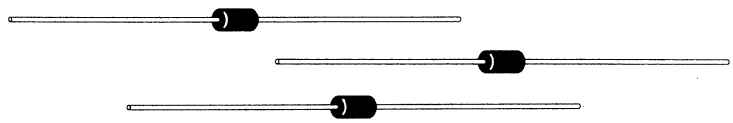


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W O R L D P R O D U C T S

500W TRANSIENT VOLTAGE SUPPRESSION DIODES

SA5.0-SA170A

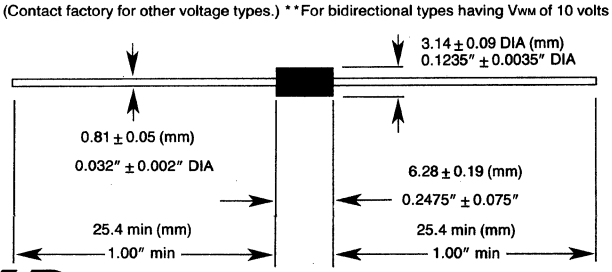


ELECTRICAL CHARACTERISTICS @ 25°C

Part Number*		Rated Stand-off Voltage V_{WM} (Volts)	Breakdown Voltage V_{BR} (Volts) min	Breakdown Voltage V_{BR} (Volts) max	@ I_T (mA)	Maximum Stand-By Current @ V_{WM}** I_D (uA)	Maximum Clamping Voltage @ I_{PPM} (Fig. 3) V_C max (Volts)	Rated Peak Impulse Current (Fig. 3) I_{PPM} (Amperes)	Temperature Coefficient of V_{BR} ∅v max (mV/Deg C)
SA5.0		5.0	6.40	7.30	10	600	9.6	52.0	5.0
SA5.0A		5.0	6.40	7.00	10	600	9.2	54.3	5.0
SA6.0		6.0	6.67	8.15	10	600	11.4	43.9	5.0
SA6.0A		6.0	6.67	7.37	10	600	10.3	48.5	5.0
SA6.5		6.5	7.22	8.82	10	400	12.3	40.7	5.0
SA6.5A		6.5	7.22	7.98	10	400	11.2	44.7	5.0
SA7.0		7.0	7.78	9.51	10	200	13.3	37.8	6.0
SA7.0A		7.0	7.78	8.60	10	200	12.0	41.7	6.0
SA7.5		7.5	8.33	10.2	1	50	14.3	35.0	7.0
SA7.5A		7.5	8.33	9.21	1	50	12.9	38.8	7.0
SA8.0		8.0	8.89	10.9	1	25	15.0	33.3	7.0
SA8.0A		8.0	8.89	9.83	1	25	13.6	36.7	7.0
SA8.5		8.5	9.44	11.5	1	10	15.9	31.4	8.0
SA8.5A		8.5	9.44	10.4	1	10	14.4	34.7	8.0
SA9.0		9.0	10.0	12.2	1	5	16.9	29.5	9.0
SA9.0A		9.0	10.0	11.1	1	5	15.4	32.5	9.0
SA10		10	11.1	13.6	1	3	18.8	26.6	10.0
SA10A		10	11.1	12.3	1	3	17.0	29.4	10.0
SA11		11	12.2	14.9	1	3	20.1	24.9	11.0
SA11A		11	12.2	13.5	1	3	18.2	27.4	11.0
SA12		12	13.3	16.3	1	3	22.0	22.7	12.0
SA12A		12	13.3	14.7	1	3	19.9	25.1	12.0
SA13		13	14.4	17.6	1	3	23.8	21.0	13.0
SA13A		13	14.4	15.9	1	3	21.5	23.2	13.0
SA14		14	15.6	19.1	1	3	25.8	19.4	14.0
SA14A		14	15.6	17.2	1	3	23.2	21.5	14.0
SA15		15	16.7	20.4	1	3	26.9	18.8	16.0
SA15A		15	16.7	18.5	1	3	24.4	20.6	16.0
SA16		16	17.8	21.8	1	3	28.8	17.6	19.0
SA16A		16	17.8	19.7	1	3	26.0	19.2	17.0
SA17		17	18.9	23.1	1	3	30.5	16.4	20.0
SA17A		17	18.9	20.9	1	3	27.6	18.1	19.0
SA18		18	20.0	24.4	1	3	32.2	15.5	21.0
SA18A		18	20.0	22.1	1	3	29.2	17.2	20.0
SA20		20	22.2	27.1	1	3	35.8	13.9	25.0
SA20A		20	22.2	24.5	1	3	32.4	15.4	23.0
SA22		22	24.4	29.8	1	3	39.4	12.7	28.0
SA22A		22	24.4	26.9	1	3	35.5	14.1	25.0
SA24		24	26.7	32.6	1	3	43.0	11.6	31.0
SA24A		24	26.7	29.5	1	3	38.9	12.8	28.0
SA26		26	28.9	35.3	1	3	46.6	10.7	31.0
SA26A		26	28.9	31.9	1	3	42.1	11.9	30.0
SA28		28	31.1	38.0	1	3	50.0	9.9	35.0
SA28A		28	31.1	34.4	1	3	45.4	11.0	31.0
SA30		30	33.3	40.7	1	3	53.5	9.3	39.0
SA30A		30	33.3	36.8	1	3	48.4	10.3	36.0
SA33		33	36.7	44.9	1	3	59.0	8.5	42.0
SA33A		33	36.7	40.6	1	3	53.3	9.4	39.0
SA36		36	40.0	48.9	1	3	64.3	7.8	46.0
SA36A		36	40.0	44.2	1	3	58.1	8.6	41.0
SA43		43	47.8	58.4	1	3	76.7	6.5	55.0
SA43A		43	47.8	52.8	1	3	69.4	7.2	50.0
SA48		48	53.3	65.1	1	3	85.5	5.8	63.0
SA48A		48	53.3	58.9	1	3	77.4	6.5	56.0
SA58		58	64.4	78.7	1	3	103.0	4.9	78.0
SA58A		58	64.4	71.2	1	3	93.6	5.3	70.0
SA60		60	66.7	81.5	1	3	107.0	4.7	80.0
SA60A		60	66.7	73.7	1	3	96.8	5.2	71.0
SA75		75	83.3	102.0	1	3	134.0	3.7	101.0
SA75A		75	83.3	92.1	1	3	121.0	4.1	91.0
SA90		90	100.0	122.0	1	3	160.0	3.1	121.0
SA90A		90	100.0	111.0	1	3	146.0	3.4	110.0
SA110		110	122.0	149.0	1	3	196.0	2.6	148.0
SA110A		110	122.0	135.0	1	3	177.0	2.8	133.0
SA160		160	178.0	218.0	1	3	287.0	1.7	217.0
SA160A		160	178.0	197.0	1	3	259.0	1.9	195.0
SA170		170	189.0	231.0	1	3	304.0	1.6	230.0
SA170A		170	189.0	209.0	1	3	275.0	1.8	208.0

*Add C or CA suffix for bidirectional device types. (Contact factory for other voltage types.) **For bidirectional types having V_{WM} of 10 volts and under, their I_D limit is doubled.

MECHANICAL DIMENSIONS

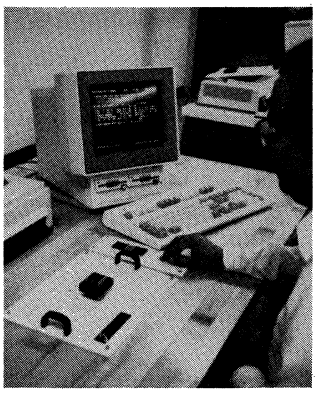


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- **Proven engineering and quality**
- **Competitive pricing; prompt delivery.**

Immediate Delivery From Distributors
See EEM Pages A•2278 thru A•2298
and Coil Section 1800 Page A•1212

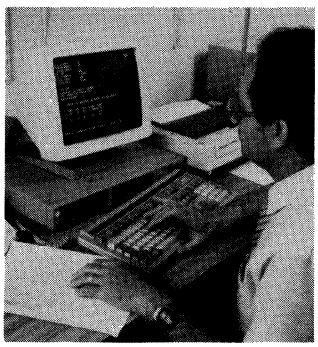


QUALITY CONTROL

As a result of our 100% quality control and use of automated state-of-the-art testing equipment, many of our customers have eliminated incoming inspection.

MAGNETICS FOR:

- **TELECOMMUNICATIONS**
- **MILITARY/AEROSPACE**
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- **SWITCH MODE POWER SUPPLIES**



PRICING

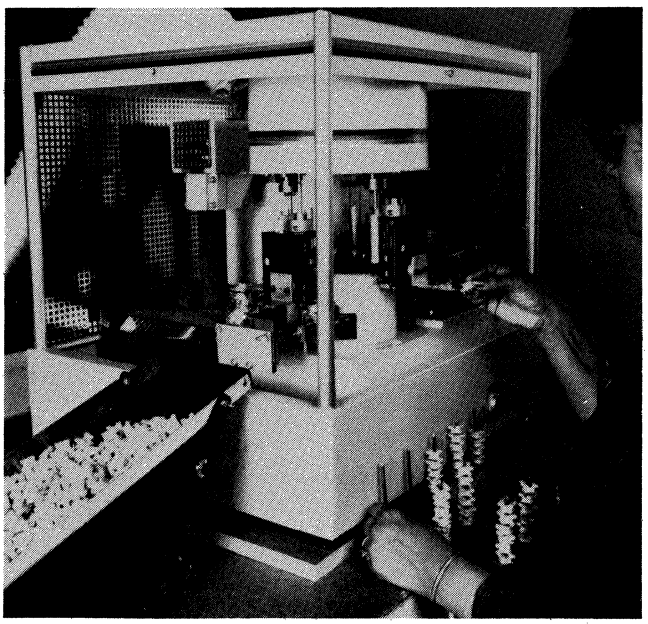
Domestic and off-shore facilities provide competitive prices on both high volume and short runs.

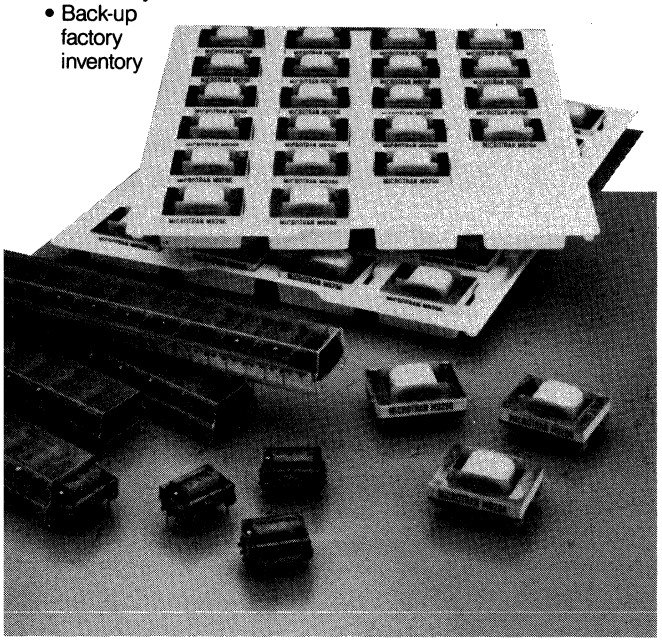
DELIVERY

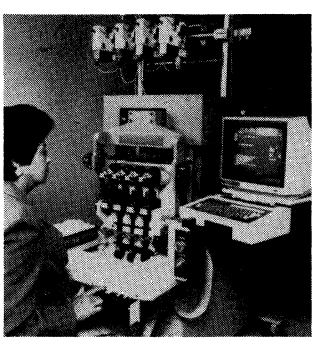
- Over 2,000 catalog items
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Our experienced engineering team and regional offices make us truly accessible and responsive. CAE enhances our close technical support and quick turnaround on custom designs.







AUTOMATED PRODUCTION

Coil winding, soldering and other automated equipment, enable Microtran to deliver consistent quality at competitive pricing.

SPECIFICATIONS / STANDARDS

- Compliance with MIL-I-45208
- QPL listed for MIL-T-27
- MIL-STD-981 available
- Solderability per MIL-STD-202
- Safety agency approvals:

ROBOTIC PACKAGING

- Tubes or trays available

OTHER OPTIONS

- Just-In-Time delivery
- Certification for ship-to-stock

MICROTRAN
company, inc.

145 East Mineola Avenue, P.O. Box 236, Valley Stream, New York 11582
Tel: (516) 561-6050. Fax: (516) 561-1117.

AUDIO, RF, SPECIAL

Manufacturer	Starting EEM Page No.	Driver	Input	Inter-stage	Matching	Micro-phone	Output	Telephone Coupling	Isolation	RF-IF	Pulse including Trigger	Balun	Local Area Networks
Abbott Technologies Inc.	A•2134						√§*		√§*		√§*		
Albar, Inc.	A•2152	√							√				
Amecon	A•2154	√*	√*		√*		√*	√*	√*		√*	√*	
AT & T Microelectronics	A•2170										√		√
Automatic Coil Corp.	A•2174	√*			√*	√*				√*	√		
Bel Fuse	A•2178								√				√
Bey Electric	A•2182	√	√	√	√		√		√	√	√	√	
BH Electronics	A•2184	√§	√	√	√		√		√§	√§	√§	√§	√§
C & C Jetronic	A•2188	√	√		√	√	√	√	√	√	√	√	
Chloride Electro Networks	A•2189	√§*	√§*		√§*		√§*		√§*		√§*		
Communication Coil Inc.	A•2190	√§*	√§*	√§*	√§*		√*	√*		√§*	√§*	√§*	
Cramer Coil Corp.	A•2191							√§	√		√		
CUI/STACK, Inc.	A•2195				√			√		√			
Custom Coils, Inc.	A•2197	√			√		√				√	√	
Dale Electronics	A•2198	√	√	√	√	√	√	√	√	√	√		
Del Electronics Corp.	A•2200										√*		
Dynage Power & Magnetics	A•2201	√*	√*	√*	√*		√*	√*	√*		√*		√*
Enegren Electronics, Inc.	A•2210	√	√	√	√		√			√*	√*		
ESC Electronics Corp.	A•2211	√*	√*	√*	√*		√*	√*	√§*	√*	√*		√§*
EWC Inc.	A•2212	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*		√§*		
Fernwood	A•2227	√§*	√§*		√§*		√*	√*			√*	√§*	√•
Globtek Inc.	A•2229	√	√	√	√	√	√	√	√				
Hi-Sonic Inc.	A•2234				√§*						√§*		
ISL Products Int'l Ltd.	A•2237	√	√	√	√	√	√	√	√	√	√		√
JBM Electronics, Inc.	A•2238										√		√
Kappa Networks	A•2248								√		√		
Magnecomp	A•2252								√*		√*		
Magne-Lab	A•2253	√§	√	√	√§	√	√		√		√		
Magnetek Triad	A•2259			√§	√§	√§	√§	√§			√§		
Magnetico Inc.	A•2264	√§*			√§*				√§*	√§*	√§*		
MCI Transformer Corp.	A•2266	√§			√§				√§	√§	√§		
Microtran Co. Inc.	A•2278	√*	√*	√*	√*	√*	√*	√*	√*		√*		
Midcom, Inc.	A•2300							√			√		
Mitchell Electronics	A•2306	√			√	√		√	√	√	√		
Multi-Comp	A•2307		√						√				
Multi -Products Int'l.	A•2309			√	√	√		√					
North Hills Electronics Inc.	A•2310				√*			√*	√*	√*	√*	√*	√*
PCA Electronics	A•2318								√				
PC Transformer Corp.	A•2324		√	√	√		√	√					
Pico Electronic	A•2333	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*		
Power Magnetech Corp.	A•2371	√*	√*	√*	√*	√*	√*	√*	√*		√*	√	√*
Prem Magnetics Inc.	A•2372				√			√	√				
Renco Electronics Inc.	A•2385	√§*	√§	√§*	√§	√§	√§*	√§	√§*	√§*	√§	√§	√§*
Shogyo Int'l.	A•2391	√				√		√		√	√	√	
Tamura Corp. of America	A•2427							√					
Torotel Products	A•2448	√*	√*	√*	√*	√*	√*		√*			√*	
Tortran	A•2447	√	√	√			√		√				
Transformer Technologies	A•2453	√	√						√§	√§	√		
Ulveco, Inc.	A•2454				√		√						
Vernitron International	A•2458	√	√	√	√	√	√§	√§	√§	√§	√§	√§	√§
Vitec Electronics	A•2459	√			√§		√§	√	√§		√§	√	√§
Wilco	A•2464	√					√			√		√	√

§ Surface Mount; * MIL Spec.

TRANSFORMERS, POWER

Manufacturer	Starting EEM Page No.	Power												Control			
		115-230V Input															
		50-60 Hz	400 Hz	Filament	Rectifier	Split Bobbin	Isolation	Voltage Regulating	DC-to-DC Converter	Variable Incl. Auto Transformer	High Voltage	Toroidal	Scott T	PCB Mount	Synchro/ Resolver Synchro	Servo	Current Instrument	Switch Mode
Advanced Comp.	A•2150	√	√			√	√	√						√				
Albar Inc.	A•2152	√	√	√	√	√	√	√	√		√	√	√	√				√
Amecon Inc.	A•2154	√*	√*	√*	√*	√*	√*		√*			√*		√*	√	√	√*	√*
American Zettler	A•2167	√				√								√				
APX/Arstan Prods.	A•2168	√	√	√					√					√				
Automatic Coil Corp.	A•2174				√	√						√		√				
Avel - Lindberg Inc.	A•2175	√	√			√	√					√		√				
Bel Fuse	A•2178						√					√						
Bey Electric	A•2182	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√
BH Electronics	A•2184											√		√		√	√	√
Bicron Electronics	A•2186	√		√	√		√			√		√						
C & C Jetronic	A•2188	√	√	√	√	√	√	√	√	√	√	√		√		√	√	√
Chloride Electro Networks	A•2189	√*	√*	√*	√*	√*	√*	√*	√*		√*	√*		√*			√*	√*
Communication Coils	A•2190		√*			√*			√*		√*	√*		√*	√*	√*	√*	√*
Cramer Coil Co.	A•2191	√	√		√	√	√	√	√		√	√		√			√	√
CR Magnetics	A•2194	√	√			√					√	√		√			√	
Custom Coils	A•2197	√	√			√	√	√	√		√	√	√	√				√
Dale Electronics	A•2198					√	√	√	√			√		√				
Del Electronics	A•2200	√*	√*	√*	√*		√*	√*	√*		√*			√*			√*	√*
Dynage Power & Magnetics	A•2201	√*	√*	√*	√*	√*	√*	√*	√*		√*	√*		√*				√*
Eichoff Electronics	A•2206	√					√							√				
Electromech Inc.	A•2208	√	√	√	√	√	√	√						√				√
Enegren	A•2210	√*	√*		√	√	√	√				√	√	√	√			√
EWC Inc.	A•2212	√*	√*	√*	√*	√*	√*		√*		√*	√*		√*		√*	√*	√*
Fernwood	A•2227	√*	√*	√*	√*	√*	√*			√*	√*	√*		√*				√*
Flex - Core	A•2228																√	
Globtek Inc.	A•2229	√	√	√	√	√	√	√	√	√	√		√	√				√
Hipotronics Inc.	A•2230	√		√			√	√		√	√		√					
Hi-Sonic Inc.	A•2234	√*	√*						√*									
Hitran	A•2235	√	√	√	√		√	√		√	√		√					
ISL Products Int'l	A•2237	√	√				√	√	√					√				
Jerome Industries	A•2241	√				√	√	√		√				√				
JM Transformers Co.	A•2242	√	√	√	√	√	√			√	√	√		√				
Kappa Networks	A•2248						√	√										

TRANSFORMERS, POWER (cont'd)

Manufacturer	Starting EEM Page No.	Power													Control			
		115-230V Input																
		50-60 Hz	400 Hz	Filament	Rectifier	Split Bobbin	Isolation	Voltage Regulating	DC-to-DC Converter	Variable Incl. Auto Transformer	High Voltage	Toroidal	Scott T	PCB Mount	Synchro/ Resolver Synchro	Servo	Current Instrument	Switch Mode
Lenco Electronics	A•2250	√	√	√	√	√	√	√	√		√		√	√			√	√
Magnecomp	A•2252	√*	√*				√*		√*			√*	√*	√*	√*		√*	√*
Magnelab	A•2253	√*	√*	√	√	√	√		√*		√	√		√*			√	√*
Magnetek Triad	A•2259	√*	√*	√*	√*	√*	√*							√*				√*
Magnetico	A•2264	√*	√*	√*	√*	√*			√*		√*	√*	√*	√*	√*		√*	√*
MCI Transformer	A•2266	√	√			√	√	√		√	√			√			√	√
Microtran Co.	A•2278	√*	√*	√*	√*	√*	√*		√*			√*	√*	√*				√*
Mitchell Electronics	A•2306	√	√		√	√	√	√				√		√			√	√
Multi-Comp Inc.	A•2307	√*		√*	√*	√*	√*	√	√*	√*	√*			√				√*
Multi Products Int"l	A•2309	√		√	√	√	√		√			√		√				
NWL Transformers	A•2314	√*	√*	√*	√*		√*	√*		√*	√*		√*					
Panel Comps.	A•2316	√					√											
Paraline Transformer Co. Inc.	A•2317	√				√	√			√								
PCA Electronics	A•2318											√						
PC Transformer	A•2326	√	√	√	√	√	√							√				
Pearson Electronics	A•2332										√						√	
Pico Electronics	A•2333	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
Plitron	A•2368	√					√					√						
Power Magna-Tech	A•2371	√*	√*	√*	√*	√*	√*	√*	√*	√	√*	√*	√*	√*	√*		√*	√*
Prem Magnetics Inc.	A•2372	√		√	√	√	√							√				
Renco Electronics	A•2385	√*		√	√	√*	√*	√	√*	√	√	√	√	√*		√		√*
Shogyo Int'l.	A•2391	√	√			√	√	√	√	√				√				√
Signal Transformer	A•2392	√		√	√	√	√	√		√		√		√				√
Staco Energy Products Co.	A•2412	√*	√*				√	√		√		√						
Stancor/ White Rudgers		√	√	√	√	√	√			√				√				
Superior Electric Co.	A•2421	√	√							√								
Talema Electronic	A•2422	√					√					√		√				
Tamura Corp. of America	A•2427	√	√							√		√		√				√
Todd Systems	A•2438	√*		√			√			√								
Toroid Corp of MD	A•2442	√	√		√		√			√		√					√	
Torotel Products	A•2448	√*	√*	√*	√*		√*					√*		√*		√*		√*
Tortran	A•2447	√*	√*	√	√		√			√		√*		√			√*	
Trans American Transformers	A•2452	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
Ulveco	A•2454				√		√					√					√	
Vernitron Int'l	A•2458			√	√	√	√	√	√			√						√
Vitec Electronic	A•2459					√*	√*	√*	√		√	√*		√*			√*	√*
Wilco	A•2464					√			√		√	√		√		√		√

§ Surface Mount; * MIL Spec.

Abbott TECHNOLOGIES, INC.

60 & 400 Hz Military & Industrial Transformers

Since 1973, Abbott Technologies, Inc., Burbank Division has been committed to providing high quality, reliable power transformers and inductors to the electronics industry.

Abbott now offers over 2,000 standard catalog models to choose from—all of which will satisfy your most demanding requirements. Also, if you don't see the exact specifications you require, we have the expertise to design and produce custom and special transformers up to 5,000 watts.

For your convenience, the Ready Reference Guide below will allow quick selection of the model that best fits your requirement. For complete information and a copy of the Abbott Transformer Catalog, contact the office or representative nearest you.

READY REFERENCE GUIDE

Model Family		Input		Construction		Power Levels (VA)	Output Voltages	EEM Page
Cat.	QPL*	Freq. (Hz)	Phase	Mil-Spec	Ind'l			
P	M27/312-322	50-60	1ϕ	Grade 4		5-300	5-486	**A**•2136-37
6C	M27/326-331	50-60	1ϕ	Grade 4		5-170	5-120	**A**•2138
6DM	—	50-60	3ϕ	Grade 5		200-3000	5-200	**A**•2139
6DF	—	50-60	3ϕ		Ind'l	200-3000	5-200	**A**•2139
6B	—	50-60	1ϕ		Ind'l	10-1300	5-120	**A**•2140
TM	M27/350-354	380-420	1ϕ	Grade 5		15-100	5-115	**A**•2141
TF	—	380-420	1ϕ		Ind'l	15-100	5-115	**A**•2141
E	M27/388-343	380-420	1ϕ	Grade 5		2-175	5-486	**A**•2142-43
4A	M27/332-337	380-420	1ϕ	Grade 5		7-150	5-120	**A**•2144
4D	M27/344-349	380-420	3ϕ	Grade 5		90-1000	5-200	**A**•2145
R	—	380-420	1ϕ	Grade 5		1.5-9	5-300	**A**•2146-47
Custom-Designed MIL-SPEC Magnetics								**A**•2148-49

*For specific QPL Model Numbers contact the sales office nearest you.

EASTERN SALES OFFICE
321 Commercial Ave., Suite 104
Palisades Park, New Jersey 07650
(201) 461-4005
FAX: (201) 461-6323

HEAD OFFICE
8203 Vineland Avenue
Sun Valley, CA 91352
(818) 504-0644
FAX: (818) 768-0395

Abbott TECHNOLOGIES, INC.

QPL Transformers

Over 750 Power Transformers Qualified to MIL-T-27

As a design engineer or purchasing agent for a military prime contractor or sub-contractor, you now can achieve rapid project approval and eliminate the time and expense of transformer qualification simply by specifying Abbott QPL transformers.

Abbott offers over 750 military transformers—six complete product lines—proven to meet the demanding requirements of MIL-T-27.

- Thermal Shock 25 cycles (−55°C to +130°C)
- Humidity
- Shock
- Life Testing
- Vibration
- Immersion
- Flammability



Abbott's military transformers have proven themselves in the Space Shuttle, B-1 Bomber, Cruise Missile, Phalanx, Ram, Harpoon, AWACS and Apache Helicopter programs.

Only Abbott offers a selection this wide.

60 Hz	400 Hz (1ϕ and 3ϕ)
5-220 Volts	5-300 Volts
5-300 VA	**2-375 VA**
Grade 4, Class S	**Grade 5, Class S**

(See "Ready Reference Guide" on adjacent page for more model information.)

Only Abbott offers this commitment to quality

Our reputation for reliability has been earned by a conservative design philosophy in which special attention is given to thermal margins and the use of quality materials. Our Quality Assurance program is in accordance with MIL-I-45208A and MIL-STD-45662. Each transformer is 100% tested to the following requirements: visual and mechanical, turns ratio, excitation current, dielectric withstanding voltage and continuity.

We have our own fully equipped test laboratory which has been accepted by the Defense Logistics Agency to perform qualification testing and Group A and B Inspection to military specification MIL-T-27. This is a reflection of our commitment to serving the defense electronics and aerospace industries.

NEW Abbott Catalog including QPL Cross-references

To help you take advantage of Abbott's QPL status, we have included all QPL Cross-reference numbers in our new catalog. Call or write today for your free copy.



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Eastern Sales Office: 321 Commercial Avenue, Suite 304, Palisades Park, NJ 07650, (201) 461-4005, FAX (201) 461-6323

Abbott TECHNOLOGIES, INC.

60 Hz MIL-T-27 Transformers

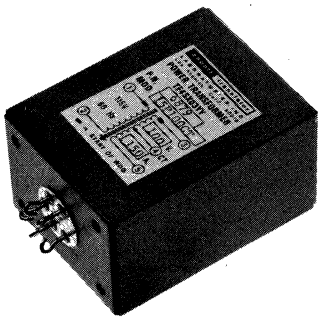
MODEL **P**

SPECIFICATIONS

INPUT PRIMARY: 115 VAC, 60 Hz ± 5 Hz, 1 phase.†
"A" Option: 230 V ac. Add suffix "A" to model number, e.g., 5P10CTA (Fig. 1).
"B" Option: 115/230 V ac. Add suffix "B" to model number, e.g., 5P10CTB (Fig. 2).
REGULATION: 10% no load to full load.
SECONDARY VOLTAGE TOLERANCE: Within 3% of listed output voltage when measured at full load and 115 VAC input.
CONSTRUCTION: To MIL-T-27, Grade 4, Class S, Case: steel.
ENVIRONMENT: To operate in 95°C maximum ambient temperature. Encapsulated to meet MIL-STD-810 for vibration, shock, acceleration, sand, dust, humidity, salt-spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: For high altitude operation, encapsulate terminals.
INSULATION TEST: 1750 VAC.
SECONDARY: See output voltage and current of specific models listed.

†For 50 Hz operation, reduce secondary current by 10% of ratings listed. These units are capable of 400 Hz operation; however, see Abbott's distinct line of miniature 400 Hz transformers.

Now QPL!



TF4S03YY

Size	B	C	D	E	F	G
A1	1½	1¾	2⅜	1 1/16	1¼	6-32
A2	1¾	2 1/16	2¾	1¼	1½	6-32
A3	1⅞	2⅜	3⅛	1¼	1¾	8-32
A4	2	2⅜	3⅛	1½	1¾	8-32
A5	2⅛	2 11/16	3½	1½	2	8-32
A6	2¼	2 11/16	3½	1⅝	2	8-32
A7*	2⅝	3⅛	4⅛	2	2¼	8-32
A8*	2⅞	3 7/16	4½	2¼	2½	10-32
A9*	3⅛	3¾	4⅞	2 7/16	2¾	10-32
A10*	3⅜	4 1/16	5¼	2⅝	3	¼-20
A11*	3⅞	4 11/16	6	2¾	3½	¼-20

Model Type	Weight Lbs. (Max.)	Primary DCR (ohms typical)
5P	1.0	86
10P	1.5	36
15P	2.0	24
20P	2.5	15
30P	3.0	8.5
40P	3.3	6.7
80P	5.0	3.7
120P	6.5	1.9
160P	8.2	1.6
200P	10.5	1.1
300P	17.0	0.5

*See Fig. 3 for header configuration used on any unit with output current greater than 10 amps.

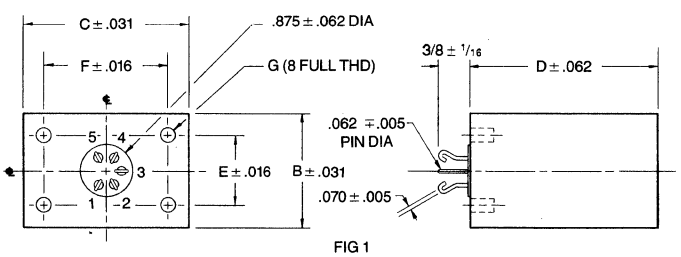


FIG 1

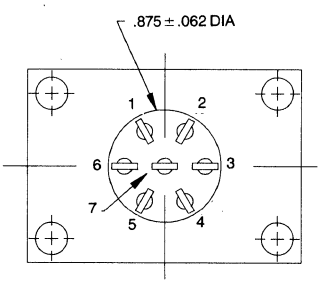


FIG 2

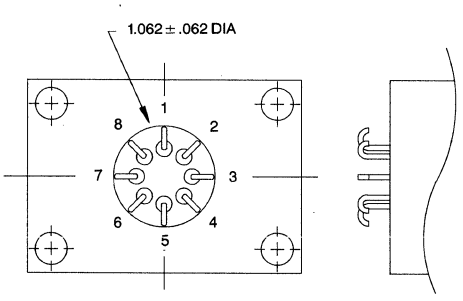
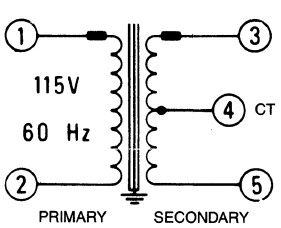
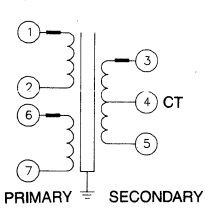


FIG 3

CIRCUIT DIAGRAM
Standard and "A" Option



"B" Option
for 115 V. Connect 1 and 6, 2 and 7.
for 230 V. Connect 2 and 6.



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Abbott TECHNOLOGIES, INC — 60 Hz MIL-T-27 Transformers

MODEL **P**

Output Volts (F.L.)	Output Current (Amp)	Size	Secondary DCR ohms (typical)	Model Number	QPL Model No.
5.0	1.00	A1	0.335	5P5CT	M27/312-01
	2.00	A2	0.12	10P5CT	M27/313-01
	3.00	A3	0.07	15P5CT	M27/314-01
	4.00	A4	0.066	20P5CT	M27/315-01
	6.00	A5	0.04	30P5CT	M27/316-01
	8.00	A6	0.03	40P5CT	M27/317-01
	16.00	A7	0.014	80P5CT	M27/318-01
6.3	0.79	A1	0.53	5P6.3CT	M27/312-02
	1.58	A2	0.18	10P6.3CT	M27/313-02
	2.38	A3	0.094	15P6.3CT	M27/314-02
	3.16	A4	0.1	20P6.3CT	M27/315-02
	4.76	A5	0.06	30P6.3CT	M27/316-02
	6.35	A6	0.059	40P6.3CT	M27/317-02
	12.70	A7	0.02	80P6.3CT	M27/318-02
	19.00	A8	0.0014	120P6.3CT	M27/319-01
8.0	0.67	A1	0.87	5P8CT	M27/312-03
	1.25	A2	0.27	10P8CT	M27/313-03
	1.88	A3	0.16	15P8CT	M27/314-03
	2.50	A4	0.15	20P8CT	M27/315-03
	3.76	A5	0.08	30P8CT	M27/316-03
	5.00	A6	0.079	40P8CT	M27/317-03
	10.00	A7	0.04	80P8CT	M27/318-03
	15.00	A8	0.022	120P8CT	M27/319-02
	20.00	A9	0.0072	160P8CT	M27/320-01
10	0.50	A1	1.34	5P10CT	M27/312-04
	1.00	A2	0.42	10P10CT	M27/313-04
	1.50	A3	0.23	15P10CT	M27/314-04
	2.00	A4	0.23	20P10CT	M27/315-04
	3.00	A5	0.14	30P10CT	M27/316-04
	4.00	A6	0.11	40P10CT	M27/317-04
	8.00	A7	0.05	80P10CT	M27/318-04
	12.00	A8	0.031	120P10CT	M27/319-03
	16.00	A9	0.008	160P10CT	M27/320-02
	20.00	A10	0.02	200P10CT	M27/321-01
12.6	0.39	A1	2.06	5P12.6CT	M27/312-05
	0.79	A2	0.65	10P12.6CT	M27/313-05
	1.19	A3	0.4	15P12.6CT	M27/314-05
	1.59	A4	0.34	20P12.6CT	M27/315-05
	2.38	A5	0.2	30P12.6CT	M27/316-05
	3.18	A6	0.18	40P12.6CT	M27/317-05
	6.35	A7	0.07	80P12.6CT	M27/318-05
	9.53	A8	0.041	120P12.6CT	M27/319-04
	12.70	A9	0.035	160P12.6CT	M27/320-03
	15.90	A10	0.027	200P12.6CT	M27/321-02
14	0.36	A1	2.95	5P14CT	M27/312-06
	0.72	A2	0.74	10P14CT	M27/313-06
	1.07	A3	0.6	15P14CT	M27/314-06
	1.43	A4	0.4	20P14CT	M27/315-06
	2.15	A5	0.23	30P14CT	M27/316-06
	2.86	A6	0.19	40P14CT	M27/317-06
	5.72	A7	0.1	80P14CT	M27/318-06
	8.59	A8	0.055	120P14CT	M27/319-05
	11.40	A9	0.042	160P14CT	M27/320-04
	14.30	A10	0.029	200P14CT	M27/321-03
16	0.34	A1	3.35	5P16CT	M27/312-07
	0.68	A2	1.08	10P16CT	M27/313-07
	0.94	A3	0.67	15P16CT	M27/314-07
	1.25	A4	0.52	20P16CT	M27/315-07
	1.87	A5	0.28	30P16CT	M27/316-07
	2.50	A6	0.28	40P16CT	M27/317-07
	5.00	A7	0.12	80P16CT	M27/318-07
	7.50	A8	0.072	120P16CT	M27/319-06
	10.00	A9	0.046	160P16CT	M27/320-05
	12.50	A10	0.034	200P16CT	M27/321-04
	18.70	A11	0.02	300P16CT	M27/322-01
18	0.28	A1	4.65	5P18CT	M27/312-08
	0.55	A2	1.42	10P18CT	M27/313-08
	0.83	A3	0.78	15P18CT	M27/314-08
	1.11	A4	0.62	20P18CT	M27/315-08
	1.67	A5	0.38	30P18CT	M27/316-08
	2.21	A6	0.36	40P18CT	M27/317-08
	4.44	A7	0.16	80P18CT	M27/318-08
	6.68	A8	0.08	120P18CT	M27/319-07
	8.89	A9	0.060	160P18CT	M27/320-06
	11.10	A10	0.04	200P18CT	M27/321-05
	16.70	A11	0.022	300P18CT	M27/322-02
20	0.25	A1	5.25	5P20CT	M27/312-09
	0.50	A2	1.54	10P20CT	M27/313-09
	0.75	A3	0.9	15P20CT	M27/314-09
	1.00	A4	0.85	20P20CT	M27/315-09
	1.50	A5	0.4	30P20CT	M27/316-09
	2.00	A6	0.43	40P20CT	M27/317-09
	4.00	A7	0.19	80P20CT	M27/318-09
	6.00	A8	0.120	120P20CT	M27/319-08
	8.00	A9	0.070	160P20CT	M27/320-07
	10.00	A10	0.066	200P20CT	M27/321-06
	15.00	A11	0.026	300P20CT	M27/322-03
22	0.22	A1	7.3	5P22CT	M27/312-10
	0.45	A2	1.9	10P22CT	M27/313-10
	0.68	A3	1.2	15P22CT	M27/314-10
	0.91	A4	0.95	20P22CT	M27/315-10
	1.36	A5	0.55	30P22CT	M27/316-10
	1.82	A6	0.57	40P22CT	M27/317-10
	3.64	A7	0.25	80P22CT	M27/318-10
	5.45	A8	0.125	120P22CT	M27/319-09
	7.27	A9	0.092	160P22CT	M27/320-08
	9.10	A10	0.073	200P22CT	M27/321-07
	13.60	A11	0.031	300P22CT	M27/322-04
25	0.20	A1	8.23	5P25CT	M27/312-11
	0.40	A2	2.55	10P25CT	M27/313-11
	0.60	A3	1.4	15P25CT	M27/314-11
	0.80	A4	1.37	20P25CT	M27/315-11
	1.20	A5	0.7	30P25CT	M27/316-11
	1.60	A6	0.67	40P25CT	M27/317-11
	3.20	A7	0.3	80P25CT	M27/318-11
	4.80	A8	0.182	120P25CT	M27/319-10
	6.40	A9	0.11	160P25CT	M27/320-09
	8.00	A10	0.079	200P25CT	M27/321-08
	12.00	A11	0.042	300P25CT	M27/322-05
28	0.18	A1	11.4	5P28CT	M27/312-12
	0.36	A2	3.0	10P28CT	M27/313-12
	0.54	A3	1.9	15P28CT	M27/314-12
	0.71	A4	1.6	20P28CT	M27/315-12
	1.07	A5	0.94	30P28CT	M27/316-12
	1.43	A6	0.90	40P28CT	M27/317-12
	2.86	A7	0.4	80P28CT	M27/318-12
	4.29	A8	0.205	120P28CT	M27/319-11
	5.72	A9	0.150	160P28CT	M27/320-10
	7.10	A10	0.11	200P28CT	M27/321-09
	10.70	A11	0.046	300P28CT	M27/322-06
31	0.16	A1	13.8	5P31CT	M27/312-13
	0.32	A2	3.8	10P31CT	M27/313-13
	0.48	A3	2.2	15P31CT	M27/314-13
	0.64	A4	2.2	20P31CT	M27/315-13
	0.97	A5	0.96	30P31CT	M27/316-13
	1.29	A6	0.95	40P31CT	M27/317-13
	2.58	A7	0.45	80P31CT	M27/318-13
	3.87	A8	0.31	120P31CT	M27/319-12
	5.17	A9	0.166	160P31CT	M27/320-11
	6.40	A10	0.12	200P31CT	M27/321-10
	9.67	A11	0.054	300P31CT	M27/322-07
35	0.14	A1	17.6	5P35CT	M27/312-14
	0.29	A2	4.5	10P35CT	M27/313-14
	0.43	A3	3.0	15P35CT	M27/314-14
	0.57	A4	2.4	20P35CT	M27/315-14
	0.86	A5	1.4	30P35CT	M27/316-14
	1.14	A6	1.32	40P35CT	M27/317-14
	2.28	A7	0.5	80P35CT	M27/318-14
	3.43	A8	0.35	120P35CT	M27/319-13
	4.57	A9	0.240	160P35CT	M27/320-12
	5.71	A10	0.17	200P35CT	M27/321-11
	8.59	A11	0.072	300P35CT	M27/322-08
39	0.13	A1	19.7	5P39CT	M27/312-15
	0.26	A2	6.3	10P39CT	M27/313-15
	0.38	A3	3.5	15P39CT	M27/314-15
	0.51	A4	3.6	20P39CT	M27/315-15
	0.77	A5	1.62	30P39CT	M27/316-15
	1.03	A6	1.5	40P39CT	M27/317-15
	2.05	A7	0.7	80P39CT	M27/318-15
	3.07	A8	0.342	120P39CT	M27/319-14
	4.10	A9	0.270	160P39CT	M27/320-13
	5.12	A10	0.18	200P39CT	M27/321-12
	7.69	A11	0.08	300P39CT	M27/322-09
43	0.12	A1	22.0	5P43CT	M27/312-16
	0.23	A2	7.0	10P43CT	M27/313-16
	0.35	A3	4.65	15P43CT	M27/314-16
	0.46	A4	4.0	20P43CT	M27/315-16
	0.70	A5	2.15	30P43CT	M27/316-16
	0.93	A6	1.62	40P43CT	M27/317-16
	1.85	A7	0.94	80P43CT	M27/318-16
	2.79	A8	0.48	120P43CT	M27/319-15
	3.70	A9	0.382	160P43CT	M27/320-14
	4.64	A10	0.26	200P43CT	M27/321-13
	6.95	A11	0.108	300P43CT	M27/322-10
48	0.10	A1	30.0	5P48CT	M27/312-17
	0.21	A2	9.3	10P48CT	M27/313-17
	0.31	A3	5.2	15P48CT	M27/314-17
	0.42	A4	4.4	20P48CT	M27/315-17
	0.63	A5	2.4	30P48CT	M27/316-17
	0.83	A6	2.35	40P48CT	M27/317-17
	1.63	A7	1.0	80P48CT	M27/318-17
	2.50	A8	0.66	120P48CT	M27/319-16
	3.33	A9	0.405	160P48CT	M27/320-15
	4.17	A10	0.29	200P48CT	M27/321-14
	6.26	A11	0.165	300P48CT	M27/322-11
55	0.09	A1	34.4	5P55CT	M27/312-18
	0.18	A2	11.0	10P55CT	M27/313-18
	0.27	A3	7.5	15P55CT	M27/314-18
	0.36	A4	6.0	20P55CT	M27/315-18
	0.55	A5	3.5	30P55CT	M27/316-18
	0.73	A6	3.2	40P55CT	M27/317-18
	1.46	A7	1.5	80P55CT	M27/318-18
	2.18	A8	0.82	120P55CT	M27/319-17
	2.91	A9	0.6	160P55CT	M27/320-16
	3.64	A10	0.41	200P55CT	M27/321-15
	5.46	A11	0.175	300P55CT	M27/322-12
63	0.08	A1	52.0	5P63CT	M27/312-19
	0.16	A2	16.4	10P63CT	M27/313-19
	0.24	A3	8.6	15P63CT	M27/314-19
	0.32	A4	8.6	20P63CT	M27/315-19
	0.48	A5	3.9	30P63CT	M27/316-19
	0.64	A6	3.7	40P63CT	M27/317-19
	1.27	A7	1.7	80P63CT	M27/318-19
	1.91	A8	1.11	120P63CT	M27/319-18
	2.25	A9	0.64	160P63CT	M27/320-17
	3.18	A10	0.47	200P63CT	M27/321-16
	4.76	A11	0.187	300P63CT	M27/322-13
70	0.071	A1	68.0	5P70CT	M27/312-20
	0.143	A2	19.0	10P70CT	M27/313-20
	0.212	A3	11.2	15P70CT	M27/314-20
	0.286	A4	9.8	20P70CT	M27/315-20
	0.429	A5	5.5	30P70CT	M27/316-20
	0.572	A6	5.2	40P70CT	M27/317-20
	1.140	A7	2.4	80P70CT	M27/318-20
	1.720	A8	1.20	120P70CT	M27/319-19
	2.280	A9	0.93	160P70CT	M27/320-18
	2.860	A10	0.67	200P70CT	M27/321-17
	4.290	A11	0.26	300P70CT	M27/322-14
80	0.067	A1	80.0	5P80CT	M27/312-21
	0.125	A2	25.0	10P80CT	M27/313-21
	0.187	A3	13.6	15P80CT	M27/314-21
	0.250	A4	13.4	20P80CT	M27/315-21
	0.375	A5	6.4	30P80CT	M27/316-21
	0.500	A6	6.4	40P80CT	M27/317-21
	1.000	A7	2.7	80P80CT	M27/318-21
	1.500	A8	1.43	120P80CT	M27/319-20
	2.000	A9	1.06	160P80CT	M27/320-19
	2.500	A10	0.74	200P80CT	M27/321-18
	3.750	A11	0.3	300P80CT	M27/322-15
90	0.055	A1	112.00	5P90CT	M27/312-22
	0.111	A2	30.4	10P90CT	M27/313-22
	0.167	A3	20.0	15P90CT	M27/314-22
	0.222	A4	14.8	20P90CT	M27/315-22
	0.332	A5	8.6	30P90CT	M27/316-22
	0.445	A6	8.4	40P90CT	M27/317-22
	0.890	A7	3.8	80P90CT	M27/318-22
	1.340	A8	1.96	120P90CT	M27/319-21
	1.780	A9	1.49	160P90CT	M27/320-20
	2.220	A10	1.05	200P90CT	M27/321-19
	3.320	A11	0.43	300P90CT	M27/322-16
100	0.050	A1	113.0	5P100CT	M27/312-23
	0.100	A2	40.5	10P100CT	M27/313-23
	0.150	A3	22.0	15P100CT	M27/314-23
	0.200	A4	15.5	20P100CT	M27/315-23
	0.300	A5	10.0	30P100CT	M27/316-23
	0.400	A6	9.4	40P100CT	M27/317-23
	0.800	A7	4.2	80P100CT	M27/318-23
	1.200	A8	2.75	120P100CT	M27/319-22
	1.600	A9	1.69	160P100CT	M27/320-21
	2.000	A10	1.17	200P100CT	M27/321-20
	3.000	A11	0.48	300P100CT	M27/322-17
110	0.045	A1	140.0	5P110CT	M27/312-24
	0.091	A2	44.5	10P110CT	M27/313-24
	0.136	A3	28.0	15P110CT	M27/314-24
	0.182	A4	23.0	20P110CT	M27/315-24
	0.272	A5	13.6	30P110CT	M27/316-24
	0.364	A6	12.5	40P110CT	M27/317-24
	0.726	A7	5.7	80P110CT	M27/318-24
	1.090	A8	3.05	120P110CT	M27/319-23
	1.450	A9	2.3	160P110CT	M27/320-22
	1.820	A10	1.6	200P110CT	M27/321-21
	2.720	A11	0.65	300P110CT	M27/322-18
123	0.040	A1	198.0	5P123CT	M27/312-25
	0.081	A2	70.0	10P123CT	M27/313-25
	0.122	A3	33.5	15P123CT	M27/314-25
	0.162	A4	35.0	20P123CT	M27/315-25
	0.244	A5	15.3	30P123CT	M27/316-25
	0.325	A6	14.6	40P123CT	M27/317-25
	0.650	A7	6.5	80P123CT	M27/318-25
	0.970	A8	4.35	120P123CT	M27/319-24
	1.300	A9	2.57	160P123CT	M27/320-23
	1.620	A10	1.8	200P123CT	M27/321-22
	2.440	A11	0.74	300P123CT	M27/322-19

Other standard models to 300V output and 1000 VA are available. Contact our nearest office for complete information.

ABBOTT TECHNOLOGIES, INC.
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Eastern Sales Office: 321 Commercial Avenue, Suite 304, Palisades Park, NJ 07650, (201) 461-4005, FAX (201) 461-6323

Abbott TECHNOLOGIES, INC.

60 Hz MIL-T-27 Transformers

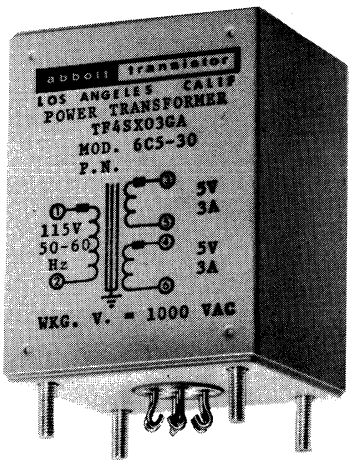
MODEL 6C

SPECIFICATIONS

INPUT PRIMARY: 115 VAC, 50 to 65 Hz, 1 Phase. See "A" and "X" options below.
REGULATION: 10% no load to full load.
SECONDARY VOLTAGE TOLERANCE: Within 3% when measured at full load and 115 VAC input.
INSULATION TEST: 1500 VAC.
OPERATING TEMP.: 90°C maximum ambient temperature.
CONSTRUCTION: To MIL-T-27, Grade 4, Class S, life "X" (10,000 hrs.)

EFFICIENCY: From 80% to 90% typical.
ENVIRONMENT: Encapsulated to meet MIL-STD-810 for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals.
OPTIONS AVAILABLE: Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information.

Now QPL!



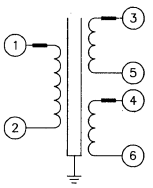
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NOTE: These units are also capable of 400 Hz operation.

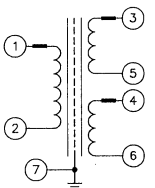
Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number	QPL Number
5V Parallel	1.00	0.50	EB	1.2	6C5-5	M27/326-01
10V C.T.	3.00	1.50	FA	2.2	6C5-15	M27/327-01
Series	6.00	3.00	GA	3.3	6C5-30	M27/328-01
	12.00	6.00	HA	4.7	6C5-60	M27/329-01
	20.00	10.00	JA	7.4	6C5-100	M27/330-01
6.3V Parallel	0.80	0.40	EB	1.2	6C6-5	M27/326-02
12.6V C.T.	2.38	1.19	FA	2.2	6C6-15	M27/327-02
Series	4.76	2.38	GA	3.3	6C6-30	M27/328-02
	9.52	4.76	HA	4.7	6C6-60	M27/329-02
	20.00	10.00	JA	7.4	6C6-126	M27/330-02
8V Parallel	0.62	0.31	EB	1.2	6C8-5	M27/326-03
16V C.T.	1.86	0.93	FA	2.2	6C8-15	M27/327-03
Series	3.72	1.86	GA	3.3	6C8-30	M27/328-03
	7.44	3.72	HA	4.7	6C8-60	M27/329-03
	17.50	8.75	JA	7.4	6C8-140	M27/330-03
	20.00	10.00	KA	9.8	6C8-160	M27/331-01
10V Parallel	0.50	0.25	EB	1.2	6C10-5	M27/326-04
20V C.T.	1.50	0.75	FA	2.2	6C10-15	M27/327-04
Series	3.00	1.50	GA	3.3	6C10-30	M27/328-04
	6.00	3.00	HA	4.7	6C10-60	M27/329-04
	14.00	7.00	JA	7.4	6C10-140	M27/330-04
	17.00	8.50	KA	9.8	6C10-170	M27/331-02
12V Parallel	0.40	0.20	EB	1.2	6C12-5	M27/326-05
24V C.T.	1.20	0.60	FA	2.2	6C12-15	M27/327-05
Series	2.40	1.20	GA	3.3	6C12-30	M27/328-05
	4.80	2.40	HA	4.7	6C12-60	M27/329-05
	11.60	5.80	JA	7.4	6C12-140	M27/330-05
	14.16	7.08	KA	9.8	6C12-170	M27/331-03
17V Parallel	0.30	0.15	EB	1.2	6C17-5	M27/326-06
34V C.T.	0.88	0.44	FA	2.2	6C17-15	M27/327-06
Series	1.76	0.88	GA	3.3	6C17-30	M27/328-06
	3.52	1.76	HA	4.7	6C17-60	M27/329-06
	8.20	4.10	JA	7.4	6C17-140	M27/330-06
	10.00	5.00	KA	9.8	6C17-170	M27/331-04
20V Parallel	0.24	0.12	EB	1.2	6C20-5	M27/326-07
40V C.T.	0.72	0.36	FA	2.2	6C20-15	M27/327-07
Series	1.44	0.72	GA	3.3	6C20-30	M27/328-07
	2.88	1.44	HA	4.7	6C20-60	M27/329-07
	7.00	3.50	JA	7.4	6C20-140	M27/330-07
	8.50	4.25	KA	9.8	6C20-170	M27/331-05
28V Parallel	0.18	0.09	EB	1.2	6C28-5	M27/326-08
56V C.T.	0.54	0.27	FA	2.2	6C28-15	M27/327-08
Series	1.08	0.54	GA	3.3	6C28-30	M27/328-08
	2.16	1.08	HA	4.7	6C28-60	M27/329-08
	5.00	2.50	JA	7.4	6C28-140	M27/330-08
	6.06	3.03	KA	9.8	6C28-170	M27/331-06
44V Parallel	0.10	0.05	EB	1.2	6C44-5	M27/326-09
88V C.T.	0.30	0.15	FA	2.2	6C44-15	M27/327-09
Series	0.60	0.30	GA	3.3	6C44-30	M27/328-09
	1.20	0.60	HA	4.7	6C44-60	M27/329-09
	3.16	1.58	JA	7.4	6C44-140	M27/330-09
	3.86	1.93	KA	9.8	6C44-170	M27/331-07
60V Parallel	0.08	0.04	EB	1.2	6C60-5	M27/326-10
120V C.T.	0.24	0.12	FA	2.2	6C60-15	M27/327-10
Series	0.48	0.24	GA	3.3	6C60-30	M27/328-10
	0.96	0.48	HA	4.7	6C60-60	M27/329-10
	2.32	1.16	JA	7.4	6C60-140	M27/330-10
	2.82	1.41	KA	9.8	6C60-170	M27/331-08

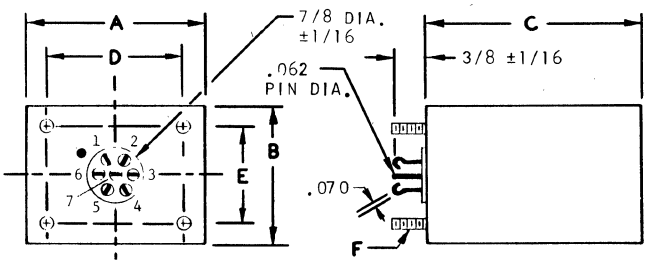
Circuit Diagram

Standard and "A" Option
Series Connected: Connect 4 and 5.
Parallel Connected: Connect 3 and 4, 5 and 6.
230 V ac. Add suffix "A" to model number, e.g., 6C5-5A.



"X" Option
Series Connected: Connect 4 and 5.
Parallel Connected: Connect 3 and 4, 5 and 6.
Electrostatic shield grounded to case and Pin 7.
Add suffix "X" to model number, e.g., 6C5-5X.





NOTE: Black dot at Pin #1.

Size	A	B	C	D	E	F
EB	1.938	1.812	2.438	1.375	1.250	6-32 x 3/8
FA	2.312	2.062	3.125	1.688	1.438	6-32 x 3/8
GA	2.750	2.375	3.812	2.125	1.750	6-32 x 3/8
HA	3.062	2.625	4.250	2.297	1.859	8-32 x 3/8
JA	3.562	3.062	4.875	2.625	2.125	8-32 x 3/8
KA	3.938	3.375	5.250	3.000	2.438	10-32 x 1/2

Dimension A, B = +0.000 −0.125
Dimension C = +0.000 −0.188
Dimension D, E = ±0.016 except size KA = 0.031
Dimension F = ±0.062

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Abbott TECHNOLOGIES, INC.

60 Hz, 3 Ø MIL-T-27 and Industrial Transformers

MODEL 6D

SPECIFICATIONS

INPUT PRIMARY:

WYE:	120V L-Com. or 208V L-L	Suffix A
DELTA:	120V L-L	Suffix C
DELTA:	230V L-L	Suffix E
DELTA:	440V L-L	Suffix F

NOTE: To order a specific input voltage add suffix to model number. (EXAMPLE: 6D ( ) 15-200E has input 230V L-L (3 wire DELTA)).

INPUT FREQUENCY: 50 Hz to 65 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

REGULATION: 10% max. no load to full load. (6% on size 3 thru 6).

INSULATION TEST: 1500 VRMS

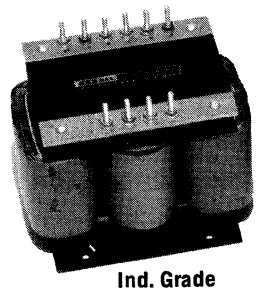
EFFICIENCY: Ranges from 90% to 95% typical.

OPERATING AMBIENT TEMP.: 80°C maximum on sizes 1-6; 60°C maximum on sizes 7-9.

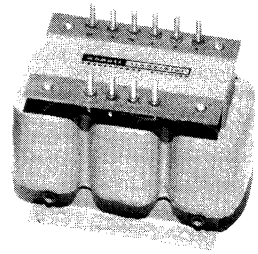
MIL-T-27 CONSTRUCTION: (Grade 5 Class S). Specify the letter "M" in the model number. (Example: 6DM15-200 ( )).

NOTE: MIL-T-27 add .20 to Dim. A, B, C. Other inputs and/or outputs available.

INDUSTRIAL CONSTRUCTION: Industrial Grade (open frame): Specify the letter "F" in the model number. (Example: 6DF 15-200 ( )).



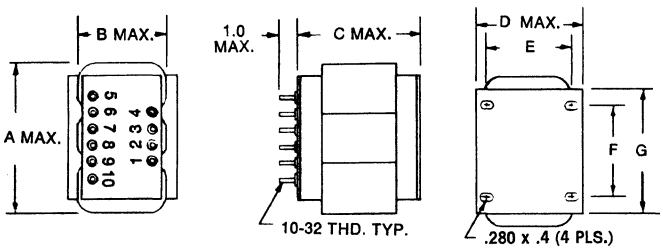
Ind. Grade



MIL-T-27
TF 5S03ZZ

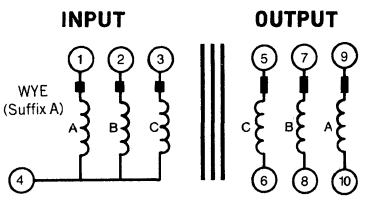
Model No.	Delta: L to L (3 wire) WYE: L to Com. (4 wire) Volts R.M.S.	Load Current (Amps)	WYE: L to L (3 wire) Volts R.M.S.	Load Current (Amps)	Size	Wt. Lbs. (Typ.)
6D( )5-200( )	5	13.30	8.66	7.70	1	14
6D( )5-450( )	5	30.00	8.66	17.30	2	20
6D( )5-650( )	5	43.30	8.66	25.00	3	28
6D( )12-200( )	12	5.56	20.8	3.21	1	14
6D( )12-450( )	12	12.50	20.8	7.21	2	20
6D( )12-650( )	12	18.10	20.8	10.40	3	28
6D( )12-850( )	12	23.60	20.8	13.60	4	39
6D( )12-1100( )	12	30.60	20.8	17.60	5	48
6D( )12-1500( )	12	41.70	20.8	24.00	6	58
6D( )12-2000( )	12	55.55	20.8	32.05	7	60
6D( )12-2500( )	12	69.44	20.8	40.09	8	68
6D( )12-3000( )	12	83.30	20.8	48.08	9	78
6D( )15-200( )	15	4.44	26.0	2.56	1	14
6D( )15-450( )	15	10.00	26.0	5.77	2	20
6D( )15-650( )	15	14.40	26.0	8.33	3	28
6D( )15-850( )	15	18.90	26.0	10.90	4	39
6D( )15-1100( )	15	24.40	26.0	14.10	5	48
6D( )15-1500( )	15	33.30	26.0	19.20	6	58
6D( )15-2000( )	15	44.44	26.0	25.65	7	60
6D( )15-2500( )	15	55.55	26.0	32.05	8	68
6D( )15-3000( )	15	66.66	26.0	38.46	9	78
6D( )20-200( )	20	3.33	34.6	1.93	1	14
6D( )20-450( )	20	7.50	34.6	4.33	2	20
6D( )20-650( )	20	10.80	34.6	6.26	3	28
6D( )20-850( )	20	14.20	34.6	8.19	4	39
6D( )20-1100( )	20	18.30	34.6	10.60	5	48
6D( )20-1500( )	20	25.00	34.6	14.40	6	58
6D( )20-2000( )	20	33.33	34.6	19.27	7	60
6D( )20-2500( )	20	41.66	34.6	24.08	8	68
6D( )20-3000( )	20	50.00	34.6	28.88	9	78

Model No.	Delta: L to L (3 wire) WYE: L to Com. (4 wire) Volts R.M.S.	Load Current (Amps)	WYE: L to L (3 wire) Volts R.M.S.	Load Current (Amps)	Size	Wt. Lbs. (Typ.)
6D( )28-200( )	28	2.38	48.5	1.37	1	14
6D( )28-450( )	28	5.36	48.5	3.09	2	20
6D( )28-650( )	28	7.74	48.5	4.47	3	28
6D( )28-850( )	28	10.10	48.5	5.83	4	39
6D( )28-1100( )	28	13.10	48.5	7.56	5	48
6D( )28-1500( )	28	17.90	48.5	10.30	6	58
6D( )28-2000( )	28	23.81	48.5	13.75	7	60
6D( )28-2500( )	28	29.76	48.5	17.18	8	68
6D( )28-3000( )	28	35.71	48.5	20.62	9	78
6D( )48-200( )	48	1.39	83.1	.80	1	14
6D( )48-450( )	48	3.13	83.1	1.81	2	20
6D( )48-650( )	48	4.51	83.1	2.61	3	28
6D( )48-850( )	48	5.90	83.1	3.41	4	39
6D( )48-1100( )	48	7.64	83.1	4.41	5	48
6D( )48-1500( )	48	10.40	83.1	6.02	6	58
6D( )48-2000( )	48	13.88	83.1	8.02	7	60
6D( )48-2500( )	48	17.36	83.1	10.02	8	68
6D( )48-3000( )	48	20.83	83.1	12.03	9	78
6D( )115-200( )	115	.58	200.0	.34	1	14
6D( )115-450( )	115	1.30	200.0	.75	2	20
6D( )115-650( )	115	1.88	200.0	1.09	3	28
6D( )115-850( )	115	2.46	200.0	1.42	4	39
6D( )115-1100( )	115	3.19	200.0	1.84	5	48
6D( )115-1500( )	115	4.35	200.0	2.51	6	58
6D( )115-2000( )	115	5.80	200.0	3.33	7	60
6D( )115-2500( )	115	7.25	200.0	4.18	8	68
6D( )115-3000( )	115	8.67	200.0	5.00	9	78



SIZE	A	B	C	D	E	F	G
1	6.10	4.10	4.62	4.10	3.10	3.75	4.81
2	7.70	4.10	5.43	4.10	3.10	4.00	6.00
3	7.70	5.10	5.43	5.10	4.10	4.00	6.00
4	9.20	4.60	6.78	5.10	3.86	5.24	7.50
5	9.20	5.10	6.78	5.60	4.36	5.24	7.50
6	9.20	5.85	6.78	6.35	5.11	5.24	7.50
7	11.00	4.85	8.13	5.10	3.86	6.40	9.00
8	11.00	5.35	8.13	5.60	4.36	6.40	9.00
9	11.00	5.85	8.13	6.10	5.11	6.40	9.00

DIM. TOL.: E, F, G, ±.06



INPUT CONNECTION

WYE: L-Com. 1, 2, 3 Line. 4 com.
WYE: L-L 1, 2, 3 (Pin 4 not used)
DELTA: L-L 1, 2, 3 (Pin 4 not used)

OUTPUT CONNECTION

WYE: L-Com. connect 6-8-10 Load 5-6, 7-6, 9-6
DELTA: L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE: L-L connect 6-10, 8-10 Load 5, 7, 9

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Eastern Sales Office: 321 Commercial Avenue, Suite 304, Palisades Park, NJ 07650, (201) 461-4005, FAX (201) 461-6323

Abbott TECHNOLOGIES, INC. — 60 Hz Industrial Transformers

MODEL 6B

SPECIFICATIONS

INPUT PRIMARY: 115 VAC standard. 230 VAC at 10% additional cost. Specify by suffixing "A" to model number. 115/230 VAC dual input at 10% additional cost. Specify by suffixing "B" to model number.

INPUT FREQUENCY: 50 to 400 Hz, 1 phase.

REGULATION: 15% Max. from no load to full load (6% on units size 8 and larger).

SECONDARY VOLTAGE TOLERANCE: Within 5% of listed output voltage when measured at full load and 115 VAC input.

INSULATION TEST: 1500 VAC.

OPERATING TEMPERATURE: 80°C maximum ambient (70°C on units size 8 and larger).

APPROXIMATE EFFICIENCY: Ranges from 80% to 90% typical.

CONSTRUCTION: Commercial grade using Silicon Iron for core and heavy insulated synthetic film magnet wire with class "B" rating impregnated with a high quality insulating varnish having a class "H" rating. Other outputs and/or inputs available on request.

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Series Connection	Size	Weight Lbs. Typ.	Model Number
5V Parallel	2.0	1.0	1	1.2	6B5-10
10V C.T. Series	3.0	1.5	2	1.5	6B5-15
	6.0	3.0	3	2.2	6B5-30
	12.0	6.0	4	3.0	6B5-60
	18.0	9.0	5	4.3	6B5-90
	26.0	13.0	6	5.5	6B5-130
	32.0	16.0	7	7.0	6B5-160†
	60.0	30.0	8	13.0	6B5-300†
	100.0	50.0	9	23.0	6B5-500†
6.3V Parallel	1.60	0.80	1	1.2	6B6-10
12.6V C.T. Series	2.40	1.20	2	1.5	6B6-15
	4.80	2.40	3	2.2	6B6-30
	9.40	4.70	4	3.0	6B6-60
	14.4	7.20	5	4.3	6B6-90
	20.6	10.3	6	5.5	6B6-130
	25.4	12.7	7	7.0	6B6-160†
	48.0	24.0	8	13.0	6B6-300†
	95.0	47.5	9	23.0	6B6-600†
8V Parallel	1.20	0.60	1	1.2	6B8-10
16V C.T. Series	1.80	0.90	2	1.5	6B8-15
	3.60	1.80	3	2.2	6B8-30
	7.60	3.80	4	3.0	6B8-60
	11.2	5.60	5	4.3	6B8-90
	16.2	8.10	6	5.5	6B8-130
	20.0	10.0	7	7.0	6B8-160*
	37.5	18.75	8	13.0	6B8-300†
	75.0	37.50	9	23.0	6B8-600†
	100.0	50.0	10	26.0	6B8-800†
10V Parallel	1.0	0.5	1	1.2	6B10-10
20V C.T. Series	1.5	0.75	2	1.5	6B10-15
	3.0	1.5	3	2.2	6B10-30
	6.0	3.0	4	3.0	6B10-60
	9.0	4.5	5	4.3	6B10-90
	13.0	6.5	6	5.5	6B10-130
	16.0	8.0	7	7.0	6B10-160*
	30.0	15.0	8	13.0	6B10-300†
	60.0	30.0	9	23.0	6B10-600†
	85.0	42.5	10	26.0	6B10-850†
	100.0	50.0	11	36.0	6B10-1000†
12V Parallel	0.82	0.41	1	1.2	6B12-10
24V C.T. Series	1.24	0.62	2	1.5	6B12-15
	2.50	1.25	3	2.2	6B12-30
	5.0	2.50	4	3.0	6B12-60
	7.5	3.75	5	4.3	6B12-90
	10.82	5.41	6	5.5	6B12-130
	13.32	6.66	7	7.0	6B12-160*
	25.00	12.50	8	13.0	6B12-300†
	50.00	25.00	9	23.0	6B12-600†
	71.00	35.50	10	26.0	6B12-850†
	100.00	50.00	11	36.0	6B12-1200†

* Use Fig. 3 for layout †Use Fig. 4 for layout

SIZE	A	B	C	D	E	F	HOLE	FIG.
1	1.95	1.68	2.31	2.37	—	2.87	0.18	1
2	2.26	1.93	2.68	2.81	—	3.12	0.18	1
3	2.57	2.18	3.06	3.12	—	3.56	0.18	1
4	2.81	2.43	3.37	2.25	2.12	2.70	0.2 x 0.3	2
5	3.12	2.68	3.75	2.50	2.25	2.86	0.2 x 0.3	2
6	3.44	2.93	4.12	2.75	2.37	2.98	0.2 x 0.3	3
7	3.75	3.18	4.50	3.00	2.50	3.11	0.2 x 0.3	3
7A	4.50	3.18	3.75	3.75	2.50	3.11	0.26 x 0.4	4
8	5.25	3.87	4.37	4.37	2.85	3.75	0.26 x 0.4	3
8A	5.25	3.87	4.37	4.37	2.85	3.75	0.26 x 0.4	4
9	6.37	4.62	5.31	5.31	3.22	4.20	0.26 x 0.4	4 or 5
10	6.37	4.99	5.31	5.31	3.60	4.58	0.26 x 0.4	4 or 5
11	7.50	5.37	6.25	6.75	3.60	4.85	0.26 x 0.4	4

DIMENSIONAL TOLERANCE: ±0.06 except B is max.

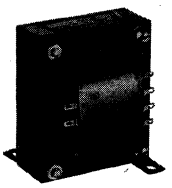


FIG. 1, 2, 3

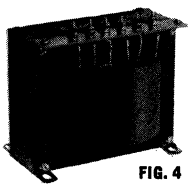
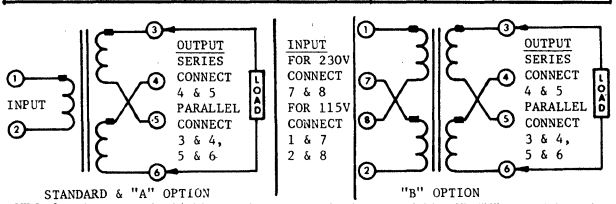


FIG. 4

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Series Connection	Size	Weight Lbs. Typ.	Model Number
17V Parallel	0.58	0.29	1	1.2	6B17-10
34V C.T. Series	0.88	0.44	2	1.5	6B17-15
	1.76	0.88	3	2.2	6B17-30
	3.52	1.76	4	3.0	6B17-60
	5.28	2.64	5	4.3	6B17-90
	7.64	3.82	6	5.5	6B17-130
	9.40	4.70	7	7.0	6B17-160*
	17.65	8.8	8	13.0	6B17-300†
	35.00	17.5	9	23.0	6B17-600†
	50.00	25.00	10	26.0	6B17-850†
	76.5	38.25	11	36.0	6B17-1300†
20V Parallel	0.5	0.25	1	1.2	6B20-10
40V C.T. Series	0.74	0.37	2	1.5	6B20-15
	1.5	0.75	3	2.2	6B20-30
	3.0	1.5	4	3.0	6B20-60
	4.5	2.25	5	4.3	6B20-90
	6.5	3.25	6	5.5	6B20-130
	8.0	4.0	7	7.0	6B20-160*
	15.0	7.50	8	13.0	6B20-300*
	30.0	15.0	9	23.0	6B20-600†
	42.5	21.25	10	26.0	6B20-850†
	65.0	32.50	11	36.0	6B20-1300†
28V Parallel	0.36	0.18	1	1.2	6B28-10
56V C.T. Series	0.52	0.26	2	1.5	6B28-15
	1.06	0.53	3	2.2	6B28-30
	2.14	1.07	4	3.0	6B28-60
	3.20	1.60	5	4.3	6B28-90
	4.64	2.32	6	5.5	6B28-130
	5.70	2.85	7	7.0	6B28-160*
	10.70	5.35	8	13.0	6B28-300*
	21.43	10.71	9	23.0	6B28-600†
	30.36	15.18	10	26.0	6B28-850†
	46.42	23.21	11	36.0	6B28-1300†
44V Parallel	0.22	0.11	1	1.2	6B44-10
88V C.T. Series	0.34	0.17	2	1.5	6B44-15
	0.68	0.34	3	2.2	6B44-30
	1.36	0.68	4	3.0	6B44-60
	2.04	1.02	5	4.3	6B44-90
	2.94	1.47	6	5.5	6B44-130
	3.62	1.81	7	7.0	6B44-160*
	6.82	3.41	8	13.0	6B44-300*
	13.64	6.82	9	23.0	6B44-600*
	19.32	9.66	10	26.0	6B44-850*
	29.54	14.77	11	36.0	6B44-1300†
60V Parallel	0.16	0.08	1	1.2	6B60-10
120V C.T. Series	0.250	0.125	2	1.5	6B60-15
	0.50	0.25	3	2.2	6B60-30
	1.0	0.50	4	3.0	6B60-60
	1.5	0.75	5	4.3	6B60-90
	2.16	1.08	6	5.5	6B60-130
	2.66	1.33	7	7.0	6B60-160*
	5.00	2.50	8	13.0	6B60-300*
	10.00	5.00	9	23.0	6B60-600*
	14.16	7.08	10	26.0	6B60-850*
	21.67	10.83	11	36.0	6B60-1300†



STANDARD & "A" OPTION "B" OPTION

"X" Option: Electrostatic shield grounded to mounting bracket. Add suffix "X" to model number, e.g., 6A5-10X.

MECHANICAL DRAWINGS

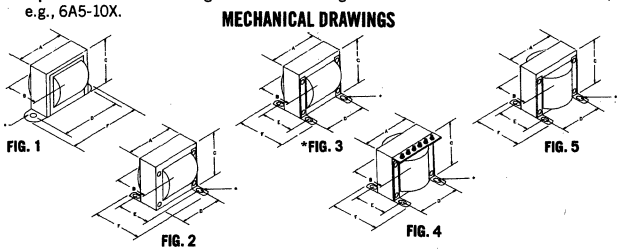


FIG. 1 FIG. 2 *FIG. 3 FIG. 4 FIG. 5

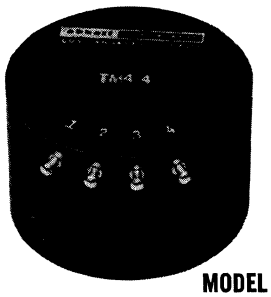
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Abbott TECHNOLOGIES, INC.

400 Hz MIL-T-27 and Industrial Toroid Transformers

MODELS TM TF

Now QPL!



MODEL TM
TF5S03ZZ

SPECIFICATIONS

INPUT PRIMARY: 115V, 400 Hz ±20 Hz, 1 phase; for 230V operation add the suffix "A"

REGULATION: 5% or less, no load to full load

SECONDARY VOLTAGE TOLERANCE: Within 5% when measured at full load and 115 VAC input

INSULATION TEST: 1000 VAC

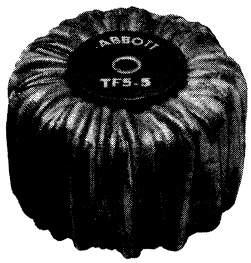
OPERATING TEMPERATURE: MODEL TM 90°C maximum ambient/MODEL TF 80°C maximum ambient.

APPROXIMATE EFFICIENCY: 90% to 95% typical.

OUTPUT SECONDARY: See voltage and current of specific models listed

CONSTRUCTION: MODEL TF — Open frame, Industrial Grade with Teflon leads 6" long. MODEL TM — to meet MIL-T-27, Grade 5, Class S, MIL-type Designation TF5S03ZZ

OPTIONS: "A" option is for 230V input primary. Add suffix "A" to model number (i.e. TF10-1A). "C" option is for center tapped output. Add suffix "C" to mode number (i.e. TF10-1C)



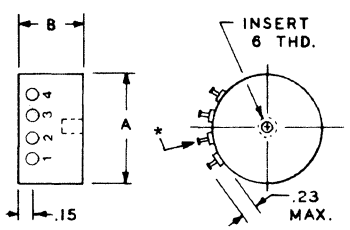
MODEL TF
Industrial Grade

Output Volts (F.L.)	Model No. TM	Model No. TF	QPL No. (Style M only)	Output Current (Amps)	Size	VA
5V	TM1-1	TF1-1	M27/350-01	3.00	1	15
	TM1-2	TF1-2	M27/351-01	5.00	2	25
	TM1-3	TF1-3	M27/352-01	10.00	3	50
7V	TM2-1	TF2-1	M27/350-02	2.14	1	15
	TM2-2	TF2-2	M27/351-02	3.57	2	25
	TM2-3	TF2-3	M27/352-02	7.14	3	50
	TM2-4	TF2-4	M27/353-01	10.00	4	70
10V	TM3-1	TF3-1	M27/350-03	1.50	1	15
	TM3-2	TF3-2	M27/351-03	2.50	2	25
	TM3-3	TF3-3	M27/352-03	5.00	3	50
	TM3-4	TF3-4	M27/353-02	7.50	4	75
	TM3-5	TF3-5	M27/354-01	10.00	5	100
12V	TM4-1	TF4-1	M27/350-04	1.25	1	15
	TM4-2	TF4-2	M27/351-04	2.08	2	25
	TM4-3	TF4-3	M27/352-04	4.17	3	50
	TM4-4	TF4-4	M27/353-03	6.25	4	75
	TM4-5	TF4-5	M27/354-02	8.33	5	100
14V	TM5-1	TF5-1	M27/350-05	1.07	1	15
	TM5-2	TF5-2	M27/351-05	1.79	2	25
	TM5-3	TF5-3	M27/352-05	3.57	3	50
	TM5-4	TF5-4	M27/353-04	5.36	4	75
	TM5-5	TF5-5	M27/354-03	7.14	5	100
17V	TM6-1	TF6-1	M27/350-06	0.88	1	15
	TM6-2	TF6-2	M27/351-06	1.47	2	25
	TM6-3	TF6-3	M27/352-06	2.94	3	50
	TM6-4	TF6-4	M27/353-05	4.41	4	75
	TM6-5	TF6-5	M27/354-04	5.88	5	100

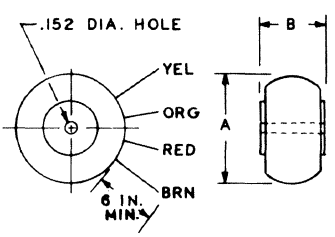
NEW 26V models available. Contact our nearest office for complete information.

Output Volts (F.L.)	Model No. TM	Model No. TF	QPL No. (Style M only)	Output Current (Amps)	Size	VA
24V	TM7-1	TF7-1	M27/350-07	0.63	1	15
	TM7-2	TF7-2	M27/351-07	1.04	2	25
	TM7-3	TF7-3	M27/352-07	2.08	3	50
	TM7-4	TF7-4	M27/353-06	3.13	4	75
	TM7-5	TF7-5	M27/354-05	4.17	5	100
26V	TM7.5-1	TF7.5-1	*	0.58	1	15
	TM7.5-2	TF7.5-2	*	0.96	2	25
	TM7.5-3	TF7.5-3	*	1.92	3	50
	TM7.5-4	TF7.5-4	*	2.88	4	75
	TM7.5-5	TF7.5-5	*	3.85	5	100
28V	TM8-1	TF8-1	M27/350-08	0.54	1	15
	TM8-2	TF8-2	M27/351-08	0.89	2	25
	TM8-3	TF8-3	M27/352-08	1.79	3	50
	TM8-4	TF8-4	M27/353-07	2.68	4	75
	TM8-5	TF8-5	M27/354-06	3.57	5	100
34V	TM9-1	TF9-1	M27/350-09	0.44	1	15
	TM9-2	TF9-2	M27/351-09	0.75	2	25
	TM9-3	TF9-3	M27/352-09	1.47	3	50
	TM9-4	TF9-4	M27/353-08	2.21	4	75
	TM9-5	TF9-5	M27/354-07	2.94	5	100
115V	TM10-1	TF10-1	M27/350-10	0.13	1	15
	TM10-2	TF10-2	M27/351-10	0.21	2	25
	TM10-3	TF10-3	M27/352-10	0.43	3	50
	TM10-4	TF10-4	M27/353-09	0.65	4	75
	TM10-5	TF10-5	M27/354-08	0.87	5	100

*QPL Testing underway.

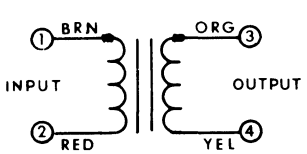


MODEL TM

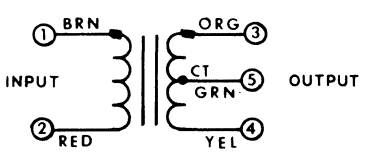


MODEL TF

STANDARD & OPTION A



OPTION C



SIZE	1		2		3		4		5	
MODEL	TM	TF	TM	TF	TM	TF	TM	TF	TM	TF
DIM A	1.62	1.50	1.75	1.63	2.13	2.00	2.13	2.00	2.38	2.25
DIM B	0.95	0.95	1.00	1.00	1.10	1.10	1.30	1.30	1.60	1.60
WT. (LB. MAX.)	0.26	0.17	0.33	0.25	0.52	0.38	0.66	0.52	1.1	0.79
INSERT	6-32	—	8-32	—	8-32	—	10-32	—	10-32	—

DIMENSIONAL TOLERANCE: Model TM ±.03; Model TF Dim A, B Max.
*Terminal Spacing is 0.35.

ABBOTT TECHNOLOGIES, INC.
Head Office: 8203 Vineland Avenue, Sun Valley, CA 91352, (818) 504-0644, FAX (818) 768-0395
Eastern Sales Office: 321 Commercial Avenue, Suite 304, Palisades Park, NJ 07650, (201) 461-4005, FAX (201) 461-6323

Abbott TECHNOLOGIES, INC. 400 Hz MIL-T-27 Transformers

MODEL **E**

SPECIFICATIONS

Input Primary:
115 VAC, 400 Hz ± 20 Hz, 1 phase.

Regulation:
10% no load to full load. (12% for 2E models)

Secondary Voltage
Tolerance: Within 5% when measured at full load and 11 VAC input

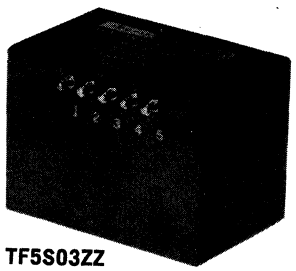
Construction:
To MIL-T-27, Grade 5, Class S Molded Dially Phthalate

Environment:
Encapsulated to meet MIL-STD-810, including vibration, ambient temperature to 85°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum).

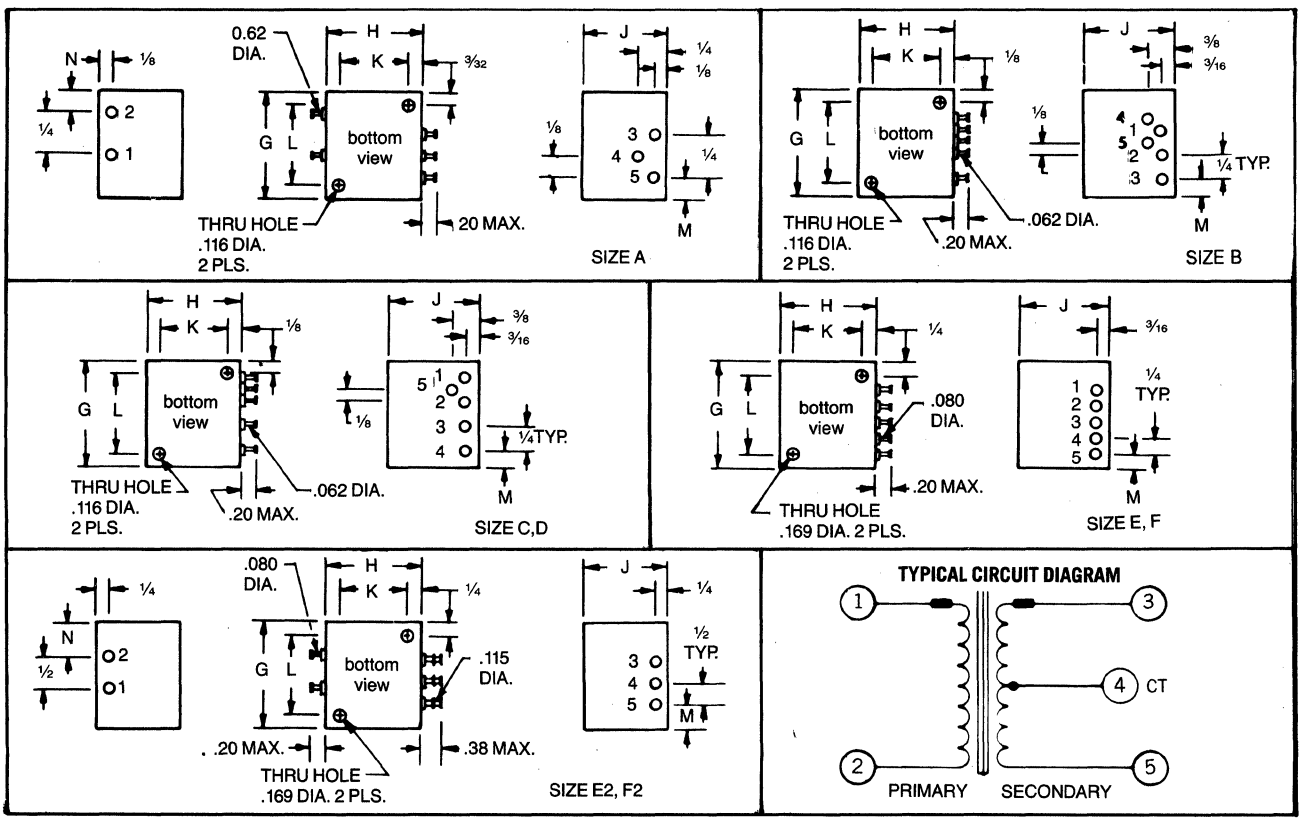
Secondary:
See output voltage and current of specific models listed.

Other models are available. Contact our nearest office for complete information.

Now QPL!



TF5S03ZZ



Size	G	H	J	K	L	M	N
A	.87	.74	.78	.55	.68	3/16	3/16
B	1.25	1.19	.88	.94	1.00	1/4	—
C	1.43	1.24	1.27	.99	1.18	1/4	—
D	1.47	1.28	1.40	1.03	1.22	1/4	—
E	2.31	1.52	1.75	1.02	1.81	1/2	—
E2	2.31	1.52	1.75	.102	1.81	1/2	3/4
F	2.75	2.71	2.31	2.21	2.25	3/4	—
F2	2.75	2.71	2.31	2.21	2.25	3/4	1

Dim. Tol. =
Fraction ± 1/32,
xx = ±0.015,
xxx = ±0.005

NOTE:
DIMENSIONS G & H MEASURED ATTOP OF TRANSFORMER

MODEL TYPE	WEIGHT lbs. (max)	PRIMARY DCR ohms (typical)
2E	0.06	201
6E	0.15	61
15E	0.28	14
24E	0.32	12
80E	0.80	2.0
175E	2.2	0.7

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Abbott TECHNOLOGIES, INC.

400 Hz MIL-T-27 Transformers

MODEL E

Output Volts	Output Current (Amps)	Size	Secondary DCR ohms	Model Number	QPL No.
5.0	0.400	A	0.60	2E5CT	M27/338-01
	1.200	B	0.173	6E5CT	M27/339-01
	3.000	C	0.046	15E5CT	M27/340-01
	4.800	D	0.040	24E5CT	M27/341-01
	16.000	E2	0.009	80E5CT	M27/342-01
	35.000	F2	0.012	175E5CT	M27/343-01
6.3	0.317	A	1.06	2E6.3CT	M27/338-02
	0.950	B	0.24	6E6.3CT	M27/339-02
	2.380	C	0.088	15E6.3CT	M27/340-02
	3.800	D	0.107	24E6.3CT	M27/341-02
	12.800	E2	0.016	80E6.3CT	M27/342-02
	27.800	F2	0.019	175E6.3CT	M27/343-02
8.0	0.250	A	1.63	2E8CT	M27/338-03
	0.750	B	0.396	6E8CT	M27/339-03
	1.880	C	0.135	15E8CT	M27/340-03
	3.000	D	0.140	24E8CT	M27/341-03
	10.000	E2	0.017	80E8CT	M27/342-03
	22.000	F2	0.010	175E8CT	M27/343-03
10.0	0.200	A	2.50	2E10CT	M27/338-04
	0.600	B	0.587	6E10CT	M27/339-04
	1.500	C	0.27	15E10CT	M27/340-04
	2.400	D	0.180	24E10CT	M27/341-04
	8.000	E	7.2	80E10CT	M27/342-04
	17.500	F2	0.020	175E10CT	M27/343-04
12.6	0.158	A	4.10	2E12.6CT	M27/338-05
	0.475	B	0.99	6E12.6CT	M27/339-05
	1.180	C	0.32	15E12.6CT	M27/340-05
	1.900	D	0.225	24E12.6CT	M27/341-05
	6.350	E	0.030	80E12.6CT	M27/342-05
	13.900	F2	0.021	175E12.6CT	M27/343-05
14.0	0.142	A	5.59	2E14CT	M27/338-06
	0.428	B	1.11	6E14CT	M27/339-06
	1.070	C	0.35	15E14CT	M27/340-06
	1.720	D	0.32	24E14CT	M27/341-06
	5.600	E	0.04	80E14CT	M27/342-06
	12.500	F2	0.022	175E14CT	M27/343-06
16	0.125	A	6.63	2E16CT	M27/338-07
	0.375	B	1.58	6E16CT	M27/339-07
	0.940	C	0.54	15E16CT	M27/340-07
	1.500	D	0.35	24E16CT	M27/341-07
	5.000	E	0.05	80E16CT	M27/342-07
	10.900	F2	0.025	175E16CT	M27/343-07
18	0.111	A	9.00	2E18CT	M27/338-08
	0.333	B	2.21	6E18CT	M27/339-08
	0.832	C	0.74	15E18CT	M27/340-08
	1.330	D	0.40	24E18CT	M27/341-08
	4.450	E	0.08	80E18CT	M27/342-08
	9.700	F	0.027	175E18CT	M27/343-08
20	0.100	A	10.9	2E20CT	M27/338-09
	0.300	B	2.78	6E20CT	M27/339-09
	0.750	C	1.4	15E20CT	M27/340-09
	1.200	D	0.48	24E20CT	M27/341-09
	4.000	E	0.09	80E20CT	M27/342-09
	8.750	F	0.020	175E20CT	M27/343-09
22	0.091	A	14.6	2E22CT	M27/338-10
	0.273	B	2.80	6E22CT	M27/339-10
	0.680	C	0.92	15E22CT	M27/340-10
	1.090	D	0.63	24E22CT	M27/341-10
	3.630	E	0.12	80E22CT	M27/342-10
	7.900	F	0.020	175E22CT	M27/343-10
25	0.080	A	20.40	2E25CT	M27/338-11
	0.240	B	3.60	6E25CT	M27/339-11
	0.600	C	1.30	15E25CT	M27/340-11
	0.960	D	0.68	24E25CT	M27/341-11
	3.200	E	0.13	80E25CT	M27/342-11
	7.000	F	0.042	175E25CT	M27/343-11
26	0.077	A	21.22	2E26CT	*
	0.231	B	3.74	6E26CT	*
	0.577	C	1.35	15E26CT	*
	0.923	D	0.71	24E26CT	*
	3.08	E	0.14	80E26CT	*
	6.73	F	0.044	175E26CT	*
28	0.071	A	30.0	2E28CT	M27/338-12
	0.214	B	4.20	6E28CT	M27/339-12
	0.535	C	1.83	15E28CT	M27/340-12
	0.855	D	0.98	24E28CT	M27/341-12
	2.850	E	0.14	80E28CT	M27/342-12
	6.250	F	0.043	175E28CT	M27/343-12
31	0.064	A	25.6	2E31CT	M27/338-13
	0.192	B	5.71	6E31CT	M27/339-13
	0.485	C	1.62	15E31CT	M27/340-13
	0.772	D	1.27	24E31CT	M27/341-13
	2.470	E	0.18	80E31CT	M27/342-13
	5.650	F	0.061	175E31CT	M27/343-13
35	0.057	A	29.5	2E35CT	M27/338-14
	0.171	B	6.89	6E35CT	M27/339-14
	0.428	C	2.28	15E35CT	M27/340-14
	0.685	D	1.70	24E35CT	M27/341-14
	2.280	E	0.28	80E35CT	M27/342-14
	5.000	F	0.098	175E35CT	M27/343-14
39	0.051	A	38.6	2E39CT	M27/338-15
	0.154	B	9.39	6E39CT	M27/339-15
	0.384	C	2.54	15E39CT	M27/340-15
	0.615	D	2.20	24E39CT	M27/341-15
	2.050	E	0.32	80E39CT	M27/342-15
	4.480	F	0.110	175E39CT	M27/343-15
43	0.046	A	44.3	2E43CT	M27/338-16
	0.139	B	10.25	6E43CT	M27/339-16
	0.348	C	2.85	15E43CT	M27/340-16
	0.556	D	2.42	24E43CT	M27/341-16
	1.860	E	0.35	80E43CT	M27/342-16
	4.060	F	0.114	175E43CT	M27/343-16
48	0.041	A	57.0	2E48CT	M27/338-17
	0.125	B	15.30	6E48CT	M27/339-17
	0.312	C	4.05	15E48CT	M27/340-17
	0.500	D	3.27	24E48CT	M27/341-17
	1.660	E	0.40	80E48CT	M27/342-17
	3.650	F	0.160	175E48CT	M27/343-17
55	0.036	A	89.0	2E55CT	M27/338-18
	0.109	B	17.30	6E55CT	M27/339-18
	0.262	C	7.2	15E55CT	M27/340-18
	0.435	D	3.83	24E55CT	M27/341-18
	1.450	E	0.67	80E55CT	M27/342-18
	3.170	F	0.196	175E55CT	M27/343-18
63	0.031	A	100.0	2E63CT	M27/338-19
	0.095	B	24.9	6E63CT	M27/339-19
	0.238	C	6.51	15E63CT	M27/340-19
	0.380	D	5.35	24E63CT	M27/341-19
	1.270	E	0.71	80E63CT	M27/342-19
	2.770	F	0.20	175E63CT	M27/343-19
70	0.028	A	139.0	2E70CT	M27/338-20
	0.085	B	27.1	6E70CT	M27/339-20
	0.214	C	9.4	15E70CT	M27/340-20
	0.342	D	8.10	24E70CT	M27/341-20
	1.140	E	0.80	80E70CT	M27/342-20
	2.500	F	0.25	175E70CT	M27/343-20
80	0.025	A	163.0	2E80CT	M27/338-21
	0.075	B	39.0	6E80CT	M27/339-21
	0.198	C	13.4	15E80CT	M27/340-21
	0.300	D	9.0	24E80CT	M27/341-21
	1.000	E	0.92	80E80CT	M27/342-21
	2.180	F	0.34	175E80CT	M27/343-21
90	0.022	A	218.0	2E90CT	M27/338-22
	0.067	B	41.0	6E90CT	M27/339-22
	0.166	C	15.9	15E90CT	M27/340-22
	0.267	D	12.5	24E90CT	M27/341-22
	0.890	E	1.08	80E90CT	M27/342-22
	1.940	F	0.38	175E90CT	M27/343-22
100	0.020	A	283.0	2E100CT	M27/338-23
	0.060	B	59.5	6E100CT	M27/339-23
	0.150	C	16.8	15E100CT	M27/340-23
	0.240	D	14.4	24E100CT	M27/341-23
	0.800	E	1.64	80E100CT	M27/342-23
	1.750	F	0.52	175E100CT	M27/343-23
110	0.018	A	392.0	2E110CT	M27/338-24
	0.054	B	62.3	6E110CT	M27/339-24
	0.136	C	22.1	15E110CT	M27/340-24
	0.218	D	19.5	24E110CT	M27/341-24
	0.728	E	2.03	80E110CT	M27/342-24
	1.590	F	0.72	175E110CT	M27/343-24
115	0.017	A	410.00	2E115CT	*
	0.052	B	65.10	6E115CT	*
	0.130	C	23.10	15E115CT	*
	0.209	D	20.40	24E115CT	*
	0.696	E	2.12	80E115CT	*
	1.520	F	0.72	175E115CT	*
123	0.016	A	495.00	2E123CT	M27/338-25
	0.048	B	96.00	6E123CT	M27/339-25
	0.122	C	30.70	15E123CT	M27/340-25
	0.195	D	21.90	24E123CT	M27/341-25
	0.650	E	2.35	80E123CT	M27/342-25
	1.420	F	0.81	175E123CT	M27/343-25
138	0.014	A	550.00	2E138CT	M27/338-26
	0.043	B	133.00	6E138CT	M27/339-26
	0.108	C	36.00	15E138CT	M27/340-26
	0.174	D	30.30	24E138CT	M27/341-26
	0.580	E	3.17	80E138CT	M27/342-26
	1.260	F	1.14	175E138CT	M27/343-26
157	0.038	B	153.00	6E157CT	M27/339-27
	0.095	C	53.00	15E157CT	M27/340-27
	0.152	D	36.10	24E157CT	M27/341-27
	0.508	E	3.60	80E157CT	M27/342-27
	1.100	F	1.31	175E157CT	M27/343-27
175	0.034	B	168.00	6E175CT	M27/339-28
	0.085	C	56.00	15E175CT	M27/340-28
	0.136	D	49.50	24E175CT	M27/341-28
	0.455	E	5.50	80E175CT	M27/342-28
	1.000	F	1.87	175E175CT	M27/343-28
200	0.030	B	248.00	6E200CT	M27/339-29
	0.071	C	65.00	15E200CT	M27/340-29
	0.120	D	57.00	24E200CT	M27/341-29
	0.400	E	5.60	80E200CT	M27/342-29
	1.875	F	2.65	175E200CT	M27/343-29
220	0.027	B	278.00	6E220CT	M27/339-30
	0.068	C	91.50	15E220CT	M27/340-30
	0.109	D	79.00	24E220CT	M27/341-30
	0.364	E	8.10	80E220CT	M27/342-30
	0.790	F	2.92	175E220CT	M27/343-30
250	0.024	B	407.00	6E250CT	N/A
	0.060	C	141.00	15E250CT	N/A
	0.096	D	114.00	24E250CT	N/A
	0.320	E	11.20	80E250CT	N/A
	0.700	F	3.95	175E250CT	N/A
275	0.021	B	417.00	6E275CT	N/A
	0.054	C	146.00	15E275CT	N/A
	0.087	D	120.00	24E275CT	N/A
	0.290	E	13.60	80E275CT	N/A
	0.635	F	4.65	175E275CT	N/A
310	0.019	B	592.00	6E310CT	N/A
	0.048	C	160.00	15E310CT	N/A
	0.077	D	180.00	24E310CT	N/A
	0.256	E	14.10	80E310CT	N/A
	0.565	F	6.80	175E310CT	N/A
350	0.017	B	680.00	6E350CT	N/A
	0.042	C	232.00	15E350CT	N/A
	0.068	D	200.00	24E350CT	N/A
	0.217	E	21.20	80E350CT	N/A
	0.500	F	8.00	175E350CT	N/A
387	0.038	C	310.00	15E387CT	N/A
	0.062	D	225.00	24E387CT	N/A
	0.206	E	22.70	80E387CT	N/A
	0.450	F	10.00	175E387CT	N/A
433	0.034	C	457.00	15E433CT	N/A
	0.055	D	300.00	24E433CT	N/A
	0.184	E	31.60	80E433CT	N/A
	0.404	F	11.20	175E433CT	N/A
486	0.049	D	340.00	24E486CT	N/A
	0.164	E	35.60	80E486CT	N/A
	0.360	F	16.00	175E486CT	N/A

Other standard models to 1000 Volts are available. Contact our nearest office for complete information.
*QPL Testing underway.

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Abbott TECHNOLOGIES, INC.

400 Hz MIL-T-27 Transformers

MODEL 4A

SPECIFICATIONS

INPUT PRIMARY: 115 V, 400 Hz ± 20 Hz, 1 Phase.

"A" Option: 230 V ac. Add suffix "A" to model number, e.g., 4A5-50A.

"X" Option: Electrostatic shield grounded to core. Add "X" to model number, e.g., 4A5-50X.

REGULATION: 10% no load to full load.

SECONDARY VOLTAGE TOLERANCE: Within 5% when measured at full load and 115 VAC input.

INSULATION TEST: 1500 VAC.

OPERATING TEMP.: 95°C maximum ambient temperature.

CONSTRUCTION: To MIL-T-27, Grade 5, Class S, life "X", (10,000 hrs.)

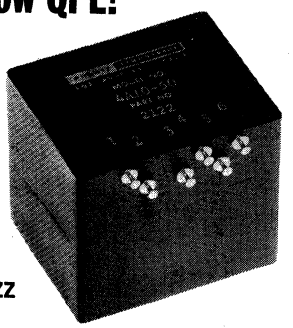
EFFICIENCY: From 90% to 93% typical.

ENVIRONMENT: Encapsulated to meet MIL-STD-810 for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals.

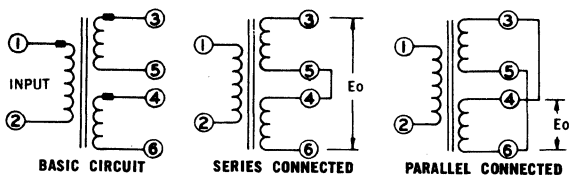
OPTIONS AVAILABLE: Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information.

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number	QPL Number
5V Parallel	1.40	0.70	1	0.26	4A5-7	M27/332-01
10V C.T.	2.00	1.00	2	0.30	4A5-10	M27/333-01
Series	5.00	2.50	3	0.47	4A5-25	M27/334-01
	8.00	4.00	4	0.77	4A5-40	M27/335-01
	24.0	12.0	5	1.6	4A5-120	M27/336-01
	30.0	15.0	6	2.0	4A5-150	M27/337-01
6.3V Parallel	1.11	0.55	1	0.26	4A6-7	M27/332-02
12.6V C.T.	1.58	0.79	2	0.30	4A6-10	M27/333-02
Series	4.00	2.00	3	0.47	4A6-25	M27/334-02
	8.00	4.00	4	0.77	4A6-50	M27/335-02
	19.0	9.50	5	1.6	4A6-120	M27/336-02
	23.8	11.9	6	2.0	4A6-150	M27/337-02
	*31.70	15.85	7	2.2	4A6-200	
8V Parallel	0.87	0.43	1	0.26	4A8-7	M27/332-03
16V C.T.	1.25	0.62	2	0.30	4A8-10	M27/333-03
Series	3.12	1.56	3	0.47	4A8-25	M27/334-03
	6.24	3.12	4	0.77	4A8-50	M27/335-03
	15.0	7.50	5	1.6	4A8-120	M27/336-03
	18.7	9.35	6	2.0	4A8-150	M27/337-03
	*25.00	12.50	7	2.2	4A8-200	
10V Parallel	0.70	0.35	1	0.26	4A10-7	M27/332-04
20V C.T.	1.00	0.50	2	0.30	4A10-10	M27/333-04
Series	2.50	1.25	3	0.47	4A10-25	M27/334-04
	5.00	2.50	4	0.77	4A10-50	M27/335-04
	12.0	6.00	5	1.6	4A10-120	M27/336-04
	15.0	7.50	6	2.0	4A10-150	M27/337-04
	*20.00	10.00	7	2.2	4A10-200	
12V Parallel	0.58	0.29	1	0.26	4A12-7	M27/332-05
24V C.T.	0.84	0.42	2	0.30	4A12-10	M27/333-05
Series	2.08	1.04	3	0.47	4A12-25	M27/334-05
	4.16	2.08	4	0.77	4A12-50	M27/335-05
	10.0	5.00	5	1.6	4A12-120	M27/336-05
	12.5	6.25	6	2.0	4A12-150	M27/337-05
	*16.7	8.35	7	2.2	4A12-200	
17V Parallel	0.41	0.20	1	0.26	4A17-7	M27/332-06
34V C.T.	0.58	0.29	2	0.30	4A17-10	M27/333-06
Series	1.47	0.73	3	0.47	4A17-25	M27/334-06
	2.94	1.47	4	0.77	4A17-50	M27/335-06
	7.06	3.53	5	1.6	4A17-120	M27/336-06
	8.82	4.41	6	2.0	4A17-150	M27/337-06
	*11.80	5.90	7	2.2	4A17-200	
20V Parallel	0.35	0.17	1	0.26	4A20-7	M27/332-07
40V C.T.	0.50	0.25	2	0.30	4A20-10	M27/333-07
Series	1.25	0.62	3	0.47	4A20-25	M27/334-07
	2.50	1.25	4	0.77	4A20-50	M27/335-07
	6.00	3.00	5	1.6	4A20-120	M27/336-07
	7.50	3.75	6	2.0	4A20-150	M27/337-07
	*10.00	5.00	7	2.2	4A20-200	
28V Parallel	0.25	0.12	1	0.26	4A28-7	M27/332-08
56V C.T.	0.35	0.17	2	0.30	4A28-10	M27/333-08
Series	0.89	0.44	3	0.47	4A28-25	M27/334-08
	1.78	0.89	4	0.77	4A28-50	M27/335-08
	4.28	2.14	5	1.6	4A28-120	M27/336-08
	5.36	2.68	6	2.0	4A28-150	M27/337-08
	*7.14	3.57	7	2.2	4A28-200	
44V Parallel	0.15	0.07	1	0.26	4A44-7	M27/332-09
88V C.T.	0.22	0.11	2	0.36	4A44-10	M27/333-09
Series	0.56	0.28	3	0.47	4A44-25	M27/334-09
	1.12	0.56	4	0.77	4A44-50	M27/335-09
	2.72	1.36	5	1.6	4A44-120	M27/336-09
	3.40	1.70	6	2.0	4A44-150	M27/337-09
	*4.54	2.27	7	2.2	4A44-200	
60V Parallel	0.11	0.05	1	0.26	4A60-7	M27/332-10
120V C.T.	0.16	0.08	2	0.30	4A60-10	M27/333-10
Series	0.41	0.20	3	0.47	4A60-25	M27/334-10
	0.82	0.41	4	0.77	4A60-50	M27/335-10
	2.00	1.00	5	1.6	4A60-120	M27/336-10
	2.50	1.25	6	2.0	4A60-150	M27/337-10
	*3.53	1.66	7	2.2	4A60-200	

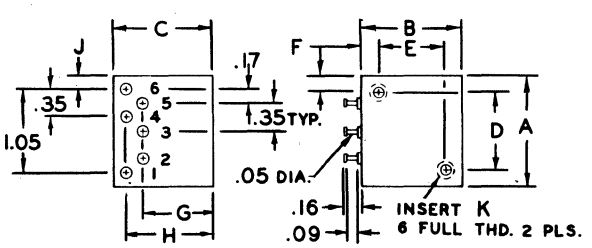
Now QPL!



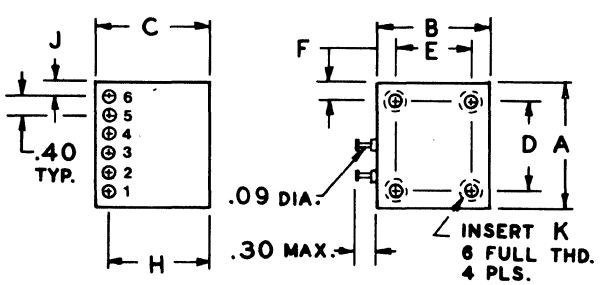
TF5S03ZZ



"X" Option: Electrostatic shield grounded to core. Add "X" to model number, e.g., 4A5-50X.



SIZES 1,2,3,4



SIZES 5,6,7

Size	A	B	C	D	E	F	G	H	J	K
1	1.37	1.25	1.31	1.00	.87	.19	1.00	1.19	.16	4-40
2	1.50	1.37	1.37	1.12	1.00	.19	1.06	1.25	.22	4-40
3	1.75	1.50	1.56	1.25	1.00	.25	1.25	1.44	.35	6-32
4	2.00	1.62	1.81	1.50	1.12	.25	1.50	1.69	.47	6-32
5	2.43	2.00	2.10	1.93	1.50	.25	—	1.90	.21	6-32
6	2.81	2.12	2.43	2.21	1.52	.30	—	2.23	.40	8-32
7	2.81	2.25	2.43	2.21	1.65	.30	—	2.23	.40	8-32

Tolerance: ±.02 except F, G, H, J: ±.04.

Note: NEW models available to 200 VA. Contact our nearest office for complete information.

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Abbott TECHNOLOGIES, INC.

400 Hz, 3 Ø MIL-T-27 Transformers

MODEL 4D

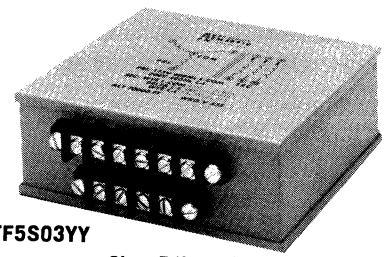
Now QPL!



TF5S03ZZ

Sizes 1 through 6

- Designed to meet the light weight and high temperature requirements of airborne, shipboard, and military electronics.
- Power levels range from 90 to 1,000 watts.



TF5S03YY

Sizes 7 through 10

MODEL NUMBER	STD. INPUT QPL NUMBER*	OUTPUT PER PHASE: DELTA: L to L (3 wire) WYE: L to COM. (4 wire) VOLTS R.M.S.	DELTA: L to L (3 wire) WYE: L to COM. (4 wire) LOAD CURRENT AMPS	WYE: L to L (3 wire) VOLTS R.M.S.	WYE: L to L (3 wire) LOAD CURRENT AMPS	SIZE	WEIGHT LBS. (TYP.)
4D5-90	M27/344-01	5	6.00	8.66	3.47	1	1.3
4D5-120	M27/345-01	5	8.00	8.66	4.62	2	1.6
4D5-150	M27/346-01	5	10.00	8.66	5.78	3	2.3
4D5-200	M27/347-01	5	13.34	8.66	7.70	4	2.4
4D5-500	**	5	20.00	8.66	19.24	7	6.1
4D5-650	**	5	30.00	8.66	25.02	8	6.8
4D12-90	M27/344-02	12	2.50	20.8	1.45	1	1.3
4D12-120	M27/345-02	12	3.34	20.8	1.93	2	1.6
4D12-150	M27/346-02	12	4.17	20.8	2.41	3	2.3
4D12-200	M27/347-02	12	5.56	20.8	3.21	4	2.4
4D12-270	M27/347-01	12	7.50	20.8	4.33	5	2.8
4D12-375	M27/349-01	12	10.42	20.8	6.02	6	3.8
4D12-500	**	12	13.88	20.8	8.01	7	6.1
4D12-650	**	12	18.05	20.8	10.42	8	6.8
4D12-800	**	12	22.22	20.8	12.82	9	7.6
4D12-1000	**	12	27.78	20.8	16.02	10	8.1
4D15-90	M27/344-03	15	2.00	26.0	1.16	1	1.3
4D15-120	M27/345-03	15	2.67	26.0	1.54	2	1.6
4D15-150	M27/346-03	15	3.34	26.0	1.93	3	2.3
4D15-200	M27/347-03	15	4.45	26.0	2.57	4	2.4
4D15-270	M27/348-02	15	6.00	26.0	3.47	5	2.8
4D15-375	M27/349-02	15	8.34	26.0	4.82	6	3.8
4D15-500	**	15	11.11	26.0	6.41	7	6.1
4D15-650	**	15	14.44	26.0	8.33	8	6.8
4D15-800	**	15	17.78	26.0	10.25	9	7.6
4D15-1000	**	15	22.23	26.0	12.82	10	8.1
4D20-90	M27/344-04	20	1.50	34.6	.87	1	1.3
4D20-120	M27/345-04	20	2.00	34.6	1.16	2	1.6
4D20-150	M27/346-04	20	2.50	34.6	1.45	3	2.3
4D20-200	M27/347-04	20	3.34	34.6	1.93	4	2.4
4D20-270	M27/348-03	20	4.50	34.6	2.60	5	2.8
4D20-375	M27/349-03	20	6.25	34.6	3.61	6	3.8
4D20-500	**	20	8.33	34.6	4.81	7	6.1
4D20-650	**	20	10.83	34.6	6.26	8	6.8
4D20-800	**	20	13.33	34.6	7.70	9	7.6
4D20-1000	**	20	16.67	34.6	9.63	10	8.1
4D28-90	M27/344-05	28	1.08	48.5	.62	1	1.3
4D28-120	M27/345-05	28	1.43	48.5	.83	2	1.6
4D28-150	M27/346-05	28	1.79	48.5	1.03	3	2.3
4D28-200	M27/347-05	28	2.38	48.5	1.38	4	2.4
4D28-270	M27/348-04	28	3.22	48.5	1.86	5	2.8
4D28-375	M27/349-04	28	4.47	48.5	2.58	6	3.8
4D28-500	**	28	5.95	48.5	3.43	7	6.1
4D28-650	**	28	7.74	48.5	4.46	8	6.8
4D28-800	**	28	9.52	48.5	5.50	9	7.6
4D28-1000	**	28	11.91	48.5	6.87	10	8.1
4D48-90	M27/344-06	48	.63	83.1	.36	1	1.3
4D48-120	M27/345-06	48	.84	83.1	.49	2	1.6
4D48-150	M27/346-06	48	1.05	83.1	.61	3	2.3
4D48-200	M27/347-06	48	1.39	83.1	.81	4	2.4
4D48-270	M27/348-05	48	1.88	83.1	1.09	5	2.8
4D48-375	M27/349-05	48	2.61	83.1	1.51	6	3.8
4D48-500	**	48	3.47	83.1	2.00	7	6.1
4D48-650	**	48	4.51	83.1	2.60	8	6.8
4D48-800	**	48	5.56	83.1	3.20	9	7.6
4D48-1000	**	48	6.95	83.1	4.01	10	8.1
4D115-90	M27/344-07	115	.26	200.0	.15	1	1.3
4D115-120	M27/345-07	115	.35	200.0	.20	2	1.6
4D115-150	M27/346-07	115	.44	200.0	.25	3	2.3
4D115-200	M27/347-07	115	.58	200.0	.34	4	2.4
4D115-270	M27/348-06	115	.79	200.0	.45	5	2.8
4D115-375	M27/349-06	115	1.09	200.0	.63	6	3.8
4D115-500	**	115	1.45	200.0	.83	7	6.1
4D115-650	**	115	1.88	200.0	1.08	9	6.8
4D115-800	**	115	2.32	200.0	1.33	9	7.6
4D115-1000	**	115	2.90	200.0	1.66	10	8.1

* For Suffix "A" and "B" DELTA numbers, call factory. **QPL Testing underway.

SPECIFICATIONS

INPUT PRIMARY: WYE: (4 wire) Line to Common 115 VAC
WYE: (3 wire) Line to Line 200 VAC
DELTA: (3 wire) Line to Line 115 VAC (see option "A")
DELTA: (3 wire) Line to Line 200 VAC (see option "B")

INPUT FREQUENCY: 400 Hz ±20 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

REGULATION: 10% no load to full load.

INSULATION TEST: 1500 VRMS

EFFICIENCY: Ranges from 90% to 95% typical.

OPERATING TEMPERATURE: 80°C maximum ambient temperature.

TEMPERATURE RISE: Less than 50°C.

Construction: To MIL-T-27 Grade 5, Class S.

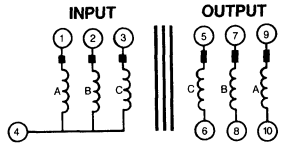
ENVIRONMENT: Encapsulated to meet MIL-STD-810, including vibration temperature to 80°C, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion. Note: For high altitude operation, encapsulate terminals.

Option "A"—To order DELTA input 115 VAC L-L; Add suffix "A" to Model No., e.g., 4D5-90A.

Option "B"—To order DELTA input 200 VAC L-L; Add suffix "B" to Model No., e.g., 4D5-90B.

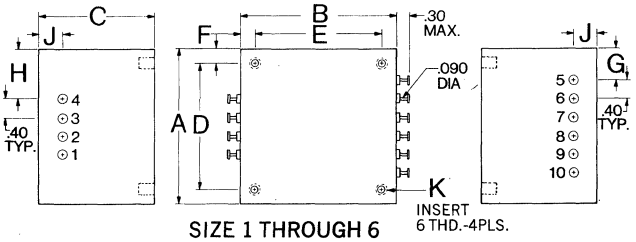
Size	A	B	C	D	E	F	G	H	J	K
1	2.90	2.40	1.45	2.50	2.00	.20	.45	.85	.20	6-32
2	2.90	2.70	1.55	2.50	2.30	.20	.45	.85	.20	6-32
3	3.65	2.80	1.70	3.15	2.30	.25	.82	1.22	.20	8-32
4	3.65	3.00	1.70	3.15	2.50	.25	.82	1.22	.20	8-32
5	3.65	3.00	1.95	3.15	2.50	.25	.82	1.22	.20	8-32
6	4.95	3.20	1.90	4.45	2.70	.25	1.47	1.87	.20	8-32
7	5.31	4.50	2.00	4.31	3.50	.50	.62	1.37	—	10-32
8	5.62	4.20	2.31	4.62	3.20	.50	.78	1.53	—	10.32
9	5.31	4.75	2.31	4.31	3.75	.50	.78	1.53	—	10.32
10	6.12	4.75	2.31	5.12	3.75	.50	.78	1.53	—	10.32

Load current more then 20 amps. Dim. H is 1.56
Dim. Tol.: D. E. ±.02 all others ±.04

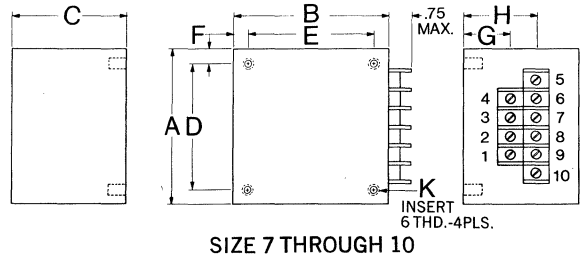


INPUT CONNECTION:
WYE, 115V to Com. 1, 2, 3, Line 4 Com
WYE, 200V L-L 1, 2, 3 (Pin 4 not used)
DELTA 115V or 200V L-L 1, 2, 3 (Pin 4 not used)

OUTPUT CONNECTION:
WYE, L-Com Connect 6-8 10 Load 5-6, 7-6, 9-6
DELTA L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE L-L Connect 6-10, 8-10 Load 5, 7, 9



SIZE 1 THROUGH 6



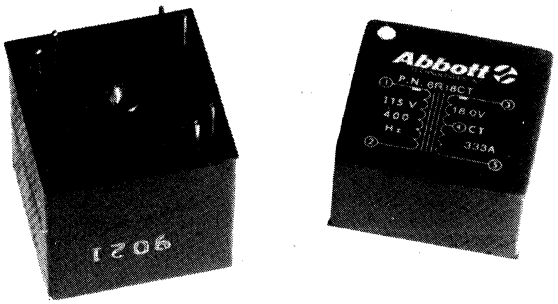
SIZE 7 THROUGH 10

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Abbott TECHNOLOGIES, INC. 400 Hz MIL-T-27 P.C. Toroid Transformers

MODEL **R**

- Military designation TF5S03ZZ
- Compact toroidal construction in a convenient printed-circuit mount package
- Power levels 1.5, 3, 6, and 9 VA
- Standard output voltages 5 to 300 volts



SPECIFICATIONS

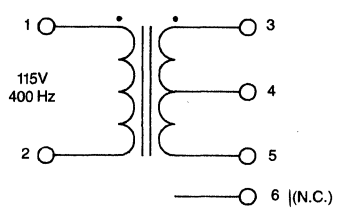
INPUT PRIMARY: 115 VAC, 400 Hz ± 20 Hz, 1 phase.
REGULATION: Ranges from 10% to 23% maximum
ELECTROSTATIC SHIELD OPTION: (1.5, 3, 6 VA only) add "X" suffix to part number (eg: 3R6CTBX)
SECONDARY VOLTAGE TOLERANCE: Within 3% of listed output voltage when measured at full load and 115 VRMS input
DIELECTRIC WITHSTANDING VOLTAGE: 910 VRMS (1624 VRMS – 200 to 300 V outputs)
EFFICIENCY: Ranges from 70% to 83% minimum
OPERATING AMBIENT TEMPERATURE: 95°C maximum
CONSTRUCTION: To MIL-T-27 Grade 5, Class S
ENVIRONMENT: Encapsulated to meet MIL-STD-810, including vibration, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion and altitude (to a vacuum).

DIMENSIONS

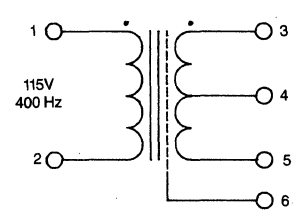
STANDARD (WITHOUT SHIELD)			"X" OPTION (WITH SHIELD)		
VA	CASE HEIGHT (MAX)	WEIGHT LBS (MAX)	VA	CASE HEIGHT (MAX)	WEIGHT LBS (MAX)
1.5	.47	.053	1.5	.59	.068
3.0	.59	.068	3.0	.78	.103
6.0	.78	.103	6.0	1.03	.137
9.0	1.03	.137	9.0	N/A	N/A

CIRCUIT DIAGRAM

Standard

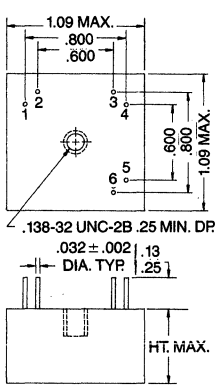


"X" Option (With Electrostatic Shield)

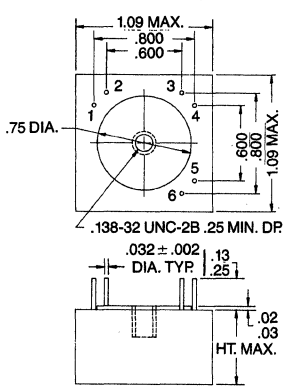


MECHANICAL DRAWINGS

CONFIGURATION A



CONFIGURATION B



ORDER INSTRUCTIONS: R Line Toroid Transformers can be ordered in A or B configuration, and with electrostatic shielding ("X" Option). Add "A" or "B" suffix to model number to select configuration. Add "X" suffix after A or B to order electrostatic shielding. (Not available as standard on 9 VA models). Follow this example:

1.5R110CTBX

Model number — Configuration — Electrostatic shielding option

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Head Office: 8203 Vineland Avenue, Sun Valley, CA 91352, (818) 504-0644, FAX (818) 768-0395
Eastern Sales Office: 321 Commercial Avenue, Suite 304, Palisades Park, NJ 07650, (201) 461-4005, FAX (201) 461-6323

Abbott TECHNOLOGIES, INC

400 Hz MIL-T-27 P.C. Toroid Transformers

MODEL R

Output Volts (F.L.)	Output Current (Amp)	V.A.	Model Number	Output Volts (F.L.)	Output Current (Amp)	V.A.	Model Number	Output Volts (F.L.)	Output Current (Amp)	V.A.	Model Number
5.0	.300	1.5	1.5R5CT	20.0	.075	1.5	1.5R20CT	75.0	.020	1.5	1.5R75CT
	.600	3.0	3R5CT		.150	3.0	3R20CT		.040	3.0	3R75CT
	1.20	6.0	6R5CT		.300	6.0	6R20CT		.080	6.0	6R75CT
	1.80	9.0	9R5CT		.450	9.0	9R20CT		.120	9.0	9R75CT
6.0	.250	1.5	1.5R6CT	22.0	.068	1.5	1.5R22CT	82.0	.018	1.5	1.5R82CT
	.500	3.0	3R6CT		.136	3.0	3R22CT		.036	3.0	3R82CT
	1.00	6.0	6R6CT		.272	6.0	6R22CT		.073	6.0	6R82CT
	1.50	9.0	9R6CT		.409	9.0	9R22CT		.109	9.0	9R82CT
6.3	.238	1.5	1.5R6.3CT	24.0	.062	1.5	1.5R24CT	91.0	.016	1.5	1.5R91CT
	.476	3.0	3R6.3CT		.125	3.0	3R24CT		.033	3.0	3R91CT
	.952	6.0	6R6.3CT		.250	6.0	6R24CT		.066	6.0	6R91CT
	1.43	9.0	9R6.3CT		.375	9.0	9R24CT		.099	9.0	9R91CT
7.0	.214	1.5	1.5R7CT	26.0	.057	1.5	1.5R26CT	100	.015	1.5	1.5R100CT
	.428	3.0	3R7CT		.115	3.0	3R26CT		.030	3.0	3R100CT
	.857	6.0	6R7CT		.230	6.0	6R26CT		.060	6.0	6R100CT
	1.28	9.0	9R7CT		.346	9.0	9R26CT		.090	9.0	9R100CT
7.5	.200	1.5	1.5R7.5CT	28.0	.053	1.5	1.5R28CT	110	.014	1.5	1.5R110CT
	.400	3.0	3R7.5CT		.107	3.0	3R28CT		.027	3.0	3R110CT
	.800	6.0	6R7.5CT		.214	6.0	6R28CT		.054	6.0	6R110CT
	1.20	9.0	9R7.5CT		.321	9.0	9R28CT		.082	9.0	9R110CT
8.0	.187	1.5	1.5R8CT	30.0	.050	1.5	1.5R30CT	115	.013	1.5	1.5R115CT
	.375	3.0	3R8CT		.100	3.0	3R30CT		.026	3.0	3R115CT
	.750	6.0	6R8CT		.200	6.0	6R30CT		.052	6.0	6R115CT
	1.12	9.0	9R8CT		.300	9.0	9R30CT		.078	9.0	9R115CT
9.0	.166	1.5	1.5R9CT	33.0	.045	1.5	1.5R33CT	120	.012	1.5	1.5R120CT
	.333	3.0	3R9CT		.091	3.0	3R33CT		.025	3.0	3R120CT
	.666	6.0	6R9CT		.182	6.0	6R33CT		.050	6.0	6R120CT
	1.00	9.0	9R9CT		.272	9.0	9R33CT		.075	9.0	9R120CT
10.0	.150	1.5	1.5R10CT	36.0	.041	1.5	1.5R36CT	130	.011	1.5	1.5R130CT
	.300	3.0	3R10CT		.083	3.0	3R36CT		.023	3.0	3R130CT
	.600	6.0	6R10CT		.166	6.0	6R36CT		.046	6.0	6R130CT
	.900	9.0	9R10CT		.250	9.0	9R36CT		.069	9.0	9R130CT
11.0	.136	1.5	1.5R11CT	39.0	.038	1.5	1.5R39CT	150	.010	1.5	1.5R150CT
	.272	3.0	3R11CT		.077	3.0	3R39CT		.020	3.0	3R150CT
	.545	6.0	6R11CT		.166	6.0	6R39CT		.040	6.0	6R150CT
	.818	9.0	9R11CT		.230	9.0	9R39CT		.060	9.0	9R150CT
12.0	.125	1.5	1.5R12CT	43.0	.035	1.5	1.5R43CT	180	.008	1.5	1.5R180CT
	.250	3.0	3R12CT		.069	3.0	3R43CT		.017	3.0	3R180CT
	.500	6.0	6R12CT		.139	6.0	6R43CT		.033	6.0	6R180CT
	.750	9.0	9R12CT		.209	9.0	9R43CT		.050	9.0	9R180CT
12.6	.119	1.5	1.5R12.6CT	47.0	.032	1.5	1.5R47CT	200	.007	1.5	1.5R200CT
	.238	3.0	3R12.6CT		.064	3.0	3R47CT		.015	3.0	3R200CT
	.476	6.0	6R12.6CT		.127	6.0	6R47CT		.030	6.0	6R200CT
	.714	9.0	9R12.6CT		.191	9.0	9R47CT		.045	9.0	9R200CT
13.0	.115	1.5	1.5R13CT	51.0	.029	1.5	1.5R51CT	220	.007	1.5	1.5R220CT
	.230	3.0	3R13CT		.059	3.0	3R51CT		.013	3.0	3R220CT
	.461	6.0	6R13CT		.117	6.0	6R51CT		.027	6.0	6R220CT
	.692	9.0	9R13CT		.176	9.0	9R51CT		.041	9.0	9R220CT
15.0	.100	1.5	1.5R15CT	56.0	.027	1.5	1.5R56CT	240	.006	1.5	1.5R240CT
	.200	3.0	3R15CT		.053	3.0	3R56CT		.012	3.0	3R240CT
	.400	6.0	6R15CT		.107	6.0	6R56CT		.025	6.0	6R240CT
	.600	9.0	9R15CT		.160	9.0	9R56CT		.037	9.0	9R240CT
16.0	.093	1.5	1.5R16CT	62.0	.024	1.5	1.5R62CT	270	.005	1.5	1.5R270CT
	.187	3.0	3R16CT		.048	3.0	3R62CT		.011	3.0	3R270CT
	.375	6.0	6R16CT		.096	6.0	6R62CT		.022	6.0	6R270CT
	.562	9.0	9R16CT		.145	9.0	9R62CT		.033	9.0	9R270CT
18.0	.083	1.5	1.5R18CT	68.0	.022	1.5	1.5R68CT	300	.005	1.5	1.5R300CT
	.166	3.0	3R18CT		.044	3.0	3R68CT		.010	3.0	3R300CT
	.333	6.0	6R18CT		.088	6.0	6R68CT		.020	6.0	6R300CT
	.500	9.0	9R18CT		.132	9.0	9R68CT		.030	9.0	9R300CT

* ADD "A" OR "B" SUFFIX TO SELECT A OR B CONFIGURATION
ADD "X" SUFFIX AS DESIRED TO INDICATE ELECTROSTATIC SHIELDING OPTION
(E.S. SHIELDING NOT AVAILABLE AS STANDARD ON 9 VA MODELS) EG. 1.5R110CTBX

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Abbott TECHNOLOGIES, INC.

Custom-Designed MIL-SPEC Magnetics

Abbott is a leading source of custom-designed magnetics which comply with the rigorous requirements of today's military environment. Abbott custom magnetics have successfully performed in some of the most demanding applications known. A sample of these applications is shown on the opposite page.

A Broad Range of Capabilities

Abbott's design team is experienced with a broad range of magnetic technologies, and can develop solutions to your magnetic problems, in a very short amount of time. Our custom designs reflect the same high standards and conservative design margins of our standard products. The table below describes our normal capabilities.

Our standard quality system is in compliance with MIL-I-45208 and enhanced quality assurance is available to conform to MIL-Q-9858. Our designs normally comply with MIL-STD-454, and MIL-T-27. Special testing can be performed on these units to demonstrate compliance with MIL-STD-810, and MIL-STD-202. Other testing is available upon request.

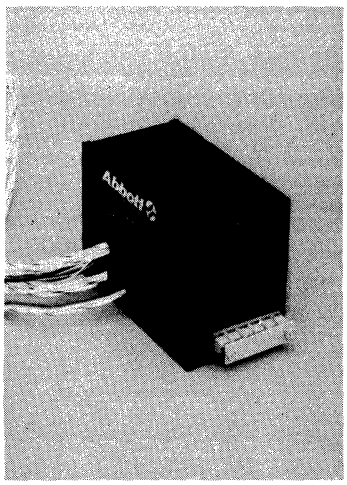
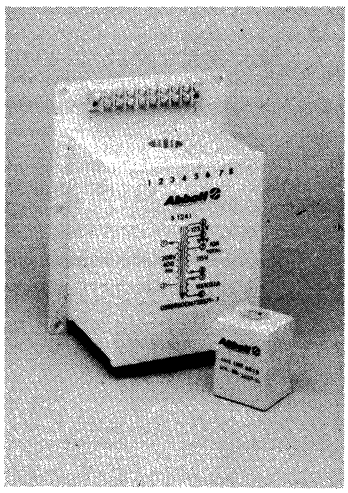
Many custom requirements can be satisfied by modifying an existing product which can shorten the time needed for delivering the initial prototype. Often we can qualify a modified standard unit to various MIL specs by SIMILARITY, thereby reducing testing costs. We have the capability of providing customers QPL qualification on their custom or modified standard designs.

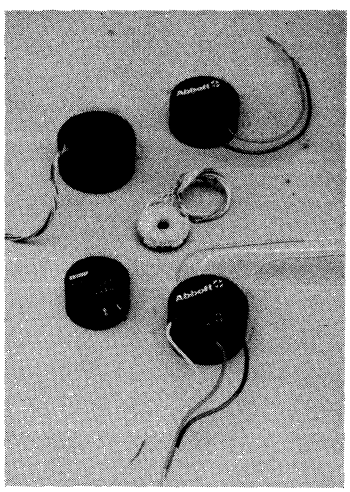
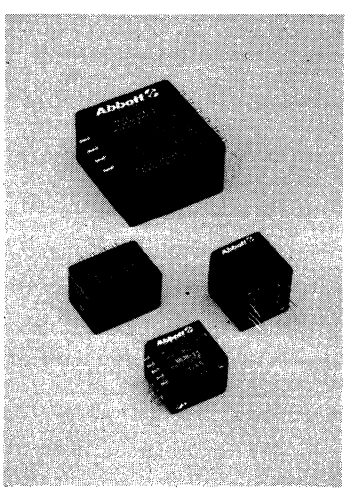
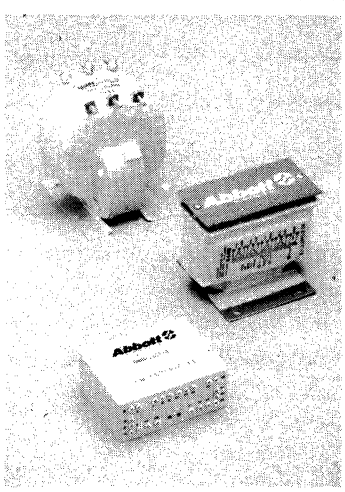
Device Types	Size	Frequency	Construction
Power Transformers (single and multiple phase) Signal Transformers Autotransformers Pulse Transformers Switching Transformers Multiple and Complex Windings Instrument Transformers Magnetic Amplifiers Current Transformers Inductors Ferroresonant Transformers Audio Transformers	Up to 100 lbs.	Up to 1 Megahertz	Laminated Toroidal Ferrite Cut-Core Metal Cased Epoxy Cased Hermetically Sealed Open Frame Conformal Coated Diallyl Phthalate Cased Hermetically Sealed Headers Turrent Terminals Hooked Pins Lead Wires Quick Disconnects Connectors Special Terminations Standard Terminations Special/Custom Terminations

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Abbott TECHNOLOGIES, INC.

Custom-Designed MIL-SPEC Magnetics

- Space Shuttle
- Cruise Missile
- Tactical Computer Terminal (TCT)
- F-14 Charging System
- AH-64 (Apache Helicopter)
- TADS
- B-1 Bomber
- MK-37 Torpedo
- Harpoon
- AN/SLQ-37
- Trident Submarine
- MK-118 Fire Control System
- Patriot Missile
- MS^3
- Lantirn
- LAMPS
- Maverick Missile
- LLADS
- Aquila-RPV
- A-6

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ENCAPSULATED POWER TRANSFORMERS

Step Down Size... Step Up Performance..!

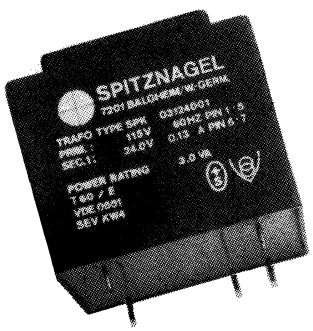
PC-Mountable Power Transformer

- are manufactured according to the International Safety Standards, such as UL, VDE, IEC.
- provide an insulation system which allows the 5,000 Vrms HiPot Test (up to 12,000 Vrms on request.)
- are encapsulated for a higher heat transfer, which results in a higher power/volume ratio.
- are encapsulated for mechanical strength, shock resistance, moisture resistance, better insulation system for the price of the open frame version.
- provide an interchangeable pin placement on the bobbin base, which increase the available options for custom-made transformers.

SPACE LIMITING SPK SERIES

Offers 9 sizes from 0.2 VA to 5.5 VA (power ratings up to 50 VA on request).

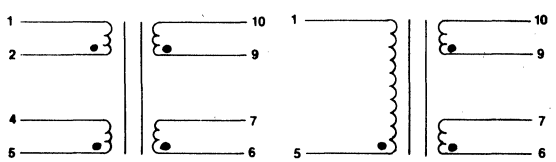
The SPK series is manufactured with a split bobbin, which allows the primary and secondary to be wound side by side, rather than one over the other.

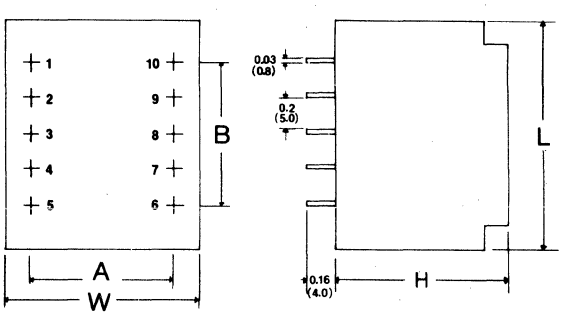


AVAILABLE VOLTAGES:

SINGLE PRIMARY DUAL PRIMARY	115V, 60 HZ or 2x115V, 50/60 HZ
DUAL OR SINGLE SECONDARY	6, 9, 12, 15, 18 and 24 V
LOAD REGULATION	30% SPK060 25%
TEMPERATURE RISE	<35° C Class B 130
Hi Pot TEST	5000V RMS

CUSTOM MADE TRANSFORMERS ON REQUEST





TOP VIEW

Cat. #	Rated Power VA	Dimension L	W	H	A	B
SPK002	**0.2**	0.87	1.0	0.67	0.8	0.6
SPK007	**0.7**	1.06	1.06	0.8	0.8	0.8
SPK005	**0.6**	1.26	1.06	0.6	0.8	0.8
SPK015	**1.5**	1.26	1.06	0.86	0.8	0.8
SPK020	**2.0**	1.26	1.06	0.94	0.8	0.8
SPK030	**2.2**	1.26	1.06	1.06	0.8	0.8
SPK031	**2.7**	1.26	1.06	1.2	0.8	0.8
SPK040	**4.3**	1.61	1.4	1.1	1.1	0.8
SPK060	**5.5**	1.75	1.46	1.3	1.1	1.0

SPK 002 x 4 Pins

SPK 060 x 6 Pins

ADVANCED COMPONENTS INDUSTRIES, INC.
1308 Sartori Avenue, #105 • Torrance, California 90501
(310) 328-0060 • Fax (310) 328-0062

ENCAPSULATED POWER TRANSFORMERS

Step Down Size... Step Up Performance..!

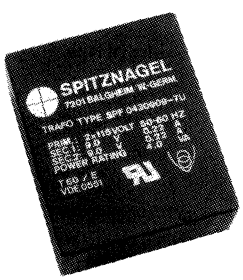
PC-Mountable Power Transformer

- are manufactured according to the International Safety Standards, such as UL, VDE, IEC.
- provide an insulation system which allows the 5,000 Vrms HiPot Test (up to 12,000 Vrms on request.)
- are encapsulated for a higher heat transfer, which results in a higher power/volume ratio.
- are encapsulated for mechanical strength, shock resistance, moisture resistance, better insulation system for the price of the open frame version.
- provide an interchangeable pin placement on the bobbin base, which increase the available options for custom-made transformers.

HEIGHT LIMITING SPF SERIES

Offers 10 sizes from 3.0 VA to 25.0 VA (power ratings up to 45 VA on request).

The Low-Profile design of the SPF Series allows a closer card spacing (3/4" card spacing for the 3.0 VA transformer). The SPF Series is wound non-concentrical on a dual split bobbin.

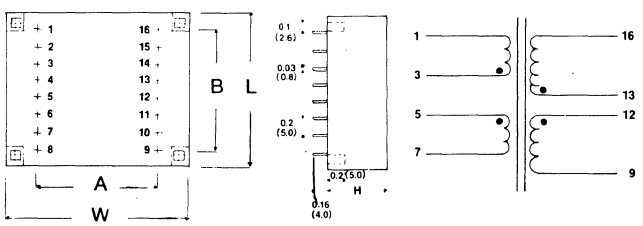


AVAILABLE VOLTAGES:

DUAL PRIMARY	2 X 115V, 50/60 HZ
DUAL SECONDARY	6, 9, 12, 15, 18 and 24 V
LOAD REGULATION	20%
TEMPERATURE RISE	< 40° C Class B 130
Hi Pot TEST	5000V RMS

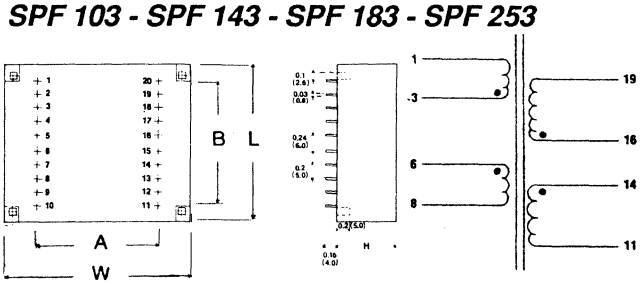
CUSTOM MADE TRANSFORMERS ON REQUEST

SPF 033 - SPF 043 - SPF 063 - SPF 093



TOP VIEW

SPF 103 - SPF 143 - SPF 183 - SPF 253



TOP VIEW

Cat.#	Rated Power VA	Dimensions L	W	H	A	B
SPF033	**3.0**	1.75	2.1	0.67	1.4	1.4
SPF043	**4.0**	1.75	2.1	0.73	1.4	1.4
SPF063	**6.0**	1.75	2.1	0.87	1.4	1.4
SPF093	**9.0**	1.75	2.1	1.0	1.4	1.4
SPF103	**10.0**	2.3	2.75	0.87	1.8	1.84
SPF143	**14.0**	2.3	2.75	0.94	1.8	1.84
SPF183	**18.0**	2.3	2.75	1.06	1.8	1.84
SPF253	**25.0**	2.3	2.75	1.38	1.8	1.84

ADVANCED COMPONENTS INDUSTRIES, INC.
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CUSTOM MAGNETICS...

ASK US ABOUT TOROIDS

If you would not settle for an off-the-shelf printed circuit board, why should you have to settle for an off-the-shelf transformer?

When off-the-shelf components don't meet your design needs, Albar products will.

Albar: Part of the solution

Since 1979, Albar products have been found in applications as diverse as our customers' imaginations, keeping cable television signals coming in to millions of homes, protecting the delicate circuitry of medical equipment, and helping people to keep healthy through exercise equipment. Manufacturers of a wide variety of electrical and electronic equipment turn to Albar for custom power conversion products.

We produce solutions to power conversion problems, in the form of custom designed magnetics and power supplies. Even in applications, where standard products are acceptable, an opitimized design by Albar can be a cost effective means of improving performance.

With Albar's engineering and manufacturing capabilities you can be assured of getting the products you need, when you need them.

Albar's engineering: Your first step toward a quality product.

Our engineering staff has a wealth of experience, from microwatt to megawatt power ranges, with numerous patents and publications in the field of power conversion.

Engineering expertise has made us a leader in magnetics and power supply technology. Albar's products are not just designed, but engineered under licensed professional engineering supervision to assure quality, safety, and performance.

Our engineering staff can prepare your design for production, develop a new design or even a new technology to solve your power conversion problem.

Albar is much more than a vendor; we can be a valuable part of your product development and engineering team.

Albar's manufacturing: Converting designs into superior products.

Our production efficiency and high volume purchasing enable us to meet your production needs at a competitive price, whether your requirements are for one of a kind or thousands of units per month.

Quality is an integral part of our manufacturing process, from incoming inspection of raw materials, through numerous in-process checks, to 100 percent testing of everything we make. Production history can be traced through the date, work order, and test codes marked on every finished part. This assures you that the full potential of the design is realized in your final product.

Our satisfied customers are the basis of our continuing growth. Let us show you why.

ALBAR
Part of the Solution

ALBAR, INC.

P.O. Box 2368 • 19013-36th Avenue W • Lynnwood, WA 98036 • (206) 771-4006 • FAX (206) 771-2163

Toll Free Number (800) 822-5227

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION
WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
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Opto Semiconductors, Miniglossary **B**•1334
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Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
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Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

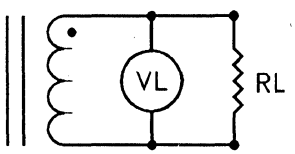
AMECON
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SNAP-ON LOAD DETECTOR "LD-50"

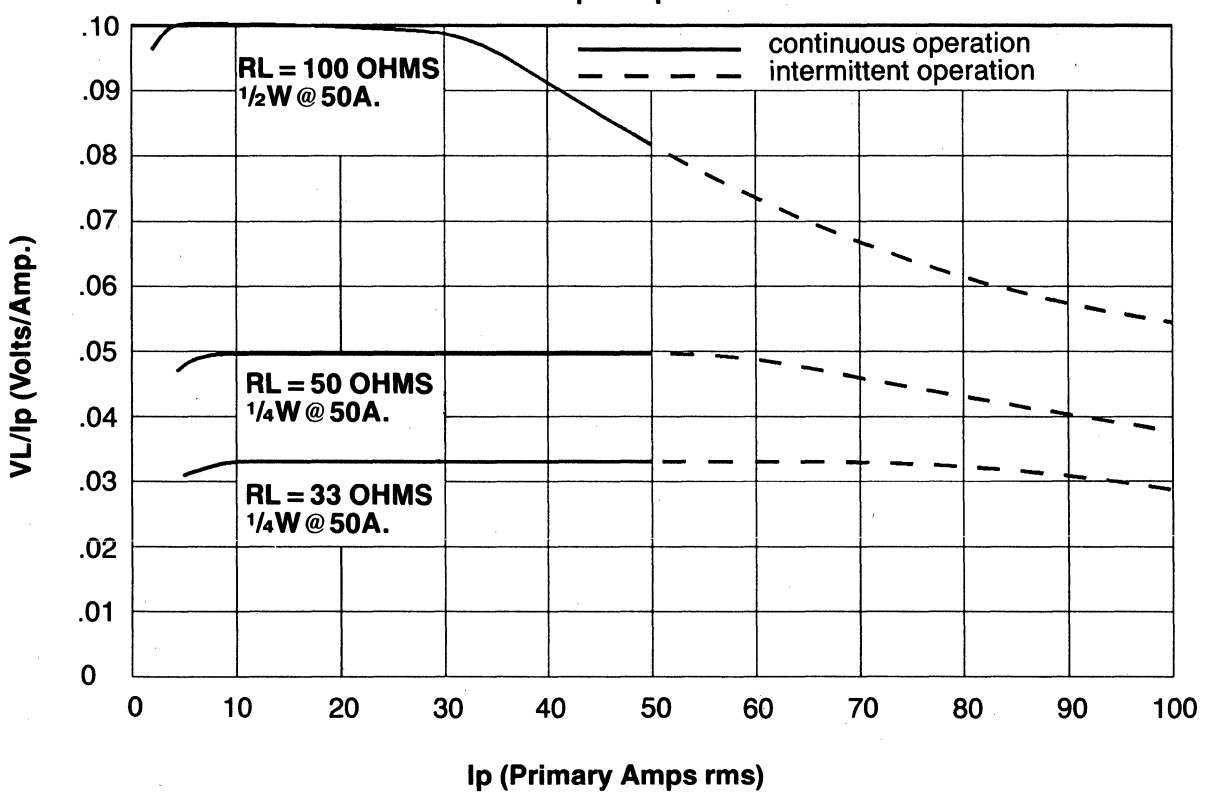
- This brand new snap-on load detector mounts on pre-wired systems without disrupting existing connections. (i.e. Field assembleable.)
- Broad frequency response: 30Hz. to 15kHz. (See Curve.)
- Measure currents up to 50 Amps continuous, 150 Amps intermittent.
- Magnetic device for high reliability applications.
- Output linear to within 3% from 5 to 50 Amps input. (See VL/Ip vs. Ip curves.)
- Excellent for low-budget energy management and automation control.
- Available pre-assembled or un-assembled.
- Note: These features have made this new device the answer to a myriad of new applications such as monitoring relays and lamps, Hi/Low current limits, instrumentation, solid-state switchgear, motor controls, and much more.

ELECTRICAL SPECS

Winding resistance: 29 ohms.
Winding inductance: 1.25 Hy.
Dielectric test voltage: 3750 Vrms.

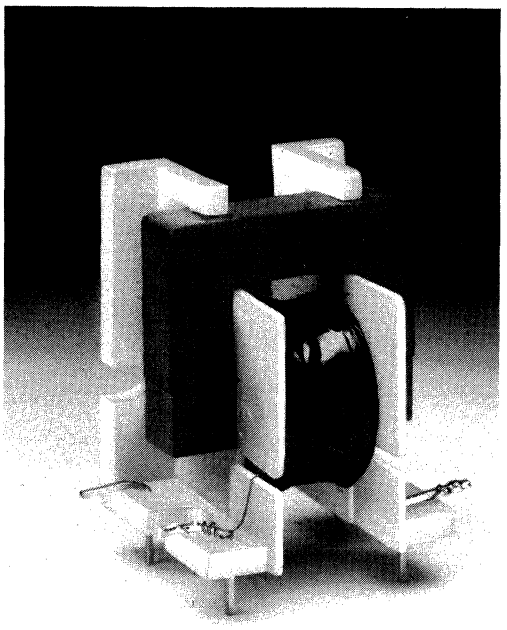


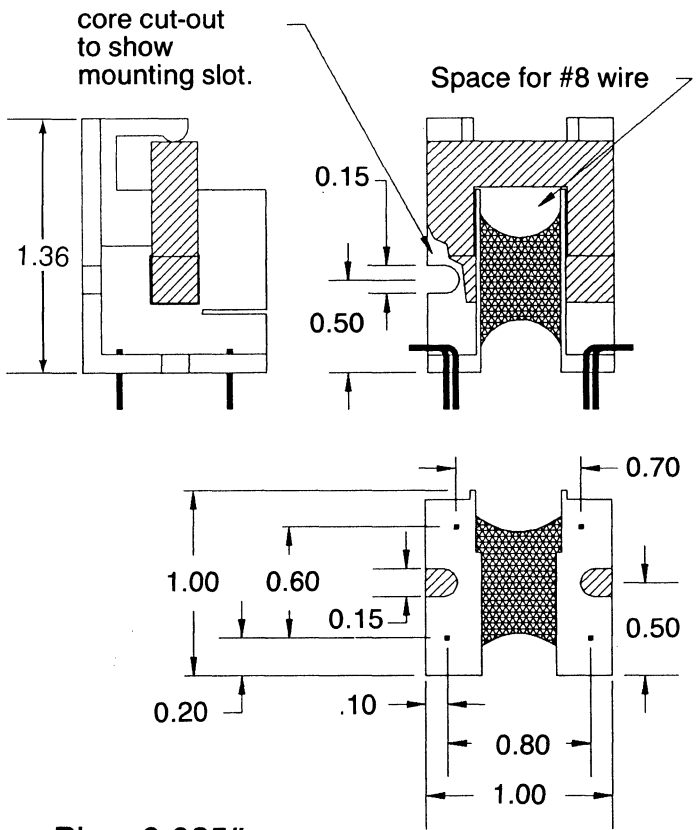
VL/Ip vs. Ip @ 60Hz.



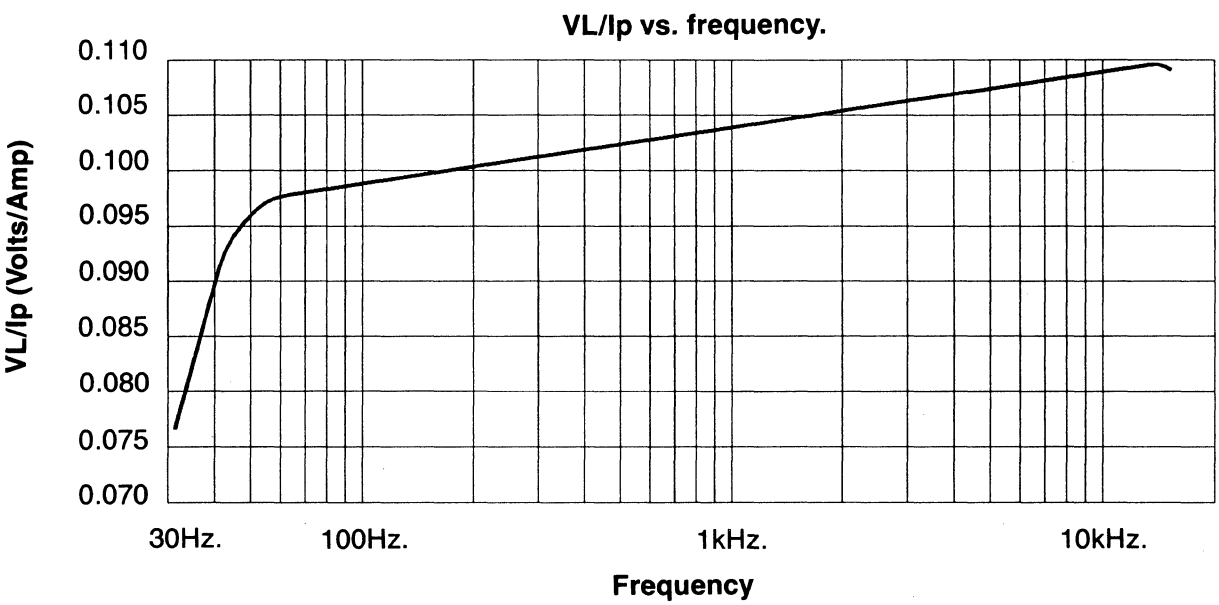
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MECHANICAL SPECS





Pins: 0.025″ square
Tin-plated copper
Weight: 0.062#

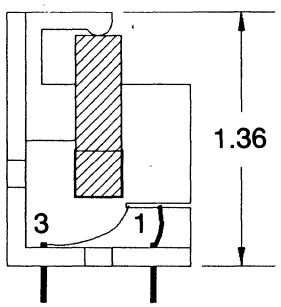


Output of the load sensor as a function of frequency across a 100 ohm terminating resistor for a primary current of 20 A.rms

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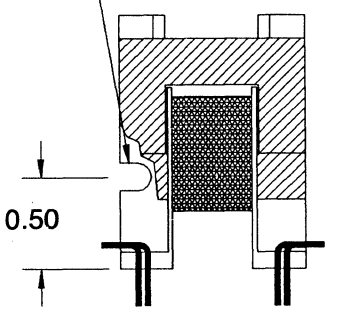
NEW HIGH SENSITIVITY CURRENT TRANSFORMERS AT ATTRACTIVE PRICES.

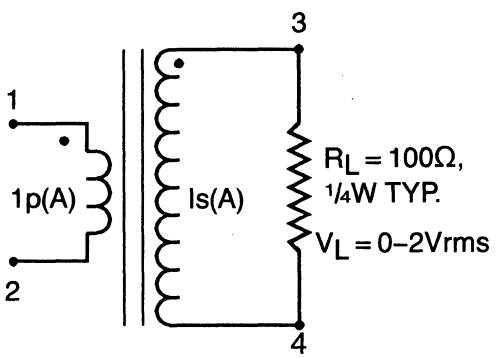
The high-sensitivity series of current transformers has been specifically designed for those applications where a low value of current is to be monitored. A primary winding is supplied (pins 1 & 2) which helps increase the sensitivity of the transformer.

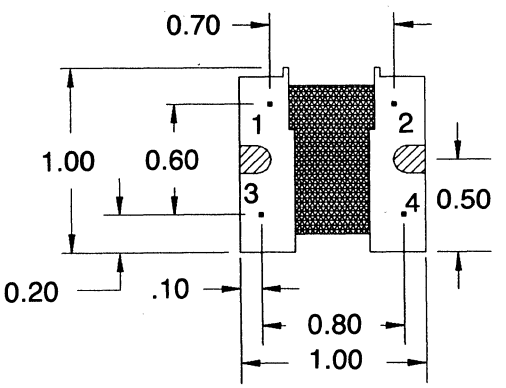


Pins .025" sq. tin-plated copper, 4 plcs.

core cut-out shows mounting slot, .15 x .175, 4 plcs.

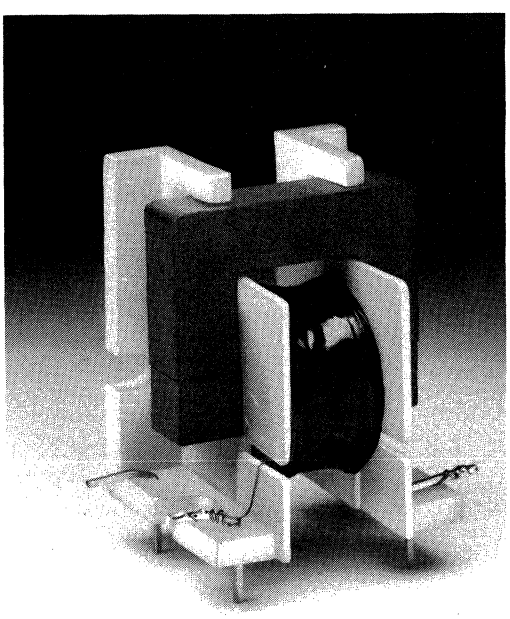






ELECTRICAL SPECS

VL Volts	RL Ohms	Is Amps	Sec. DCR Ohms	Sec. Ind. Hy	Accy at 100%	Accy at 10%
2.0*	100	0.02*	30	1.1	1.0	0.3
TEMPERATURE – 55° TO 120°C						
P/N	Load Current Ip(A)	Turns Ratio	Pri. Ind. mHy	Pri. DCR Ohms		
5361	0.05	1000:400	176	5.0		
5362	0.1	1000:200	44	1.2		
5363	0.2	1000:100	11	0.30		
5364	0.5	1000:40	1.76	0.05		
5365	1	1000:20	0.44	0.013		
5366	2	1000:10	0.11	0.003		
5367	5	1000:4	0.018	0.0005		



*Many customized output voltages and currents are available on special request, at same low price.

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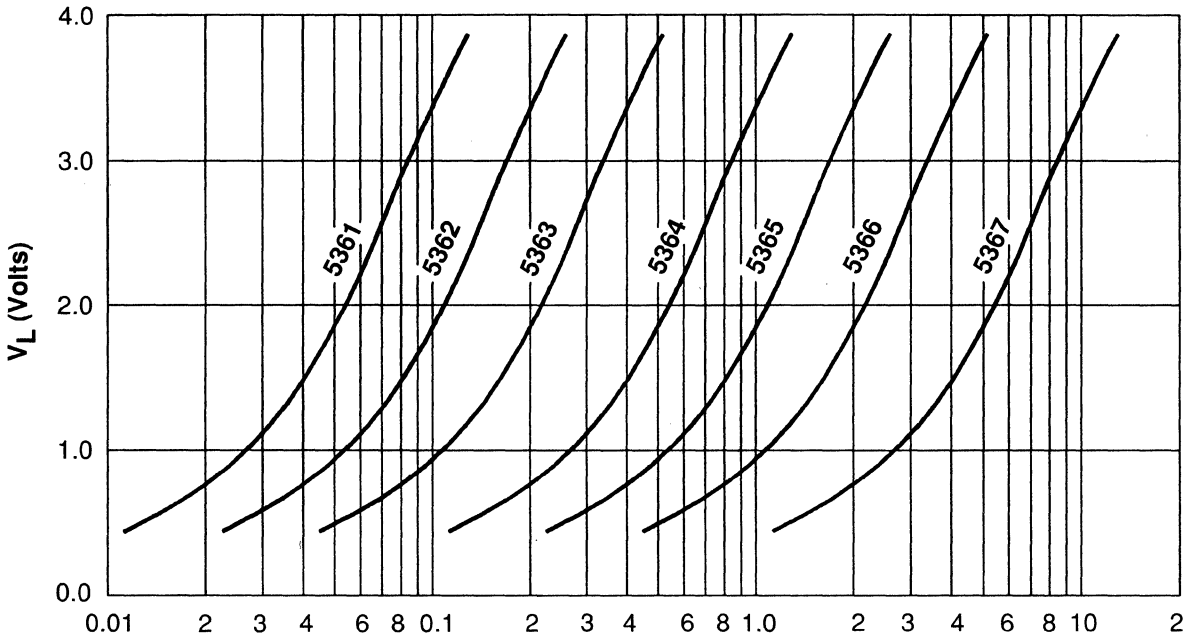


Fig. 1

Fig. 1 shows the output of the 5360 series of load detectors when terminated with a 100 ohm resistor. Ip ranging from 0.25 to 2.5 times the rated current.

Fig. 2 shows the output of the 5360 series of load detectors (including the LD–50) at rated input load current Ip with load resistance RL varying from 10 to 20,000 ohms.

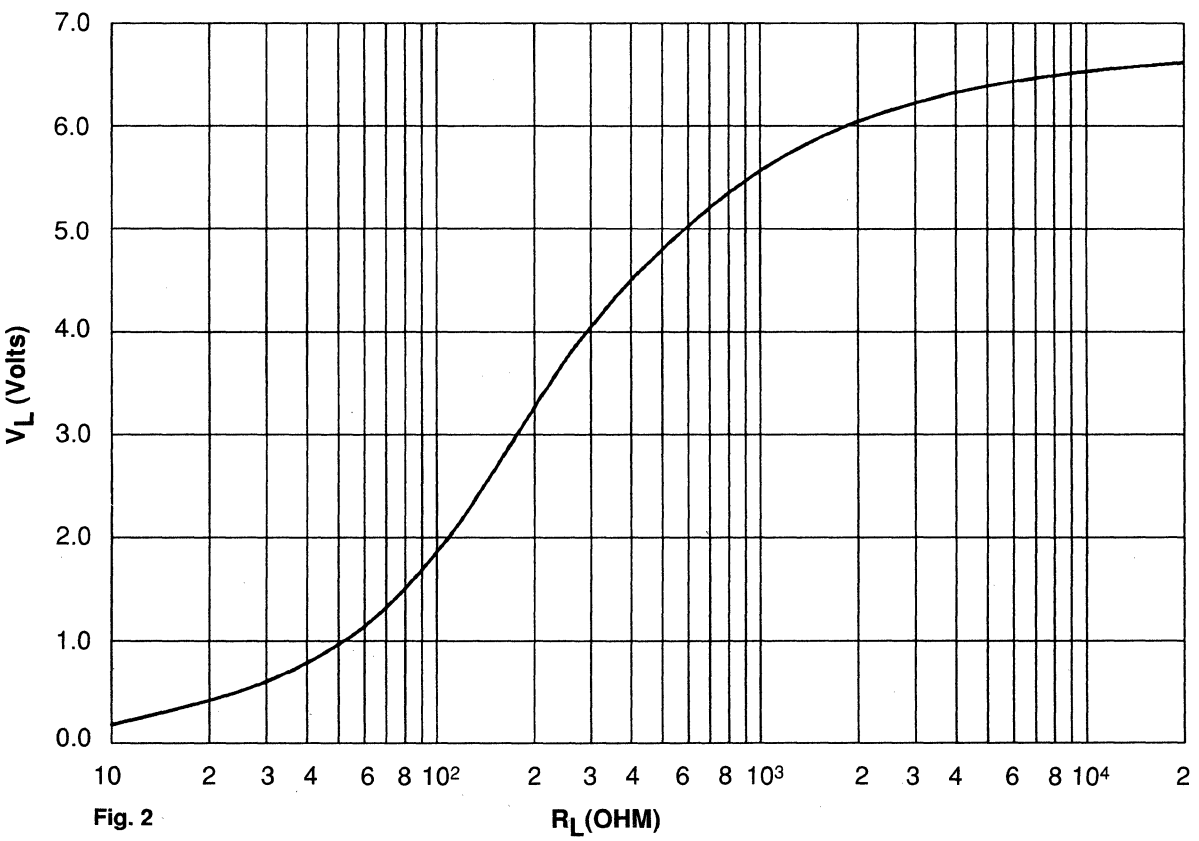


Fig. 2

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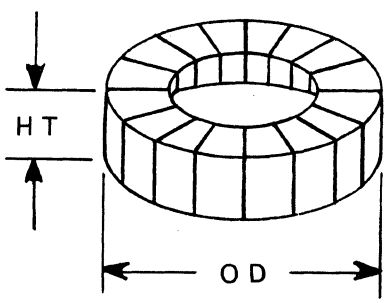
LARGEST SELECTION OF HEAVY DUTY 50/60Hz TOROIDAL POWER TRANSFORMERS

SOME ADVANTAGES OF TOROIDAL POWER TRANSFORMERS COMPARED TO LAMINATED TRANSFORMERS

- Lower mechancial hum
- Lower electrical noise
- Lower magnetic leakage
- Easier to electrostatically shield
- Lower weight
- Smaller dimensions
- Higher efficiency
- And most important price competitive vs. old fashioned laminated transformers

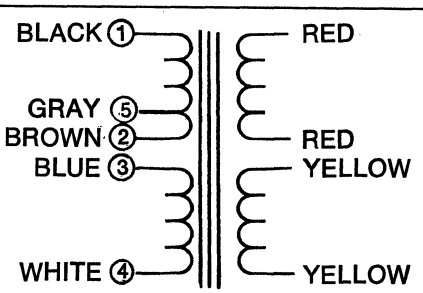


MECHANICAL DRAWING



INTERNATIONAL PRIMARY CONFIGURATIONS

Voltage	100 V	120 V	220 V	240 V
Input	1 & 5	1 & 2	1 & 4	1 & 4
Connection	1 & 3 2 & 4	1 & 3 2 & 4	5 & 3	2 & 3



TYPICAL INTERNATIONAL PRIMARIES WITH TWO SECONDARIES

Secondary Power VA	Part No. 5800	Secondary			Dimensions	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
6	5807	7.0	6	1.0	2.0	1.0
	5811	13.9	12	0.5		
	5812	17.4	15	0.4		
8	5820	10.4	9	0.89	2.2	1.0
	5821	13.9	12	0.67		
	5822	17.4	15	0.53		
	5826	34.8	30	0.27		
12	5830	11.6	10	1.2	2.3	1.1
	5832	17.4	15	0.8		
	5835	34.8	30	0.4		
	5829	2 x 7.0	2 x 6	1.0		
	5836	2 x 10.5	2 x 9	0.67		
	5837	2 x 13.9	2 x 12	0.50		
	5838	2 x 17.4	2 x 15	0.40		
	5839	2 x 20.9	2 x 18	0.33		
	5840	2 x 27.8	2 x 24	0.25		
	5841	2 x 32.5	2 x 28	0.21		

Secondary Power VA	Part No.	Secondary			Dimensions	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
20	5845	11.6	10	2.0	2.6	1.2
	5846	13.9	12	1.7		
	5849	27.7	24	0.83		
	5850	34.7	30	0.67		
	5844	2 x 7	2 x 6	1.7		
	5851	2 x 11.6	2 x 10	1.0		
	5853	2 x 17.3	2 x 15	0.67		
	5854	2 x 20.7	2 x 18	0.56		
	5855	2 x 27.7	2 x 24	0.38		
	5856	2 x 32.4	2 x 28	0.35		
25	5862	17.3	15	1.7	2.6	1.3
	5864	27.7	24	1.0		
	5865	34.7	30	0.83		
	5859	2 x 7	2 x 6	2.0		
	5866	2 x 11.6	2 x 10	1.25		
	5868	2 x 17.3	2 x 15	0.83		
	5869	2 x 20.7	2 x 18	0.69		
	5870	2 x 27.7	2 x 24	0.52		

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LARGEST SELECTION OF HEAVY DUTY 50/60Hz TOROIDAL POWER TRANSFORMERS

Secondary Power VA	Part No.	Secondary			Dimensions*	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
40	5873	27.2	24	1.66	3.0	1.3
	5874	34.2	30	1.33		
	5876	2 x 13.6	2 x 12	1.67		
	5877	2 x 17.1	2 x 15	1.33		
	5878	2 x 20.5	2 x 18	1.11		
	5879	2 x 22.8	2 x 20	1.00		
	5880	2 x 27.2	2 x 24	0.833		
60	5885	17.0	15	4.0	3.1	1.4
	5886	27.0	24	2.5		
	5887	33.4	30	2.0		
	5882	40.5	36	1.67		
	5883	47.4	42	1.43		
	5884	2 x 6.8	2 x 6	5.0		
	5891	2 x 20.4	2 x 18	1.67		
	5892	2 x 27.0	2 x 24	1.25		
	5893	2 x 33.4	2 x 30	1.00		
80	5901	16.8	15	5.33	3.6	1.5
	5902	20.2	18	4.44		
	5903	26.8	24	3.33		
	5904	33.6	30	2.67		
	5905	2 x 9	2 x 8	5.00		
	5906	2 x 16.8	2 x 15	2.67		
	5907	2 x 20.2	2 x 18	2.22		
	5908	2 x 26.8	2 x 24	1.67		
	5909	2 x 33.6	2 x 30	1.33		
100	5911	26.8	24	4.16	3.6	1.5
	5912	33.6	30	3.33		
	5913	47.0	42	2.38		
	5919	2 x 20	2 x 18	2.78		
	5920	2 x 24.5	2 x 22	2.27		
	5923	2 x 31.2	2 x 28	1.79		
	5921	2 x 33.5	2 x 30	1.67		
	5922	133.5	120	0.833		
120	5925	26.5	24	5.0	4.0	1.5
	5926	33.2	30	4.0		
	5927	66.5	60	2.0		
	5933	2 x 20	2 x 18	3.33		
	5934	2 x 26.5	2 x 24	2.50		
	5937	2 x 39.8	2 x 36	1.67		
160	5939	13.2	12	13.3	4.2	1.9
	5940	26.5	24	6.67		
	5941	39.8	36	4.44		
	5942	66.5	60	2.67		
	5943	2 x 66.4	2 x 60	1.33		
	5944	2 x 33	2 x 30	2.67		

Secondary Power VA	Part No.	Secondary			Dimensions*	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
250	5950	13.0	12	20.8	4.6	2.0
	5951	26.5	24	10.4		
	5952	2 x 26.5	2 x 24	5.21		
	5953	2 x 33	2 x 30	4.17		
	5954	2 x 66	2 x 60	2.08		
	5955	2 x 53	2 x 48	2.60		
320	5960	13.0	12	26.7	4.9	2.2
	5961	26.0	24	13.3		
	5962	32.5	30	10.7		
	5963	52.0	2 x 48	3.33		
	5964	2 x 65	2 x 60	2.67		
400	5966	12.9	12	33.4	5.2	2.3
	5967	25.8	24	16.7		
	5968	64.8	60	6.7		
	5969	38.6	2 x 36	5.56		
	5970	40.7	2 x 38	5.10		
	5971	51.6	2 x 48	4.04		
600	5973	2 x 25.7	2 x 24	12.5	5.6	2.7
	5974	2 x 29.7	2 x 28	10.7		
	5975	2 x 35	2 x 33	9.09		
	5976	2 x 40.3	2 x 38	7.8		
	5977	2 x 51	2 x 48	6.2		
	5978	2 x 64	2 x 60	5.0		
800	5982	2 x 31.6	2 x 30	13.3	6.4	2.7
	5981	2 x 50.5	2 x 48	8.3		
	5983	2 x 63.4	2 x 60	6.7		
	5984	2 x 126.5	2 x 120	3.3		
1200	5980	2 x 31.4	2 x 30	20	6.6	3.3
	5985	2 x 63	2 x 60	10		
	5986	2 x 125	2 x 120	5		
2000	5987	2 x 49.8	2 x 48	20.8	7.3	4.4
	5988	2 x 62.4	2 x 60	16.7		
	5989	2 x 124.5	2 x 120	8.3		
5K	5280	2 x 62.2	2 x 60	41.6	10.87	4.25
	5281	2 x 124	2 x 120	20.8		
7.5K	5290	2 x 61.5	2 x 60	62.5	12.62	4.25
	5291	2 x 122.5	2 x 120	31.2		
10K	5295	2 x 61.5	2 x 60	83.3	14.75	5.25
	5296	2 x 122.5	2 x 120	41.6		

* Semi Epoxy Molded, Add 0.20" O.D. & 0.09" Ht. Full Epoxy Molded, Add 0.20" O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

IMPORTANT NOTES:

1. All transformers have been designed for 50/60HZ.
2. 60HZ to 400HZ. Designs available upon request.
3. Custom designs tailored to your specs. are made & evaluated on a 2 wk. cycle.
4. 100% electrostatic shielding available on all transformers with a small power derating.
5. Magnetic shielding & lower magnetic leakage designs for sensitive areas such as encountered in computers & audio equipment, are available on all transformers.
6. Low profile designs are available upon request.
7. Amecon has the world's most complete toroidal mfg. facilities. We can machine wind toroids in excess of 50" dia. & 2000 lbs.

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LARGEST SELECTION OF HEAVY DUTY 60 Hz TOROIDAL POWER TRANSFORMERS

Output Power VA	Part Number	No Load Voltage Volts	Load Voltage Volts	Load Current Amp	DCR @ 20°C	Core Loss W	Copper Loss W	Maximum Dimensions* OD x HT in Inches	Total Weight lbs	Voltage Regulation %
7.5	6810	10.9	9	.833	1.06	.101	1.33	2.0 x 1.0	0.38	21.1
	6811	14.5	12	.625	1.76	.101	1.28			20.3
	6812	18.1	15	.500	2.8	.101	1.29			20.5
	6813	21.8	18	.417	4.23	.101	1.33			21.2
	6814	29.0	24	.313	7.12	.101	1.29			20.4
	6815	34.0	28	.268	10.4	.101	1.34			21.4
10	6820	10.8	9	1.11	.747	.123	1.67	2.2 x 1.0	0.45	19.8
	6821	14.3	12	.833	1.25	.123	1.61			19.1
	6822	17.9	15	.667	1.96	.123	1.61			19.2
	6823	21.7	18	.555	3.02	.123	1.68			20.0
	6824	28.6	24	.417	5.00	.123	1.60			19.1
	6825	32.9	28	.357	5.75	.123	1.44			17.2
15	6830	10.75	9	1.66	.434	.160	2.41	2.3 x 1.1	0.61	19.2
	6831	14.8	12	1.25	.95	.160	2.78			21.9
	6832	18.4	15	1.00	1.50	.160	2.78			21.9
	6833	21.6	18	.833	1.75	.160	2.43			20.0
	6834	28.5	24	.625	2.92	.160	2.34			18.6
	6835	33.6	28	.536	4.37	.160	2.48			19.0
	6836	2 x 10.8	2 x 9	.833	2 x .878	.160	2.45			19.4
	6837	2 x 14.2	2 x 12	.625	2 x 1.45	.160	2.33			18.6
	6838	2 x 17.9	2 x 15	.500	2 x 2.33	.160	2.38			18.8
	6839	2 x 21.6	2 x 18	.417	2 x 3.51	.160	2.44			19.3
	6840	2 x 28.6	2 x 24	.313	2 x 5.91	.160	2.36			18.7
	6841	2 x 33.47	2 x 28	.268	2 x 8.59	.160	2.44			19.5
25	6845	10.6	9	2.78	.252	.205	3.58	2.6 x 1.2	0.82	17.8
	6846	14.5	12	2.08	.547	.205	4.07			20.0
	6847	18.1	15	1.66	.865	.205	4.10			20.3
	6848	21.2	18	1.39	1.01	.205	3.60			17.9
	6849	28.2	24	1.04	1.68	.205	3.46			17.2
	6850	33.0	28	.89	2.49	.205	3.62			18.0
	6851	2 x 10.7	2 x 9	1.39	2 x .51	.205	3.62			18.0
	6852	2 x 14.1	2 x 12	1.04	2 x .84	.205	3.46			17.2
	6853	2 x 17.6	2 x 15	.833	2 x 1.33	.205	3.48			17.3
	6854	2 x 21.2	2 x 18	.69	2 x 2.03	.205	3.60			17.9
	6855	2 x 28.2	2 x 24	.52	2 x 3.4	.205	3.47			17.3
	6856	2 x 33.2	2 x 28	.45	2 x 5.01	.205	3.64			18.1
30	6860	10.5	9	3.33	.183	.240	4.03	2.6 x 1.3	0.90	16
	6861	13.9	12	2.5	.306	.240	3.89			15.4
	6862	17.3	15	2.00	.479	.240	3.89			15.5
	6863	21.0	18	1.66	.731	.240	4.03			16.0
	6864	27.8	24	1.25	1.23	.240	3.91			15.5
	6865	32.6	28	1.07	1.80	.240	4.07			16.2
	6866	2 x 10.5	2 x 9	1.66	2 x .366	.240	4.03			16.0
	6867	2 x 13.9	2 x 12	1.25	2 x .615	.240	3.91			15.5
	6868	2 x 17.4	2 x 15	1.00	2 x .961	.240	3.89			15.5
	6869	2 x 17.4	2 x 18	.833	2 x 1.47	.240	4.04			16.0
	6870	2 x 27.8	2 x 24	.625	2 x 2.45	.240	3.88			15.4
	6871	2 x 32.6	2 x 28	.536	2 x 3.65	.240	4.09			16.3
50	6875	2 x 10.4	2 x 9	2.78	2 x .218	.318	6.64	3.0 x 1.3	1.3	15.9
	6876	2 x 13.9	2 x 12	2.08	2 x .367	.318	6.48			15.4
	6877	2 x 17.3	2 x 15	1.66	2 x .575	.318	6.46			15.4
	6878	2 x 20.9	2 x 18	1.39	2 x .879	.318	6.66			15.9
	6879	2 x 27.8	2 x 24	1.04	2 x 1.46	.318	6.45			15.3
	6880	2 x 32.7	2 x 28	.893	2 x 2.18	.318	6.79			16.1
75	6885	17.2	15	5.00	.196	.415	8.88	3.1 x 1.4	1.6	14.1
	6886	27.7	24	3.125	.504	.415	8.96			14.1
	6887	34.6	30	2.5	.793	.415	8.99			14.2
	6888	2 x 10.4	2 x 9	4.16	2 x .150	.415	9.25			14.7
	6889	2 x 13.8	2 x 12	3.125	2 x .252	.415	8.96			14.1
	6890	2 x 17.3	2 x 15	2.50	2 x .397	.415	8.99			14.2
	6891	2 x 20.7	2 x 18	2.08	2 x .6	.415	9.25			14.6
	6892	2 x 27.5	2 x 24	1.56	2 x 1.01	.415	8.93			14.2
	6893	2 x 34.4	2 x 30	1.25	2 x 1.58	.415	8.95			14.2

* Semi Epoxy Molded, Add 0.20″ O.D. & 0.09″ Ht. Full Epoxy Molded, Add 0.20″ O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

AMECON
QUALITY MAGNETIC COMPONENTS • DESIGNED WITH 30 YRS. OF EXPERTISE
1900 CHRIS LANE / ANAHEIM, CA 92805 / 714-634-2220 / FAX 714-634-0905 / TLX 510-100-0364

LARGEST SELECTION OF HEAVY DUTY 60 Hz TOROIDAL POWER TRANSFORMERS

Output Power VA	Part Number	No Load Voltage Volts	Load Voltage Volts	Load Current Amp	DCR @ 20°C	Core Loss W	Copper Loss W	Maximum Dimensions* OD x HT In Inches	Total Weight lbs	Voltage Regulation %
100	6900	13.6	12	8.33	.075	.524	10.4	3.6 x 1.5	2.2	12.3
	6901	16.9	15	6.66	.118	.524	10.4			12.4
	6902	20.4	18	5.55	.179	.524	10.8			12.8
	6903	27.1	24	4.17	.299	.524	10.4			12.3
	6904	33.7	30	3.33	.470	.524	10.4			12.4
	6905	2 x 9.5	2 x 8.5	5.88	2 x .660	.524	9.67			11.5
	6906	2 x 16.9	2 x 15	3.33	2 x .236	.524	10.5			12.4
	6907	2 x 20.4	2 x 18	2.78	2 x .358	.524	10.8			12.8
	6908	2 x 26.9	2 x 24	2.08	2 x .595	.524	10.3			12.3
	6909	2 x 33.8	2 x 30	1.67	2 x .95	.524	10.4			12.4
120	6915	20.5	18	6.66	.152	.67	11.4	3.6 x 1.5	2.4	13.0
	6916	25.0	22	5.45	.23	.67	11.6			13.3
	6917	2 x 13.7	2 x 12	5.00	2 x .128	.67	11.0			12.6
	6918	2 x 17.0	2 x 15	4.00	2 x .20	.67	11.11			12.6
	6919	2 x 20.4	2 x 18	3.33	2 x .30	.67	11.4			13.0
	6920	2 x 25.0	2 x 22	2.73	2 x .47	.67	11.6			13.0
	6921	2 x 34.1	2 x 30	2.00	2 x .80	.67	11.2			12.6
	6922	2 x 135	2 x 110, 120	.500	2 x 12.9	.67	11.1			12.7
150	6930	2 x 9.6	2 x 8.5	8.82	2 x .039	.806	20	4.0 x 1.5	2.8	13.0
	6931	2 x 13.6	2 x 12	6.25	2 x .07	.806	20			13.0
	6932	2 x 17.0	2 x 15	5.00	2 x .11	.806	20			13.0
	6933	2 x 20.5	2 x 18	4.17	2 x .16	.806	20			13.0
	6934	2 x 27.1	2 x 24	3.13	2 x .28	.806	20			13.0
	6935	2 x 34	2 x 30	2.50	2 x .45	.806	20			13.0
	6936	2 x 135	2 x 110, 120	.625	2 x 7.1	.806	20			13.0
200	6940	2 x 9.3	2 x 8.5	11.76	2 x .0253	1.03	13.1	4.2 x 1.9	4.4	7.7
	6941	2 x 12.9	2 x 12	8.33	2 x .0443	1.03	12.0			7.2
	6942	2 x 19.3	2 x 18	5.56	2 x .106	1.03	1.24			7.4
	6943	2 x 23.7	2 x 22	4.55	2 x .164	1.03	12.7			7.6
	6944	2 x 32.2	2 x 30	3.33	2 x .280	1.03	12.1			7.2
	6945	2 x 128.9	2 x 110, 120	.833	2 x 4.5	1.03	12.1			7.2
300	6950	28.6	26.5	11.3	0.074	1.69	22.5	4.6 x 2.0	5.7	7.5
	6951	2 x 9.15	2 x 8.5	17.6	0.030	1.69	20.5			6.9
	6952	2 x 28.3	2 x 26.5	5.67	0.294	1.69	20.8			7.0
	6953	2 x 35.3	2 x 33	4.55	0.366	1.69	18.5			6.2
	6954	2 x 56.6	2 x 53	2.83	0.935	1.69	18.9			6.2
	6955	2 x 70.5	2 x 66	2.27	1.47	1.69	18.5			6.2
400	6960	2 x 38.2	2 x 36	5.55	2 x .170	1.72	20.0	4.9 x 2.2	6.9	5.9
	6961	2 x 40.5	2 x 38	5.26	2 x .180	1.72	19.5			5.8
	6962	2 x 51.0	2 x 48	4.17	2 x .287	1.72	19.4			5.8
	6963	2 x 127.5	2 x 110, 120	1.67	2 x 1.81	1.72	19.5			5.8
500	6967	2 x 25.5	2 x 24	10.42	2 x .058	1.84	24.3	5.2 x 2.3	8.0	5.8
	6968	2 x 31.9	2 x 30	8.33	2 x .091	1.84	24.4			5.8
	6969	2 x 34.8	2 x 33	7.58	2 x .099	1.84	23.1			5.5
	6970	2 x 40.5	2 x 38	6.58	2 x .146	1.84	24.5			5.8
	6971	2 x 51.0	2 x 48	5.20	2 x .231	1.84	24.3			5.8
	6972	2 x 63.7	2 x 60	4.17	2 x .365	1.84	24.5			5.8
	6973	2 x 127.5	2 x 110, 120	2.08	2 x 1.46	1.84	24.5			5.8
750	6976	2 x 31.8	2 x 30	12.5	2 x .0505	2.62	30.6	5.6 x 2.7	11.2	4.8
	6977	2 x 50.5	2 x 48	7.81	2 x .127	2.62	30.0			4.8
	6978	2 x 63.3	2 x 60	6.25	2 x .200	2.62	30.3			4.8
	6979	2 x 126	2 x 110, 120	3.13	2 x .800	2.62	30.1			4.8
1K	6982	2 x 31.1	2 x 30	16.66	2 x .0283	3.52	30.1	6.4 x 2.7	15.5	3.6
	6983	2 x 62.3	2 x 60	8.33	2 x .113	3.52	30.1			3.6
	6984	2 x 124.6	2 x 110, 120	4.17	2 x .454	3.52	30.1			3.6
2.5K	6987	2 x 49.3	2 x 48	26.0	2 x .0214	7.71	56.3	7.3 x 4.4	32.0	2.7
	6988	2 x 62.2	2 x 60	20.8	2 x .0335	7.71	56.1			2.7
	6989	2 x 123.3	2 x 110, 120	10.4	2 x .133	7.71	55.5			2.7

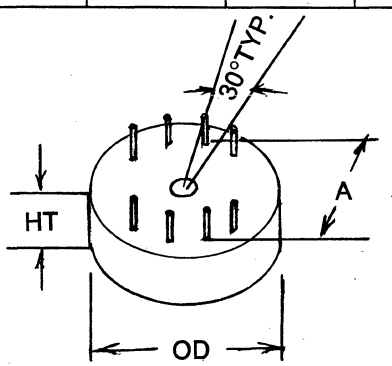
* Semi Epoxy Molded, Add 0.20" O.D. & 0.09" Ht. Full Epoxy Molded, Add 0.20" O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

AMECON
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1900 CHRIS LANE / ANAHEIM, CA 92805 / 714-634-2220 / FAX 714-634-0905 / TLX 510-100-0364

PRECISION TOROIDAL POWER TRANSFORMERS 400 Hz

- PRIMARY VOLTAGE: 115 ±15 VOLTS
  230 ±30 VOLTS
- OPERATING FREQUENCY: 400 Hz ±20 Hz
- INSULATION VOLTAGE: 1500 VAC
- MOLDED FOR P.C. MOUNTING
- 400 Hz POWER TRANSFORMERS FEATURE LOW PROFILES AND ARE DESIGNED FOR STANDARD REGULATOR CHIPS USING FULL WAVE BRIDGE CENTER TAP OR FULL WAVE BRIDGE.
- ANY SIZE 5VA TO 15,000VA. THESE TRANSFORMERS ARE ALL MACHINE MADE TO ACHIEVE HIGH CONSISTENCY AND RELIABILITY.

Part Number	Volt. Amps	Volts Load Rms	Current Amp Rms	Volts N/L Rms	A	Size OD	Size HT
6490		2 x 5	10	2 x 5.9	2.80	3	1.0
6491		2 x 10	5	2 x 11.8	2.80	3	1.0
6492	100	2 x 12	4.2	2 x 14.0	2.80	3	1.0
6493		2 x 18	2.8	2 x 21.2	2.80	3	1.0
6494		2 x 24	2.1	2 x 28.4	2.80	3	1.0
6495		2 x 28	1.78	2 x 33.0	2.80	3	1.0
6470		2 x 5	5	2 x 5.5	2.55	2¾	1.0
6471		2 x 10	2.5	2 x 11.0	2.55	2¾	1.0
6472	50	2 x 12	2.1	2 x 12.8	2.55	2¾	1.0
6473		2 x 18	1.4	2 x 19.0	2.55	2¾	1.0
6474		2 x 24	1.05	2 x 25.5	2.55	2¾	1.0
6475		2 x 28	.89	2 x 30	2.55	2¾	1.0
6450		2 x 5	2.5	2 x 5.5	2.18	2⅜	¾
6451		2 x 10	1.125	2 x 11.2	2.18	2⅜	¾
6452	25	2 x 12	1.05	2 x 13.0	2.18	2⅜	¾
6453		2 x 18	.70	2 x 19.6	2.18	2⅜	¾
6454		2 x 24	.50	2 x 26.0	2.18	2⅜	¾
6455		2 x 28	.45	2 x 30.4	2.18	2⅜	¾
6430		2 x 5	1.00	2 x 5.3	1.80	2	¾
6431		2 x 10	.5	2 x 10.8	1.80	2	¾
6432	10	2 x 12	.42	2 x 12.8	1.80	2	¾
6433		2 x 18	.28	2 x 19	1.80	2	¾
6434		2 x 24	.208	2 x 25.5	1.80	2	¾
6435		2 x 28	.18	2 x 31	1.80	2	¾
6410		2 x 5	.50	2 x 5.3	1.67	1⅞	¾
6411		2 x 10	.25	2 x 10.8	1.67	1⅞	¾
6412	5	2 x 12	.21	2 x 12.8	1.67	1⅞	¾
6413		2 x 18	.14	2 x 19	1.67	1⅞	¾
6414		2 x 24	.104	2 x 25.5	1.67	1⅞	¾
6415		2 x 28	.09	2 x 30.0	1.67	1⅞	¾



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CT SERIES—STANDARD ACCURACY AND SIZE

P/N	I_P A	Volt per Amp	R_L Ω	R.C.F. at 100% I_P	R.C.F. at 10% I_P	Approximate Open Style Dims. OD	ID	W	Wt. Lb.	Potted Dimensions L	ID	HT	W	C	D
*5301	5	.1	100	100.0	106.1	.83	.40	.35	.025	0.938	.375	0.938	.438	0.6	.3
*5302	10	.1	100	100.0	103.4	.83	.40	.35	.025	0.938	.375	0.938	.438	0.6	.3
*5303	15	.1	100	100.0	103.0	.83	.40	.35	.025	0.938	.375	0.938	.438	0.6	.3
*5304	20	.1	100	100.0	102.8	.83	.40	.35	.025	0.938	.375	0.938	.438	0.6	.3
*5305	25	.1	100	100.0	102.0	1.08	.53	.47	.06	1.188	.5	1.188	.563	.08	.4
*5306	30	.1	100	100.0	101.9	1.08	.53	.47	.06	1.188	.5	1.188	.563	.08	.4
*5307	40	.1	100	100.0	102.0	1.20	.66	.46	.07	1.375	.625	1.375	.563	1.0	.4
*5308	50	.1	100	100.0	101.9	1.20	.66	.46	.07	1.375	.625	1.375	.563	1.0	.4
5309	60	.1	100	100.0	101.8	1.35	.76	.49	.09	1.5	.688	1.5	.563	1.2	.4
5310	75	.1	100	100.0	101.6	1.35	.76	.49	.09	1.5	.688	1.5	.563	1.2	.4
5311	100	.1	100	100.0	101.4	1.60	.88	.49	.13	1.75	.75	1.75	.563	1.4	.4
5312	150	.1	100	100.0	101.0	2.04	1.05	.70	.30	2.188	.938	2.188	.813	1.8	.5
5313	200	.1	100	100.0	100.9	2.04	1.05	.70	.30	2.188	.938	2.188	.813	1.8	.5

* Stock Items

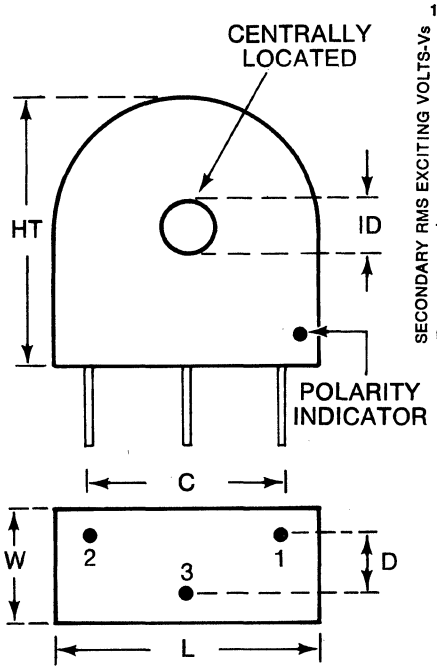


Fig. 1

All dimensions in inches

* This output voltage only occurs when transformer is used with the RL recommended and in its most linear range as shown in Fig. 4.

Fig. 2 Typical Excitation Curve for Models 5301 and 5302 Current Transformers.

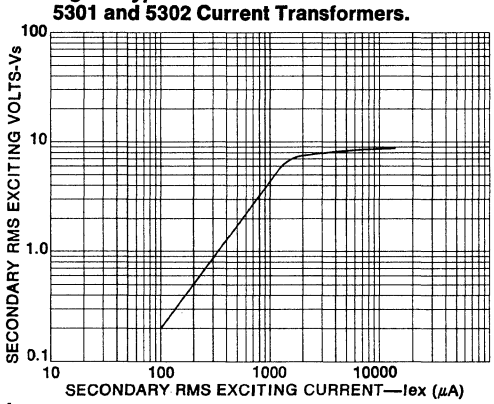


Fig. 3 Ratio Error RE vs. Load RL Across Secondary at the Rated Current Input of 5 Amps for the Current Transformer Model 5301

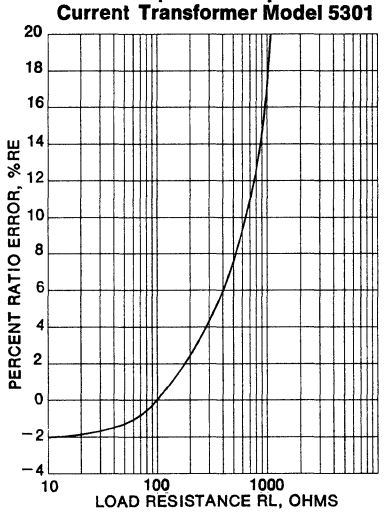
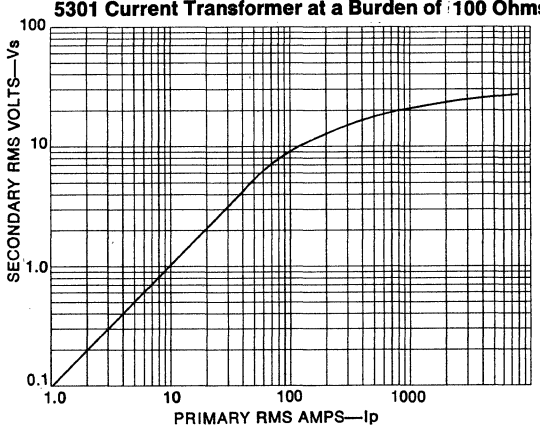


Fig. 4 Output Voltage vs. Input Current for Model 5301 Current Transformer at a Burden of 100 Ohms.



Should you be interested request **ELXS CT Catalog** on your letterhead directly from AMECON.

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CT SERIES—HIGH ACCURACY MINIATURE

P/N	I_P Amp	Volt per Amp	Burden Ohms	R.C.F. at 100% I_P	R.C.F. at 10% I_P	Approximate Open Style Dims. OD	ID	W	WT Lb.	Potted Dimensions L	ID	HT	W	C	D
5326	3.5	.2	200	100.0	102.8	.6	.23	.50	.012	.625	.188	.625	.625	.5	.4
*5327	5.0	.1	100	100.0	101.1	.6	.23	.25	.007	.625	.188	.625	.375	.5	.25
*5328	5.0	.2	200	100.0	101.37	.6	.23	.5	.012	.625	.188	.625	.625	.5	.4
*5329	10.0	.05	100	100.0	100.70	.6	.23	.25	.008	.625	.188	.625	.375	.5	.25
*5330	10.0	.10	200	100.0	100.87	.6	.23	.5	.013	.625	.188	.625	.625	.5	.4
5331	15.0	.05	100	100.0	100.40	.6	.23	.5	.013	.625	.188	.625	.625	.5	.4
5332	20.0	.025	50	100.0	100.30	.6	.23	.5	.014	.625	.188	.625	.625	.5	.4

* Stock Items

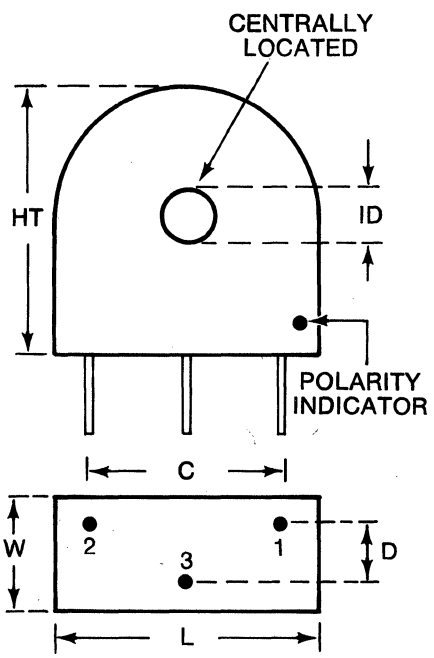


Fig. 1

All dimensions in inches

Fig. 2 Ratio Error RE vs. Load RL Across Secondary at the Rated Current Input of 3.5 Amps for the Current Transformer Model 5326

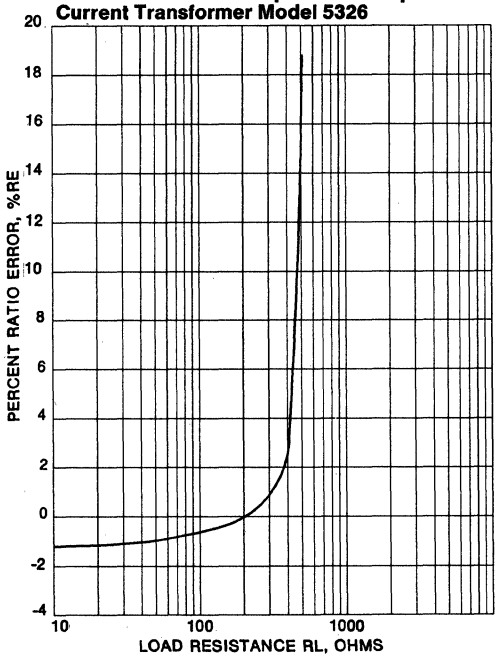
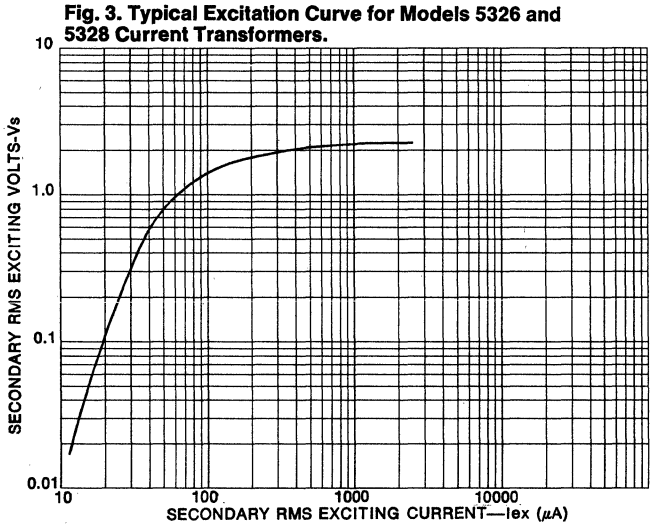


Fig. 3. Typical Excitation Curve for Models 5326 and 5328 Current Transformers.



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*5351	5	.1	100	100.0	103.3	0.9	.33	.42	.025	1.06	.188	1.06	.563	0.8	.4
*5352	10	.1	100	100.0	101.9	0.9	.33	.42	.025	1.06	.188	1.06	.563	0.8	.4
*5353	15	.1	100	100.0	101.6	1.14	.48	.40	.042	1.25	.375	1.25	.563	1.0	.4
*5354	20	.1	100	100.0	101.1	1.14	.48	.40	.042	1.25	.375	1.25	.563	1.0	.4
5355	25	.1	100	100.0	100.9	1.26	.61	.53	.067	1.375	.5	1.375	.625	1.0	.5
5356	30	.1	100	100.0	100.8	1.26	.61	.53	.067	1.375	.5	1.375	.625	1.0	.5
5357	40	.1	100	100.0	100.7	1.53	.71	.55	.11	1.75	.625	1.75	.625	1.5	.5
5358	50	.1	100	100.0	100.6	1.53	.71	.55	.11	1.75	.625	1.75	.625	1.5	.5
5359	60	.1	100	100.0	100.5	1.67	.82	.71	.17	1.875	.625	1.875	.875	1.5	.7
5360	75	.1	100	100.0	100.4	1.67	.82	.71	.17	1.875	.625	1.875	.875	1.5	.7

* Stock Items

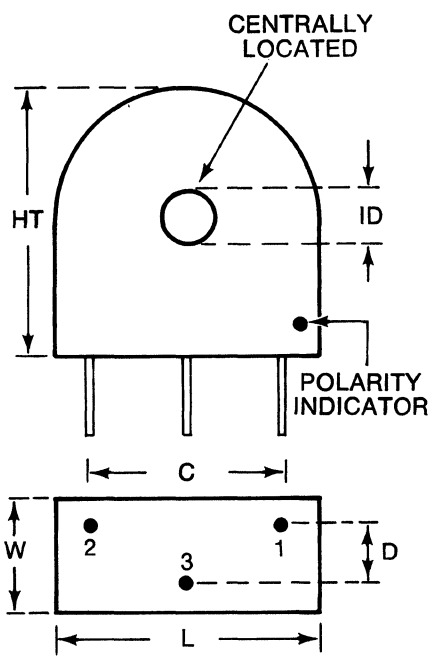


Fig. 1

All dimensions in inches

Fig. 2 Ratio Error RE vs. Load RL Across Secondary at the Ratel Current Input of 5 Amps for the Current Transformer Model 5351.

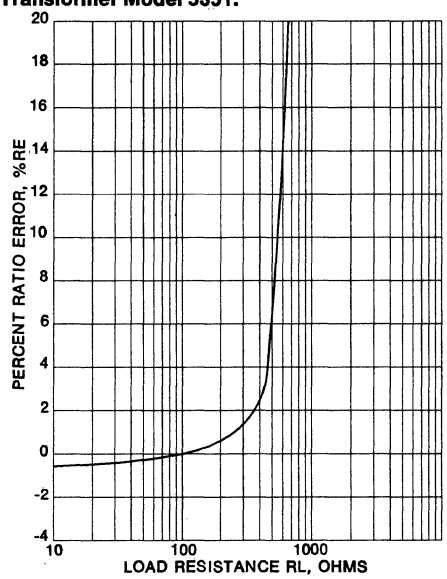
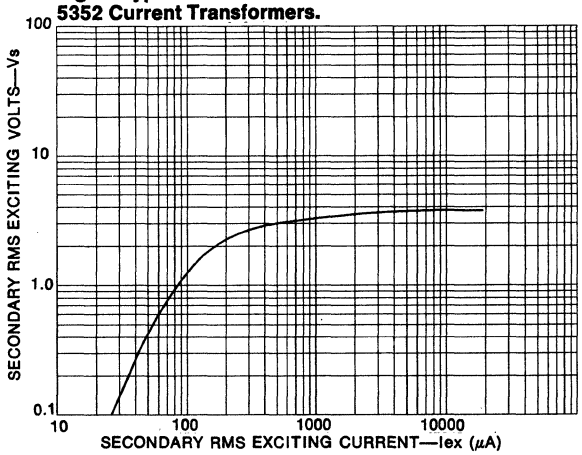


Fig. 3. Typical Excitation Curve for Models 5351 and 5352 Current Transformers.



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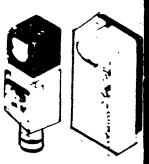
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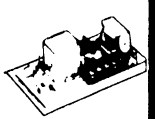
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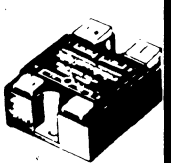
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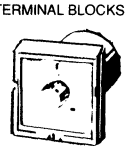

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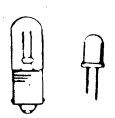
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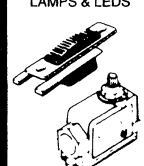
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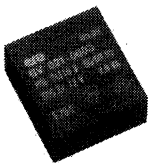
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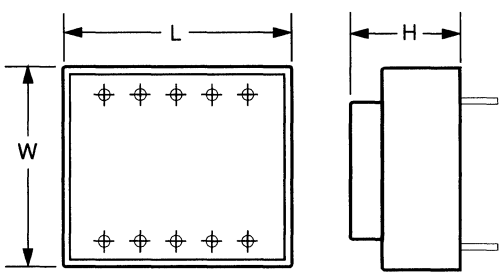




STANDARD

Power: 0.35 VA to 16 VA
Primary: 115V
Secondary: 6V, 9V, 12V, 15V, 18V, 24V (Dual Winding Available)

- Potted Under Vacuum
- Split-Bobbin Transformers
- Short-Circuit Proof
- Dielectric Strength 5000 Vrms Primary/Secondary
- Temperature Rise Approx. 30°C Class 130
- UL and Most International Approvals



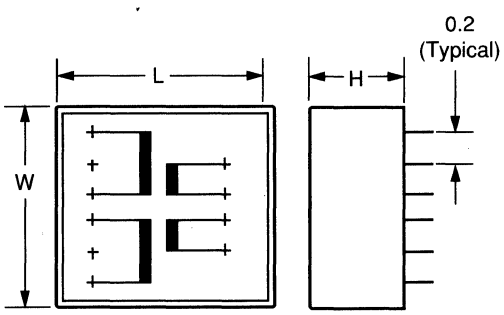
Dimensions (inches)

Power (VA)	L (Length)	W (Width)	H (Height)
0.35	0.87	0.90	0.59
0.5	1.28	1.08	0.60
1.0	1.28	1.08	0.87
1.2	1.28	1.08	0.94
1.8	1.28	1.08	1.06
2.3	1.28	1.08	1.14
3.2	1.65	1.40	1.10
5.0	1.79	1.52	1.26
10.0	2.00	1.67	1.36
16.0	2.28	1.93	1.54

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Power: 0.8 VA to 30 VA
Primary: 2 x 115
Secondary: 3V, 6V, 9V, 12V, 15V, 18V, 21V, 24V

- Potted Under Vacuum
- Split-Bobbin Transformers
- Short-Circuit Proof
- Dielectric Strength 5000 Vrms Primary/Secondary
- Temperature Rise Approx. 30°C Class 130
- UL and Most International Approvals



Dimensions (inches)

Power (VA)	L (Length)	W (Width)	H (Height)
0.8	1.34	1.24	0.60
2.0	2.09	1.73	0.67
4.0	2.09	1.73	0.75
6.0	2.09	1.73	0.87
10.0	2.09	1.73	1.12
14.0	2.68	2.24	0.94
18.0	2.68	2.24	1.06
24.0	2.68	2.24	1.22
30.0	2.68	2.24	1.38

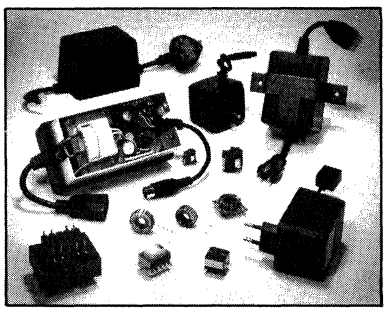
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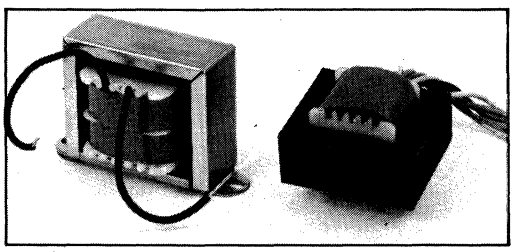


Power Transformers 0.1-250VA

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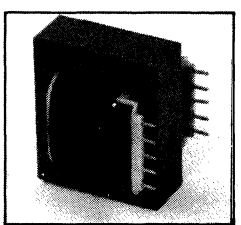
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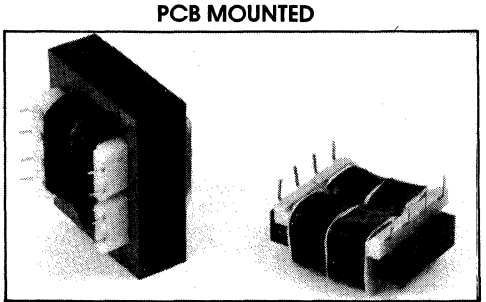


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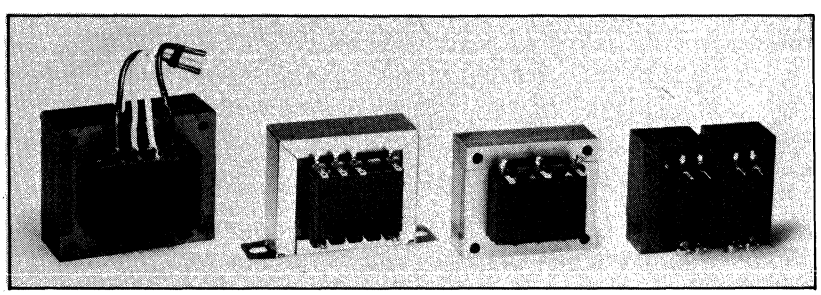
POWER AND SIZE

Power (VA)	Sizes EI
3	EI-35
6	EI-35, EI-41
15	EI-41, EI-48
40	EI-57, EI-60
60	EI-66
100	EI-76, EI-85
180	EI-85
250	EI-96

The sizes shown above are recommended sizes for consideration up to the indicated power level.

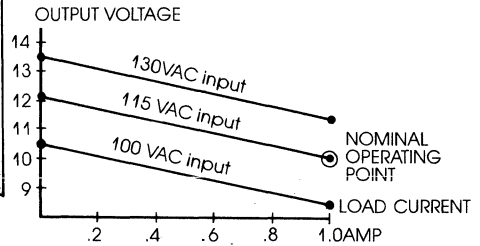
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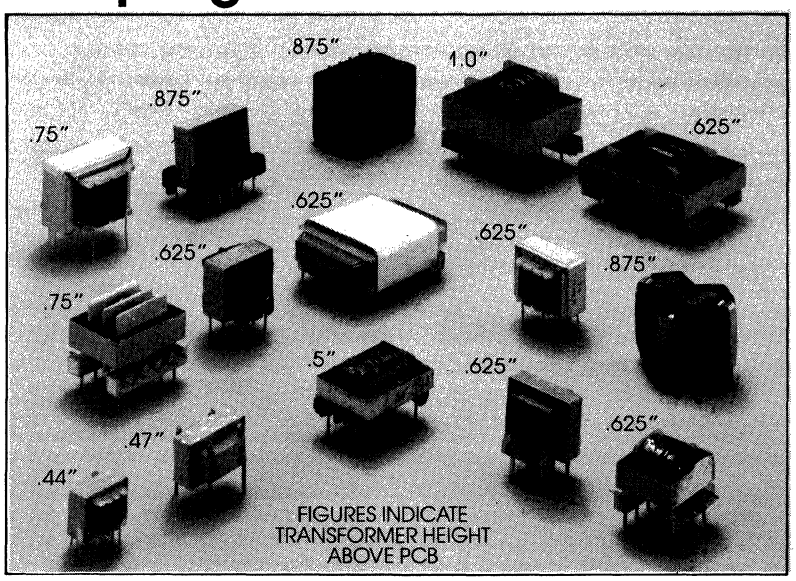
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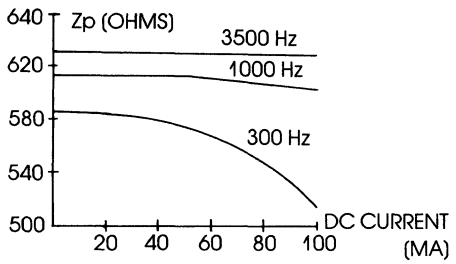


PARAMETERS SELECTION GUIDE

Impedance	Ohms
Return Loss	DB
DC Current	0-120 MA
DCR	Ohms
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Insertion Loss	DB
Max. Power Level	DBM
Longitudinal Balance	40–90 DB
Cross Talk	60–90 DB
Breakdown Voltage	250–4000 VRMS

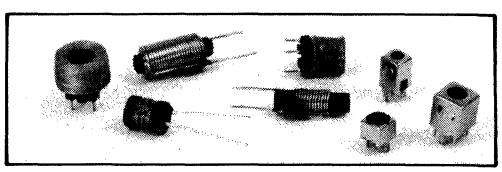
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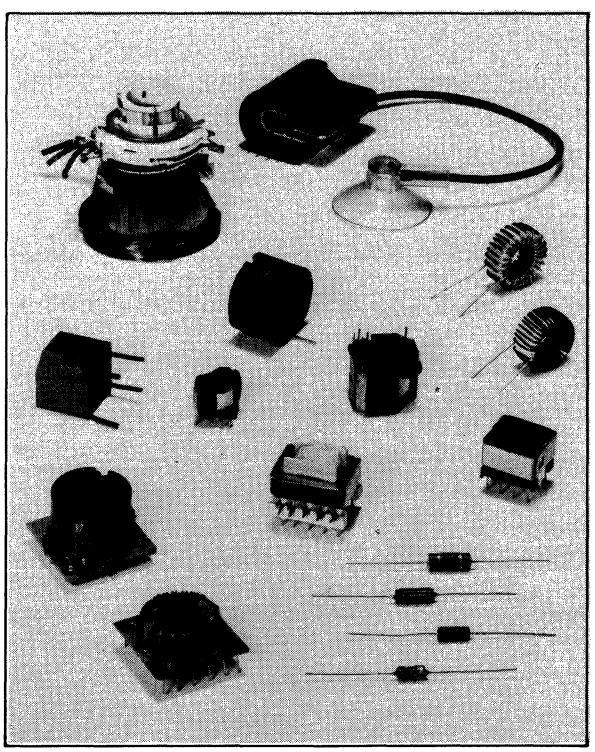
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eem MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

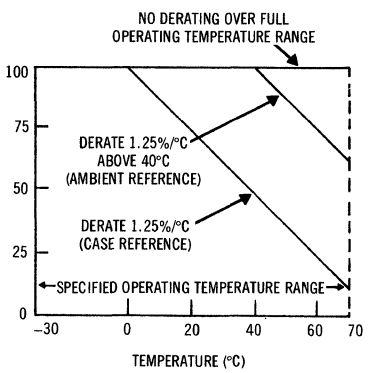


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

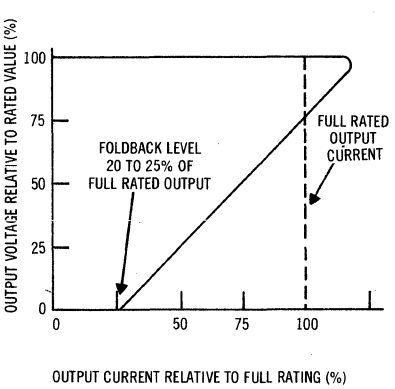


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

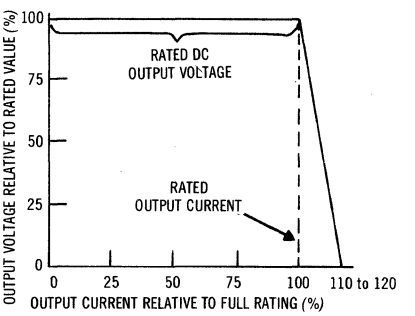


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

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TRANSFORMERS

StarLAN-10 Dual Isolation Transformer — 2759A

Description

The 2759A StarLAN-10 Dual Isolation Transformer is a ferrite-core device designed for local area network (LAN) applications. The device provides extra low-leakage inductance and low-winding capacitance for fast rise times. The 2759A device complies with the international safety requirements for LANs.

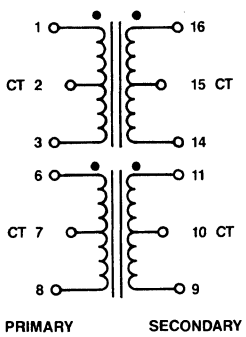
Electrical Characteristics

Parameter	Device
Turns Ratio	1CT:1CT
Maximum dc Resistance:	
Primary	0.36 Ω
Secondary	0.36 Ω
Minimum Primary ET Constant	3.5 V-μs
Maximum Primary Leakage Inductance	0.2 μH
Maximum Interwinding Capacitance	32 pF
Minimum Primary Open Circuit Inductance (OCL) (at 10 kHz, 0.1 Vac)	200 μH
Voltage Breakdown (between primary & secondary)	2400 Vac

Benefits

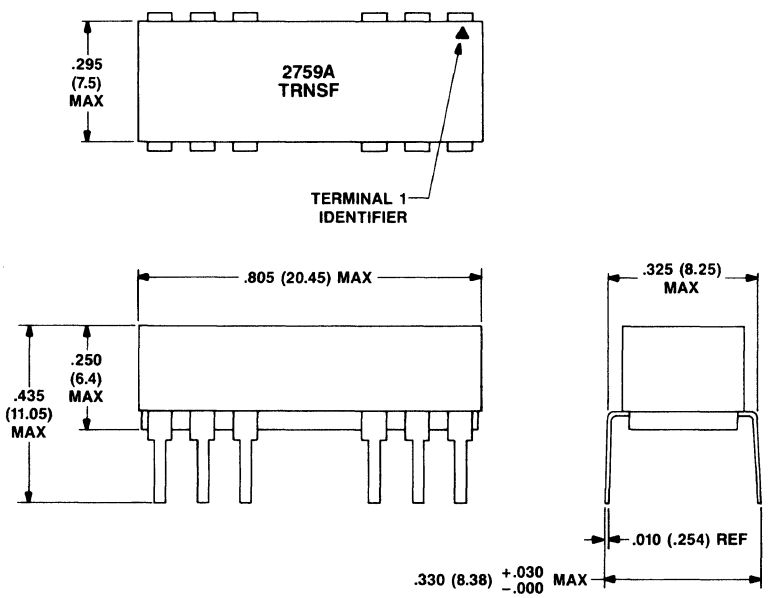
- Conforms with IEEE 802.3 10BASE-T proposed standards
- Low-profile, 16-pin plastic DIP
- Total-immersion-cleaning (TIC) compatible
- Isolation up to 2400 Vac
- Center-tap provided on all windings

2759A Transformer



Outline Drawing

Dimensions in Inches and (Millimeters)



For additional information, contact your AT&T Account Manager or the following:
☐ AT&T Microelectronics, Dept. 52AL040420, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

AT&T Microelectronics

TRANSFORMERS

ISDN S/T Interface

Electronic Circuit Transformer — 2718AM

Description

The 2718AM Transformer is a ferrite core device which operates at 192 kb/s. The 2718AM device has a compact design for densely populated boards. It supports CCITT I.430 Recommendations for ISDN Basic Access (2B+D) and the S/T reference point in terminal equipment. The device is printed circuit board mountable.

Electrical Characteristics

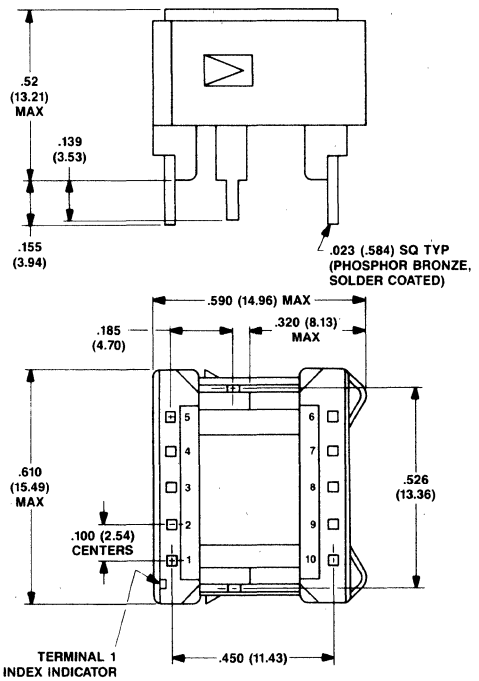
Parameter	Specification
Turns Ratio Primary:Secondary	2.5CT:1CT
Min. Secondary Open Circuit Inductance (OCL)*	22 mH
Max. Leakage Inductance**	18 μH
Max. Primary ET Constant	1000 V/μs
Max. dc Resistance Primary (4-6) Secondary (1-9)	 6.0 Ω 2.8 Ω
Max. Interwinding Capacitance Secondary to Primary	 25 pF
Min. ac Breakdown Voltage (Dielectric Strength) Secondary to Primary	 1000 Vac

* At 10 kHz: 0.5 Vac

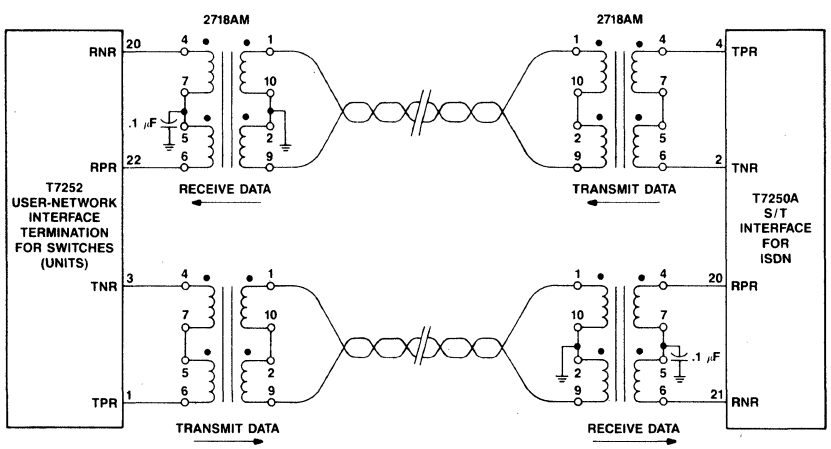
** Measured between leads 1 and 9. Lead 4 is connected to lead 6.

Outline Drawing

(Dimensions in Inches)

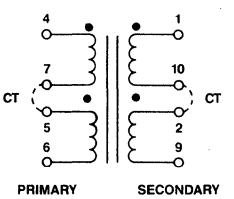


Typical ISDN Application



Note: Line termination and protection circuitry should be added as required for customer applications.

2718AM Transformer



Note: Center taps are formed by externally connecting terminal 7 to 5 and 10 to 2.

For additional information, contact your AT&T Account Manager or the following:
☐ AT&T Microelectronics, Dept. 52AL040420, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

AT&T Microelectronics

TRANSFORMERS

Miniature Pulse Transformers — 2745B & 2745C

Description

The 2745B & 2745C Miniature Pulse Transformers are ferrite-core devices. They have a compact design for use on densely populated boards. They are compatible with water-soluble fluxes and can be cleaned with aqueous or solvent systems. The devices are packed in tubes for easy machine insertion and are available in through-hole or surface-mount technology. These devices are just two of the many quality transformers offered by AT&T.

Application

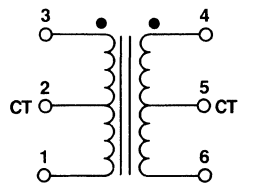
The 2745B & 2745C Transformers are designed for use as line interface transformers and are compatible with the AT&T LC1046 Digital Signaling Interface (DSI) device. These transformers contain well-balanced windings to help cancel common-mode noise on the line and improve longitudinal suppression. The 2745B device is designed with a 1CT:2CT turns ratio for use on the receive line. The 2745C device is designed with a 1:1.37CT turns ratio for use on the transmit line.

Electrical Characteristics

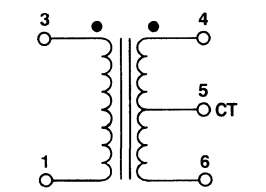
Parameter	2745B	2745C
Turns Ratio	1CT:2CT	1:1.37CT
Max. dc Resistance		
Primary	4.9 Ω	1.0 Ω
Secondary	10.2 Ω	1.4 Ω
Max. Primary ET Constant	48 V-μs	21 V-μs
Max. Primary Leakage Inductance	7.0 μH	1.2 μH
Effective Distributed Capacitance*	50 pF	15 pF
Interwinding Capacitance		
Primary to Secondary	110 pF	85 pF
Min. Primary Sine Wave Open Circuit Inductance (OCL)	3500 μH	680 μH

* Measured at primary winding with one end grounded; other winding not grounded.

2745B Transformer

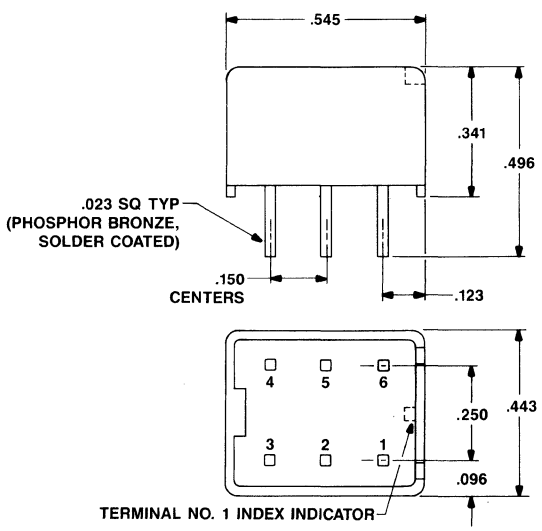


2745C Transformer



Outline Drawing

(Dimensions in Inches)



NOTE:
TERMINAL NUMBERS ARE FOR REFERENCE ONLY
AND ARE NOT STAMPED ON APPARATUS

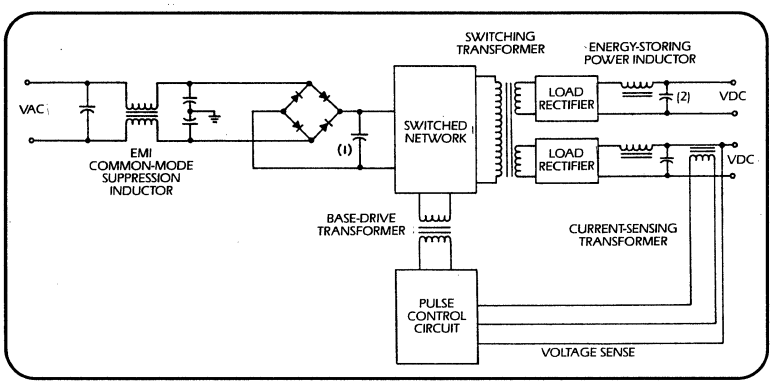
For additional information, contact your AT&T Account Manager or the following:
☐ AT&T Microelectronics, Dept. 52AL040420, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

Automatic Coil Corp.

Subsidiary of Designatronics, Inc.
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Switched-Mode Power Supplies



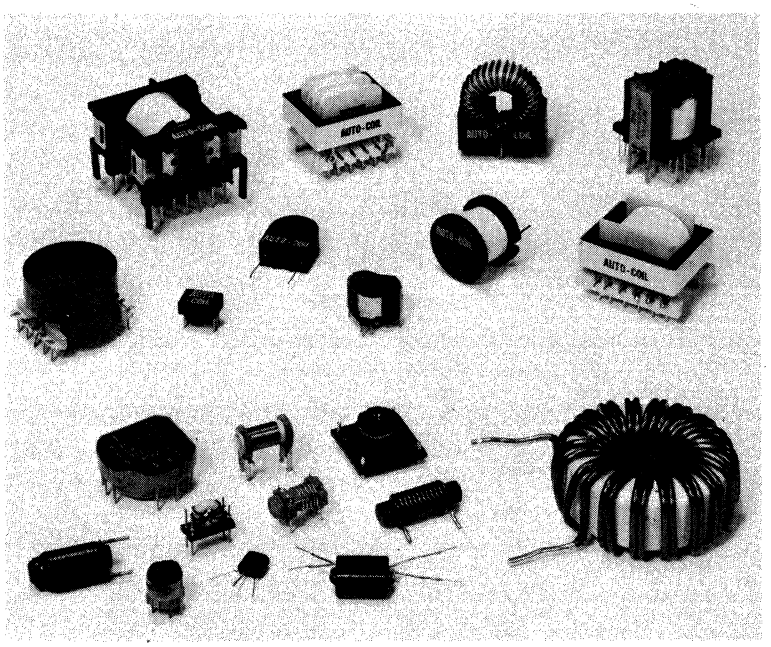
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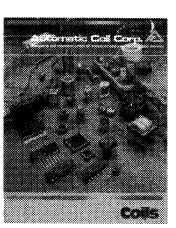
Simply FAX your specs for a response within 24 hours: FAX: (305) 696-0626

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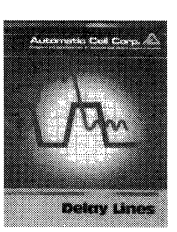
With its reputation for quality and service for over 40 years, the Automatic Coil Corporation has firmly established itself as a leading manufacturer of custom designed inductive components. We offer a complete line of IF-RF coils, transformers, toroids, baluns, bobbins, delay lines, and related windings for commercial and military applications. In addition, specially engineered inductors, transformers, filters and delay lines are available along with assembly services for electronic and mechanical devices, wire harnesses, and printed circuit boards.

Automatic Coil continues to be the free world's largest manufacturer of coils for military radios and is currently fulfilling long-term contracts for electronic components used in the AN/VRC-12, AN/PRC-77, AN/GRC-106, AN/PRC-104, AN/PRC-90, ANC/PRC-126, PRC90-2, AN/ARC-115, AN/ARC-131, AN/ARC-164, WRC-1 and Sincgars military radio programs. Automatic Coil also manufactures coils for many of the nation's leading CATV turnkey manufacturers. Many other companies in the computer and commercial communications fields have come to rely on us as an excellent source for custom designed components.





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Ask for Catalog AC37

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Call: 305-696-6660

Low Profile Power Transformers off-the-shelf...Ask AVEL

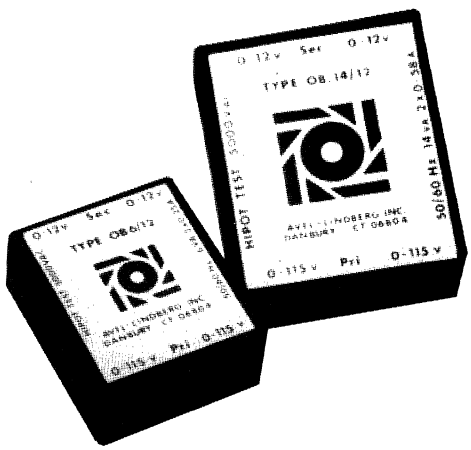
GENERAL SPECIFICATION **OB RANGE** 2-30VA

Primary voltage 120V + 120 V. Frequency 50/60 Hz. Secondary voltage tolerance: within 5% at nominal input and full load.

Flash tested 5 kVAC. Temperature rise between 30 to 40°C. Mounted in resin filled flat thermoplastic cases.

CERTIFIED TO:

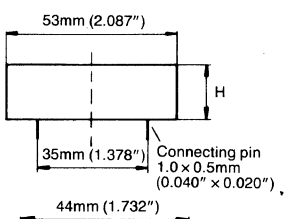
UL506 • CSA C22.2 • SEV TP 21/2A • VDE 0551-9.75 including IEC 742

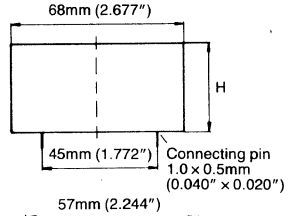


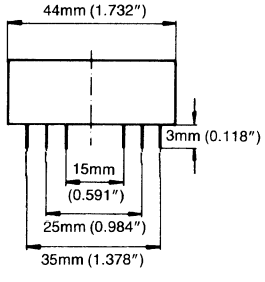
ENCAPSULATED—SLIMLINE—PCB MOUNTED

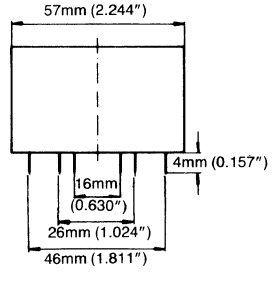
ESPECIALLY SUITED FOR CLOSE-BOARD SPACING

DIMENSIONS









Type	H=Height	Fixing
OB 2	17mm (0.669")	1.87×1.50in No 4 Self Tap
OB 4	19mm (0.748")	
OB 6	22mm (0.866")	

Type	H=Height	Fixing
OB 10	22mm (0.866")	2.50×2.00in No 4 Self Tap
OB 14	24mm (0.945")	
OB 18	27mm (1.063")	
OB 24	31mm (1.220")	
OB 30	35mm (1.378")	

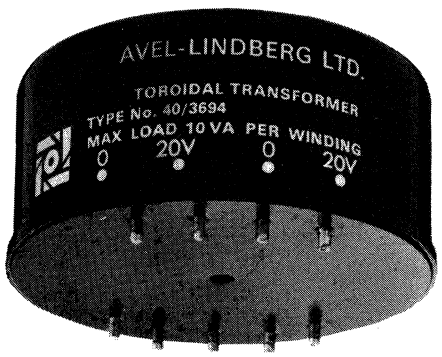
Type	Load VA	Secondary RMS Rating Series	Secondary RMS Rating Parallel	Regulation Typically	Weight Grams	Weight lbs
OB2-5	2	10V @ 200mA	5V @ 400mA	25%	115	0.254
OB2-6	2	12V @ 170mA	6V @ 330mA	25%	115	0.254
OB2-9	2	18V @ 110mA	9V @ 220mA	25%	115	0.254
OB2-12	2	24V @ 85mA	12V @ 170mA	25%	115	0.254
OB2-15	2	30V @ 70mA	15V @ 140mA	25%	115	0.254
OB2-18	2	36V @ 55mA	18V @ 110mA	25%	115	0.254
OB2-24	2	48V @ 40mA	24V @ 80mA	25%	115	0.254
OB4-5	4	10V @ 400mA	5V @ 800mA	22%	145	0.320
OB4-6	4	12V @ 330mA	6V @ 660mA	22%	145	0.320
OB4-9	4	18V @ 220mA	9V @ 440mA	22%	145	0.320
OB4-12	4	24V @ 165mA	12V @ 330mA	22%	145	0.320
OB4-15	4	30V @ 135mA	15V @ 270mA	22%	145	0.320
OB4-18	4	36V @ 110mA	18V @ 220mA	22%	145	0.320
OB4-24	4	48V @ 85mA	24V @ 170mA	22%	145	0.320
OB6-5	6	10V @ 600mA	5V @ 1•2A	19%	175	0.386
OB6-6	6	12V @ 500mA	6V @ 1•0A	19%	175	0.386
OB6-9	6	18V @ 330mA	9V @ 660mA	19%	175	0.386
OB6-12	6	24V @ 250mA	12V @ 500mA	19%	175	0.386
OB6-15	6	30V @ 200mA	15V @ 400mA	19%	175	0.386
OB6-18	6	36V @ 165mA	18V @ 330mA	19%	175	0.386
OB6-24	6	48V @ 125mA	24V @ 250mA	19%	175	0.386
OB10-5	10	10V @ 1•0A	5V @ 2•0A	26%	280	0.617
OB10-6	10	12V @ 830mA	6V @ 1•66A	26%	280	0.617
OB10-9	10	18V @ 550mA	9V @ 1•10A	26%	280	0.617
OB10-12	10	24V @ 420mA	12V @ 840mA	26%	280	0.617
OB10-15	10	30V @ 335mA	15V @ 670mA	26%	280	0.617
OB10-18	10	36V @ 280mA	18V @ 560mA	26%	280	0.617
OB10-24	10	48V @ 210mA	24V @ 420mA	26%	280	0.617
OB14-5	14	10V @ 1•4A	5V @ 2•8A	18%	315	0.695
OB14-6	14	12V @ 1•15A	6V @ 2•3A	18%	315	0.695
OB14-9	14	18V @ 780mA	9V @ 1•56A	18%	315	0.695
OB14-12	14	24V @ 585mA	12V @ 1•17A	18%	315	0.695
OB14-15	14	30V @ 470mA	15V @ 940mA	18%	315	0.695
OB14-18	14	36V @ 390mA	18V @ 780mA	18%	315	0.695
OB14-24	14	48V @ 290mA	24V @ 580mA	18%	315	0.695
OB18-5	18	10V @ 1•8A	5V @ 3•6A	17%	375	0.827
OB18-6	18	12V @ 1•5A	6V @ 3•0A	17%	375	0.827
OB18-9	18	18V @ 1•0A	9V @ 2•0A	17%	375	0.827
OB18-12	18	24V @ 750mA	12V @ 1•5A	17%	375	0.827
OB18-15	18	30V @ 600mA	15V @ 1•2A	17%	375	0.827
OB18-18	18	36V @ 500mA	18V @ 1•0A	17%	375	0.827
OB18-24	18	48V @ 375mA	24V @ 750mA	17%	375	0.827
OB24-5	24	10V @ 2•4A	5V @ 4•8A	16%	445	0.981
OB24-6	24	12V @ 2•0A	6V @ 4•0A	16%	445	0.981
OB24-9	24	18V @ 1•33A	9V @ 2•66A	16%	445	0.981
OB24-12	24	24V @ 1•0A	12V @ 2•0A	16%	445	0.981
OB24-15	24	30V @ 800mA	15V @ 1•6A	16%	445	0.981
OB24-18	24	36V @ 670mA	18V @ 1•34A	16%	445	0.981
OB24-24	24	48V @ 500mA	24V @ 1•0A	16%	445	0.981
OB30-5	30	10V @ 3•0A	5V @ 6•0A	15%	530	1.169
OB30-6	30	12V @ 2•5A	6V @ 5•0A	15%	530	1.169
OB30-9	30	18V @ 1•67A	9V @ 3•33A	15%	530	1.169
OB30-12	30	24V @ 1•25A	12V @ 2•5A	15%	530	1.169
OB30-15	30	30V @ 1•0A	15V @ 2•0A	15%	530	1.169
OB30-18	30	36V @ 830mA	18V @ 1•67A	15%	530	1.169
OB30-24	30	48V @ 625mA	24V @ 1•25A	15%	530	1.169

Or, for special needs, let us quote on a custom design with competitive pricing!

Avel-Lindberg Inc.
203-355-4711 5 Old Town Park Road Unit 47
Fax: 203-354-8597 New Milford, Connecticut 06776

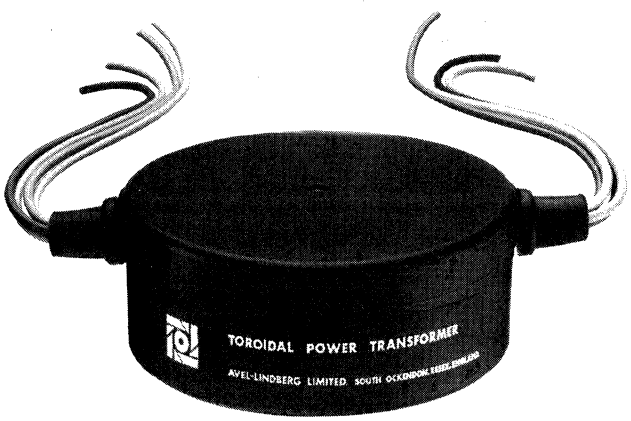
Toroidal Line Transformers off-the-shelf ... Ask AVEL

ENCAPSULATED RANGE PRINTED CIRCUIT STYLE



Type	Primary Volts V	Nom. Load VA	Secondary RMS Volts V	Secondary RMS Current A	Dimensions Dia. in	Dimensions Ht. in	Weight lbs Typical	Mounting
40/3030	115+115	15	6+6	1.250	2.60	1.30	0.77	8–23 Central
40/3031	115+115	15	9+9	0.830	2.60	1.30	0.77	
40/3032	115+115	15	12+12	0.625	2.60	1.30	0.77	
40/3033	115+115	15	15+15	0.500	2.60	1.30	0.77	
40/3034	115+115	15	20+20	0.375	2.60	1.30	0.77	
40/3035	115+115	30	6+6	2.500	3.25	1.40	1.30	8–23 Central
40/3036	115+115	30	9+9	1.666	3.25	1.40	1.30	
40/3037	115+115	30	12+12	1.250	3.25	1.40	1.30	
40/3038	115+115	30	15+15	1.000	3.25	1.40	1.30	
40/3039	115+115	30	20+20	0.750	3.25	1.40	1.30	
40/3040	115+115	50	9+9	2.800	3.75	1.55	2.00	2 × 8-32 spaced 0.40in
40/3041	115+115	50	12+12	2.100	3.75	1.55	2.00	
40/3042	115+115	50	15+15	1.670	3.75	1.55	2.00	
40/3043	115+115	50	20+20	1.250	3.75	1.55	2.00	
40/3044	115+115	50	25+25	1.000	3.75	1.55	2.00	

ENCAPSULATED RANGE FLEXIBLE LEAD STYLE



Type	Primary Volts V	Nom. Load VA	Secondary RMS Volts V	Secondary RMS Current A	Dimensions Dia. in	Dimensions Ht. in	Weight lbs Typical	Mounting
40/3000	115+115	15	6+6	1.250	2.70	1.25	0.77	8–32 Central
40/3001	115+115	15	9+9	0.830	2.70	1.25	0.77	
40/3002	115+115	15	12+12	0.625	2.70	1.25	0.77	
40/3003	115+115	15	15+15	0.500	2.70	1.25	0.77	
40/3004	115+115	15	20+20	0.375	2.70	1.25	0.77	
40/3005	115+115	30	6+6	2.500	3.30	1.35	1.30	8–32 Central
40/3006	115+115	30	9+9	1.666	3.30	1.35	1.30	
40/3007	115+115	30	12+12	1.250	3.30	1.35	1.30	
40/3008	115+115	30	15+15	1.000	3.30	1.35	1.30	
40/3009	115+115	30	20+20	0.750	3.30	1.35	1.30	
40/3010	115+115	50	9+9	2.800	3.90	1.55	2.00	2×8—32 spaced 0.40in
40/3011	115+115	50	12+12	2.100	3.90	1.55	2.00	
40/3012	115+115	50	15+15	1.670	3.90	1.55	2.00	
40/3013	115+115	50	20+20	1.250	3.90	1.55	2.00	
40/3014	115+115	50	25+25	1.000	3.90	1.55	2.00	
40/3015	115+115	90	12+12	3.750	4.20	1.80	3.00	2×8—32 spaced 0.40in
40/3016	115+115	90	15+15	3.000	4.20	1.80	3.00	
40/3017	115+115	90	20+20	2.250	4.20	1.80	3.00	
40/3018	115+115	90	25+25	1.800	4.20	1.80	3.00	
40/3019	115+115	90	30+30	1.500	4.20	1.80	3.00	
40/3020	115+115	130	18+18	3.610	4.90	1.90	4.30	2×8—32 spaced 0.80in
40/3021	115+115	130	22+22	3.000	4.90	1.90	4.30	
40/3022	115+115	130	30+30	2.160	4.90	1.90	4.30	
40/3023	115+115	130	35+35	1.850	4.90	1.90	4.30	
40/3024	115+115	130	40+40	1.620	4.90	1.90	4.30	

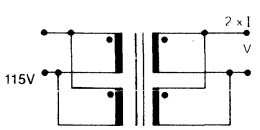
GENERAL SPECIFICATION—PRINTED CIRCUIT, FLEXIBLE LEAD STYLE

Input line voltage: 115 or 230V
Frequency: 50/60Hz Operating Range 47 to 400Hz
Secondary voltage tolerance: within 3% at nominal input and full load.
Primary to Secondary insulation: 2500V r.m.s.
Maximum operating temperature 55°C ambient.

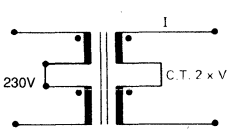
PERFORMANCE DETAILS

Nominal Load VA	Regulation %	Temp. Rise °C	Iron Loss W	Copper Loss W
15	15	14	0.26	2.25
30	13	30	0.40	4.00
50	10	35	0.60	5.00
90	7	40	1.00	6.50
130	6.5	40	2.00	10.00

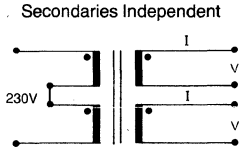
Primaries & Secondaries Parallel Connected



Primaries & Secondaries Series Connected



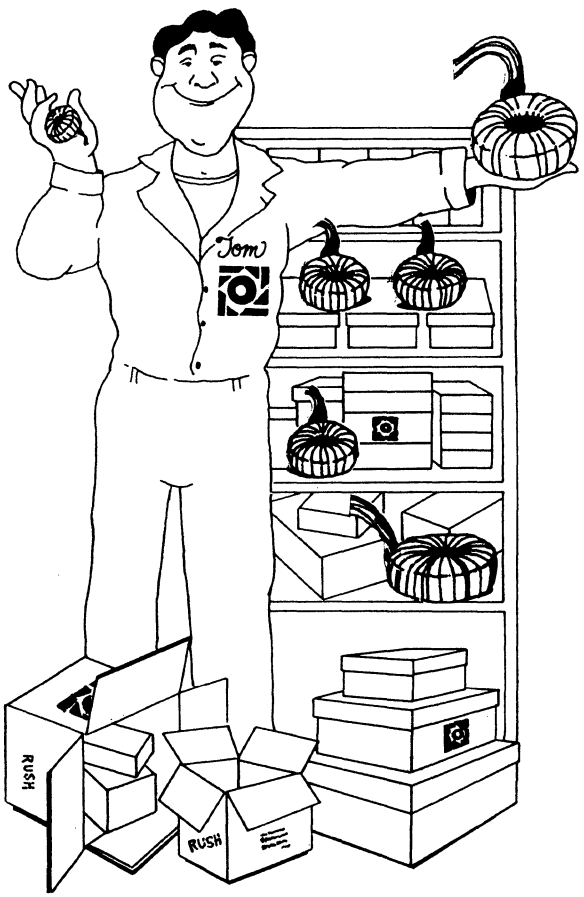
Primaries Series Connected Secondaries Independent



Or, for special needs, let us quote on a custom design with competitive pricing!

Iberg Inc.
11 4-8597 5 Old Town Park Road Unit 47
New Milford, Connecticut 06776

Toroidal Line Transformers off-the-shelf...Ask AVEL

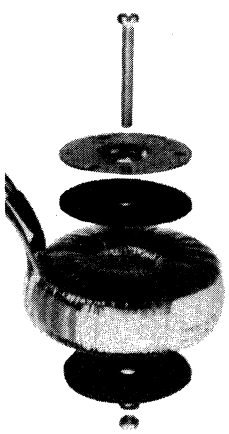


GENERAL SPECIFICATION

Primaries: 120V + 120V
Frequency: 50/60 Hz
Operating range: 47 to 400 Hz
Secondary voltage tolerance: within 3% at nominal input and full load.
Primary to secondary insulation: 4000V rms
Ambient plus temperature rise should not exceed 105°C
Leads: 6 inches long pvc insulated

PERFORMANCE DETAILS

Load VA	Regulation %	Temp. Rise °C	Iron Loss W	Copper Loss W
30	16	50	0.35	4.5
60	13	50	0.6	8
100	10	50	1.5	10
160	9	56	2.0	17
230	8	56	2.5	20
330	7	58	3.0	24
530	6	60	3.5	30



Recognized Component
Underwriters Labs, Inc.

BUDGET RANGE

Type	Load VA	Secondary RMS Volts V	Secondary RMS Current A	Dimensions Dia. in	Dimensions Ht. in	Weight lb Typical	
D4000	30	6+6	2.50	2.76	1.22	1.00	
D4001	30	9+9	1.67	2.76	1.22	1.00	
D4002	30	12+12	1.25	2.76	1.22	1.00	2 in. Dished Fixing Plate 0.08 in. Clearance
D4003	30	15+15	1.00	2.76	1.22	1.00	
D4004	30	18+18	0.83	2.76	1.22	1.00	
D4005	30	22+22	0.68	2.76	1.22	1.00	
D4006	30	25+25	0.60	2.76	1.22	1.00	
D4007	30	30+30	0.50	2.76	1.22	1.00	
D4010	60	9+9	3.33	3.46	1.34	1.87	
D4011	60	12+12	2.50	3.46	1.34	1.87	
D4012	60	15+15	2.00	3.46	1.34	1.87	
D4013	60	18+18	1.67	3.46	1.34	1.87	2.75 in. Dished Fixing Plate 0.16 in. Clearance
D4014	60	22+22	1.36	3.46	1.34	1.87	
D4015	60	25+25	1.20	3.46	1.34	1.87	
D4016	60	30+30	1.00	3.46	1.34	1.87	
D4017	60	110	0.55	3.46	1.34	1.87	
D4018	60	220	0.27	3.46	1.34	1.87	
D4019	60	240	0.25	3.46	1.34	1.87	
D4020	100	12+12	4.17	3.58	1.69	2.65	
D4021	100	15+15	3.33	3.58	1.69	2.65	
D4022	100	18+18	2.78	3.58	1.69	2.65	
D4023	100	22+22	2.27	3.58	1.69	2.65	2.75 in. Dished Fixing Plate 0.16 in. Clearance
D4024	100	25+25	2.00	3.58	1.69	2.65	
D4025	100	30+30	1.67	3.58	1.69	2.65	
D4026	100	110	0.91	3.58	1.69	2.65	
D4027	100	220	0.45	3.58	1.69	2.65	
D4028	100	240	0.42	3.58	1.69	2.65	
D4030	160	18+18	4.44	4.45	1.73	4.19	
D4031	160	22+22	3.64	4.45	1.73	4.19	
D4032	160	25+25	3.20	4.45	1.73	4.19	3.5 in. Dished Fixing Plate 0.16 in. Clearance
D4033	160	30+30	2.67	4.45	1.73	4.19	
D4034	160	35+35	2.29	4.45	1.73	4.19	
D4035	160	110	1.46	4.45	1.73	4.19	
D4036	160	220	0.73	4.45	1.73	4.19	
D4037A	160	120+120	0.67	4.45	1.73	4.19	
D4040	230	25+25	4.60	4.72	2.01	5.89	
D4041	230	30+30	3.83	4.72	2.01	5.89	
D4042	230	35+35	3.29	4.72	2.01	5.89	4.3 in. Dished Fixing Plate 0.16 in. Clearance
D4043	230	40+40	2.88	4.72	2.01	5.89	
D4044	230	110	2.09	4.72	2.01	5.89	
D4045	230	220	1.05	4.72	2.01	5.89	
D4046A	230	120+120	0.96	4.72	2.01	5.89	
D4050	330	25+25	6.60	5.24	2.05	7.27	
D4051	330	30+30	5.50	5.24	2.05	7.27	
D4052	330	35+35	4.71	5.24	2.05	7.27	4.3 in. Dished Fixing Plate 0.16 in. Clearance
D4053	330	40+40	4.13	5.24	2.05	7.27	
D4054	330	45+45	3.67	5.24	2.05	7.27	
D4055	330	110	3.00	5.24	2.05	7.27	
D4056	330	220	1.50	5.24	2.05	7.27	
D4057A	330	120+120	1.38	5.24	2.05	7.27	
D4060	530	30+30	8.83	5.91	2.40	11.02	
D4061	530	35+35	7.57	5.91	2.40	11.02	
D4062	530	40+40	6.63	5.91	2.40	11.02	4.3 in. Dished Fixing Plate 0.16 in. Clearance
D4063	530	45+45	5.89	5.91	2.40	11.02	
D4064	530	50+50	5.30	5.91	2.40	11.02	
D4065	530	110	4.82	5.91	2.40	11.02	
D4066	530	220	2.41	5.91	2.40	11.02	
D4067	530	240	2.21	5.91	2.40	11.02	

Or, for special needs, let us quote on a custom design with competitive pricing!

Avel-Lindberg Inc.
203-355-4711 5 Old Town Park Road Unit 47
Fax: 203-354-8597 New Milford, Connecticut 06776

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NETWORKING ISOLATION TRANSFORMERS

STARLAN APPLICATIONS

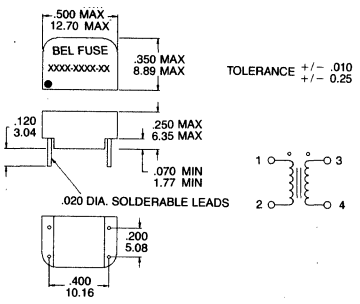
- IEEE 802.3 Compatible (1 Base 5)
- Standard Physical Packaging
- Designed for hub-node use
- All parts comply with international safety requirements for lans; including 2000V RMS isolation
- Custom designs available
- Four wire filter available

TABLE OF ELECTRICAL SPECIFICATIONS @ 25° C.

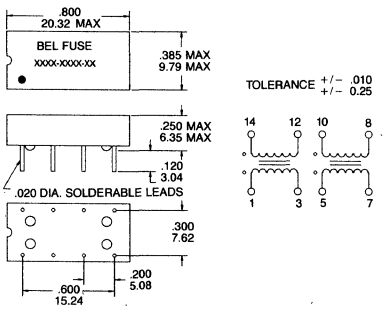
Part Number 0553-	Turns Ratio (±5%)	Pulse Inductance (μh±20%)	ET Constant (V-μs min.)	Rise Time (ns max.)	Pri/Sec CW/W (pf max.)	Pri-Sec LL (μh max.)	Primary DCR (ohms max.)	HYPOT (Vrms)	Package Style**
0033-AC	1:1	2.5	25	50	25	6.0	1.0	2000	C
3005-AC	1:1	2.5	25	20	40	0.80	1.0	2000	C
0033-AJ	1:1	2.5	25	50	25	6.0	1.0	2000	J
3005-AJ	1:1	2.5	25	20	40	0.80	1.0	2000	J
0506-JK	1:1:1:1	N/A*	N/A	N/A	30	0.30	0.065	2000	K

* Sine wave inductance: 40μh min at 100kHz 20 mv.

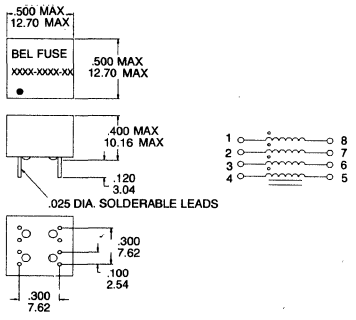
PACKAGE C



PACKAGE J



PACKAGE N



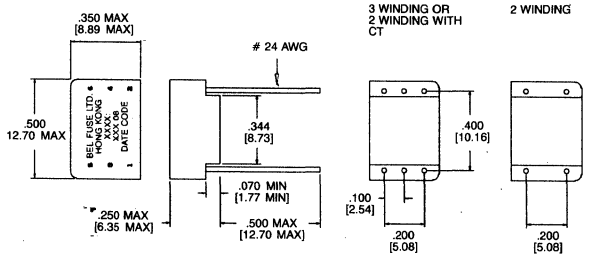
HIGH QUALITY NETWORKING TRANSFORMERS

- Wide selection of standard types (see sample table). Consult factory for complete standards list.
- Special lead lengths available at no additional cost
- Custom designs available (consult factory)
- Wide operating temperature range (0 to 70°C)
- Competitive pricing on both small and high volume orders
- Ship from stock availability on most items
- 200V RMS isolation standard on all units
- Versatile "T" case outline

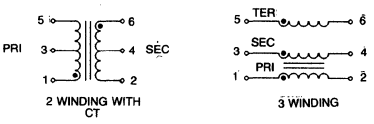
SAMPLE TABLE

Part Number* 0553-	Turns Ratio (±5%)	Primary Sine Wave OCL (μh min.)	Primary Winding ET-Constant (V-μs min.)	Rise Time ((ns max.)	Pri/Sec CW/W (pf max.)	Pri/Sec Leakage Inductance (μh max.)	Primary DCR. (ohms max.)	Secondary DCR. (ohms max.)	Tertiary DCR. (ohms max.)
0053-IC	1:1:1	5,000	25.0	10.5	60	1.3	3.9	3.9	3.9
5006-IC	1:1:1	500	8.5	5.3	32	0.4	1.3	1.3	1.3
0106-IC	1:1:1	10	3.7	5.1	22	0.5	0.9	0.9	0.9
0053-PC	2:1:1	5,000	25.0	16.0	33	3.6	3.9	2.0	2.0
0206-PC	3:1:1	20	3.2	2.7	6	1.3	0.9	0.4	0.4
0023-DC	1ct:1ct	2,000	16.0	8.2	37	0.8	2.5	2.5	—
0106-DC	1ct:1ct	10	3.7	5.1	22	0.5	0.9	0.9	—
0023-OC	2ct:1ct	2,000	16.0	11.0	19	1.8	2.5	1.4	—
0106-OC	2ct:1ct	10	3.7	4.5	9	1.5	0.9	0.5	—

INCHES
MM



PINOUTS



CUSTOM DESIGNS

Involving other ratios, variations betweeen the individual transformers, or changes in electrical parameters are welcomed by our design staff. Consult the factory for a prompt quotation based upon your requirements.

Bel Fuse manufactures a comprehensive line of pulse transformers, coils, SMD & custom magnetics. In addition to our extensive line of magnetic components we offer a complete line of standard and custom delay lines and fuses.

Specifications Subject To Change Without Notice

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HIGH ISOLATION TRANSFORMERS FOR TOKEN RING APPLICATIONS

- IEEE 802.5 token ring compatible
- Single and dual transformer packages: low profile
- High isolation voltage to comply with international safety requirements for lan's: 1000 volts minimum!
- Designed for token ring applications

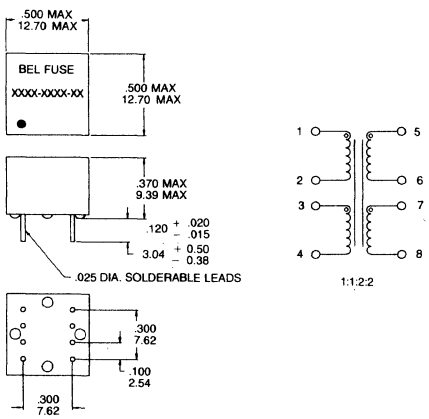
RATINGS: ALL TRANSFORMERS

Turns Ratio	Insertion Loss	CMRR	Return Loss	Rise Time	HYPOT
1:1:2:2	0.50 dB Max.	– 60 dB Min.	20 dB Min.	15 ns Max.	1000V-RMS

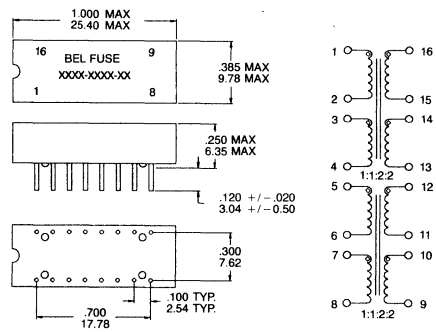
TABLE OF ELECTRICAL SPECIFICATIONS @ 25°C.

Part Number 0553-	Primary OCL (μh typ)	Primary LL (μh max.)	Pri-Sec CW/W (pf max.)	DCR (ohms max.) Pri	DCR (ohms max.) Sec
5006-KK	500	0.25	10	0.40	0.80
5006-KL	500	0.25	10	0.40	0.80

PACKAGE K



PACKAGE L



HIGH FREQUENCY ISOLATION TRANSFORMERS

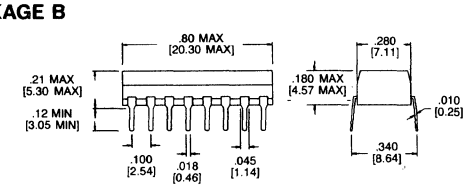
ETHERNET/LAN NETWORKING APPLICATIONS

- IEEE 802.3 compatible (10BASE2 & 10BASE5)
- High temperature suitable (0° to 70°C. operable)
- Custom designs available
- Low profile 14 and 16 pin styles available for autoinsertion
- Cost effective triad packaging
- Fast rise times — efficient operation
- All packages comply with international safety requirements for Lans; including 2,000V RMS isolation
- Suitable for high frequency applications

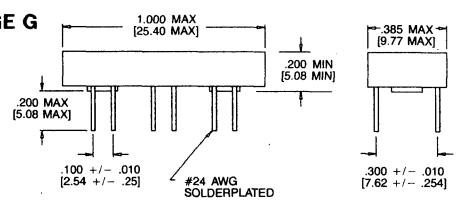
TABLE OF ELECTRICAL SPECIFICATIONS @ 25°C.

Part Number 0553-	Turns Ratio (±5%)	OCL. (μh±20%)	ET Constant (V-μs min.)	Rise Time (ns max.)	CW/W (pf max.)	LL (μh max.)	DCR (ohms max.)
0306-A( )	1:1	30	1.8	3.0	8.0	0.20	0.20
0356-A( )	1:1	35	1.8	3.0	9.0	0.20	0.20
0506-A( )	1:1	50	2.1	3.0	10.0	0.20	0.20
0756-A( )	1:1	75	2.1	3.0	10.0	0.20	0.25
0806-A( )	1:1	80	2.1	3.0	10.0	0.20	0.25
1006-A( )	1:1	100	2.1	3.5	10.0	0.20	0.25
1506-A( )	1:1	150	3.0	3.5	12.0	0.25	0.30
2506-A( )	1:1	250	3.5	3.5	15.0	0.25	0.40

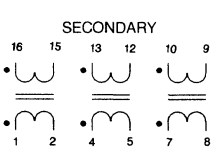
PACKAGE B



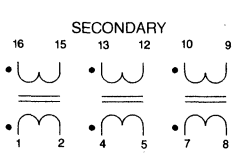
PACKAGE G



PINOUTS FOR 16 PIN PKG.



PINOUTS FOR 12 PIN PKG.



Specifications Subject To Change Without Notice

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HIGH ISOLATION TRANSFORMERS FOR TOKEN RING APPLICATIONS

- IEEE 802.5 TOKEN RING COMPATIBLE
- SINGLE AND DUAL TRANSFORMER PACKAGES: LOW PROFILE
- HIGH ISOLATION VOLTAGE TO COMPLY WITH INTERNATIONAL SAFETY REQUIREMENTS FOR LAN'S: 1000 VOLTS MINIMUM!
- DESIGNED FOR TOKEN RING APPLICATIONS

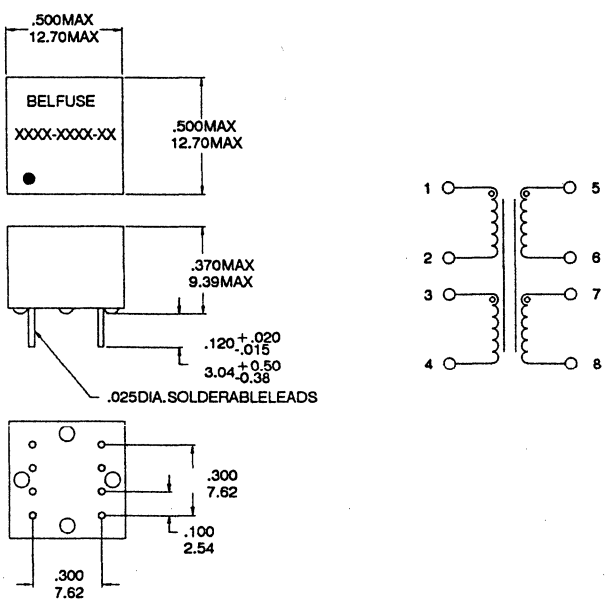
RATINGS: ALL TRANSFORMERS

TURNS RATIO	INSERTION LOSS	CMRR	RETURN LOSS	RISE TIME	HYPOT
1:1:2:2	0.50 dB Max.	−60 dB Min.	20 dB Min.	15 ns Max.	1000V-RMS

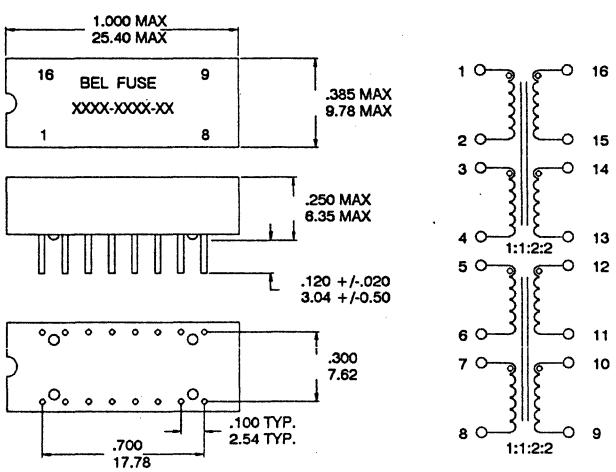
TABLE OF ELECTRICAL SPECIFICATIONS @ 25°C.

Part Number 0553-	Primary OCL (μh typ)	Primary L_L (μh max.)	Pri-Sec $C_{w/w}$ (pf max.)	DCR Pri (ohms max.)	DCR Sec (ohms max.)
5006-KK	500	0.25	10	0.40	0.80
5006-KL	500	0.25	10	0.40	0.80

PACKAGE K



PACKAGE L



Specification Subject To Change Without Notice

BEL FUSE INC./198 VAN VORST STREET/JERSEY CITY, NJ 07302 (201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

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TOKEN RING MAGNETICS COMMON MODE CHOKES

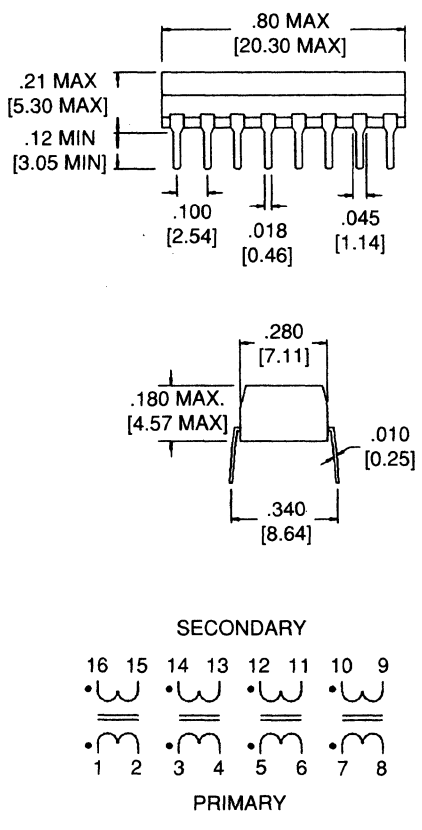
- Low Insertion Loss Over Wide Frequency Ranges (1 MHz - 32 MHz)
- Autoinsertable Packaging Available
- High Isolation To Meet International Requirements
- UTP / STP Applications
- Common Mode Chokes Available
- Single Packages Including Impedance Matching Transformers, Filtering And Common Mode Chokes

Electrical Data At 25°C

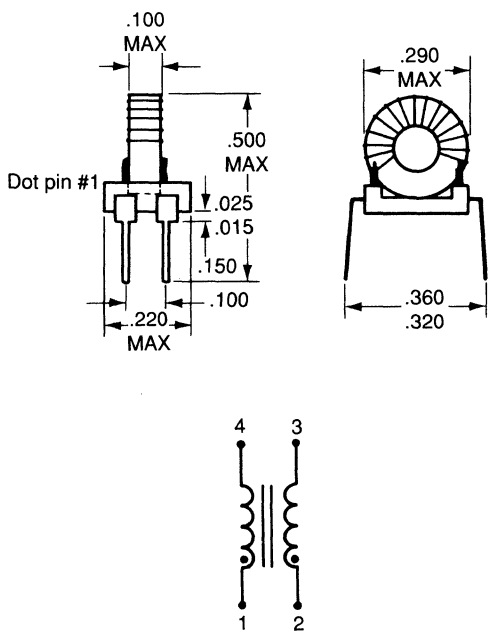
Part Number	Turns Ratio (±5%)	PRI OCL (Typ) (UH)	Leakage IND (Max) (UH)	CW/W (PRI/SEC) (Max) (PFd)	DCR (PRI/SEC) (Max) (Ohms)	Package Style
0555-5999-04	1:1	110	0.10	10	.3/.3	OO
A555-1006-AF	1:1	110	0.10	10	.3/.3	F

Notes: 1. OCL Measured At 100 KHz and 20 mV.
2. Isolation Voltage 500 Vrms 1 Minute - All Parts

F Package



OO Package



Why 201-694-5000 is the number to call for custom transformers.

Our 25 years' experience brings you fast, accurate solutions to tough transformer application problems. Power range from 10 VA to 300 kVA.

If you need a single special transformer with unusual requirements, we'll build it, and deliver it to you as promised. And if you need moderate to OEM quantities, call us too—we'll fit our schedule to your schedule.

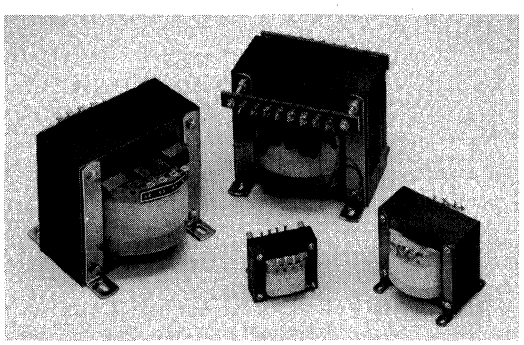
As you can see from the photos, our typical models cover a wide range. Call us. Our design and engineering expertise is ready to help you.

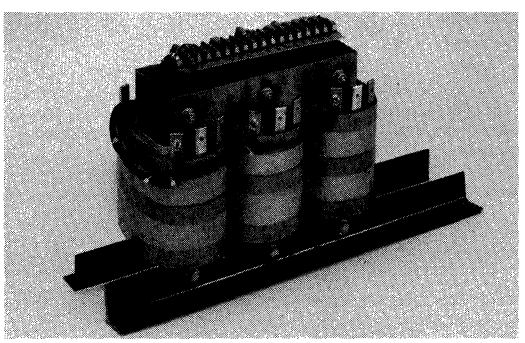
Meeting military specs (T-27D, T-16315, E-917C, and others) is as routine for us as building to UL, VDE, CSA, and other international standards.

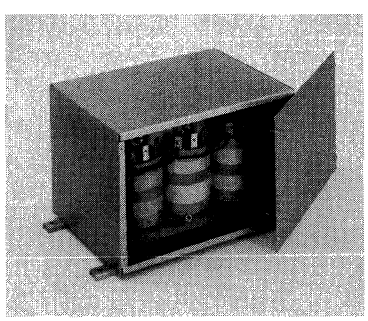
- 50/60/400 Hz and higher
- 48-hour turnaround on prototypes
- Fast rebuild of large transformers
- No order too small, or too large
- Design services available

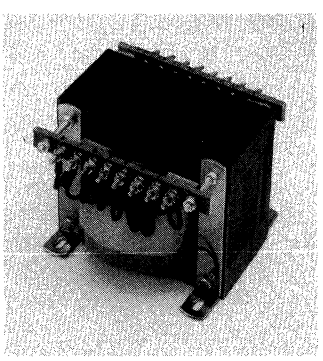
- Open-type
- Enclosed
- Encapsulated
- Hermetic

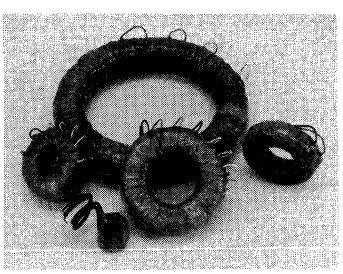
- Power transformers
- Current transformers
- Toroids
- High frequency
- Constant voltage











Bey Electric, Inc. • 362 Main Street, PO Box 548,
Lincoln Park, New Jersey 07035 • 201-694-5000
FAX 201-694-7975

Bey
BEY ELECTRIC

8441

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

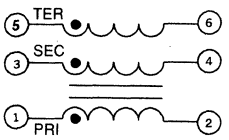
BH Electronics

General Purpose Pulse Transformers

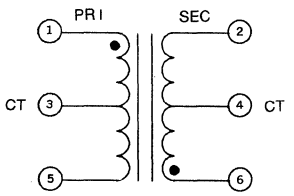
- **Designed for a Wide Variety of Low Power Applications**
- **PC Board Mounting**
- **Surface Mount Available**
- **500 VDC Hi-Pot**

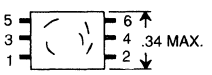
BH Part Number	Turns Ratio (±5%)	Primary Sine Wave Loc (μ H Min.)	Primary Et-Constant (Vμ Sec. Min.)	Pri./Sec. Cw/w (pf Max.)	Pri./Sec. Leakage Inductance (μ H Max.)	Primary DCR (Ohms Max.)	Secondary DCR (Ohms Max.)	Tertiary DCR (Ohms Max.)	Schematic Style
500-1300	1:1:1	5000	25.0	60	1.3	1.5	1.5	1.5	A
500-1301	1:1:1	2000	16.0	37	0.8	1.0	1.0	1.0	A
500-1302	1:1:1	500	8.5	30	0.4	1.0	1.0	1.0	A
500-1303	1:1:1	200	5.0	18	0.3	0.9	0.9	0.9	A
500-1304	1:1:1	50	5.2	18	0.5	0.5	0.5	0.5	A
500-1305	1:1:1	20	3.2	21	0.4	0.2	0.2	0.2	A
500-1306	1:1:1	10	3.7	22	0.5	0.1	0.1	0.1	A
500-1307	2:1:1	5000	25.0	33	3.6	1.0	1.0	1.0	A
500-1308	2:1:1	2000	16.0	19	1.8	0.5	0.5	1.0	A
500-1309	2:1:1	500	8.5	11	1.1	1.0	0.7	0.7	A
500-1310	2:1:1	200	5.0	8	0.8	0.9	0.5	0.5	A
500-1311	2:1:1	20	5.8	12	1.5	1.0	0.5	0.5	A
500-1312	3:1:1	200	5.0	7	1.1	0.9	0.4	0.4	A
500-1313	3:1:1	20	3.2	6	1.3	0.9	0.4	0.4	A
500-1314	4:2:1	2000	16.0	20	2.5	2.5	1.4	0.8	A
500-1315	4:2:1	500	8.5	13	0.9	1.0	0.8	0.5	A
500-1316	4:2:1	200	5.0	8	0.8	0.9	0.5	0.4	A
500-1317	1CT:1CT	2000	16.0	37	0.8	2.0	2.0	—	B
500-1318	1CT:1CT	500	8.5	32	0.4	1.0	1.0	—	B
500-1319	1CT:1CT	200	5.0	18	0.3	0.5	0.5	—	B
500-1320	1CT:1CT	50	5.2	18	0.5	1.0	1.0	—	B
500-1321	1CT:1CT	20	3.2	21	0.4	0.9	0.9	—	B
500-1322	1CT:1CT	10	3.7	22	0.5	0.9	0.9	—	B
500-1323	2CT:1CT	2000	16.0	19	1.8	1.0	0.5	—	B
500-1324	2CT:1CT	500	8.5	12	1.2	1.0	0.5	—	B
500-1325	2CT:1CT	200	5.0	8	0.8	0.9	0.5	—	B
500-1326	2CT:1CT	50	5.2	12	1.3	1.3	0.7	—	B
500-1327	2CT:1CT	20	5.8	12	1.5	1.0	0.5	—	B
500-1328	2CT:1CT	10	3.7	9	1.5	0.9	0.5	—	B

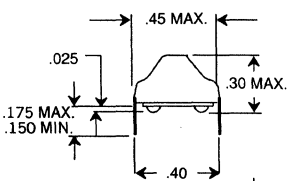
SCHEMATIC A

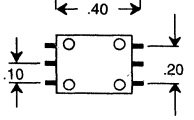


SCHEMATIC B



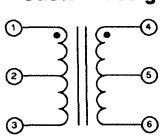




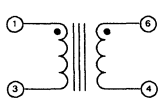


Balun Transformers

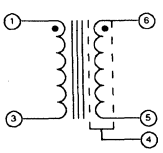
- **Designed for impedance matching of high speed data lines.**
- **Some models center tapped for balanced to unbalanced conversion.**
- **500 Volt DC isolation—models with higher voltages available.**
- **Created to match the specific waveforms of most popular networks.**
- **Call us for detailed engineering design assistance.**
- **Custom designs available.**



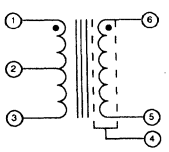
SCHEMATIC 1



SCHEMATIC 2



SCHEMATIC 3



SCHEMATIC 4

PART NUMBER	IMPEDANCE MATCHED	PRIMARY INDUCTANCE	CIW (MAX.)	SCHEMATIC	FIGURE
500-1318	100Ω CT TO 100Ω CT	.500 μ H MIN.	32*pf*	1	1
500-1349	50Ω CT TO 100Ω CT	450 μ H MIN.	60*pf*	1	1
500-1430	92Ω TO 150Ω	2.8 μ H MIN.	50*pf*	2	1
500-1480	92Ω TO 110Ω	4.2 μ H MIN.	45*pf*	2	1
500-1483	78Ω TO 150Ω	20 μ H MIN.	5*pf*	3	3
500-1484	110Ω TO 150Ω	3.0 μ H MIN.	50*pf*	2	1
500-1481	78Ω TO 100Ω	2.2 μ H MIN.	250*pf*	1	2
500-1637	78Ω CT TO 78Ω	20 m H MIN.	5*pf*	4	3

500 V_{DC} Isolation Voltage on all parts. Higher ratings by request.
DC Resistance < 2.0 ohms on all parts.

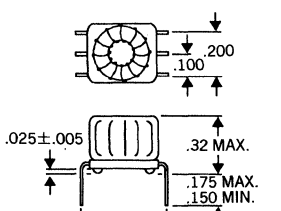
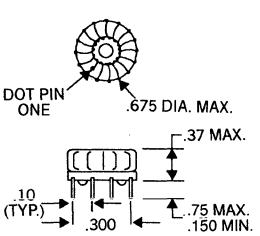


FIGURE 1



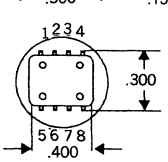
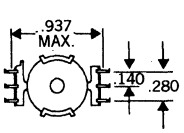


FIGURE 2



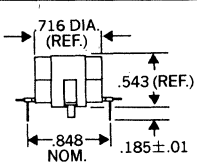




FIGURE 3

BH Electronics BH Electronics, Inc., 12219 Wood Lake Drive, Burnsville, MN 55337, (612) 894-9590

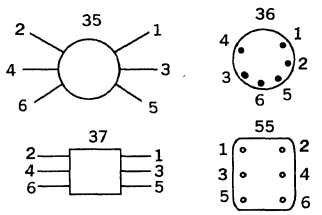
BH Electronics

Series 505 SCR Trigger Transformer

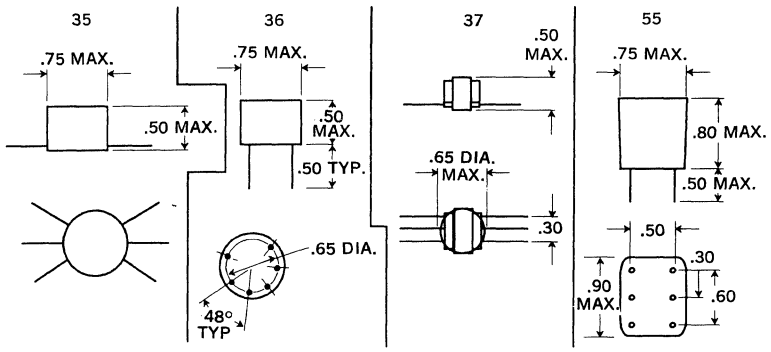
- **Four Case Styles**
- **1600 or 2500 VRMS Isolation**
- **Tinned Copper Leads**
- **Low Ciw To Prevent False Triggering**
- **PC Mountable with 20 AWG Leads**
- **Order by Part Number 505-**

STANDARD CASE STYLES

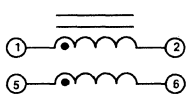
Case No.	Isolation Voltage	Temperature Range	Encapsulated
35	1600 VRMS @ 60Hz	−10° C to 70° C	Yes
36	1600 VRMS @ 60Hz	0° C to 60° C	Yes
37	1600 VRMS @ 60Hz	0° C to 60° C	No
55	2500 VRMS @ 60Hz	0° C to 60° C	Yes



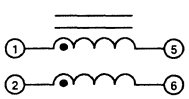
ALL STYLES ARE BOTTOM VIEW



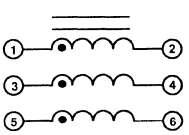
SCHEMATICS



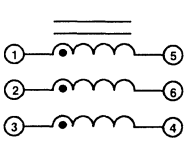
SCHEMATIC A
Pins 3 & 4 Removed



SCHEMATIC B
Pins 3 & 4 Removed



SCHEMATIC C



SCHEMATIC D

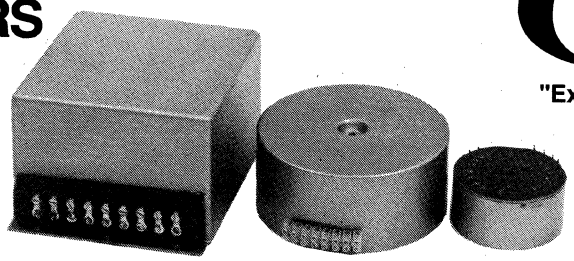
Electrical Parameter Number	Turns Ratio	Primary Inductance (mH-Min.)	Primary Et Constant (V μ Sec Min)	Leakage Inductance (μ H Max.)	Interwinding Capacitance (pf Max.)	DCR Pri. Ω Max	DCR Sec. Ω Max	DCR Ter Ω Max	Schematic Style
505- 00	1:1	.25	45	5	20	1.0	1.0	N/A	A
505- 01	1:1	1.0	90	20	30	2.0	2.0	N/A	A
505- 02	1:1	5.0	180	45	30	3.0	3.0	N/A	A
505- 03	1.1	20.0	360	45	50	5.0	5.0	N/A	A
505- 04	1:1:1	.25	45	5	20	1.0	1.0	1.0	C
505- 05	1:1:1	1.0	90	20	30	2.0	2.0	2.0	C
505- 06	1:1:1	5.0	180	45	30	3.0	3.0	3.0	C
505-5507	1:1:1	20.0	360	75	50	3.0	3.0	3.0	C
505- 08	2:1	1.0	90	40	30	2.0	1.0	N/A	A
505- 09	2:1	5.0	180	40	30	3.0	2.0	N/A	A
505- 10	2:1:1	1.0	90	40	30	2.0	1.0	1.0	C
505- 11	2:1:1	5.0	180	60	30	3.0	2.0	2.0	C
505- 12	5:1	20.0	360	200	50	5.0	2.0	N/A	A
505- 13	5:1:1	20.0	360	200	50	5.0	2.0	2.0	C
505-5570	1:1	.25	45	5	20	1.0	1.0	N/A	B
505-5571	1:1:1	.25	45	5	20	1.0	1.0	1.0	D
505-5572	1:1	1.0	90	20	30	2.0	2.0	N/A	B
505-5573	1:1:1	1.0	90	20	30	2.0	2.0	2.0	D
505-5574	1:1	5.0	180	45	30	3.0	3.0	N/A	B
505-5575	1:1:1	5.0	180	45	30	3.0	3.0	3.0	D
505-5576	1:1	20.0	360	45	50	5.0	5.0	N/A	B
505-5577	1:1:1	20.0	360	75	50	3.0	3.0	3.0	D
505-5578	2:1	1.0	90	40	30	2.0	1.0	N/A	B
505-5579	2:1:1	1.0	90	60	30	2.0	1.0	1.0	D
505-5580	2:1	5.0	180	40	30	3.0	2.0	N/A	B
505-5581	2:1:1	5.0	180	45	30	3.0	2.0	2.0	D
505-5582	2:1	20.0	360	200	75	5.0	3.0	N/A	B
505-5583	2:1:1	20.0	360	200	75	3.0	2.0	2.0	D
505-5584	5:1	20.0	360	200	50	5.0	2.0	N/A	B
505-5585	5:1:1	20.0	360	200	50	5.0	2.0	2.0	D

TOROIDAL POWER TRANSFORMERS

INFORMATION

BICRON™

"Excellence Through Teamwork"



Type 4 Mounting
Available in a Variety of Sizes, Mountings and Terminations.

IMPORTANT ADVANTAGES FOR YOUR PRODUCT

VERY HIGH EFFICIENCY
(between 85-97%)

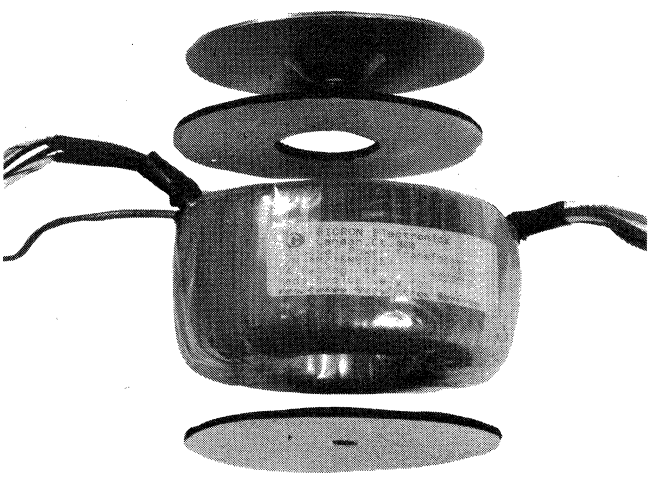
LIGHTWEIGHT
(1 KVA weighs 16 lbs.)

SMALL SIZE
(.6 KVA is 5.7 X 3.2)

LOW STRAY FIELDS
(.5 Gauss @ 1 inch attainable)

SILENT OPERATION
(<10db)

UL RECOGNIZED
(UL 478, UL 544, UL1411)



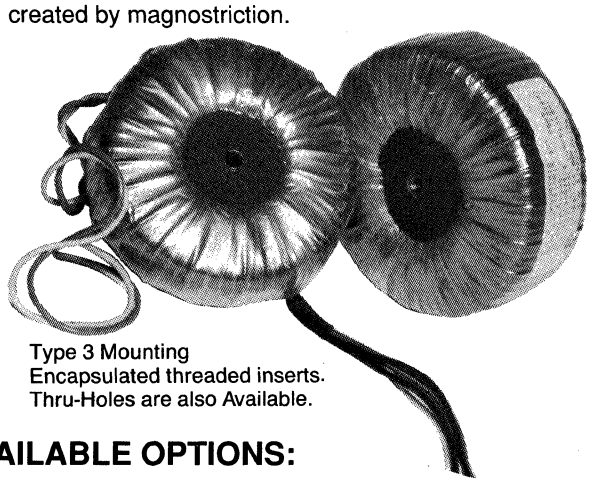
Standard Configuration Type 2
Shown above is the Standard Method of Mounting. Transformers can be supplied with out steel washer and insulating pads (specify Type 1).

The Company

BICRON ELECTRONICS was founded in 1964 as a manufacturer of custom magnetic components for military and industrial markets. The product mix expanded to encompass TOROIDAL POWER TRANSFORMERS, CURRENT TRANSFORMERS, SPECIALITY MAGNETICS and SOLENOIDS. Our customer base includes fortune 500 companies such as GE, Westinghouse, Motorola, Lucas, with whom we have long standing relationships. Our ISO 9001 Quality System has enabled us to be certified by numerous customers. BICRON employs over 120 people in facilities occupying 30,000 sq. ft. on 8.5 acres.

IMPORTANT

Toroidal transformers are the next best answer to the ideal conception of a power transformer. The compactness of the rolled core utilizing high quality silicon iron, grain oriented steel provide maximized magnetic efficiency. The large surface areas allow excellent heat transfer for the windings while minimizing the length of wire per turn. The magnetic flux flows along the magnetically oriented grains of the toroid core, without stray force lines, due to the closed field and lack of air gaps. The tightly wound core surrounded by wire and insulation confine the audible hum created by magnostriction.



Type 3 Mounting
Encapsulated threaded inserts.
Thru-Holes are also Available.

AVAILABLE OPTIONS:

- **MOUNTING**
  Tie-Wrap * Washer/Insulators * Bolt-Mount * Moulded-In Threaded-Insert * Encapsulated with Leads, PC pins, or Terminal Blocks.
- **SHIELDING**
  Faraday shielding between primary and secondary and/or secondary and secondary
  Magnetic shielding around the circumference or totally encompassing the transformer
- **AGENCY GUIDELINES**
  Transformers are manufactured to meet standard UL, CSA, IEC, VDE and other international specifications

FREE LITERATURE AVAILABLE

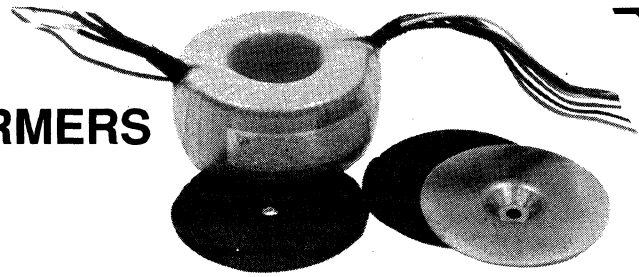
Toroidal Transformers
Application and Design Notes
Specification Guidelines

FOR TECHNICAL ASSISTANCE

CALL **203/824-5125**
FAX **203/824-1137**

Data subject to change without notice.

TOROIDAL POWER TRANSFORMERS



BICRON™

"Excellence Through Teamwork"

"Modified Standard" Part of Bicron's commitment to you.

Dimensional Flexibility

Toroids are easily adapted to your space requirements. They typically require 50% less weight and volume of conventional transformers. Toroids are ideal where space is important. Ratios of diameter to height range from 1.5:1 to 8:1, and there are no tooling costs for customized dimensions.

Power Rating VA	Dimensions Od." X Ht."	Weight Lbs.	Power Rating VA	Dimensions Od." X Ht."	Weight Lbs.
20/24	2.7 X 1.3	.8	530/640	5.7 X 2.9	9.8
40/48	3.5 X 1.3	1.5	600/720	5.7 X 3.2	11.0
60/72	3.5 X 1.6	1.9	750/900	6.3 X 3.1	13.0
80/96	4.2 X 1.5	2.1	1000/1200	6.3 X 3.7	16.0
100/120	4.2 X 1.7	2.3	1200/1440	6.3 X 4.4	18.0
160/200	4.7 X 1.7	3.1	1500/1800	7.9 X 3.5	21.0
230/275	4.7 X 2.2	5.5	2000/2400	7.9 X 4.1	28.0
330/400	4.8 X 2.7	6.8	2500/3000	8.7 X 4.7	33.0
400/480	5.7 X 2.3	7.5	3000/3600	8.7 X 4.8	36.0

NOTE: Dimensions are for reference only and will vary depending on type of mounting, insulation requirements, and options. Please consult factory.

Infinite Configurations

To meet all your requirements, BICRON supplies transformers constructed to your specifications. Which means: Primaries having a multiplicity of taps and/or multiple primaries to provide you the capability to interface with world wide power sources; Secondaries having a multiplicity of windings and taps, each to your specified voltage and current.

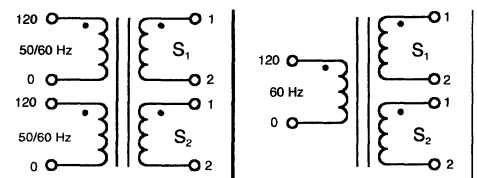
In the unlikely event the toroid causes magnetic interference with your circuitry or displays, additional shielding is available in the form of perimeter shielding or encapsulated transformers in steel enclosures. Either method is very economical.

Should you require reduced interwinding capacitance and improved common mode rejection, a faraday shield can be installed between windings.

MODIFIED STANDARDS are constructed to your requirements; and because BICRON has UL product recognition, your transformer will be labeled to UL 478, UL 544, or UL 1411 and will meet CSA, IEC, VDE depending on your application.

Standard Product Toroidal Power Transformers

Multi-Purpose Toroidal Power Transformers UL 478 Recognized



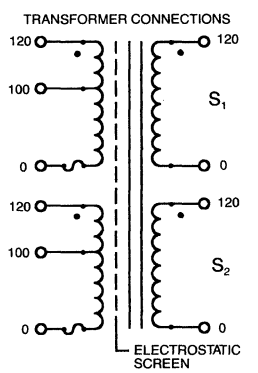
Power Rating	Part Number	Power Rating	Part Number	Designation ... = Vrms
				006 = 6
20 VA	AU202AD...D	24 VA	BU202AS...D	009 = 9
40 VA	AU204AD...D	48 VA	BU204AS...D	012 = 12
80 VA	AU208AD...D	96 VA	BU208AS...D	018 = 18
100 VA	AU210AD...D	120 VA	BU210AS...D	024 = 24
160 VA	AU216AD...D	200 VA	BU216AS...D	030 = 30
230 VA	AU223AD...D	275 VA	BU223AS...D	036 = 36
330 VA	AU233AD...D	400 VA	BU233AS...D	040 = 40
530 VA	AU253AD...D	640 VA	BU253AS...D	048 = 48
750 VA	AU275AD...D	900 VA	BU275AS...D	060 = 60
1.0KVA	AU21A0D...D	1.2KVA	BU21A0S...D	072 = 72
1.5KVA	AU21A5D...D	1.8KVA	BU21A5S...D	090 = 90
2.0KVA	AU22A0D...D	2.4KVA	BU22A0S...D	120 = 120

Specifications:

- Vrms equals secondary voltage at full load each winding
- Dielectric strength 2500 Vrms, primary to secondary
- Max. transformer operating temperature 265° F
- Max. temperature rise at rated power 150° F
- Type 2 mounting style: 2 insulating pads, 1 metal disk

Isolation Transformers for Medical Equipment UL 544 Recognized

Power Rating	Part Number
100 VA	AM210AD120S
230 VA	AM223AD120S
400 VA	AM240AD120S
600 VA	AM260AD120S
750 VA	AM375AD120S
1.0KVA	AM31A0D120D
1.5KVA	AM31A5D120D
2.0KVA	AM32A0D120D
2.5KVA	AM32A5D120D
3.0KVA	AM33A0D120D



Specifications:

- 100,120,200,220,240 Vrms, 50/60 Hz operation
- Max. transformer operating temperature 265° F
- Max. temperature rise at rated power 150° F
- Max. leakage current less than 50 uA.
- Winding S2 not supplied with power rating less than 1KVA.
- Dielectric strength 4000 Vrms, primary to secondary

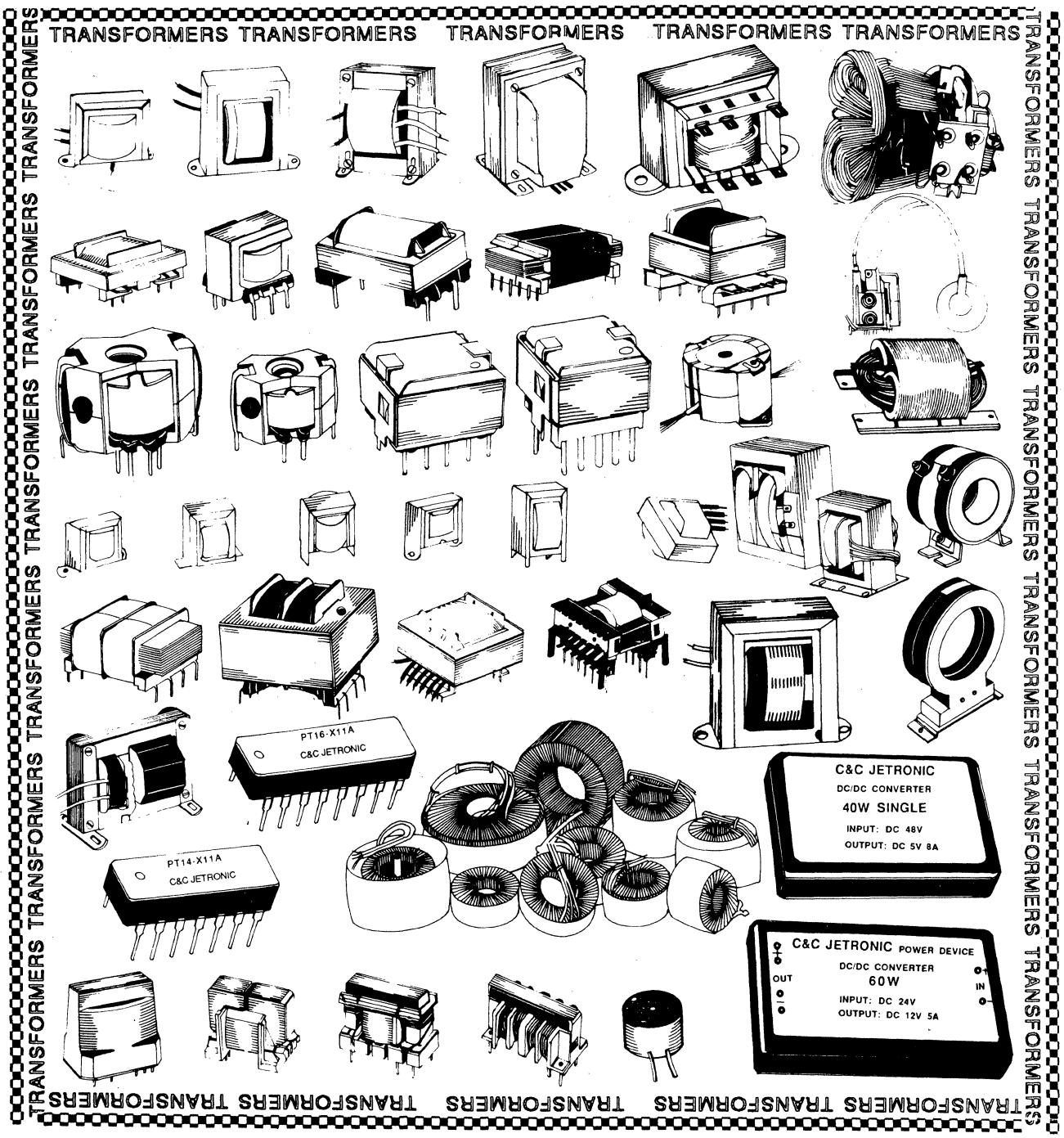
Bicron Electronics Co.

50 Barlow Street
Canaan, CT 06018

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C&C JETRONIC, INC.

CUSTOM TRANSFORMERS

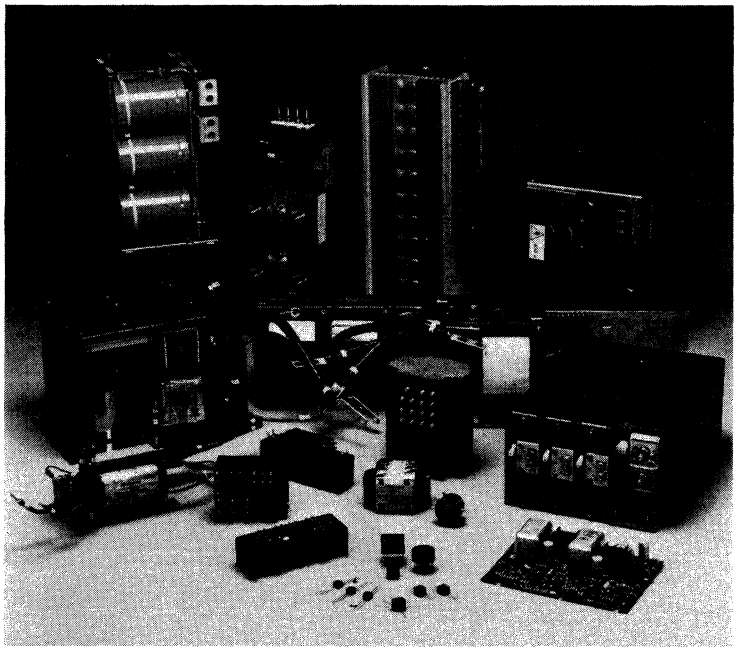


TRANSFORMER TYPES

- -ADAPTORS
- -AUDIO
- -CURRENT SENSING
- -DC.DC CONVERTERS
- -DEFLECTION YOKE
- -DELAY LINES
- -DRIVER & SWITCHMODE
- -FILTER CHOKES & RECTIFIER
- -FLYBACK
- -HIGH VOLTAGE
- -ISOLATION FOR LANS
- -MATCHING
- -P.C.BOARD MOUNT
- -POWER
- -PULSE
- -R CORE
- -STEP UP & DOWN
- -TELEPHONE & COMMUNICATION
- -TERMINAL POWER
- -TOROIDAL POWER

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Chloride-Electro Networks

•Military Transformers
•Commercial Transformers
•Commercial Power Supplies

Chloride-Electro Networks: The Experience and Capabilities to Design and Build Magnetics and Power Supplies for Custom Applications.

Our Markets

Whether it's military or a commercial application, Chloride Electro Networks has the design expertise and the manufacturing skill. For over 40 years, we have designed and built State-of-the-Art magnetic components and power supply assemblies for a wide variety of applications. Our design skill is utilized for the following applications.

•Avionics Computers
•Missile and Torpedo Systems
•Radar Signal Generation •Sonar
•Airborne Surveillance
•Electronic Countermeasures
•C3I
•Navigation Systems
•Signal Data Acquisition Systems
•Main Frame Computers
•Minicomputers
•Copier and Office Products
•Computer Peripherals
•Industrial Computer Control Systems
•Transport Systems
•Telecommunications
•Space Applications

Manufacturing Capabilities

Chloride Electro Networks has the resources to support your critical production needs. Our manufacturing operation performs to the highest standard in the industry.

Our capabilities include:

•Facility: 140,000 square feet of efficient manufacturing space located just south of Rochester, NY.
•Quality: Statistical Process Control has been implemented on a plant wide basis, assuring all quality standards are achieved. Our facility routinely works to MIL-STD-9858A and MIL-I-45208A.
•MIL-STD-2000: We are a Certified Supplier of Military Magnetics, produced to the exacting MIL STD-2000 Soldering Workmanship Standards.
•Winding: State-of-the-Art technologies are in place to support the most demanding application.
•Vacuum Impregnation: Route vacuum/pressure impregnation and molding operations which meet Grade 4, 5, and 6 standards per MIL-T-27.
•Test Facilities: Extensive, in-house thermal shock, humidity, and burn-in capabilities to assure our product can meet the most demanding environmental specifications.

Engineering by Design

Chloride has the expertise to solve your design problems. The strength of the design community at Chloride is a combination of our skill in dealing with engineering intensive applications and our commitment to work together with our customer to achieve the design goals.

As an illustration of the breadth of Chloride's design capabilities, the following list indicates some of the product types we have worked with:

•50/60/400Hz Linear and Ferroresonant Transformers and Power supplies.
•Power Transformers for use in all power supply topologies including MHz resonant applications.
•High Voltage transformers capable of withstanding 20,000 Volts.
•Complex output inductor assemblies for single or multiple output power supplies. Our capabilities include both high current and high voltage design expertise.
•Custom and Build-to-Print design of Switching Power Supplies and assemblies for commercial applications.
•Encapsulated technologies for application in the most demanding military applications.

Chloride Electro Networks is your total source for highly engineered military magnetics. Please contact us for further information regarding our ability to meet your magnetic and power supply needs.

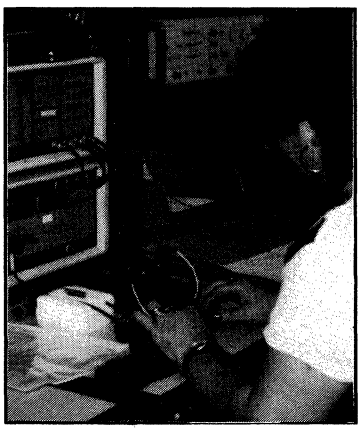
CHLORIDE® **Chloride Electro Networks**, a division of Chloride Power Electronics Incorporated
One Technology Place, Caledonia, New York 14423 716 538-4421 FAX 716 538-6345

TRANSFORMERS TOROIDS BALUNS

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- ASSURED RELIABILITY
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- TIMELY DELIVERY
- MANUFACTURED TO SPEC.

COMMUNICATION COIL INC. has been designing and producing high reliability Power Magnetics since 1944... to high exacting standards for communications, filters, and power supplies in military, avionics, satellite, telemetry, marine, GPS and commercial applications.

Using the latest CAE and CAD technology our engineers use patented and proprietary synthesis software to perform complete simulations of your unique design requirements. Our optimization system enables us to rapidly produce reliable up-to-date designs. We will custom design **power magnetics** to meet your exacting requirements. Our Toroids, SMPS transformers, Inductors, Chokes and Baluns utilize the state-of-the-art high permeability magnetic materials required for tomorrows needs.

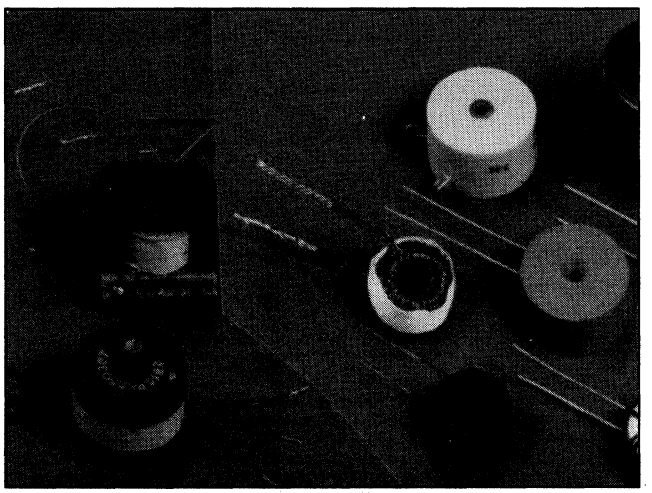


Each and every unit is 100% parametric tested. Our ultra-modern computerized **magnetics** testing equipment can provide complete data on each part, if desired. Complete lot traceability is standard.

Our award-winning quality control program is approved by major customers world-wide.

Our **power magnetics** are designed and manufactured in Chicago, IL U.S.A. to meet rigid global marketplace demands.

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- CURRENT SENSE
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- MIL-C-15305
- MIL-Q-9858A
- BOBBIN CORE
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- ENCAPSULATED
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- MINI-TOROIDAL
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- SUB-MINIATURE
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...BALUNS, COILS, CHOKES, INDUCTORS, TOROIDS, FILTERS, TRANSFORMERS...

Cramer

Coil and Transformer, Co., Inc.

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■ Knowledge.

Our design staff specializes in switchmode, linear and custom magnetics development and problem solving.

■ Responsiveness.

We offer samples in two weeks - at no charge. We stock to build any cataloged magnetic in prototype and production quantities.

■ Standardization.

Your requirements can be met with industry standard materials.

■ Experience.

Cramer has twenty-seven years in the coil-winding business.

Switching Magnetics

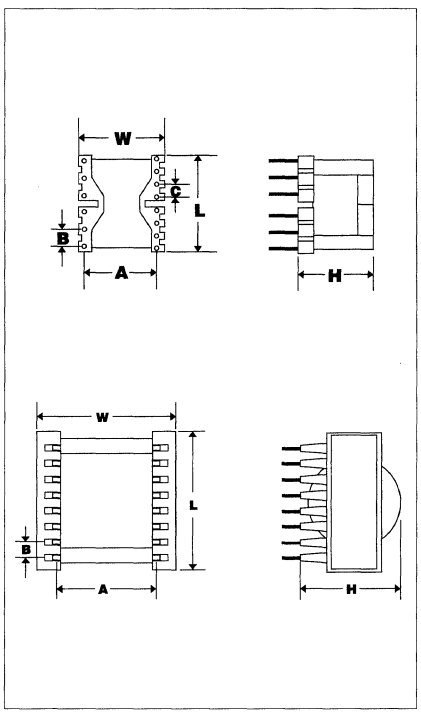
CSM Series Switchmode Power Transformers

The CSM series offers common building blocks for use as switchmode power transformers.

The materials utilized by this series offer high inductance and negative core loss tendencies versus temperature (to 80° C). This means reduced transformer size for modern switchmode supplies. CSM Series transformers are designed for use in all switching topologies (Forward, Flyback, Push-Pull, Bridge and Half-Bridge).

The power output ratings listed on this page are based on a forward converter operating at 50 KHz, 48% duty cycle, 50° C ambient temperature, and 1500 volt hipot. Within these conditions the flyback topology reduces power output by 20% or greater.

Safety agencies include V.D.E., I.E.C., C.S.A. and U.L. Most designs are constructed to Underwriters Laboratories, Inc. recognized Class 130(B) electrical insulation system (OBJY2), file #E110339.



Table

P Out	L	W	H	A	B	C	#P
30	0.92	0.92	0.85	0.80	.15	.10	14
40	0.92	0.92	1.00	0.80	.15	.10	14
70	1.10	1.20	1.10	1.00	.15	-	12
80	1.10	1.20	1.20	1.00	.15	-	12
100	1.30	1.40	1.10	1.20	.20	-	12
150	1.30	1.40	1.50	1.20	.20	-	12
200	1.40	1.60	1.60	1.40	.20	-	12
300	1.60	1.70	1.80	1.50	.20	-	12
400	2.10	2.10	2.10	1.80	.20	-	12
100	1.80	1.60	1.40	1.00	.20	-	14
200	1.90	1.80	1.50	1.20	.20	-	16
400	2.10	2.00	1.70	1.40	.20	-	18
600	2.30	2.20	1.60	1.80	.20	-	20

CVTI Series Toroidal Power Inductors

CVTI Inductors can be manufactured to any inductance, limited by energy storage rating and the amount of change required. They can be supplied self-leaded PC mountable or on standard toroid mounts. Cramer uses custom software to quickly determine turns, wire size, percent of change and temperature rise.

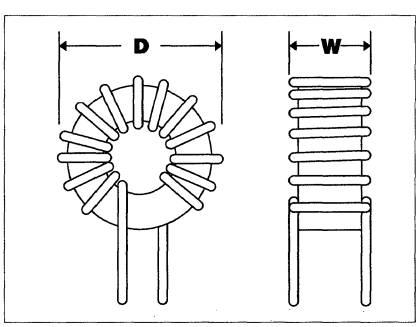


Table *Maximum Energy Storage

D	W	M.E.S.*	AL	NI
.9	.4	475	450	200
1.2	.6	1500	900	300
1.4	.6	2200	785	330
1.7	.7	3800	970	400
2.0	.9	8000	1640	440

Quality Custom Magnetics - Made in the U.S.A.

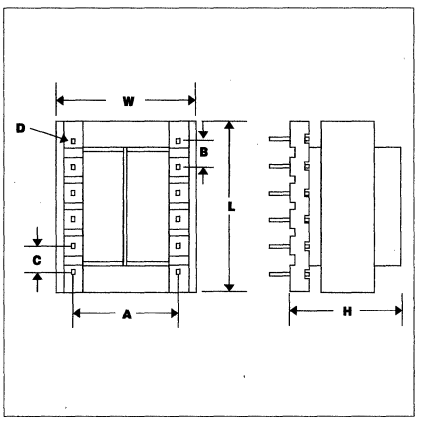
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Coil and Transformer, Co., Inc.

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Linear Magnetics

CHPT Series Power Transformers

Our most economical and versatile linear power tranformers feature low capacitive coupling and 2500 VAC dielectric. Six pins per side allow for multiple primaries either series/parallel or multiple tapped, limited to 480 volts. The secondaries are supplied series/parallel, 3 isolated or 2 isolated centertapped. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**



Table

VA	L	W	H	A	B	C	D
2.0	1.4	1.25	1.15	.87	.15	.20	.036
4.4	1.65	1.38	1.18	.95	.20	.25	.025
10.	1.9	1.58	1.38	1.1	.20	.30	.025
20.	2.3	1.8	1.58	1.3	.20	.30	.025
25.	2.3	1.8	1.82	1.3	.20	.30	.025

CIPT Series International Power Transformers

Constructed to meet International safety specifications, the CIPT series offers low capacitive coupling and a standard 4000 volt hipot. PC and chassis mount styles are available. Multiple primaries are supplied in series/parallel or series tapped configurations, limited to 480 volts, and the number of available terminals or pins per side. The secondaries are supplied with series/parallel, multiple tapped or isolated configurations. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**

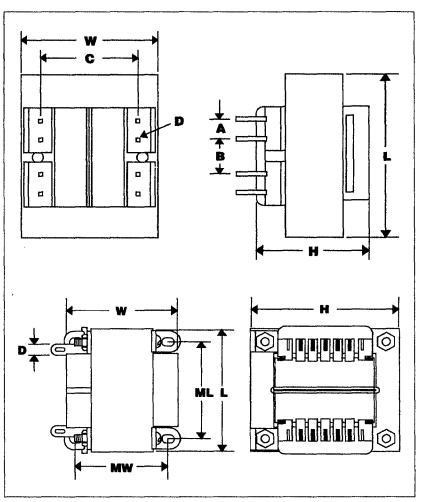


Table:

VA	L	W	H	A	B	C	D
2.5	1.63	1.31	1.13	.20	.25	1.00	.025
5	1.63	1.31	1.19	.20	.40	1.00	.025
10	1.87	1.56	1.19	.20	.40	1.14	.038
20	2.25	1.88	1.31	.40	.40	1.46	.038
25	2.81	1.88	1.31	-	-	-	.187
30	2.63	2.19	2.19	.55	.28	1.68	.045
43	3.13	2.19	2.69	-	-	-	.187
56	3.00	2.50	1.81	.60	.30	1.90	.045
80	2.50	2.38	3.00	-	-	-	.187
130	2.81	2.88	3.38	-	-	-	.250
175	3.13	2.88	3.75	-	-	-	.250

CLF Series Power Transformers

CLF chassis mount power transformers offer small size, low capacitive coupling, a standard 2500 volt hipot and .187 faston tabs for quick installation. They are supplied with single or multiple primaries. Multiple primaries are supplied in series/parallel or series tapped configurations limited to 480 volts and the 4 available lugs. Secondaries are supplied series/parallel or multiple tapped. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**

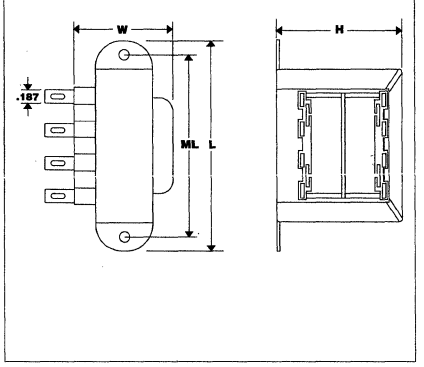


Table:

VA	L	W	H	ML
2.4	2.06	1.06	1.19	1.75
6	2.38	1.25	1.38	2.00
12	2.81	1.38	1.63	2.38
30	3.25	1.69	1.94	2.81
56	3.69	1.81	2.25	3.13
100	4.03	2.25	2.56	3.56

Quality Custom Magnetics - Made in the U.S.A.

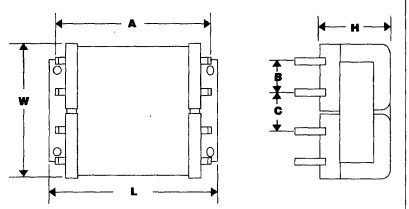
Cramer

Coil and Transformer, Co., Inc.

401 Progress Drive - Saukville, Wisconsin 53080 - (414) 377-7040 - FAX (414) 377-4028

CSPE Series Slim Pack Power Transformers

The CSPE features low profile, semi-toroidal hum bucking construction, low capacitive coupling and 2500 VAC dielectric. They are supplied with series/parallel primaries and secondaries limited to VA rating. Two isolated secondaries can be supplied when they have approximately equal VA ratings. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**



Table

VA	L	W	H	A	B	C	WT
2.5	1.87	1.56	0.65	1.60	.38	.38	.42lb
6.0	1.87	1.56	0.85	1.60	.38	.38	.58lb
12	2.50	2.00	1.07	2.00	.50	.50	.92lb
24	2.87	2.25	1.25	1.90	.60	.53	.94lb

CTFE Series Power Transformers

The CTFE series is built around cost-effective industry standard packaging. It features PC board mountability, 2500 VAC dielectric and low capacitive inductance. It can be supplied with single or multiple primaries. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**

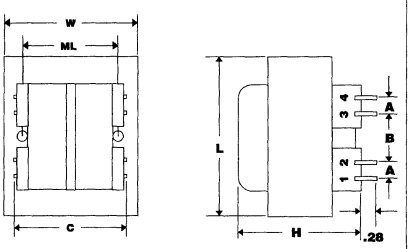
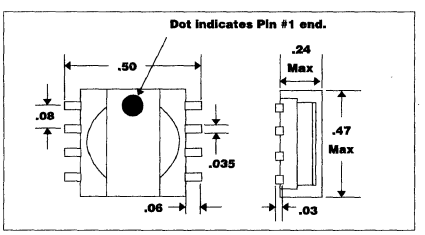


Table:

VA	L	W	H	ML	A	B	C
1.1	1.38	1.12	0.94	-	.25	.25	1.20
2.4	1.38	1.12	1.19	-	.25	.25	1.20
6.0	1.63	1.31	1.31	1.19	.25	.35	1.28
12	1.87	1.56	1.44	1.25	.30	.40	1.41
20	2.25	1.87	1.44	1.50	.30	.40	1.60
36	2.63	2.19	1.56	-	.40	.40	1.85

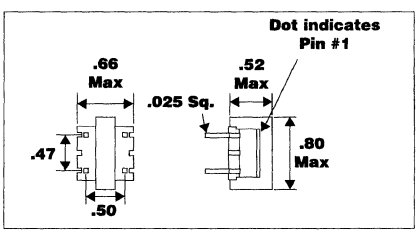
Custom and Telecommunications Magnetics

CTCT 500 Surface Mountable Modem Transformer



Impedance: Primary & Secondary - 600 Ohms each.Designed to reflect 600 Ohms on primary, with 500 ohm load on seconday.
DC Resistance: Primary: 58 ohms +/- 10%, Secondary: 72 ohms +/- 10%.
Insertion loss: 1.0 dB Max @1000 Hz.
Frequency response: 600 - 4000 Hz, +/- .5 dB, Ref. 1000 Hz.
Return Loss: 1 KHz - 20 dB Min., 600 Hz - 16 dB Min., 4 KHz - 26 dB Min.
Dielectric Strength: Primary - Secondary: 1500 Vrms.

CTCT 1104 Coupling Transformer



Impedance: Primary & Secondary - 600 Ohms each.Designed to reflect 600 Ohms on primary, with 600 ohm load on seconday.
DC Resistance: Primary: 30 ohms +/- 15%, Secondary: 40 ohms +/- 15%.
Insertion loss: 1.5 dB Max @1000 Hz.
Frequency response: 300 - 3000 Hz, +/- .5 dB, Ref. 1000 Hz.
Return Loss: 300 Hz - 20 dB Min., 1000 Hz - 26 dB Min., 3000 Hz - 20 dB Min.
Dielectric Strength: Primary - Secondary: 1500 Vrms.

Custom Coils

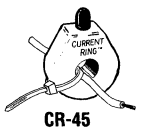
WE DO MORE!

Solenoids, air-core inductors, magnetic pick-ups and lvdts are examples of coils not listed on these pages. Cramer can manufacture these types within machine capabilities. If you have a specific requirement, or simply need help developing a new idea, PLEASE CALL. **Expert engineering support is offered for all custom requirements.**

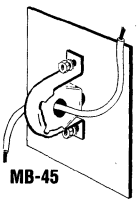
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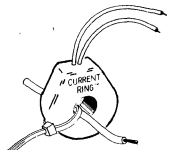
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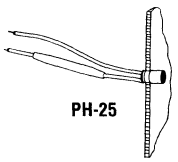
CR-45

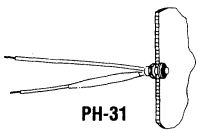

MB-45


CR-11045



MODEL 19


PH-25


PH-31

ON-OFF CURRENT INDICATORS

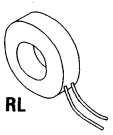
- Indicating Range (One Wire Pass): 2 to 100 A

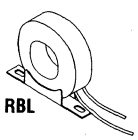
CR-45-X Wire Mounted Current Ring™ Indicator
- **R** Red
- **G** Green

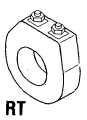
5/16″ ID, 1″ OD, 1/2″ HG

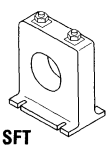
MB-45 Panel Mounting Bracket for CR-45
Model 19 Current Sensor with 12″ leads
PH-XX Remote LED indicator, connects directly to Model 19
- **25** Press-In Holder
- **31** Splash-Proof Holder

CR-11045-XX-X-XX Current Sensing Relay, use with Model 19 sensor
- **NO** Normally Open
- **NC** Normally Closed
- **3** 3 Channel
- **1** 1 Channel
- **AC** 120 VAC, 250 ma. triac output
- **DC** 12-24 VDC, 100 ma. open collector PNP output

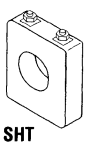

RL

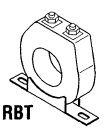

RBL


RT

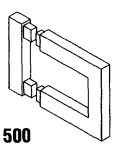

SFT


SFL


SHT


RBT


11-12-13


500
602D-603D

CURRENT TRANSFORMERS

- 50-400 HZ • Insulation Class: 600 VAC • UL Recognized
- ANSI Accuracy and Burden Data Available for most Models

SOLID CURE
XX-XXX-*

14	.5″ ID	**RL†**
2	1.13″ ID	**RBL†**
5	1.56″ ID	**RT**
56	2.06″ ID	**SFT**
7	2.5″ ID	**SFL†**
76	3.0″ ID	**RHT**
19	4.25″ ID	**RBT**
125	6.31″ ID	
126	8.25″ ID	

SPLIT-CURE
500-X-XXX-XXX-*

T	Terminals		Window Width		Window Length
L	Leads†	**041**	4.1″	**071**	7.1″
		051	5.1″	**117**	11.7″
		058	5.8″	**141**	14.1″
		080	8.0″	**181**	18.1″
		101	10.1″	**240**	24.0″
				301	30.1″

Model 11 .26″ ID, screw terminals, 500 or 1000 turns
Model 12 .37″ ID, 3/16 QC terminals, 500 or 1000 turns
Model 13 .56″ ID, PCB mount or wire leads†, 500, 1000 or 2,000 turns
Model 602D .44″×88″ window, wire leads†, 500 turns
Model 603D 2.0″×2.0″ window, wire leads†, 500 turns

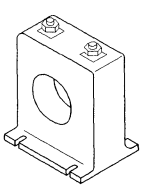
†24″ long leads standard, other lengths available

***XX X-X**
- Secondary ratio in amps, 5 amp standard
- Number of zeros following first two significant
- First two significant digits of primary ratio in amps

Standard ratios—50, 75, 100, 125, 150, 200, 500, 1000, 2000:5
Note: not all ratios are available in all IDs and mounting configurations, consult factory for exact availability.

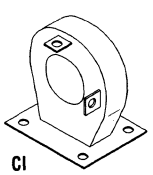
CURRENT TRANSDUCERS

- 4-20 ma OUTPUT
- 60 HZ
- ±.05 FS
- 2 Wire & 4 Wire (120 VAC) models



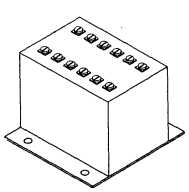
HIGH TEMPERATURE, SEALED CURRENT TRANSFORMERS

- CLASS B (130°C)
- EPOXY MOLDED
- Cu/Ag TERMINALS


CI

C1-251-2 250:2 ratio
C1-501-1 500:1 ratio

CUSTOMS—Built to customers specification
GROUND FAULT DETECTORS—5 to 1200 A trip point, 1″ to 24″ window opening, 60 HZ
HIGH VOLTAGE CURRENT TRANSFORMERS—50 to 3,000 A, 5 to 34.5 KV
RECTANGULAR WINDOW, SOLID CORE CURRENT TRANSFORMERS—100 to 4000 A, 2.75″ to 30.1″ window
HIGH ACCURACY, LABORATORY GRADE CURRENT TRANSFORMERS—10 to 1200 A, 25 to 500 HZ
MULTI-RATIO CURRENT TRANSFORMERS—10 to 5000 A, 4″ to 8.13″ window opening, 50 to 400 HZ



WATT HOUR TRANSDUCERS

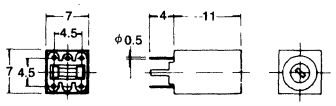
- One, two and three phase units
- 16 different output pulse rates from .01 to 10 watt-hours per pulse
- Transistor or Triac output

CR MAGNETICS, INC. • 304 AXMINISTER DR. • FENTON (ST. LOUIS) MO 63026 • 314-343-8518 • FAX 314-343-5119
(Formerly Current Ring Company, Inc)

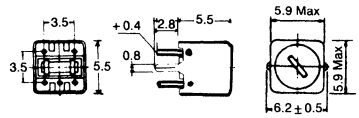
YOUR SOURCE FOR IF TRANSFORMERS
MINIATURE/SUBMINIATURE

STANDARD or CUSTOM DESIGNED FOR YOUR SPECIFIC NEEDS
QUALITY AT COMPETITIVE PRICES

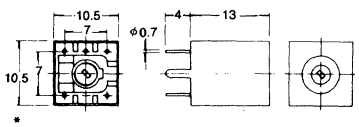
7BC
Frequency
1MC—50MC
L Range
0.2μH—10μH
No Load Q
70—120
Capacitor
None



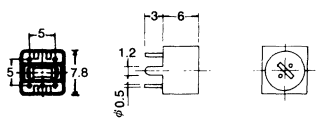
5mm
Frequency
300KC—15MC
L Range
0.6μH—500μH
No Load Q
70—90
Capacitor
27pf—200pf



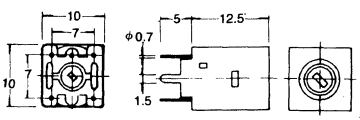
10BC
Frequency
1MC—50MC
L Range
0.4μH—150μH
No Load Q
60—120
Capacitor
5pf—100pf



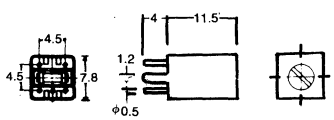
6mm
Frequency
300KC—15MC
L Range
0.6μH—700μH
No Load Q
70—100
Capacitor
27pf—200pf



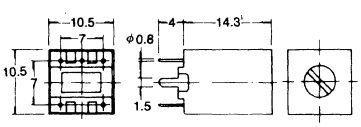
10KC
Frequency
1MC—50MC
L Range
0.1μH—5μH
No Load Q
30—100
Capacitor
10pf—100pf



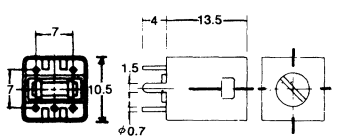
7mm
Frequency
300KC—15MC
L Range
0.6μH—1mH
No Load Q
70—120
Capacitor
27pf—200pf

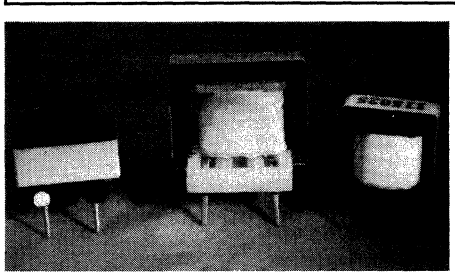


10MC
Frequency
4KC—100MC
L Range
1mHz—60mH
No Load Q
50 at 60KC
Capacitor
None



10mm
Frequency
300KC—15MC
L Range
0.6μH—2mH
No Load Q
70—150
Capacitor
27pf—200pf





QUALITY AND SERVICE THE CUI STACK DIFFERENCE...

CUI/STACK imports high quality electromechanical components. **You get the best value from us for your hard earned money.** WHY? Because we have over 20 years of world-wide electronic sourcing experience. Our service oriented staff and highly qualified sources are committed to making you a satisfied customer.

P.C. MOUNT TRANSFORMERS

Custom units are offered for high volume applications. Steel and ferrite cores as well as power and impedance matching types are available. CALL US, CUI STACK will solve all your transformer needs.

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- Triplett

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- Amperite
- Industrial Timer
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- SSAC

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- Microtran
- Sola
- Stancor
- Thordarson
- Triad
- U.T.C.

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- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

WIRE & CABLE
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- Belden
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- Carol
- Iboco
- Madison
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DORMEYER



MagneTek Triad transformers

HIGH VOLTAGE TRANSFORMERS

Designed To Your Needs

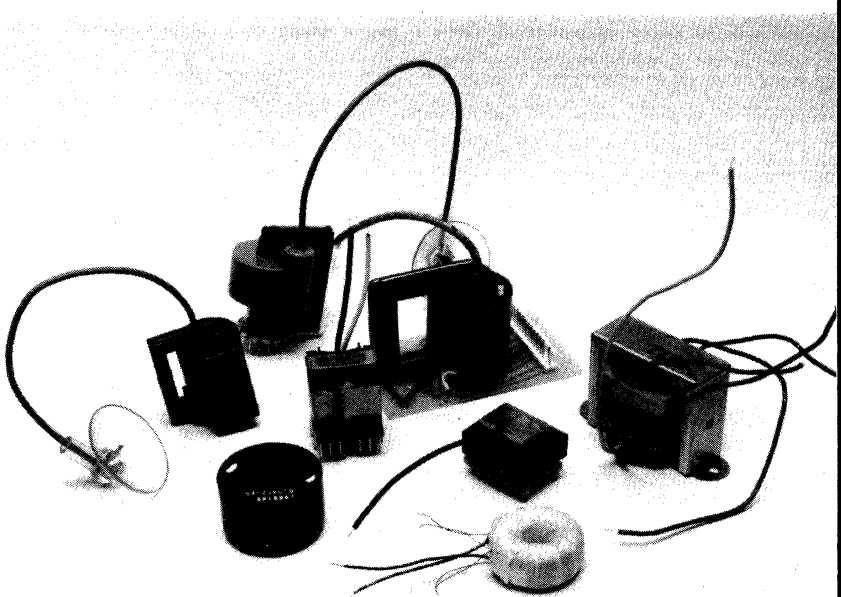
CUSTOM COILS INC.
605-934-2460

FEATURES

OUTPUT VOLTAGE
UP TO 60KV

OUTPUT POWER
UP TO 500VA

INPUT
115, 57 to 63 Hz
115/230V, 47 to 63 Hz
Switching - up to 100 KHz



FORMATS

PC MOUNT
Low profile • Split section
Horizontal • Vertical
High voltage exit - lead wire or bobbin terminal
Toroids on headers

CHASSIS MOUNT
Low profile • Split section
Lead wire or any type of termination

WINDING TECHNIQUES
Layer winding • Bobbin winding • Pi winding
Concentric winding
Non concentric winding
Toroidal winding

Dependable Personal Service & Consistent Quality

- Design Engineering Assistance
- Fast Sample / Prototype Turnaround
- Materials & Construction Applicable to CSA, TUV, VDE & UL Approvals
- Highest Quality Standards
- Specialists in Design & Manufacture of all types of Custom Transformers & Inductors
- 15,000 sq. ft. of Manufacturing Space
- In Business Since 1967

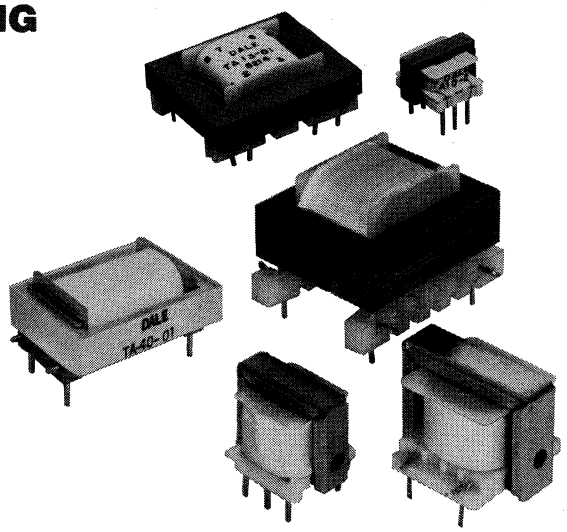
CUSTOM COILS INC.

Box 348
109 South Iowa St.
Alcester, South Dakota 57001

Phone 605-934-2460
Fax 605-934-2440
FSCM 34808 EIA 661

A COMPANY OF VISHAY DALE

TELEPHONE COUPLING AUDIO TRANSFORMERS



MODEL TA

Designed to meet FCC Part 68

FEATURES

- Designed and built to meet telephone company requirements for data and voice access on leased private telephone lines or through dial-up switched telephone networks.
- Provide line isolation, impedance matching and line balance.

SPECIFICATIONS

ELECTRICAL

Power Level: −45 dBm to +7 dBm except TA-40-01 (−45 dBm to +10 dBm)

Longitudinal Balance: Per FCC 68.310 60 dB min. = 200-1000 Hz
45 dB min. = 1000-4000 Hz

Dielectric Strength: Per FCC 68.304 1500 V peak

Frequency Range: Data/Voice = 300 to 3500 Hz
Data = 800 to 3500 Hz

MECHANICAL

Coating: Impregnated with polyester varnish.

Terminals: Precision spaced PC type plug-in terminals.

APPLICATION TABLE*

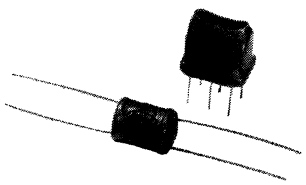
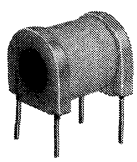
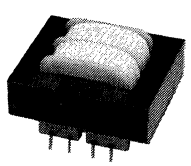
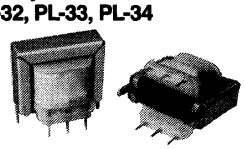
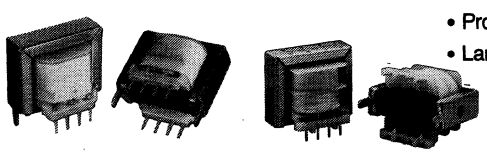
IMPEDANCE PRI	IMPEDANCE SEC	COUPLING APPLICATION	UNBALANCED DC CURRENT (MA)	RETURN LOSS MIN. (dB)	INSERTION LOSSES @1 KHz (dB)	FREQUENCY RESPONSE REF. at 1 KHz (dB)	IMPEDANCE MATCHING (%)	DISTORTION (%)	STYLE	SCHEMATIC NO.	MODEL NO.
600Ω	600Ω	DATA/VOICE	0	26	1.0	±0.5	±10	0.5	C	5	**TA-10-08**
600Ω	600Ω	DATA/VOICE	0	26	1.0	±0.5	±10	0.5	J	5	**TA-10-07**
600Ω	600Ω	DATA/VOICE	0-5	14	1.5	±1.5	±25	5.0	J	5	**TA-30-06**
600Ω	600Ω	DATA/VOICE	0	26	0.6	±0.5	±10	0.5	B	5	**TA-10-05**
600Ω	600Ω	DATA/VOICE	0-5	15	1.4	±1.5	±25	5.0	B	5	**TA-30-02**
600Ω	600Ω	DATA	0-90	8	2.4	±1.0	±25	5.0	G	5	**TA-30-03**
600Ω	600Ω	DATA/VOICE	0-80	11	1.2	±1.5	±25	5.0	M	13	**TA-32-02**
600Ω	600Ω	DATA/VOICE	0-90	14**	1.7**	±0.2**	±20	0.5	N	13	**TA-40-01**
600Ω	600Ω	DATA/VOICE	0-100	8	1.6	±1.5	±25	5.0	E	15	**TA-33-02**
600Ω	600Ω CT	DATA	0-90	8	2.4	±1.0	±25	5.0	H	9	**TA-30-04**
600Ω CT	600Ω CT	DATA/VOICE	0	26	0.6	±0.5	±10	0.5	A	4	**TA-10-04**
600Ω CT	600Ω CT	DATA/VOICE	0-5	15	1.4	±1.5	±25	5.0	A	4	**TA-30-01**
600Ω SPLIT	600Ω	DATA/VOICE	0-50	8	1.4	±1.5	±25	5.0	K	11	**TA-31-01**
600Ω SPLIT	600Ω	DATA/VOICE	0-80	11	1.2	±1.5	±25	5.0	L	14	**TA-32-03**
600Ω	600Ω SPLIT	DATA/VOICE	0-75	13	1.2	±0.5	±10	0.5	E	7	**TA-13-01**
600Ω	600Ω SPLIT	DATA/VOICE	0-100	8	1.6	±1.5	±25	5.0	E	7	**TA-33-01**
600Ω	600Ω/600Ω	DATA/VOICE HYBRID	0	26	0.8	±0.5	±10	0.5	A	1	**TA-10-01**
600Ω	600Ω/600Ω	DATA/VOICE HYBRID	0-5	14	1.4	±1.5	±25	5.0	A	10	**TA-30-05**
600Ω	600Ω/600Ω	DATA/VOICE HYBRID	0	26	0.8	±0.5	±10	0.5	D	1	**TA-11-01**
600Ω	900Ω	DATA/VOICE	0-5	14	1.5	±1.5	±25	5.0	J	2	**TA-30-07**
600Ω	900Ω	DATA/VOICE	0	26	0.7	±0.5	±10	0.5	B	2	**TA-10-02**
600Ω/900Ω	600Ω	DATA/VOICE	0-100/0-120	8	1.4	±1.5	±25	5.0	L	12	**TA-32-01**
600Ω	600Ω/900Ω	DATA/VOICE	0-100/0-120	14	0.5	±0.5	±10	0.5	F	8	**TA-14-01**
900Ω	900Ω	DATA/VOICE	0	26	0.7	±0.5	±10	0.5	A	6	**TA-10-06**
4KΩ	600Ω	DATA/VOICE	0	22	0.7	±0.5	±10	0.5	B	3	**TA-10-03**

Model **TA-3** is the **low-cost** alternative to Model TA-1.
*For HOLDING COIL information, refer to MODEL TE/TD in Section 1800. **Reference for TA-40-01 is 1.8 KHz.

CONTACT: **DALE ELECTRONICS, INC.** E. Hwy. 50, P.O. Box 180, Yankton, SD 57078-0180 • Phone (605) 665-9301

A COMPANY OF DALE

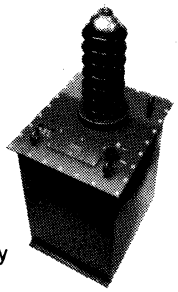
TRANSFORMERS

MODEL	FEATURES
Trigger Type, Pulse **MODELS PT10 & PT20** 	• Low-cost trigger source isolation in half and full wave SCR Power Control Circuits, including motor speed, heater and lighting controls • Choice of printed circuit or bobbin-type • Transfers high amplitude or long duration pulses without saturation • Inductance: 200 μH - 5000 μH • Temperature Range: −10°C to +70°C • Turns Ratio: 1:1, 1:1:1, 2:1, 2:1:1 and 5:1
SCR Isolation, Trigger **MODEL PT50** 	• Designed for low-cost trigger source isolation in SCR Power Control Circuits • Small physical size and low profile provide packaging advantages • Interchangeable. Designed for circuit board mounting using same mounting dimensions as 11Z and PT20 models. • Transfers high amplitude or long duration pulses without saturation • Applications include motor speed, lighting and heater controls. • Inductance: 200 μH - 5000 μH • Temperature Range: −55°C to +105°C • Turns Ratio: 1:1, 2:1 and 5:1
Power **Single Primary — Dual Secondary** **Dual Primary — Dual Secondary** **MODELS PLS & PLD** 	• P.C. pin mounting. Easily modified for special requirements. • Designed to meet UL and CSA requirements • Dual Secondary for series connection or parallel connection • Split-section winding for increased dielectric strength plus reduced interwinding capacitance • PLD: Dual Primary for operation at 115V or 230V, 50/60 Hz • Provides isolation from power line • Laminated construction for low-cost industrial applications
Low Power **Single Primary Input 115 Volts** **Dual Secondary** **MODELS PL-11, PL-12, PL-13, PL-14** **Single Secondary** **MODELS PL-32, PL-33, PL-34** 	• P.C. pin mounting. Available with mounting frames and bobbin stand-off. Easily modified for special requirements. • Recognized under the Component Program of Underwriters Laboratories, Inc. (U.L. File E71961). For general purpose transformers (U.L. Standard 506). • Provides isolation from power line • Laminated construction for low-cost industrial applications
Low Power **Dual Primary — Dual Secondary** **115/230 Volts** **MODELS PL-22, PL-23, PL-24, PL-42, PL-43, PL-44** 	• P.C. pin mounting. Available with mounting frames and bobbin stand-off. Easily modified for special requirements. • Dual Primary for operation at 115V or 230V, 50/60 Hz • Dual Secondary for series connection or parallel connection • Provides isolation from power line • Laminated construction for low-cost industrial applications

CONTACT: **DALE ELECTRONICS, INC.** E. Hwy. 50, P.O. Box 180, Yankton, SD 57078-0180 • Phone (605) 665-9301

DEL ELECTRONICS CORPORATION

High Voltage Line Isolation Transformers In Oil Insulating Tanks



Model 3–TR–150–11

FEATURES:
- ▼ Complete varnish impregnation under vacuum
- ▼ Epoxy anchoring
- ▼ Immersed in high grade insulating oil*
- ▼ Electrostatic shield between primary and secondary windings
- ▼ "AN" type connector provided for input connections
- ▼ Good regulation

*Note: Shipped without oil to minimize transportation charges, except when otherwise specified in order.

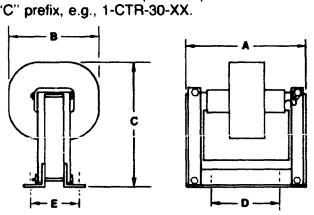
SPECIFICATIONS:
- ▼ Each model available with porcelain output insulator
- ▼ Models also available with two shielded polyethylene output cables in place of porcelain insulator
- ▼ Standard types available for 120V and 240V input lines in 1:1, 1:2, and 2:1 voltage ratios with other input and output voltages available upon request
- ▼ Recommended for industrial, research, and developmental applications

Standard 60Hz Types				
Model No.*	Max. kVA	kV dc Insulation	Tank Size (in.) (W X D X H)**	Insulator Height (in.)***
1-TR-30-XX	1	30	10 X 12 X 11	6
1.5-TR-30-XX	1.5	30	13 X 13⅞ X 16½	6
1-TR-50-XX	1	50	13 X 13⅞ X 16⅜	8½
3-TR-50-XX	3	50	13 X 13⅞ X 16⅜	8½
1-TR-60-XX	1	60	9¾ X 12⅜ X 13⅜	11
2-TR-60-XX	2	60	16½ X 16½ X 21⅜	11
3-TR-60-XX	3	60	16½ x 16½ X 21⅜	11
5-TR-60-XX	5	60	16½ X 16½ X 21⅜	11
3-TR-75-XX	3	75	16½ X 16½ X 22	11
1-TR-100-XX	1	100	20¾ X 17½ X 17 13/16	14
3-TR-100-XX	3	100	20¾ X 17½ X 17 13/16	14
3-TR-150-XX	3	150	15½ X 18¾ X 24	19½
5-TR-150-XX	5	150	15½ X 18¾ X 24	19½
0.5-TR-250-XX	0.5	250	25 X 33 X 37 5/16	28¾
2-TR-250-XX	2	250	25 X 33 X 37 5/16	28¾
3-TR-250-XX	3	250	29¾ X 29¾ X 36⅜	28¾
5-TR-250-XX	5	250	25 X 33 X 37¼	28¾
4-TR-300-XX	4	300	39½ X 47½ X 50½	35
Models With Shielded Cables Instead Of Porcelain Insulator:				
0.5-CTR-250-XX	0.5	250	25 X 33 X 37 5/16	
2-CTR-250-XX	2	250	25 X 33 X 37 5/16	
3-CTR-250-XX	3	250	29¾ X 29¾ X 36⅜	
4-CTR-300-XX	4	300	25 X 33 X 37¼	
5-CTR-250-XX	5	250	39½ X 47½ X 50½	

*Note: Add the following suffix in place of XX:

For	Suffix	For	Suffix
120/120	11	240/120	21
120/240	12	240/240	22

**Note: Dimensions are nominal and outline drawings are available upon request.
***Note: If shielded polyethylene output cables are desired in place of porcelain insulator, designate part number with a "C" prefix, e.g., 1-CTR-30-XX.



Transformer, High Voltage—Filament Isolation Open Type Construction—Epoxy Coated

High Voltage Filament Isolation Transformers				
Type	Secondary Volts	Secondary Amps	Isolation kV dc (Working)	Size (A X B X C)
AD 3227	5	1	10	2⅝ X 2⅜ X 3⅛
AD 3231	5	3	10	3 X 2⅝ X 3½
AD 3234	5	5	10	3¼ X 2⅝ X 3⅞
AD 3226	6.3	1	10	2⅝ X 2⅜ X 3⅛
AD 3230	6.3	3	10	3 X 2⅞ X 3½
AD 3233	6.3	5	10	3¼ X 2⅞ X 3⅞
AD 3238	5	1	20	4½ X 3 X 4
AD 3239	5	3	20	4⅜ X 3½ X 4⅜
AD 3240	5	5	20	4⅞ X 3½ X 5⅛
AD 3241	6.3	1	20	4½ X 3 X 4
AD 3242	6.3	3	20	4⅜ X 3½ X 4⅜
AD 3243	6.3	5	20	4⅞ X 3½ X 5⅛
AD 3247	5	1	30	4⅞ X 3½ X 5
AD 3248	5	3	30	5¾ X 3¾ X 5¼
AD 3249	5	5	30	6¼ X 3¾ X 6½
AD 3250	6.3	1	30	4⅞ X 3½ X 5
AD 3251	6.3	3	30	5¾ X 3¾ X 5¼
AD 3252	6.3	5	30	6¼ X 3¾ X 6½

All primaries: 115 volts, 60Hz.

Transformer, High Voltage—Line Isolation Open Type Construction—Epoxy Coated

FEATURES:
- ▼ Designed for continuous operation at rated voltage and power
- ▼ Epoxy coated, air insulated up to 30kV dc, oil insulated over 30kV dc
- ▼ Well suited to applications requiring reliable isolated line voltage at power ratings up to 1kVA
- ▼ Other higher voltage and power units available upon request

SPECIFICATIONS:
Primaries: 115V or 230V, 60Hz
Secondaries: 115V

Type	Rating kVA	Size (A X B X C)	Mounting Dimensions (D X E)	Insulation kV dc Working
AD 1640	0.200	6⅛ X 4 X 5⅛	4½ X 3	10
AD 1641	0.500	7⅝ X 5⅞ X 7¾	5⅜ X 4¼	10
AD 1642	0.750	9½ X 6 9/16 X 8¼	7¼ X 4 13/16	10
AD 1643	1.000	8½ X 8 X 9¾	6 X 5	10
AD 1644	0.200	8½ X 4 X 5⅝	6⅞ X 3⅛	20
AD 1645	0.500	10¼ X 5⅝ X 7½	8 X 4¼	20
AD 1646	0.750	9¾ X 6¾ X 8	7½ X 4 13/16	20
AD 1647	1.000	11¼ X 6⅝ X 8¾	8¾ X 4⅝	20
AD 3060	0.250	8½ X 7¼ X 6½	7 5/16 X 3⅜	30
AD 3061	0.500	9¾ X 7 X 8¾	7 13/16 X 3½	30
AD 3062	0.750	10½ X 7½ X 9½	8½ X 3⅝	30
AD 3063	1.000	11 X 9 X 9½	8 3/4 X 3¾	30
AD 3064	0.250	10 X 7 X 6½	8 13/16 X 3⅜	40
AD 3065	0.500	11¼ X 7¼ X 8¾	9⅛ X 3½	40
AD 3066	0.750	12½ X 7½ X 9½	10¼ X 3⅝	40
AD 3067	1.000	12¾ X 9 X 9½	10 7/16 X 3¾	40

Transformer High Voltage - Custom
- High Frequency Inverter to 100 kHz
- Pulse, Charging Chokes - Modulator Applications
- Power - 60 and 400 Hz - 1Ø - 3Ø

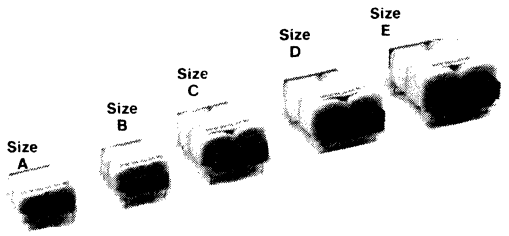
DEL ELECTRONICS CORP.
250 East Sandford Boulevard / Mount Vernon, NY 10550
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DYNAGE Magnetics
551 Third Avenue P.O. Box 95
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Telephone: (605) 296-3462
Fax: (605) 296-3231
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PANCAKE™ PC POWER TRANSFORMERS
53 models, 5 sizes, 24 voltages, dual primaries

CROSS REFERENCE CHART (OTHER MANUFACTURERS MODELS)

SIZE	DYNAGE	SIGNAL	PREM	EWC
A	PCA10-0.250	LP10-250	SPW-050	LP 10-250B23
B	PCB10-0.600	LP10-600	SPW-100	LP 10-600B1
C	PCC10-1.200	LP10-1200	SPW-300	LP 10-1200B2
D	PCD10-2.400	LP10-2400	----	----
E	PCE10-4.800	LP10-4800	----	----
A	PCA12-0.200	LP12-200	SPW-051	LP 12-200B24
B	PCB12-0.450	LP12-450	SPW-101	LP 12-450B3
C	PCC12-0.900	LP12-900	SPW-301	LP 12-900B4
D	PCD12-1.900	LP12-1900	----	----
E	PCE12-3.800	LP12-3800	----	----
A	PCA16-0.150	LP16-150	SPW-052	LP 16-150B25
B	PCB16-0.350	LP16-350	SPW-102	LP 16-350B5
C	PCC16-0.700	LP16-700	SPW-302	LP 16-700B6
D	PCD16-1.500	LP16-1500	----	----
E	PCE16-3.000	LP16-3000	----	----
A	PCA20-0.125	LP20-125	SPW-053	LP 20-125B26
B	PCB20-0.300	LP20-300	SPW-103	LP 20-300B7
C	PCC20-0.600	LP20-600	SPW-303	LP 20-600B8
D	PCD20-1.200	LP20-1200	----	----
E	PCE20-2.400	LP20-2400	----	----
A	PCA24-0.100	LP24-100	SPW-054	LP 24-100B27
B	PCB24-0.250	LP24-250	SPW-104	LP 24-250B9
C	PCC24-0.500	LP24-500	SPW-304	LP 24-500B10
D	PCD24-1.000	LP24-1000	----	----
E	PCE24-2.000	LP24-2000	----	----
A	PCA30-0.85	LP30-85	SPW-061	----
B	PCB30-0.200	LP30-200	SPW-111	----
C	PCC30-0.400	LP30-400	SPW-311	----
D	PCD30-0.800	LP30-800	----	----
E	PCE30-1.600	LP30-1600	----	----
A	PCA34-0.075	LP34-75	SPW-055	LP 34-75B28
B	PCB34-0.170	LP34-170	SPW-105	LP 34-170B11
C	PCC34-0.340	LP34-340	SPW-305	LP 34-340B12
D	PCD34-0.700	LP34-700	----	----
E	PCE34-1.400	LP34-1400	----	----



- Low prices
- High quality

Need a special? We have capability to design and produce to your requirements.

CROSS REFERENCE CHARTS (Cont'd)

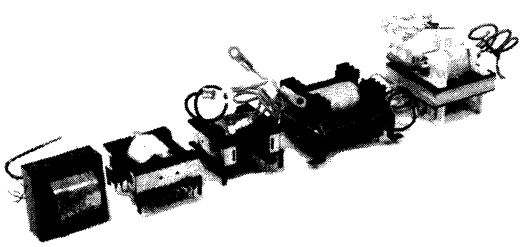
SIZE	DYNAGE	SIGNAL	PREM	EWC
A	PCA40-0.060	LP40-60	SPW-056	LP 40-60B29
B	PCB40-0.150	LP40-150	SPW-106	LP 40-150B13
C	PCC40-0.300	LP40-300	SPW-306	LP 40-300B14
D	PCD40-0.600	LP40-600	----	----
E	PCE40-1.200	LP40-1200	----	----
A	PCA56-0.045	LP56-45	SPW-057	LP 56-45B30
B	PCB56-0.100	LP56-100	SPW-107	LP 56-100B15
C	PCC56-0.200	LP56-200	SPW-307	LP 56-200B16
D	PCD56-0.425	LP56-425	----	----
E	PCE56-0.850	LP56-850	---	----
A	PCA88-0.028	LP88-28	SPW-058	LP 88-28B31
B	PCB88-0.065	LP88-65	LPW-108	LP 88-65B17
C	PCC88-0.130	LP88-130	SPW-308	LP 88-130B18
A	PCA120-0.020	LP120-20	SPW-059	LP 120-20B32
B	PCB120-0.050	LP120-50	SPW-109	LP 120-50B19
C	PCC120-0.100	LP120-100	SPW-309	LP 120-100B20
A	PCA230-0.010	LP230-10	SPW-060	LP 230-10B33
B	PCB230-0.025	LP230-15	SPW-110	LP 230-25B21
C	PCC230-0.050	LP230-50	SPW-310	LP 230-50B22

SWITCHMODE POWER SUPPLY MAGNETICS

Transformers — driver, interstage, and output

We have standard designs for your custom requirements. Selected ferrite "E" cores with associated nylon bobbins are predesigned to minimize the custom design effort to meet your needs.

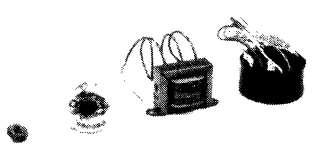
- Low prices
- High quality
- Custom designs



Inductors — toroidal and lamination types

- Designs available up to 300 amps
- Minimum possible size
- Selection of sizes
- Available with open winding or encapsulated or partial encapsulated

- Low prices
- High quality
- Custom designs



Transformers — current sense (toroidal)

- Fourteen (14) standard designs
- Low prices (cost effective designs)
- Open, sealed, or totally encapsulated

- High quality
- Custom designs



- UL, CSA, VDE and IEC Capabilities
- Designs to Military Specifications

DYNAGE Magnetics
DIVISION OF OAKLEAF, INC.
551 Third Avenue, P.O. Box 95 Canistota, SD 57012
Tel: (605) 296-3462 Fax: (605) 296-3231
Telex: 753243 (OAKLEAFINC)

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DYNAGE Magnetics

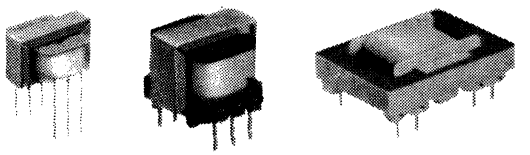
TELEPHONE INTERCONNECT TRANSFORMERS

Line coupling transformers — Hybrid transformers — Holding coils

- Designed to meet FCC Part 68
- 1500 volt dielectric strength
- For interconnecting data/voice devices to telephone lines

REFERENCE CHART (with cross reference to other mfrs.)

Size	Impedance, Pri:Sec	DYNAGE Model	STANCOR Model	MICRO-TRAN Model	DALE Model	Height, inches	Pc Bd Area, in2	Wt., oz.
Voice/Data Coupling								
26	600:600	TC26-A102	TTPC-2	T-1104	TA10-07	0.49	0.52	0.5
26	600:900	TC26-A104	TTPC-4	-----	-----	0.49	0.52	0.5
26	4000:600	TC26-A105	TTPC-5	-----	-----	0.49	0.52	0.5
26	600CT:600CT	TC26-D103	TTPC-3	-----	-----	0.49	0.52	0.5
39	600:600	TC39-A107	TTPC-7	-----	TA10-05	0.74	0.53	0.6
39	600:900	TC39-A110	TTPC-10	-----	TA10-02	0.74	0.53	0.6
39	900:900	TC39-A120	-----	-----	TA10-06	0.74	0.53	.06
39	4000:600	TC39-A111	TTPC-11	-----	TA10-03	0.74	0.53	0.6
39	600:600CT	TC39-B134	-----	-----	-----	0.74	0.53	0.6
39	600CT:600CT	TC39-D101	TTPC-1	-----	TA10-04	0.74	0.53	0.6
39	600CT:600CT	TC39-D108	TTPC-8	-----	-----	0.74	0.53	0.6
40	600:600	TC40-A121	-----	T2104	-----	0.75	0.53	0.6
40	600:900	TC40-A122	-----	T2108	-----	0.75	0.53	0.6
40	900:900	TC40-A123	-----	T2110	-----	0.75	0.53	0.6
40	4000:600	TC40-A124	-----	T2316	-----	0.75	0.53	0.6
40	600:600CT	TC40U-B106	TTPC-6	-----	-----	0.75	0.53	1.0
40	600CT:600CT	TC40-D125	-----	T2106	-----	0.75	0.53	0.6
45	600:600SP	TC45U-E113	TTPC-13	-----	-----	0.59	0.76	0.5
126	600CT:600CT	TC126U-J119	TTPC-19	-----	-----	0.60	2.10	2.5
132	600SP:600SP	TC132U-L118	TTPC-18	T9117	-----	0.63	2.10	2.5
132	600SP:600SP	TC132U-J126	-----	T9116	-----	0.63	2.10	2.5
154	600:600	TC154U-A115	TTPC-15	-----	-----	0.69	2.23	2.5
154	900:600	TC154U-A116	TTPC-16	-----	-----	0.69	2.23	2.5
154	600:600SP	TC154U-E127	-----	T5114	TA13-01	0.69	2.23	2.5
154	600:600SP	TC154U-E114	TTPC-14	-----	-----	0.69	2.23	2.5
Data Modem Coupling — For 300/1200/2400 BPS Modems for Microcomputers								
40	600:600CT	TD40U-B128	-----	T2114	-----	0.75	0.53	0.6
45	600:600	TD45U-A129	-----	T2111	-----	0.59	0.76	0.5
45	600:600CT	TD45U-B130	-----	T2112	-----	0.59	0.76	0.5
50	600:600	TD50U-A131	-----	T9311	-----	0.50	1.00	0.7
50	600:600SP	TD50U-E132	-----	T9312	-----	0.50	1.00	0.7
50	600:600SP	TD50U-E133	-----	T9317	-----	0.50	1.00	0.7



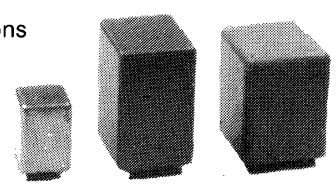
These products will meet telephone interconnect coupling, matching, and bridging requirements for use in voice, instrument, and modem applications.

- Contact us for your special requirements.

REFERENCE CHART (with cross reference to other mfrs.)

Size	Impedance, Pri:Sec	DYNAGE Model	STANCOR Model	MICRO-TRAN Model	DALE Model	Height, inches	Pc Bd Area, in2	Wt., oz.
Hybrid — Two required for conventional hybrid operation								
39	600:600/600	THY39-E148	-----	-----	TA10-01	0.74	0.53	0.6
40	600:600/600	THY40-E136	-----	T2220	-----	0.75	0.53	0.6
50	600:600/600	THY50U-E135	-----	T9320	-----	0.50	1.00	0.7
83	600:600/600	THY83-E142	-----	-----	TA11-01	0.85	0.97	1.2
86	600:600/600	THY86-E109	TTPC-9	-----	-----	0.86	1.00	1.0
86	600:600/600	THY86-E137	-----	T3220	-----	0.86	1.00	1.0
133	600:600/600	THY133U-L138	-----	T9220	-----	0.63	2.11	2.2
206	600:600/600	THY206U-P139	-----	T4220	-----	1.21	1.70	3.5
275	600:600/600	THY275U-L140	-----	T5220	-----	1.19	2.31	5.5
Holding Coils								
32		THC32-G141	-----	T7410	-----	0.41	0.79	0.8
39		THC39-G146	-----	-----	1A40-01	0.44	0.89	0.8
78		THC78-G143	-----	T8410	-----	0.63	1.23	2.0
95		THC95-G145	-----	-----	1A50-01	0.69	1.37	2.0
154		THC154-H117	TTPC-17	T5415	-----	0.69	2.23	2.5
185		THC185-G144	-----	-----	TA12-01	1.19	1.55	3.5
213		THC213-G147	-----	T4415	-----	1.25	1.70	3.5
236		THC236-G112	TTPC-12	-----	-----	1.32	1.79	1.5

CUSTOM MIL-T-27 TRANSFORMERS

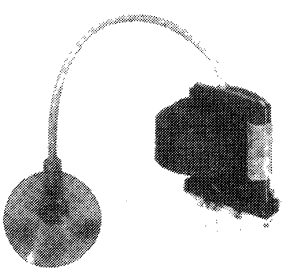


- For military applications
- For hi-rel industrial applications
- Competitive prices
- Construction to MIL-T- 27D, grade 4 or 5, Class "S", life "X", (10,000 hrs.)
- Encapsulated to meet MIL-STD-810C for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and high altitude.

Call us for your special requirements!

551 Third Avenue, P.O. Box 95 Canistota, SD 57012
Tel: (605) 296-3462 Fax: (605) 296-3231
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FLYBACK TRANSFORMERS (HIGH VOLTAGE)



- Up to 30KV output
- Epoxy (or silicon) encapsulated
- Up to 32 KHz, typical
- Varicus footprint styles available
- Made to customer specifications

Please send us your specifications for high voltage transformers (flyback). Our engineers will work with you to design transformers for your special needs.

DYNAGE Magnetics
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DYNAGE Magnetics

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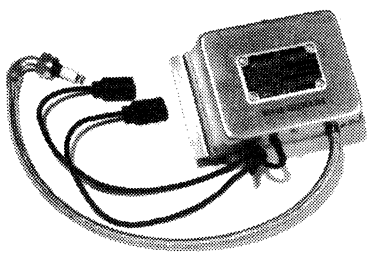
HIGH VOLTAGE TRANSFORMERS

IGNITION TRANSFORMERS

Various types of custom ignition transformers are offered ranging from the continuous sparking type to the high energy arc exciters that deliver up to a 12 joule arc at a rate of 4 times per second.

Custom ignition transformers/modulators for military applications, such as large tent heaters, are also offered.

Contact us to design custom type ignition transformers to meet your requirements.

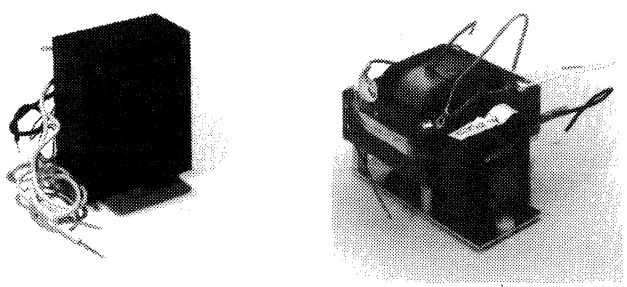


Ignition modulator for military tent heater.

OZONE GENERATOR TRANSFORMERS

Custom ozone generator transformers can be designed to meet your specific ozone generator application. Units of different frequency and voltage combinations are offered as required by the plate designs.

For your specific requirement, please contact us for engineering discussions and price quotations.

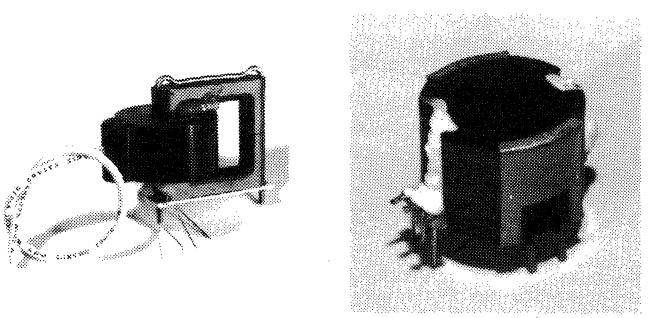


Custom ozone generator transformers

AIR CLEANER & ION GENERATOR TRANSFORMERS

Various types of air cleaner transformers for electrostatic cleaning and transformers for ion generation are offered.

Contact us to design custom units to meet your specific requirements.



Custom air cleaner and ion generator transformers

OTHER HV TRANSFORMERS

Contact us for any high voltage transformer application.

• Low Prices • High Quality • Custom Designs
Call or FAX us for your special requirements!

DYNAGE Magnetics
DIVISION OF OAKLEAF, INC.

551 Third Avenue P.O. Box 95 • Canistota, SD 57012
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DYNAGE Power

551 Third Avenue P.O. Box 95
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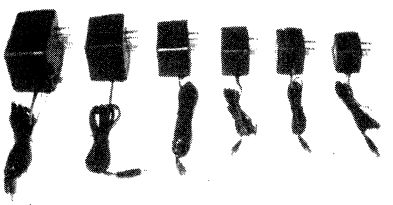
WALL PLUG-IN, DESK TOP, AND WALL MOUNT UNITS

AC/AC, AC/DC, and AC/DC Regulated

AC/AC ADAPTERS

Up to 14 case sizes are offered with a variety of output cord and connector configurations to meet your specific requirement. Units can be custom designed to meet your input and output ratings. Plug types for many different countries are available. Several standard models with UL, CSA and other approvals are offered.

Centertapped or multi-secondary versions with three or four conductor output cords are availalbe. Screw terminal outputs are also offered on some case sizes.

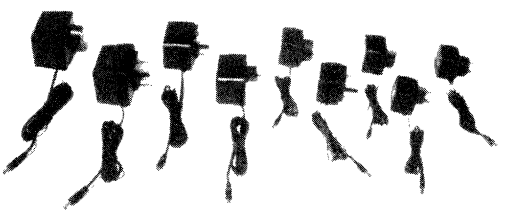


Wall plug-in units for North American receptacles.

AC/DC ADAPTERS

These adapters are unregulated, filtered, DC output units offered in up to 14 case sizes with a wide variety of output cord and connector configuation. Dual or triple DC outputs with three or four conductor output cords are available. Input plug types of many different countries are offered.

UL and CSA approved standard models are available. Units designed to meet VDE, TUV, and others are also offered.



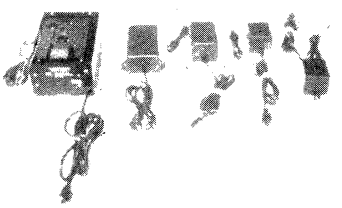
Wall plug-in units for various International receptacles.

LINEAR REGULATED POWER SUPPLIES

The larger case sizes are used for the linear regulated DC power supply units. Some of the larger cases are of the wall plug-in type mainly for North American receptacles. Most of the larger cases are of the desktop (or wall mount) style.

Single or multiple regulated outputs are offered with 2, 3, 4, or 5 conductor output cords available. Input cords for most countries are available in the desk top or wall mount units.

Custom designs can be made to meet your specific requirements.



Desktop and wall mount units with input cords for North American receptacles or various International receptacles.

SWITCHING POWER SUPPLIES

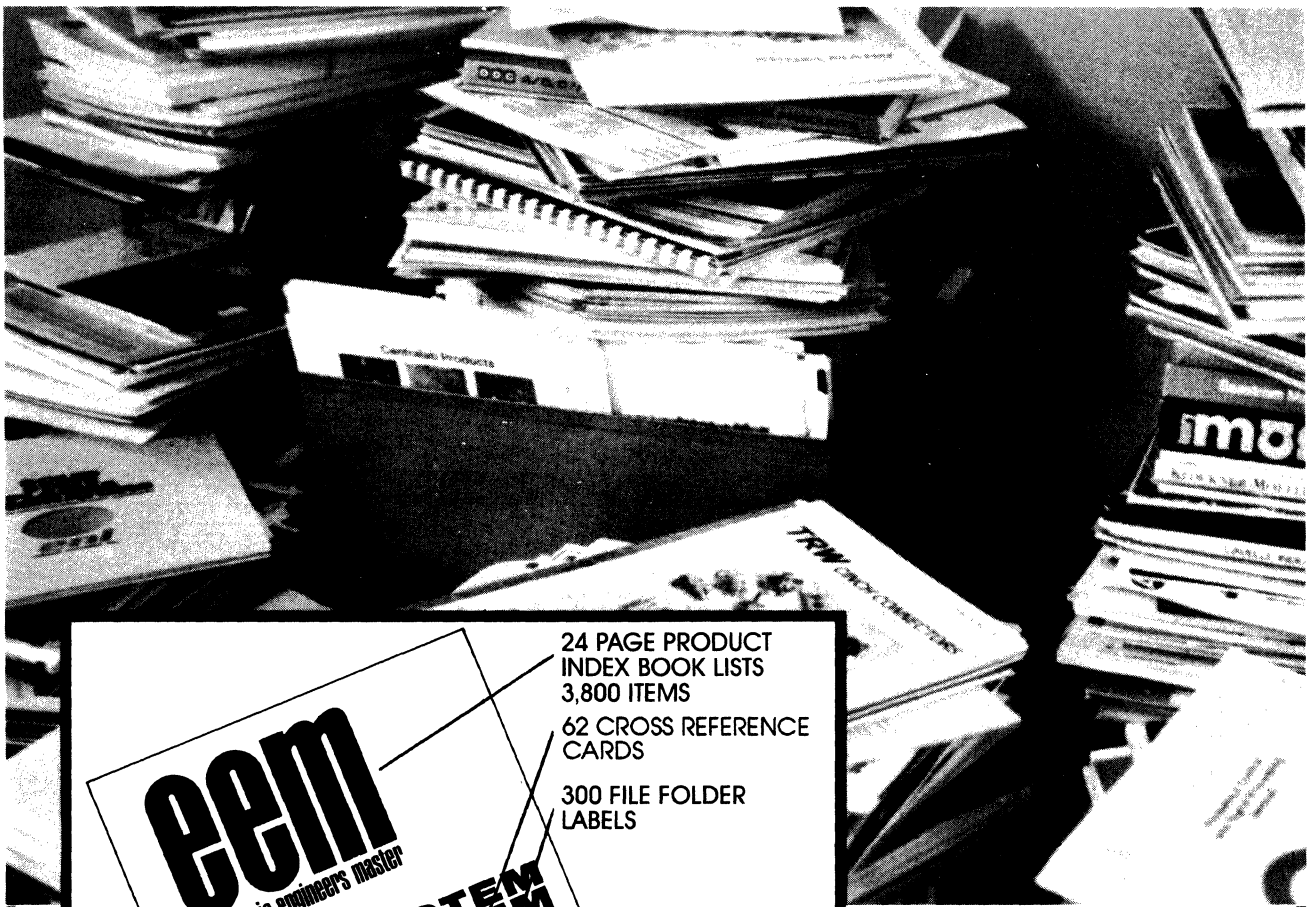
the switching regulated power supplies are offered primarily in the larger case sizes. Some versions are available in wall plug-in type cases but most offerings are in desk top units. Units are designed to meet EMI requirements per FCC Docket 20780 Class B. Wide input voltage ranges of 90–130 and 180-260 VAC are standard.

Custom designs can be made to meet your specific requirements.

- Low prices
- High quality.
- Custom designs to meet your exact requirements.
- Standard designs available with UL and CSA approvals.
- UL, CSA, and VDE submittals upon request.
- Quick delivery on preproduction units (made in USA)
- Plugs for Continental Europe, UK, Australia, North America, and others.

DYNAGE Power
DIVISION OF OAKLEAF, INC.

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ALL NEW with this edition of EEM

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You say you want to file catalogs by type of product? That's easy to do with the System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

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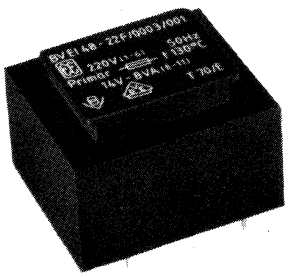
EICHHOFF

Eichhoff offers you advanced technology and custom capability in Miniature and Safety Transformers

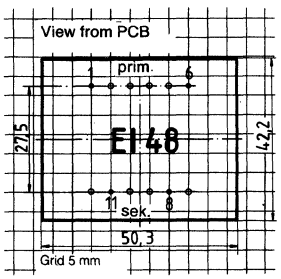
EI48 Safety Transformers

Epoxy encapsulated transformers offer:

- HIGHER VA Rating in a small package
- VDE & US Safety Approvals
- Custom designs available



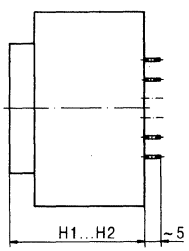
Pin configuration, e.g. 1.6, 8 and 11



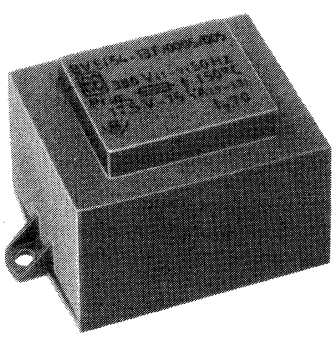
Type EI48-21

Stack: 16.8 mm			Ta 70
Protection		U-prim	U-sec.	max. output
for prim.	8	220V	6...42V	6.0VA
for prim. and sec.	11	220V	6...42V	8.0VA
with prim.		220V	6...42V	9.0VA
Approved types:		220 or 240V/10V—6VA, 14V—8VA	
		220, 240 or 380V/11V—5.5VA	
		120V—60Hz/10V—6VA, 14V—8VA	
		or 11V—5.5VA	

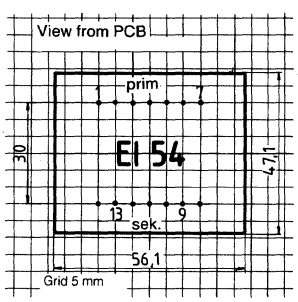
with solder wire 0.8 mm Ø



EI 54 Safety Transformers



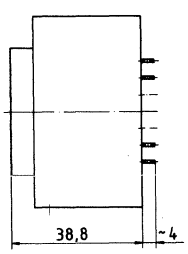
Pin configuration, e.g. 1, 7, 9 and 13



Type EI54-21

Stack: 16.8 mm			Ta 70
Protection		U-prim	U-sec.	max. output
for prim.		220V	8.5...42V	10VA
for prim. and sec.		220V	8.5...42V	15VA
with prim.	8	220V	8.5...42V	15VA
with prim.		220V	8.5...42V	15VA
Approved types:		380VA/14.5V—18VA with prim. 8	
		220V/14.5V—18VA with prim.	
		120V—50-60 Hz/14.5V—15VA	

with solder wire 0.8 mm Ø



Eichhoff Electronics, Inc.
205 Hallene Road, Warwick RI 02886
Tel (401) 738-1440
Fax (401) 738-7154

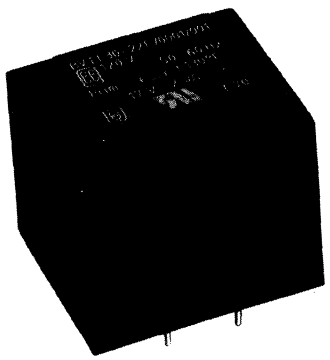
Toll Free 800-678-1040

Technical Data Subject to change without notice
Printed in U.S.A.

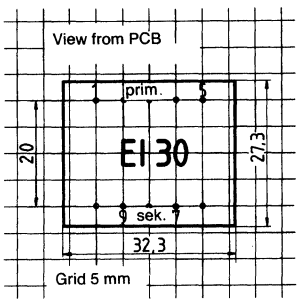
EICHHOFF

Eichhoff offers you advanced technology and custom capability in Miniature and Safety Transformers

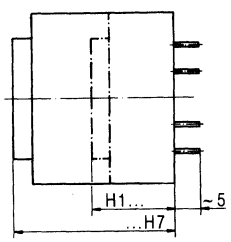
EI 30 Safety Transformers



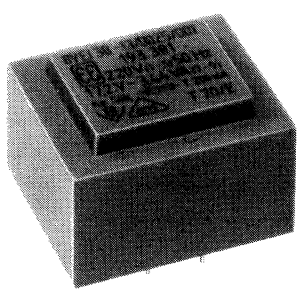
Pin configuration, e.g. 1, 5, 7 and 9



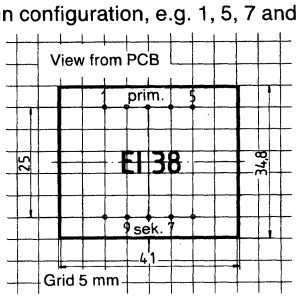
with solder wire 0.8 mm ∅



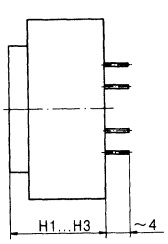
EI 38 Safety Transformers



Pin configuration, e.g. 1, 5, 7 and 9



with solder wire 0.8 mm ∅



	Height of stack	Overall height
H 1, EI38-02	8.2mm	21.8mm
H 2, EI38-12	13.5mm	28.1mm
H 3, EI38-22	15.6mm	32.1mm

BVEI38-22 has a safety coil former.
Airgaps and creepage paths amount to at least 6mm.

Eichhoff Electronics, Inc.
205 Hallene Road, Warwick RI 02886
Tel (401) 738-1440
Fax (401) 738-7154

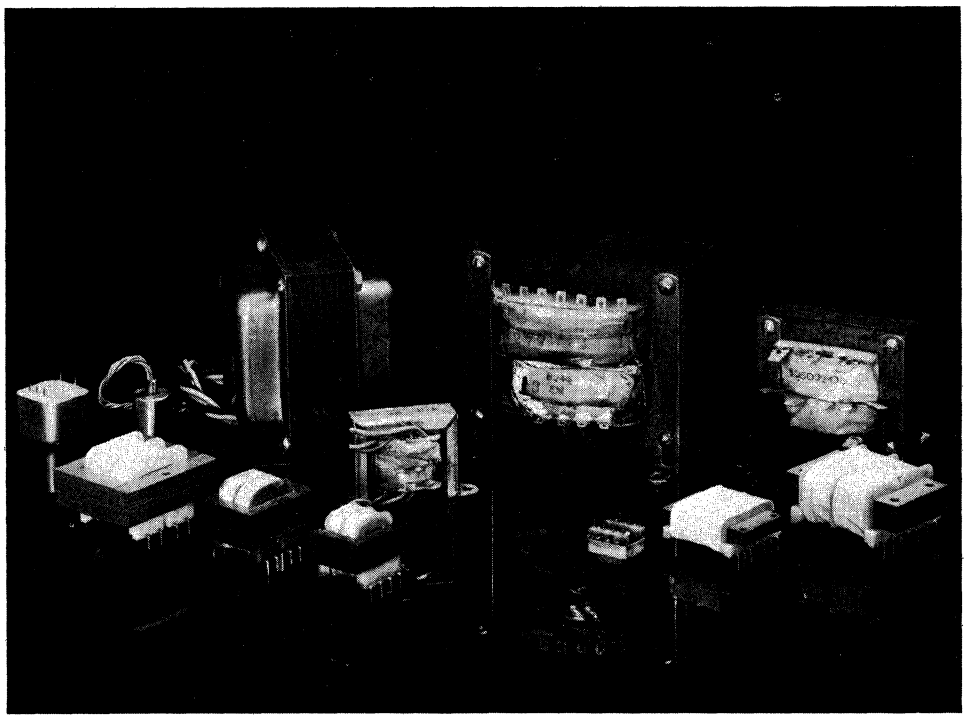
Toll Free 800-678-1040

Technical Data Subject to change without notice
Printed in U.S.A.

Electromech

TRANSFORMERS

FULL LINE OF QUALITY MAGNETIC COMPONENTS • TAILORED TO YOUR EXACT NEEDS



- **POWER**
- **ISOLATION**
- **CONTROL**
- **AUTO**
- **STEPUP**
- **STEPDOWN**
- **CURRENT**
- **C.V.T.**
- **CHOKES**
- **HI FREQ**
- **INDUCTORS**

FEATURES

TRANSFORMERS

Power—.5VA to 50KVA

115V, 57 to 63 Hz
115/230V, 47 to 63 Hz
International power input, 47 to 63 Hz
400 Hz
Single or multi outputs
For power supply, control, filament & rectifier circuits (+5, ±12, ±15 or any combination)
• Non concentric winding technique • Minimum inter-winding capacitance • Excellent isolation • Very low leakage • Minimum electrical noise • High efficiency • UL recognized components for Class B (130°C)

Hi Freq—Up to 40 KHz

Ferrite cores
Switching power supply
AC-DC converter
DC-DC converter
Inverter

Current—Up to 500 Amp

Sense
Instrumentation
Measuring devices
AC and DC

INDUCTORS

Power—50, 60, 400 Hz

1 μH to 50H of inductance
1μ Amp to 60 Amp of current

Hi Freq—Up to 100 KHz

1 μH to 50H of inductance
Switching power supply
Ferrite cores
Converter
Inverter

FORMATS

PC MOUNT

(Hi Pot 4K VRMS)

• Low profile • Split pack
• Horizontal • Vertical

CHASSIS MOUNT

(Hi Pot 4K VRMS)

• Low profile • Split pack
• Quick connect, solder tab, lead wire, or any type of termination
Open frame/Closed frame

SERVICES

• Design to your specifications • Design to UL standards • First article engineering sample within one week • No engineering set up charge • O.E.M. services • 100% Q.C.—guaranteed reliability • Our CAD system eliminates the need for a catalog

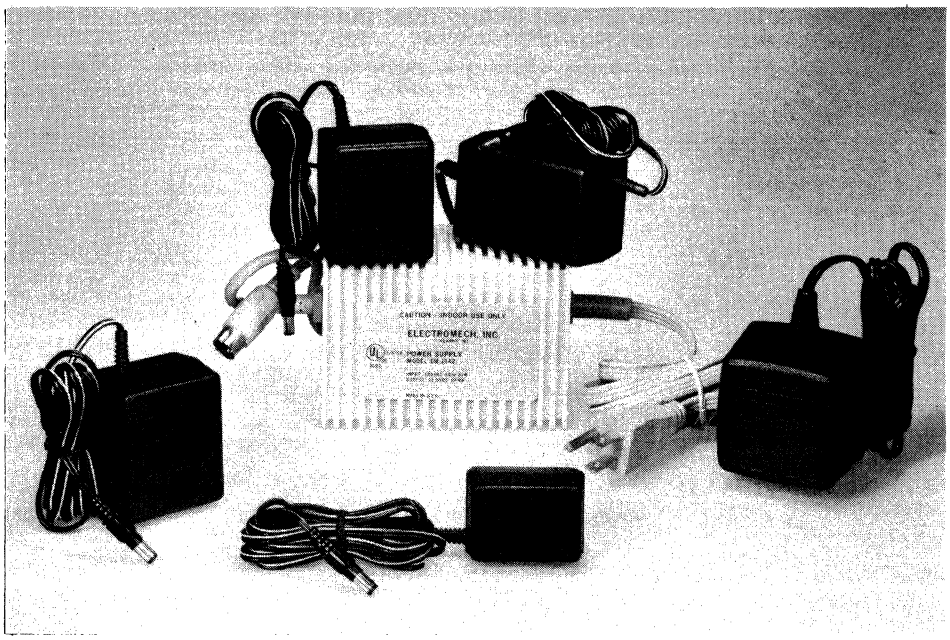
Electromech — THE LAST WORD IN TRANSFORMERS

Electromech, Inc. • 528 ELM STREET • KEARNY, NEW JERSEY 07032 • (201) 997-0950 • FAX (201) 997-9208

Electromech

TRANSFORMERS

WALL PLUG-IN/DESK TOP POWER SOURCES • TAILORED TO YOUR EXACT NEEDS



- **FULL ISOLATION**
- **AC/AC**
- **AC/DC (unreg)**
- **AC/DC (reg)**
- **BATTERY CHARGERS**
- **LINEAR SUPPLIES**

FEATURES

Power—.1VA to 40VA (WALL PLUG-IN)
.1VA to 1KVA (DESK TOP)

Input—100VAC to 240VAC

Freq.—47Hz to 400Hz

Output—.1V to 200V (WALL PLUG-IN)
.1V to 1KV (DESK TOP)

Current—.01A to 5A (WALL PLUG-IN)
.01A to 400A (DESK TOP)

Termination—CONNECTORS, SCREW TERM.
ETC.

SERVICES

- DESIGNED TO YOUR SPECIFICATIONS
- DESIGNED TO UL/CSA/VDE/IEC
- FIRST ARTICLE ENGINEERING SAMPLE WITHIN ONE (1) WEEK
- NO MINIMUM ORDER QUANTITY
- NO ENGINEERING CHARGE
- 100% Q.A.

Electromech — THE LAST WORD IN TRANSFORMERS

Electromech, Inc. • 528 ELM STREET • KEARNY, NEW JERSEY 07032 • (201) 997-0950 • FAX (201) 997-9208

ENEGREN ELECTRONICS, INC.

Post Office Box 2536
15605-C South Keeler Terrace
Olathe, Kansas 66062
Phone: 913-782-4720
FAX: 913-782-4752

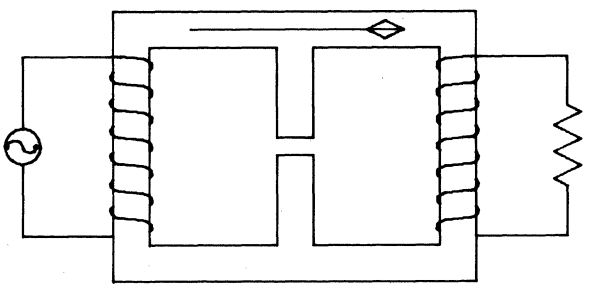
ENEGREN has stood for integrity in Magnetics since 1975. It is our goal to optimize each transformer for its specific application. Our Engineers have a broad background in the design and development of High Tech Electronics Equipment. Having worked with military and commercial air borne gear, we endeavor to give our customers benefit of this experience.

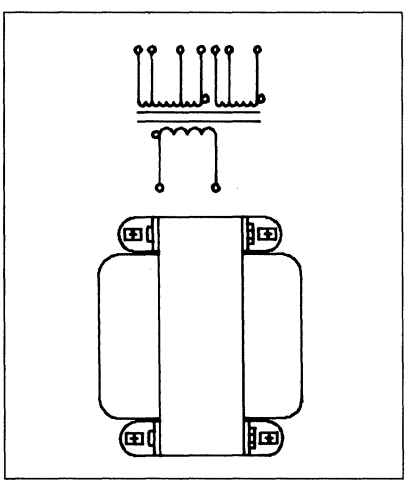
TRANSFORMERS:

We manufacture a broad line of Transformers: power, RF, audio, pulse, etc. We supply open frame as well as canned Mil-T-27 Types

FERRORESONANT:

We can supply Ferroresonant transformers to your Specifications.



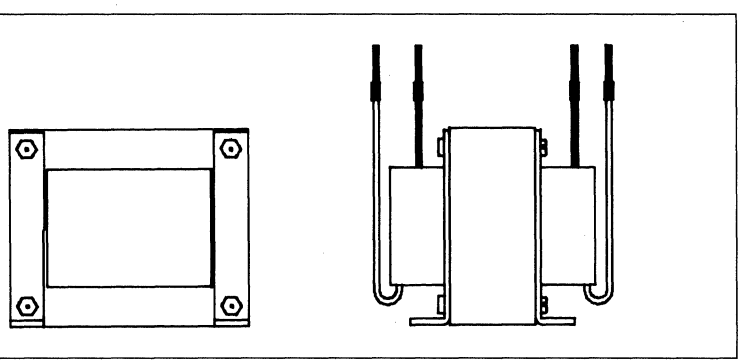


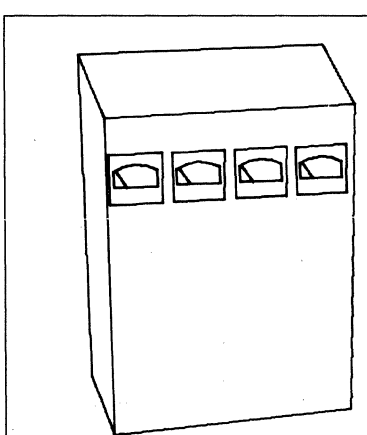
INDUCTORS:

Our Plant has produced many types of Inductors ranging from RF to Power Devices.

FILTERS:

We supply filters ranging from audio frequencies to VHF.





OTHER PRODUCTS:

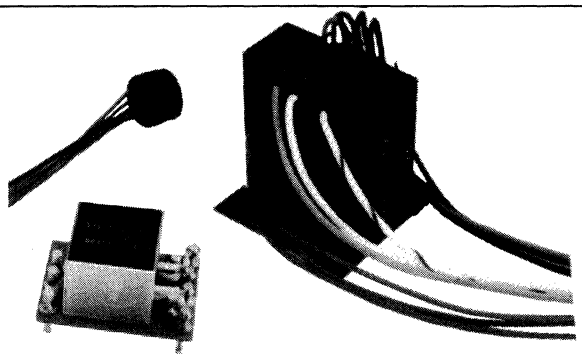
ENEGREN ELECTRONICS, INC. supplies serveral high efficiency Power Conversion Systems. A typical unit is the dual PWM POWER SUPPLY pictured here, which delivers zero to 100 VDC at 10 amps and zero to 200 VDC at 25 amps. It is designed for DC Motor tests, but has wide application in other areas.

SPECIALISTS in the DESIGN and MANUFACTURE of MAGNETIC DEVICES

ESC

TRANSFORMERS

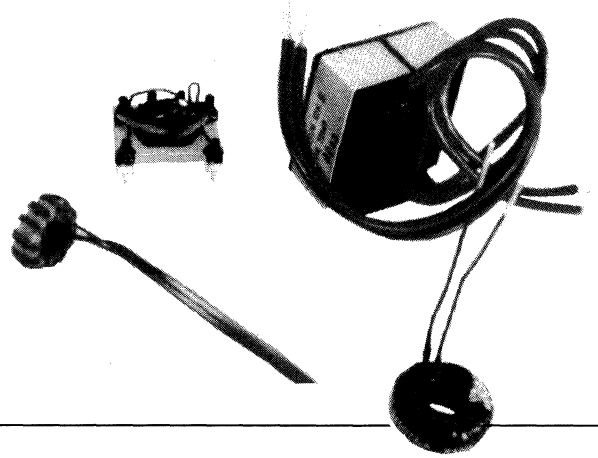
MILITARY AEROSPACE INDUSTRIAL



ESC will manufacture your transformer/coils in strict accordance with your engineering design documents. Our 35 years of manufacturing experience will be incorporated into each product which will be an exact reflection of your design. Timely and economical advantages as well as customer visibility is offered by our service to you.



ESC maintains a Quality Control System that conforms to MIL-I-45208 and MIL-Q-9858, as applicable. Equipment calibration is per MIL-STD-45662 and in-line testing is performed as well as 100% final testing of your products. All applicable testing is in accordance with MIL-T-27E. Soldering workmanship is certified to per MIL-STD-2000.



ESC is fully versed and experienced with the military and aerospace requirements as well as high volume commercial and industrial products. Our high volume capacity is achieved through manufacture in any one of our five offshore plants. Contact us for further information regarding our ability to meet your requirements.

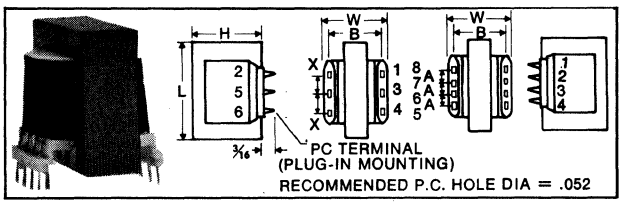
WRITE OR CALL TOLL FREE
1-800-631-0853 (EXCEPT N.J.)
FOR ESC'S NEW DELAY LINE CATALOG!

SEE OUR DELAY LINE ADS IN SECTION 2350

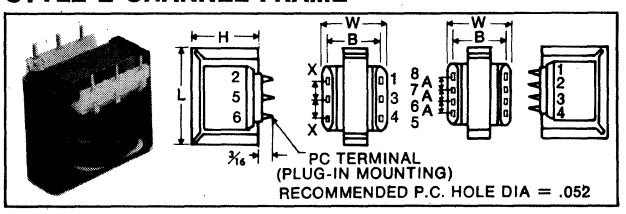
ESC ELECTRONICS CORP. ● 534 BERGEN BOULEVARD ● PALISADES PARK ● TOLL FREE 1-800-631-0853 (EXCEPT N.J.)
NEW JERSEY 07650 ● (201) 947-0400 ● TWX: 710-991-9780 ● FAX: 201-947-0406

P.C. Power Transformers—Concentric or Split Bobbin & FORM-TRAN® Construction

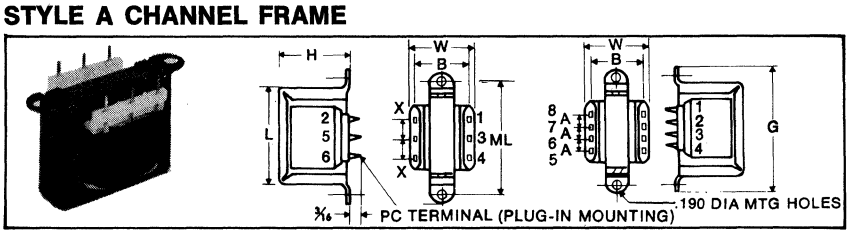
STYLE B NO CHANNEL FRAME



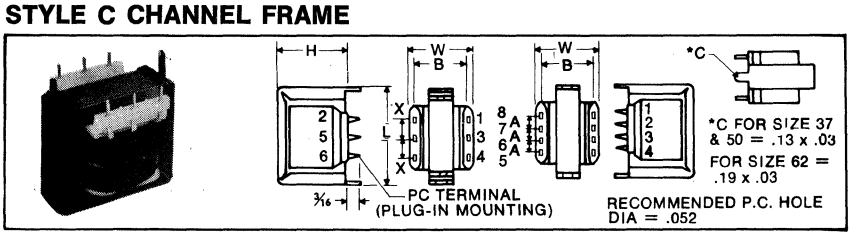
STYLE E CHANNEL FRAME



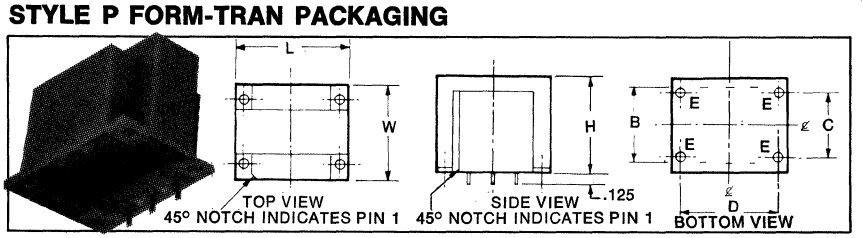
STYLE A CHANNEL FRAME

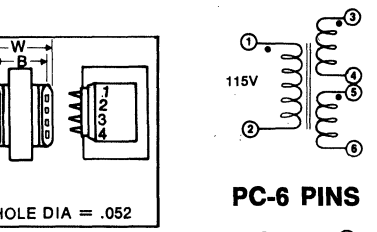


STYLE C CHANNEL FRAME

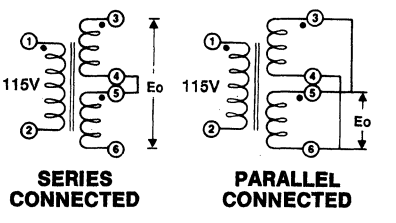


STYLE P FORM-TRAN PACKAGING

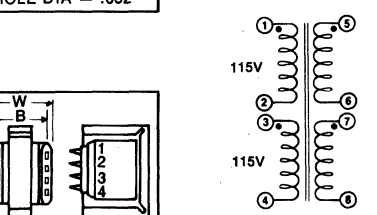




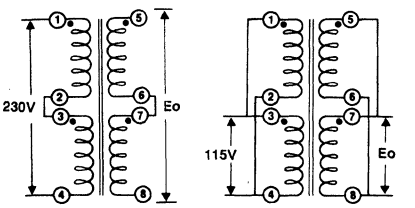
PC-6 PINS



SERIES CONNECTED **PARALLEL CONNECTED**



DPC-8 PINS



SERIES CONNECTED **PARALLEL CONNECTED**

HOW TO ORDER

D PC - 10 - 2400 B 4

Primary Rating

No Letter	115V	50/500 Hz	6 pin
C	230V	50/500 Hz	6 pin
D	115/230V	50/500 Hz	8 pin
E	277V	50/500 Hz	6 pin
F	332V	50/500 Hz	6 pin

Transformer Series
PC—Single Section Bobbin PC Transformers
EL—"2" Section" Split Bobbin PC Transformer (50/60 Hz only)

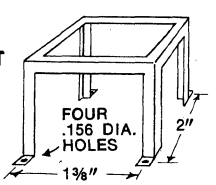
Secondary Voltage Rating
in volts RMS

Secondary Current Rating
in mA RMS

Individual Spec

Mechanical-Configuration
A=Channel Frame Mounting—Style A —Screw Mount
B=No Frame
C=Channel Frame Mounting—Style C —PC Mount
E=Channel Frame—No Mounting
P=Potted—FORM-TRAN™ Construction

"SLIDE ON" BRACKET FOR SIZE 24 P/N B24



SIZE	VA	STYLE A, B, C, E, P 6 PIN X	8 PIN A	B	STYLE B L	W	H	STYLE A, C, E L	W	H	STYLE A G	ML	STYLE P L	W	H	B	C	D	E
25	1.0	0.250	0.200	1.200	1	1.375	0.83	—	—	—	—	—	1.11	1.45	0.92	1.200	N/A	N/A	N/A
37	1.2	0.312	0.200	1.000	1.375	1.125	1.188	1.500	1.125	1.220	2.062	1.75	1.52	1.22	1.26	1.000	.840	1.270	.125
50	4.4	0.400	0.250	1.100	1.625	1.250	1.375	1.720	1.250	1.400	2.375	2.00	1.77	1.30	1.44	1.100	1.000	1.463	.159
62	10	0.400	0.250	1.300	1.875	1.438	1.625	1.970	1.438	1.660	2.813	2.38	2.02	1.50	1.70	1.300	1.125	1.625	.159
24	24	0.400	0.250	2.100	1.625	2.250	1.375	**	**	**	**	**	1.70	2.32	1.42	2.100	2.000	1.463	.159

** USE B24 BRACKET

EWC® INC. 385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
908/446-3110 FAX 908/446-5362

Recognized Component Underwriters Labs, Inc.

P.C. Power Transformers
Concentric and Split Bobbin Construction

SECONDARY RMS RATING			PRIMARY 50/500 Hz				
Series V.C.T. MA	Parallel @ 2x Current V MA	Size	Single 115V 6 Pin	Single 230V 6 Pin	Dual 115/230V 8 Pin	* Single 277V 6 Pin	* Single 332V 6 Pin
10 @ 90	5 @ 180	25	PC-10-90B53	CPC-10-90B53	DPC-10-90B53	Not Available	Not Available
10 @ 120	5 @ 240	37	PC-10-120B1	CPC-10-120B1	DPC-10-120B1	EPC-10-120B1	FPC-10-120B1
10 @ 440	5 @ 880	50	PC-10-440B2	CPC-10-440B2	DPC-10-440B2	EPC-10-440B2	FPC-10-440B2
10 @ 1000	5 @ 2000	62	PC-10-1000B3	CPC-10-1000B3	DPC-10-1000B3	EPC-10-1000B3	FPC-10-1000B3
10 @ 2400	5 @ 4800	24	PC-10-2400B4	CPC-10-2400B4	DPC-10-2400B4	EPC-10-2400B4	FPC-10-2400B4
12.6 @ 70	6.3 @ 140	25	PC-12-70B54	CPC-12-70B54	DPC-12-70B54	Not Available	Not Available
12.6 @ 100	6.3 @ 200	37	PC-12-100B5	CPC-12-100B5	DPC-12-100B5	EPC-12-100B5	FPC-12-100B5
12.6 @ 350	6.3 @ 700	50	PC-12-350B6	CPC-12-350B6	DPC-12-350B6	EPC-12-350B6	FPC-12-350B6
12.6 @ 800	6.3 @ 1600	62	PC-12-800B7	CPC-12-800B7	DPC-12-800B7	EPC-12-800B7	FPC-12-800B7
12.6 @ 2000	6.3 @ 4000	24	PC-12-2000B8	CPC-12-2000B8	DPC-12-2000B8	EPC-12-2000B8	FPC-12-2000B8
16 @ 55	8 @ 110	25	PC-16-55B55	CPC-16-55B55	DPC-16-55B55	Not Available	Not Available
16 @ 75	8 @ 150	37	PC-16-75B9	CPC-16-75B9	DPC-16-75B9	EPC-16-75B9	FPC-16-75B9
16 @ 260	8 @ 520	50	PC-16-260B10	CPC-16-260B10	DPC-16-260B10	EPC-16-260B10	FPC-16-260B10
16 @ 640	8 @ 1280	62	PC-16-640B11	CPC-16-640B11	DPC-16-640B11	EPC-16-640B11	FPC-16-640B11
16 @ 1500	8 @ 3000	24	PC-16-1500B12	CPC-16-1500B12	DPC-16-1500B12	EPC-16-1500B12	FPC-16-1500B12
20 @ 45	10 @ 90	25	PC-20-45B56	CPC-20-45B56	DPC-20-45B56	Not Available	Not Available
20 @ 60	10 @ 120	37	PC-20-60B13	CPC-20-60B13	DPC-20-60B13	EPC-20-60B13	FPC-20-60B13
20 @ 220	10 @ 440	50	PC-20-220B14	CPC-20-220B14	DPC-20-220B14	EPC-20-220B14	FPC-20-220B14
20 @ 500	10 @ 1000	62	PC-20-500B15	CPC-20-500B15	DPC-20-500B15	EPC-20-500B15	FPC-20-500B15
20 @ 1200	10 @ 2400	24	PC-20-1200B16	CPC-20-1200B16	DPC-20-1200B16	EPC-20-1200B16	FPC-20-1200B16
24 @ 35	12 @ 70	25	PC-24-35B57	CPC-24-35B57	DPC-24-35B57	Not Available	Not Available
24 @ 50	12 @ 100	37	PC-24-50B17	CPC-24-50B17	DPC-24-50B17	EPC-24-50B17	FPC-24-50B17
24 @ 180	12 @ 360	50	PC-24-180B18	CPC-24-180B18	DPC-24-180B18	EPC-24-180B18	FPC-24-180B18
24 @ 450	12 @ 900	62	PC-24-450B19	CPC-24-450B19	DPC-24-450B19	EPC-24-450B19	FPC-24-450B19
24 @ 1000	12 @ 2000	24	PC-24-1000B20	CPC-24-1000B20	DPC-24-1000B20	EPC-24-1000B20	FPC-24-1000B20
28 @ 30	14 @ 60	25	PC-28-30B58	CPC-28-30B58	DPC-28-30B58	Not Available	Not Available
28 @ 40	14 @ 80	37	PC-28-40B49	CPC-28-40B49	DPC-28-40B49	EPC-28-40B49	FPC-28-40B49
28 @ 160	14 @ 320	50	PC-28-160B50	CPC-28-160B50	DPC-28-160B50	EPC-28-160B50	FPC-28-160B50
28 @ 360	14 @ 720	62	PC-28-360B51	CPC-28-360B51	DPC-28-360B51	EPC-28-360B51	FPC-28-360B51
28 @ 800	14 @ 1.6A	24	PC-28-800B52	CPC-28-800B52	DPC-28-800B52	EPC-28-800B52	FPC-28-800B52
34 @ 25	17 @ 50	25	PC-34-25B59	CPC-34-25B59	DPC-34-25B59	Not Available	Not Available
34 @ 35	17 @ 70	37	PC-34-35B21	CPC-34-35B21	DPC-34-35B21	EPC-34-35B21	FPC-34-35B21
34 @ 125	17 @ 250	50	PC-34-125B22	CPC-34-125B22	DPC-34-125B22	EPC-34-125B22	FPC-34-125B22
34 @ 300	17 @ 600	62	PC-34-300B23	CPC-34-300B23	DPC-34-300B23	EPC-34-300B23	FPC-34-300B23
34 @ 700	17 @ 1400	24	PC-34-700B24	CPC-34-700B24	DPC-34-700B24	EPC-34-700B24	FPC-34-700B24
40 @ 20	20 @ 40	25	PC-40-20B60	CPC-40-20B60	DPC-40-20B60	Not Available	Not Available
40 @ 30	20 @ 60	37	PC-40-30B25	CPC-40-30B25	DPC-40-30B25	EPC-40-30B25	FPC-40-30B25
40 @ 110	20 @ 220	50	PC-40-110B26	CPC-40-110B26	DPC-40-110B26	EPC-40-110B26	FPC-40-110B26
40 @ 250	20 @ 500	62	PC-40-250B27	CPC-40-250B27	DPC-40-250B27	EPC-40-250B27	FPC-40-250B27
40 @ 600	20 @ 1200	24	PC-40-600B28	CPC-40-600B28	DPC-40-600B28	EPC-40-600B28	FPC-40-600B28
56 @ 15	28 @ 30	25	PC-56-15B61	CPC-56-15B61	DPC-56-15B61	Not Available	Not Available
56 @ 20	28 @ 40	37	PC-56-20B29	CPC-56-20B29	DPC-56-20B29	EPC-56-20B29	FPC-56-20B29
56 @ 80	28 @ 160	50	PC-56-80B30	CPC-56-80B30	DPC-56-80B30	EPC-56-80B30	FPC-56-80B30
56 @ 180	28 @ 360	62	PC-56-180B31	CPC-56-180B31	DPC-56-180B31	EPC-56-180B31	FPC-56-180B31
56 @ 420	28 @ 840	24	PC-56-420B32	CPC-56-420B32	DPC-56-420B32	EPC-56-420B32	FPC-56-420B32
88 @ 10	44 @ 20	25	PC-88-10B62	CPC-88-10B62	DPC-88-10B62	Not Available	Not Available
88 @ 15	44 @ 30	37	PC-88-15B33	CPC-88-15B33	DPC-88-15B33	EPC-88-15B33	FPC-88-15B33
88 @ 50	44 @ 100	50	PC-88-50B34	CPC-88-50B34	DPC-88-50B34	EPC-88-50B34	FPC-88-50B34
88 @ 120	44 @ 240	62	PC-88-120B35	CPC-88-120B35	DPC-88-120B35	EPC-88-120B35	FPC-88-120B35
88 @ 270	44 @ 540	24	PC-88-270B36	CPC-88-270B36	DPC-88-270B36	EPC-88-270B36	FPC-88-270B36
120 @ 8	60 @ 16	25	PC-120-8B63	CPC-120-8B63	DPC-120-8B63	Not Available	Not Available
120 @ 10	60 @ 20	37	PC-120-10B37	CPC-120-10B37	DPC-120-10B37	EPC-120-10B37	FPC-120-10B37
120 @ 35	60 @ 70	50	PC-120-35B38	CPC-120-35B38	DPC-120-35B38	EPC-120-35B38	FPC-120-35B38
120 @ 85	60 @ 170	62	PC-120-85B39	CPC-120-85B39	DPC-120-85B39	EPC-120-85B39	FPC-120-85B39
120 @ 200	60 @ 400	24	PC-120-200B40	CPC-120-200B40	DPC-120-200B40	EPC-120-200B40	FPC-120-200B40
180 @ 5	90 @ 10	25	PC-180-5B64	CPC-180-5B64	DPC-180-5B64	Not Available	Not Available
180 @ 6	90 @ 12	37	PC-180-6B41	CPC-180-6B41	DPC-180-6B41	EPC-180-6B41	FPC-180-6B41
180 @ 24	90 @ 48	50	PC-180-24B42	CPC-180-24B42	DPC-180-24B42	EPC-180-24B42	FPC-180-24B42
180 @ 55	90 @ 110	62	PC-180-55B43	CPC-180-55B43	DPC-180-55B43	EPC-180-55B43	FPC-180-55B43
180 @ 130	90 @ 260	24	PC-180-130B44	CPC-180-130B44	DPC-180-130B44	EPC-180-130B44	FPC-180-130B44
230 @ 4	115 @ 8	25	PC-230-4B65	CPC-230-4B65	DPC-230-4B65	Not Available	Not Available
230 @ 5	115 @ 10	37	PC-230-5B45	CPC-230-5B45	DPC-230-5B45	EPC-230-5B45	FPC-230-5B45
230 @ 20	115 @ 40	50	PC-230-20B46	CPC-230-20B46	DPC-230-20B46	EPC-230-20B46	FPC-230-20B46
230 @ 40	115 @ 80	62	PC-230-40B47	CPC-230-40B47	DPC-230-40B47	EPC-230-40B47	FPC-230-40B47
230 @ 100	115 @ 200	24	PC-230-100B48	CPC-230-100B48	DPC-230-100B48	EPC-230-100B48	FPC-230-100B48

RATINGS BASED ON 20% REGULATION.

***UL CSA APPROVAL AVAILABLE UPON REQUEST**

METHOD OF DETERMINING SECONDARY RMS CURRENT:

Rectifier Type	Filter Type	RMS Secondary Current
Full Wave Center Tap	Choke Input	.7 x DC Amps
Full Wave Center Tap	Capacitor Input	1.2 x DC Amps
Full Wave Bridge	Choke Input	1.0 x DC Amps
Full Wave Bridge	Capacitor Input	1.8 x DC Amps

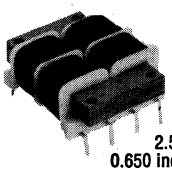
EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

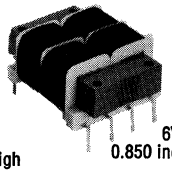
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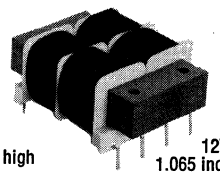
EWC® INC.

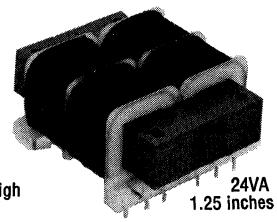
Miniature LO-PROFILE Plug-In Power Transformers

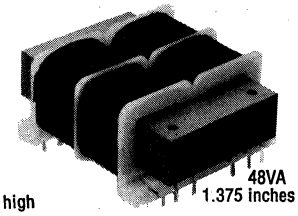
Recognized Component
Underwriters Labs, Inc.


2.5VA
0.650 inches high


6VA
0.850 inches high


12VA
1.065 inches high


24VA
1.25 inches high


48VA
1.375 inches high

FIVE SIZES:

EWC's Lo-Profile, plug-in power transformers are designed for low height, critical pc board applications in semiconductor control and instrumentation. Interchangeable with those of other manufacturers, the units are for use in single, dual or reference dc supplies or isolated control circuits. Sizes 2, 6 and 12 are available encapsulated in form-fitting shells to protect against possible damage due to water-soluble or other fluxes as well as electrolytic corrosion experienced on open-type constructions.

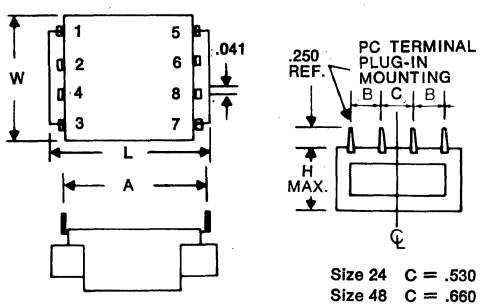


Figure 1

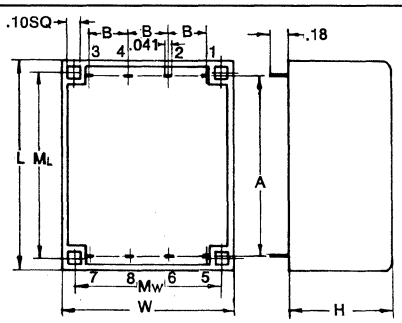
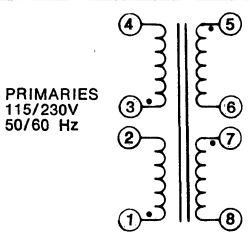


Figure 2 — Replace "B" in part no. with "P"



• INDICATES LIKE POLARITY

SIZE	FIG.	L	W	H	A	B	ML	MH	Oz.
2	1	1.875	1.562	0.650	1.600	0.375	—	—	5
6	1	1.875	1.562	0.850	1.600	0.375	—	—	7
12	1	2.500	2.000	1.065	2.000	0.500	—	—	11
24	1	2.875	2.250	1.250	1.900	0.600	—	—	15
48	1	3.125	2.500	1.375	2.180	0.600	—	—	21
2	2	2.030	1.635	0.785	1.600	0.375	1.795	1.340	
6	2	2.030	1.635	0.950	1.600	0.375	1.795	1.340	
12	2	2.675	2.126	1.185	2.000	0.500	2.440	1.850	

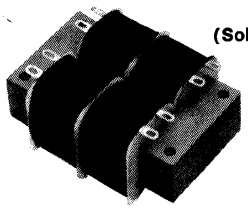
EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

PART NO.	SIZE	SECONDARY RMS RATINGS SERIES	SECONDARY RMS RATINGS PARALLEL
LP 10-250B23	2	10V C.T. @ 250mA	5V @ 500mA
LP 10-600B1	6	10V C.T. @ 600mA	5V @ 1.20A
LP 10-1200B2	12	10V C.T. @ 1.20A	5V @ 2.40A
LP 10-2400B89	24	10V C.T. @ 2.40A	5V @ 4.80A
LP 10-4800B90	48	10V C.T. @ 4.80A	5V @ 9.60A
LP 12-200B24	2	12.6V C.T. @ 200mA	6.3V @ 400mA
LP 12-450B3	6	12.6V C.T. @ 450mA	6.3V @ 900mA
LP 12-900B4	12	12.6V C.T. @ 900mA	6.3V @ 1.80A
LP 12-1900B91	24	12.6V C.T. @ 1.90A	6.3V @ 3.80A
LP 12-3800B92	48	12.6V C.T. @ 3.80A	6.3V @ 7.60A
LP 16-150B25	2	16V C.T. @ 150mA	8V @ 300mA
LP 16-350B5	6	16V C.T. @ 350mA	8V @ 700mA
LP 16-700B6	12	16V C.T. @ 700mA	8V @ 1.40A
LP 16-1500B93	24	16V C.T. @ 1.50A	8V @ 3.00A
LP 16-3000B94	48	16V C.T. @ 3.00A	8V @ 6.00A
LP 18-135B105	2	18V C.T. @ 135mA	9V @ 270mA
LP 18-325B106	6	18V C.T. @ 325mA	9V @ 650mA
LP 18-650B107	12	18V C.T. @ 650 mA	9V @ 1.30A
LP 18-1300B108	24	18V C.T. @ 1.30A	9V @ 2.60A
LP 18-2600B109	48	18V C.T. @ 2.60A	9V @ 5.20A
LP 20-125B26	2	20V C.T. @ 125mA	10V @ 250mA
LP 20-300B7	6	20V C.T. @ 300mA	10V @ 600mA
LP 20-600B8	12	20V C.T. @ 600mA	10V @ 1.20A
LP 20-1200B95	24	20V C.T. @ 1.20A	10V @ 2.40A
LP 20-2400B96	48	20V C.T. @ 2.40A	10V @ 4.80A
LP 24-100B27	2	24V C.T. @ 100mA	12V @ 200mA
LP 24-250B9	6	24V C.T. @ 250mA	12V @ 500mA
LP 24-500B10	12	24V C.T. @ 500mA	12V @ 1.00A
LP 24-1000B97	24	24V C.T. @ 1.00A	12V @ 2.00A
LP 24-2000B98	48	24V C.T. @ 2.00A	12V @ 4.00A
LP 28-90B115	2	28V C.T. @ 90 mA	14V @ 180mA
LP 28-215B116	6	28V C.T. @ 215mA	14V @ 430mA
LP 28-430B117	12	28V C.T. @ 430mA	14V @ 860mA
LP 28-850B118	24	28V C.T. @ 850mA	14V @ 1.70A
LP 28-1700B119	48	28V C.T. @ 1.70A	14V @ 3.40A
LP 30-85B125	2	30V C.T. @ 85mA	15V @ 170mA
LP 30-200B126	6	30V C.T. @ 200mA	15V @ 400mA
LP 30-400B127	12	30V C.T. @ 400mA	15V @ 800mA
LP 30-800B128	24	30V C.T. @ 800mA	15V @ 1.60A
LP 30-1600B129	48	30V C.T. @ 1.60A	15V @ 3.20A
LP 34-75B28	2	34V C.T. @ 75mA	17V @ 150mA
LP 34-170B11	6	34V C.T. @ 170mA	17V @ 340mA
LP 34-340B12	12	34V C.T. @ 340mA	17V @ 680mA
LP 34-700B99	24	34V C.T. @ 700mA	17V @ 1.40A
LP 34-1400B100	48	34V C.T. @ 1.40A	17V @ 2.80A
LP 40-60B29	2	40V C.T. @ 60mA	20V @ 120mA
LP 40-150B13	6	40V C.T. @ 150mA	20V @ 300mA
LP 40-300B14	12	40V C.T. @ 300mA	20V @ 600mA
LP 40-600B101	24	40V C.T. @ 600mA	20V @ 1.20A
LP 40-1200B102	48	40V C.T. @ 1.20A	20V @ 2.40A
LP 56-45B30	2	56V C.T. @ 45mA	28V @ 90mA
LP 56-100B15	6	56V C.T. @ 100mA	28V @ 200mA
LP 56-200B16	12	56V C.T. @ 200mA	28V @ 400mA
LP 56-425B103	24	56V C.T. @ 425mA	28V @ 850mA
LP 56-850B104	48	56V C.T. @ 850mA	28V @ 1.70A
LP 88-28B31	2	88V C.T. @ 28mA	44V @ 56mA
LP 88-65B17	6	88V C.T. @ 65mA	44V @ 130mA
LP 88-130B18	12	88V C.T. @ 130mA	44V @ 260mA
LP 120-20B32	2	120V C.T. @ 20mA	60V @ 40mA
LP 120-50B19	6	120V C.T. @ 50mA	60V @ 100mA
LP 120-100B20	12	120V C.T. @ 100mA	60V @ 200mA
LP 230-10B33	2	230V C.T. @ 10 mA	115V @ 20mA
LP 230-25B21	6	230V C.T. @ 25mA	115V @ 50mA
LP 230-50B22	12	230V C.T. @ 50mA	115V @ 100mA

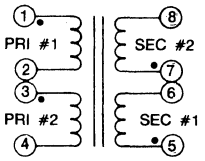
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908/446-3110 FAX 908/446-5362

LO-PROFILE Hi-Power Humbucking Transformers

Varnish Finish (Standard)

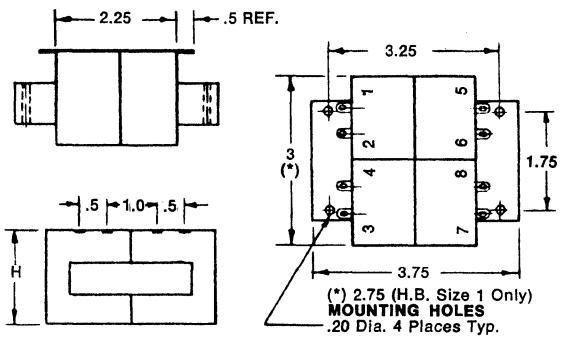


(Solder Terminals)



115/230V 50/60 Hz
DUAL PRI.

SOLDER TERMINALS (.5-1-.5) Approx. Spacing



H.B. Size	H (Max.)	Wt. (lbs.) (Approx.)	VA (Nom.)	Reg. (%) (Typ.)	T. Rise (°C) (Typ.)
I	.850	1.00	20	30	25
II	1.25	1.75	50	30	45
III	1.50	2.25	75	25	55
IV	1.85	3.00	135	20	65
V	2.35	4.25	200	15	75

- **SOLDER TERMINALS**
- **SIDE-BY-SIDE BOBBINS**
- **20VA TO 200VA • 115/230V @ 50/60Hz**
- **1.5KV RMS HIPOT • CLASS B (130°C)**

ADVANTAGES:

- Side-By-Side Bobbins (Secondary Wound alongside of Primary) Lower Interwinding Capacitance — eliminates the need for electro-static shield
- Hum-bucking (Semi-Toroidal) Construction [Lower Radiated Magnetic Fields, Balanced Wdgs., Larger Heat Radiating Surface and Lower Center of Gravity]
- High Power for Low Panel Heights and Narrow Card Spacing

MOUNTING: (4) Lamination Holes .20 Dia. Insulated hardware required.

RATINGS PER SECONDARY OUTPUT: VA-SEC = 0.5 x VA (Output) • V-SEC = V-SEC (Parallel) • I-SEC = I-SEC (Series)

NON-STANDARD RATINGS: Tapped primaries, secondaries different voltages, currents or frequencies can be furnished.

Units with higher VA ratings up to 1.25 KVA can also be supplied.

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

PART NO.	Size	SECONDARY RMS RATINGS SERIES	SECONDARY RMS RATINGS PARALLEL
LP 10-2B34	I	10V C.T. @ 2.00A	5V @ 4.00A
LP 10-5B35	II	10V C.T. @ 5.00A	5V @ 10.0A
LP 10-7.5B36	III	10V C.T. @ 7.50A	5V @ 15.0A
LP 10-13.5B37	IV	10V C.T. @ 13.5A	5V @ 27.0A
LP 10-20B38	V	10V C.T. @ 20.0A	5V @ 40.0A
LP 12-1.6B39	I	12.6V C.T. @ 1.60A	6.3V @ 3.20A
LP 12-4B40	II	12.6V C.T. @ 4.00A	6.3V @ 8.00A
LP 12-6B41	III	12.6V C.T. @ 6.00A	6.3V @ 12.0A
LP 12-11B42	IV	12.6V C.T. @ 11.0A	6.3V @ 22.0A
LP 12-16B43	V	12.6V C.T. @ 16.0A	6.3V @ 32.0A
LP 16-1.25B44	I	16V C.T. @ 1.25A	8V @ 2.50A
LP 16-3.15B45	II	16V C.T. @ 3.15A	8V @ 6.30A
LP 16-4.75B46	III	16V C.T. @ 4.75A	8V @ 9.50A
LP 16-8.5B47	IV	16V C.T. @ 8.50A	8V @ 17.0A
LP 16-12.5B48	V	16V C.T. @ 12.5A	8V @ 25.0A
LP 18-1.1B110	I	18V C.T. @ 1.10A	9V @ 2.20A
LP 18-2.75B111	II	18V C.T. @ 2.75A	9V @ 5.50A
LP 18-4.2B112	III	18V C.T. @ 4.20A	9V @ 8.40A
LP 18-7.5B113	IV	18V C.T. @ 7.50A	9V @ 15.0A
LP 18-11B114	V	18V C.T. @ 11.0A	9V @ 22.0A
LP 20-1B49	I	20V C.T. @ 1.00A	10V @ 2.00A
LP 20-2.5B50	II	20V C.T. @ 2.50A	10V @ 5.00A
LP 20-3.75B51	III	20V C.T. @ 3.75A	10V @ 7.50A
LP 20.6.75B52	IV	20V C.T. @ 6.75A	10V @ 13.5A
LP 20-10B53	V	20V C.T. @ 10.0A	10V @ 20.0A
LP 24-0.85B54	I	24V C.T. @ 0.85A	12V @ 1.70A
LP 24-2.1B55	II	24V C.T. @ 2.10A	12V @ 4.20A
LP 24-3.15B56	III	24V C.T. @ 3.15A	12V @ 6.30A
LP 24-5.75B57	IV	24V C.T. @ 5.75A	12V @ 11.5A
LP 24-8.5B58	V	24V C.T. @ 8.50A	12V @ 17.0A
LP 28-0.7B120	I	28V C.T. @ 0.70A	14V @ 1.40A
LP 28-1.75B121	II	28V C.T. @ 1.75A	14V @ 3.50A
LP 28-2.7B122	III	28V C.T. @ 2.70A	14V @ 5.40A
LP 28-4.8B123	IV	28V C.T. @ 4.80A	14V @ 9.60A
LP 28-7B124	V	28V C.T. @ 7.00A	14V @ 14.0A
LP 30-0.65B130	I	30V C.T. @ 0.65A	15V @ 1.30A
LP 30-1.65B131	II	30V C.T. @ 1.65A	15V @ 3.30A
LP 30-2.5B132	III	30V C.T. @ 2.50A	15V @ 5.00A
LP 30-4.5B133	IV	30V C.T. @ 4.50A	15V @ 9.00A
LP 30-6.65B134	V	30V C.T. @ 6.65A	15V @ 13.3A
LP 34-0.6B59	I	34V C.T. @ 0.60A	17V @ 1.20A
LP 34-1.5B60	II	34V C.T. @ 1.50A	17V @ 3.00A
LP 34-2.25B61	III	34V C.T. @ 2.25A	17V @ 4.50A
LP 34-4B62	IV	34V C.T. @ 4.00A	17V @ 8.00A
LP 34-6B63	V	34V C.T. @ 6.00A	17V @ 12.0A
LP 40-0.5B64	I	40V C.T. @ 0.50A	20V @ 1.00A
LP 40-1.25B65	II	40V C.T. @ 1.25A	20V @ 2.50A
LP 40-1.9B66	III	40V C.T. @ 1.90A	20V @ 3.80A
LP 40-3.4B67	IV	40V C.T. @ 3.40A	20V @ 6.80A
LP 40-5B68	V	40V C.T. @ 5.00A	20V @ 10.0A
LP 56-0.35B69	I	56V C.T. @ 0.35A	28V @ 0.70A
LP 56-0.9B70	II	56V C.T. @ 0.90A	28V @ 1.80A
LP 56-1.35B71	III	56V C.T. @ 1.35A	28V @ 2.70A
LP 56-2.4B72	IV	56V C.T. @ 2.40A	28V @ 4.80A
LP 56-3.5B73	V	56V C.T. @ 3.50A	28V @ 7.00A
LP 88-0.23B74	I	88V C.T. @ 0.23A	44V @ 0.46A
LP 88-0.575B75	II	88V C.T. @ 0.575A	44V @ 1.15A
LP 88-0.85B76	III	88V C.T. @ 0.85A	44V @ 1.70A
LP 88-1.5B77	IV	88V C.T. @ 1.50A	44V @ 3.00A
LP 88-2.3B78	V	88V C.T. @ 2.30A	44V @ 4.60A
LP 120-0.17B79	I	120V C.T. @ 170mA	60V @ 340mA
LP 120-0.425B80	II	120V C.T. @ 425mA	60V @ 850mA
LP 120-0.625B81	III	120V C.T. @ 625mA	60V @ 1.25A
LP 120-1.1B82	IV	120V C.T. @ 1.10A	60V @ 2.20A
LP 120-1.7B83	V	120V C.T. @ 1.70A	60V @ 3.40A
LP 230-0.09B84	I	230V C.T. @ 90mA	115V @ 180mA
LP 230-0.22B95	II	230V C.T. @ 220mA	115V @ 440mA
LP 230-0.325B86	III	230V C.T. @ 325mA	115V @ 650mA
LP 230-0.6B87	IV	230V C.T. @ 600mA	115V @ 1.20A
LP 230-0.9B88	V	230V C.T. @ 900mA	115V @ 1.80A

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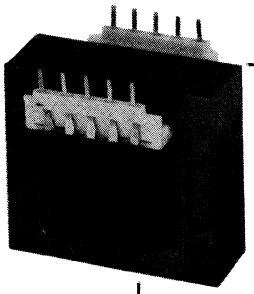
Triple Output Power Transformers

Recognized Component Underwriters Labs, Inc.

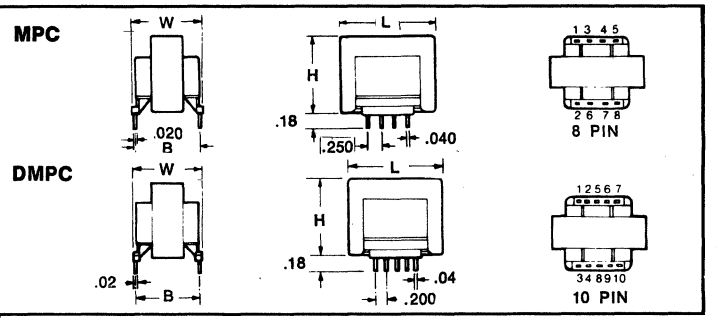
For triple-output regulated supplies

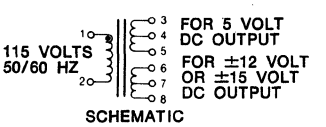
IDEAL FOR MICROPROCESSOR APPLICATIONS

These lines were designed around our standard PC, LP and CHASSIS-TRAN series transformers and are rated in terms of the final DC output after regulation by a 3-terminal IC regulator. 1500V Hipot is standard.

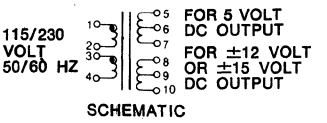


TYPE MPC AND DMPC

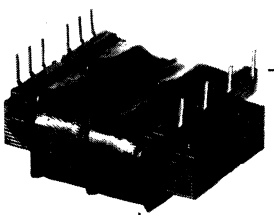




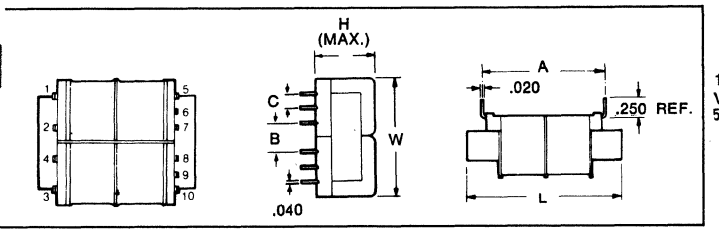
SCHEMATIC

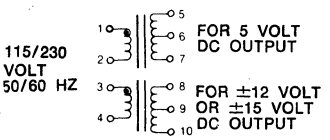


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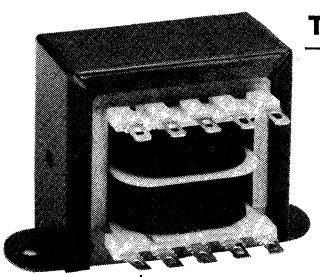


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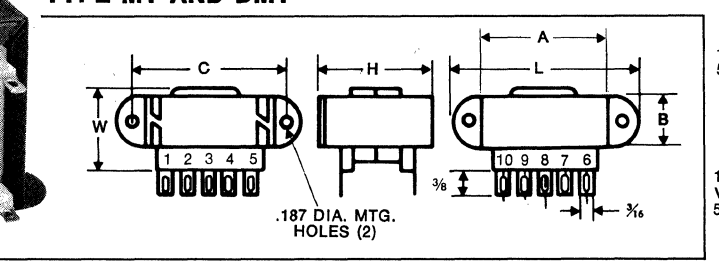


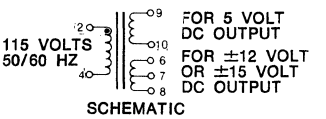


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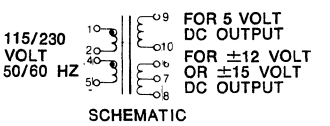


TYPE MT AND DMT





SCHEMATIC



SCHEMATIC

Part Number Primary 50/60 Hz		DC Output		
115V	115/230V	Output 1	Output 2	Size
MPC-V-12B1	N/A	5V @ 180mA	12V @ 35mA	V
MPC-V-15B2	N/A	5V @ 180mA	15V @ 30mA	V
MPC-X-12B11	DMPC-X-12B31	5V @ 360mA	12V @ 60mA	X
MPC-X-15B12	DMPC-X-15B32	5V @ 360mA	15V @ 50mA	X
MPC-Y-12B21	DMPC-Y-12B41	5V @ 835mA	12V @ 150mA	Y
MPC-Y-15B22	DMPC-Y-15B42	5V @ 835mA	15V @ 130mA	Y
N/A	MPL-6-12B51	5V @ 135mA	12V @ 40mA	6
N/A	MPL-6-15B52	5V @ 135mA	15V @ 35mA	6
N/A	MPL-12-12B61	5V @ 270mA	12V @ 85mA	12
N/A	MPL-12-15B62	5V @ 270mA	15V @ 70mA	12
MT-6-12A01	DMT-6-12A01	5V @ 1.75A	12V @ 210mA	6
MT-6-15A02	DMT-6-15A02	5V @ 1.75A	15V @ 175mA	6
MT-7-12A03	DMT-7-12A03	5V @ 2.8A	12V @ 350mA	7
MT-7-15A04	DMT-7-15A04	5V @ 2.8A	15V @ 280mA	7
MT-8-12A05	DMT-8-12A05	5V @ 4A	12V @ 600mA	8
MT-8-15A06	DMT-8-15A06	5V @ 4A	15V @ 500mA	8

Size	Type	Lbs.	L	W	H	A	B	C
6	MT	1.1	3¼	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16
7	MT	1.7	3 11/16	1 13/16	2¼	2 11/16	1 1/16	3⅛
8	MT	2.75	4 1/32	2¼	2 5/16	3 1/16	1 5/16	3 5/16
V	MPC	0.31	1 5/8	1¼	1⅜	—	1.100	—
X	MPC	0.56	1 7/8	1 1/16	1 5/8	—	1.300	—
Y	MPC	0.75	1 5/8	2¼	1⅜	—	2.100	—
6	MPL	0.43	1 7/8	1 5/16	0.850	1.600	0.375	0.187
12	MPL	0.68	2½	2.000	1.065	2.000	0.500	0.250

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

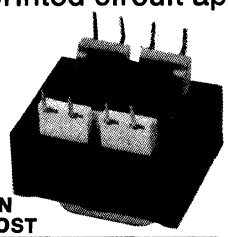
EWC® INC. 385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
201/446-3110 FAX 201/446-5362

Recognized Component
Underwriters Labs, Inc.

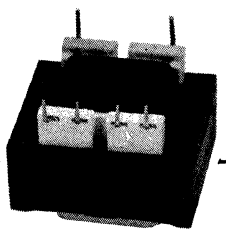
Miniature Split-Bobbin Plug-In Power Transformers

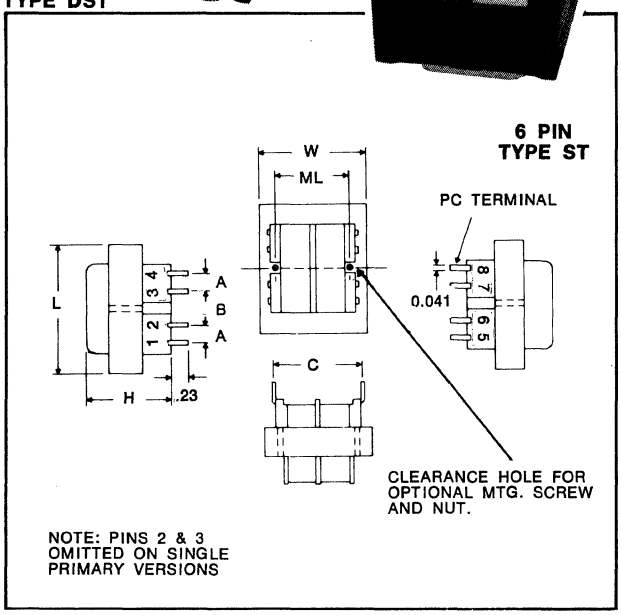
For printed circuit applications

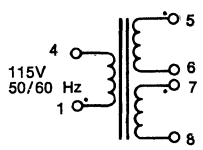
SPLIT BOBBIN — HIGHLY ISOLATED



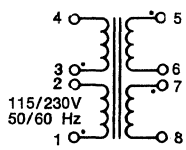
8 PIN TYPE DST







6 PIN TYPE ST



8 PIN TYPE DST

TRANSFORMERS WOUND ON A SPLIT BOBBIN PERMIT THE PRIMARIES AND SECONDARIES TO BE WOUND SIDE BY SIDE RATHER THAN ONE OVER THE OTHER.

FEATURES ARE:

2500V RMS Hipot
Elimination of electro-static shield
No cross-overs of primary and secondary leads
Class B insulation — 130°C

Transformers can be supplied with single 115V or 115/230V, 50/60 Hz dual primaries. Secondaries can be series or parallel connected.

Size	VA	L	W	H	ML	A	B	C	Lbs.
2	1.1	1 3/8	1 1/8	15/16	—	.250	.250	1.200	0.17
3	2.4	1 3/8	1 1/8	1 3/16	—	.250	.250	1.200	0.25
4	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	0.44
5	12	1 7/8	1 5/16	1 7/16	1 1/4	.300	.400	1.410	0.70
6	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	0.80
7	36	2 5/8	2 3/16	1 5/16	†	.400	.400	1.850	1.10

†Size 7 has 4 mtg. holes on 2 3/16 x 1 3/4 centers for a #6 screw. Need not be nylon.

Part Number		Secondary RMS Rating	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10B41	DST 2-10B41	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10B1	DST 3-10B1	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10B2	DST 4-10B2	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10B3	DST 5-10B3	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10B4	DST 6-10B4	10V C.T. @ 2A	5V @ 4A
ST 7-10B51	DST 7-10B51	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12B42	DST 2-12B42	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12B5	DST 3-12B5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12B6	DST 4-12B6	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12B7	DST 5-12B7	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12B8	DST 6-12B8	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12B52	DST 7-12B52	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16B43	DST 2-16B43	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16B9	DST 3-16B9	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16B10	DST 4-16B10	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16B11	DST 5-16B11	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16B12	DST 6-16B12	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16B53	DST 7-16B53	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20B44	DST 2-20B44	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20B13	DST 3-20B13	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20B14	DST 4-20B14	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20B15	DST 5-20B15	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20B16	DST 6-20B16	20V C.T. @ 1A	10V @ 2A
ST 7-20B54	DST 7-20B54	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24B45	DST 2-24B45	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24B17	DST 3-24B17	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24B18	DST 4-24B18	24VC.T. @ 0.25A	12V @ 0.5A
ST 5-24B19	DST 5-24B19	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24B20	DST 6-24B20	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24B55	DST 7-24B55	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28B46	DST 2-28B46	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28B21	DST 3-28B21	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28B22	DST 4-28B22	28V C.T. @ 0.2A	14V @ 0.4A
ST 5-28B23	DST 5-28B23	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28B24	DST 6-28B24	28V C.T. @0.7A	14V @ 1.4A
ST 7-28B56	DST 7-28B56	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36B47	DST 2-36B47	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36B25	DST 3-36B25	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36B26	DST 4-36B26	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36B27	DST 5-36B27	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36B28	DST 6-36B28	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36B57	DST 7-36B57	36V C.T. @ 1A	18V @ 2A
ST 2-48B48	DST 2-48B48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48B29	DST 3-48B29	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48B30	DST 4-48B30	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48B31	DST 5-48B31	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48B32	DST 6-48B32	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48B58	DST 7-48B58	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56B49	DST 2-56B49	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56B33	DST 3-56B33	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56B34	DST 4-56B34	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56B35	DST 5-56B35	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56B36	DST 6-56B36	56V C.T. @ 0.35A	28V @ 0.7A
ST 7-56B59	DST 7-56B59	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120B50	DST 2-120B50	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120B37	DST 3-120B37	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120B38	DST 4-120B38	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120B39	DST 5-120B39	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120B40	DST 6-120B40	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120B60	DST 7-120B60	120V C.T. @ 0.3A	60V @ 0.6A

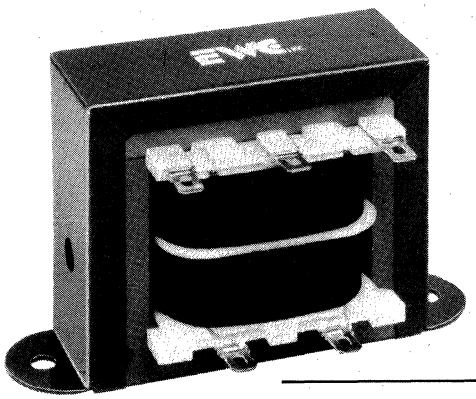
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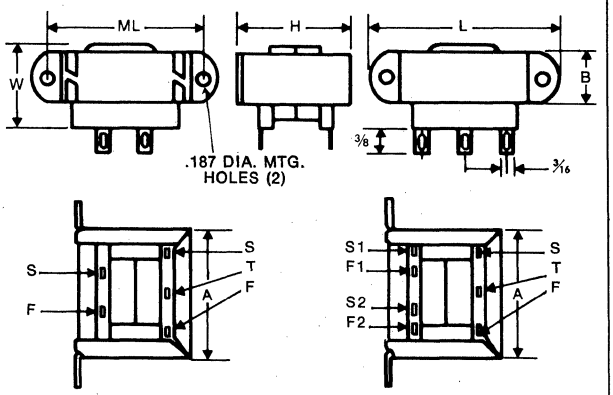
385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
201/446-3110 FAX 201/446-5362

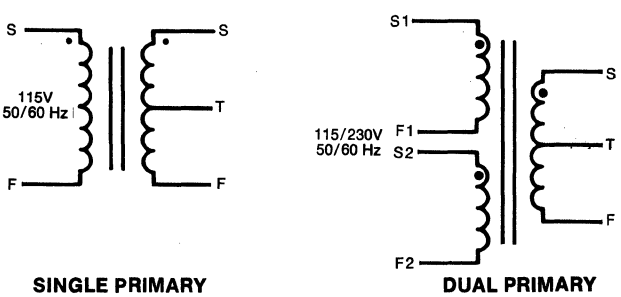
EWC® INC.

CHASSIS-TRAN®

Recognized Component
Underwriters Labs, Inc.







SIZE	VA	L	W	H	A	B	ML	LBS.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	5/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 5/16	3 1/16	1 5/16	3 5/16	2.75

QUICK CONNECT POWER TRANSFORMERS

2500 Volt RMS Hipot in a variety of practical sizes. Maximum operating temperature 130°C available with either single 115 or dual 115/230V primary.

EWC's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

PART NUMBER		SECONDARY RMS RATING
SINGLE 115V	DUAL 115/230V	
241-3-10A1	NOT AVAILABLE	10V C.T. @ 0.25A
241-4-10A11	DP 241-4-10A11	10V C.T. @ 0.6A
241-5-10A21	DP 241-5-10A21	10V C.T. @ 1.2A
241-6-10A31	DP 241-6-10A31	10V C.T. @ 3.0A
241-7-10A41	DP 241-7-10A41	10V C.T. @ 5.0A
241-8-10A51	DP 241-8-10A51	10V C.T. @ 10A
241-3-12A2	NOT AVAILABLE	12.6V C.T. @ 0.2A
241-4-12A12	DP 241-4-12A12	12.6V C.T. @ 0.5A
241-5-12A22	DP 241-5-12A22	12.6V C.T. @ 1.0A
241-6-12A32	DP 241-6-12A32	12.6V C.T. @ 2.5A
241-7-12A42	DP 241-7-12A42	12.6V C.T. @ 4.0A
241-8-12A52	DP 241-8-12A52	12.6V C.T. @ 8.0A
241-3-16A3	NOT AVAILABLE	16V C.T. @ 0.15A
241-4-16A13	DP 241-4-16A13	16V C.T. @ 0.4A
241-5-16A23	DP 241-5-16A23	16V C.T. @ 0.8A
241-6-16A33	DP 241-6-16A33	16V C.T. @ 2.0A
241-7-16A43	DP 241-7-16A43	16V C.T. @ 3.5A
241-8-16A53	DP 241-8-16A53	16V C.T. @ 6.25A
241-3-20A4	NOT AVAILABLE	20V C.T. @ 0.12A
241-4-20A14	DP 241-4-20A14	20V C.T. @ 0.3A
241-5-20A24	DP 241-5-20A24	20V C.T. @ 0.6A
241-6-20A34	DP 241-6-20A34	20V C.T. @ 1.5A
241-7-20A44	DP 241-7-20A44	20V C.T. @ 2.8A
241-8-20A54	DP 241-8-20A54	20V C.T. @ 5.0A
241-3-24A5	NOT AVAILABLE	24V C.T. @ 0.1A
241-4-24A15	DP 241-4-24A15	24V C.T. @ 0.25A
241-5-24A25	DP 241-5-24A25	24V C.T. @ 0.5A
241-6-24A35	DP 241-6-24A35	24V C.T. @ 1.25A
241-7-24A45	DP 241-7-24A45	24V C.T. @ 2.4A
241-8-24A55	DP 241-8-24A55	24V C.T. @ 4.0A
241-3-28A6	NOT AVAILABLE	28V C.T. @ 0.085A
241-4-28A16	DP 241-4-28A16	28V C.T. @ 0.2A
241-5-28A26	DP 241-5-28A26	28V C.T. @ 0.42A
241-6-28A36	DP 241-6-28A36	28V C.T. @ 1.1A
241-7-28A46	DP 241-7-28A46	28V C.T. @ 2.0A
241-8-28A56	DP 241-8-28A56	28V C.T. @ 3.6A
241-3-36A7	NOT AVAILABLE	36V C.T. @ 0.065A
241-4-36A17	DP 241-4-36A17	36V C.T. @ 0.17A
241-5-36A27	DP 241-5-36A27	36V C.T. @ 0.35A
241-6-36A37	DP 241-6-36A37	36V C.T. @ 0.85A
241-7-36A47	DP 241-7-36A47	36V C.T. @ 1.5A
241-8-36A57	DP 241-8-36A57	36V C.T. @ 2.8A
241-3-48A8	NOT AVAILABLE	48V C.T. @ 0.05A
241-4-48A18	DP 241-4-48A18	48V C.T. @ 0.125A
241-5-48A28	DP 241-5-48A28	48V C.T. @ 0.25A
241-6-48A38	DP 241-6-48A38	48V C.T. @ 0.63A
241-7-48A48	DP 241-7-48A48	48V C.T. @ 1.2A
241-8-48A58	DP 241-8-48A58	48V C.T. @ 2.0A
241-3-56A9	NOT AVAILABLE	56V C.T. @ 0.045A
241-4-56A19	DP 241-4-56A19	56V C.T. @ 0.11A
241-5-56A29	DP 241-5-56A29	56V C.T. @ 0.22A
241-6-56A39	DP 241-6-56A39	56V C.T. @ 0.54A
241-7-56A49	DP 241-7-56A49	56V C.T. @ 1.0A
241-8-56A59	DP 241-8-56A59	56V C.T. @ 1.8A
241-3-120A10	NOT AVAILABLE	120V C.T. @ 0.02A
241-4-120A20	DP 241-4-120A20	120V C.T. @ 0.05A
241-5-120A30	DP 241-5-120A30	120V C.T. @ 0.1A
241-6-120A40	DP 241-6-120A40	120V C.T. @ 0.25A
241-7-120A50	DP 241-7-120A50	120V C.T. @ 0.5A
241-8-120A60	DP 241-8-120A60	120V C.T. @ 0.85A

Explanation of part number series 241 Size-4 Sec. Volts — 36 Prefix "DP" used in dual primary versions.

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

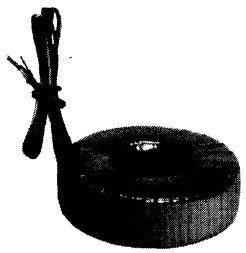
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NEW! Toroidal Power Transformers — Up to 1.0 KVA

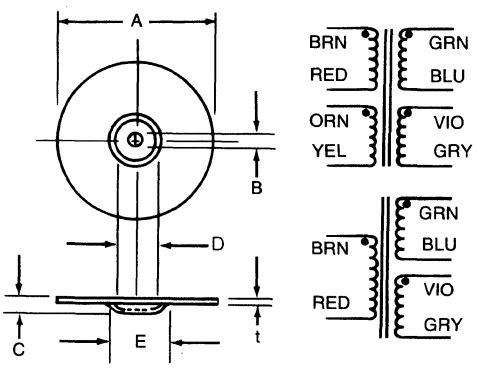
Toroidal Power Transformers

Standard transformers suitable for use in applications where low magnetic noise and superior electrical performance in a small package is required. Designed and built to meet the basic requirements of UL, CSA, VDE and IEC, these transformers are 100% dielectric tested at 4000V rms and utilize a Class B, 130C recognized insulation system. Available with either 115V, 50-500Hz or 115/230, 50-500Hz primaries and up to 1KVA output, these transformers may be specified for use in many applications.

Optional mounting hardware includes two Neoprene pads and a metal washer. Standard leads are 8" long self-leads. Other ratings available upon request.



VA	O.D.	HT.	LBS
20	2.88	1.25	1.10
40	3.25	1.38	1.54
70	3.75	1.44	2.20
100	3.75	1.57	2.86
150	4.50	1.57	3.30
340	4.50	2.32	5.28
600	5.50	2.75	9.68
1000	6.38	2.88	14.5

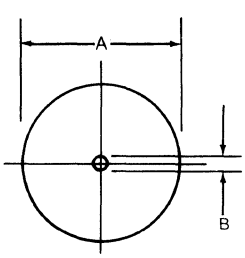


ZINC PLATED STEEL CENTERING WASHER

PART NO.	A	B	C	D	E	t	WT/OZ
200109A0001	2.0	0.17	0.18	0.30	0.44	.04	0.5
200109A0002	2.4	0.20	0.22	0.40	0.75	.05	1.0
200109A0003	2.8	0.25	0.26	0.62	1.08	.05	1.3
200109A0004	3.5	0.25	0.28	0.85	1.29	.06	2.6
200109A0005	4.4	0.32	0.33	1.08	1.64	.08	5.5
200109A0006	5.7	0.32	0.37	1.08	1.64	.08	9.1

NEOPRENE WASHER

PART NO.	A	B
200110A0001	2.0	0.17
200110A0002	2.4	0.20
200110A0003	2.8	0.25
200110A0004	3.5	0.25
200110A0005	4.4	0.32
200110A0006	5.7	0.32



PART NO.		SECONDARY RMS RATING	
SINGLE 115V PRIMARY	DUAL 115/230V PRIMARY	VOLTGE Vrms	CURRENT Arms
T20-10B1	DT20-10B1	2×5	2.00
T40-10B2	DT40-10B2	2×5	4.00
T70-10B3	DT70-10B3	2×5	7.00
T100-10B4	DT100-10B4	2×5	10.0
T150-10B5	DT150-10B5	2×5	15.0
T340-10B6	DT340-10B6	2×5	34.0
T20-12B7	DT20-12B7	2×6.3	1.58
T40-12B8	DT40-12B8	2×6.3	3.17
T70-12B9	DT70-12B9	2×6.3	5.55
T100-12B10	DT100-12B10	2×6.3	7.93
T150-12B11	DT150-12B11	2×6.3	11.9
T340-12B12	DT340-12B12	2×6.3	27.0
T20-16B13	DT20-16B13	2×8	1.25
T40-16B14	DT40-16B14	2×8	2.50
T70-16B15	DT70-16B15	2×8	4.37
T100-16B16	DT100-16B16	2×8	6.25
T150-16B17	DT150-16B17	2×8	9.37
T340-16B18	DT340-16B18	2×8	21.2
T600-16B19	DT600-16B19	2×8	37.5
T20-18B20	DT20-18B20	2×9	1.11
T40-18B21	DT40-18B21	2×9	2.22
T70-18B22	DT70-18B22	2×9	3.88
T100-18B23	DT100-18B23	2×9	5.55
T150-18B24	DT150-18B24	2×9	8.33
T340-18B25	DT340-18B25	2×9	18.8
T600-18B26	DT600-18B26	2×9	33.3
T20-20B27	DT20-20B27	2×10	1.00
T40-20B28	DT40-20B28	2×10	2.00
T70-20B29	DT70-20B29	2×10	3.50
T100-20B30	DT100-20B30	2×10	5.00
T150-20B31	DT150-20B31	2×10	7.50
T340-20B32	DT340-20B32	2×10	17.0
T600-20B33	DT600-20B33	2×10	30.0
T20-24B34	DT20-20B34	2×12	0.83
T40-24B35	DT40-24B35	2×12	1.66
T70-24B36	DT70-24B36	2×12	2.91
T100-24B37	DT100-24B37	2×12	4.16
T150-24B38	DT150-24B38	2×12	6.25
T340-24B39	DT340-24B39	2×12	14.1
T600-24B40	DT600-24B40	2×12	25.0
T20-28B41	DT20-28B41	2×14	0.71
T40-28B42	DT40-28B42	2×14	1.42
T70-28B43	DT70-28B43	2×14	2.50
T100-28B44	DT100-28B44	2×14	3.57
T150-28B45	DT150-28B45	2×14	5.35
T340-28B46	DT340-28B46	2×14	12.1
T600-28B47	DT600-28B47	2×14	21.4
T1000-28B48	DT1000-28B48	2×14	35.7
T20-36B49	DT20-36B49	2×18	0.55
T40-36B50	DT40-36B50	2×18	1.11
T70-36B51	DT70-36B51	2×18	1.94
T100-36B52	DT100-36B52	2×18	2.77
T150-36B53	DT150-36B53	2×18	4.16
T340-36B54	DT340-36B54	2×18	9.44
T600-36B55	DT600-36B55	2×18	16.6
T1000-36B56	DT1000-36B56	2×18	27.7

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Power Transformers

Recognized Component
Underwriters Labs, Inc.

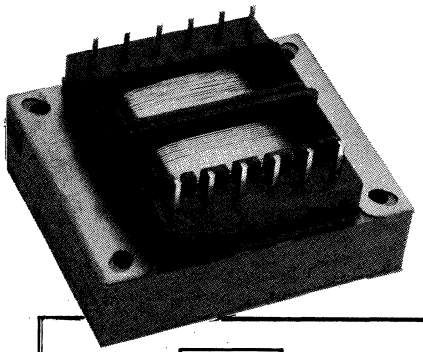
INTERNATIONAL SERIES POWER TRANSFORMERS

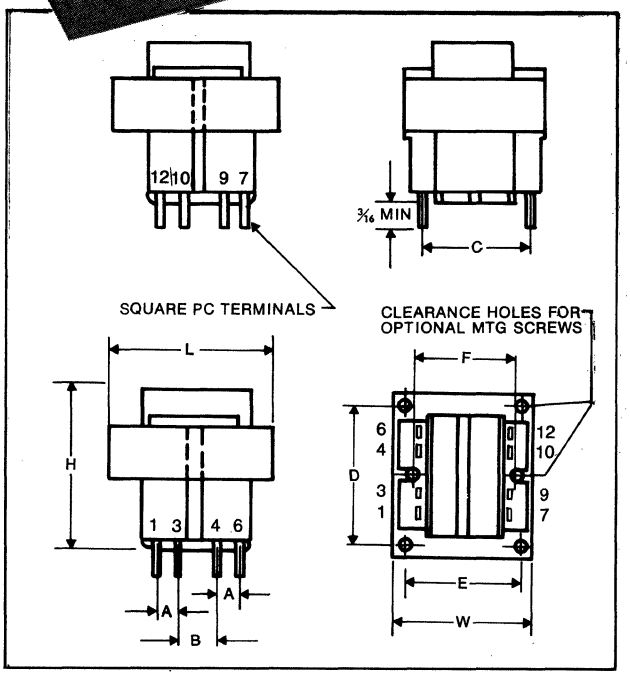
UL, VDE, IEC and CSA certified.

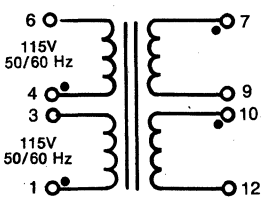
In addition to being certified to VDE 0806, IEC 380, CSA 22.2 No. 66 and UL506, the EWC series of International Transformers is designed and built to meet most other international safety standards.

These transformers are available in both PC and chassis-mount construction. With power ratings of 2.5VA to 175VA, these transformers are built on dual-bobbins with insulating shrouds to provide 4000V RMS isolation between primary and secondary. The non-concentric construction reduces primary to secondary capacitance and eliminates the need for an electrostatic shield.

PART NO. PC MOUNT	VA (SIZE)	SECONDARY RMS RATING	
		SERIES	PARALLEL
14A-2.5-10B1	2.5	10V C.T. @0.25A	5V @0.5A
14A-5.0-10B2	5.0	10V C.T. @0.5A	5V @1.0A
14A-10-10B3	10.0	10V C.T. @1.0A	5V @2.0A
14A-20-10B4	20.0	10V C.T. @2.0A	5V @4.0A
14A-30-10B5	30.0	10V C.T. @3.0A	5V @6.0A
14A-56-10B6	56.0	10V C.T. @5.6A	5V @11.2A
14A-2.5-12B7	2.5	12.6V C.T. @0.2A	6.3V @0.4A
14A-5.0-12B8	5.0	12.6V C.T. @0.4A	6.3V @0.8A
14A-10-12B9	10.0	12.6V C.T. @0.8A	6.3V @1.6A
14A-20-12B10	20.0	12.6V C.T. @1.6A	6.3V @3.2A
14A-30-12B11	30.0	12.6V C.T. @2.4A	6.3V @4.8A
14A-56-12B12	56.0	12.6V C.T. @4.4A	6.3V @8.8A
14A-2.5-16B13	2.5	16V C.T. @0.15A	8V @0.3A
14A-5.0-16B14	5.0	16V C.T. @0.31A	8V @0.62A
14A-10-16B15	10.0	16V C.T. @0.62A	8V @1.25A
14A-20-16B16	20.0	16V C.T. @1.25A	8V @2.5A
14A-30-16B17	30.0	16V C.T. @1.9A	8V @3.8A
14A-56-16B18	56.0	16V C.T. @3.5A	8V @7.0A
14A-2.5-20B19	2.5	20V C.T. @0.12A	10V @0.24A
14A-5.0-20B20	5.0	20V C.T. @0.25A	10V @0.5A
14A-10-20B21	10.0	20V C.T. @0.5A	10V @1.0A
14A-20-20B22	20.0	20V C.T. @1.0A	10V @2.0A
14A-30-20B23	30.0	20V C.T. @1.5A	10V @3.0A
14A-56-20B24	56.0	20V C.T. @2.8A	10V @5.6A
14A-2.5-24B25	2.5	24V C.T. @0.1A	12V @0.2A
14A-5.0-24B26	5.0	24V C.T. @0.21A	12V @0.42A
14A-10-24B27	10.0	24V C.T. @0.42A	12V @0.84A
14A-20-24B28	20.0	24V C.T. @0.83A	12V @1.66A
14A-30-24B29	30.0	24V C.T. @1.25A	12V @2.5A
14A-56-24B30	56.0	24V C.T. @2.33A	12V @4.66A
14A-2.5-28B31	2.5	28V C.T. @0.09A	14V @0.18A
14A-5.0-28B32	5.0	28V C.T. @0.18A	14V @0.36A
14A-10-28B33	10.0	28V C.T. @0.36A	14V @0.72A
14A-20-28B34	20.0	28V C.T. @0.72A	14V @1.44A
14A-30-28B35	30.0	28V C.T. @1.06A	14V @2.12A
14A-56-28B36	56.0	28V C.T. @2.0A	14V @4.0A
14A-2.5-36B37	2.5	36V C.T. @0.07A	18V @0.14A
14A-5.0-36B38	5.0	36V C.T. @0.14A	18V @0.28A
14A-10-36B39	10.0	36V C.T. @0.28A	18V @0.56A
14A-20-36B40	20.0	36V C.T. @0.56A	18V @1.12A
14A-30-36B41	30.0	36V C.T. @0.82A	18V @1.64A
14A-56-36B42	56.0	36V C.T. @1.56A	18V @3.12A







MECHANICAL DIMENSIONS

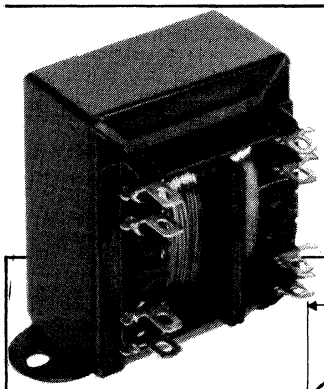
VA	WT.	L	W	H	A	B
2.5	0.25	1.625	1.312	1.125	.200	.250
5.0	0.37	1.625	1.312	1.375	.200	.400
10.0	0.53	1.875	1.562	1.375	.200	.400
20.0	0.90	2.250	1.875	1.625	.400	.400
30.0	1.15	2.625	2.187	1.562	.550	.275
56.0	1.70	3.000	2.500	1.812	.600	.300

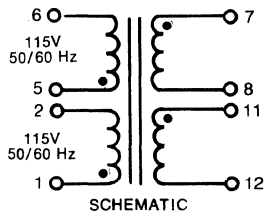
VA	C	D	E	F	PIN DIM	MTG
2.5	1.000	—	—	1.062	.025 SQ	#4
5.0	1.000	—	—	1.062	.025 SQ	#4
10.0	1.140	—	—	1.250	.038 SQ	#4
20.0	1.460	—	—	1.500	.038 SQ	#4
30.0	1.680	2.18	1.75	—	.045 SQ	#6
56.0	1.900	2.50	2	—	.045 SQ	#6

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Recognized Component
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Power Transformers





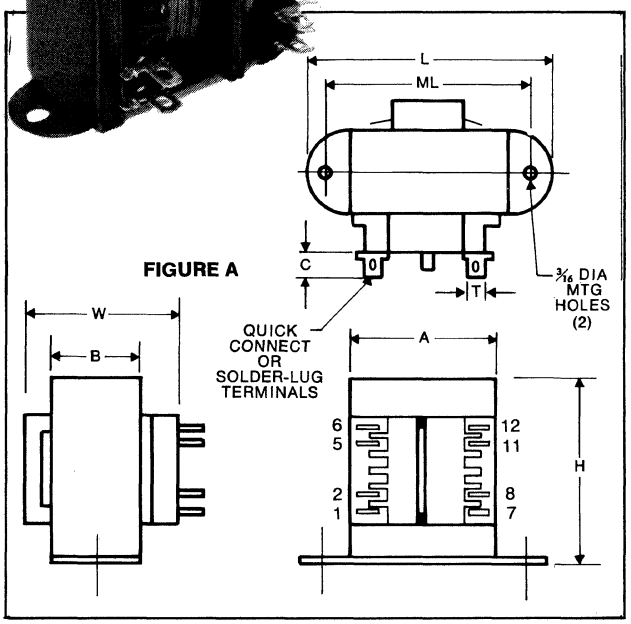
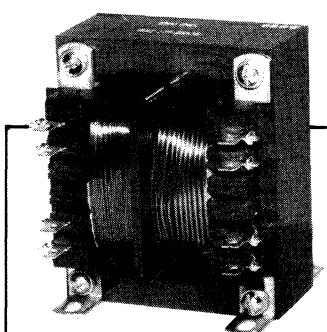


FIGURE A



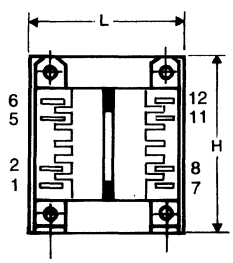
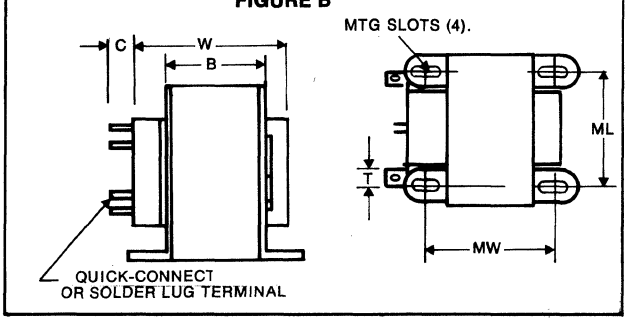


FIGURE B



INTERNATIONAL SERIES POWER TRANSFORMERS

UL, VDE, IEC and CSA certified.

PART NO. CHASIS MOUNT	(SIZE) VA	SECONDARY RMS RATING	
		SERIES	PARALLEL
A41-25-10A1	25	10V C.T. @2.5A	5V @5.0A
A41-43-10A2	43	10V C.T. @4.3A	5V @8.6A
A41-80-10A3	80	10V C.T. @8.0A	5V @16.0A
A41-130-10A4	130	10V C.T. @13.0A	5V @26.0A
A41-175-10A5	175	10V C.T. @17.5A	5V @35.0A
A41-25-12A7	25	12.6V C.T. @2.0A	6.3V @4.0A
A41-43-12A8	43	12.6V C.T. @3.4A	6.3V @6.8A
A41-80-12A9	80	12.6V C.T. @6.3A	6.3V @12.6A
A41-130-12A10	130	12.6V C.T. @10.3A	6.3V @20.6A
A41-175-12A11	175	12.6V C.T. @14.0A	6.3V @28.0A
A41-25-16A13	25	16V C.T. @1.6A	8V @3.2A
A41-43-16A14	43	16V C.T. @2.7A	8V @5.4A
A41-80-16A15	80	16V C.T. @5.0A	8V @10.0A
A41-130-16A16	130	16V C.T. @8.1A	8V @16.2A
A41-175-16A17	175	16V C.T. @11.0A	8V @22.0A
A41-25-20A19	25	20V C.T. @1.25A	10V @2.5A
A41-43-20A20	43	20V C.T. @2.2A	10V @4.4A
A41-80-20A21	80	20V C.T. @4.0A	10V @8.0A
A41-130-20A22	130	20V C.T. @6.5A	10V @13.0A
A41-175-20A23	175	20V C.T. @8.8A	10V @17.6A
A41-25-24A25	25	24V C.T. @1A	12V @2A
A41-43-24A26	43	24V C.T. @1.8A	12V @3.6A
A41-80-24A27	80	24V C.T. @3.3A	12V @6.6A
A41-130-24A28	130	24V C.T. @5.4A	12V @10.8A
A41-175-24A29	175	24V C.T. @7.3A	12V @14.6A
A41-25-28A31	25	28V C.T. @0.9A	14V @1.86A
A41-43-28A32	43	28V C.T. @1.5A	14V @3.0A
A41-80-28A33	80	28V C.T. @2.8A	14V @5.6A
A41-130-28A34	130	28V C.T. @4.6A	14V @9.2A
A41-175-28A35	175	28V C.T. @6.25A	14V @12.5A
A41-25-36A37	25	36V C.T. @0.7A	18V @1.4A
A41-43-36A38	43	36V C.T. @1.2A	18V @2.4A
A41-80-36A39	80	36V C.T. @2.2A	18V @4.4A
A41-130-36A40	130	36V C.T. @3.6A	18V @7.2A
A41-175-36A41	175	36V C.T. @4.8A	18V @9.6A
A41-25-230A42	25	230V C.T. @0.11A	115V @0.22A
A41-43-230A43	43	230V C.T. @0.19A	115V @0.38A
A41-80-230A44	80	230V C.T. @0.35A	115V @0.7A
A41-130-230A45	130	230V C.T. @0.57A	115V @1.14A
A41-175-230A46	175	230V C.T. @0.76A	115V @1.52A

MECHANICAL DIMENSIONS

VA	WT.	L	W	H	A	B
25	1.25	2.812	1.875	2.312	2.000	1.125
43	1.6	3.125	2.062	2.687	2.250	1.125
80	2.8	2.500	2.375	3.000	—	1.375
130	4.1	2.812	2.875	3.375	—	1.625
175	5.2	3.125	2.875	3.750	—	1.625

VA	C	T	ML	MW	MTG	FIG.
25	.312	.187	2.375	—	#6	A
43	.312	.187	2.812	—	#6	A
80	.312	.187	2.000	2.18	#6	B
130	.375	0.25	2.250	2.50	#8	B
175	.375	0.25	2.500	2.50	#8	B

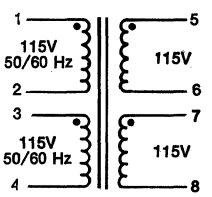
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201/446-3110 FAX 201/446-5362
EWC® INC.

Split-Bobbin Dual Chokes Isolation & Auto Transformers

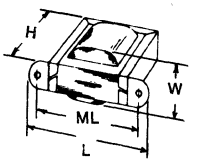
RECTIFIER POWER CHOKE	SERIES (NOM VALUES) L (mH)	Idc (A)	DCR (OHMS)	Et (Vs)	SIZE
RP-CL 0.1/0.2	3000	0.1	280	0.40	I
RP-CM 0.1/0.2	6000	0.1	360	0.75	II
RP-CH 0.1/0.2	14,000	0.1	500	1.75	IV
RP-CL 0.25/0.5	480	0.25	44	0.15	I
RP-CM 0.25/0.5	1500	0.25	72	0.50	III
RP-CH 0.25/0.5	3200	0.25	96	1.00	V
RP-CL 0.5/1	240	0.5	14	0.15	II
RP-CM 0.5/1	560	0.5	20	0.35	IV
RP-CH 0.5/1	1200	0.5	36	0.80	VI
RP-CL 1/2	100	1.0	4.4	.125	III
RP-CM 1/2	200	1.0	6.0	.250	V
RP-CH 1/2	380	1.0	8.0	.500	VII
RP-CL 2/4	25	2.0	1.1	.060	III
RP-CM 2/4	50	2.0	1.4	.125	V
RP-CH 2/4	160	2.0	3.0	.400	VIII
RP-CL 4/8	8.4	4.0	0.3	.045	IV
RP-CM 4/8	24	4.0	0.5	.125	VII
RP-CH 4/8	68	4.0	1.0	.300	IX
RP-CL 6/12	7.2	6.0	0.2	.065	VI
RP-CM 6/12	17	6.0	0.3	.125	VIII
RP-CH 6/12	28	6.0	0.4	.200	IX
RP-CL 8/16	10	8.0	0.18	.10	VIII
RP-CM 8/16	26	8.0	0.36	.25	X
RP-CH 8/16	76	8.0	0.56	.75	XIV
RP-CL 10/20	6	10	0.10	.075	VIII
RP-CM 10/20	22	10	0.28	.25	XI
RP-CH 10/20	46	10	0.34	.55	XIV
RP-CL 12/24	4.6	12	.072	.06	VIII
RP-CM 12/24	15	12	.180	.20	XI
RP-CH 12/24	32	12	.220	.45	XIV
RP-CL 15/30	4	15	.064	.08	IX
RP-CM 15/30	16	15	.140	.30	XII
RP-CH 15/30	32	15	.220	.55	XVI
RP-CL 25/50	1.7	25	.028	.05	IX
RP-CM 25/50	6.8	25	.056	.20	XIV
RP-CH 25/50	12	25	.080	.35	XVI
RP-CL 50/100	0.9	50	.012	.055	XI
RP-CM 50/100	1.7	50	.014	.10	XIV
RP-CH 50/100	3.0	50	.020	.175	XVI

SPLIT BOBBIN ISOLATION TRANSFORMERS

3 VA to 1.25 KVA (50/60 Hz) 230V/230V or 115V/115V or 230V/115V or 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C)



IT SERIES

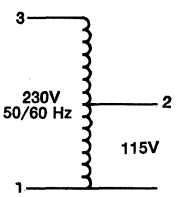


(Mtg. Style: C)
(STD. SIZE I-VII)

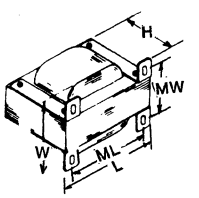
ISOLATION TRANSFORMER	VA MAX.	SIZE
IT 200.3-0F	3	I
IT 200.7-0F	7	II
IT 201.5-0F	15	III
IT 202.5-0F	25	IV
IT 204-0F	40	V
IT 206-0F	60	VI
IT 208-0F	80	VII
IT 212-0F	120	VIII
IT 218-0F	180	IX
IT 225-0F	250	X
IT 235-0F	350	XI
IT 255-0F	550	XII
IT 280-0F	800	XIV
IT 2125-0F	1250	XV

BOBBIN AUTO TRANSFORMERS

10 VA to 2.5 KVA (50-500 Hz) Step Down: 230V/115V or Step Up: 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C)



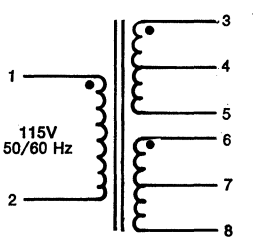
AT SERIES



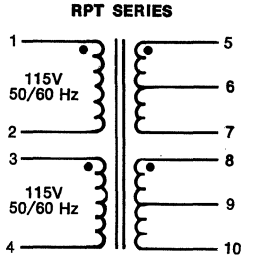
(Mtg. Style B)
(STD: SIZE VIII-XVI)

AUTO TRANSFORMER	VA MAX.	SIZE
AT 101	10	I
AT 102	20	II(a)
AT 104	40	III
AT 107	70	IV
AT 110	100	V
AT 112	120	V(a)
AT 115	150	VI
AT 120	200	VII
AT 125	250	VIII
AT 135	350	IX
AT 150	500	IX(a)
AT 175	750	IX(b)
AT 1100	1000	XII
AT 1150	1500	XIV
AT 1250	2500	XV

SIZE	WT. (LB.) APPROX.	W	L	H	ML	MW
I	.25	1¼	2 1/16	1 3/16	1¾	—
II	.375	1⅜	2⅜	1⅜	2	—
II(a)	.5	1½	2⅜	1⅜	2	—
III	.625	1½	2 13/16	1⅝	2⅜	—
IV	1.0	1⅝	3¼	1 15/16	2 13/16	—
V	1.25	1⅞	3¼	1 15/16	2 13/16	—
V(a)	1.5	2⅛	3¼	1 15/16	2 13/16	—
VI	1.75	2	3 1/16	2¼	3⅛	—
VII	2.5	2¼	4	2 5/16	3 5/16	—
VIII	3.5	2½	4½	2⅞	4	—
IX	4.75	2¾	3¾	3⅛	3⅛	2¼
IX(a)	6	3¼	3¾	3⅛	3⅛	2¾
IX(b)	8	4	3¾	3⅛	3⅛	3 1/16
X	6.25	3	4⅛	3 1/16	3 1/16	2⅜
XI	8	3¼	4½	3¾	3¾	2½
XII	12	4⅜	4½	3¾	3¾	3½
XIV	17	4½	5¼	4⅜	4⅜	3⅝
XV	25	6	5¼	4⅜	4⅜	5⅛
XVI	22.5	4½	6⅜	5 5/16	5 5/16	3¼



RPT SERIES



DRPT SERIES

EWC® INC.
385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
201/446-3110 FAX 201/446-5362

Split-Bobbin Rectifier Power Transformers

1 VA to 1.5 KVA — 115V @ 50/60 Hz Primary **1500V RMS Hipot — UL Class B (130°C) — Open Frame (STD)**

Primary 115V 50/60 Hz	Secondary Ratings (RMS) Series	Secondary Ratings (RMS) Parallel	Mtg. Style	Size
RPT 10-0.1	10V C.T. @ 0.1A	5V C.T. @ 0.2A	C	I
RPT 10-0.25	10V C.T. @ 0.25A	5V C.T. @ 0.5A	C	I
RPT 10-0.5	10V C.T. @ 0.5A	5V C.T. @ 1A	C	II
RPT 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	III
RPT 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	IV
RPT 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	V
RPT 10-6	10V C.T. @ 6A	5V C.T. @ 12A	C	VI
RPT 10-8	10V C.T. @ 8A	5V C.T. @ 16A	C	VII
RPT 10-12	10V C.T. @ 12A	5V C.T. @ 24A	C	VIII
RPT 10-15	10V C.T. @ 15A	5V C.T. @ 30A	B	IX
RPT 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	X
RPT 10-30	10V C.T. @ 30A	5V C.T. @ 60A	B	XI
RPT 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	XII
RPT 10-75	10V C.T. @ 75A	5V C.T. @ 150A	B	XIV
RPT 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	XVI
RPT 12.8-0.1	12.8V C.T. @ 0.1A	6.4V C.T. @ 0.2A	C	I
RPT 12.8-0.25	12.8V C.T. @ 0.25A	6.4V C.T. @ 0.5A	C	II
RPT 12.8-0.5	12.8V C.T. @ 0.5A	6.4V C.T. @ 1A	C	II
RPT 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	III
RPT 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	C	V
RPT 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	C	VI
RPT 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	C	VII
RPT 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	C	VIII
RPT 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	IX
RPT 12.8-20	12.8V C.T. @ 20A	6.4V C.T. @ 40A	B	X
RPT 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	XI
RPT 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	XIV
RPT 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	XVI
RPT 16-0.1	16V C.T. @ 0.1A	8V C.T. @ 0.2A	C	I
RPT 16-0.25	16V C.T. @ 0.25A	8V C.T. @ 0.5A	C	II
RPT 16-0.5	16V C.T. @ 0.5A	8V C.T. @ 1A	C	III
RPT 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	IV
RPT 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	V
RPT-16-4	16V C.T. @ 4A	8V C.T. @ 8A	C	VI
RPT 16-6	16V C.T. @ 6A	8V C.T. @ 12A	C	VIII
RPT 16-8	16V C.T. @ 8A	8V C.T. @ 16A	C	VIII
RPT 16-10	16V C.T. @ 10A	8V C.T. @ 20A	B	IX
RPT 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	X
RPT 16-20	16V C.T. @ 20A	8V C.T. @ 40A	B	XI
RPT 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	XII
RPT 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	XIV
RPT 16-75	16V C.T. @ 75A	8V C.T. @ 150A	B	XVI
RPT 24-0.1	24V C.T. @ 0.1A	12V C.T. @ 0.2A	C	I
RPT 24-0.25	24V C.T. @ 0.25A	12V C.T. @ 0.5A	C	II
RPT 24-0.5	24V C.T. @ 0.5A	12V C.T. @ 1A	C	III
RPT 24-1	24V C.T. @ 1A	12V C.T. @ 2A	C	IV
RPT 24-2	24V C.T. @ 2A	12V C.T. @ 4A	C	VI
RPT 24-3	24V C.T. @ 3A	12V C.T. @ 6A	C	VII
RPT 24-4	24V C.T. @ 4A	12V C.T. @ 8A	C	VIII
RPT 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	IX
RPT 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	X
RPT 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	XI
RPT 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	XII
RPT 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	XIV
RPT 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	XVI
RPT 36-0.1	36V C.T. @ 0.1A	18V C.T. @ 0.2A	C	II
RPT 36-0.25	36V C.T. @ 0.25A	18V C.T. @ 0.5A	C	III
RPT 36-0.5	36V C.T. @ 0.5A	18V C.T. @ 1A	C	IV
RPT 36-1	36V C.T. @ 1A	18V C.T. @ 2A	C	VI
RPT 36-2	36V C.T. @ 2A	18V C.T. @ 4A	C	VII
RPT 36-3	36V C.T. @ 3A	18V C.T. @ 6A	C	VIII
RPT 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	IX
RPT 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	X
RPT 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	XI
RPT 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	XII
RPT 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	XIV
RPT 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	XVI
RPT 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	XVI
RPT 56-01	56V C.T. @ 0.1A	28V C.T. @ 0.2A	C	II
RPT 56-0.25	56V C.T. @ 0.25A	28V C.T. @ 0.5A	C	IV
RPT 56-0.5	56V C.T. @ 0.5A	28V C.T. @ 1A	C	V
RPT 56-1	56V C.T. @ 1A	28V C.T. @ 2A	C	VI
RPT 56-2	56V C.T. @ 2A	28V C.T. @ 4A	C	VIII
RPT 56-3	56V C.T. @ 3A	28V C.T. @ 6A	B	IX
RPT 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	X
RPT 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	XI
RPT 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	XII
RPT 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	XIV
RPT 56-20	56V C.T. @ 20A	28V C.T. @ 40A	B	XVI
RPT 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	XVI

Primary 115V 50/60 Hz	Secondary Ratings (RMS) Series	Secondary Ratings (RMS) Parallel	Mtg. Style	Size
RPT 68-0.1	68V C.T. @ 0.1A	34V C.T. @ 0.2A	C	III
RPT 68-0.25	68V C.T. @ 0.25A	34V C.T. @ 0.5A	C	IV
RPT 68-0.5	68V C.T. @ 0.5A	34V C.T. @ 1A	C	V
RPT 68-1	68V C.T. @ 1A	34V C.T. @ 2A	C	VII
RPT 68-1.5	68V C.T. @ 1.5A	34V C.T. @ 3A	C	VIII
RPT 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	IX
RPT 68-3	68V C.T. @ 3A	34V C.T. @ 6A	B	X
RPT 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	XI
RPT 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	XII
RPT 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	XII
RPT 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	XIV
RPT 68-15	68V C.T. @ 15A	34V C.T. @ 30A	B	XVI
RPT 68-20	68V C.T. @ 20A	34V C.T. @ 40A	B	XVI
RPT 80-0.1	80V C.T. @ 0.1A	40V C.T. @ 0.2A	C	III
RPT 80-0.25	80V C.T. @ 0.25A	40V C.T. @ 0.5A	C	IV
RPT 80-0.5	80V C.T. @ 0.5A	40V C.T. @ 1A	C	VI
RPT 80-1	80V C.T. @ 1A	40V C.T. @ 2A	C	VII
RPT 80-1.5	80V C.T. @ 1.5A	40V C.T. @ 3A	C	VIII
RPT 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	IX
RPT 80-3	80V C.T. @ 3A	40V C.T. @ 6A	B	X
RPT 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	XI
RPT 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	XII
RPT 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	XIV
RPT 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	XVI
RPT 88-0.1	88V C.T. @ 0.1A	44V C.T. @ 0.2A	C	III
RPT 88-0.25	88V C.T. @ 0.25A	44V C.T. @ 0.5A	C	IV
RPT 88-0.5	88V C.T. @ 0.5A	44V C.T. @ 1A	C	VI
RPT 88-1	88V C.T. @ 1A	44V C.T. @ 2A	C	VII
RPT 88-2	88V C.T. @ 2A	44V C.T. @ 4A	B	IX
RPT 88-3	88V C.T. @ 3A	44V C.T. @ 6A	B	X
RPT 88-4	88V C.T. @ 4A	44V C.T. @ 8A	B	XI
RPT 88-6	88V C.T. @ 6A	44V C.T. @ 12A	B	XII
RPT 88-8	88V C.T. @ 8A	44V C.T. @ 16A	B	XIV
RPT 88-12	88V C.T. @ 12A	44V C.T. @ 24A	B	XVI
RPT 120-0.1	120V C.T. @ 0.1A	60V C.T. @ 0.2A	C	III
RPT 120-0.25	120V C.T. @ 0.25A	60V C.T. @ 0.5A	C	V
RPT 120-0.5	120V C.T. @ 0.5A	60V C.T. @ 1A	C	VI
RPT 120-1	120V C.T. @ 1A	60V C.T. @ 2A	C	VIII
RPT 120-1.5	120V C.T. @ 1.5A	60V C.T. @ 3A	B	IX
RPT 120-2	120V C.T. @ 2A	60V C.T. @ 4A	B	X
RPT 120-3	120V C.T. @ 3A	60V C.T. @ 6A	B	XI
RPT 120-4	120V C.T. @ 4A	60V C.T. @ 8A	B	XII
RPT 120-6	120V C.T. @ 6A	60V C.T. @ 12A	B	XIV
RPT 120-8	120V C.T. @ 8A	60V C.T. @ 16A	B	XVI
RPT 120-12	120V C.T. @ 12A	60V C.T. @ 24A	B	XVI
RPT 160-0.1	160V C.T. @ 0.1A	80V C.T. @ 0.2A	C	IV
RPT 160-0.25	160V C.T. @ 0.25A	80V C.T. @ 0.5A	C	VI
RPT 160-0.5	160V C.T. @ 0.5A	80V C.T. @ 1A	C	VII
RPT 160-0.75	160V C.T. @ 0.75A	80V C.T. @ 1.5A	C	VIII
RPT 160-1	160V C.T. @ 1A	80V C.T. @ 2A	B	IX
RPT 160-1.5	160V C.T. @ 1.5A	80V C.T. @ 3A	B	X
RPT 160-2	160V C.T. @ 2A	80V C.T. @ 4A	B	XI
RPT 160-4	160V C.T. @ 4A	80V C.T. @ 8A	B	XIV
RPT 160-6	160V C.T. @ 6A	80V C.T. @ 12A	B	XVI
RPT 160-8	160V C.T. @ 8A	80V C.T. @ 16A	B	XVI
RPT 180-0.1	180V C.T. @ 0.1A	90V C.T. @ 0.2A	C	IV
RPT 180-0.25	180V C.T. @ 0.25A	90V C.T. @ 0.5A	C	VI
RPT 180-0.5	180V C.T. @ 0.5A	90V C.T. @ 1A	C	VII
RPT 180-1	180V C.T. @ 1A	90V C.T. @ 2A	B	IX
RPT 180-1.5	180V C.T. @ 1.5A	90V C.T. @ 3A	B	X
RPT 180-2	180V C.T. @ 2A	90V C.T. @ 4A	B	XI
RPT 180-4	180V C.T. @ 4A	90V C.T. @ 8A	B	XIV
RPT 180-6	180V C.T. @ 6A	90V C.T. @ 12A	B	XVI
RPT 180-8	180V C.T. @ 8A	90V C.T. @ 16A	B	XVI
RPT 230-0.1	230V C.T. @ 0.1A	115V C.T. @ 0.2A	C	IV
RPT 230-0.25	230V C.T. @ 0.25A	115V C.T. @ 0.5A	C	VI
RPT 230-0.5	230V C.T. @ 0.5A	115V C.T. @ 1A	C	VIII
RPT 230-0.75	230V C.T. @ 0.75A	115V C.T. @ 1.5A	B	IX
RPT 230-1	230V C.T. @ 1A	115V C.T. @ 2A	B	X
RPT 230-1.5	230V C.T. @ 1.5A	115V C.T. @ 3A	B	XI
RPT 230-2	230V C.T. @ 2A	115V C.T. @ 4A	B	XII
RPT 230-4	230V C.T. @ 4A	115V C.T. @ 8A	B	XVI
RPT 230-6	230V C.T. @ 6A	115V C.T. @ 12A	B	XVI
RPT 300-0.1	300V C.T. @ 0.1A	150V C.T. @ 0.2A	C	V
RPT 300-0.25	300V C.T. @ 0.25A	150V C.T. @ 0.5A	C	VII
RPT 300-0.5	300V C.T. @ 0.5A	150V C.T. @ 1A	B	IX
RPT 300-1	300V C.T. @ 1A	150V C.T. @ 2A	B	XI
RPT 300-2	300V C.T. @ 2A	150V C.T. @ 4A	B	XIV
RPT 300-4	300V C.T. @ 4A	150V C.T. @ 8A	B	XVI

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

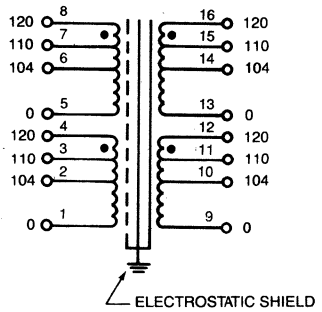
See preceding page for Mechanical Dimensions. **NOTE: DRPT also available with 115/230V, 50/60 Hz primary.**

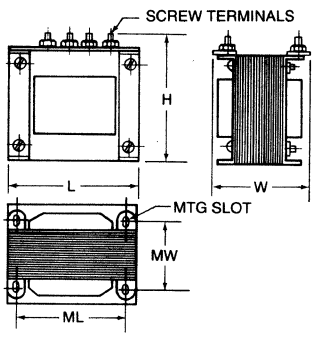
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201/446-3110 FAX 201/446-5362
EWC® INC.

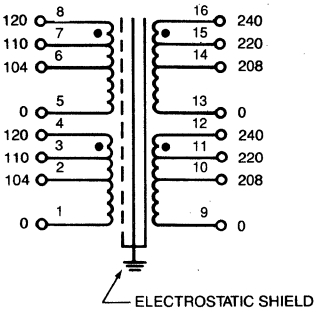
Power Isolation Transformers

These transformers are designed to eliminate the necessity of specifying many different power transformers due to variations in input line-voltage conditions. Two 120V primary windings with taps at 104V and 110V permit operation from 104V, 110V, 120V, 208V, 220V, 230V or 240V power lines. Multi-tapped secondary windings provide additional flexibility permitting a large number of possible input/output combinations including autotransformer connections which effectively double output VA ratings.

A grounded electrostatic shield, 1/4" thick terminal boards with plated hardware, varnish impregnation and 2500Vrms hipot are standard.







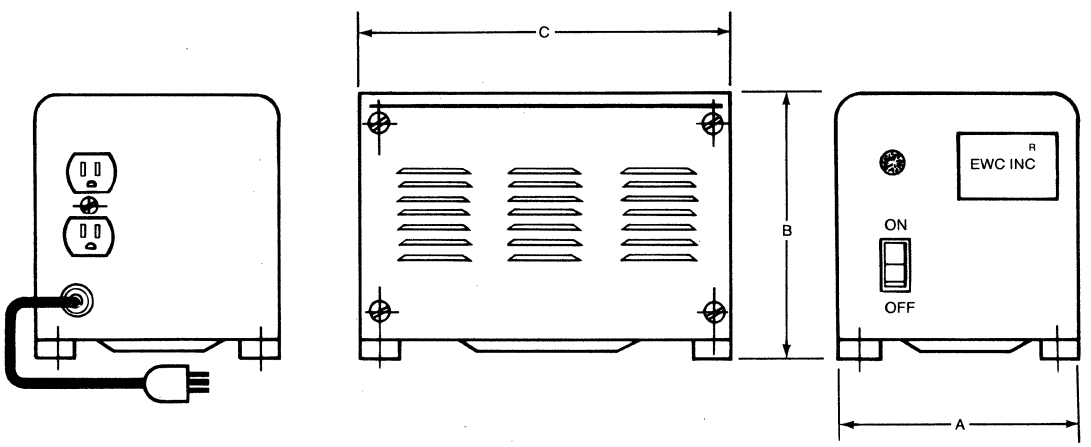
DU SERIES
110/220V 50/500Hz DUAL PRIMARIES TO 110/220 DUAL SECONDARIES

		RATING (EACH SEC)		MECHANICAL DIMENSIONS					
PART NO.	KVA	VOLTS (RMS)	AMPS	L	W	H	ML	MW	LBS
DU-1/4-B1	0.25	0/104/110/120	1.1	5.31	4.25	5.25	4.37	2.50	12
DU-1/2-B2	0.50	0/104/110/120	2.3	5.31	5.31	5.25	4.37	3.62	18
DU-1-B3	1	0/104/110/120	4.5	7.56	6.25	7.37	6.75	4.12	33
DU-2-B4	2	0/104/110/120	9	7.56	8.25	7.37	6.75	6.00	56
DU-3-B5	3	0/104/110/120	14	7.56	9.25	7.37	6.75	7.00	70
DU-5-B6	5	0/104/110/120	23	7.56	10.8	7.37	6.75	8.50	89
DU-7.5-B7	7.5	0/104/110/120	31	9.00	10.8	8.00	7.50	6.50	105
DU-10-B8	10	0/104/110/120	41	9.00	13.0	8.00	7.50	9.00	150

SU SERIES
110/220 50/500Hz DUAL PRIMARIES TO 220/440 DUAL SECONDARIES

		RATING (EACH SEC)		MECHANICAL DIMENSIONS					
PART NO.	KVA	VOLTS (RMS)	AMPS	L	W	H	ML	MW	LBS
SU-1/4-B1	0.25	0/208/220/240	0.55	5.31	4.25	5.25	4.37	2.50	12
SU-1/2-B2	0.50	0/208/220/240	1.15	5.31	5.31	5.25	4.37	3.62	18
SU-1-B3	1	0/208/220/240	2.25	7.56	6.25	7.37	6.75	4.12	33
SU-2-B4	2	0/208/220/240	4.5	7.56	8.25	7.37	6.75	6.00	56
SU-3-B5	3	0/208/220/240	7	7.56	9.25	7.37	6.75	7.00	70
SU-5-B6	5	0/208/220/240	11.5	7.56	10.8	7.37	6.75	8.50	89
SU-7.5-B7	7.5	0/208/220/240	15.5	9.00	10.8	8.00	7.50	6.50	105
SU-10-B8	10	0/208/220/240	20.5	9.00	13.0	8.00	7.50	9.00	150

Power Line Conditioners



Low-line voltages, dips, sags and spikes can cause severe damage to computers, telex, facsimile machines and other equipment. Impaired or lost data can result from electrical noise or power-line spikes.

The LC series of power line conditioners can protect these sensitive systems by providing stable output voltages of ±2% for input variations of ±15%. With built in ultra-isolation, the LC series provides common-mode noise attenuation of at least 120dB and reduces transverse-mode noise by 60dB. Harmonic distortion of less than 3% makes the LC series compatible with any type of load.

PART NO.	VA	A	B	C
LC300	300	7.00	7.75	11.0
LC500	500	7.00	7.75	11.0
LC750	750	8.50	9.25	13.0
LC1000	1000	8.50	9.25	13.0
LC1500	1500	8.50	9.25	13.0

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

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Power Transformers/MIL-T-27

400 Hz Miniature

ELECTRICAL SPECIFICATIONS

Primary voltage [1-2] = 115V ±10%
400 Hz ±5%

Secondary Voltage ±3% with [1-2] = 115V 400 Hz and delivering rated load. [Range 5 to 300V]

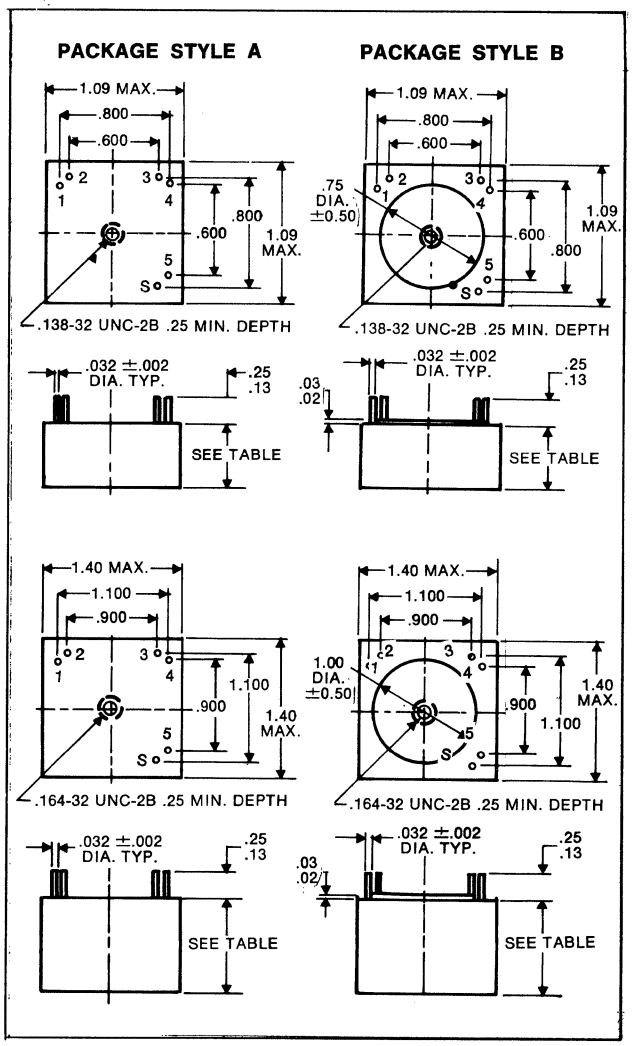
Dielectric strength 2.8 x max working voltage

See table for balance of specifications.

PHYSICAL SPECIFICATIONS

Size—sizes for standard VA ratings are given in Table.
Construction: Grade 5, Class S per MIL-T-27.

VA Rating	Package Size	Height Max	Reg. Max %	△t Max °C	Weight Max oz
1.5	1.09 sq.	0.47	23	17	.85
1.5S	1.09 sq.	0.59	18	17	1.10
3.0	1.09 sq.	0.59	18	20	1.10
3.0S	1.09 sq.	0.78	12	20	1.65
6.0	1.09 sq.	0.78	12	25	1.65
6.0S	1.09 sq.	1.03	10	25	2.20
9.0	1.09 sq.	1.03	10	30	2.20
9.0S	1.40 sq.	0.97	8	32	3.40
16	1.40 sq.	0.97	8	32	3.40
25	1.40 sq.	1.20	7	45	4.40

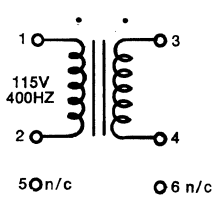


HOW TO ORDER

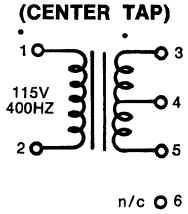
M	1.5	A	26	TS

- Series Designation
- VA rating [1.5 to 25VA]
- Package style [A or B]
- Secondary voltage [5 to 300V]
- Schematic [X, T, XS or TS]

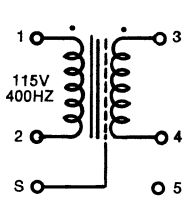
SCHEMATIC "X"



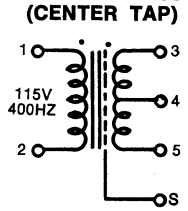
SCHEMATIC "T" (CENTER TAP)



SCHEMATIC "XS"



SCHEMATIC "TS" (CENTER TAP)

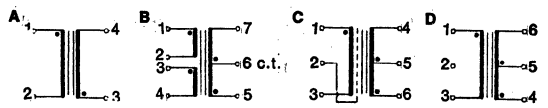


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Audio and Telephone Coupling Transformers

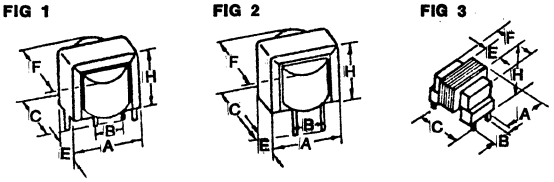
These audio/matching transformers meet FCC part 68 and feature frequency response of ±0.5 dB from 300-3500 Hz. More specific performance requirements may be met using several standard constructions or let our engineers design a custom unit for your specific application.

SCHEMATICS



MECHANICAL DIMENSIONS

FIG 1 FIG 2 FIG 3



SPECIFICATIONS:

Part Number	Impedance Pri	Impedance Sec	Max. Power	Insert. Loss	DC Current	DC Resist. Pri	DC Resist. Sec	Fig.	Sch.
T6:6A10A	600	600	+7dBm	1.0dB	2mA	55	69	1	A
T6:6A14A	600	600	+6dBm	1.4dB	0mA	60	46	1	A
T6:6A16A	600	600	+7dBm	1.2dB	0mA	52	48	1	A
T6:6A19A	600	600	+7dBm	1.1dB	0mA	35	25	1	A
T15:6A19A	1500	600	+5dBm	1.2dB	0mA	78	67	1	A
T6:6B19A	600	600	0dBm	1.9dB	120mA	69	95	2	A
T6:6B19B	600	600	+9dBm	2.4dB	100mA	65	86	2	B
T6:6C19A	600	600	+7dBm	2.0dB	0mA	35	45	1	A
T6:6D19A	600	600	+9dBm	2.4dB	100mA	65	86	3	A
T6:6C19A01	600	600	+5dBm	3.5dB	80mA	180	75	1	A
T6:6C19C	600	600	+6dBm	1.0dB	10mA	19	26	1	C

MECHANICAL DIMENSIONS:

Case	A	B	C	E	F	H
A10	.415	.160	.330	.165	.435	.335
(mm)	(10.5)	(04.0)	(08.4)	(04.2)	(11.0)	(08.5)
A14	5.70	.230	.470	.215	.525	.435
(mm)	(14.5)	(05.8)	(12.0)	(05.5)	(13.4)	(11.0)
A16	.670	.235	.510	.215	.670	.580
(mm)	(17.0)	(06.0)	(13.0)	(05.5)	(17.0)	(14.7)
A19	.770	.290	.590	.215	.570	.455
(mm)	(19.5)	(07.4)	(15.0)	(05.4)	(14.5)	(11.5)
B19	.770	.375	.420	.225	.690	.690
(mm)	(19.5)	(09.5)	(10.7)	(06.5)	(17.5)	(17.5)
C19	.770	.375	.640	.225	.690	.690
(mm)	(19.5)	(09.5)	(16.3)	(06.5)	(17.5)	(17.5)
D19	.800	.315	.570	.270	.620	.630
(mm)	(20.3)	(08.0)	(14.5)	(06.8)	(15.8)	(16.0)

Wall Plug-in Adapters [Class 2]

FIG. 1

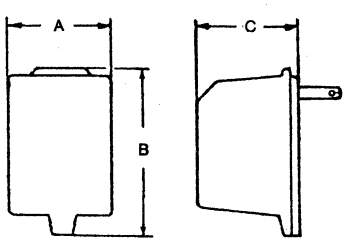
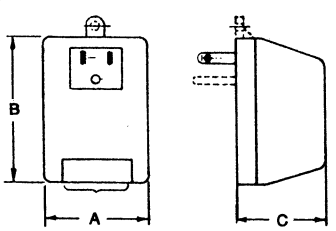
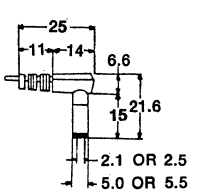


FIG. 2





ALL DIMENSIONS IN MM

The products listed below provide general information about our standard product line. We have many other standard items available as well as custom design and manufacturing capabilities. Please contact our sales or engineering staff at the toll-free number listed below for information on your specific application.

MECHANICAL DIMENSIONS

Series	Figure	Case Size (mm) A	B	C
35	1	43	69	42
41	1	43	69	42
41	2	50	70	40
48	1	54	65	42
48	2	56	82	49

AC OUTPUT MODELS

Model Number	Voltage	Current	Series
A4-900P	4V	900mA	35
A5-700P	5V	700mA	35
A6-700P	6V	700mA	35
A8-500P	8V	500mA	35
A12-400P	12V	400mA	35
A24-200P	24V	200mA	35
A4-1000P	4V	1000mA	41
A8-1000P	8V	1000mA	41
A12-1000P	12V	1000mA	41
A18-600P	18V	600mA	41
A24-500P	24V	500mA	41
A27-400P	27V	400mA	41
A6-3000P	6V	3000mA	48
A8-2400P	8V	2400mA	48
A12-1600P	12V	1600mA	48
A16-1200P	16V	1200mA	48
A24-800P	24V	800mA	48
A27-700P	27V	700mA	48

DC OUTPUT MODELS

Model Number	Voltage	Current	Series
D3-500P	3V	500mA	35
D6-500P	6V	500mA	35
D9-300P	9V	300mA	35
D12-200P	12V	200mA	35
D15-200P	15V	200mA	35
D24-100P	24V	100mA	35
D4-1000P	4.5V	1000mA	41
D6-1000P	6V	1000mA	41
D9-600P	9V	600mA	41
D12-500P	12V	500mA	41
D15-400P	15V	400mA	41
D24-200P	24V	200mA	41
D6-1100P	6V	1100mA	48
D8-1100P	8V	1100mA	48
D12-1100P	12V	1100mA	48
D15-900P	15V	900mA	48
D18-800P	18V	800mA	48
D24-600P	24V	600mA	48

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

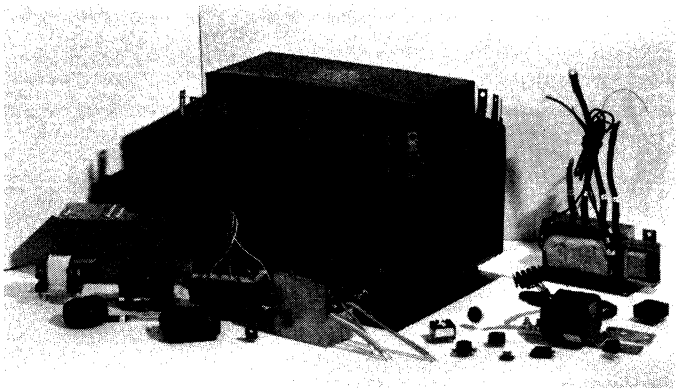
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908/446-3110 FAX 908/446-5362

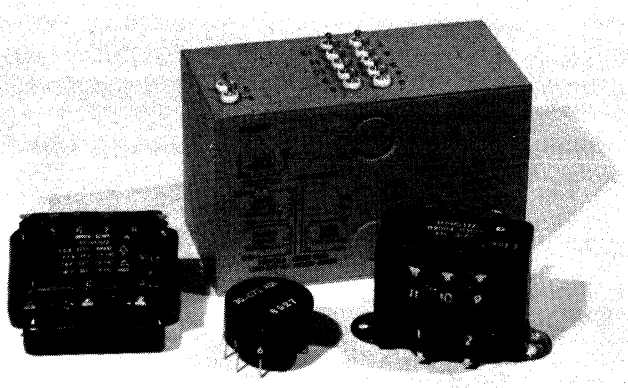
QUALITY MAGNETICS

Fernwood Transformer

MILITARY • AEROSPACE • INDUSTRIAL

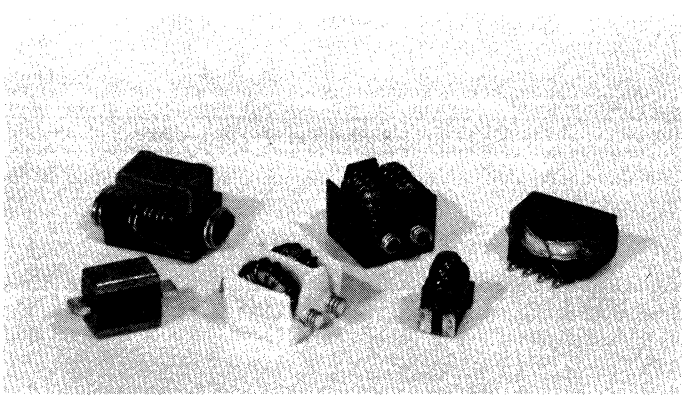
Fernwood Transformer will manufacture products from your drawings or from your written requirements through our computer-aided design department. This program will produce optimum design and size for your high frequency requirements. Power range up to 50 KVA and frequencies up to 1 GHZ.





Fernwood Transformer is on the QPL list for grade 4 and grade 5, MIL-T-27E. Military demands high quality and reliability. Our assembly lines have in-process inspection and all products are tested 100%. Our facility is approved to MIL-I-45208 and instrument calibration is per MIL-STD-45662. Our soldering is certified to MIL-STD-2000.

We design to meet UL, CSA, and VDE when required. Our production is computer-controlled so each customer can have a timely flow chart of materials, processes, and delivery dates.



A UNIT OF

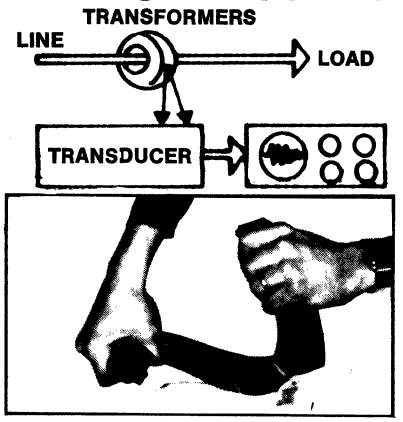
Transistor Devices Inc.

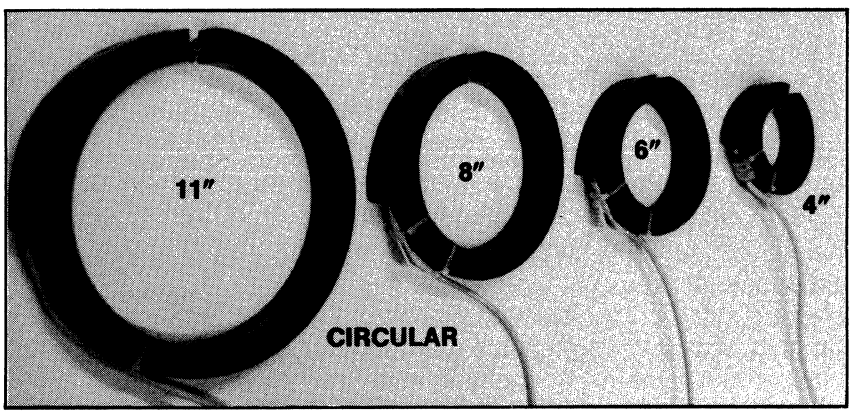
560 Independence St., Belvidere, NJ 07823-2099 Phone: (908) 475-3207 Fax: (908) 475-3242

FLEX-CORE DIV.
MORLAN & ASSOCIATES, INC.
6625 McVey Blvd., Worthington, OH 43235
FAX (614) 876-8538 (614) 889-6152

ENERGY MONITORING EQUIPMENT

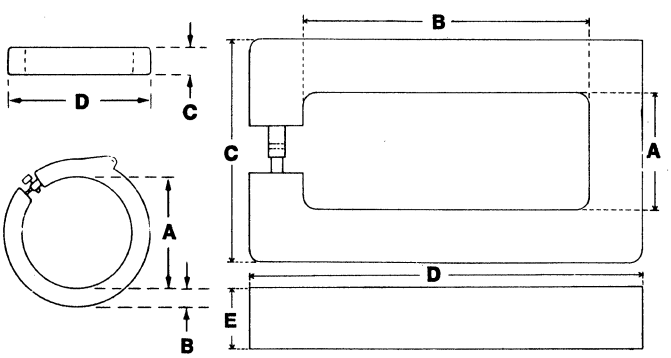
SPLIT CORE CURRENT (INSTRUMENT) TRANSFORMERS





Four models are available for round conductors plus one for buss bars. Use with any 5 Amp indicating or recording ammeter or with an Amp or Watt transducer. The flexible core is made of directional silicon steel. The secondary windings are copper wire. Encapsulation is silicon rubber to protect against moisture, dirt, oil and corona. Remains flexible from −45° to +200°C. Insulation level is 600 Vac and can be used over insulated conductors at higher voltages. Frequency: 50-60 Hz. Safety Factor: Secondary voltage is limited to less than 40 Vac when secondary leads are open. An electronic voltage clamp holds secondary voltage to less than 1 Volt when open circuit voltage exceeds 40 Vac. Transformer is red and secondary leads are yellow with spade connectors.

CIRCULAR **RECTANGULAR**

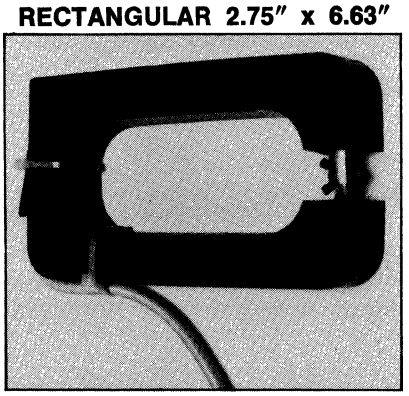


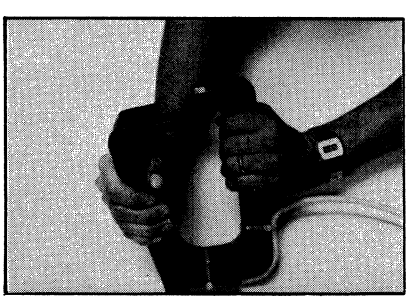
SPECIFICATIONS

Dimensions—Inches					
	4" I.D.	6" I.D.	8" I.D.	11" I.D.	Rectangular
"A"	4.00	6.00	8.00	11.00	2.75
"B"	1.25	1.25	1.25	1.25	6.63
"C"	1.50	1.50	1.50	1.50	5.50
"D"	6.50	8.50	10.50	13.50	9.38
"E"					1.50
Average Weight—Lbs					
	3.50	4.25	5.50	7.50	4.25

Current Ratio	Circular				Rect	Burden VA	Accuracy	Thrml Factor
	4"	6"	8"	11"	2.75x6.63			
200/5	X					2	4%	1.25
250/5	X					2	4%	1.25
300/5	X	X				2	4%	1.25
400/5	X	X				2	3%	1.25
500/5	X	X			X	3	3%	1.25
600/5	X	X			X	3	2%	1.25
800/5	X	X			X	5	2%	1.50
1000/5	X	X	X		X	10	2%	2.00
1200/5	X	X	X		X	10	2%	2.00
1500/5	X	X	X		X	10	2%	2.00
2000/5	X	X	X	X	X	10	2%	2.00
2500/5		X	X	X	X	10	2%	2.00
3000/5		X	X	X	X	10	2%	1.50
3500/5		X	X	X	X	10	2%	1.50
4000/5		X	X	X	X	10	2%	1.25
5000/5		X	X	X	X	10	2%	1.25
6000/5		X	X	X	X	10	2%	1.25

RECTANGULAR 2.75" x 6.63"



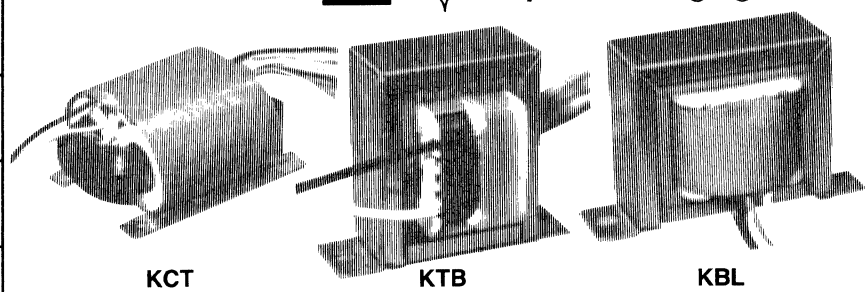


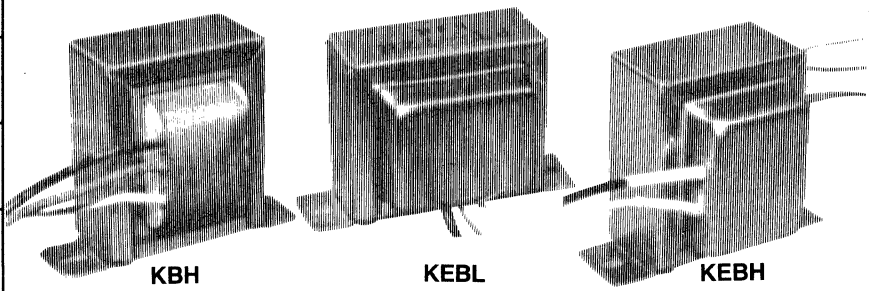
GlobTek, Inc.

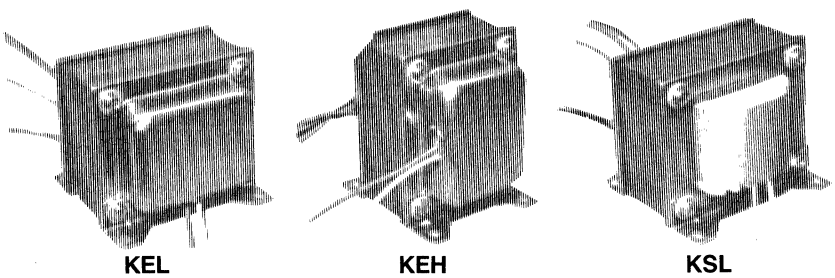
TRANSFORMERS

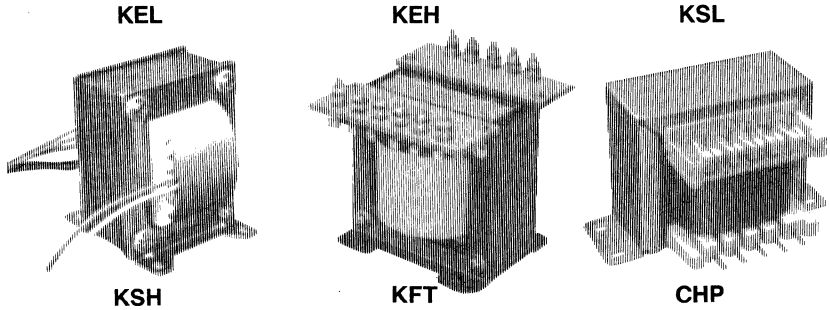
POWER TRANSFORMERS

KCT	20VA-600 VA
KBP	0.02 VA - 1.5 VA
KTB	0.9 VA - 28 VA
KBL	0.95 VA - 35 VA
KBH	0.95 V - 35 VA
KEBL	0.95 V - 35 VA
KEBH	0.95 V - 35 VA
KEL	50 VA - 320 VA
KEH	50 VA - 320 VA
KSL	50 VA - 5 KVA
KSH	50 VA - 5 KVA
KFT	100 VA - 20 KVA
CCS	32 VA - 1 KVA
CCD	50 VA - 4 KVA
CHP	0.95 VA - 12 VA
CPT	0.95 VA - 12 VA


KCT KTB KBL

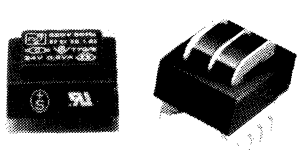

KBH KEBL KEBH


KEL KEH KSL


KSH KFT CHP

Note: Many other transformers available.

PC Board Mounted Transformers also available.



APPROVALS:

WORLDWIDE APPROVED ELECTRICAL & ELECTRONIC COMPONENTS

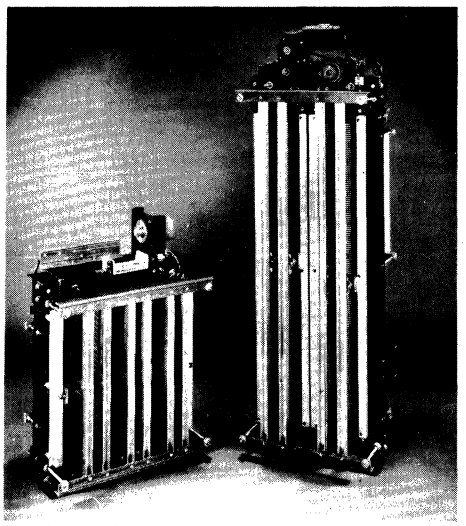
ASK FOR OUR COMPLETE CATALOG

GLOBTEK INC. • 7700 MARINE ROAD, NORTH BERGEN, N.J. 07047 • USA
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CONTINUOUSLY ADJUSTABLE AUTOTRANSFORMERS

30 YEARS OF SERVICE

Hipotronics®



ELECTRICAL FEATURES

- **NO SHORTED TURNS**
- **1-3% IMPEDANCE**
- **NO THREE-PHASE IMBALANCE**
- **15 TIMES OVERLOAD CAPABILITY**
- **CONTINUOUSLY ADJUSTABLE OUTPUT**
- **LINE ISOLATION AVAILABLE**
- **25% AND 100% STEP-UP AVAILABLE**

MECHANICAL FEATURES

- **STANDARD SINGLE OR THREE-PHASE CORE**
- **EPOXY ENCAPSULATED COIL FACE**
- **PLATED COIL TAPS/TURNS**
- **SLIDING COPPER CONTACTS**
- **SINGLE CORE ASSEMBLY UP TO 240 AMPS**
- **LESS SIZE AND WEIGHT THAN COMPETITION**
- **CLASS H, HIGH TEMPERATURE COPPER WIRE**
- **UPPER LIMIT, LOWER LIMIT, AND ZERO START MICRO SWITCHES**
- **MOTORIZED CONTROL; FIXED OR VARIABLE SPEED**

The patented Peschel™ Variable Transformer is a linearly wound, continuously adjustable autotransformer. A sliding copper contact traverses the coil face to provide variable voltage control.

The PVT can provide **variable ac voltage from 240V to 13.8 kV**, one or three phase and variable **dc voltage from 300V to 40 kV.** Flexibility in design enables the PVT to meet varied applications. Applications include: primary voltage control of high voltage and high current power supplies; ac or dc test equipment; motor, furnace and oven control; industrial and laboratory use; line stabilization; transformer testing; and much more.

SERVING APPLICATIONS NEVER BEFORE POSSIBLE WITH A VARIABLE TRANSFORMER

AC VARIABLE TRANSFORMERS

480 Volt Input, Three Phase, Delta Connected

	KVA	Amps	Model
0-600 V Output	216	120	30A48-60D12
	324	180	60A48-60D18
	432	240	60A48-60D24
0-960 V Output	346	120	30A48-96D12
	518	180	60A48-96D18
	691	240	60A48-96D24

240 Volt Input, Three Phase, Wye Connected

	KVA	Amps	Model
0-300 V Output	31	60	30A24-30Y6
	46	90	30A24-30Y9
	62	120	30A24-30Y12
	93	180	30A24-30Y18
	124	240	30A24-30Y24
	187	360	30A24-30Y36
0-480 V Output	50	60	30A24-48Y6
	75	90	30A24-48Y9
	100	120	30A24-48Y12
	150	180	30A24-48Y18
	200	240	30A24-48Y24
	300	360	30A24-48Y36

480 Volt Input, Three Phase, Wye Connected

	KVA	Amps	Model
0-600 V Output	62	60	30A48-60Y6
	94	90	30A48-60Y9
	125	120	30A48-60Y12
	187	180	60A48-60Y18
	249	240	60A48-60Y24
	374	360	60A48-60Y36
0-960 V Output	150	90	30A48-96Y9
	200	120	30A48-96Y12
	299	180	60A48-96Y18
	399	240	60A48-96Y24
	599	360	60A48-96Y36

240 Volt Input, Single Phase

	KVA	Amps	Model
0-300 V Output	27	90	30A24-30S9
	36	120	30A24-30S12
	54	180	30A24-30S18
	72	240	30A24-30S24
	108	360	30A24-30S36
	144	480	30A24-30S48
0-480 V Output	43	90	45A24-48S9
	57	120	45A24-48S12
	86	180	45A24-48S18
	115	240	45A24-48S24
	173	360	45A24-48S36
	230	480	45A24-48S48

480 Volt Input, Single Phase

	KVA	Amps	Model
0-600 V Output	54	90	30A48-60S9
	72	120	30A48-60S12
	108	180	30A48-60S18
	144	240	30A48-60S24
	216	360	30A48-60S36
0-960 V Output	86	90	60A48-96S9
	115	120	60A48-96S12
	173	180	60A48-96S18
	230	240	60A48-96S24
	346	360	60A48-96S36

HIPOTRONICS, INC. ■ ROUTE 22, BREWSTER, NY 10509 ■ PHONE: (914) 279-8091 ■ TWX: (710) 574-2420 HIPO BRWS NY ■ FAX: (914) 279-2467

VARIABLE TRANSFORMER

DESIGN HISTORY

Variable Transformers have been built for over 50 years by many companies around the world. There are two basic designs of electromechanical variable tranformers, linear and toroidal. The linear variable transformer is constructed in a vertical, or linear manner while the toroidal is constructed on a ring core, or "donut." The toroidal variable tranformer is the most common device used.

They are both single layer windings on a laminated steel core. The turns on one face of the coil are exposed. A carbon brush traverses the coil face to provide for voltage adjustment. In order to provide continuous, noninterrupted output voltage, the carbon brush must contact the next turn before leaving the previous turn. This creates a shorted turn condition. When the two turns, at different voltages, are bridged, or shorted, a circulating current results. This current, flowing through the shorted wire loop and carbon brush, creates heat. This heat must be dissipated through the coil and brush holder. This inherent design flaw severely limits the capability of these devices. To build a toroidal variable transformer capable of commutating greater than their limit of 8 kVA of power, would require larger wire sizes and more brushes. Both of these changes would increase the short circuit current, thus rendering such a device impossible, without extravagant heat sinks, forced air, or oil cooling.

In order to use the devices for applications greater than 8 kVA single-phase or 29 kVA three-phase, it becomes necessary to multi-stack or "gang" many core/coil assemblies in a series/parallel configuration. This becomes not only cumbersome, but also less reliable due to the multiple brush and motor drive system required. Serviceability is also difficult with such a "mechanical monster."

Other variable voltage control devices designed for high power voltage control, above 100 kVA, have other design or operational flaws. These devices sacrifice efficiency, size and weight, waveform purity, power factor, and/or cost.

What the industry needed was a variable autotransformer, which is the most efficient variable voltage device, that is smaller, lighter, more reliable, easy to service and reasonably priced.

THE PESCHEL SOLUTION

Having tried every device available, Hipotronics sought to design the perfect voltage control device. What had to be done was to design a variable transformer that eliminated the shorted turn problem. The result of our efforts was the **PESCHEL VARIABLE TRANFORMER.**

Having eliminated the short circuited turn problem, through our patented diode switching technique, it is now possible to build a variable tranformer capable of commutating greater kVAs and voltages than ever before possible. Most PVTs are constructed on a standard single-phase or three-legged, three-phase core. With no series or paralleling of core/coil assemblies necessary (most models), the PVT is generally smaller, lighter, more efficient and more reliable than any other means of variable voltage control.

Construction in a linear fashion affords greater design flexibility; core size, wire size, winding length. This allows for the design and construction of almost any kVA or MVA and any voltage, **enabling the PVT to be used in applications previously impossible with other variable transformers.**

DESIGN

The Peschel Variable Transformer is a continuously adjustable autotransformer. It is constructed of copper coils wound on a linear, laminated steel core. One face of the coil is epoxy encapsulated, then sanded to expose the turns. The exposed coil turns, or taps, are then plated. Each coil is wound in such a fashion as to expose two separate tracks of turns; one track of all the odd turns, the other even. Each track is traversed by a sliding copper contact. The sliding contacts are thinner than the distance between adjacent turns of the same track, thus not shorting the turns. Between the contacts is a series of back-to-back diodes. Using the diodes solely for their forward voltage drop (FVD), the voltage required across the diode before it will conduct current, and maintaining transformer volts per turn less than the total FVD, essentially no current can circulate between the two contacts. As the contacts traverse the coil, the current flow to the load alternates between contacts, depending upon which turn of the transformer is being used, odd or even.

This patented method provides for continuous voltage control with no shorted turns.

PESCHEL tm VARIABLE TRANSFORMER

Hipotronics®

USES:
- DC Motor Speed Controller
- Chemical Processes
- Electro-Magnets
- Electropainting

ADVANTAGES:
- No Electronics
- No Waveshape Chopping
- No Effect on Power Factor
- No EMI
- Same Ripple, Any Voltage

DC VARIABLE TRANSFORMERS

DC Output, Insulated Primary, Three Phase, Full Wave Bridge

Output Voltage	Amps	KW	Model	Input Voltage
300	50	15	D30A24P-30Y5	240
500	50	25	D30A24P-50Y5	240
750	50	37.5	D30A24P-750Y5	240
1000	50	50	D60A24P-100Y5	240
2500	50	125	D60A48P-250Y5	480
5000	50	250	D60A48P-500Y5	480
10000	50	500	D60A48P-1000Y5	480
20000	50	1000	D60A416P-2000Y5	4160
40000	50	2000	D60A416P-4000Y5	4160

Output Voltage	Amps	KW	Model	Input Voltage
300	90	27	D30A24P-30Y9	240
500	90	45	D30A24P-50Y9	240
750	90	67.5	D30A24P-750Y9	240
1000	90	90	D60A24P-100Y9	240
2500	90	225	D60A48P-250Y9	480
5000	90	450	D60A48P-500Y9	480
10000	90	900	D60A48P-1000Y9	480
20000	90	1800	D60A416P-2000Y9	4160
40000	90	3600	D60A416P-4000Y9	4160

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30 YEARS OF SERVICE

Hipotronics®

HIGH VOLTAGE TRANSFORMERS "RM" SERIES

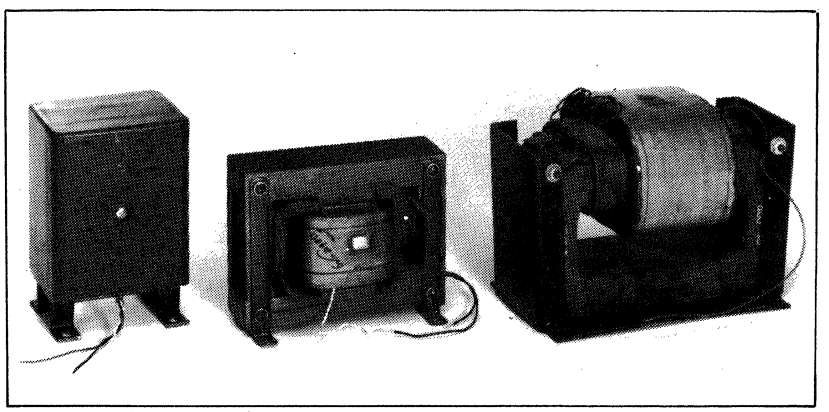
Hipotronics RM Series of high voltage transformers are designed for both air and oil environments. Models RM-17-3, RM 21-3 & RM 25-3 are manufactured for oil environment only.

Models RM 6-1, RM 7-1, RM 8-1, RM 9-1 and RM 10-1 are epoxy cast by special request.

TECHNICAL DATA

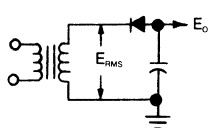
INPUT—117 VOLTS AC
FREQUENCY—TYPE A&C—50/60 Hz TYPE B—60 Hz
OUTPUT CURRENT—15mA AT RATED RMS OUTPUT.

Model Number	Type	Secondary Volts	Half Wave Rectifier (5 mA)	Full Wave Bridge (10 mA)	Full Wave Doubler (5 mA)	Secondary VA	Insulation Primary to Secondary
RM1-1	A	1 kV	1.2 kV	1.2 kV	2.4 kV	15	5 kV
RM1-2	B	1 kV	1.2kV	1.2 kV	2.4	15	5 kV
RM1.5-1	A	1.5 kV	1.8 kV	1.8 kV	3.6	23	5 kV
RM1.5-2	B	1.5 kV	1.8 kV	1.8 kV	3.6	23	5 kV
RM2-1	A	2 kV	2.4 kV	2.4 kV	4.8	30	6 kV
RM2-2	B	2 kV	2.4 kV	2.4 kV	4.8	30	6 kV
RM2.5-1	A	2.5 kV	3 kV	3 kV	6	38	6 kV
RM2.5-2	B	2.5 kV	3 kV	3 kV	6	38	6 kV
RM3-1	A	3 kV	3.6 kV	3.6 kV	7	45	8 kV
RM3-2	B	3 kV	3.6 kV	3.6 kV	7	45	8 kV
RM3.5-1	A	3.5 kV	4.2 kV	4.2 kV	8	53	10 kV
RM3.5-2	B	3.5 kV	4.2 kV	4.2 kV	8	53	10 kV
RM4-1	A	4 kV	4.8 kV	4.8 kV	9.5	60	10 kV
RM4-2	B	4 kV	4.8 kV	4.8 kV	9.5	60	10 kV
RM4.5-1	A	4.5 kV	5.5 kV	5.5 kV	10.5	68	12 kV
RM4.5-2	B	4.5 kV	5.5 kV	5.5 kV	10.5	68	12 kV
RM5-1	A	5 kV	6 kV	6 kV	12	75	12 kV
RM5-2	B	5 kV	6 kV	6 kV	12	75	12 kV
RM6-1	A	6 kV	7 kV	7 kV	14	90	14 kV
RM7-1	A	7 kV	8 kV	8 kV	16	105	15 kV
RM8-1	A	8 kV	9.5 kV	9.5 kV	19	120	17 kV
RM9-1	A	9 kV	10.5 kV	10.5 kV	21	135	20 kV
RM10-1	A	10 kV	12.5 kV	125 kV	24	150	24 kV
RM12.5-3	C	12.5 kV	15 kV	15 kV	30	188	28 kV
RM17-3	C	17 kV	20 kV	20 kV	40	255	32 kV
RM21-3	C	21 kV	25 kV	25 kV	50	315	45 kV
RM25-3	C	25 kV	30 kV	30 kV	60	375	54 kV



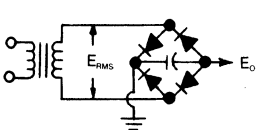
DC RECTIFER CIRCUITS FOR LISTED TRANSFORMERS

HALF WAVE RECTIFIER (COLUMN 4 ABOVE)



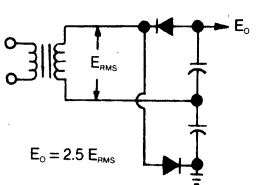
$E_O = 1.25\ E_{RMS}$

FULL WAVE BRIDGE (COLUMN 5 ABOVE)

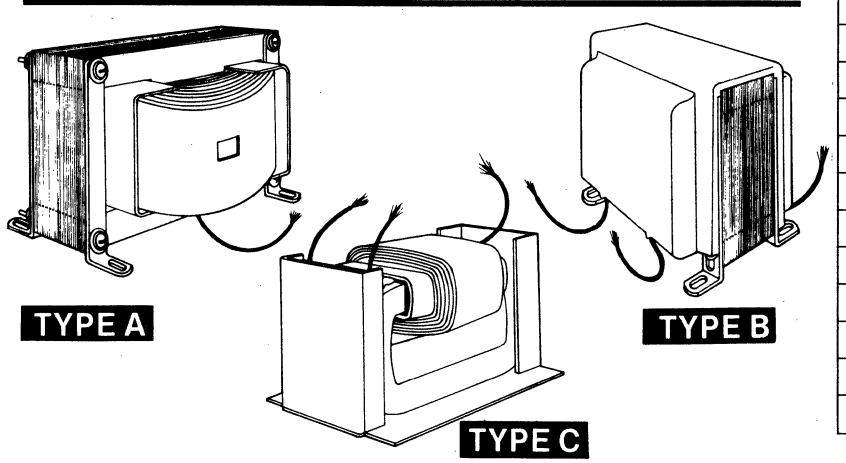


$E_O = 1.25\ E_{RMS}$

FULL WAVE DOUBLER (COLUMN 6 ABOVE)



$E_O = 2.5\ E_{RMS}$



DIMENSIONAL DATA

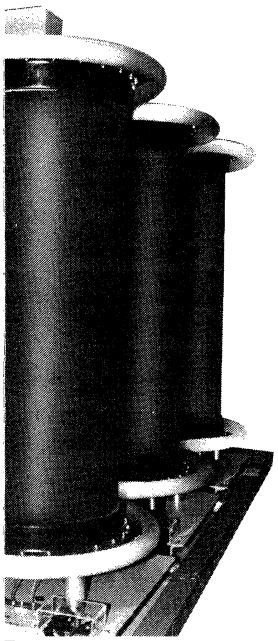
Model Number	Dimensions A in. (mm)	Dimensions B in. (mm)	Dimensions C in. (mm)	Weights lbs. (kg)
RM1-1	2-13/16" (71)	3" (76)	2-1/4" (57)	2 (.9)
RM1-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM1.5-1	21-3/16" (71)	3-3/8" (86)	2-3/8" (60)	3 (1.4)
RM1.5-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM2-1	2-13/16" (71)	3-3/8" (86)	2-3/8" (60)	3 (1.4)
RM2-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM2.5-1	3-3/8" (86)	3-3/4" (95)	2-7/16" (62)	3-1/2 (1.6)
RM2.5-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM3-1	3-3/8" (86)	3-3/4" (95)	2-7/16" (62)	3-1/2 (1.6)
RM3-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM3.5-1	3-3/8" (86)	3-3/4" (95)	2-7/8" (73)	3-3/4 (17)
RM3.5-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM4-1	4" (101)	4-1/2" (14)	3-1/8" (79)	6 (2.7)
RM4-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM4.5-1	—" (101)	4-1/2" (114)	3-1/8" (79)	6 (2.7)
RM4.5-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM5-1	4" (101)	4-1/2" (114)	3-1/4" (83)	6-1/8 (28)
RM5-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM6-1	4" (101)	4-1/2" (114)	3-3/8" (86)	6-1/4 (28)
RM7-1	4-1/2" (114)	5-3/4" (146)	3-1/16" (78)	8-3/4 (40)
RM8-1	4-1/2" (114)	5-3/4" (146)	3-3/16" (81)	9 (4.0)
RM9-1	4-1/2" (114)	5-3/4" (146)	3-5/16" (84)	9-1/2 (4.3)
RM10-1	4-1/2" (114)	5-3/4" (146)	3-1/2" (89)	1-3/4 (53)
RM12.5-3	5-3/8" (137)	7-5/8" (194)	4-1/2" (114)	18-3/4 (85)
RM17-3	5-5/8" (142)	7-5/8" (194)	4-1/2" (114)	19-1/2 (87)
RM21-3	5-3/4" (148)	7-5/8" (194)	4-1/2" (114)	19-3/4 (90)
RM25-3	6" (152)	7-5/8" (194)	5" (127)	20-1/4 (92)

HIPOTRONICS, INC. ■ ROUTE 22, BREWSTER, NY 10509 ■ PHONE: (914) 279-8091 ■ TWX: (710) 574-2420 HIPO BRWS NY ■ FAX: (914) 279-2467

30 YEARS OF SERVICE

Hipotronics®

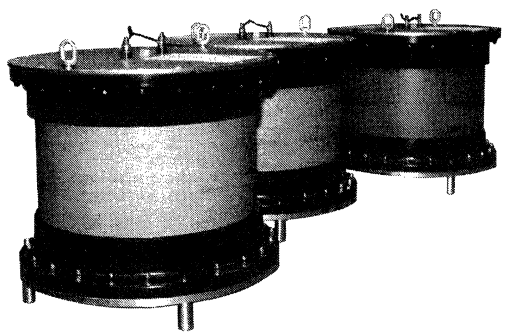
ISOLATION TRANSFORMERS



High Voltage Isolation Transformers are used to supply ac power to systems operated at dc voltage above (or below) ground potential. Typical applications include filament transformers, HV decks used in accelerators, E-beam systems, ion sources, and neutral beam lines.

SLIMLINE SERIES

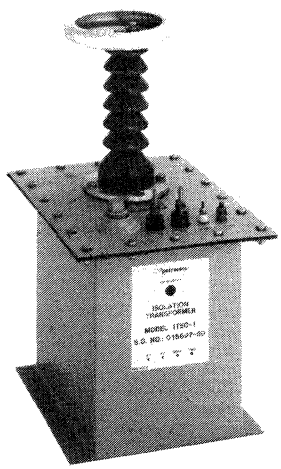
Ratings vary from 1 kVA to 10 kVA and 150 kV to 1 Megavolt in isolation voltage. The relatively light weight and compact size may be arranged physically or electrically to suit the application and installation configuration. Alternate input/output voltages are available.



MODEL	DC ISOLATION VOLTAGE	RATED KVA	INPUT/OUTPUT VOLTAGE
IT150-5S	150 kV	5	220 V/220 V
IT150-10S	150 kV	10	220 V/220 V
IT200-3S	200 kV	3	115 V/115 V
IT200-5S	200 kV	5	220 V/220 V
IT200-10S	200 kV	10	220 V/220 V
IT300-0S	300 kV	10	220 V/220 V

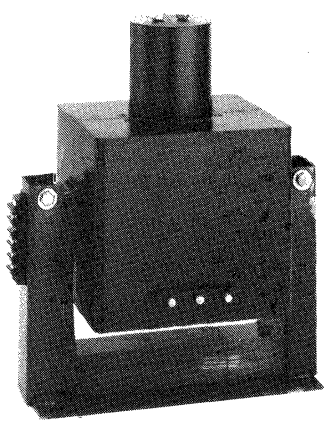
ALPHA SERIES

MODEL	DC ISOLATION VOLTAGE	RATED KVA	INPUT/OUTPUT VOLTAGE
IT50-1A	50 kV	1	115 V/115 V
IT50-3A	50 kV	3	115 V/115 V
IT50-5A	50 kV	5	220 V/220 V
IT50-10A	50 kV	10	220 V/220 V
IT100-1A	100 kV	1	115 V/115 V
IT100-3A	100 kV	3	115 V/115 V
IT100-5A	100 kV	5	220 V/220 V
IT100-10A	100 kV	10	220 V/220 V



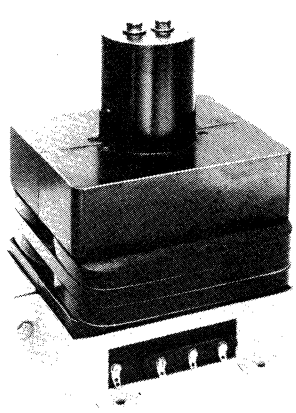
Alpha series units are double shielded and insulated with mineral based oil (non PCB). Ratings range from 1 kVA to 10 kVA at isolation voltages of 50 kV and 100 kV. Standard units are 60 Hz, 50 Hz units and alternate voltages available upon request.

EMERALD SERIES



Emerald series units have a molded epoxy encasement for insulation. Ratings range from 500 VA to 5 kVA and isolation voltages from 25 kV to 100 kV, in air. Higher voltage versions are available designed for use in oil or SF6 insulation.

MODEL	DC ISOLATION VOLTAGE	RATED KVA	INPUT/OUTPUT VOLTAGE
IT25-.5E	25 kV	0.5	115 V/115 V
IT50-1E	50 kV	1	115 V/115 V
IT100-1EA	100 kV	1	115 V/115 V
IT50-SE	50 kV	5	220 V/220 V
IT100-SE	100 kV	5	220 V/220 V



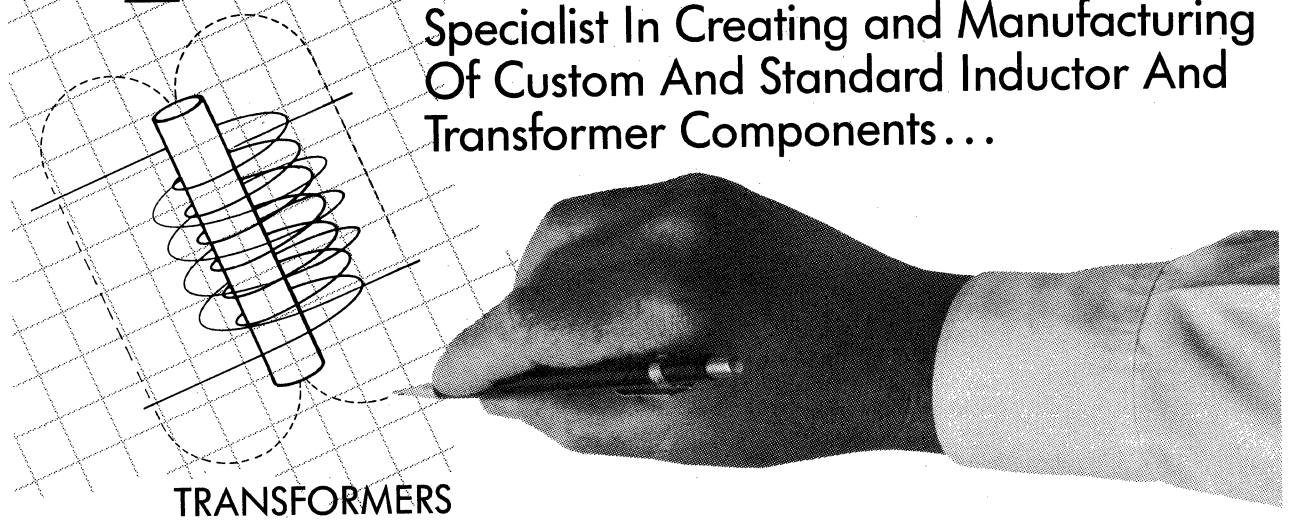
We welcome a discussion of your application. For more information ask for Catalog 41.

HIPOTRONICS, INC. ■ ROUTE 22, BREWSTER, NY 10509 ■ PHONE: (914) 279-8091 ■ TWX: (710) 574-2420 HIPO BRWS NY ■ FAX: (914) 279-2467

The control of electric current is only as good as the components that carry it.

hi-sonic..."Concept Engineering"

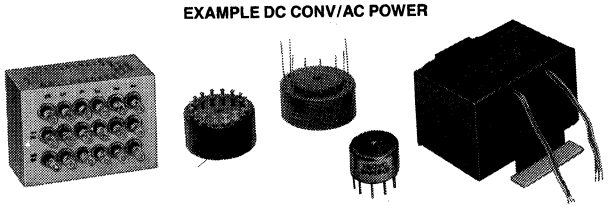
Specialist In Creating and Manufacturing Of Custom And Standard Inductor And Transformer Components...



TRANSFORMERS

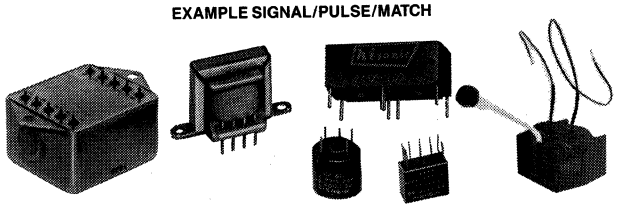
TRANSFORMERS: Hisonic's special power/converter and signal/matching transformers for both audio and wide video ranges are used in airborne comm/nav and ground communications systems. Included are toroidal, pot core, and laminated core types manufactured to commercial and MIL specifications. Our 30 year experience is at your disposal to help solve your transformer and inductor problems.

EXAMPLE DC CONV/AC POWER



P/N	Input	OP Freq.	VA Rating	Output Volts Peak (or RMS)	Size
24-0170-10	10V DC	24KHZ	0.8	20CT	.28x.6x48H
24-0193-10	14/28V DC	6KHZ	18	4.7,11.5CT.22.5CT.550	1.8 ODx.94H
06-2124-10	200V L-L	400HZ-3Ø	840	200L-L	4.3x3.9x2.1H
24-0107-10	14/28V DC	2KHZ	27	90/45CT.180/25.180/25	2.1 ODx.88H
24-0512-10	260V PK	100PPS	20KVA PK	4.6 KV PK PULSE	2.5x2.3x1.1H
24-0114-10	14/28V DC	400HZ	75	26.60	2.9 ODx1.5H
24-0271-10	14/28V DC	5KHZ	80	6.5CT.22.5CT.100.100	2.0x2.0x1.0H
24-0277-10	42V DC	10KHZ	200	100	2.0x2.5x1.2H
24-0177-10	10V AC	400HZ	2	1.4.1.4.10(RMS)	1.9 ODx.86H
24-0169-10	26V AC	400HZ	17	21/13CT(RMS)	1.0x1.4x1.3H
24-0215-10	115V AC	400HZ	180	20.27.27.42(RMS)	3.2x3.8x4.1H

EXAMPLE SIGNAL/PULSE/MATCH

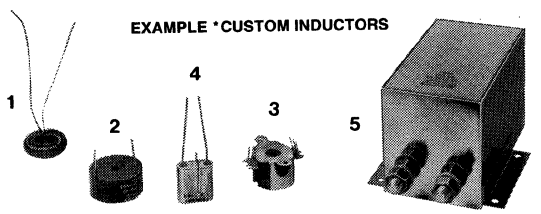


P/N	Description	Impedance	Response	Level	Size
24-0239-11	Video Range Match	150:150.25	100KHZ-2.5MHZ	60mw	.63x.63x.44H
24-0275-10	Wide Band Match	135CT:1000	1KHZ-2MHZ	4mw	1.1 ODx.75H
24-0659-10	Syncro/Resolver	800 OHMS	400HZ	270mw	1.5x.75x.56H
24-0240-10	Wide Bank Hybrid	600.600+600	50HZ-50KHZ	1mw	1.8x2.0x1.0H
24-0171-10	Radio Freq. Hybrid	50.100+100	700KHZ-4MHZ	10mw	75 ODx85H
24-0153-10	Pulse Match	10K.40K	tp 1.2ms.tr60us	25mw	.53x.53x.7H
24-0180-10	Pulse Output	5.600w/tap	tp.4us.tr.2us	6KW	1.5 ODx.8H
24-1108-03	Epoxy encapsulated	10,000 V pulse transformer			3.2 in^3

INDUCTORS

INDUCTORS: Our manufacturing capabilities are the result of experience dating back to 1950 and now include virtually every known construction your special applications may require . . . and at reasonable prices.

EXAMPLE *CUSTOM INDUCTORS



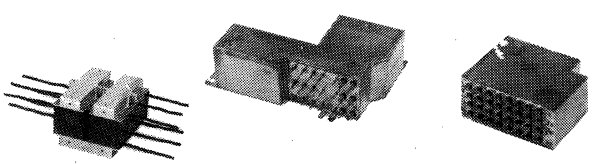
P/N	Fig.	Description	Characteristics	Type	Size
26-5103 Series	2	Encaps. PC Mtg.	See R Series Std.	Tor.	1.06x.5H
06-4000-27	1	DC Filter Choke	250uH@1.5ACD	Tor.	970Dx.4H
06-4000-39	3	Var. Ind. PC Mtg.	90-110 MH Q250	Pot	.80Dx.5H
26-5034 Series	4	Xtal Case Mtg.	See J Series Std.	Tor.	.34x.75x.8H
26-5135-00	5	Shielded Choke	50uH@100ADC	Lam.	2.65x5x3H

*Advise requirements for recommended solution and quotation

SPECIAL ASSEMBLIES

SPECIAL ASSEMBLIES: Today's equipment designs place extreme demands on component configurations. No challenge is too great for our engineers to tackle. If it can be built, Hisonic can build it.

EXAMPLE CUSTOM ASSEMBLIES



P/N	Description	Size
27-0049-00	Metal cased multiple transformer/inductor/capacitor network	7.8 lb^3
24-1100-00	Encapsulated dual multi-winding inductor w/heat sink	18.9 m^3
27-0053-00	Metal cased/4 inductor and 2 transformer assemblies	4.5 in^3

OTHER PRODUCTS: :(Mil Spec & Commercial) Filters—Transformers—Tuned Circuits—Amp/phase Equalizers—Lumped Constant Delay Lines

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Key source for reliable magnetic components, power supplies and control systems for over 40 years.

300 VA TO 3000 KVA STANDARD & SPECIALTY MAGNETIC COMPONENTS

Also see our catalog pages under AC POWER SUPPLIES and DC POWER SUPPLIES.

STANDARD TRANSFORMERS

DIT SERIES — Drive Isolation Transformers. (12-550KVA, U.L. Listed)

Designed to provide electrical isolation and voltage transformation for SCR adjustable-speed motor drives. Dry type. 600V class. Single phase and three phase. 50HZ and 60Hz. 5% FCAN and FCBN primary taps. Open frame or NEMA 1 enclosed, 150°C rise/220°C insulation class standard, 115°C or 80°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 1, 1½, 3, 5, 8, 12, 15, 20, 27, 30, 34

Three Phase

• 8, 12, 15, 20, 27, 34, 40, 51, 63, 75, 93, 120, 150, 180, 220, 280, 330, 440, 550, 660, 760, 870, 980, 1100.

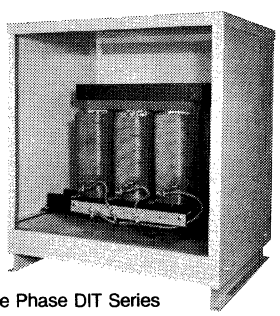
Standard Voltages Available

Single Phase

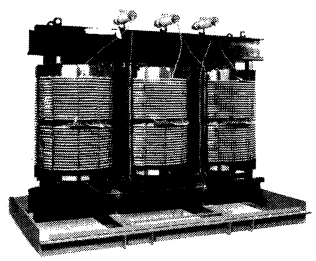
• Primary or Secondary 208, 230, 380, 460, 575, 230/460, 415

Three Phase

• Primary (△) 208, 230, 380, 460, 575, 230/460, 415
• Secondary 208Y/120, 230Y/133, 380Y/220, 460Y/266, 575Y/332, 230x460Y/133x266, 415Y/240



Three Phase DIT Series



HVDT 15KV Class Transformer

GPT SERIES — General Purpose Transformers (3-500KVA, UL Listed)

Designed to provide electrical isolation and voltage transformation for lighting, electric heating and industrial motor loads. Dry type, 600V class, single phase and three phase, 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 110°C or 85°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 3, 5, 7½, 10, 15, 25, 37½, 50, 75, 100, 167

Three Phase

• 3, 6, 9, 15, 25, 30, 45, 50, 60, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

Standard Voltages Available

Single Phase

• Primary (3KVA-15KVA) 240/480, 208, 277, 480, 600
(25KVA-167KVA) 240x480, 600
• Secondary (All KVA sizes) 120/240

Three Phase

• Primary (Δ) 240, 480, 600
• Secondary 208Y/120, 240Δ, 480Y/277

HVDT SERIES — High Voltage Distribution Transformers

Designed for in-plant distribution and voltage step-down. Conventional dry type or resin cast coil. 5KV through 15KV class. Single phase and three phase. 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 110°C or 85°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 3, 5, 10, 15, 25, 37½, 50, 75, 100, 167, 200, 250, 333, 500

Three Phase

• 15, 30, 45, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

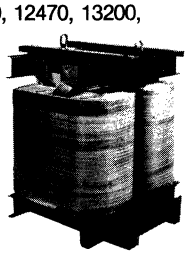
Standard Voltages Available

Single Phase

• Primary
5KV Class: 2400/4160Y
8.66KV Class: 4160/7200Y
15KV Class: 7200/12470Y
7620/13200Y, 7960/13800Y
• Secondary (All KVA Sizes) 120/240

Three Phase

• Primary (△)
5KV Class: 2400, 4160, 4800
8.66KV Class: 7200
15 KV Class: 12000, 12470, 13200, 13800
• Secondary 208Y/120, 240△, 480Y/277



DC Link Choke
4 mH at 1000 Adc
5 KV Class

SPECIALTY MAGNETIC COMPONENTS

Transformers

• Convection, forced air or water cooled.
• Dry type, liquid filled, cast-resin.
• Low voltage, high voltage to 300KV.
• High current to 20,000 Amperes.
• High frequency to 10KHz.
• Low temperature rise, high efficiency.
• Ferroresonant transformers - conventional constant voltage and harmonic-neutralized.
• Computer grade isolation transformers to 0.001 picofarads.
• Low capacitance transformers, electrostatic shielded.
• High reactance transformers - short circuit current limited.
• Modulation (Output) transformers to 50KW.
• Rectifier and filament transformers.

Inductors

LC Series - Link Chokes (DC)

Designed for use as a smoothing inductor in the DC link between rectifier and inverter in variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class.

LR Series - Line Reactors (AC)

Designed for use as a line reactor in the three phase input lines supplying variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class; three phase; 50Hz and 60Hz.
Other specialty inductors include:
• AC, DC.
• Iron-core, air-core.
• Linear, swinging.
• AC current limiting reactors.
• AC power factor correction reactors.
• DC filter chokes.
• AM modulation reactors.

Saturable Reactors:

Low voltage, High voltage to 15 KV. Sizes to 1000 KVA.

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SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

ABNT **Brazil (ABNT)** Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

ELOT **Greece (ELOT)** The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

SII **Israel (SII)** Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

STAS **Romania** Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

ISL PRODUCTS INTERNATIONAL LTD.

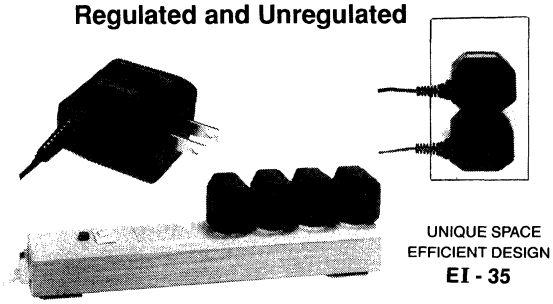
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- EUROPEAN APPROVED TRANSFORMERS AVAILABLE
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TRANSFORMERS
Telecom, Industrial, Power

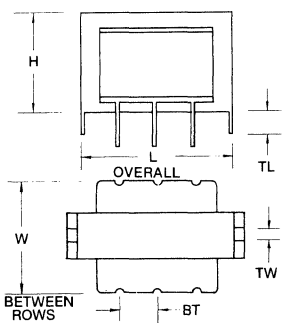
- Standard and Custom Design
- Power Ranges 75 mW—300W
- UL Construction as Required
- Telecommunications Transformers Meet FCC Specs Part 68
- Split Bobbin and Other Lead Configurations Available

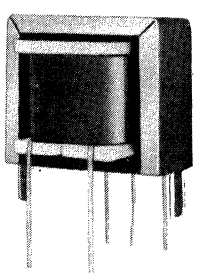
WALL PLUG-IN ADAPTORS POWER SUPPLIES WITH BUILT IN DIPLEXERS
Case Sizes EI - 28 to EI - 76
Regulated and Unregulated



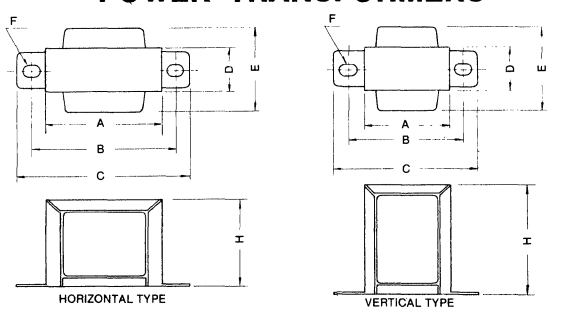
UNIQUE SPACE EFFICIENT DESIGN
EI - 35

AUDIO/COMMUNICATIONS TELEPHONE TRANSFORMERS





POWER TRANSFORMERS



DIMENSIONS: M/M HORIZONTAL TYPE / VERTICAL TYPE

Type	Part No.	Description	Impedance Pri	Impedance Sec	Resistance Pri	Resistance Sec	Dimension
EI-14 Series .075 Watts Max.	AT-141	Output	500C.T.	8	35	.8	L =15.2mm(.599) H =11.0mm(.433) W =12.0mm(.473) TW= 2.0mm(.079) TL = 3.8mm(.150) BT = 2.5mm(.098) All Dimensions Nom
	AT-142	Coupling	600C.T.	600C.T.	45	40	
	AT-143	Output	1KC.T.	8	60	.8	
	AT-144	Coupling	10KC.T.	600C.T.	450	100	
	AT-145	Driver	10KC.T.	2KC.T.	500	200	
EI-16 Series .100 Watts Max.	AT-161	Output	500C.T.	8	22	.8	L =17.7mm(.697) H =14.0mm(.551) W =16.0mm(.630) TW= 2.2mm(.086) TL = 4.0mm(.157) BT = 2.8mm(.110) All Dimensions Nom
	AT-162	Interstage	500C.T.	500C.T.	30	28	
	AT-163	Output	1.2KC.T.	8	80	.8	
	AT-164	Output	48C.T.	8	2.5	.5	
	AT-165	Output	200C.T.	8	12	.8	
EI-19 Series .200 Watts Max.	AT-191	Output	200C.T.	8	12	.8	L =20.3mm(.800) H =16.2mm(.640) W =14.5mm(.571) TW= 2.2mm(.086) TL = 4.2mm(.165) BT =3.0mm(.118) All Dimensions Nom
	AT-192	Output	500C.T.	8	26	.8	
	AT-193	Coupling	600C.T.	600C.T.	65	55	
	AT-194	Output	800C.T.	8	40	.8	
	AT-195	Output	1.2KC.T.	8	80	.8	
	AT-196	Interstage	1.5KC.T.	500C.T.	120	50	
	AT-197	Coupling	10KC.T.	600C.T.	600	100	
	AT-198	Driver	10KC.T.	2KC.T.	600	155	
EI-24 Series .460 Watts Max.	AT-241	Output	48C.T.	8	2.5	.5	L =25.3mm(.100) H =18.4mm(.725) W =16.0mm(.630) TW= 2.6mm(.102) TL = 4.8mm(.189) BT = 4.5mm(.177) All Dimensions Nom
	AT-242	Output	120C.T.	8	7.0	.7	
	AT-243	Output	200C.T.	8	12.0	.5	
	AT-244	Output	500C.T.	8	180	.7	
	AT-245	Interstage	500C.T.	500C.T.	35	28	
	AT-246	Driver	10KC.T.	2KC.T.	600	155	
	AT-247	Output	1.2KC.T.	8	75	.8	
	AT-248	Coupling	600C.T.	600C.T.	65	55	

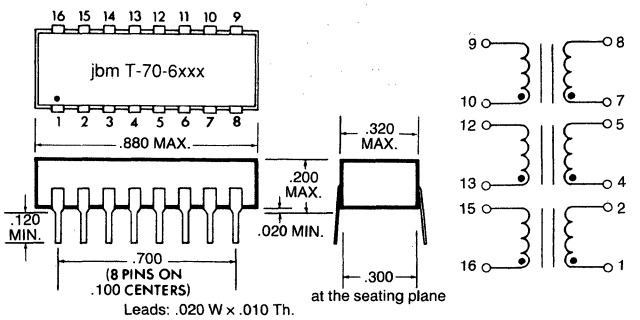
Metric Size Output (VA)	Input	A	B	C	D	E	F	H
EI-28 (1)	120	29.5	37.5	49.5	9-15	25-34	3.5 x 5.8	28
		27	35	47				31
EI-35 (2)	120	36.5	45	56.5	10-17	31-40	3.5 x 5.8	32.5
		31.5	41	53				38
EI-41 (4.5)	120	42.5	52	61	14-24	32-43	3.5 x 5.8	37
		35	45	57				44
EI-48 (7)	120	50.5	60	69.5	17-25	37-46	3.5 x 5.8	43.5
		42	52	64				51
EI-54 (13)	120	56	67	78	20-26	44-56	4.2 x 6.5	49
		48	59	70				56
EI-57 (18)	120	59	70	80	20-26	44-56	4.2 x 6.5	51
		49.5	61	75				60
EI-60 (25)	120	62	75	89	21-33	45-2	4.2 x 6.5	54
		52	66	78				63
EI-66 (40)	120	68.5	81	92	23-41	53-70	4.2 x 6.5	59
		57.5	74	84				69
EI-76 (75)	120	79	90	100	31-41	60	5 x 7	65
		67	78	89				78
EI-86 (110)	120	87.5	105	107	31-41	67	5 x 7	74
		75	86	97				89
EI-96 (300)	120	98	109	120	40-60	77	5 x 7	84
		85	96	107				98

• Welcome Offer Original Sample and Diagram

SEE OUR PAGES IN SECTIONS 2100, 3130, 4750 & 6000

Pulse Transformers

Type T-70 ETHERNET LAN APPLICATIONS



JBM Model #	Turns Ratio	OCL UH	E-T Constant	Rise Time	Pri/sec. Leakage	Capacitance (Pf max)	DCR Ohm
T-70-601	1:1	35	2.5	3.0	.25	10	.30
T-70-602	1:1	50	2.5	3.0	.25	10	.30
T-70-603	1:1	75	2.5	3.0	.25	10	.30
T-70-604	1:1	100	2.5	3.0	.25	10	.30
T-70-605	1:1	200	3.0	3.0	.25	10	.30

Note: .OCL is the Pulse Inductance measured with a pulse voltage of 1.0 V peak, a pulse width of .4

OSEC and PRR of 1MHz.

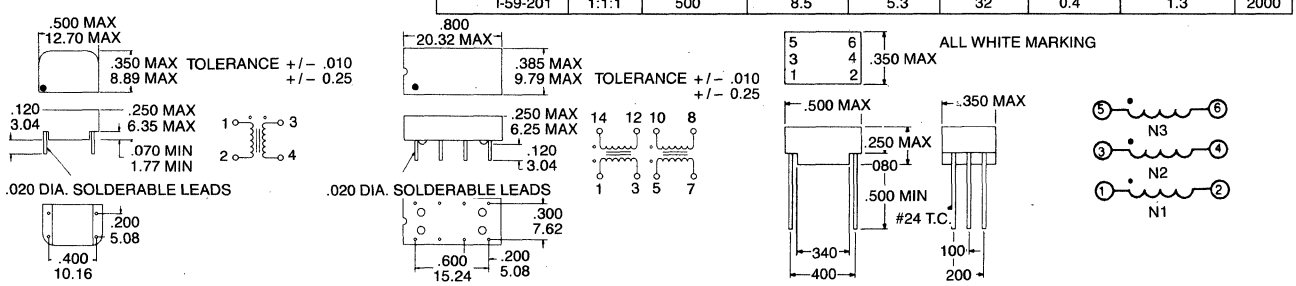
- Comply with all international safety requirements
- IEEE 802.3 compatible
- Suitable for high frequency applications

TYPE T-59 STARLAN APPLICATIONS

- IEEE 802.3 compatible
- All parts comply with safety requirements for LAN
- Custom design available

TABLE OF ELECTRICAL SPECIFICATIONS @ 25°C

JBM Model #	Turns Ratio (±5%)	Pulse Inductance (µh ± 20%)	ET Constant (V-µs min.)	Rise Time (ns max.)	Pri/Sec CW/W (pf max.)	Pri-Sec LL (µh max.)	Primary DCR (ohms max.)	HYPOT (Vrms)
SING T-59-101	1:1	2.5	25	50	35	6.0	1.0	2000
DOUB T-59-301	1:1	2.5	25	20	40	0.80	1.0	2000
T-59-201	1:1:1	500	8.5	5.3	32	0.4	1.3	2000



TYPE T-90 TOKEN RING APPLICATIONS

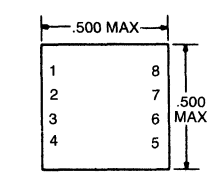
- 802.5 Token ring compatible
- Single and dual package
- Meets all international safety standards
- Designed for T1 token ring applications

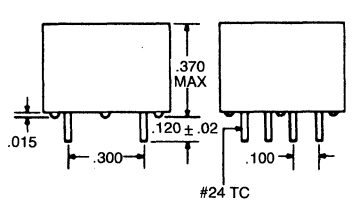
RATINGS: ALL TRANSFORMERS

Turns Ratio	Insertion Loss	CMRR	Return Loss	Rise Time	HYPOT
1:1:2:2	0.50 dB Max.	– 60 dB Min.	20 dB Min.	15 ns Max.	1000V-RMS

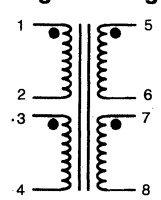
TABLE OF ELECTRICAL SPECIFICATIONS @ 25°C

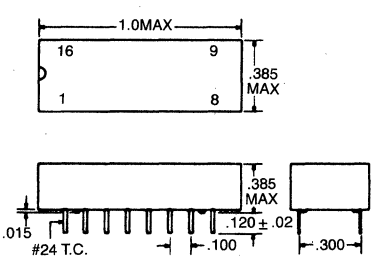
JBM Model	Primary OCL (µh typ)	Primary LL (µh max.)	Pri-Sec CW/W (pf max.)	DCR Pri (ohms max.)	DCR Sec (ohms max.)
SINGLE T-90-301	500	0.25	10	0.40	0.80
DUAL T-90-601	500	0.25	10	0.40	0.80



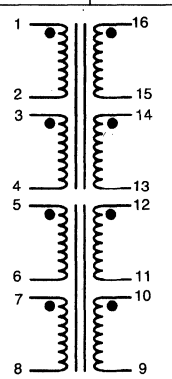


Single Package





Dual Package



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603-623-0222 • Fax: 603-623-0446

Pulse Transformers

10 BASE-T DUAL ISOLATION AND FILTER MODULE WITH COUPLING TRANSFORMER

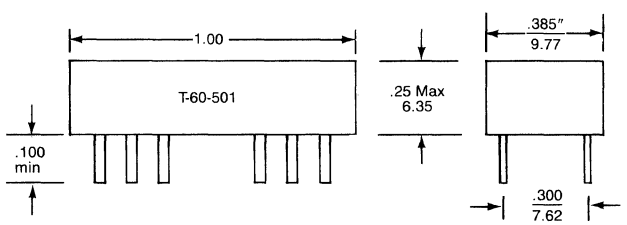
- IEEE 802.3 10 Base-T Spec
- Compact size
- Designed for use with several 10 Base-T-Chip

Type T-60-501

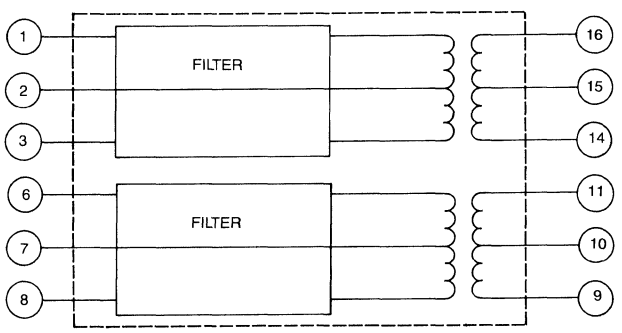
TABLE OF ELECTRICAL SPECIFICATIONS

Insertion Loss (1-10MHz)	Return Loss	Cross Talk	Group Delay Change	Pri/Sec Isolation	Cut-off Frequency
TX:1.0dB Max RX:1.0dB Max	5 MHZ 15dB Min	1~10MHZ 30dB Min	2.ns Max	2000 Vrms	17MHZ ± .7MHZ

MECHANICAL DIMENSION



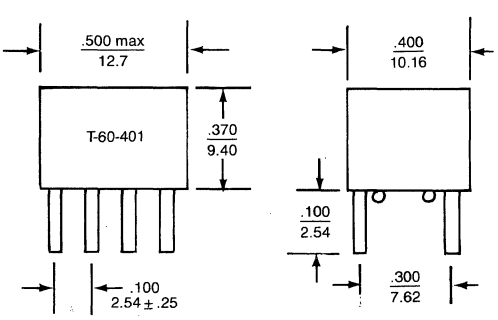
SCHEMATIC



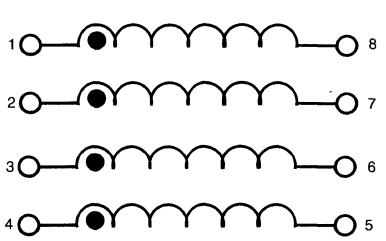
Type T-60-401
SIGNAL LINE/FILTER/COMMON MODE CHOKE

OCL	Turn Ratio (± 2%)	CWW Max	Leakage Inductance	DCR OHMS Max	Hipot
24~36 UH	1:1:1:1	25 PF	.3 UH Max	.2 Ohm Max	500Vrms

MECHANICAL DIMENSION



SCHEMATIC



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603-623-0222 • Fax: 603-623-0446

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
Microwave Components, Product Selection Guide **A**•1746
Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
Power Supplies, AC, Product Selection Guide **D**•2146
Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
Solenoids, Product Selection Guide **B**•1614
Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
Thermal Components, Product Selection Guide **B**•1831
Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
Thyristors/High Power Diodes, Miniglossary **A**•1728, **A**•2084
Timers, Miniglossary **B**•1409, **D**•1149
Trademark & Logofinder Directories **C**•901
Transducers & Encoders, Product Selection Guide **B**•1872
Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

JEROME INDUSTRIES CORPORATION

TRANSFORMERS
CUSTOM DESIGNED AND STANDARD

Made in the USA
DESIGNED
FOR THE WORLD

WALL PLUG-IN/DESKTOP STYLE/WALL MOUNTED

APPLICATIONS—Computers, Modems, Microprocessor Controlled Systems, Telecommunications, Operational Amplifiers, Computer Peripherals, Test Equipment, Security Systems, Multiplexers, Medical Equipment.

ELECTRICAL SPECIFICATION

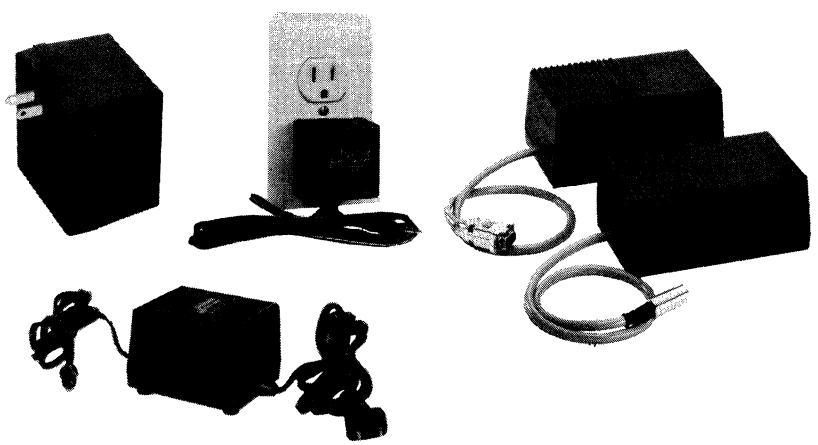
INPUT:
120 VAC 50/60 Hz, 240 VAC-50/60 Hz, 120/240 VAC-50/60 Hz, Switchable

OUTPUT
TRANSFORMERS: Up to 90 Watts

MECHANICAL SPECIFICATION

WALL PLUG-IN/WALL MOUNTED/DESKTOP

Standard Cords For Output, or to Customer Specifications
Screw Terminal Output On Various Styles
Customer Logo can be Applied
Variety of Case Colors Available
European Style Plug-In Configuration
On & Off Switch
Pilot Light



TYPICAL PRODUCTS

TRANSFORMERS Partial Listing—Others Available

Part No.	Output Vac	Output Iac	VA	Case Size	UL	CSA
PITB-63	7.5	1.5	11.5	B	YES	YES
PITG-34	7.5	3.5	26	G	YES	
PITB-162	8	0.1	0.6	B	YES	YES
PITF-56	5	2.0	15	F	YES	
PITB-10	10	0.5	5	B	YES	YES
PITB-125	10	0.75	7.5	B	YES	YES
PITH-15	10	1.5	15	H	YES	
PITB-28	12	0.25	3	B	YES	
PITB-134	12	0.45	5.4	B	YES	
PITB-149	12	0.93	11	B	YES	YES
PITB-140	12	1.25	15	B	YES	YES
PITF-23	12	2.0	24	F	YES	
PITB-67	13.5	1.1	15	B	YES	YES
PITH-25	14	1.43	20	H		YES
PITB-152	15	0.65	9.5	B	YES	YES
PITB-185	16 ct	0.625	10	B	YES	YES
PITH-40	16 ct	1.25	20	H	YES	YES
PITB-125	18	0.25	4.5	B	YES	
PITB-161	19.5 ct	0.3	6	B	YES	
PITF-22	25.4 ct	1.0	25.5	F	YES	
ILTF-9	12.5	2.5	31	F	YES	YES
ILTX-40	12	3.5	42	X		
ILTX-11	16	3	48	X		
ILTX-12	24	2.5	60	X		
ILTY-10	12	4	48	Y		
ILTY-11	16	3.5	54	Y		
ILTY-12	24	2.5	60	Y		
ILTF-26	27	1	27	F	YES	YES

All items made to U.L. specifications 478, 1310, 504, 516, 544 (Patient & Non Patient Connected), 694, 1012, 1235, 1411 and also equivalent C.S.A., V.D.E., IEC and other National and European specifications.

EUROPEAN STYLES

INTERNATIONAL DESIGNED WALL PLUG-IN AND DESKTOP PRODUCTS

Custom designed to European specifications

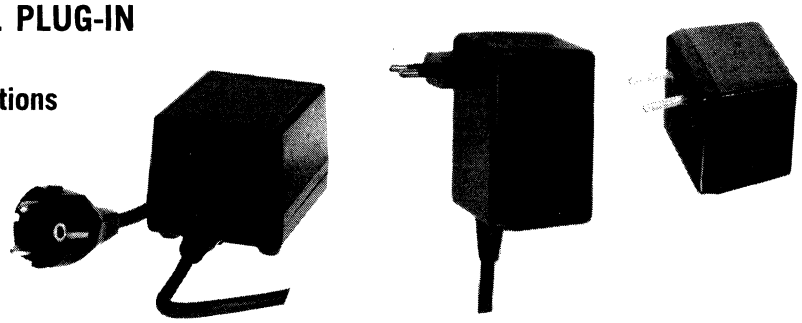
FOR BATTERY CHARGERS

- Ni-Cad batteries
- Lead acid/Gel Cells
- Fixed & automatic dual voltage

FOR POWER SUPPLIES

- Non-filtered/non-regulated
- Filtered only
- Regulated
- Multi output
- Switchers

All types of fast chargers available



See pages of this issue for additional information on battery chargers and power supplies.

CALL CUSTOMER SERVICE 908-353-5700

Jerome Industries Corporation/730E Division St., Elizabeth, NJ 07201/908-353-5700/FAX: 908-353-1021

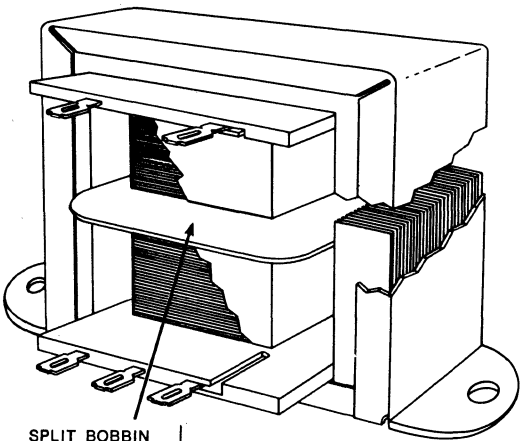
Split Bobbin Power Transformers & Split Bobbin Isolation Transformers

JM transformer
YOUR PRIMARY SOURCE

- 50/60 Hz
- Power Ratings to 1800 VA
- Single, Dual, and Tapped Primaries
- Single and Multiple Outputs
- Terminals for Quick-Connect or Soldering
- Flexible Leads also Available
- Available enclosed with Steel Covers

- Non-Concentric Winding — Lower Capacitance — Better Insulation — **2500-4000** VRMS Hipot — No Need for Electro-static Shield
- **LOW LEAKAGE**
- We design to meet UL, CSA, VDE, IEC, and TUV Standards.

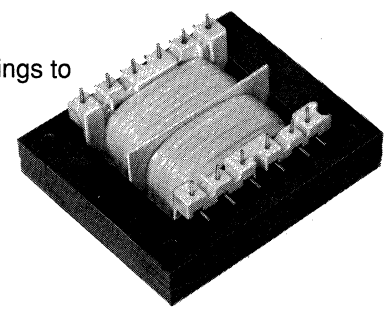
WE SPECIALIZE IN POWER TRANSFORMERS AND ISOLATION TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS.



CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

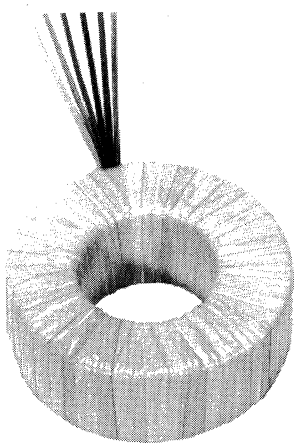
Split Bobbin and Low Profile Split Bobbin PC Board Transformers

- 50/60 Hz
- Power Ratings to 48 VA



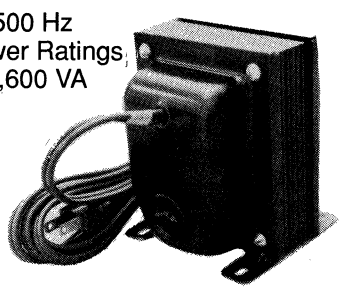
Toroidal Power & Toroidal Isolation Transformers

- 50/500 Hz
- Power Ratings to Over 1,000 VA



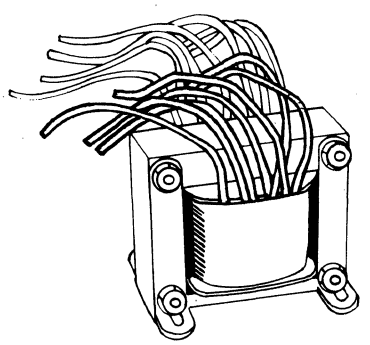
Auto-transformers

- 50/500 Hz
- Power Ratings to 3,600 VA



Rectifier Power Transformers with Flexible Leads

- 50/500 Hz
- Power Ratings up to 1800 VA
- Wide Range of Voltages
- Single, Dual, and Tapped Primaries
- Single and Multiple Outputs
- Available Enclosed in Steel Covers



WE DESIGN TO MEET UL, CSA, VDE, IEC, & TUV STANDARDS

See the Following Pages for Our Standard Split Bobbin Power, Isolation and PC Board Transformers and Toroidal Transformers

J M Transformer Co., Inc.

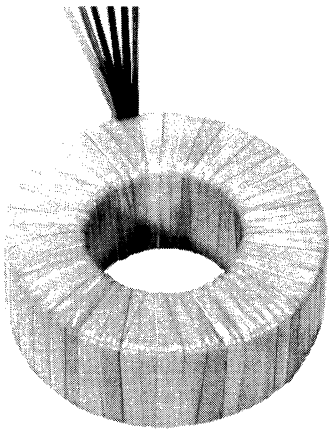
112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 • FAX: (516) 293-3923

JM transformer
YOUR PRIMARY SOURCE

Toroids

- Low Magnetic Strayfield
- High Efficiency
- Light Weight and Small
- Quiet
- Easy Mounting
  (Optional mtg. washer with 2 neoprene pads available)
- Low Profile Designs Are Readily Available

CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

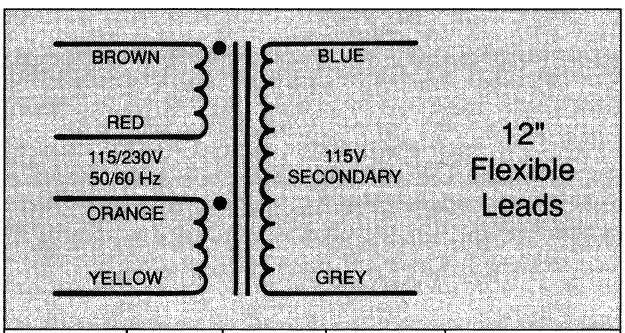


TOROIDAL ISOLATION TRANSFORMERS

- Low Leakage
- 4,000 VRMS Hipot
- Insulated With Extra Care And Extra Insulating Material

WE SPECIALIZE IN POWER TRANSFORMERS AND ISOLATION TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS

STANDARD TRANSFORMERS



Part Number	OD	HT	Approx. Lbs.	Secondary RMS Rating
Ti-1.9	5.4"	1.9"	4.9	115V @ 1.9A
Ti-2.5	5.4"	2.2"	5.8	115V @ 2.5A
Ti-3.6	5.4"	2.9"	8.3	115V @ 3.6A
Ti-4.7	5.9"	2.9"	10.5	115V @ 4.7A
Ti-8.7	7.8"	2.7"	16.0	115V @ 8.7A

TOROIDAL POWER TRANSFORMERS

ideal for use in rectifier circuits

Toroids are ideally suited for Custom Designs at **NO EXTRA COST**; your requirements for power transformers are likely to vary mechanically and or electrically. Consequently we do not feature standard toroidal power transformers.

Size	OD	HT	Approx. Lbs.	Typical power 60 Hz	Typical Power 50/60Hz
250	5.4"	1.9"	4.9	300 VA	250 VA
325	5.4"	2.2"	5.8	390 VA	325 VA
475	5.4"	2.9"	8.3	570 VA	475 VA
600	5.9"	2.9"	10.5	720 VA	600 VA
1,000	7.8"	2.7"	16.0	1,200 VA	1,000 VA

MANY OTHER SIZES ARE AVAILABLE.

Phone or send your requirements for immediate response.

J M Transformer Co., Inc. 112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 • FAX: (516) 293-3923

Split Bobbin Transformers

jm transformer
YOUR PRIMARY SOURCE

The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.
- Low Leakage

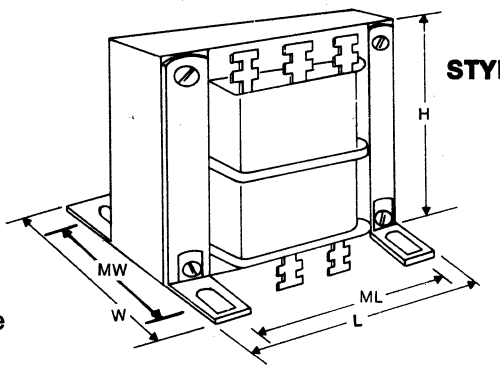
Also available:

- **Units with 4000 VRMS hipot**
- Steel covers
- **Flexible leads**
- Multiple outputs
- Tapped primaries
- Quick disconnect terminals
- Consult factory for any other configurations you may require
- **High voltage transformers**
- **We Design to Meet UL, CSA, VDE, IEC, & TUV Standards.**

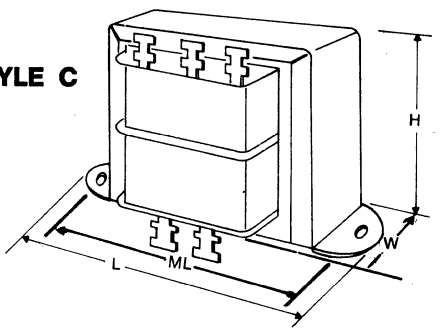
CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK. CHECK OUR LOW PRICES.

WE SPECIALIZE IN POWER TRANSFORMERS AND ISOLATION TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS

STYLE B



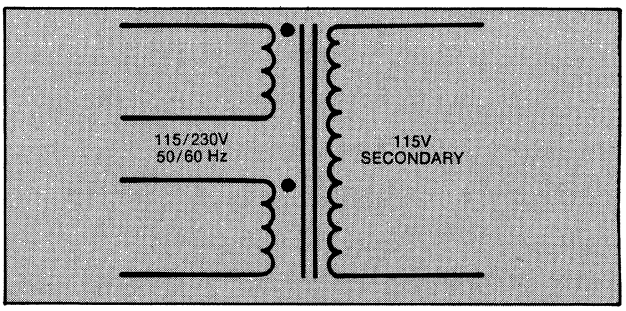
STYLE C



Size	Mounting Style	L	W	H	ML	MW	Approx. Lbs.	Typical Power
40	C	3 11/16	1 31/32	2 1/4	3 1/8	—	1 1/2	40VA
50	C	3 11/16	2 1/16	2 1/4	3 1/8	—	1 3/4	50VA
75	C	4 1/32	2 7/32	2 9/16	3 9/16	—	2	75VA
100	C	4 1/32	2 15/32	2 9/16	3 9/16	—	2 3/4	100VA
120	C	4 1/2	2 15/32	2 7/8	4	—	3	120VA
150	B	3 3/4	2 13/16	3 1/8	3 1/8	2 1/4	4	150VA
200	B	4 1/8	3	3 7/16	3 7/16	2 3/8	5 1/2	200VA
300	B	4 1/2	3 1/4	3 3/4	3 3/4	2 1/2	7	300VA
500	B	4 1/2	4 1/4	3 3/4	3 3/4	3 1/2	11	500VA
750	B	5 1/4	4 1/2	4 3/8	4 3/8	3 5/8	16	750VA
1000	B	6 3/8	4 5/8	5 5/16	5 5/16	3 1/4	20	1000VA
1800	B	7 1/2	5 3/8	6 1/4	6 3/4	3 5/8	32	1800VA

Split Bobbin Power Isolation Transformers

Part Number	Size	Secondary RMS Rating
I-.8	100	115V @ .8A
I-1	120	115V @ 1A
I-1.3	150	115V @ 1.3A
I-1.7	200	115V @ 1.7A
I-2.6	300	115V @ 2.6A
I-4.3	500	115V @ 4.3A
I-6.5	750	115V @ 6.5A
I-9	1000	115V @ 9A
I-15	1800	115V @ 15A

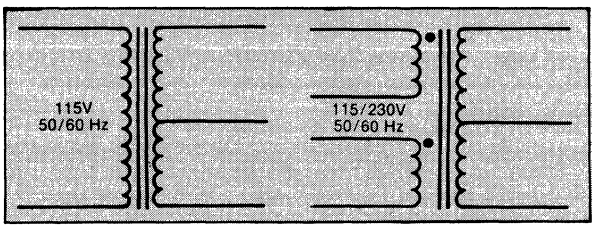


J M Transformer Co., Inc. 112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 • FAX: (516) 293-3923

JM transformer
YOUR PRIMARY SOURCE

Split Bobbin Power Transformers

Ideal for use in rectifier circuits



Add Prefix D to Part Numbers below if Dual Primary is Required

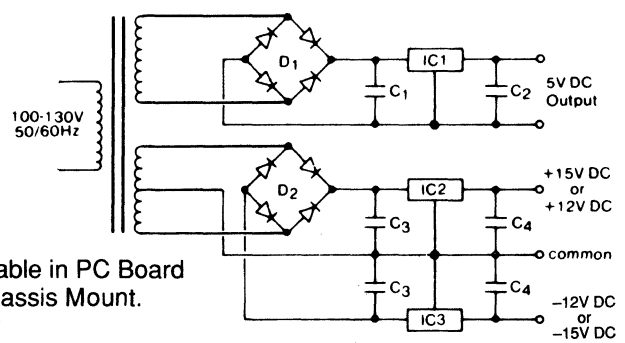
Part Number	Secondary RMS Rating	Size
10T-4	10VCT @ 4A	40
10T-5	10VCT @ 5A	50
10T-7.5	10VCT @ 7.5A	75
10-10*	10V @ 10A	100
10-12*	10V @ 12A	120
10-15*	10V @ 15A	150
12T-3.2	12.6VCT @ 3.2A	40
12T-4	12.6VCT @ 4A	50
12T-6	12.6VCT @ 6A	75
12T-8	12.6VCT @ 8A	100
12-10*	12.6V @ 10A	120
12-12*	12.6V @ 12A	150
16T-2.5	16VCT @ 2.5A	40
16T-3.2	16VCT @ 3.2A	50
16T-4.5	16VCT @ 4.5A	75
16T-6	16VCT @ 6A	100
16T-8	16VCT @ 8A	120
16-10*	16V @ 10A	150
16-12*	16V @ 12A	200
20T-2	20VCT @ 2A	40
20T-2.5	20VCT @ 2.5A	50
20T-3.8	20VCT @ 3.8A	75
20T-5	20VCT @ 5A	100
20T-6	20VCT @ 6A	120
24T-1.7	24VCT @ 1.7A	40
24T-2	24VCT @ 2A	50
24T-3.2	24VCT @ 3.2A	75
24T-4	24VCT @ 4A	100
24T-5	24VCT @ 5A	120
24T-6	24VCT @ 6A	150
24T-8	24VCT @ 8A	200
24-12*	24V @ 12A	300
28T-1.4	28VCT @ 1.4A	40
28T-1.8	28VCT @ 1.8A	50
28T-2.6	28VCT @ 2.6A	75
28T-3.5	28VCT @ 3.5A	100
28T-4.2	28VCT @ 4.2A	120
28T-5.4	28VCT @ 5.4A	150
28T-7	28VCT @ 7A	200
28-10*	28V @ 10A	300
32T-1.2	32VCT @ 1.2A	40
32T-1.5	32VCT @ 1.5A	50
32T-2.4	32VCT @ 2.4A	75
32T-3	32VCT @ 3A	100
32T-3.8	32VCT @ 3.8A	120
32T-4.5	32VCT @ 4.5A	150
32T-6	32VCT @ 6A	200
36T-1	36VCT @ 1A	40
36T-1.4	36VCT @ 1.4A	50
36T-2	36VCT @ 2A	75
36T-2.8	36VCT @ 2.8A	100
36T-3.3	36VCT @ 3.3A	120
36T-4	36VCT @ 4A	150
36T-5.5	36VCT @ 5.5A	200
36T-8	36VCT @ 8A	300
36-12*	36V @ 12A	500
40T-1	40VCT @ 1A	40
40T-1.2	40VCT @ 1.2A	50
40T-1.8	40VCT @ 1.8A	75
40T-2.5	40VCT @ 2.5A	100
40T-3	40VCT @ 3A	120
40T-3.8	40VCT @ 3.8A	150
40T-5	40VCT @ 5A	200
40T-7.5	40VCT @ 7.5A	300
48T-.8	48VCT @ .8A	40
48T-1	48VCT @ 1A	50
48T-1.5	48VCT @ 1.5A	75
48T-2	48VCT @ 2A	100
48T-2.5	48VCT @ 2.5A	120
48T-3	48VCT @ 3A	150
48T-4	48VCT @ 4A	200
48T-6	48VCT @ 6A	300
56T-.7	56VCT @ .7A	40
56T-.9	56VCT @ .9A	50
56T-1.3	56VCT @ 1.3A	75
56T-1.7	56VCT @ 1.7A	100
56T-2.1	56VCT @ 2.1A	120
56T-2.7	56VCT @ 2.7A	150
56T-3.6	56VCT @ 3.6A	200
56T-5.4	56VCT @ 5.4A	300
56-8*	56V @ 8A	500
56-13*	56V @ 13A	750
68T-.6	68VCT @ .6A	40
68T-.7	68VCT @ .7A	50
68T-1.1	68VCT @ 1.1A	75
68T-1.4	68VCT @ 1.4A	100
68T-1.8	68VCT @ 1.8A	120
68T-2.2	68VCT @ 2.2A	150
68T-2.9	68VCT @ 2.9A	200
68T-4.4	68VCT @ 4.4A	300
68-7*	68V @ 7A	500
68-11*	68V @ 11A	750
80T-.5	80VCT @ .5A	40
80T-.6	80VCT @ .6A	50
80T-.9	80VCT @ .9A	75
80T-1.2	80VCT @ 1.2A	100
80T-1.5	80VCT @ 1.5A	120
80T-1.9	80VCT @ 1.9A	150
80T-2.5	80VCT @ 2.5A	200
80T-3.8	80VCT @ 3.8A	300
80T-6	80VCT @ 6A	500
80-9*	80V @ 9A	750
120T-.3	120VCT @ .3A	40
120T-.4	120VCT @ .4A	50
120T-.6	120VCT @ .6A	75
120T-.8	120VCT @ .8A	100

* These items do not have center-tapped secondaries

Please note that the sizes shown above refer to the chart on the facing page

CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

Transformers for Triple Output (Microprocessor) Applications



- Available in PC Board or Chassis Mount.

112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 • FAX: (516) 293-3923 J M Transformer Co., Inc.

Split Bobbin PC Board Transformers

JM transformer
YOUR PRIMARY SOURCE

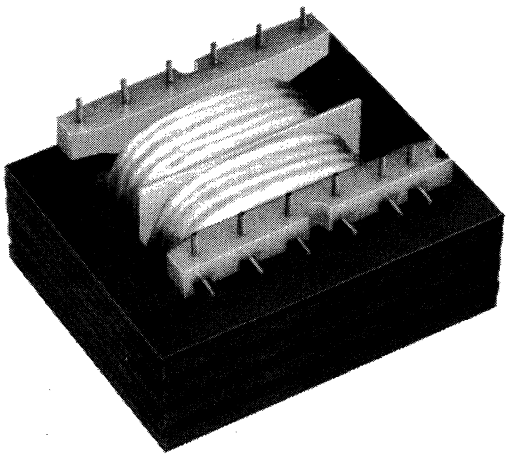
The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.

Please note that the standard items listed below utilize 6 or 8 pins, while 12 pins are available. We would like to quote your more complex requirements . . . you may save cost and space by combining two less complex Transformers into one.

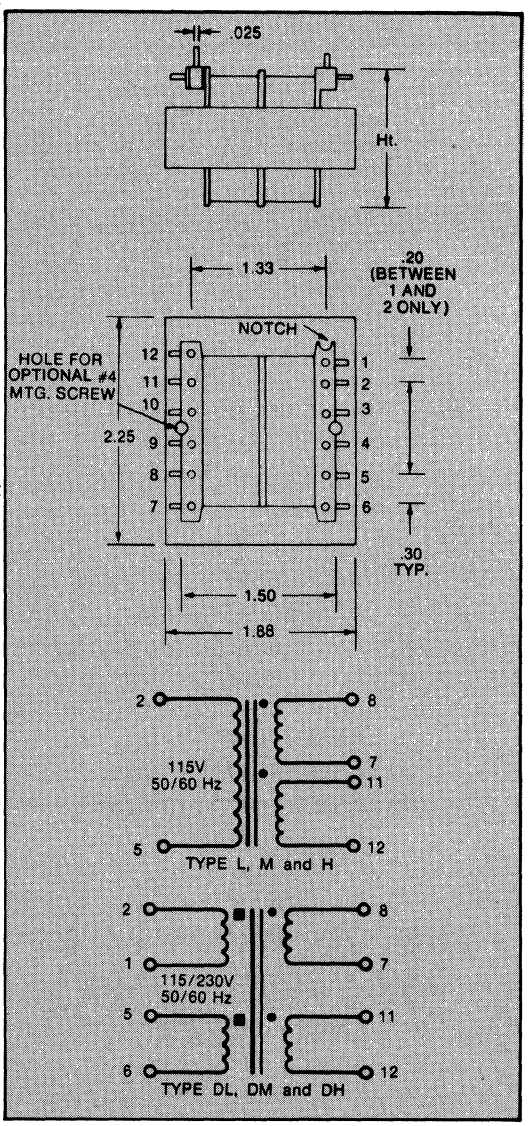
We would also be glad to quote your less complex requirements. For example, if only a Single Primary and Single Secondary are needed, you can save considerable cost by utilizing only 4 Pins.

CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK



STANDARD TRANSFORMERS

	Part Number		Secondary RMS Ratings			
	Single 115V Pri.	Dual 115/230V Pri.	Series	Parallel	Ht.	Approx. Lbs.
LOW PROFILE	L-10	DL-10	10VCT @ 2A	5V @ 4A	1.34	.75
	L-12	DL-12	12.6VCT @ 1.6A	6.3V @ 3.2A	1.34	.75
	L-16	DL-16	16VCT @ 1.25A	8V @ 2.5A	1.34	.75
	L-20	DL-20	20VCT @ 1A	10V @ 2A	1.34	.75
	L-24	DL-24	24VCT @ .8A	12V @ 1.6A	1.34	.75
	L-32	DL-32	32VCT @ .625A	16V @ 1.25A	1.34	.75
	L-40	DL-40	40VCT @ .5A	20V @ 1A	1.34	.75
	L-48	DL-48	48VCT @ .4A	24V @ .8A	1.34	.75
	L-80	DL-80	80VCT @ .25A	40V @ .5A	1.34	.75
	L-120	DL-120	120VCT @ .16A	60V @ .32A	1.34	.75
	M-10	DM-10	10VCT @ 2.4A	5V @ 4.8A	1.55	.9
	M-12	DM-12	12.6VCT @ 1.9A	6.3V @ 3.8A	1.55	.9
	M-16	DM-16	16VCT @ 1.5A	8V @ 3A	1.55	.9
	M-20	DM-20	20VCT @ 1.2A	10V @ 2.4A	1.55	.9
	M-24	DM-24	24VCT @ 1A	12V @ 2A	1.55	.9
	M-32	DM-32	32VCT @ .75A	16V @ 1.5A	1.55	.9
	M-40	DM-40	40VCT @ .6A	20V @ 1.2A	1.55	.9
	M-48	DM-48	48VCT @ .5A	24V @ 1A	1.55	.9
	M-80	DM-80	80VCT @ .3A	40V @ .6A	1.55	.9
	M-120	DM-120	120VCT @ .2A	60V @ .4A	1.55	.9
	H-10	DH-10	10VCT @ 3A	5V @ 6A	1.79	1.1
	H-12	DH-12	12.6VCT @ 2.4A	6.3V @ 4.8A	1.79	1.1
	H-16	DH-16	16VCT @ 1.8A	8V @ 3.6A	1.79	1.1
	H-20	DH-20	20VCT @ 1.5A	10V @ 3A	1.79	1.1
	H-24	DH-24	24VCT @ 1.25A	12V @ 2.5A	1.79	1.1
	H-32	DH-32	32VCT @ .95A	16V @ 1.9A	1.79	1.1
	H-40	DH-40	40VCT @ .75A	20V @ 1.5A	1.79	1.1
	H-48	DH-48	48VCT @ .625A	24V @ 1.25A	1.79	1.1
	H-80	DH-80	80VCT @ .375A	40V @ .75A	1.79	1.1
	H-120	DH-120	120VCT @ .25A	60V @ .5A	1.79	1.1



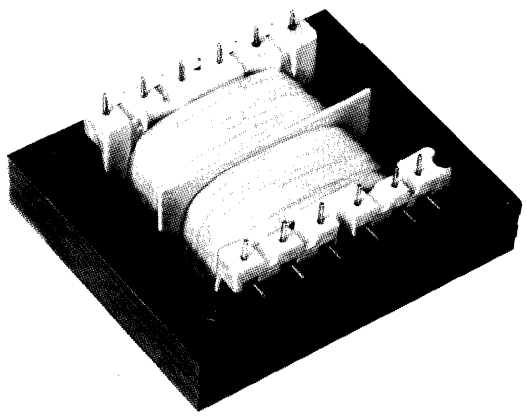
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JM transformer
YOUR PRIMARY SOURCE

Low Profile Split Bobbin PC Board Transformers

- **Only 1.13" high**

XL Series transformers offer a particularly low profile for 18VA, allowing for 1.25" card spacing.



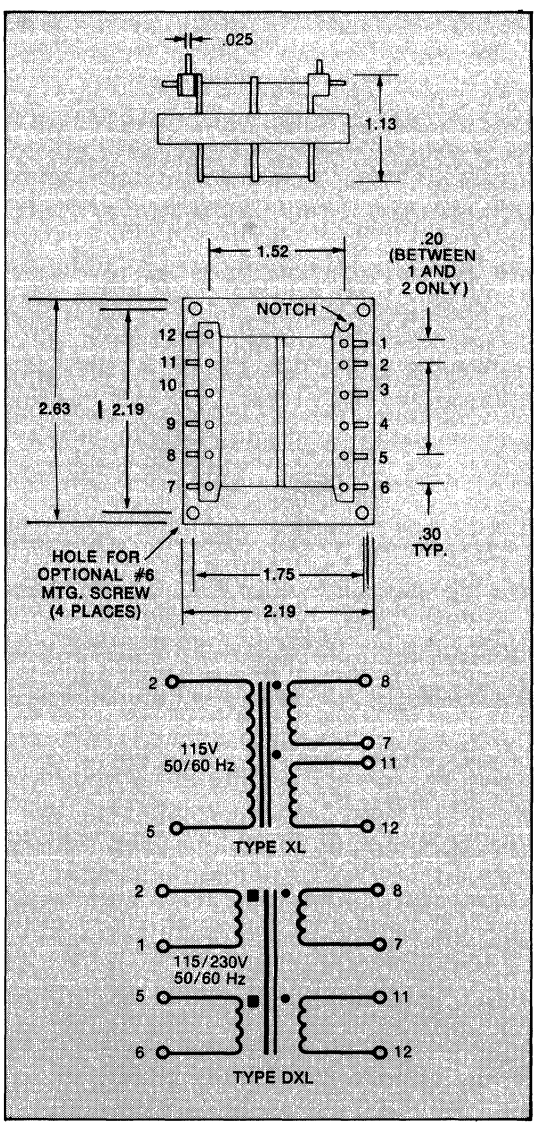
The use of a split bobbin allows winding to be non-concentric (side-by-side), consequently high isolation is achieved at low cost.

- Better Insulation — 2500 VRMS hipot is standard.
- Lower Capacitance — no need for electro-static shield.

If the standard items shown here do not fit your requirements, we would be glad to quote on your custom needs. Often this can save space and considerable cost.

STANDARD TRANSFORMERS

Part Number				
Single 115V Pri.	Dual 115/230V Pri.	Secondary RMS Ratings		Approx. Lbs.
		Series	Parallel	
XL-10	DXL-10	10VCT @ 1.6A	5V @ 3.2A	.7
XL-12	DXL-12	12.6VCT @ 1.25A	6.3V @ 2.5A	.7
XL-14	DXL-14	14VCT @ 1.28A	7V @ 2.56A	.7
XL-16	DXL-16	16VCT @ 1A	8V @ 2A	.7
XL-18	DXL-18	18VCT @ 1A	9V @ 2A	.7
XL-20	DXL-20	20VCT @ .8A	10V @ 1.6A	.7
XL-22	DXL-22	22VCT @ .8A	11V @ 1.6A	.7
XL-24	DXL-24	24VCT @ .68A	12V @ 1.36A	.7
XL-28	DXL-28	28VCT @ .64A	14V @ 1.28A	.7
XL-32	DXL-32	32VCT @ .5A	16V @ 1A	.7
XL-36	DXL-36	36VCT @ .5A	18V @ 1A	.7
XL-40	DXL-40	40VCT @ .4A	20V @ .8A	.7
XL-44	DXL-44	44VCT @ .4A	22V @ .8A	.7
XL-48	DXL-48	48VCT @ .34A	24V @ .68A	.7
XL-56	DXL-56	56VCT @ .32A	28V @ .64A	.7
XL-72	DXL-72	72VCT @ .25A	36V @ .5A	.7
XL-88	DXL-88	88VCT @ .2A	44V @ .4A	.7
XL-120	DXL-120	120VCT @ .134A	60V @ .268A	.7



AT JM WE USE ONLY PRIME RAW MATERIALS

CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

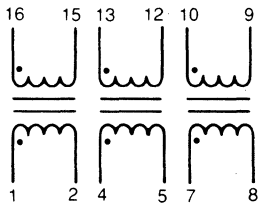
SERVICE IS AN IMPORTANT PART OF OUR PRODUCTS

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CHOKES AND TRANSFORMERS FOR LAN APPLICATIONS

ETHERNET ISOLATION TRANSFORMER (SERIES TP385 16 PIN)

SCHEMATIC DIAGRAMS



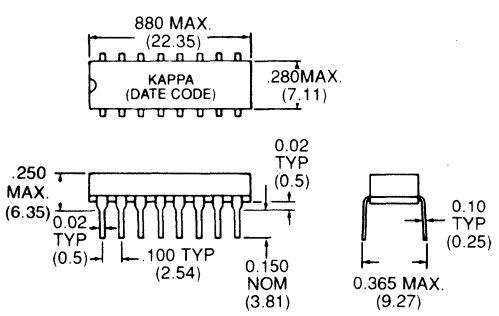
ELECTRICAL SPECIFICATIONS (AT 25°C)

Part Number	OCL µH+20%	ET-Constant V-µs min	Rise Time nS max	CW pF max	LE µH max	DCR ohms max
TP385(*)1100250	25	2.0	2.0	5	0.15	0.15
TP385(*)1100300	30	2.0	3.0	5	0.15	0.15
TP385(*)1100350	35	2.2	3.0	6	0.15	0.20
TP385(*)1100500	50	2.2	3.0	7	0.20	0.20
TP385(*)1100750	75	2.5	3.0	8	0.20	0.25
TP385(*)1100101	100	2.5	3.0	9	0.25	0.30
TP385(*)1100125	125	3.0	3.0	10	0.25	0.30
TP385(*)1100151	150	3.0	3.0	11	0.25	0.40
TP385(*)1100175	175	3.5	3.5	12	0.25	0.50
TP385(*)1100201	200	3.5	3.5	13	0.30	0.50

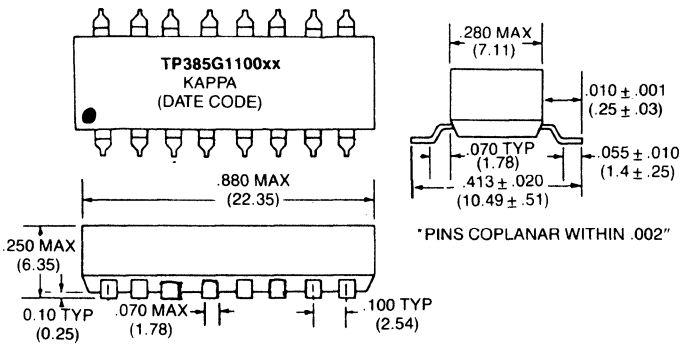
*Insert package code letter D=Dip; G=Std Gull-Wing SMD; S=S016; E=Wide-Body DIL

MARKINGS AND DIMENSIONS in (mm)

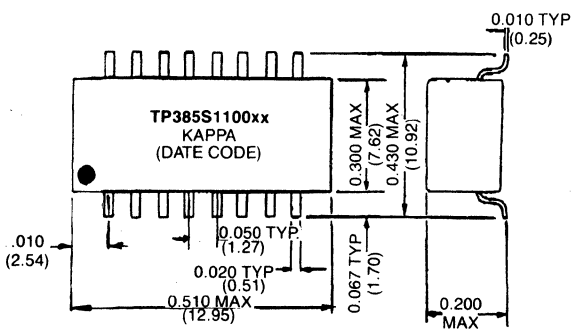
TP385D (500 V rms)



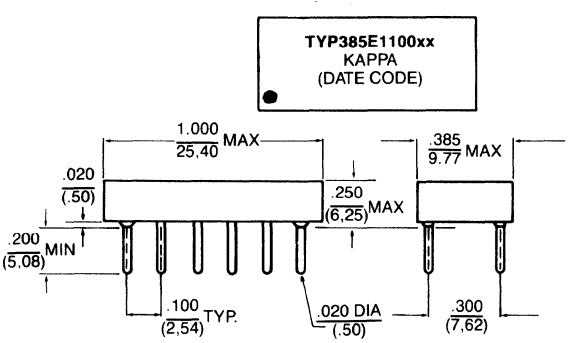
TP385G (500Vrms)



TP385S (500 Vrms)



TP385E (2000 Vrms)



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CHOKES AND TRANSFORMERS FOR LAN APPLICATIONS

TOKEN RING ISOLATION TRANSFORMER
(SERIES TP18/TP28 SINGLE DUAL)

FEATURES

- Available in single and dual configurations
- IEEE 802.5 compatible
- Case Material: Molded DAP or epoxy
- Potting: 100% filled two-component epoxy
- Terminals: Flat, DIP-type or 24 AWG round leads; Kovar or equivalent, tin-plated

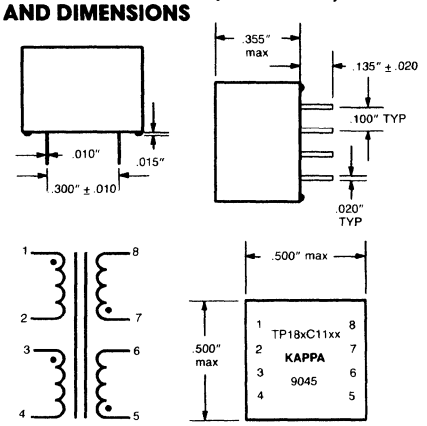
ELECTRICAL SPECIFICATIONS (@ 25°C)

PART NUMBER		OCL	Turns	CW	Rise Time	LE	DCR Q max.		
Single	Dual	µHy min.	Ratio ±5%	pF max.	nS max.	µHy max.	Pri.	Sec.	Application
TP183C1122	TP284E1122	1000	1:1:2:2	15.0	15.0	0.40	0.40	0.80	4 MHz
TP186C1122	TP287E1122	250	1:1:2:2:	15.0	15.0	0.15	0.50	0.80	16 MHz
TP187C1111	TP288E1111	750	1:1:1:1	25.0	5.0	0.20	1.00	1.00	16 MHz

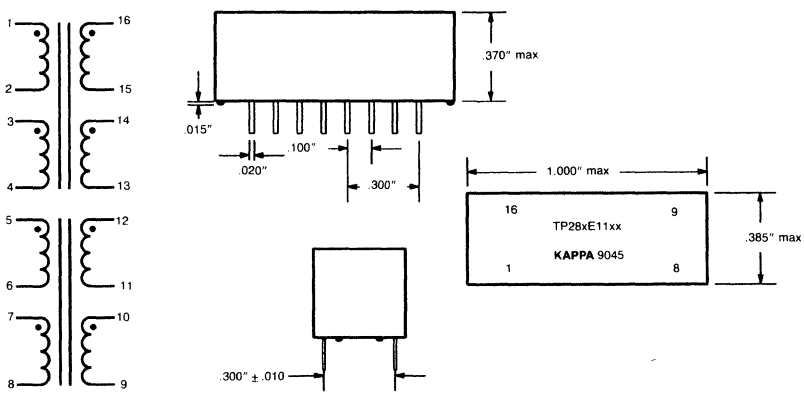
RATINGS:	*Insertion Loss (db max.)	(CMRR (db min.)	Return Loss (db min.)	DWV
	0.5@10 MHz	−60@1 MHz	20@1 MHz	500 Vrms

*All insertion loss and CMRR measurements are made in a 78 ohm system.

SINGLE: SCHEMATIC, MARKING, AND DIMENSIONS

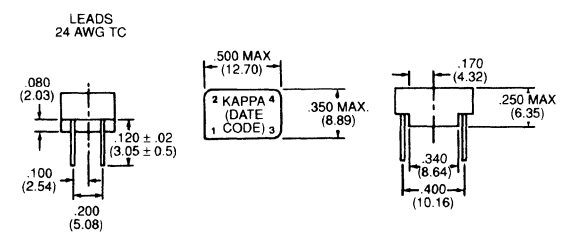


DUAL: SCHEMATIC, MARKING, AND DIMENSIONS



STARLAN-LAN ISOLATION TRANSFORMER
(SERIES TP181A/TP282B SINGLE/DUAL)

SINGLE: PART NUMBER TP181A1100252 MARKINGS AND DIMENSIONS in (mm)

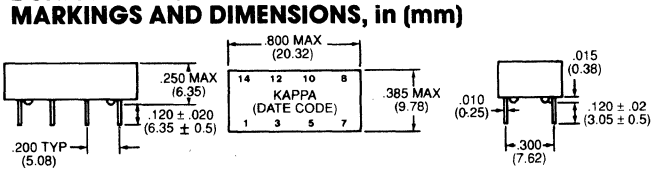


ELECTRICAL SPECIFICATIONS (AT 25°C)

Pulse inductance measured at 3V and PW of 3µS at PRR of 1 mS	2.5 mH ± 20% (See Test Circuit)
Primary ET Constant	20.0 V-µS min
Rise Time	100 nS max
Pri/Sec Inter-winding Capacitance	25 pF max
Pri/Sec Leakage Inductance	8µH max
Pri or Sec DCR	1.0 ohms max
Turns Ratio	1:1 ± 5%
HIPOT between Pri and Sec and also from coil to coil in dual configuration	2000 Vrms*

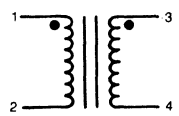
*500 Vrms also available.

DUAL: PART NUMBER TP282B1100252 MARKINGS AND DIMENSIONS, in (mm)

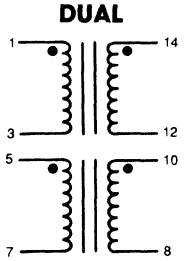


SCHEMATIC DIAGRAMS

SINGLE



DUAL



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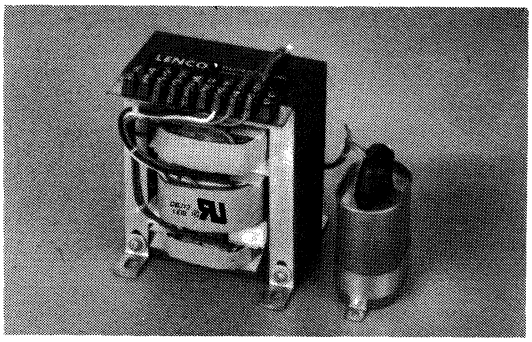
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IN STOCK TRANSFORMERS for immediate delivery

Regulating Transformers

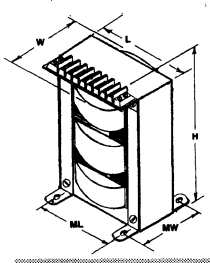
Output regulated to ±3% for input variations of +15% -25% • Removes most voltage sags, surges, brownouts, noise and distortion • Less than 3% distortion • Minimum load efficiency of 85% • Temperature −20°C to +70°C • Low cost, quiet operation



FREQUENCY 60Hz/OUTPUT 120V

MODEL	POWER	INPUT	MOUNTING
CVS-50-120-60*	50VA	120V	H
CVS-50-240-60*	50VA	240V	H
CVS-50-480-60*	50VA	480V	H
CVS-100-120-60	100VA	120V	A
CVS-100-240-60	100VA	240V	A
CVS-100-480-60	100VA	480V	A
CVS-150-120-60	150VA	120V	B
CVS-150-240-60	150VA	240V	B
CVS-150-480-60	150VA	480V	B
CVS-250-120-60	250VA	120V	C
CVS-250-240-60	250VA	240V	C
CVS-250-480-60	250VA	480V	C
CVS-500-120-60	500VA	120V	D
CVS-500-240-60	500VA	240V	D
CVS-500-480-60	500VA	480V	D
CVS-750-120-60	750VA	120V	E
CVS-750-240-60	750VA	240V	E
CVS-750-480-60	750VA	480V	E
CVS-1000-120-60	1000VA	120V	F
CVS-1000-240-60	1000VA	240V	F
CVS-1000-480-60	1000VA	480V	F
CVS-1500-120/240-60	1500VA	120/240V	G
CVS-1500-240/480-60	1500VA	240/480V	G

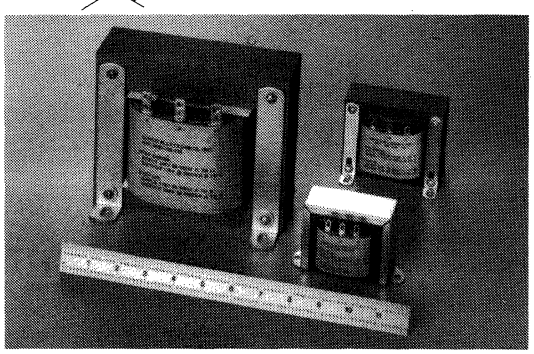
*** Minimum load efficiency of 70%**



MOUNTING	L	W	H	ML	MW
A	4.5	3.8	6	3.75	2.35
B	5.35	4.35	6.51	4.38	2.62
C	5.35	5.15	6.51	4.38	3.62
D	5.85	6.42	7.01	4.81	4.75
E	7.20	6.10	8.70	5.94	3.60
F	7.20	7.0	8.70	5.94	4.68
G	8.69	7.0	10.50	7.22	3.92
H	3.70	3.70	5.00	3.06	2.25

Autotransformer

Designed and manufactured to Lenco's high standards. Stocked in 100 VA through 5000 VA for immediate delivery. Approximately 50% reduction in size, cost, high efficiency and bi-directional. Note: Does not provide isolation.



FREQUENCY 50/60Hz

LUG STYLE	MODEL NO.	POWER	INPUT/OUTPUT BI-DIRECTIONAL	FIGURE NO.	MOUNTING
Solder	ATF-100-230-115	100VA	115/230V	1	A
Solder	ATF-100-480-240	100VA	240/480V	1	A
Solder	ATF-150-230-115	150VA	115/230V	1	B
Solder	ATF-150-480-240	150VA	240/480V	1	B
Solder	ATF-250-230-115	250VA	115/230V	2	C
Solder	ATF-250-480-240	250VA	240/480V	2	C
Solder	ATF-500-230-115	500VA	115/230V	2	D
Solder	ATF-500-480-240	500VA	240/480V	2	D
10-32 Tapped	ATF-1000-230-115	1000VA	115/230V	2	E
10-32 Tapped	ATF-1000-480-240	1000VA	240/480V	2	E
10-32 Tapped	ATF-1500-230-115	1500VA	115/230V	2	F
10-32 Tapped	ATF-1500-480-240	1500VA	240/480V	2	F
10-32 Tapped	ATF-2000-230-115	2000VA	115/230V	2	G
10-32 Tapped	ATF-2000-480-240	2000VA	240/480V	2	G
10-32 Tapped	ATF-2500-230-115	2500VA	115/230V	2	H
10-32 Tapped	ATF-2500-480-240	2500VA	240/480V	2	H
10-32 Tapped	ATF-3000-230-115	3000VA	115/230V	2	I
10-32 Tapped	ATF-3000-480-240	3000VA	240/480V	2	J
10-32 Tapped	ATF-5000-230-115	5000VA	115/230V	2	K
10-32 Tapped	ATF-5000-480-240	5000VA	240/480V	2	L

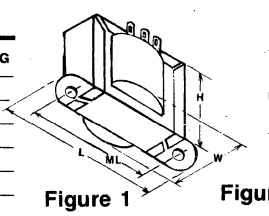


Figure 1

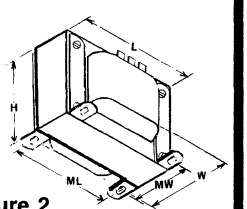


Figure 2

MOUNTING	L	W	H	ML	MW
A	4.06	2.4	2.64	3.56	—
B	4.06	2.7	2.64	3.56	—
C	3.81	2.9	3.19	3.13	2.38
D	4.56	3.5	3.81	3.75	2.75
E	5.31	4.3	4.44	4.38	3.13
F	6.44	4.3	5.38	5.31	2.88
G	6.44	5.6	5.38	5.31	3.75
H	7.13	5.0	6.10	5.81	3
I	7.13	5.3	6.10	5.81	3.25
J	7.13	5.6	6.10	5.81	3.25
K	7.13	7.1	6.10	5.81	4.75
L	7.13	7.0	6.10	5.81	4.75

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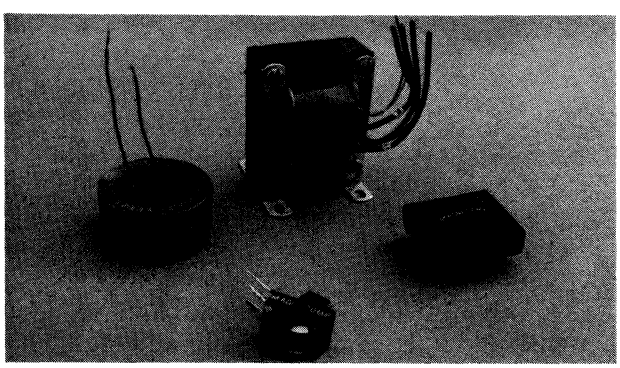
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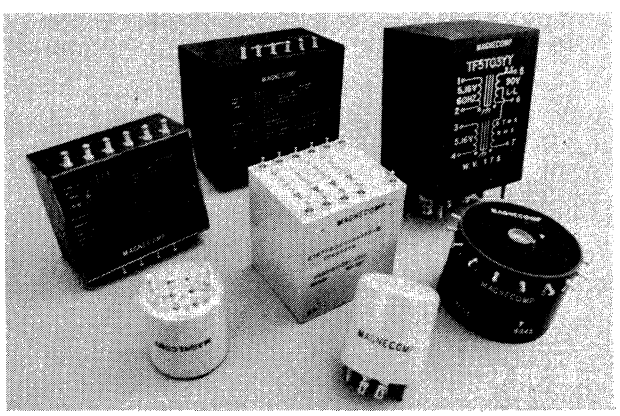
Twenty five years of experience designing and building magnetic components to military specifications allows MagneComp to deliver prompt accurate solutions to your most difficult requests. Powers up to 1 kVA and frequencies to 500 mHZ.

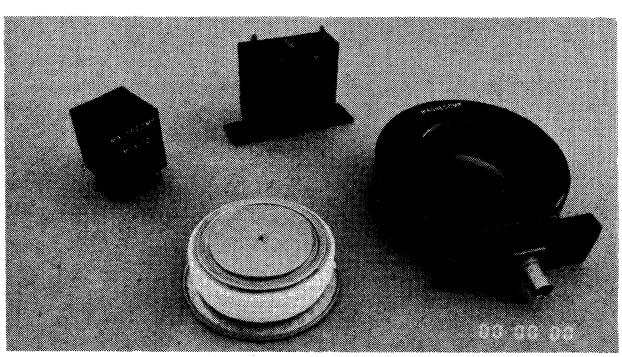
From one special transformer to thousands we'll deliver what you need when you need it. Call us. Our experienced engineers are ready to help you.

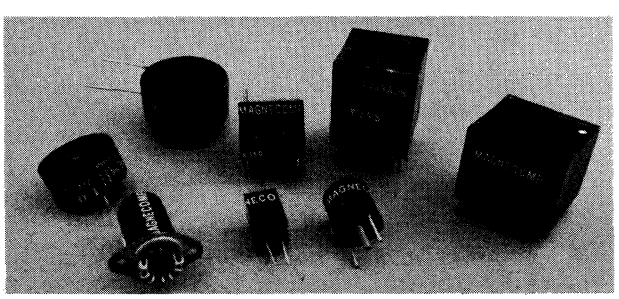
The photos show only a small fraction of the types and styles of magnetic components available. All can be designed and manufactured to meet military specifications MIL-T-27 and others. Our quality control system is designed to meet MIL-I-45208. Instrument calibration is per MIL-STD-45662.

• POWER TRANSFORMERS •
50 Hz to 5 KHz up to 1 KVA • Laminated
• toroidal • cut core •
• SWITCHING POWER TRANSFORMERS •
Up to 1 MHz and 500 Watts
• SWITCHING INDUCTORS •
Up to 1 MHz and 30 Amps
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accuracies to 10 parts per million.
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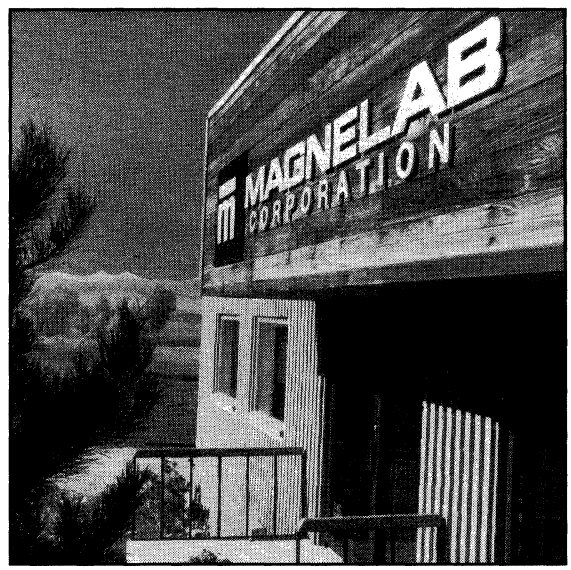
DESIGN & MANUFACTURE OF TRANSFORMER PRODUCTS

MEETING THE NEEDS OF TODAY'S HIGH TECHNOLOGY

Science and industry rely on today's complex electronics technology to support a wide array of advanced equipment and systems such as:

- Medical
- Computer
- Instrumentation
- Energy
- Aerospace
- Military

MAGNELAB has been playing an important role in each of these fields for over twenty-two years, specializing in



engineering and manufacture of electromagnetic products such as:

- Power Transformers
- Current Transformers
- Toroid Transformers
- Surface Mnt. Trans.
- Power Inductors
- Filter Inductors
- Miniature coils
- Antenna coils
- Converter Transformers
- Pulse Transformers
- DIP Transformers
- Toroid Inductors
- Tuning Inductors
- EMI Filters
- Self-bonded coils
- Solenoids

ENGINEERING

MAGNELAB has a completely equipped engineering facility to serve you:

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- Spectrum Analyzers
- Precision Inductance Analyzers
- Automatic Data Acquisiton
- Precision Voltage and Current Generators
- Environmental Testing
- Design ability to MIL, UL, TUV, CSA and ETL Standards.

TOOLING

At MAGNELAB you will find an extensive tooling facility along with the skills to develop the intricate fixtures required for precision manufacturing. We are particularly proud of this capability in providing you with just the right part.

Please see our other page in Section 1800 A•1209

STATISTICAL PROCESS CONTROL (SPC)

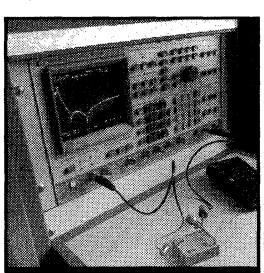
MAGNELAB'S philosophy is ZERO DEFECTS through continuous on-line and off-line SPC, involving:

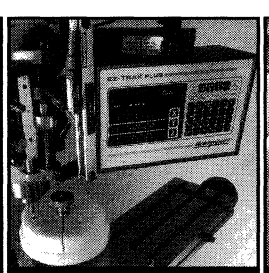
- Fast, accurate data acquisition
- IEEE data bussing
- Continuous X-bar-R charting
- Total employee participation
- Cause and effect diagramming
- Targeting critical processes and measurements
- Timely corrective action

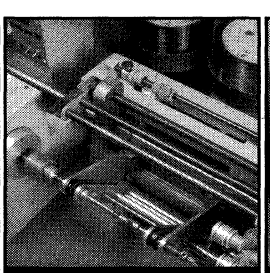
VOLUME MANUFACTURING

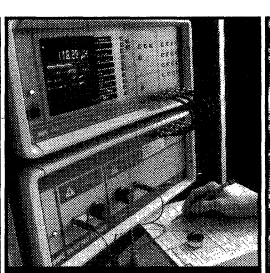
MAGNELAB operates a competitive volume manufacturing operation, delivering orders from a few dozen to many thousands of parts. A wide array of equipment and facility allows us to manufacture a great variety of products from simple antenna coils to complex military switching transformers. SPC and precision tooling play a key role in the uniform quality parts we produce.

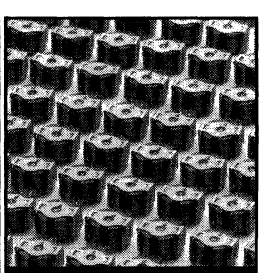
We look forward to helping you solve your next magnetics problem and delivering quality production parts.


Frequency measurement using spectrum analyzer


Computerized milling operation


Custom fixturing


SPC with inductance analyzer


Production run of precision inductors

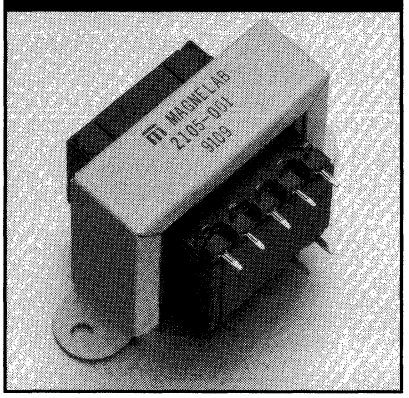
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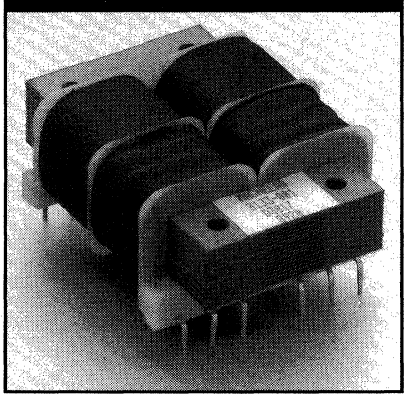
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SEMI-CUSTOM PRODUCTS

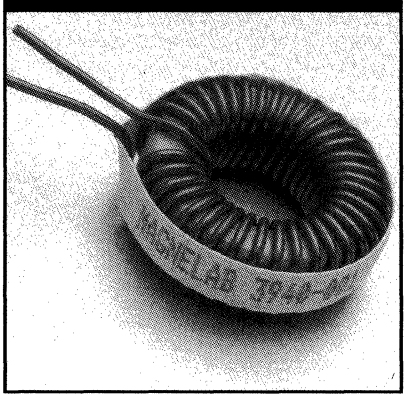
EUR



LLP



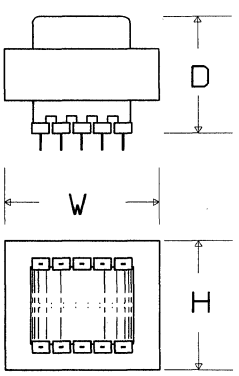
MPP



LAMINATED POWER TRANSFORMERS FOR EUROPEAN PERFORMANCE REQUIREMENTS

Size Code	Rating (a) (Volt-Amps)	Efficiency (%)	Dimensions (in.) D	W(c)	H(c)	Terms Pri	Sec
0560	5.0	56	1.30	1.69	1.41	5	10
0620	8.5	64	1.41	1.88	1.57	6	12
0680	13.4	70	1.54	2.07	1.72	6	12
0750	20.4	74	1.71	2.25	1.88	5	10
0751	27.5	78	1.96	2.25	1.88	5	10
0870	34.8	78	1.94	2.63	2.19	5	10
0871	42.0	81	2.07	2.63	2.19	5	10
0872	53.7	83	2.33	2.63	2.19	5	10
1000	62.6	83	2.19	3.00	2.50	6	12
1001	79.2	85	2.44	3.00	2.50	6	12
1002	98.7	87	2.69	3.00	2.50	6	12
1101	97.5	87	2.44	3.38	2.82	6	12
1200	143.0	89	2.70	3.75	3.13	7	16

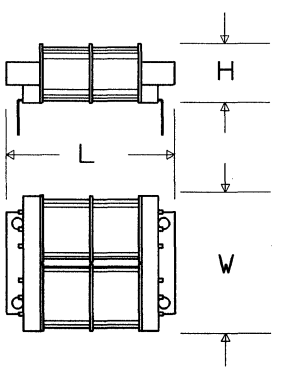
(a) Power rating based on 40°C temperature rise, 50/60 hz, input voltage range ± 10% of nominal.
(b) Fully shrouded bobbins.
(c) Mounting: Dimensions W and H shown with no mounting. Mounting may be channel frame through 1000 except 0560. Corner bracket 1001 through 1200.
(d) Terminals: Solder lugs or printed circuit pins.
(e) To order, specify: 1) Input voltage and range, 2) Frequency, 3) Output voltages and currents, 4) Size code, 5) Terminal type, 6) Mounting method.



LAMINATED LOW—PROFILE POWER TRANSFORMERS

Size Code	Rating (a) (Volt-Amps)	Efficiency (%)	Dimension (in.) L	W	H
0370	2.5	40	1.88	1.57	.65
0371	6.0	60	1.88	1.57	.85
0500	12.0	68	2.50	2.0	1.07
0560	24.0	75	2.88	2.25	1.25
0620	48.0	82	3.13	2.50	1.38

(a) Power based on 40°C temperature rise, 50/60 hz, input voltage range ± 10% of nominal.
(b) To order, specify: 1) Input voltage and range, 2) Output voltages and currents, 3) Size code.
(c) Four equal bobbin sections are available, two for primaries, two for secondaries; three pins for each section.
(d) To order, specify: 1) Input voltage and range, 2) Frequency, 3) Output voltages and currents, 4) Size code.

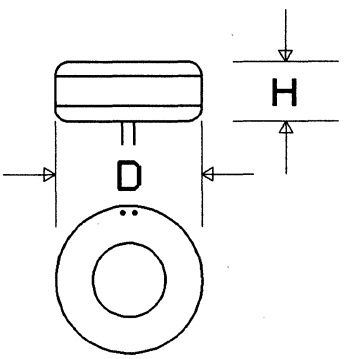


MAGNELAB also provides custom designing and manufacturing to meet your particular requirements.

PRECISION TOROIDAL INDUCTORS FOR OSCILLATORS AND FILTERS

Size Code	Energy (a) (Microwatt-sec.)	Dimensions (in.) D	H
0140	.34	.16	.09
0180	.91	.22	.15
0250	1.78	.29	.16
0310	4.94	.35	.19
0380	9.55	.43	.20
0400	14.10	.45	.23
0500	28.90	.57	.30
0650	115.00	.74	.38
0800	161.00	.91	.41
0900	270.00	1.10	.48
1060	590.00	1.20	.63
1300	790.00	1.40	.56

(a) Calculated at 5% roll-off of inductance with current at 25°C. (uW - S = 1/2 mHy x Amp² x 10^3).
(b) Mounting options: Unmounted as shown, vertical pc mount, or horizontal pc mount.
(c) To order, specify: 1) Inductance and current, 2) Accuracy (2. 5. or 10%), 3) Size code (from graph), 4) Mounting option.



Please see our other page in Section 1800 A•1209

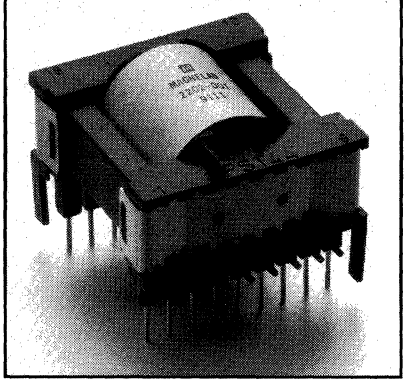
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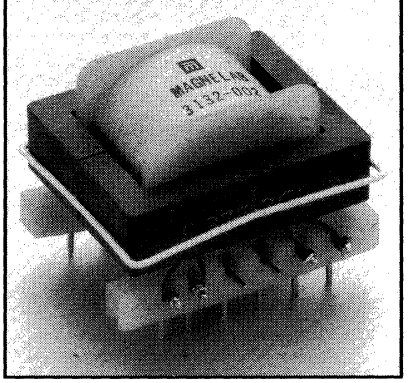
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Custom requirements can often be met cost-effectively by designing onto existing core/bobbin assemblies which are already available and tooled for manufacturing. MAGNELAB stocks the following six families of cores, bobbins and hardware as a starting point for your particular requirement. Electrical and mechanical information is provided to assist you. Call MAGNELAB for additional design information.

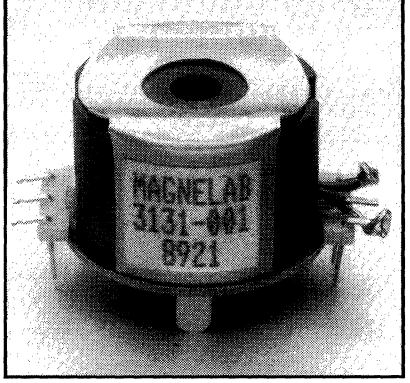
ETD



FEP



POT

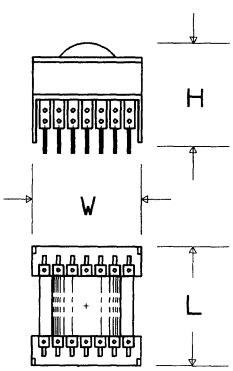


FERRITE HIGH-FREQUENCY, HIGH-PERFORMANCE SWITCHING POWER TRANSFORMERS

Size Code	Rating (watts) (a) 20 Khz	50 Khz	100 Khz
0340	70	110	170
0390	150	240	380
0440	300	450	700
0490	410	650	1000

Size Code	Dimensions (in.) L	W	H	Pins Available
0340	1.66	1.56	1.35	14
0390	1.87	1.76	1.46	16
0440	2.07	1.96	1.57	18
0490	2.26	2.15	1.67	20

(a) Power rating based on square-wave drive.
(b) To order, specify: 1) Input voltage and range, waveform, and frequency, 2) Output voltages and currents, 3) Size code, 4) Circuit topology.



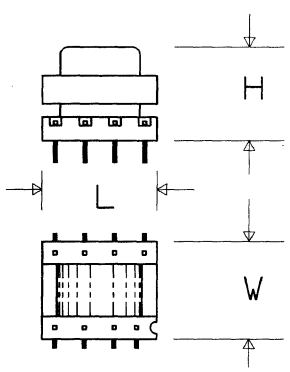
Please see our other page in Section 1800 A•1209

FERRITE E-CORE TRANSFORMERS FOR LOW-COST, HIGH-FREQUENCY DRIVING AND SWITCHING

Size Code	Rating (watts) (a) 20 Khz	50 Khz	100Khz	Inductor Energy (b) (milliwatt-sec.)
0187	5	8	13	.249
0250	13	20	30	.535
0375	60	100	150	3.12
0500	140	210	340	5.41
0625	200	310	500	9.90
0750	410	650	1000	23.30

Size Code	Dimensions (in.) L	W	H	Pins Available
0187	.722	.652	.627	8
0250	1.01	.764	.802	10
0375	1.38	1.13	1.01	12
0500	1.63	1.32	1.14	12
0625	1.88	1.50	1.27	12
0750	2.25	1.88	1.49	12

(a) Power rating for square-wave drive.
(b) Calculated at 20% roll-off of inductance with current at 25°C. (mW - S = 1/2 x mHy x Amps²).
(c) To order, specify: 1) Input voltage and range, frequency, and waveform, 2) Output voltages and currents, 3) Size code, 4) For inductor, inductance, current, and frequency.

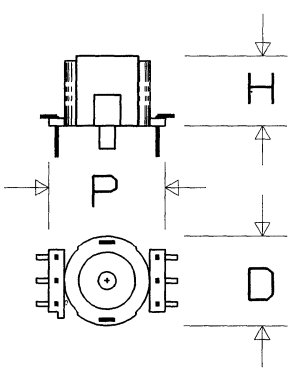


FERRITE HIGHLY-SHIELDED POT-CORE TRANSFORMERS AND INDUCTORS

Size Code	Rating (watts) (a) 20 Khz	50 Khz	100Khz	Inductor Energy (b) (milliwatt-sec.)
1408	1.5	2.4	3.9	.068
1811	5.0	8.0	13.0	.23
2213	15.0	22.0	32.0	.62
2616	19.0	30.0	48.0	1.26
3019	33.0	53.0	80.0	2.75
3622	110.0	190.0	280.0	5.33
4229	280.0	430.0	650.0	14.56

Size Code	Dimensions (in.) D	H	P	Pins Available
1408	.55	.380	.638	6
1811	.71	.460	.848	6
2213	.87	.585	.99	6
2626	1.04	.655	1.13	6
3019	1.21	.770	1.42	6
3622	1.43	.915	1.60	12
4229	1.70	1.230	no pins	0

(a) Power rating based on square-wave drive.
(b) Calculated at 20% reduction in inductance with current at 25°C.
(c) To order, specify: 1) Input voltage and range, frequency, and waveform, 2) Output voltages and currents, 3) Size code, 4) For inductor, inductance, current, and frequency.



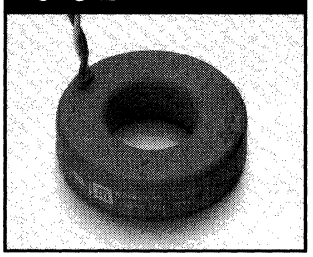
MAGNELAB CORPORATION
DESIGN & MANUFACTURE OF TRANSFORMER PRODUCTS

7315 Red Deer Drive
Boulder, Colorado 80301
(303) 442-6700 FAX: (303) 447-1588

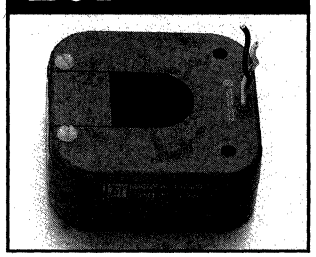
MAGNELAB

CURRENT TRANSFORMERS

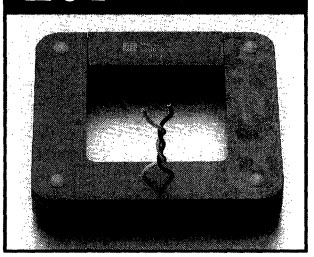
UCT



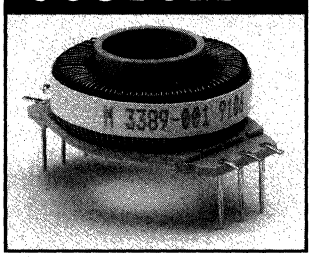
ECT



LCT



CUSTOM



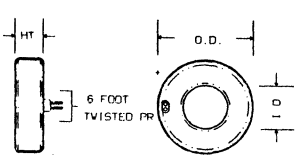
UL RECOGNIZED TOROIDAL CURRENT TRANSFORMERS

MAGNELAB'S UL Recognized C.T.'s are designed to measure service entrance and circuit currents in residential, commercial, and industrial buildings.

- Precision internal burden resistor
- Six-foot twisted pair cable
- Fully encapsulated in noryl housing
- Rugged design for extreme environments

Part Number	Rated Input	Rated Output	Accuracy (1)
2697-001	30 A	.333 V	2%
2749-001	60 A	.333 V	2%
2685-001	100 A	.333 V	2%
2750-001	200 A	.333 V	2%
2686-001	400 A	.333 V	2%
2697-003	30 A	.333 V	1%
2749-003	60 A	.333 V	1%
2685-003	100 A	.333 V	1%
2750-003	200 A	.333 V	1%
2686-003	400 A	.333 V	1%

Part Number	Angle (2)	Size Code	100 Pc. Price (3)
2697-001	60′	A	$16.79
2749-001	60′	B	17.00
2685-001	83′	C	17.76
2750-001	52′	D	18.59
2686-001	45′	E	20.85
2697-003	30′	A	$18.81
2749-003	18′	B	23.00
2685-003	47′	C	24.80
2750-003	14′	D	26.69
2686-003	39′	E	29.39



SIZE CODE	SIZE	I.D.	O.D.	HT.
	A	.30	1.70	.75
	B	.50	1.90	.75
	C	.75	2.10	.75
	D	1.00	2.40	.80
	E	1.25	2.70	.80

NOTE: ALL DIMENSIONS ARE IN INCHES.

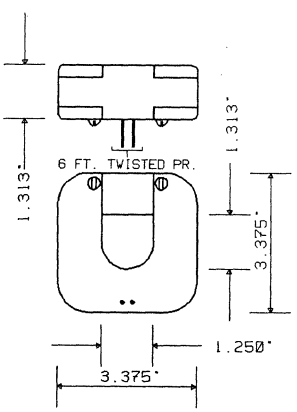
ETL LISTED OPENING CURRENT TRANSFORMERS

MAGNELAB'S opening, ETL Recognized C.T.'s are designed to monitor service entrance currents in commercial buildings and other locations where the service may not easily be interrupted while installing a C.T.

- Precision internal burden resistor
- Six-foot twisted pair cable
- Fully encapsulated in Noryl housing
- No exposed metal parts on assembled unit
- Interleaved core mating to maintain accuracy

Part Number	Rated Input	Rated Output	Accuracy (1)
3244-001	200 A	.333 V	2%
2789-001	400 A	.333 V	2%

Part Number	Angle (2)	100 Pc. Price (3)
3244-001	15′	$40.79
2789-001	17′	40.79

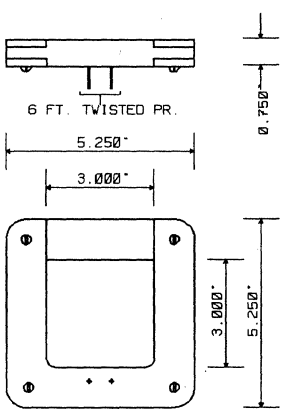


LARGE FRAME OPENING CURRENT TRANSFORMERS

The LCT series C.T.'s are designed to measure currents in large conductors or where multiple conductor currents must be simultaneously monitored. Construction is similar to the ECT Series.

Part Number	Rated Input	Rated Output	Accuracy (1)
3082-001	400 A	.333 V	2%
3100-001	600 A	.333 V	2%
3119-001	800 A	.333 V	2%

Part Number	Angle (2)	100 Pc. Price (3)
3082-001	24′	$36.50
3100-001	24′	36.50
3119-001	24′	36.50



Notes:

(1) Output tracks input within this limit from 10% to 100% of rated current.

(2) Typical angle measured between input and output at 50% of rated current.

(3) FOB Boulder, CO. Subject to change without notice.

(4) C.T.'s are available without internal burden resistors. Call MAGNELAB for part numbers and prices.

CUSTOM CURRENT TRANSFORMERS

MAGNELAB builds a variety of custom C.T.'s for applications in the energy monitoring field. MAGNELAB has also designed a variety of C.T.'s for electronic applications such as switch-mode power supply circuits, many of which are printed circuit mounted.

Please see our other page in Section 1800 A•1209

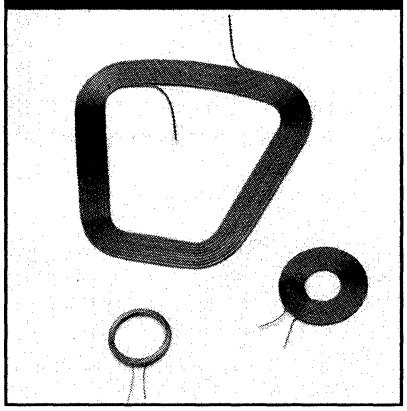
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DESIGN & MANUFACTURE OF TRANSFORMER PRODUCTS

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MAGNELAB

COIL PRODUCTS

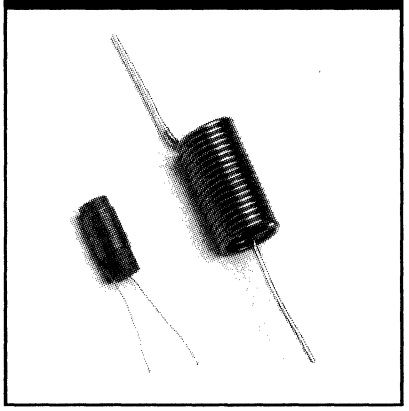
FREE-FORM COILS



Custom free-form bonded wire coils are a major activity at MAGNELAB. Precision fixturing is the key to this capability. Complex shapes are easily tooled with our complete array of machine tools including a computer-programmed milling machine. Applications include:

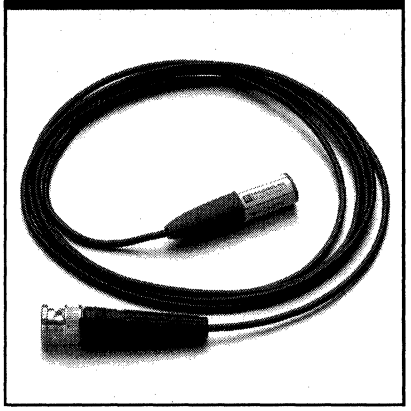
- Loop antennas
- Flat magnetic drive coils
- Planar inductors
- Bobbinless transformer windings
- Induction coils

SOLENOIDS



MAGNELAB is experienced in the tooling and volume manufacture of miniature solenoid coils for inductors, rod antennas, and flux sensors. Coils as small as .040 in. dia. using 50 AWG wire are manufactured at MAGNELAB.

AC MAGNETIC FLUX PROBE



MODEL 1846-001

MAGNELAB'S AC flux probe is a highly sensitive, calibrated coil assembly which measures magnetic flux. Unwanted stray flux from transformers, motors, generators, relays, conductors, etc., is easily detected and mapped:

- 100mV per gauss sensitivity at 60 hz.
- Accuracy ± 5%.
- Electrostatically shielded.
- Senses field amplitude and direction.
- Convenient coaxial cable and BNC connector.
- Observe signal on oscilloscope or DVM.
- Identify flux sources, paths, fields.
- Sense conductor currents.

Price: $135.00 for single quantity purchase. Contact MAGNELAB for quantity purchases. FOB Boulder, CO. Subject to change without notice.

Please see our other page in Section 1800 A•1209

MAGNELAB CORPORATION
DESIGN & MANUFACTURE OF TRANSFORMER PRODUCTS

7315 Red Deer Drive
Boulder, Colorado 80301
(303) 442-6700 FAX: (303) 447-1588

eem MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

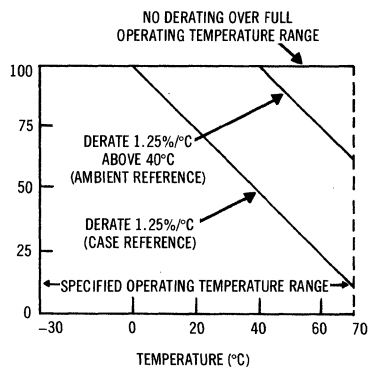


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

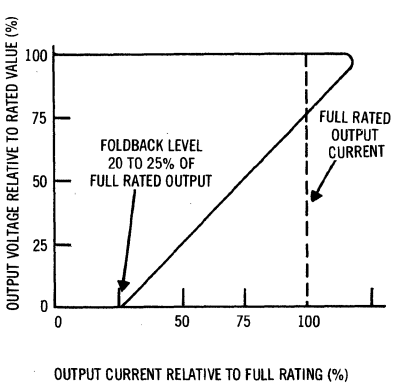


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

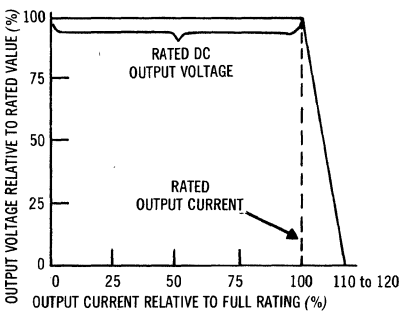


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

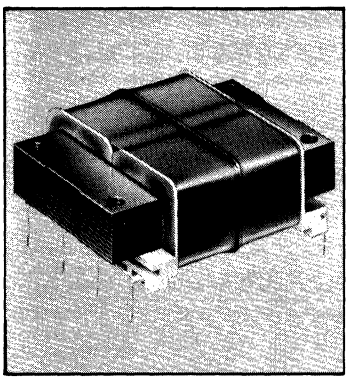
Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

MagneTek
1124 E. Franklin St., Huntington, IN 46750
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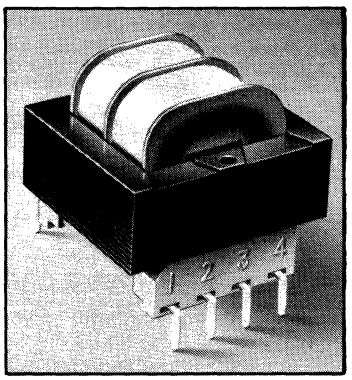
TRANSFORMERS

TRIAD POWER TRANSFORMERS



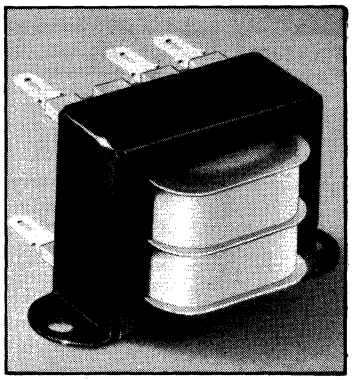
Flat Pack

Low profile design for low clearance PC board, solid state power, control and instrumentation applications. 2000 VRMS Hi-pot test. Dual 115/230V primary with dual secondary outputs of 5-230V; 2.5, 6 and 12VA.



Split Pack

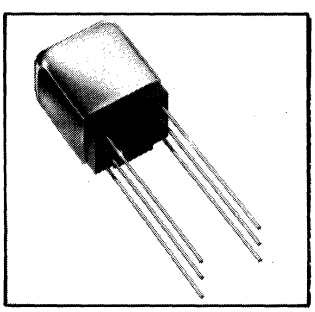
High isolation at low cost. PC board mounting. Split bobbin nonconcentric winding eliminates costly electrostatic shielding. 2500 VRMS Hi-pot test. 115V or 115/230V primary with dual secondaries of 5-120V. PC terminal pin spacing. Rating from 1.1-36VA.



Quick Pack

Offers significant reduction in size and weight for given VA rating. Split bobbin nonconcentric winding eliminates costly electrostatic shielding. 2500 VRMS Hi-pot test. 115V or 115/230V primary with outputs of 10-120V. Ratings from 2.4-100VA.

TRIAD HIGH RELIABILITY AUDIO TRANSFORMERS

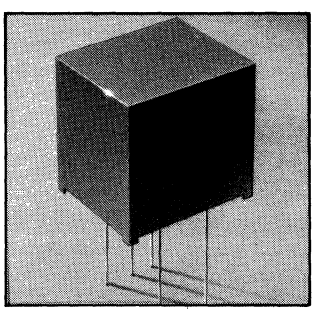


Red Spec

Miniaturized design (.310x.410x.465"h) that meets MIL-T-27D. Epoxy molded case, gold plated leads, 1000 VRMS Hi-pot test. Exceptional operation from 300Hz to 150 KHz.

Blue Spec

Low cost equivalent of Red Spec with larger footprint base of .505x.575x.575"h. Pin-for-pin compatible.



MAGNETEK CUSTOM MAGNETICS

- 50/60 Hz Linear .05 VA to 4000 VA
- Ferro-Resonant
- 3 Phase
- Audio
- Switch Mode – High Frequency
- Inverter/Converter

If a standard off-the-shelf Triad transformer doesn't meet your needs, we'll customize one to your specs. We design and manufacture hundreds of thousands of custom magnetics, from switch mode to three phase, surface mount to high voltage, in any class, temperature or agency classification. Using CAD, we produce prototypes quickly, even on one-day turnaround if required. And we deliver finished product quickly in any quantity.

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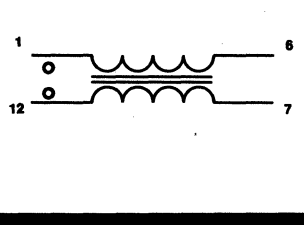
TRANSFORMERS

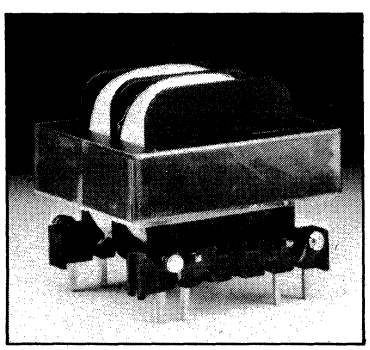
COMMON MODE EMI SUPPRESSION INDUCTORS

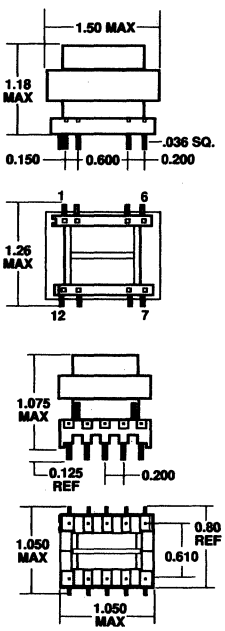
Used in all types of power supplies to eliminate noise common to all lines and reduce noise conducted back into power lines. Normally placed close to the input power. Also provide effective differential mode filtering and can attenuate noise not common to all lines. Available off-the-shelf.

E-CORE INDUCTORS

- Compact construction
- 2500 HIPot
- VDE, IEC, UL, CSA compatible
- Constructed with UL rated 130 C materials



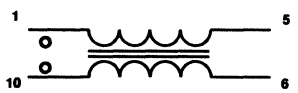




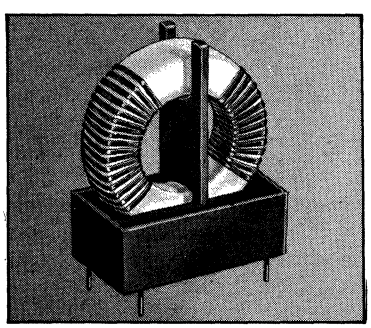
Part Number	Inductance	Amps R.M.S.	D.C. Resistance	Leakage
CME375-1	4.40mHYS	5.50	.049 OHMS	45.0 uHYS
CME375-2	6.90mHYS	4.40	.077 OHMS	70.0 uHYS
CME375-3	10.9mHYS	3.50	.122 OHMS	125.0 uHYS
CME375-4	17.8mHYS	2.70	.196 OHMS	180.0 uHYS
CME375-5	28.6mHYS	2.20	.316 OHMS	300.0 uHYS
CME375-6	43.6mHYS	1.75	.489 OHMS	440.0 uHYS
CME375-7	70.3mHYS	1.38	.785 OHMS	720.0 uHYS
CME375-8	111.6mHYS	1.10	1.240 OHMS	1.10 mHYS
CME375-9	176.1mHYS	.087	1.980 OHMS	1.80 mHYS

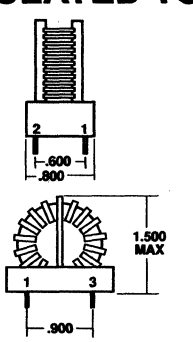
Part Number	Inductance	Amps R.M.S.	D.C. Resistance	Leakage IND
CME2425-1	2.10mHYS	2.50	.050 OHMS	9.00 uHYS
CME2425-2	3.50mHYS	2.00	.080 OHMS	14.0 uHYS
CME2425-3	5.50mHYS	1.60	.127 OHMS	25.0 uHYS
CME2425-4	9.00mHYS	1.28	.202 OHMS	36.0 uHYS
CME2425-5	13.9mHYS	1.00	.319 OHMS	60.0 uHYS
CME2425-6	22.4mHYS	0.80	.500 OHMS	90.0 uHYS
CME2425-7	36.0mHYS	0.63	.820 OHMS	144.0 uHYS
CME2425-8	54.0mHYS	0.50	1.26 OHMS	240.0 uHYS
CME2425-9	86.9mHYS	0.40	2.02 OHMS	360.0 uHYS

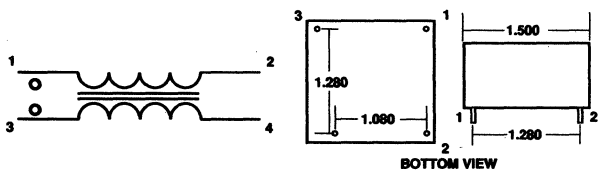
Notes • Inductances are min. measured at 10 Gauss
• Current ratings for approx. 40 C temp. rise
• DC resistance @ 20 C ± 10%



ENCAPSULATED TOROIDAL INDUCTORS







- Mounted on rugged epoxy base
- Designed for automatic insertion on PC boards
- Provide stable inductance and protection against current spikes
- Constructed with UL rated 130 C materials

Part Number	Inductance	Amps R.M.S.	D.C. Resistance	Leakage
CMT908-V1/H1	2.00mHYS	7.50	.020 OHMS	25.0 uHYS
CMT908-V2/H2	4.00mHYS	5.20	.040 OHMS	45.0 uHYS
CMT908-V3/H3	8.00mHYS	3.20	.120 OHMS	90.0 uHYS
CMT908-V4/H4	16.0mHYS	2.60	.160 OHMS	180.0 uHYS

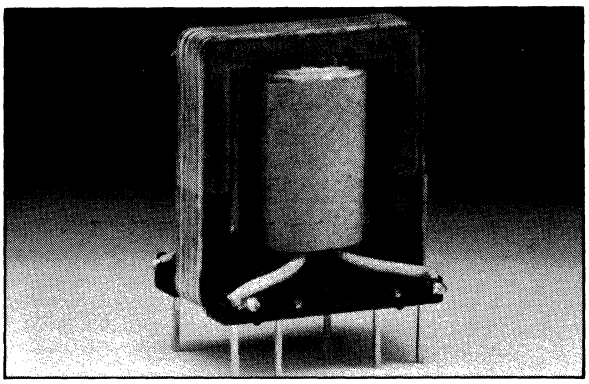
Notes • Inductances are min. measured at 10 Gauss
• Current ratings for approx. 40 C temp. rise
• DC resistance @ 20 C ± 10%

MagneTek
1124 E. Franklin St., Huntington, IN. 46750
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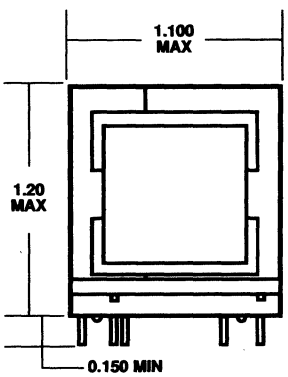
TRANSFORMERS

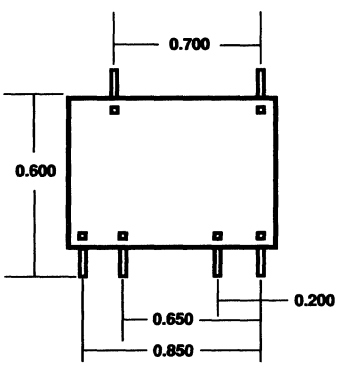
GATE DRIVE TRANSFORMERS

Easily standardized and used universally in all switching topologies, MagneTek gate drive transformers provide an isolation barrier from the control circuitry to the line-connected switches. Turn ratios of 1:1 and 1:1.5 optimize coupling and enhance performance. Available off-the shelf.



- 3750V Hi-pot drive to gate winding
- Interleaved windings for lowest practical leakage inductance
- Available with single or dual secondaries
- Operating frequency to 200 KHz
- Constructed with UL rated 130 C materials



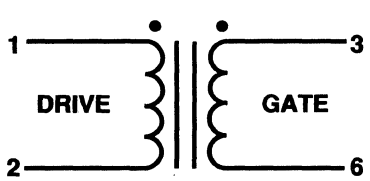


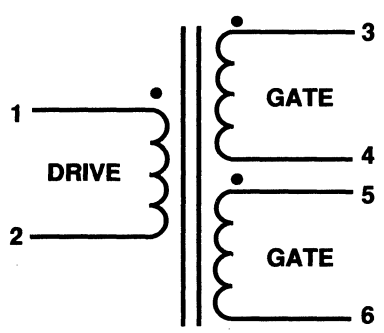
Part No.	MAX DCR 1-2	MAX DCR Gate	MIN ET Product	MAX Leakage	MIN Inductance	Turns Ratio
GDE25-1	.350 OHMS	.350 OHMS	540 VuS	2.5 uHYS	.680 mHYS	1:1
GDE25-2	.350 OHMS	.650 OHMS	540 VuS	2.5 uHYS	.680 mHYS	1:1:1
GDE25-3	.875 OHMS	.350 OHMS	840 VuS	3.5 uHYS	1.50 mHYS	1.5:1
GDE25-4	.875 OHMS	.650 OHMS	840 VuS	3.5 uHYS	1.50 mHYS	1.5:1:1
GDE25-5	.350 OHMS	.875 OHMS	540 VuS	3.5 uHYS	.680 mHYS	1:1.5
GDE25-6	.350 OHMS	1.75 OHMS	540 VuS	3.5 uHYS	.680 mHYS	1:1.5:1.5

NOTES: • Derate ET product by 32% for 50 KHz,40% for 100 KHz and 50% for unidirectional operation.
• Operation @ rated current per winding renders approx. 40 C temperature rise.

RATED CURRENT PER WDG

DCR OHMS	AMPS RMS
0.350	0.500
0.650	0.200
0.875	0.150
1.750	0.075



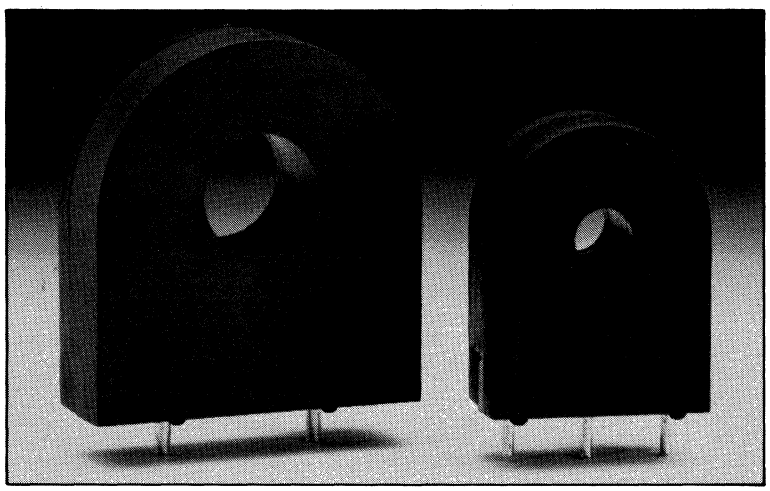


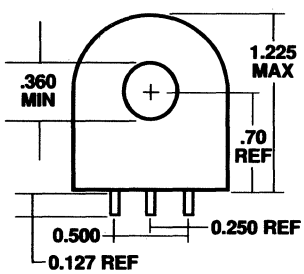
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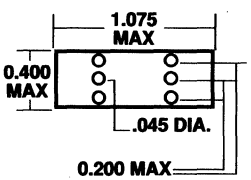
TRANSFORMERS

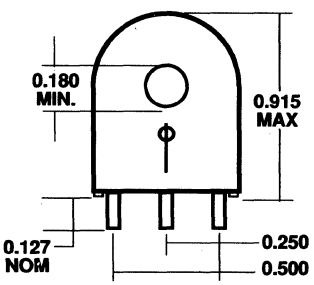
CURRENT SENSE INDUCTORS

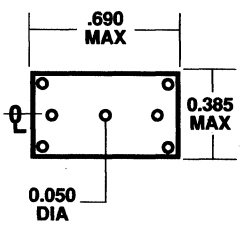
MagneTek Current Sense Inductors detect the current in a conductor and protect against high voltages, arcing and damage to the device. Designed for switching power supply applications, they are constructed with UL rated 130° C materials and feature 2500 V Hi-pot and a frequency range of 20-200 KHz. CST-206 models are available with a center pin for center tap option. Available off-the-shelf.











Part No.	Turns	REF 20 KHz ET Product	MIN Inductance	DCR OHMS	PRI AMPS
CST206-1	100	2.0 mVSEC	14.0 mHY	.400 MAX	110.0 RMS
CST206-2	200	4.0 mVSEC	56.0 mHYS	1.35 MAX	80.0 RMS
CST206-3	300	6.0 mVSEC	130 mHYS	12.0 MAX	70.0 RMS

Part No.	Turns	REF 20 KHz ET Product	MIN Inductance	DCR OHMS	PRI AMPS
CST306-1A	50	500 uVSEC	3.5 mHYS	.330 MAX	25.0 RMS
CST306-1T	50CT	500 uVSEC	3.5 mHYS	.330 MAX	25.0 RMS
CST306-2A	100	1.0 mVSEC	14.0 mHYS	1.350 MAX	25.0 RMS
CST306-2T	100CT	1.0 mVSEC	14.0 mHYS	1.350 MAX	25.0 RMS
CST306-3A	200	2.0 mVSEC	55.0 mHYS	2.750 MAX	35.0 RMS
CST306-3T	200CT	2.0 mVSEC	55.0 mHYS	2.750 MAX	35.0 RMS

NOTES:
- Derate ET product by 68% for 50 KHz, 52% for 100 KHz and 50% for unidirectional operation.
- Rated primary current renders approx. 40° C rise.
- CST-206 models have max. recommended terminating resistance of 1 ohm per turn.

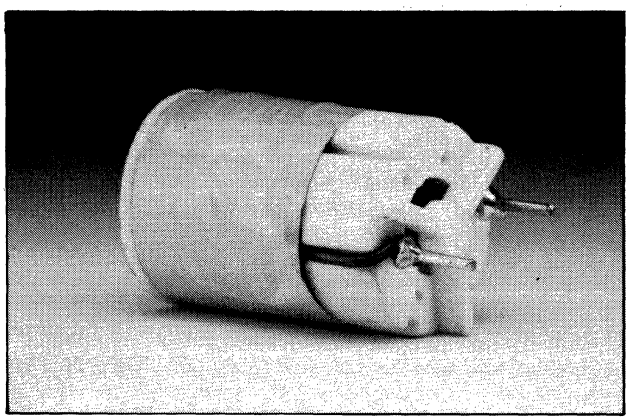
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TRANSFORMERS

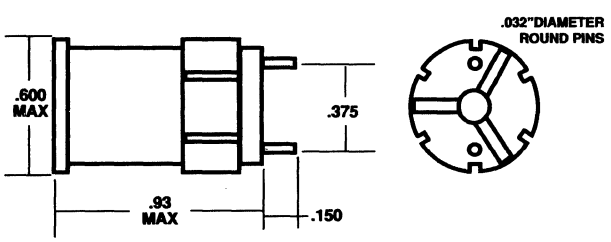
OUTPUT FILTER INDUCTORS

Primary function is energy storage. By conditioning the output signal, they smooth out the current waveform to provide a more stable and continuous current. While typically comprised of a single winding, these devices can also have several outputs fed through different windings on the same core. Both styles are available off-the-shelf.

ROD CORE FILTER INDUCTORS

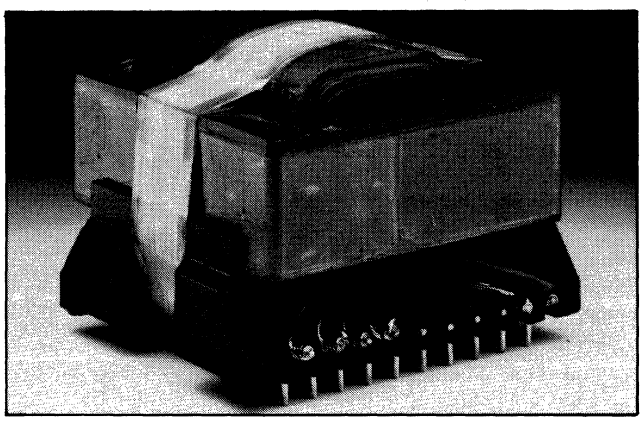


NOTES: • DC resistance ± 15%
• Inductance ± 10%
• DC current at 400 CM/Amp

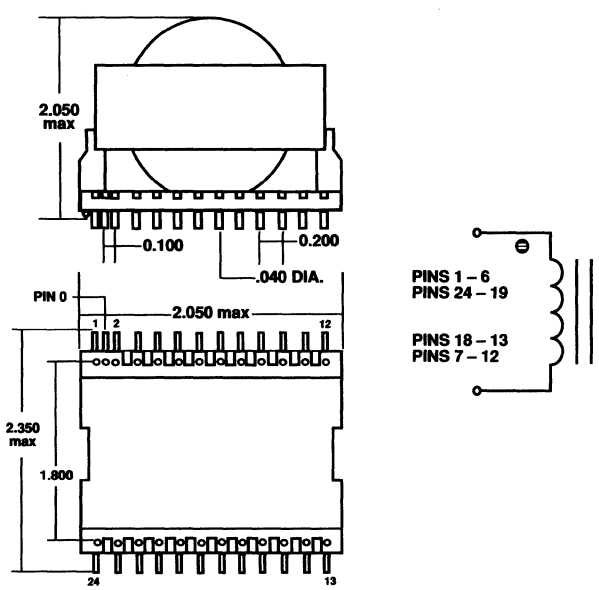


PART NO.	INDUCTANCE	DC. CURRENT	D.C. RESISTANCE
RC – 1	5.6 MHY	.250 AMPS	6.10 OHMS
RC – 2	3.9 MHY	.320 AMPS	3.90 OHMS
RC – 3	2.5 MHY	.400 AMPS	2.45 OHMS
RC – 4	1.5 MHY	.500 AMPS	1.53 OHMS
RC – 5	960 uHY	.625 AMPS	1.00 OHMS
RC – 6	560 uHY	.800 AMPS	.600 OHMS
RC – 7	450 uHY	1.00 AMPS	.420 OHMS
RC – 8	250 uHY	1.25 AMPS	.210 OHMS
RC – 9	200 uHY	1.60 AMPS	.200 OHMS
RC – 10	100 uHY	2.00 AMPS	.077 OHMS
RC – 11	75 uHY	2.50 AMPS	.070 OHMS

HIGH CURRENT DC FILTER INDUCTORS



NOTES: • Rated current 10 amps per pin max.
• Rated current renders approx. 40° C temp. rise.



PART NO.	IND. @ no DC	DC AMPS	DC RESISTANCE	IND @ DC BIAS
FIE220 – 1	11.7 uHYS	120.0	444.0 uOHMS	6.0 uHYS
FIE220 – 2	46.8 uHYS	60.0	1.776 mOHMS	24.0 uHYS

WHEN QUALITY COUNTS . . .

MAGNETICO

THE BEST IN MILITARY MAGNETICS

MIL-STD-981 - Electromagnetic Devices For Space Applications
WS6536/DOD2000/MIL-STD-2000 - Approved Certified Program for High Reliability Soldering
QUALIFICATION INSPECTION MIL-T-27 - Complete Environmental Testing

STANDARD MINIATURE 400 Hz POWER TRANSFORMERS

CONDENSED PERFORMANCE DATA-PRIMARY VOLTAGE 115 VRMS.
All Units Designed to meet MIL-T-27E.
IMMEDIATE DELIVERY FOR PROTOTYPE QUANTITIES.

Catalog Number	VA Rating	Secondary Voltage (RMS)	O.D. ± 1/32	Height ± 1/32	Nominal Weight	Nom. Reg.	Nom.* Temp. Rise
9600	2	6-300 V	1"	1 19/32"	1 oz/ 30 gm	18%	10°C
9601	4	6-300 V	1"	1 1/16"	1.2 oz/ 35 gm	15%	12°C
9602	6	6-300 V	1"	7/8"	1.6 oz/ 45 gm	10%	18°C
9603	9	6-300 V	1"	1 1/16"	2.1 oz/ 60 gm	8%	20°C
9604	30	6-300 V	1 3/8"	1 1/2"	5.3 oz/150 gm	7%	23°C
10648	75	10-300 V	2"	1 5/16"	10 oz	±3%	30°C
10649	150	10-300 V	2 1/4"	1 9/16"	18 oz	±3%	40°C

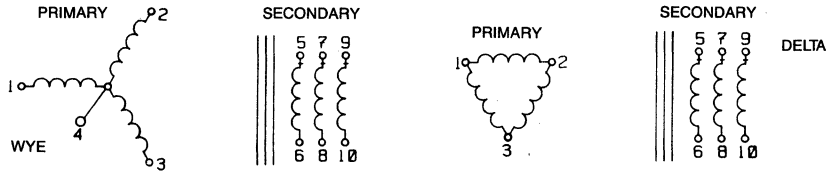
CALL FOR STANDARD LITERATURE

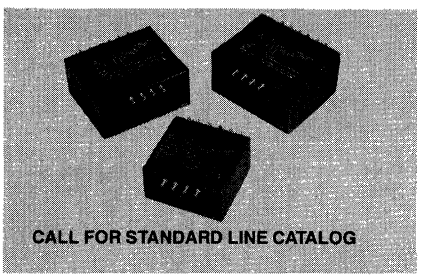


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CUSTOM DESIGNS AVAILABLE
UPON REQUEST

400 HZ 3φ POWER TRANSFORMERS... *Off The Shelf*

* Designed to meet the requirements of: **MIL-T-27/344/345/346/347/348/349** ①
* 120 standard designs from 90 VA thru 375 VA, including a wide variety of input and output voltage configurations offering maximum design flexibility.



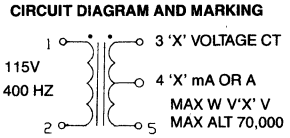


CALL FOR STANDARD LINE CATALOG

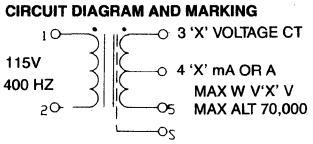
MINIATURE 400HZ POWER TRANSFORMERS... *Off The Shelf* ①

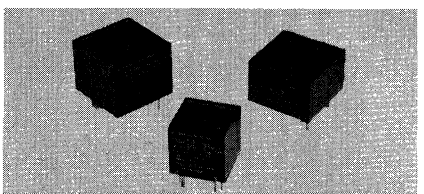
* Designed to meet the requirements of: **MIL-T-27/37** thru **MIL-T-27/47**
* 308 standard designs from 1.5 VA thru 25 VA**, including a wide variety of output voltages offering maximum design flexibility.

CIRCUIT DIAGRAM AND MARKING



CIRCUIT DIAGRAM AND MARKING

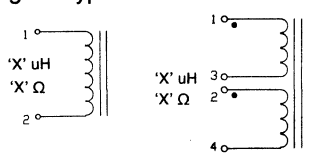


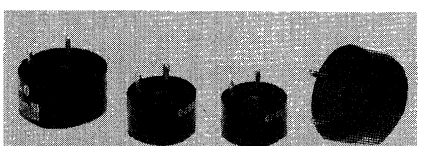


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SWITCHING REGULATOR INDUCTORS... *Off The Shelf* ①

* Designed to meet the requirements of: **MIL-T-27/287/288/289**
* 24 standard designs. Type TF5S04ZZ

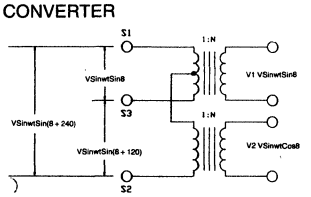




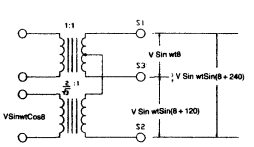
INDUCTANCE: 8uhy to 10MH, up to 13ADC
CALL FOR STANDARD LITERATURE

STANDARD SCOTT "T" TRANSFORMERS

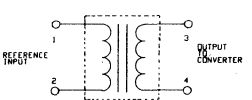
SYNCHRO TO RESOLVER CONVERTER

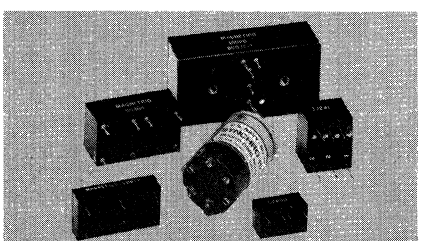


RESOLVER TO SYNCHRO CONVERTER



STANDARD REFERENCE TRANSFORMER





CALL FOR STANDARD LINE
CATALOG OR TO ORDER CUSTOM DESIGN

① "All units designed to meet the dimensional and performance requirements of MIL-T-XXX, however not all part numbers are listed on the Qualified Products List (QPL). The current status should be verified with the factory."

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ENGINEERING "HOT LINE" 516-654-1167 • FAX: 516-758-7408

WHEN QUALITY COUNTS . . .

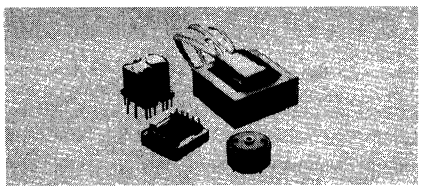
MAGNETICO *THE BEST IN MILITARY MAGNETICS*

MIL-STD-981 - Electromagnetic Devices For Space Applications
WS6536/DOD2000/MIL-STD-2000 - Approved Certified Program for High Reliability Soldering
QUALIFICATION INSPECTION MIL-T-27 - Complete Environmental Testing

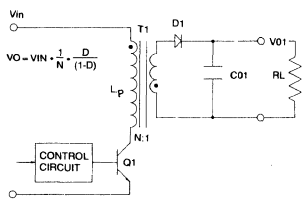
PWM AND RESONANT POWER CONVERSION TRANSFORMERS

TYPICAL TOPOLOGIES

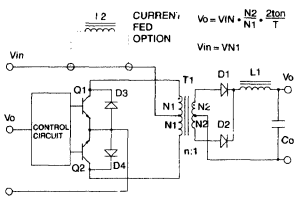
Actual circuit operation verified in switching topology.. Leakage inductance, efficiency, temperature rise, and SRF characterized. Single-ended 20 Khz-500 Khz to 250 watts. Bridge and push-pull 20 Khz-250Khz to 1 Kw. Low profile designs are available for sem modules. Proximity effect and skin depth accounted for. Our wide variety of cores in stock allows quick custom modification. Call, write, or fax for specific device bulletin.



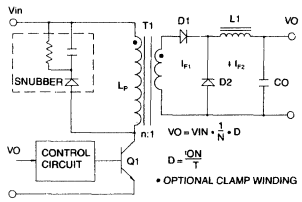
DISCONTINUOUS/CONTINUOUS MODE FLYBACK REGULATOR



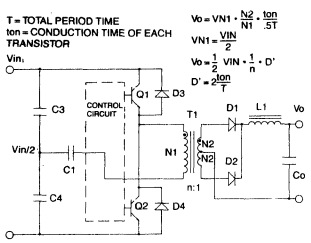
CENTER TAPPED PUSH-PULL SWITCHING REGULATOR



DOUBLE/SINGLE ENDED FORWARD CONVERTER



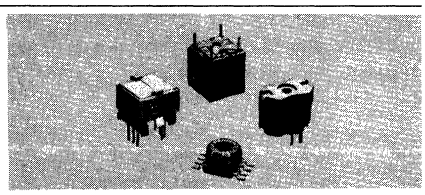
HALF-BRIDGE CIRCUIT



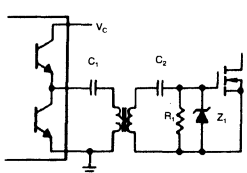
GATE DRIVE TRANSFORMERS

TYPICAL APPLICATION

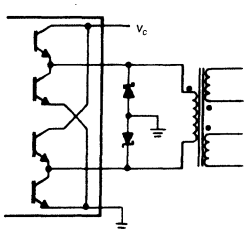
Meant to interface with PWM IC output or standard driver IC_S to supply Hi peak currents with low rise times to power fets. Low stray capacity - Hi SRF. Standard ratios 2:1, 1.5:1, 1:1. Models to 3750 DWV. Lowest leakage inductance on toroids. 20Khz to 1 Mhz. Wide variety to choose from. Call, write or fax for catalog.



SINGLE ENDED TRANSFORMER DRIVE

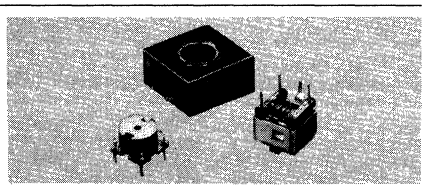


BALANCED TRANSFORMER DRIVE

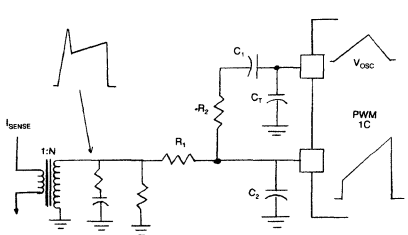


CURRENT SENSE TRANSFORMERS

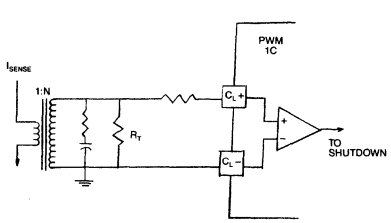
Typical applications shown. A wide variety of devices are offered in a variety of geometric shapes including toroids where the user can thread his current sense lead thru the center post. I_{IN} pk to 20 A in range from 10 Khz to 1 Mhz., Uni-polar or Bi-polar. High shock mounting available. Ratios from 1:20 to 1:200. Call, write, or fax for individual brochure.



CURRENT MODE CONTROL (slope added to inductor Waveform)



CURRENT LIMIT



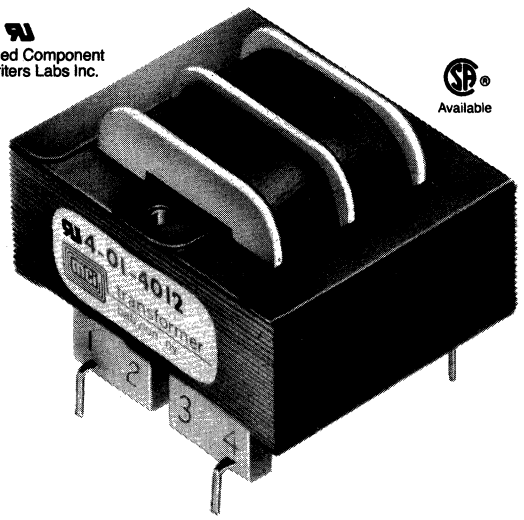
MAGNETICO INC. *182 MORRIS AVENUE • HOLTSVILLE, NY 11742 • TEL: 516-654-1166*
ENGINEERING "HOT LINE" 516-654-1167 • FAX: 516-758-7408

HORIZONTAL PC TRANSFORMERS

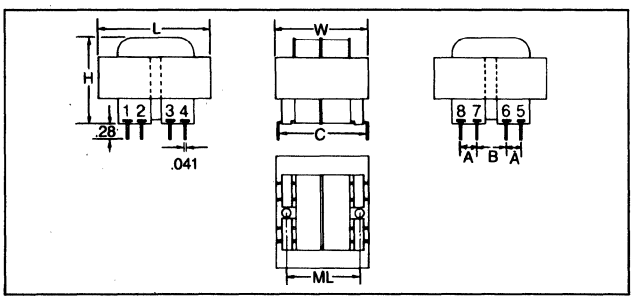
SERIES 4-01 & 4-02

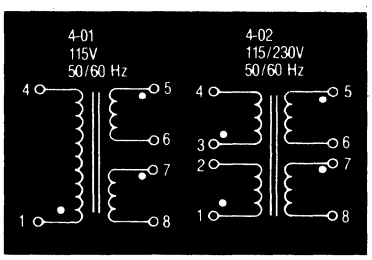
Recognized Component Underwriters Labs Inc.

Available



2,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with either single 115V, or dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Heavier transformers are provided with mounting holes for additional mounting security. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.





To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—single 115V primary or dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

DIMENSIONS

Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut	Lbs.
2	1.1	1-3/8	1-1/8	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1-3/8	1-1/8	1-3/16	—	.250	.250	1.200	None	0.25
4	6.0	1-5/8	1-5/16	1-5/16	1-1/16	.250	.350	1.280	4-40x1-3/8 Nylon	0.44
5	12.0	1-7/8	1-9/16	1-7/16	1-1/4	.300	.400	1.410	4-40x1-3/8 Nylon	0.70
6	20.0	2-1/4	1-7/8	1-7/16	1-1/2	.300	.400	1.600	4-40x1-3/8 Nylon	0.80
7	36.0	2-5/8	2-3/16	1-9/16	†	.400	.400	1.850	†	1.1

† 4 mounting holes 2 3/16 x 1 3/4 for #6 screw

CURRENT RATINGS (AMPS RMS)

Last 3 Digits of Part Number:			-010	-012	-016	-020	-024	-028	-036	-048	-056	-120
First 4 Digits: Single 115V Primary	Dual 115/230V Primary		SERIES CONNECTION SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V. C.T.	24V C.T.	28V C.T.	36V C.T.	48V C.T.	56V C.T.	120V C.T.
4-01-2___	4-02-2___		.110	.090	.070	.055	.045	.040	.030	.023	.020	.010
4-01-3___	4-02-3___		.250	.200	.150	.120	.100	.085	.065	.050	.045	.020
4-01-4___	4-02-4___		.600	.500	.400	.300	.250	.200	.170	.125	.110	.050
4-01-5___	4-02-5___		1.200	1.000	.800	.600	.500	.420	.350	.250	.220	.100
4-01-6___	4-02-6___		2.000	1.600	1.250	1.000	.800	.700	.550	.400	.350	.160
4-01-7___	4-02-7___		3.600	2.850	2.250	1.800	1.500	1.300	1.000	.750	.650	.300
			PARALLEL CONNECTION SECONDARY VOLTAGE 5V	6.3V	8V	10V	12V	14V	18V	24V	28V	60V
4-01-2___	4-02-2___		.220	.180	.140	.110	.090	.080	.060	.046	.040	.020
4-01-3___	4-02-3___		.500	.400	.300	.240	.200	.170	.130	.100	.090	.040
4-01-4___	4-02-4___		1.200	1.000	.800	.600	.500	.400	.340	.250	.220	.100
4-01-5___	4-02-5___		2.400	2.000	1.600	1.200	1.000	.840	.700	.500	.440	.200
4-01-6___	4-02-6___		4.000	3.200	2.500	2.000	1.600	1.400	1.100	.800	.700	.320
4-01-7___	4-02-7___		7.200	5.700	4.500	3.600	3.000	2.600	2.000	1.500	1.300	.600

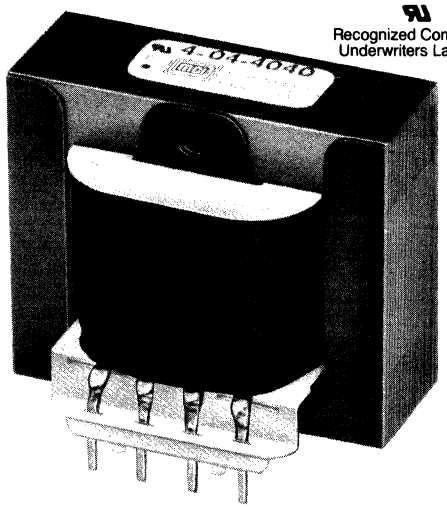
MCI TRANSFORMER CORPORATION

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SERIES 4-03 & 4-04

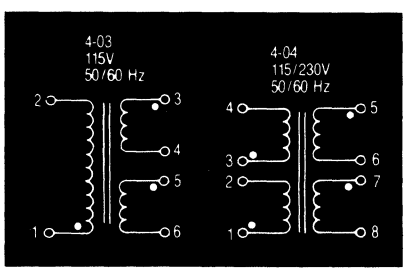
VERTICAL PC TRANSFORMERS

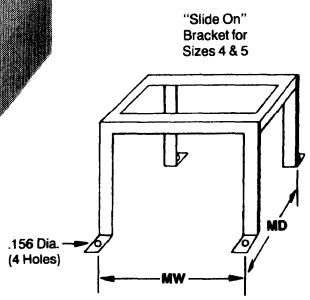


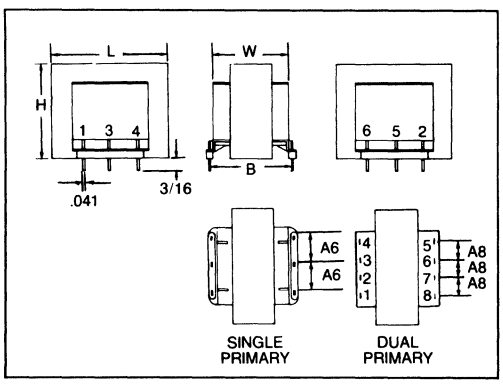
Recognized Component Underwriters Labs Inc.

Available

1,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.







DIMENSIONS									OPTIONAL BRACKET*		
Size	VA	L	W	H	A-6 (C Pin)	A-8 (8 Pin)	B	WT. (oz.)	No.	MW	MD
1	1.0	1	1-3/8	0.83	0.250	0.200	1.200	2.5	—	—	—
2	1.2	1-3/8	1-1/8	1-3/16	0.312	0.200	1.000	3.0	—	—	—
3	4.4	1-5/8	1-1/4	1-3/8	0.400	0.250	1.100	5.0	—	—	—
4	10.0	1-7/8	1-7/16	1-5/8	0.400	0.250	1.300	9.0	9-14 9901	1-41/64	1-1/8
5	24.0	1-5/8	2-1/4	1-3/8	0.400	0.250	2.100	12.0	9-14 9902	1-3/8	2

To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—single 115V primary or dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

CURRENT RATINGS (AMPS RMS)

Last 3 Digits of Part Number:			-010	-012	-016	-020	-024	-028	-034	-040	-056	-088	-120	-180	-230
First 4 Digits: Single 115V Primary	Dual 115/230V Primary		SERIES CONNECTION SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V C.T.	24V C.T.	28V C.T.	34V C.T.	40V C.T.	56V C.T.	88V C.T.	120V CT.	180V C.T.	230V C.T.
4-03-1___	4-04-1___		.090	.070	.055	.045	.035	.030	.025	.020	.015	.010	.008		
4-03-2___	4-04-2___		.120	.100	.075	.060	.050	.040	.035	.030	.020	.015	.010	.006	.005
4-03-3___	4-04-3___		.440	.350	.260	.220	.180	.160	.125	.110	.080	.050	.035	.024	.020
4-03-4___	4-04-4___		1.000	.800	.640	.500	.450	.360	.300	.250	.180	.120	.085	.055	.040
4-03-5___	4-04-5___		2.400	2.000	1.500	1.200	1.000	.800	.700	.600	.420	.270	.200	.130	.100
			PARALLEL CONNECTION SECONDARY VOLTAGE 5V	6.3V	8V	10V	12V	14V	17V	20V	28V	44V	60V	90V	115V
4-03-1___	4-04-1___		.180	.140	.110	.090	.070	.060	.050	.040	.030	.020	.016		
4-03-2___	4-04-2___		.240	.200	.150	.120	.100	.080	.070	.060	.040	.030	.020	.012	.010
4-03-3___	4-04-3___		.880	.700	.520	.440	.360	.320	.250	.220	.160	.100	.070	.048	.040
4-03-4___	4-04-4___		2.000	1.600	1.280	1.000	.900	.720	.600	.500	.360	.240	.170	.110	.080
4-03-5___	4-04-5___		4.800	4.000	3.000	2.400	2.000	1.600	1.400	1.200	.840	.540	.400	.260	.200

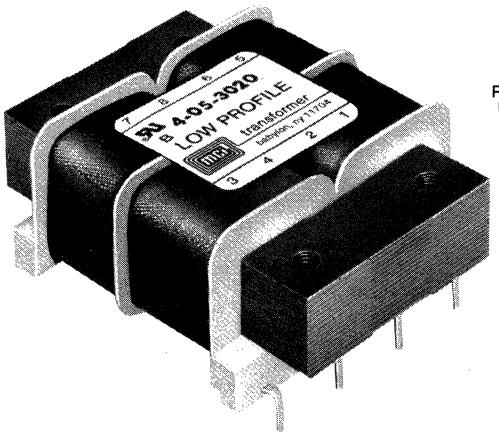
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LOW PROFILE PC TRANSFORMERS

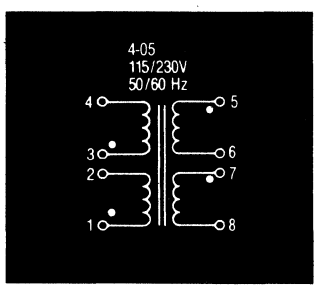
SERIES 4-05

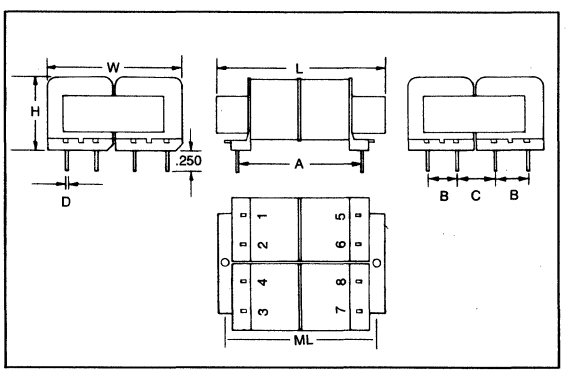


Recognized Component Underwriters Labs Inc.

Available

1,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.





DIMENSIONS										
Part No.:	VA	L	W	H	A	B	C	D	ML	OZ
4-05-1___	2.5	1-7/8	1-9/16	.650	1.600	.375	.375	.041 x .020		5
4-05-2___	6	1-7/8	1-9/16	.850	1.600	.375	.375	.041 x .020		7
4-05-3___	12	2-1/2	2	1.065	2.000	.500	.500	.041 x .020		11
4-05-4___	24	2-7/8	2-1/4	1-1/4	1.900	.600	.530	.040 SQ	2-13/32 (with 2 holes for #4 screws)	15
4-05-5___	48	3-1/8	2-1/2	1-3/8	2.180	.600	.660	.040 SQ	2-5/8 (with 2 holes for #6 screws)	21

CURRENT RATINGS (AMPS RMS)												
Last 3 Digits of Part Number:	-010	-012	-016	-020	-024	-030	-034	-040	-056	-088	-120	-230
First 4 Digits: Dual 115/230V Primary	SERIES CONNECTION SECONDARY VOLTAGE											
	10VCT	12.6VCT	16VCT	20VCT	24VCT	30VCT	34VCT	40VCT	56VCT	88VCT	120VCT	230VCT
4-05-1___	.250	.200	.156	.125	.104	.085	.073	.062	.044	.028	.020	.010
4-05-2___	.600	.450	.350	.300	.250	.200	.170	.150	.100	.065	.050	.025
4-05-3___	1.200	.900	.700	.600	.500	.400	.340	.300	.200	.130	.100	.050
4-05-4___	2.400	1.900	1.500	1.200	1.000	.800	.700	.600	.425	.275	.200	.100
4-05-5___	4.800	3.800	3.000	2.400	2.000	1.600	1.400	1.200	.850	.550	.400	.200
	PARALLEL CONNECTION SECONDARY VOLTAGE											
	5V	6.3V	8V	10V	12V	15V	17V	20V	28V	44V	60V	115V
4-05-1___	.500	.400	.312	.250	.208	.170	.146	.124	.088	.056	.040	.020
4-05-2___	1.200	.900	.700	.600	.500	.400	.340	.300	.200	.130	.100	.050
4-05-3___	2.400	1.800	1.400	1.200	1.000	.800	.680	.600	.400	.260	.200	.100
4-05-4___	4.800	3.800	3.000	2.400	2.000	1.600	1.400	1.200	.850	.550	.400	.200
4-05-5___	9.600	7.600	6.000	4.800	4.000	3.200	2.800	2.400	1.700	1.100	.800	.400

MCI TRANSFORMER CORPORATION

TOLL FREE: 1-800-MCI-TRAN

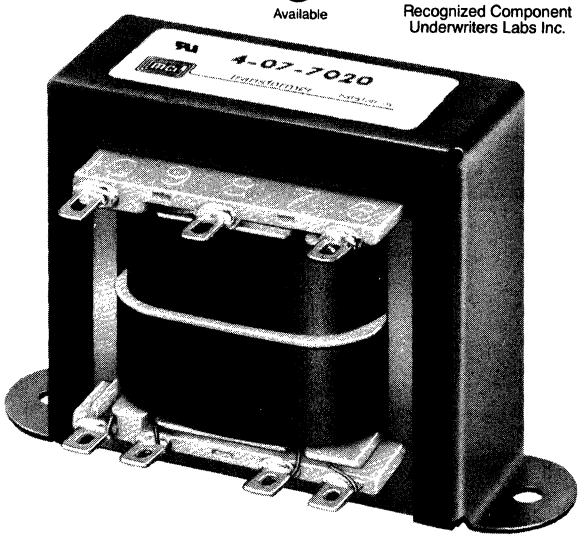
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SERIES 4-06 & 4-07

QUICK CONNECT POWER TRANSFORMERS

Available

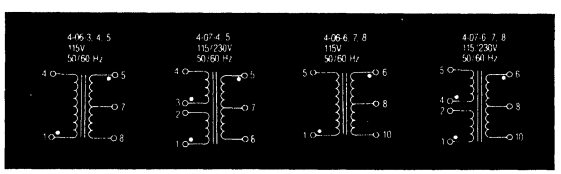
Recognized Component Underwriters Labs Inc.

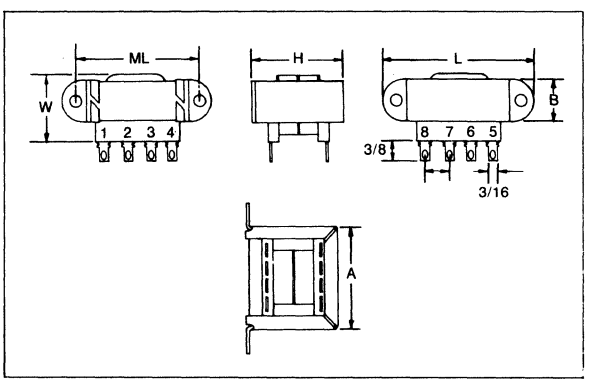


2,500 Volt RMS Hipot in a variety of practical sizes. Maximum operating temperature 130°C available with either single 115 or dual 115/230V primary (for all but 2.4 VA size).

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.





To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—single 115V primary or dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

DIMENSIONS								
Size	**VA**	**L**	**W**	**H**	**A**	**B**	**ML**	**Lbs.**
3	2.4	2-1/16	1-1/16	1-3/16	1-7/16	9/16	1-3/4	0.25
4	6	2-3/8	1-1/4	1-3/8	1-11/16	11/16	2	0.44
5	12	2-13/16	1-3/8	1-5/8	1-15/16	13/16	2-3/8	0.7
6	30	3-1/4	1-11/16	1-15/16	2-5/16	1-1/16	2-13/16	1.1
7	56	3-11/16	1-13/16	2-1/4	2-11/16	1-1/16	3-1/8	1.7
8	100	4-1/32	2-1/4	2-9/16	3-1/16	1-5/16	3-9/16	2.75

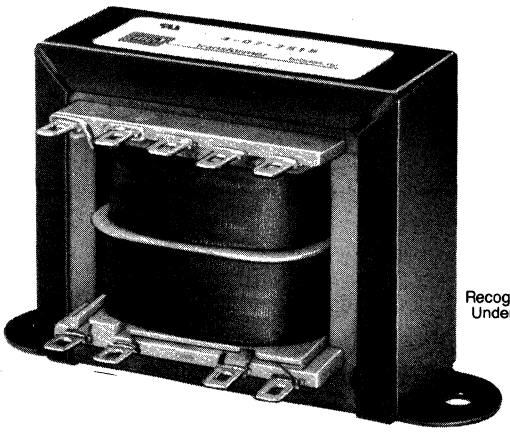
CURRENT RATINGS (AMPS RMS)											
Last 3 Digits of Part Number:		**-010**	**-012**	**-016**	**-020**	**-024**	**-028**	**-036**	**-048**	**-056**	**-120**
First 4 Digits: Single 115V Primary	**Dual 115/230V Primary**	**SECONDARY VOLTAGE**									
		10V C.T.	**12.6V C.T.**	**16V C.T.**	**20V C.T.**	**24V C.T.**	**28V C.T.**	**36V C.T.**	**48V C.T.**	**56V C.T.**	**120V C.T.**
4-06-3___		.250	.200	.150	.120	.100	.085	.065	.050	.045	.020
4-06-4___	4-07-4___	.600	.500	.400	.300	.250	.200	.170	.125	.110	.050
4-06-5___	4-07-5___	1.200	1.000	.800	.600	.500	.420	.350	.250	.220	.100
4-06-6___	4-07-6___	3.000	2.500	2.000	1.500	1.250	1.100	.850	.630	.540	.250
4-06-7___	4-07-7___	5.000	4.000	3.500	2.800	2.400	2.000	1.500	1.200	1.000	.500
4-06-8___	4-07-8___	10.000	8.000	6.250	5.000	4.000	3.600	2.800	2.000	1.800	.850

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QUICK CONNECT TRIPLE OUTPUT TRANSFORMERS

SERIES 4-06-X5 4-07-X5

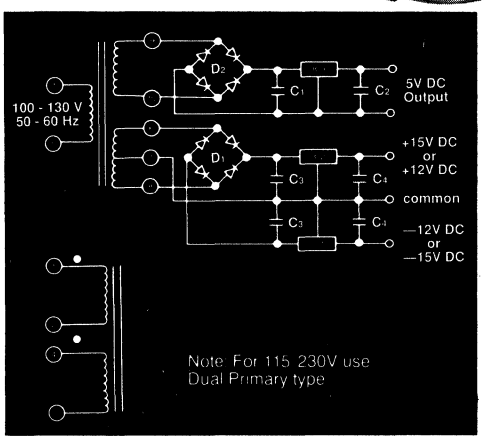


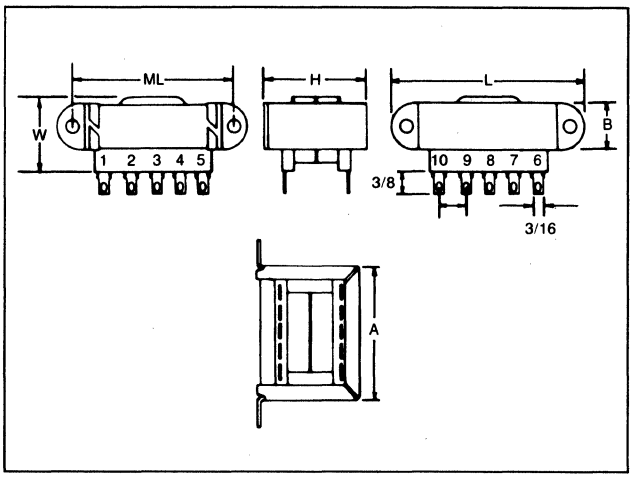
MCI has added these transformers to our product line for our customers with a need for one transformer to supply either 5VDC and ±12VDC or 5VDC and ±15VDC, in 3 power ratings of 35, 22.4, and 13.8 watts DC regulated.

There are 2 primary voltages available. Our 4-06 series which is for 100-130 volts, and our 4-07 series which is for either 100-130 volts or 200-260 volts.

The additional components necessary are supplied in the chart below.

Recognized Component
Underwriters Labs Inc.





To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—single 115V primary or dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

DIMENSIONS								
SIZE	REGULATED POWER WATTS	L	W	H	A	B	ML	lbs.
6	13.8	3-1/4	1-3/4	1-15/16	2-5/16	1-1/16	2-13/16	1.1
7	22.4	3-11/16	1-13/16	2-1/4	2-11/16	1-1/16	3-1/8	1.7
8	35.0	4-1/32	2-1/4	2-9/16	3-1/16	1-5/16	3-9/16	2.75

SPECIFICATION

MCI PART NO. PRIMARY 50/60 Hz		DC OUTPUT		SIZE	REGU-LATED POWER	SUGGESTED COMPONENTS C_2, C_4, See Note ①						
115V	115/230V	OUTPUT 1	OUTPUT 2		WATTS	D1 ④	C1	IC1 ③	D2 ④	C3	IC2 ③	IC3 ③
4-06-6512	4-07-6512	5V @ 1.75A	±12V @ 210MA	6	13.8	3N253	10 KMFD @ 20VDC	LM 323K-5	3N247	1.5 KMFD @ 50 VDC	LM 340K-12	LM 320K-12
4-06-6515	4-07-6515		±15V @ 175MA								LM 340K-15	LM 320K-15
4-06-7512	4-07-7512	5V @ 2.8A	±12V @ 350MA	7	22.4	MDA-400	15 KMFD @ 20VDC	LM 323K-5	3N247	2 KMFD @ 50 VDC	LM 340K-12	LM 320K-12
4-06-7515	4-07-7515		± 15V @ 280MA								LM 340K-15	LM 320K-15
4-06-8512	4-07-8512	5V @ 4A	± 12V @ 600MA	8	35.0	MDA-800	26 KMFD @ 20VDC	LM-338 ②	3N247	3.1 KMFD @ 50 VDC	LM 340K-12	LM 320K-12
4-06-8515	4-07-8515		± 15V @ 500MA								LM 340K-15	LM 320K-15

Note ①: Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic, 20V min.
Note ②: LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③: All IC's are National Semiconductor types.
Note ④: All diodes are Motorola types.

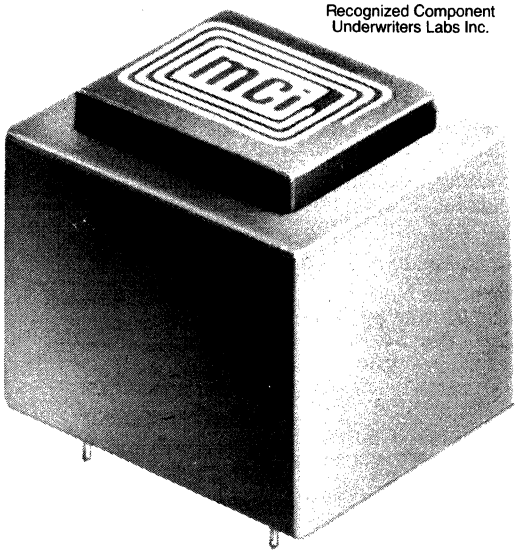
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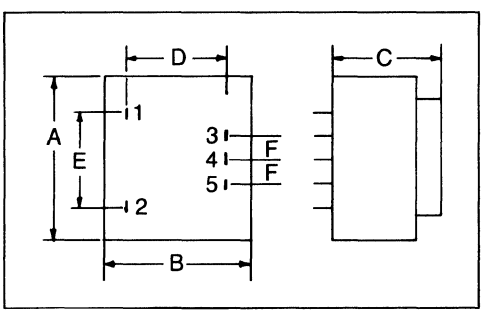
SERIES 4-11 & 4-12

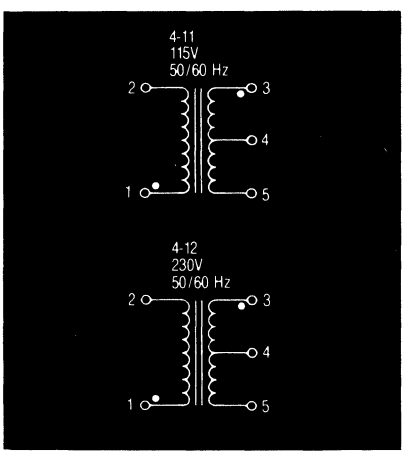
HORIZONTAL PC ENCAPSULATED TRANSFORMERS

Recognized Component
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Our encapsulated design offers high reliability because of its mechanical strength, electrical insulation and moisture resistance. The internal construction consists of a split bobbin which isolates the primary and secondary thereby eliminating any need for an electrostatic shield. The construction will pass requirements of U.L., C.S.A. and V.D.E.





To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—single 115V primary or 230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

DIMENSIONS

Size	VA	A	B	C	D	Primary E	Secondary F	Wt. (Lb.)
2	1.0	1.280	1.080	.890	.800	.800	.200	.16
3	1.2	1.280	1.080	.970	.800	.800	.200	.19
4	1.8	1.280	1.080	1.085	.800	.800	.200	.21
5	2.2	1.280	1.080	1.185	.800	.800	.200	.25
6	3.2	1.660	1.415	1.125	1.000	.800	.200	.33
7	4.5	1.780	1.500	1.300	1.000	1.000	.300	.44

CURRENT RATING (AMPS RMS)

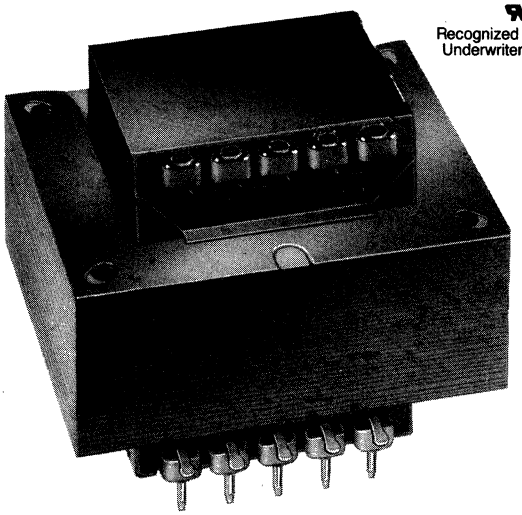
Last 3 Digits of Part Number:		-010	-012	-016	-020	-024	-028	-036	-048	-056	-120
First 4 Digits: Single 115V Primary	Single 230V Primary	SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V C.T.	24V C.T.	28V C.T.	36V C.T.	48V C.T.	56V C.T.	120V C.T.
4-11-2___	4-12-2___	.100	.080	.065	.050	.045	.035	.030	.020	.018	.008
4-11-3___	4-12-3___	.120	.095	.075	.060	.050	.045	.035	.025	.021	.010
4-11-4___	4-12-4___	.180	.145	.115	.090	.075	.065	.050	.038	.032	.015
4-11-5___	4-12-5___	.220	.175	.140	.110	.095	.080	.060	.045	.040	.018
4-11-6___	4-12-6___	.320	.255	.200	.160	.135	.115	.090	.067	.057	.027
4-11-7___	4-12-7___	.450	.360	.280	.225	.190	.160	.125	.095	.080	.038

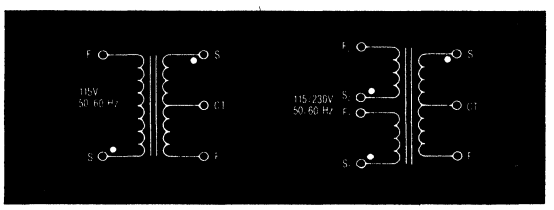
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VDE HORIZONTAL P.C. TRANSFORMERS

SERIES 4-41& 4-42

Recognized Component
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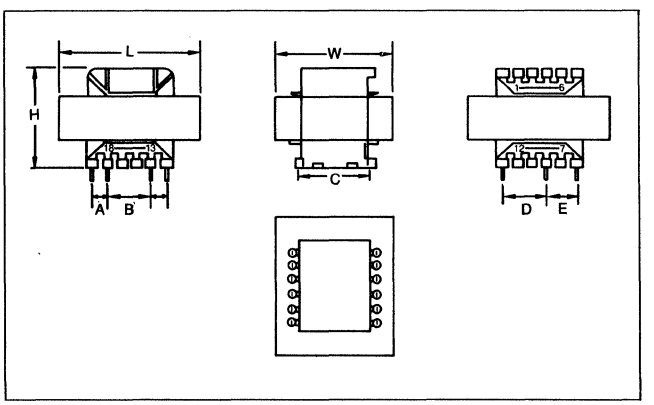


4,000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.



TERMINAL POSITIONS

	4-41 115V Primary		4-42 115/230V Primary				Secondary		
	S	F	S1	F1	S2	F2	S	C.T.	F
2	13	18	13	14	17	18	7	9	12
3	11	15	11	12	14	15	6	8	10
4	11	15	11	12	14	15	6	8	10
5	11	15	11	12	14	15	6	8	10

DIMENSIONS

SIZE	VA	L	W	H	A	B	C	D	E	Lbs.
2	10	1⅞	1 9/16	2½	.200	.600	1.000	.600	.400	.57
3	20	2¼	1⅞	1 13/16	.300	.600	1.200	.600	.600	.97
4	30	2¼	1⅞	2 1/16	.300	.600	1.200	.600	.600	1.20
5	45	2⅝	2 3/16	2 1/32	.300	.600	1.400	.600	.600	1.40

CURRENT RATING (AMPS RMS)

Last 3 Digits of Part Number:		-010	-012	-016	-020	-024	-028	-036	-048	-056	-120
First 4 Digits: of Part Number:		SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V C.T.	24V C.T.	28V C.T.	36V C.T.	48V C.T.	56V C.T.	120V C.T.
Single 115V Primary	Dual 115/230V Primary										
4-41-2___	4-42-2___	1.000	.800	.625	.500	.420	.360	.280	.210	.180	.085
4-41-3___	4-42-3___	2.000	1.600	1.250	1.000	.840	.720	.560	.420	.360	.170
4-41-4___	4-42-4___	3.000	2.400	1.875	1.500	1.250	1.075	.835	.625	.540	.250
4-41-5___	4-42-5___	4.500	3.600	2.815	2.250	1.875	1.610	1.250	.940	.805	.375

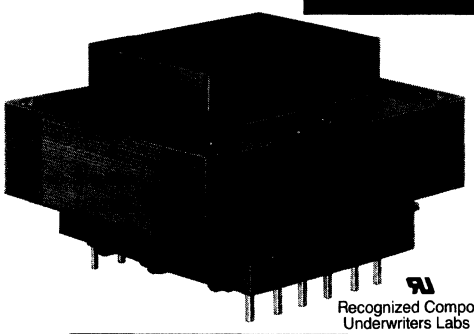
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SERIES 4-44

VDE P.C. MOUNT TRANSFORMERS



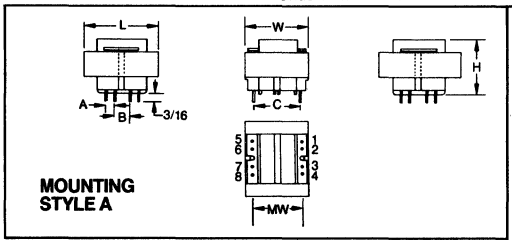
Recognized Component
Underwriters Labs Inc.

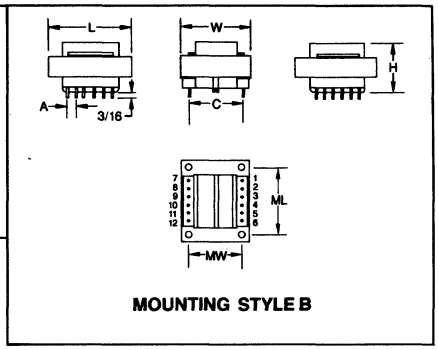
4,000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

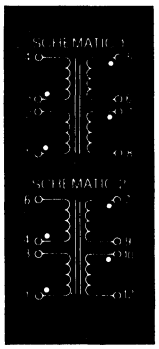
MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.







To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

DIMENSIONS

Transformer	VA	Schematic	Mounting Style	L	W	H	A	B	C	Pin Dimensions	MW	ML	Screw Size	Maximum Number Terminals	Lbs.
4-44-3___	2.5	1	A	1-5/8	1-5/16	1-1/8	.200	.250	1.000	.025 sq.	1-1/16		4	8	.25
4-44-4___	5.0	1	A	1-5/8	1-5/16	1-3/8	.200	.400	1.000	.025 sq.	1-1/16		4	8	.37
4-44-5___	10.0	1	A	1-7/8	1-9/16	1-3/8	.200	.400	1.128	.036 sq.	1-1/4		4	8	.53
4-44-6___	20.0	2	A	2-1/4	1-7/8	1-5/8	.400	.400	1.436	.036 sq.	1-1/2		4	12	.90
4-44-7___	30.0	2	B	2-5/8	2-3/16	1-9/16	.275		1.650	.045 sq.	1-3/4	2-3/16	6	12	1.15
4-44-8___	56.0	2	B	3	2-1/2	1-13/16	.300		1.866	.045 sq.	2	2-1/2	6	12	1.70

CURRENT RATING (AMPS RMS)

Last 3 Digits of Part No.	-010	-012	-016	-20	-024	-028	-036
	SERIES CONNECTION			SECONDARY VOLTAGE			
First 4 Digits:	10V CT	12.6V CT	16V CT	20V CT	24V CT	28V CT	36V CT
4-44-3___	.25	.20	.15	.12	.10	.09	.07
4-44-4___	.50	.40	.31	.25	.21	.18	.14
4-44-5___	1.00	.80	.62	.50	.42	.36	.28
4-44-6___	2.00	1.60	1.25	1.00	.83	.72	.56
4-44-7___	3.00	2.40	1.90	1.50	1.25	1.06	.82
4-44-8___	5.60	4.40	3.50	2.80	2.33	2.00	1.56
	PARALLEL CONNECTION			SECONDARY VOLTAGE			
	5V	6.3V	8V	10V	12V	14V	18V
4-44-3___	.50	.40	.30	.24	.20	.18	.14
4-44-4___	1.00	.80	.62	.50	.42	.36	.28
4-44-5___	2.00	1.60	1.25	1.00	.84	.73	.56
4-44-6___	4.00	3.20	2.50	2.00	1.66	1.44	1.12
4-44-7___	6.00	4.80	3.80	3.00	2.50	2.12	1.64
4-44-8___	11.20	8.80	7.00	5.60	4.66	4.00	3.12

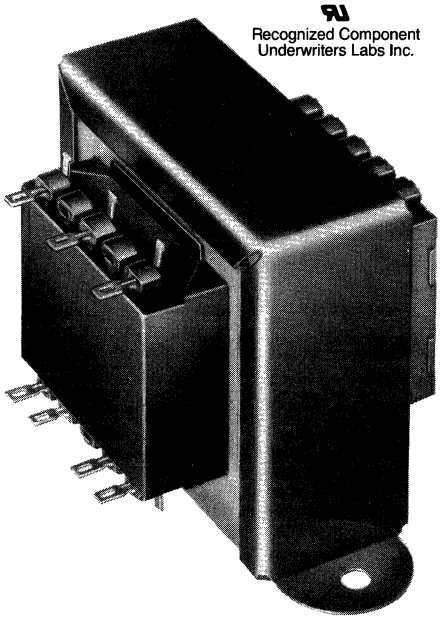
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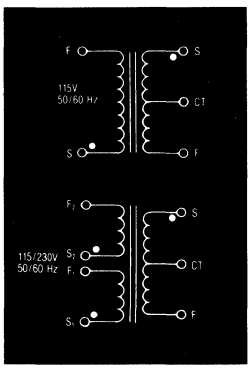
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VDE QUICK CONNECT POWER TRANSFORMERS

SERIES 4-46 & 4-47



Recognized Component
Underwriters Labs Inc.

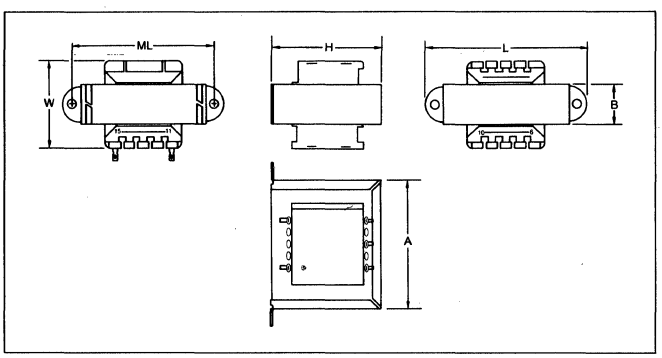


4,000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.



TERMINAL POSITIONS

	4-46 115V Primary		4-47 115/230V Primary				Secondary		
	S	F	S1	F1	S2	F2	S	C.T.	F
2	13	18	13	14	17	18	7	9	12
3	11	15	11	12	14	15	6	8	10
4	11	15	11	12	14	15	6	8	10
5	11	15	11	12	14	15	6	8	10
6	11	15	11	12	14	15	6	8	10
7	13	18	13	14	17	18	7	9	12
8	13	18	13	14	17	18	7	9	12
9	13	18	13	14	17	18	7	9	12

DIMENSIONS

SIZE	VA	L	W	H	A	B	ML	Lbs.
2	10	2 13/16	1 1/2	1 5/8	1 15/16	1/16	2 3/8	.57
3	20	3 1/4	1 13/16	1 15/16	2 5/16	7/8	2 13/16	.97
4	30	3 1/4	2 1/32	1 15/16	2 5/16	1 1/8	2 13/16	1.20
5	45	3 11/16	2 1/32	2 1/4	2 11/16	1	3 1/8	1.40
6	56	3 11/16	2 5/32	2 1/4	2 11/16	1 1/8	3 1/8	1.70
7	70	4 1/32	2 9/32	2 9/16	3 1/16	1 1/16	3 9/16	2.40
8	80	4 1/32	2 1/2	2 9/16	3 1/16	1 5/16	3 9/16	2.80
9	100	4 1/2	2 17/32	2 13/16	3 13/32	1 7/32	4	3.20

CURRENT RATING (AMPS RMS)

Last 3 Digits of Part Number:		-010	-012	-016	-020	-024	-028	-036	-048	-056	-120
First 4 Digits: of Part Number:		SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V C.T.	24V C.T.	28V C.T.	36V C.T.	48V C.T.	56V C.T.	120V C.T.
Single 115V Primary	Dual 115/230V Primary										
4-46-2___	4-47-2___	1.000	.800	.625	.500	.420	.360	.280	.210	.180	.085
4-46-3___	4-47-3___	2.000	1.600	1.250	1.000	.840	.720	.560	.420	.360	.170
4-46-4___	4-47-4___	3.000	2.400	1.875	1.500	1.250	1.075	.835	.625	.540	.250
4-46-5___	4-47-5___	4.500	3.600	2.815	2.250	1.875	1.610	1.250	.940	.805	.375
4-46-6___	4-47-6___	5.600	4.500	3.500	2.800	2.335	2.000	1.560	1.170	1.000	.470
4-46-7___	4-47-7___		5.560	4.375	3.500	2.290	2.500	1.950	1.460	1.250	.585
4-46-8___	4-47-8___			5.000	4.000	3.335	2.860	2.225	1.670	1.430	.670
4-46-9___	4-47-9___				5.000	4.170	3.575	2.780	2.090	1.790	.835

MCI TRANSFORMER CORPORATION

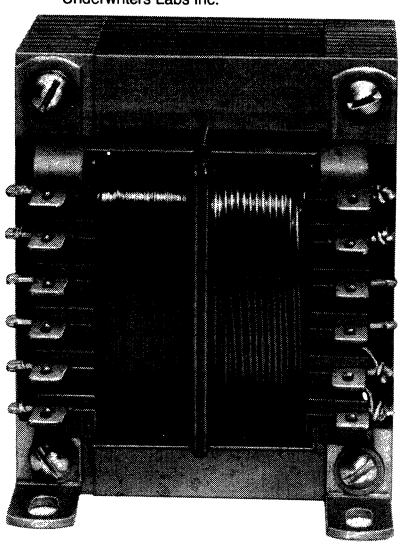
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SERIES 4-49

VDE QUICK CONNECT TRANSFORMERS

Recognized Component
Underwriters Labs Inc.





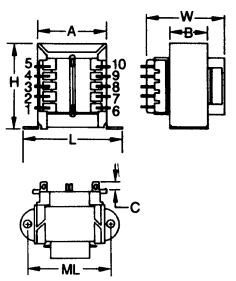
4,000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

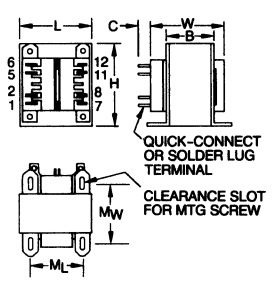
These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

MOUNTING STYLE C



MOUNTING STYLE D



To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

CURRENT RATINGS (AMPS RMS)

Last 3 Digits of Part No.:	-010	-012	-016	-020	-024	-028	-036	-230
	SERIES CONNECTION			SECONDARY VOLTAGE				
First 4 Digits:	10V CT	12.6V CT	16V CT	20V CT	24V CT	28V CT	36V CT	230V CT
4-49-4___	2.50	2.00	1.60	1.25	1.00	.90	.70	.11
4-49-5___	4.30	3.40	2.70	2.20	1.80	1.50	1.20	.19
4-49-6___	8.00	6.30	5.00	4.00	3.30	2.80	2.20	.35
4-49-7___	13.00	10.30	8.10	6.50	5.40	4.60	3.60	.57
4-49-8___	17.50	14.00	11.00	8.80	7.30	6.25	4.80	.76
	PARALLEL CONNECTION			SECONDARY VOLTAGE				
	5V	6.3V	8V	10V	12V	14V	18V	115V
4-49-4___	5.00	4.00	3.20	2.50	2.00	1.86	1.40	.22
4-49-5___	8.60	6.80	5.40	4.40	3.60	3.00	2.40	.38
4-49-6___	16.00	12.60	10.00	8.00	6.60	5.60	4.40	.70
4-49-7___	26.00	20.60	16.20	13.00	10.80	9.20	7.20	1.14
4-49-8___	35.00	28.00	22.00	17.60	14.60	12.50	9.60	1.52

DIMENSIONS

Transformer	VA	Schematic	Mounting Style	L	W	H	A	B	C	Terminals	ML	MW	Screw Size	Maximum Number Terminals	Lbs.
4-49-4___	25	1	C	2-13/16	1-7/8	1-5/16	2	1-1/8	5/16	3/16	2-3/8		6	10	1.25
4-49-5___	43	1	C	3-1/8	2-1/16	2-11/16	2-1/4	1-1/8	5/16	3/16	2-13/16		6	10	1.60
4-49-6___	80	2	D	2-1/2	2-3/8	3		1-3/8	5/16	3/16	2	2-3/16	6	12	2.80
4-49-7___	130	2	D	2-13/16	2-7/8	3-3/8		1-5/8	3/8	1/4	2-1/4	2-1/2	8	12	4.10
4-49-8___	175	2	D	3-1/8	2-7/8	3-3/4		1-5/8	3/8	1/4	2-1/2	2-1/2	8	12	5.5

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PRICE LIST

HORIZONTAL P C

PART NO.	PRICE	PAGE
4-01-2___	6.45	A•2266
4-01-3___	6.60	A•2266
4-01-4___	7.50	A•2266
4-01-5___	8.30	A•2266
4-01-6___	10.00	A•2266
4-01-7___	11.15	A•2266
4-02-2___	7.50	A•2266
4-02-3___	7.70	A•2266
4-02-4___	8.30	A•2266
4-02-5___	9.25	A•2266
4-02-6___	11.30	A•2266
4-02-7___	12.45	A•2266

QUICK CONNECT POWER

PART NO.	PRICE	PAGE
4-06-3___	6.55	A•2269
4-06-4___	7.20	A•2269
4-06-5___	8.25	A•2269
4-06-6___	11.00	A•2269
4-06-7___	14.50	A•2269
4-06-8___	19.15	A•2269
4-07-4___	8.74	A•2269
4-07-5___	9.50	A•2269
4-07-6___	12.16	A•2269
4-07-7___	14.92	A•2269
4-07-8___	20.14	A•2269

VDE P C

PART NO.	PRICE	PAGE
4-41-2___	8.05	A•2272
4-41-3___	10.39	A•2272
4-41-4___	11.40	A•2272
4-41-5___	13.52	A•2272
4-42-2___	9.36	A•2272
4-42-3___	11.83	A•2272
4-42-4___	13.03	A•2272
4-42-5___	15.33	A•2272
4-44-3___	7.82	A•2273
4-44-4___	8.40	A•2273
4-44-5___	9.43	A•2273
4-44-6___	11.51	A•2273
4-44-7___	13.24	A•2273
4-44-8___	16.13	A•2273

VERTICAL P C

PART NO.	PRICE	PAGE
4-03-1___	9.10	A•2267
4-03-2___	6.90	A•2267
4-03-3___	8.20	A•2267
4-03-4___	9.30	A•2267
4-03-5___	12.90	A•2267
4-04-1___	10.40	A•2267
4-04-2___	8.00	A•2267
4-04-3___	9.40	A•2267
4-04-4___	10.75	A•2267
4-04-5___	14.00	A•2267

TRIPLE OUTPUT

PART NO.	PRICE	PAGE
4-06-65___	14.50	A•2270
4-06-75___	19.00	A•2270
4-06-85___	25.00	A•2270
4-07-65___	16.00	A•2270
4-07-75___	20.00	A•2270
4-07-85___	26.00	A•2270

VDE QUICK CONNECT

PART NO.	PRICE	PAGE
4-46-2___	8.23	A•2274
4-46-3___	10.62	A•2274
4-46-4___	11.69	A•2274
4-46-5___	13.85	A•2274
4-46-6___	15.15	A•2274
4-46-7___	20.31	A•2274
4-46-8___	22.65	A•2274
4-46-9___	26.50	A•2274
4-47-2___	9.54	A•2274
4-47-3___	12.06	A•2274
4-47-4___	13.32	A•2274
4-47-5___	15.66	A•2274
4-47-6___	17.09	A•2274
4-47-7___	22.44	A•2274
4-47-8___	24.90	A•2274
4-47-9___	28.94	A•2274
4-49-4___	12.46	A•2275
4-49-5___	15.92	A•2275
4-49-6___	21.74	A•2275
4-49-7___	28.79	A•2275
4-49-8___	33.05	A•2275

LOW PROFILE P C

PART NO.	PRICE	PAGE
4-05-1___	9.80	A•2268
4-05-2___	10.85	A•2268
4-05-3___	13.75	A•2268
4-05-4___	14.80	A•2268
4-05-5___	17.90	A•2268

*ENCAPSULATED P C

PART NO.	PRICE	PAGE
4-11/12-2___	7.68	A•2271
4-11/12-3___	7.74	A•2271
4-11/12-4___	7.80	A•2271
4-11/12-5___	7.86	A•2271
4-11/12-6___	8.40	A•2271
4-11/12-7___	8.99	A•2271

*These parts are not a stock item.
Terms: Net 30 for customers with approved credit.
F.O.B.: Babylon, N.Y.
Prices subject to change without notice.

DISCOUNT SCHEDULE

QUANTITY	PRICE	QUANTITY	PRICE
1-9	Net	50-99	43%
10-24	25%	100-249	50%
25-49	35%	250 UP	POR

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 91/92 EDITION OF EEM

Abbreviations/Acronyms **A**•1114, **B**•1037, **C**•1116, **D**•1068
AC Power Supplies, Product Selection Guide **D**•2146
ASCII Code **D**•1086
Batteries, Product Selection Guide **D**•1427
Batteries & Fuel Cells, Characteristics **D**•1468
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C**•1003
Capacitors, Basic Formulas **A**•1078
Capacitors, Miniglossary **A**•1054
Capacitors, Product Selection Guide **A**•1003
Coils, Chokes, Inductors, Product Selection Guide **A**•1155
Conductors, Maximum Current Capacity of Copper & Aluminum **C**•1825
Connectors, Miniglossary **C**•1329
Connectors, Terminals & Sockets, Product Selection Guide **C**•1149
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A**•1300
DC Power Supplies, Product Selection Guide **D**•1501
Delay Lines, Product Selection Guide **A**•1493
Dielectrics, Thermal Conductivity **C**•1709
Discrete Semiconductors, Product Selection Guide **A**•2082
Displays, Readouts, & CRTs, Product Selection Guide **B**•1032
EBCDIC Code **D**•1110
Encapsulation, Miniglossary **C**•1126
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C**•1601
Fiber Optics, Miniglossary **B**•1224
Fiber Optics, Product Selection Guide **B**•1214
Filters, Power, Product Selection Guide **A**•1609
Filters, Signal, Product Selection Guide **A**•1651
Instruments, Test & Measuring, Product Selection Guide **D**•1207
Interconnection Systems, Product Selection Guide **C**•1678
Keyboards & Keypads, Product Selection Guide **B**•1794
Lamps, Lights, & Indicators, Product Selection Guide **B**•1135
Logofinder & Trademark Directories **C**•901
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Military Qualified Products List **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide **B**•1233
Opto Semiconductors, Miniglossary **B**•1334
Oscilloscopes, Product Selection Guide **D**•1406
Panel Hardware, Product Selection Guide **C**•1582
Panel Meters, Analog & Digital, Product Selection Guide **D**•1340
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A**•2013
Power Supplies, Miniglossary **D**•1522, **D**•2184
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Power Supplies, DC, Product Selection Guide **D**•1501
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B**•1347
Relay Contact Forms **B**•1550
Relays, Electromechanical, Miniglossary **B**•1449
Relays, Product Selection Guide **B**•1397
Resistor Color Codes **A**•1924
Resistors, Product Selection Guide **A**•1835
Servo Components, Miniglossary **B**•1270, **D**•2244
SI Units, Basic Guide To, **A**•2080, **B**•1666, **C**•1362, **D**•2246
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Switches, Product Selection Guide **B**•1639
Symbols—International Authorities **A**•1139, **B**•1024, **C**•1156, **D**•1090
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Thermal Conductivity of Dielectrics at Room Temperature **C**•1709
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Trademark & Logofinder Directories **C**•901
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Transformers, Product Selection Guide **A**•2131
Wire & Cable, Product Selection Guide **C**•1705
Wire Gauges—Diameter, Area, Copper Weight **C**•1864

SMPS MAGNETICS

MICROTRAN company, inc.

toroidal power inductors

Part No.	Inductance @ 0 DC μH	Max. DCR (Ohms)	Rated Current (Amps)	5% L Drop (DC Amps)	10% L Drop (DC Amps)	20% L Drop (DC Amps)	30% L Drop (DC Amps)	40% L Drop (DC Amps)	50% L Drop (DC Amps)
SL1 SIZE SERIES									
SL1-1.1 (*)	1.1	.002	5.0	26.3	34.1	50.0	59.8	71.8	83.3
SL1-2.5 (*)	2.5	.003	5.0	17.0	22.1	32.4	38.8	46.6	54.1
SL1-4.5 (*)	4.5	.004	5.0	10.7	14.3	21.0	25.2	30.2	35.1
SL1-8.0 (*)	8.0	.005	5.0	8.8	11.6	16.0	20.0	24.0	27.8
SL1-15 (*)	15	.007	5.0	5.1	7.5	11.0	14.0	16.9	20.0
SL1-30 (*)	30	.009	5.0	4.2	5.5	8.0	10.2	12.4	14.9
SL1-60 (*)	60	.017	5.0	2.1	3.6	5.4	6.9	8.5	10.2
SL1-120 (*)	120	.027	5.0	1.7	2.6	3.9	5.0	6.1	7.4
SL1-220 (*)	220	.037	5.0	1.5	2.0	3.0	3.8	4.6	5.5
SL1-450 (*)	450	.090	3.2	1.3	1.6	2.2	2.8	3.4	4.0
SL1-900 (*)	900	.230	1.5	.9	1.2	1.6	1.9	2.4	2.8
SL1-1500(*)	1500	.470	1.1	.6	.8	1.2	1.5	1.8	2.1
SL2 SIZE SERIES									
SL2-1.4 (*)	1.4	.003	5.0	28.3	43.8	62.2	82.1	102.5	123.0
SL2-2.5 (*)	2.5	.003	5.0	23.8	36.8	52.5	69.7	87.0	104.3
SL2-5.5 (*)	5.5	.005	5.0	16.0	24.8	35.4	47.0	58.7	70.4
SL2-13 (*)	13	.007	5.0	9.5	14.7	21.0	31.5	39.3	47.1
SL2-26 (*)	26	.010	5.0	6.3	10.0	15.0	20.0	25.0	30.0
SL2-50 (*)	50	.013	5.0	4.2	6.9	10.3	13.9	17.4	21.0
SL2-100 (*)	100	.018	5.0	3.3	4.9	7.5	9.8	12.2	14.9
SL2-225 (*)	225	.034	5.0	2.9	3.7	5.1	6.9	8.3	9.9
SL2-475 (*)	475	.055	4.5	1.5	2.0	3.4	4.4	5.5	6.8
SL2-1000(*)	1000	.130	4.5	1.2	1.6	2.3	3.1	3.9	4.7
SL2-1800(*)	1800	.340	2.0	1.0	1.3	1.9	2.4	2.9	3.5
SL2-2700(*)	2700	.520	2.0	.6	.9	1.4	1.8	2.3	2.8
SL3 SIZE SERIES									
SL3-1.3 (*)	1.3	.003	9.0	51.6	72.2	101.0	128.3	160.3	192.3
SL3-3.0 (*)	3.0	.004	9.0	40.0	56.0	78.4	99.5	124.3	149.0
SL3-6.5 (*)	6.5	.005	9.0	31.2	43.6	61.0	77.5	96.8	116.1
SL3-14 (*)	14	.008	9.0	24.4	34.3	48.6	62.1	77.5	92.9
SL3-30 (*)	30	.011	9.0	17.6	24.8	35.2	45.0	56.2	67.4
SL3-55 (*)	55	.015	9.0	12.2	18.5	26.3	33.6	42.0	50.4
SL3-100 (*)	100	.020	9.0	9.4	13.3	19.7	25.2	31.6	37.9
SL3-220 (*)	220	.020	9.0	4.9	6.6	9.4	11.9	14.4	17.1
SL3-470 (*)	470	.034	7.0	2.7	4.1	6.3	8.1	10.0	12.0
SL3-1000(*)	1000	.120	3.5	2.0	2.7	4.2	5.4	6.8	8.2
SL3-2200(*)	2200	.220	2.8	1.6	2.1	3.0	3.8	4.6	5.5
SL3-4000(*)	4000	.300	2.0	1.1	1.5	2.1	2.8	3.3	4.0
SL4 SIZE SERIES									
SL4-2.2 (*)	2.2	.003	14.0	49.8	67.2	100.2	130.2	158.8	190.6
SL4-5 (*)	5.0	.004	14.0	40.0	54.0	80.5	104.6	127.6	153.1
SL4-11 (*)	11	.005	14.0	32.1	43.3	64.5	83.8	102.2	122.6
SL4-23 (*)	23	.007	14.0	24.6	33.2	49.5	64.3	78.4	94.1
SL4-50 (*)	50	.011	14.0	18.3	24.7	36.9	47.8	58.3	70.0
SL4-100 (*)	100	.016	14.0	12.8	17.3	25.9	33.6	41.0	49.2
SL4-230 (*)	230	.023	14.0	7.1	10.4	15.8	20.5	25.0	30.0
SL4-470 (*)	470	.023	14.0	3.5	5.4	8.0	10.4	12.7	15.4
SL4-1000(*)	1000	.065	9.0	2.4	3.5	5.5	7.2	8.8	10.7
SL4-2200(*)	2200	.120	7.0	2.0	3.0	4.0	5.0	6.1	7.3
SL4-4000(*)	4000	.260	4.5	1.1	1.8	2.8	3.5	4.5	5.4
SL4-5600(*)	5600	.310	4.5	.9	1.4	2.2	3.0	3.8	4.5

*** Add either -F, -B, or -M to Part No. to designate construction. See photos and outline drawings on adjacent page.**

NOTES:

1. Non-standard inductance values available on special order, i.e., specify P/N SL2-75-F for 75 μH.
2. Inductance ±15% measured at 1 kHz. See drive level test condition chart.
3. DCR measured at 20°C. 130°C insulation system.
4. Current values for percentage inductance drop are typical.
5. Recommended PC board clearance hole .065 dia. min.

DRIVE LEVEL TEST CONDITIONS

Inductance	Drive Level @ 1 kHz
0-200 μH	100 mA AC
200 μH — 2 mH	10 mA AC
2 mH — 20 mH	1 mA AC

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MICROTRAN company, inc.

SMPS MAGNETICS

toroidal power inductors

OUTLINE DRAWINGS FOR SL SERIES

New Swinging Chokes for Switch Mode Power Supplies, Regulators, and EMI/RFI Filter Applications

NEW!

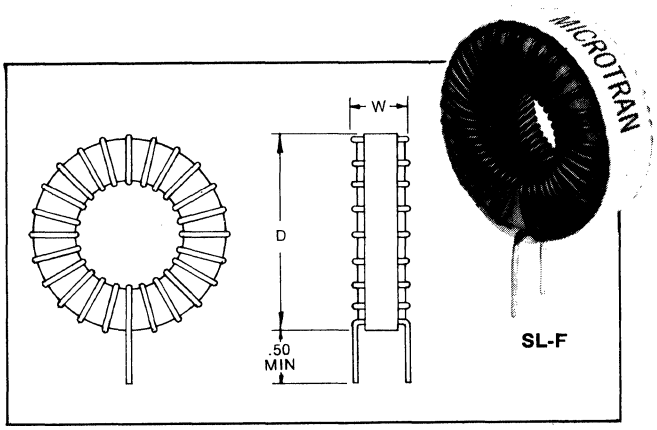
- Specially designed for controlled saturation — repeatable specific inductance at a specific current.
- Designed to handle high current spikes typically encountered in high current SMPS applications.
- Application frequencies up to 1 MHz.
- Toroidal construction — closed magnetic field — low EMI.

OPEN FRAME -F

Tinned leads to 1/16" of body for PCB mounting. Additional mechanical mounting recommended for larger units with finer wire. To order add -F to Part No., i.e. SL2-50-F.

DIMENSIONS (Inches)

Series	D Max.	W Max.	Wt. Oz.
SL1-F	1.00	.50	.14
SL2-F	1.25	.65	.44
SL3-F	1.90	.90	1.10
SL4-F	2.20	1.10	2.10



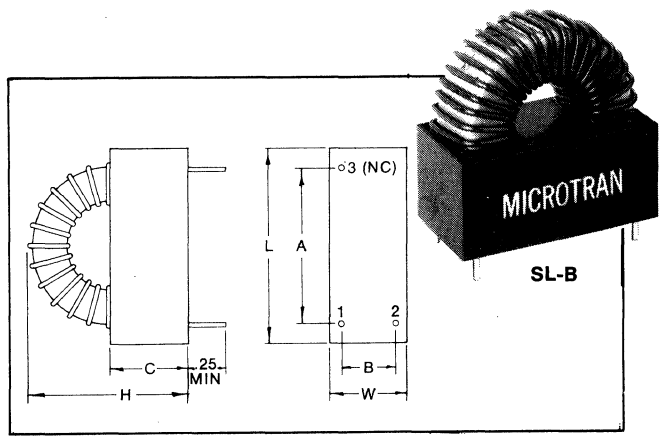
BASE MOUNTED -B

Rugged, epoxy base mounted for PCB applications. To order add -B to Part No., i.e. SL2-50-B.

DIMENSIONS (Inches)

Series	L Max.	W Max.	H Max.	A	B	C Max.	Wt. Oz.
SL1-B	1.00	.56	1.05	.75	.35	.40	.23
SL2-B	1.26	.70	1.30	.95	.40	.60	.65
SL3-B	1.96	.91	1.95	1.625	.50	.70	1.60
SL4-B	2.12	1.08	2.30	1.75	.90	1.00	3.00

Tolerances dimensions A and B ± .015.



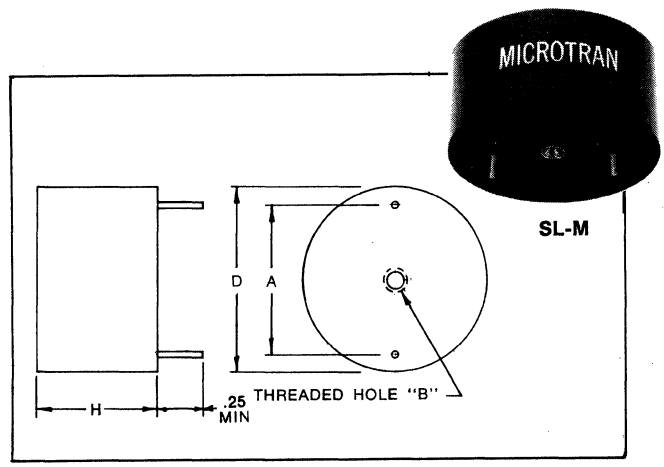
MOLDED -M

Epoxy molded with threaded insert for MIL and industrial PCB applications. MIL designation TF5S04ZZ. To order add -M to Part No., i.e. SL2-50-M.

DIMENSIONS (Inches)

Series	D	H	A	B	Wt. Oz.
SL1-M	1.08	.52	.90	4-40 x 8	.26
SL2-M	1.375	.70	1.20	6-32 x 8	.80
SL3-M	2.00	1.00	1.70	8-32 x 10	2.10
SL4-M	2.50	1.25	1.25	10-32 x 12	3.80

Tolerance ±.015.



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SMPS MAGNETICS

MICROTRAN company, inc.

common mode suppression inductors

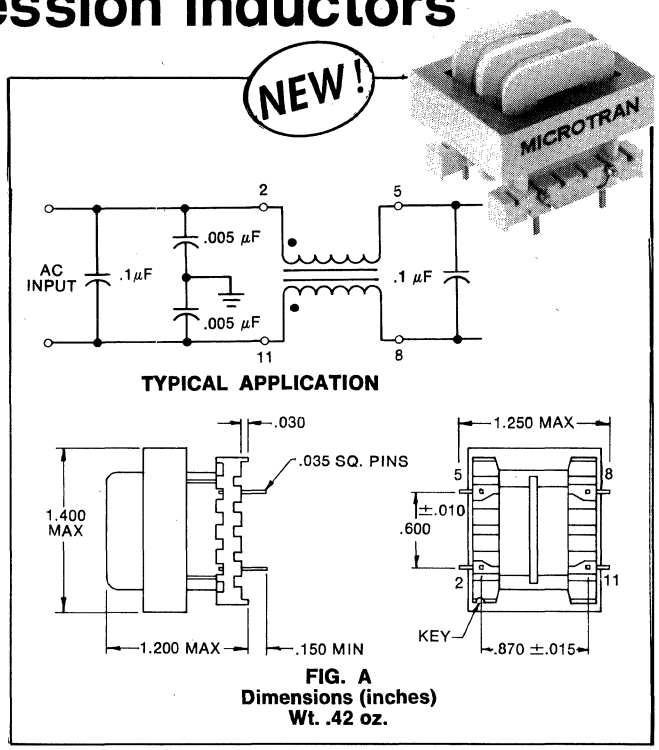
For Elimination of Line Transmitted EMI/RFI Interference from SMPS Equipment

- Compact PC construction.
- 3750V RMS hipot.
- VDE, IEC, UL, CSA compatible.
- 130°C insulation system.
- Cost effective design.

Common mode suppression inductors are used to minimize AC line-conducted interference produced by switching power supplies and regulators. Balun winding to within 1% produces opposing magnetic fluxes in the core to effectively cancel differential-mode noise signals appearing across the AC line. Use of common mode chokes substantially reduces component count as well as inductor size, as compared to differential filtering. Constructed with spacing between windings to meet international safety requirements.

Part No.	Inductance mH	RMS Max. Amps	DCR Max. Ohms	Fig.
SC1-16800	16.8	.50	1.0	A
SC1-07900	7.9	.75	.43	A
SC1-04900	4.9	1.00	.22	A
SC1-03770	3.77	1.25	.156	A
SC1-01960	1.96	1.5	.11	A
SC1-01280	1.28	2.0	.071	A
SC1-00840	.84	2.5	.046	A
SC1-00490	.49	3.0	.027	A
SC1-00290	.29	4.0	.0175	A

Other ratings and MIL constructions available on special order.
NOTES: Inductance shown is for each winding. Inductance ±25% measured @ 10 kHz, 1V RMS. Inductance with each winding connected series opposing under 100 μH typical @ 10 kHz, 1V RMS. Inter-winding capacitance: 5 pF typical @ 10 kHz, 1V RMS.



TYPICAL APPLICATION

FIG. A
Dimensions (inches)
Wt. .42 oz.

custom switch mode power transformers

For Switching Power Supplies

Utilizes latest core materials and shape factor to provide smallest possible volume and minimum PC board footprint for effective manufacturing cost reduction. These transformers are available in standard size/power ratings from 25 to 880 watts output for use over a wide frequency range. Standard configurations allow short turn-around time on custom-design samples. Other packaging and styles are available, such as horizontally mounted units. For application assistance, contact our Engineering Department.

- Standardized components speeds delivery.
- VDE, IEC, UL, CSA compatible.
- Frequency range 20 kHz — 300 kHz and higher.
- Core material for newest generation of higher frequency SMPS.

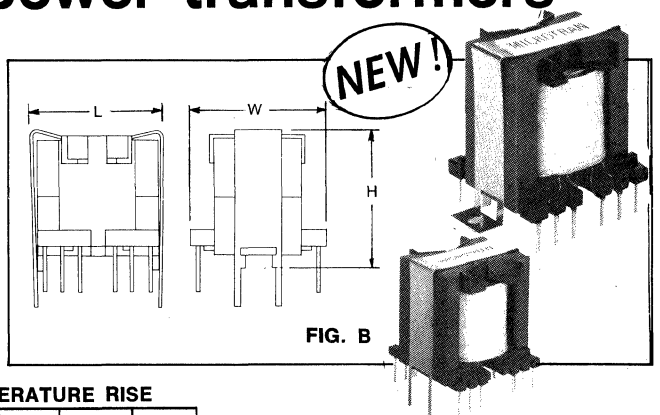


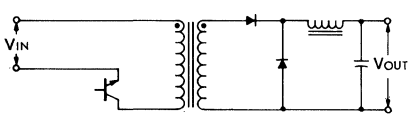
FIG. B

TRANSFORMER OUTPUT POWER VS. FREQUENCY AND TEMPERATURE RISE

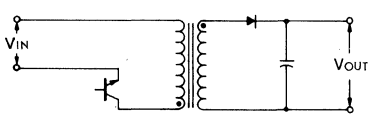
Size Series	Power (W) 50 kHz			Power (W) 100 kHz			Max. Dimensions (Inches)			Wt. Oz.	Fig.
	20°C	30°C	40°C	20°C	30°C	40°C	L	W	H		
SP2016-(*)	25	35	40	40	55	63	.92	.92	.83	.8	B
SP2020-(*)	35	45	55	55	70	80	.92	.92	1.0	.9	B
SP2620-(*)	60	80	95	90	115	135	1.15	1.17	1.0	1.5	B
SP2625-(*)	70	90	110	105	130	160	1.15	1.17	1.17	1.8	B
SP3220-(*)	80	110	130	120	155	190	1.36	1.34	1.0	2.2	B
SP3230-(*)	115	150	185	155	210	260	1.36	1.34	1.4	3.2	B
SP3535-(*)	170	220	265	230	315	355	1.48	1.55	1.6	4.4	B
SP4040-(*)	225	325	385	350	460	525	1.67	1.67	1.76	6.9	B
SP5050-(*)	310	445	525	580	740	880	2.10	2.10	2.10	12.9	B

* Custom P/N assigned by factory.

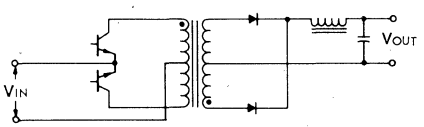
NOTES: The power ratings are based on forward converter circuitry with 40% duty cycle. Flyback circuits provide less power; bi-polar circuits will provide more. If the design is to meet VDE or IEC requirements, derate output power by 20%.



TYPICAL FORWARD CONVERTER



TYPICAL FLYBACK CONVERTER



TYPICAL BI-POLAR PUSH-PULL CONVERTER

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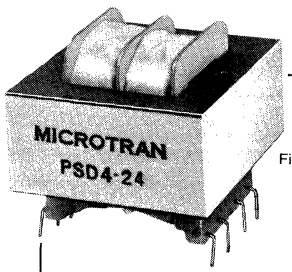
MICROTRAN company, inc.

POWER TRANSFORMERS

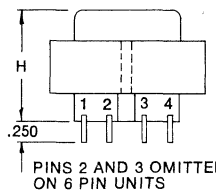
SPLITFORM® split bobbin power transformers

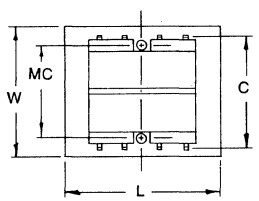
For PC Board Solid-State Power, Control, and Instrumentation Applications

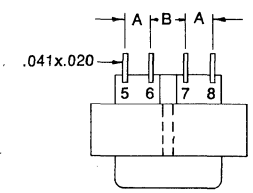
- Split Bobbin Construction
  Center Flange Insulation Barrier
  High Isolation for Low Leakage Applications
  Low Capacitive Coupling Minimizes Line Noise and False Triggering
- 2,500V RMS Hipot
- 115V Single or 115/230V 50/60 Hz Dual Primary
- Dual Secondaries may be either Parallel or Series Connected
- Precision Spaced Terminals
  Terminal Numbers are Molded on Bobbin
- 130°C Insulation System
- Attractive Pricing — Superior Quality



File #LR73078 UL 1585 Class 2 & 3 - File #E96720
UL 506 - File #E79781

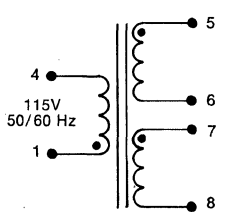




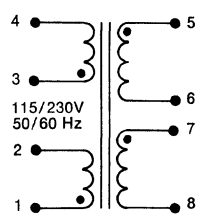


PART NO.		SECONDARY RMS RATING			
		Parallel Connected		Series Connected	
Single 115V PSS Series	Dual 115/230V PSD Series	AC Volts	RMS Amps	AC Volts	RMS Amps
PSS2-10	PSD2-10	5.0	0.22	10.0 CT	0.11
PSS3-10	PSD3-10	5.0	0.5	10.0 CT	0.25
PSS4-10	PSD4-10	5.0	1.2	10.0 CT	0.60
PSS5-10	PSD5-10	5.0	2.4	10.0 CT	1.2
PSS2-12	PSD2-12	6.3	0.18	12.6 CT	0.09
PSS3-12	PSD3-12	6.3	0.4	12.6 CT	0.2
PSS4-12	PSD4-12	6.3	1.0	12.6 CT	0.5
PSS5-12	PSD5-12	6.3	2.0	12.6 CT	1.0
PSS2-16	PSD2-16	8.0	0.14	16.0 CT	0.07
PSS3-16	PSD3-16	8.0	0.3	16.0 CT	0.15
PSS4-16	PSD4-16	8.0	0.8	16.0 CT	0.4
PSS5-16	PSD5-16	8.0	1.6	16.0 CT	0.8
PSS2-20	PSD2-20	10.0	0.11	20.0 CT	0.055
PSS3-20	PSD3-20	10.0	0.24	20.0 CT	0.12
PSS4-20	PSD4-20	10.0	0.6	20.0 CT	0.3
PSS5-20	PSD5-20	10.0	1.2	20.0 CT	0.6
PSS2-24	PSD2-24	12.0	0.09	24.0 CT	0.045
PSS3-24	PSD3-24	12.0	0.2	24.0 CT	0.1
PSS4-24	PSD4-24	12.0	0.5	24.0 CT	0.25
PSS5-24	PSD5-24	12.0	1.0	24.0 CT	0.5
PSS2-28	PSD2-28	14.0	0.08	28.0 CT	0.04
PSS3-28	PSD3-28	14.0	0.17	28.0 CT	0.085
PSS4-28	PSD4-28	14.0	0.4	28.0 CT	0.2
PSS5-28	PSD5-28	14.0	0.84	28.0 CT	0.42
PSS2-36	PSD2-36	18.0	0.06	36.0 CT	0.03
PSS3-36	PSD3-36	18.0	0.13	36.0 CT	0.065
PSS4-36	PSD4-36	18.0	0.34	36.0 CT	0.17
PSS5-36	PSD5-36	18.0	0.7	36.0 CT	0.35
PSS2-48	PSD2-48	24.0	0.046	48.0 CT	0.023
PSS3-48	PSD3-48	24.0	0.1	48.0 CT	0.05
PSS4-48	PSD4-48	24.0	0.25	48.0 CT	0.125
PSS5-48	PSD5-48	24.0	0.5	48.0 CT	0.25
PSS2-56	PSD2-56	28.0	0.04	56.0 CT	0.02
PSS3-56	PSD3-56	28.0	0.09	56.0 CT	0.045
PSS4-56	PSD4-56	28.0	0.22	56.0 CT	0.11
PSS5-56	PSD5-56	28.0	0.44	56.0 CT	0.22
PSS2-120	PSD2-120	60.0	0.02	120.0 CT	0.01
PSS3-120	PSD3-120	60.0	0.04	120.0 CT	0.02
PSS4-120	PSD4-120	60.0	0.1	120.0 CT	0.05
PSS5-120	PSD5-120	60.0	0.2	120.0 CT	0.1

SCHEMATICS



6 PIN PSS SERIES



8 PIN PSD SERIES

DIMENSIONS Inches (mm)

PSS, PSD Series	VA	L	W	H	MC	A	B	C	Lb. (Gm.)
2	1.1	1.44 (36.6)	1.23 (31.2)	1.00 (25.4)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.17 (77.4)
3	2.4	1.44 (36.6)	1.23 (31.2)	1.26 (32)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.25 (114)
4	6	1.69 (43)	1.39 (35.3)	1.36 (34.5)	1.0625* (27.0)*	.250 (6.35)	.350 (8.9)	1.280 (32.5)	0.44 (200)
5	12	1.97 (50)	1.63 (41.4)	1.5 (38.1)	1.250* (31.8)*	.300 (7.62)	.400 (10.16)	1.410 (35.8)	0.70 (319)

* Clearance hole for 4-40 x 1⅜" nylon mtg. screws. Order screw as P/N PS-S and nut as P/N PS-N; Sold only in pkgs. of 100 each.

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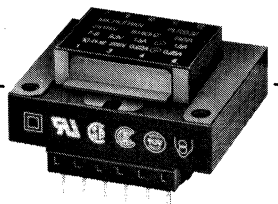
POWER TRANSFORMERS

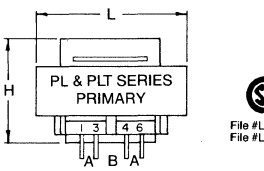
MICROTRAN company, inc.

low profile international series power transformers

For PC Board Solid-State Power, Control, and Instrumentation Applications
115/230V 50/60 Hz Primary

- Meets US and International Safety Standards—UL, VDE, IEC, CSA
- 4,000 Volt RMS Hipot Test — Dual Non-concentric Bobbins and Insulating Shroud Provide High Isolation and Reduced Capacitance
- 130°C Insulation System — Insulating Materials Meet UL 94V-0 Flammability Requirements
- Cost Effective Design



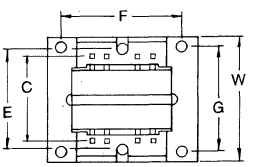


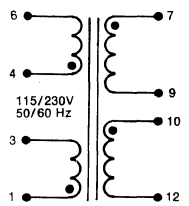
File #LR69222
File #LR69223

File 810/89
811/89
VDE 0551, 0806

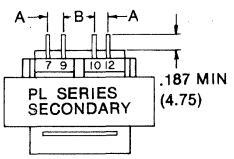
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811/89
IEC 380 EN60950

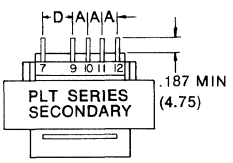
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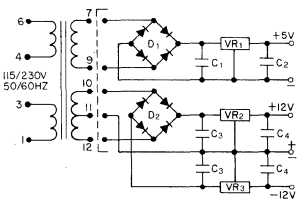




PL SERIES







PLT SERIES —
TYPICAL SCHEMATIC

PL SERIES—FOR CONTROL AND POWER SUPPLY APPLICATIONS

Part No.	VA (Size)	Secondary			
		Parallel Connected		Series Connected	
		AC Volts	RMS Amps	AC Volts	RMS Amps
PL2.5-10	2.5	5.0	0.5	10.0 CT	0.25
PL5.0-10	5.0	5.0	1.0	10.0 CT	0.5
PL10-10	10.0	5.0	2.0	10.0 CT	1.0
PL20-10	20.0	5.0	4.0	10.0 CT	2.0
PL30-10	30.0	5.0	6.0	10.0 CT	3.0
PL56-10	56.0	5.0	11.2	10.0 CT	5.6
PL2.5-12	2.5	6.3	0.4	12.6 CT	0.2
PL5.0-12	5.0	6.3	0.8	12.6 CT	0.4
PL10-12	10.0	6.3	1.6	12.6 CT	0.8
PL20-12	20.0	6.3	3.2	12.6 CT	1.6
PL30-12	30.0	6.3	4.8	12.6 CT	2.4
PL56-12	56.0	6.3	8.8	12.6 CT	4.4
PL2.5-16	2.5	8.0	0.3	16.0 CT	0.15
PL5.0-16	5.0	8.0	0.62	16.0 CT	0.31
PL10-16	10.0	8.0	1.25	16.0 CT	0.62
PL20-16	20.0	8.0	2.5	16.0 CT	1.25
PL30-16	30.0	8.0	3.8	16.0 CT	1.9
PL56-16	56.0	8.0	7.0	16.0 CT	3.5
PL2.5-20	2.5	10.0	0.24	20.0 CT	0.12
PL5.0-20	5.0	10.0	0.5	20.0 CT	0.25
PL10-20	10.0	10.0	1.0	20.0 CT	0.5
PL20-20	20.0	10.0	2.0	20.0 CT	1.0
PL30-20	30.0	10.0	3.0	20.0 CT	1.5
PL56-20	56.0	10.0	5.6	20.0 CT	2.8
PL2.5-24	2.5	12.0	0.2	24.0 CT	0.1
PL5.0-24	5.0	12.0	0.42	24.0 CT	0.21
PL10-24	10.0	12.0	0.84	24.0 CT	0.42
PL20-24	20.0	12.0	1.66	24.0 CT	0.83
PL30-24	30.0	12.0	2.5	24.0 CT	1.25
PL56-24	56.0	12.0	4.66	24.0 CT	2.33
PL2.5-28	2.5	14.0	0.18	28.0 CT	0.09
PL5.0-28	5.0	14.0	0.36	28.0 CT	0.18
PL10-28	10.0	14.0	0.72	28.0 CT	0.36
PL20-28	20.0	14.0	1.44	28.0 CT	0.72
PL30-28	30.0	14.0	2.12	28.0 CT	1.06
PL56-28	56.0	14.0	4.0	28.0 CT	2.0
PL2.5-36	2.5	18.0	0.14	36.0 CT	0.07
PL5.0-36	5.0	18.0	0.28	36.0 CT	0.14
PL10-36	10.0	18.0	0.56	36.0 CT	0.28
PL20-36	20.0	18.0	1.12	36.0 CT	0.56
PL30-36	30.0	18.0	1.64	36.0 CT	0.82
PL56-36	56.0	18.0	3.12	36.0 CT	1.56

DIMENSIONS Inches (mm)

VA (Size)	L	W	H	A†	B	C	D	Mounting E	Mounting F	Mounting G	Mtg. Screws	Pin Square	Lbs. (Kg.)
2.5	1.625 (41.3)	1.313 (33.3)	1.125 (28.6)	.200 (5.1)	.250 (6.4)	1.000 (25.4)	—	1.063 (27.0)	—	—	2X #4 (2X M3)	.025 (.635)	.25 (.11)
5.0	1.625 (41.3)	1.313 (33.3)	1.375 (34.9)	.200 (5.1)	.400 (10.2)	1.000 (25.4)	—	1.063 (27.0)	—	—	2X #4 (2X M3)	.025 (.635)	.37 (.17)
10.0	1.875 (47.6)	1.563 (39.7)	1.375 (34.9)	.200 (5.1)	.400 (10.2)	1.140 (29.0)	—	1.250 (31.8)	—	—	2X #4 (2X M3)	.036 (.914)	.53 (.24)
20.0	2.250 (57.1)	1.875 (47.6)	1.625 (41.3)	.400 (10.2)	.400 (10.2)	1.460 (37.1)	.40 (10.2)	1.500 (38.1)	—	—	2X #4 (2X M3)	.036 (.914)	.90 (.41)
30.0	2.625 (66.7)	2.188 (55.6)	1.563 (39.7)	.550 (14.0)	.275 (7.0)	1.680 (42.7)	.55 (14.0)	—	2.19 (55.6)	1.75 (44.5)	4X #6 (4X M3)	.045 (1.14)	1.15 (.52)
56.0	3.000 (76.2)	2.500 (63.5)	1.813 (46.0)	.600 (15.2)	.300 (7.6)	1.900 (48.3)	.60 (15.2)	—	2.50 (63.5)	2.00 (50.8)	4X #6 (4X M5)	.045 (1.14)	1.70 (.77)

† For PLT series secondary only, dimension A is ½ of value shown.

PLT SERIES—FOR TRIPLE OUTPUT REGULATED POWER SUPPLIES

For Microprocessor, Logic, and Op Amp Applications

Part No.	VA AC (Size)	DC Output #1		DC Output #2		C_1	C_3	VR_1	VR_2	VR_3	D_1	D_2
		DC Volts	Amps DC	DC Volts	mA DC							
PLT20-32	20.0	5.0	1.25	±12	150	7,500 µF 20V DC	1,500 µF 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
PLT30-32	30.0	5.0	1.75	±12	210	10,000 µF 20V DC	1,500 µF 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
PLT56-32	56.0	5.0	2.8	±12	350	15,000 µF 20V DC	2,000 µF 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	MDA-400	3N247

C_2 and C_4 10,000 µF @ 20V. All VR's are National Semiconductor P/N's. All diodes are Motorola P/N's.

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MICROTRAN company, inc.

POWER TRANSFORMERS

international series power transformers

For PC Board Solid-State Power, Control, and Instrumentation Applications

- UL Recognized — Meets IEC-65 Safety Requirements for Worldwide Usage. UL 1411-File #E82992.
- Physical Barriers Between Primary and Secondary — Double Protection System — 4,000 Volt Hipot

PW SERIES — FOR CONTROL AND POWER SUPPLY APPLICATIONS

115/230V 50/60 Hz Primary

Part No.	Secondary: Parallel Connected AC Volts	Parallel Connected RMS Amps	Series Connected AC Volts	Series Connected RMS Amps	Schematic	Fig.
PW28 SERIES • 0.5 VA						
PW28-10	10.0 CT	.050	(Single Secondary)		1†	A
PW28-16	16.0 CT	.031	(Single Secondary)		1†	A
PW28-24	24.0 CT	.021	(Single Secondary)		1†	A
PW35 SERIES • 1.1 VA						
PW35-10	10.0 CT	.110	(Single Secondary)		1	A
PW35-12	12.6 CT	.090	(Single Secondary)		1	A
PW35-16	16.0 CT	.070	(Single Secondary)		1	A
PW35-24	24.0 CT	.046	(Single Secondary)		1	A
PW35-36	36.0 CT	.031	(Single Secondary)		1	A
PW41 SERIES • 3.5 VA						
PW41-10	10.0 CT	.350	(Single Secondary)		1	B
PW41-12	12.6 CT	.280	(Single Secondary)		1	B
PW41-16	16.0 CT	.220	(Single Secondary)		1	B
PW41-24	24.0 CT	.150	(Single Secondary)		1	B
PW41-36	36.0 CT	.100	(Single Secondary)		1	B
PW48 SERIES • 9.5 VA						
PW48-10	5.0	1.900	10.0 CT	.950	2	B
PW48-12	6.3	1.500	12.6 CT	.750	2	B
PW48-16	8.0	1.200	16.0 CT	.600	2	B
PW48-24	12.0	.800	24.0 CT	.400	2	B
PW48-36	18.0	.520	36.0 CT	.260	2	B
PW48-56	28.0	.340	56.0 CT	.170	2	B
PW54 SERIES • 12.5 VA						
PW54-10	5.0	2.500	10.0 CT	1.250	2	C
PW54-12	6.3	2.000	12.6 CT	1.000	2	C
PW54-16	8.0	1.560	16.0 CT	.780	2	C
PW54-24	12.0	1.040	24.0 CT	.520	2	C
PW54-36	18.0	.700	36.0 CT	.350	2	C
PW54-56	28.0	.446	56.0 CT	.223	2	C

† PW28 Series has 115V only primary. For 230V only primary, order as PW28-10-230, etc.

PWT SERIES — FOR TRIPLE OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

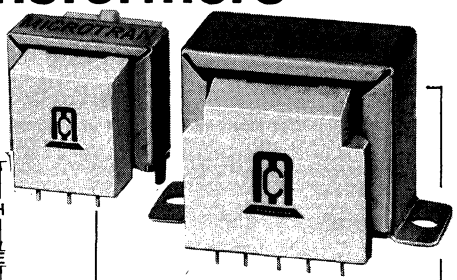
115/230V 50/60 Hz Primary

Part No.	Secondary #1 AC Volts	Secondary #1 RMS Amps	Secondary #2 AC Volts	Secondary #2 RMS Amps	DC Output #1 CT FW DC Volts	DC Output #1 mA DC	DC Output #2 CT FW DC Volts	DC Output #2 mA DC	Schematic	Fig.
PWT54-1024	9.0 CT	.800	24.0 CT	.300	+5	670	±15	170	3	C
PWT54-1633	16.0 CT	.550	33.0 CT	.180	+9.0*	470	±21*	120	4	C

* +9.0 and ±21 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator; see Schematic #4.

Recognized Component Underwriters Labs Inc.

UL 1411
File #E82992



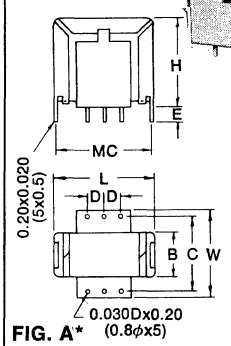


FIG. A*

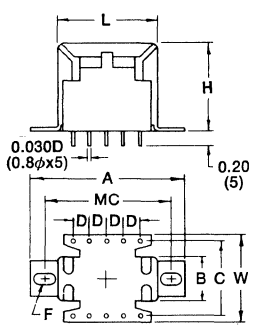


FIG. B*

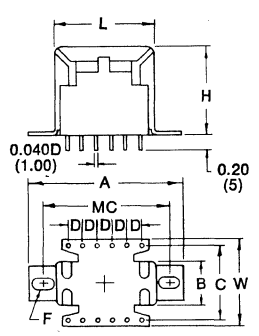
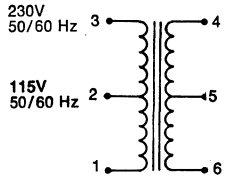
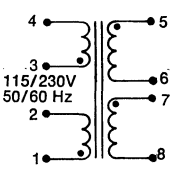


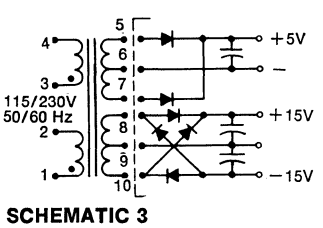
FIG. C*



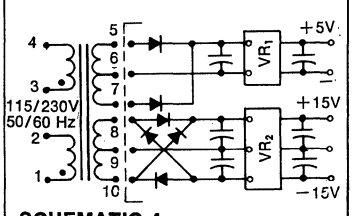
SCHEMATIC 1



SCHEMATIC 2



SCHEMATIC 3



SCHEMATIC 4

DIMENSIONS Inches (mm)

Series	Max VA	L	W	H	MC	A	B	C	D	E	F	Oz. (Gm)
PW28	0.7	1.16 (29.5)	1.32 (33.5)	1.10 (28)	1.12 (28.5)	— —	0.50 (12.5)	0.984 (25)	0.197 (5)	0.20 (5)	— —	2.5 (70)
PW35	2	1.44 (36.5)	1.69 (43)	1.26 (32)	1.40 (35.5)	— —	0.61 (15.5)	1.380 (35)	0.295 (7.5)	0.24 (6)	— —	4.5 (130)
PW41	5	1.67 (42.5)	1.91 (48.5)	1.42 (36)	2.05 (52)	2.36 (60)	0.85 (21.5)	1.575 (40)	0.394 (10)	— —	0.138x0.177 (3.5x4.5)	8.0 (230)
PW48	9.5	1.99 (50.5)	2.05 (52)	1.69 (43)	2.32 (59)	2.72 (69)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	14.0 (400)
PW54	15	2.22 (56.5)	2.09 (53)	1.93 (49)	2.72 (69)	3.15 (80)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	18.0 (510)

PWT54 and PW54 have same dimensions
* Request terminal layout sheet for pin locations.

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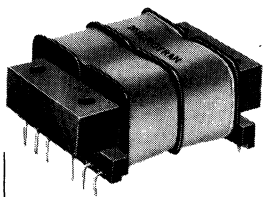
POWER TRANSFORMERS

MICROTRAN company, inc.

FLATSTACK ® low profile power transformers

For Low Height PC Board Solid-State Power, Control, and Instrumentation Applications

- **FOUR SIZES**
  - ***NEW!*** 2.5 VA Size 0.650 inches high for 13/16" Card Spacing
  - 6 VA Size 0.85" high for 1" Card Spacing
  - 12 VA Size 1.065" high for 1 1/4" Card Spacing
  - 24 VA Size 1.250" high for 19/16" card Spacing
- **SPLIT BOBBIN**—Primaries and Secondaries Wound Side by Side.
  - High Isolation for Low Leakage Applications. 1500V Hipot.
  - Low Capacity Coupling Minimizes Line Noise and False Triggering
- **HUM-BUCKING SEMI-TOROIDAL CONSTRUCTION**
- **PRECISION SPACED MOLDED-IN TERMINALS**
- **DUAL PRIMARIES: 115/230V, 50/60 Hz.**

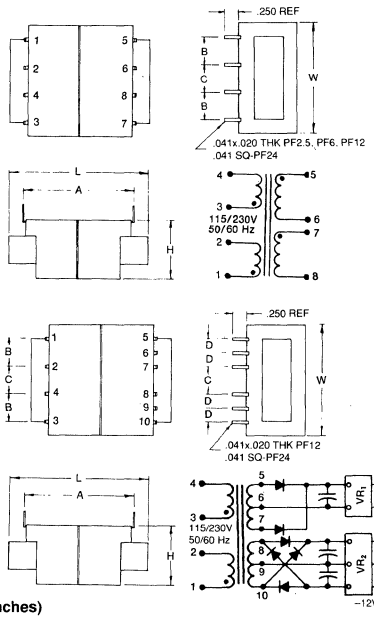


UL 506 File #E79781
130°C Insulation System

PF SERIES—FOR POWER SUPPLIES, INSTRUMENTS, CONTROL EQUIPMENT

		Secondary			
	VA	Parallel Connected		Series Connected	
Part No.	(Size)	AC Volts	RMS Amps	AC Volts	RMS Amps
PF2.5-10	2.5	5.0	.50	10.0 CT	.250
PF6-10	6	5.0	1.20	10.0 CT	.60
PF12-10	12	5.0	2.40	10.0 CT	1.20
PF24-10	24	5.0	4.80	10.0 CT	2.40
PF2.5-12	2.5	6.3	.40	12.6 CT	.20
PF6-12	6	6.3	.90	12.6 CT	.45
PF12-12	12	6.3	1.90	12.6 CT	.95
PF24-12	24	6.3	3.80	12.6 CT	1.90
PF2.5-16	2.5	8.0	.30	16.0 CT	.15
PF6-16	6	8.0	.70	16.0 CT	.35
PF12-16	12	8.0	1.50	16.0 CT	.75
PF24-16	24	8.0	3.00	16.0 CT	1.50
PF2.5-20	2.5	10.0	.25	20.0 CT	.125
PF6-20	6	10.0	.60	20.0 CT	.30
PF12-20	12	10.0	1.20	20.0 CT	.60
PF24-20	24	10.0	2.40	20.0 CT	1.20
PF2.5-24	2.5	12.0	.20	24.0 CT	.10
PF6-24	6	12.0	.50	24.0 CT	.25
PF12-24	12	12.0	1.00	24.0 CT	.50
PF24-24	24	12.0	2.00	24.0 CT	1.00
PF2.5-30	2.5	15.0	.17	30.0 CT	.085
PF6-30	6	15.0	.40	30.0 CT	.20
PF12-30	12	15.0	.80	30.0 CT	.40
PF24-30	24	15.0	1.60	30.0 CT	.80
PF2.5-34	2.5	17.0	.15	34.0 CT	.075
PF6-34	6	17.0	.34	34.0 CT	.17
PF12-34	12	17.0	.70	34.0 CT	.35
PF24-34	24	17.0	1.40	34.0 CT	.70
PF2.5-56	2.5	28.0	.09	56.0 CT	.045
PF6-56	6	28.0	.20	56.0 CT	.10
PF12-56	12	28.0	.42	56.0 CT	.21
PF24-56	24	28.0	.85	56.0 CT	.43

PF SERIES



DIMENSIONS (Inches)

VA (Size)	L	W	H	A	B	C	D†	Wt. Oz.
2.5	1.870	1.560	0.650	1.600	0.375	0.375	—	5
6	1.875	1.563	0.850	1.600	0.375	0.375	—	7
12	2.500	2.000	1.065	2.000	0.500	0.500	0.250	11
24	2.870	2.250	1.250	1.900	0.600	0.530	0.300	15

† Dimension D only applies to PFT Series.

PFT SERIES—FOR TRIPLE OUTPUT REGULATED POWER SUPPLIES

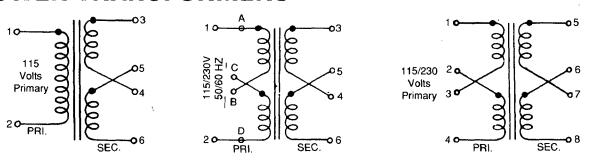
		Secondary #1		Secondary #2		DC Output #1		DC Output #2	
Part No.	VA (Size)	AC Volts	RMS Amps	AC Volts	RMS Amps	CT FW DC Volts	mA DC	CT FW DC Volts	mA DC
PFT12-35	12	16.0 CT	0.36	35.0 CT	.15	+8.75*	300	±22*	85
PFT12-28	12	16.0 CT	0.36	28.0 CT	.187	+8.75*	300	±17.6	106
PFT24-35	24	16.0 CT	0.72	35.0 CT	.30	+8.75*	600	±22*	170
PFT24-28	24	16.0 CT	0.72	28.0 CT	.375	+8.75*	600	±17.6	212

*+8.75, ±17.6 or ±22 DC output volts are for inputs to +5V and ±12 or ±15V IC Voltage Regulators.
See PFT schematic. Line input 115/230V ±10%.

PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS

- COMPACT DESIGN FOR MINIATURIZED SOLID STATE CIRCUITRY
- FOR POWER SUPPLIES, INSTRUMENTS AND CONTROL APPLICATIONS
- DUAL SECONDARIES MAY BE PARALLEL OR SERIES CONNECTED

Top lugs on PC2000 series provide for 115/230V primary voltage options without changes in PC board.
PC 3000 series has 8 PC pins. 50/60 Hz.

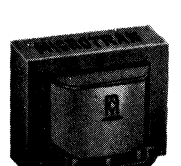


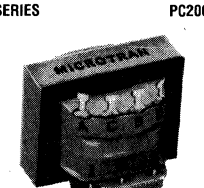
PC6000 SERIES PC3000 SERIES PC2000 SERIES

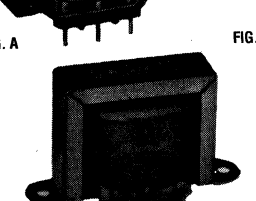
Primary						Secondary			
115V		115/230V				Parallel Connected		Series Connected	
Part No.	Fig.	Part No.	Fig.	Part No.	Fig.	AC Volts	RMS Amps	AC Volts	RMS Amps
PC6506	A	PC2506	C	PC3506	A	6.3 CT	.250	(Single Secondary)	
PC6512	A	PC2512	C	PC3512	A	12.6	.120	25.2 CT	.060
PC6524	A	PC2524	C	PC3524	A	40	.040	80.0 CT	.020
PC6528	A	PC2528	C	PC3528	A	58	.026	116.0 CT	.013
PC6608	B	PC2608	D	PC3608	B	6.3	.700	12.6 CT	.350
PC6616	B	PC2616	D	PC3616	B	28	.156	56.0 CT	.078
PC6624	B	PC2624	D	PC3624	B	40	.110	80.0 CT	.055
PC6628	B	PC2628	D	PC3628	B	58	.066	116.0 CT	.033
PC6632	B	PC2632	D	PC3632	B	115.0V	@ .020A	& 12.6V	@ .150A
PC6708	B	PC2708	D	PC3708	B	6.3	1.200	12.6 CT	.600
PC6712	B	PC2712	D	PC3712	B	12.6	.600	25.2 CT	.300
PC6715	B	PC2715	D	PC3715	B	20	.370	40.0 CT	.185
PC6716	B	PC2716	D	PC3716	B	28	.270	56.0 CT	.135
PC6724	B	PC2724	D	PC3724	B	40	.180	80.0 CT	.090
PC6728	B	PC2728	D	PC3728	B	58	.130	116.0 CT	.065
PC6732	B	PC2732	D	PC3732	B	115.0 V	@ .025A	& 12.6V	@ .250 A

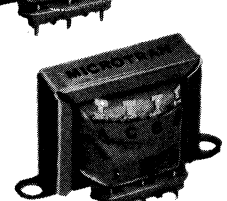
Series	Watts	W	D	H	Wt. Oz.
PC2500/PC3500/PC6500	1.5	1.390	1.156	1.172	3.2
PC2600/PC3600/PC6600†	4.5	1.703	1.25	1.390	6.5
PC2700/PC3700/PC6700‡	7.5	1.953	1.469	1.641	9.5

† Channel mounting 2" M.C. ‡2.375" M.C.


FIG. A


FIG. C


FIG. B


FIG. D

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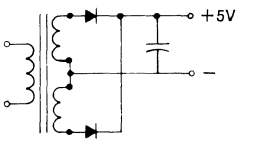
POWER TRANSFORMERS

plug-in printed circuit power transformers

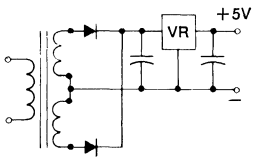
FOR DC POWER SUPPLIES

For Microprocessor Logic and OP AMP Power Supplies. For construction of low cost, miniaturized, regulated and unregulated DC power supplies for latest solid-state digital and linear circuitry. Permits packaging flexibility unobtainable with prepackaged power supplies. Low-profile, miniaturized construction permits close stacking of P.C. boards. Precision spaced molded-in terminals. All primaries 115 V 50/60 Hz except PCL6600 Series. 115 230V 50/60 Hz. **Transformers supplied with engineering bulletin providing schematics and suggested components.**

TRANSFORMERS FOR +5V DC UNREGULATED AND REGULATED POWER SUPPLIES



#1 — UNREGULATED

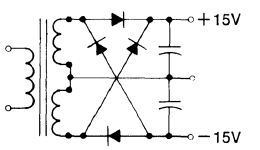


#2 — REGULATED

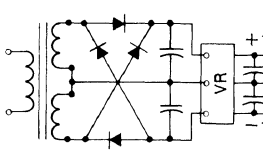
Part No.	SECONDARY Parallel Connected AC Volts	SECONDARY Parallel Connected RMS Amps	SECONDARY Series Connected AC Volts	SECONDARY Series Connected RMS Amps	DC OUTPUT C.T.F.W. DC Volts	DC OUTPUT Current mA DC	DC OUTPUT Schematic No.	Fig.
PC6205	4.50	0.18	9.0 CT	0.09	+5	75	1	A
PC6505	4.50	0.36	9.0 CT	0.18	+5	150	1	B
PC6605	4.50	1.10	9.0 CT	0.55	+5	450	1	D
PCL6605*	4.50	1.10	9.0 CT	0.55	+5	450	1	C
PC6705	4.50	2.00	9.0 CT	1.00	+5	825	1	D
PC6905	4.50	5.00	9.0 CT	2.50	+5	2000	1	A
PC6210	7.75	0.12	15.5 CT	0.06	+8.5†	50	2	A
PC6510	7.75	0.22	15.5 CT	0.11	+8.5†	90	2	B
PC6610	7.75	0.64	15.5 CT	0.32	+8.5†	265	2	D
PCL6610*	7.75	0.64	15.5 CT	0.32	+8.5†	265	2	C
PC6710	7.75	1.20	15.5 CT	0.60	+8.5†	500	2	D
PC6910	7.75	3.10	15.5 CT	1.55	+8.5†	1300	2	A

†+8.5 DC output volts for input to +5V IC Voltage Regulator, see Typical Schematic Regulated.
*115/230V primary.

TRANSFORMERS FOR ±15V DC DUAL OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES



#3 — UNREGULATED

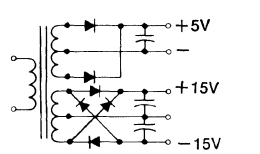


#4 — REGULATED

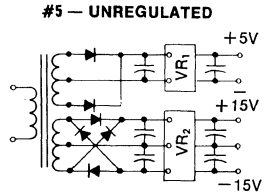
Part No.	SECONDARY Parallel Connected AC Volts	SECONDARY Parallel Connected RMS Amps	SECONDARY Series Connected AC Volts	SECONDARY Series Connected RMS Amps	DC OUTPUT C.T.F.W. DC Volts	DC OUTPUT Current mA DC	DC OUTPUT Schematic No.	Fig.
PC6211	12.0	0.07	24.0 CT	0.035	±15	22	3	A
PC6511	12.0	0.13	24.0 CT	0.065	±15	40	3	B
PC6611	12.0	0.40	24.0 CT	0.200	±15	120	3	D
PCL6611*	12.0	0.40	24.0 CT	0.200	±15	120	3	C
PC6711	12.0	0.76	24.0 CT	0.380	±15	220	3	D
PC6911	12.0	1.90	24.0 CT	0.950	±15	550	3	A
PC6214	16.0	0.05	32.0 CT	0.025	±20†	15	4	A
PC6514	16.0	0.10	32.0 CT	0.050	±20†	30	4	B
PC6614	16.0	0.30	32.0 CT	0.150	±20†	90	4	D
PCL6614*	16.0	0.30	32.0 CT	0.150	±20†	90	4	C
PC6714	16.0	0.56	32.0 CT	0.280	±20†	165	4	D
PC6914	16.0	1.40	32.0 CT	0.700	±20†	410	4	A

† ±20 DC output volts for input to ±15V IC Voltage Regulator, see Typical Schematic - Regulated.
*115/230V primary.

TRANSFORMERS FOR +5V AND ±15V DC TRIPLE OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES



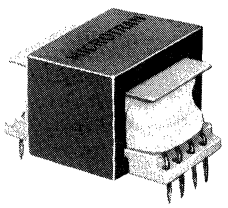
#5 — UNREGULATED



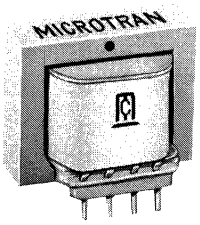
#6 — REGULATED

Part No.	SECONDARY #1 AC Volts	SECONDARY #1 RMS Amps	SECONDARY #2 AC Volts	SECONDARY #2 RMS Amps	DC OUTPUT #1 C.T.F.W. DC Volts	DC OUTPUT #1 mA DC	DC OUTPUT #2 C.T.F.W. DC Volts	DC OUTPUT #2 mA DC	Schematic No.	Fig.
PCT6230	9.0 CT	0.048	24.0 CT	0.020	+5	40	±15	12	5	A
PCT6530	9.0 CT	0.072	24.0 CT	0.032	+5	60	±15	12	5	B
PCT6630	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	5	D
PCL6630*	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	5	C
PCL6730*	9.0 CT	0.480	24.0 CT	0.160	+5	400	±15	100	5	D
PCT6930	9.0 CT	1.200	24.0 CT	0.440	+5	1000	±15	275	5	A
PCT6531	15.5 CT	0.048	32.0 CT	0.020	+8.5†	40	±20†	12	6	B
PCT6631	15.5 CT	0.140	32.0 CT	0.058	+8.5†	115	±20†	35	6	D
PCL6631*	15.5 CT	0.140	32.0 CT	0.058	+8.5†	115	±20†	35	6	C
PCT6731	15.5 CT	0.300	32.0 CT	0.100	+8.5†	250	±20†	60	6	D
PCT6931	15.5 CT	0.690	32.0 CT	0.298	+8.5†	575	±20†	175	6	A

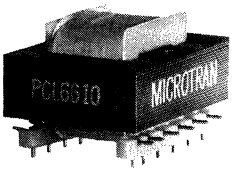
† +8.5 and ±20 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator, See Typical Schematic - Regulated
*115/230V primary.



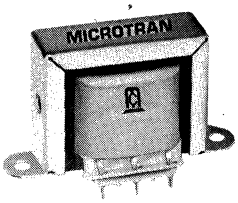
6200/PCT6200 SERIES
PC6900/PCT6900 SERIES
FIG. A



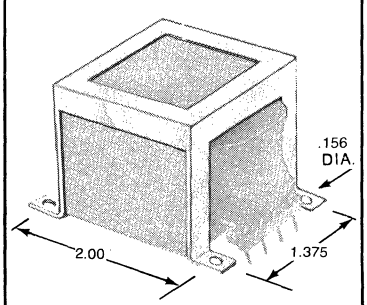
PC6500/PCT6500 SERIES
FIG. B



PCL6600 SERIES
FIG. C



PC6600/PCT6600 SERIES
PC6700/PCT6700 SERIES
FIG. D



SLIP-ON BRACKET
For PC6900 Series
Order as Part Number PC6900-FB
Max. Height 1.438"

DIMENSIONAL CHART

Series	Watts	W (Inches)	D (Inches)	H (Inches)	Wt. Oz.
PC6200/PCT6200	1.0	1.016	1.375	.844	2.3
PC6500/PCT6500	1.5	1.391	1.156	1.172	3.2
PC6600/PCT6600†	4.5	1.703	1.250	1.391	6.5
PCL6600	4.5	1.797	1.406	1.187	6.6
PC6700/PCT6700‡	7.5	1.953	1.469	1.641	9.5
PC6900/PCT6900	24.0	1.641	2.25	1.344	12.0

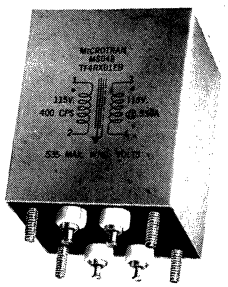
† Channel mounting 2" M.C. ‡ 2.375" M.C.

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POWER TRANSFORMERS AND INDUCTORS

MICROTRAN company, inc.

FIG A:



HERMETICALLY SEALED PER MIL-T-27.

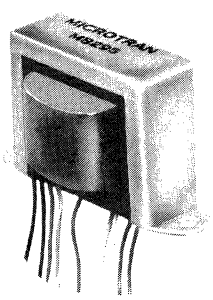
50/60 Hz CONTROL AND POWER SUPPLY TRANSFORMERS—MIL/COMMERCIAL

Designed for solid state and low voltage power supply applications. Primary 105/115/125 Volts. Part numbers listed on left are hermetically sealed per MIL Designation: TF4S03XX. Part numbers listed on right are open frame construction.

MIL		COMMON ELECTRICAL RATINGS				COMMERCIAL					
		Secondary		Rectifier Circuit				Open Frame Dimensions			
MIL Part No.	Fig. A MIL Case XX	AC Volts	RMS Amps	CT FW DC Volts**	FW Bridge DC Volts**	Open Frame Part No.	Fig.	L	W	H	Mounting Centers
M8042	AJ	6.3 CT	.6	1.9	3.8	M8242	FB	2.375	1.375	1.500	2.000
M8043	FB	6.3 CT	2.0	1.9	3.8	M8243	FB	3.250	1.625	1.940	2.812
M8086	GA	6.3 CT	6.0	1.9	3.8	M8286*	FB	3.688	2.125	2.250	3.125
M8087	GA	12.6 CT	3.0	4.7	9.4	M8287	FB	3.688	2.125	2.250	3.125
—	—	12 CT	4.0	9.9 (series)	19.8 (series)	M8247†	K	4.125	3.125	3.750	3.437×2.500
		12	4.0	9.9 (series)	19.8 (series)						
M8044	JB	12.6 CT	2.0	10.5 (series)	21 (series)	M8244	K	3.375	2.875	3.094	2.812×2.500
		12.6	2.0	10.5 (series)	21 (series)						
M8022	JB	18.5 CT	3.0	7.4	14.8	M8222	K	3.375	2.500	3.094	2.812×2.125
M8088	HA	26 CT	2.5	10.8	21.6	M8288	K	3.000	2.750	2.750	2.500×3.375
M8152	AJ	28 CT	0.15	11.7	23.4	—	—	—	—	—	—
M8045	FA	28 CT	.6	11.7	23.4	M8245	FB	3.250	2.125	1.940	2.812
M8055	JA	30 CT	2.5	12.5	25	M8255	K	3.750	2.750	3.469	3.125×2.250
M8023	KA	35 CT	3.0	14.5	29	M8223*	K	4.125	3.000	3.750	3.438×2.375
M8089	AJ	40 CT	.1	17	34	M8289	FB	2.375	1.375	1.500	2.000
M8090	EA	40 CT	.3	17	34	M8290	FB	2.812	1.625	1.625	2.375
M8091	GB	40 CT	.75	17	34	M8291	FB	3.688	2.125	2.250	3.125
M8046	LA	49 CT	2.5	21	42	M8246	K	4.500	3.250	4.031	3.750×2.500
M8024	JA	70 CT	1.0	30	60	M8224	K	3.750	2.750	3.469	3.125×2.250
M8056	HA	80 CT	.6	35	70	M8256	K	3.000	2.625	2.750	2.500×2.375

†Secondary may be connected in series to provide 24V @ 4A or parallel for 12 V @ 8A. *60 Hz only.
**DC Output for resistive or inductive loads. Output volts based on approx. 1V drop per rectifier.

FIG. FB



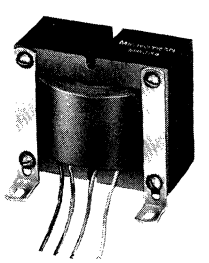
50/60 Hz ISOLATION/POWER TRANSFORMERS—MIL/COMMERCIAL

Center tap permits use in either F.W. Bridge or F.W. CT circuitry. Electrostatic shielding. Part numbers listed on left are hermetically sealed per MIL Designation: TF4S03XX. Part numbers listed on right are open frame construction.

MIL		COMMON ELECTRICAL RATINGS				COMMERCIAL					
								Open Frame Dimensions			
MIL Part No.	Fig. A MIL Case XX	Input Voltage	Output Voltage	Current RMS Amps	VA Rating	Open Frame Part No.	Fig.	L	W	H	Mounting Centers
M8094	AH	115	115 CT	0.0085	1	M8294	FB	2.125	1.125	1.187	1.750
M8095	EA	115	115 CT	0.030	3.5	M8295	FB	2.812	1.625	1.625	2.375
			12.6 CT	0.25	3.15						
			12.6	0.25	3.15						
M8151	FA	115	115 CT	0.13	15	M8251	FB	3.250	1.625	1.940	2.812
M8096*	GA	115	115 CT	0.35	40	M8296*	FB	4.000	2.250	2.562	3.562
M8078*	KA	115	115 CT	0.9	100	M8278*	K	3.750	3.125	3.469	3.125×2.750

*Primary 105/115/125V.

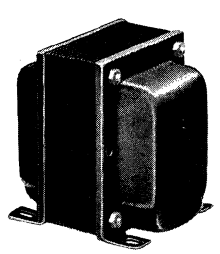
FIG. K



FILTER INDUCTORS—MIL/COMMERCIAL

For 50/60 and 400 Hz Power Supplies. 1500 Test Volt. May be connected in series or parallel for inductive requirements. Part numbers listed on left are hermetically sealed per MIL Designation: TF4S03XX. Part numbers listed on right are open frame construction. Inductance values shown are for 60 Hz, except M8102 120 Hz.

MIL		COMMON ELECTRICAL RATINGS						COMMERCIAL					
		Series Connected			Parallel Connected					Open Frame Dimensions			
MIL Part No.	Fig. A MIL Case XX	Inductance Henrys	DC Amps	DCR Ohms	Inductance Henrys	DC Amps	DCR Ohms	Open Frame Part No.	Fig.	L	W	H	Mounting Centers
M8098	AH	3.5	0.050	200	0.875	0.10	50	M8198	FB	2.125	1.125	1.189	1.750
M8099	AJ	1.0	0.15	65	0.25	0.30	16	M8199	FB	2.375	1.250	1.500	2.000
M8100	EB	0.5	0.3	30	0.125	0.6	7.5	M8200	FB	2.812	1.375	1.625	2.375
M8101	FB	0.32	0.6	16	0.08	1.2	4	M8201	FB	3.250	1.625	1.940	2.812
M8102	JA	0.2	1.0	4	0.05	2.0	1	M8202	K	3.375	2.375	3.094	2.812×2.125
M8103	JA	0.07	2.5	0.84	0.0175	5.0	0.21	M8203	K	3.750	2.875	3.469	3.125×2.500
M8104	JA	0.022	4.0	0.4	0.0055	8.0	0.1	M8204	K	3.375	2.750	3.094	2.812×2.500
M8105	KA	0.022	5.0	0.2	0.0055	10.0	0.05	M8205	K	4.500	3.125	4.031	3.750×2.500



VERTICAL END BELL

50/60 Hz STEP DOWN AUTOFORMER—COMMERCIAL

240/220V to 120/110V. Equipped with 3 prong 6 foot U.L. line cord & receptacle for safety. Baked enamel finish.

Part No.	Output Watts (VA)	Typical Dimensions			Typical Mounting Centers†	Typical Wt. Lbs.
		L	W	H		
M1552*	80	3.719	2.500	2.281	3.125	3.5
M1556	100	3.125	2.875	3.500	1.750×2.250	4
M1553	150	3.250	2.875	3.500	2.250×2.375	5
M1555	250	3.875	3.250	3.875	2.688×2.500	6
M1559	350	3.750	3.875	4.625	2.438×3.000	7
M1558	500	4.875	3.875	4.625	2.562×3.000	12
M1551	750	5.500	4.500	5.375	3.250×3.500	16
M1557	1000	7.000	4.500	5.375	5.250×3.500	25
M1554	1500	8.000	4.500	5.375	6.250×3.500	29
M1550	2000	8.500	4.375	6.000	6.312×3.438	37

*Supplied with 2 prong line cord and receptacle. † Contact factory for exact mounting centers.

DIMENSIONS IN INCHES.

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MICROTRAN company, inc.

POWER TRANSFORMERS



FIG. A

FIG. A:
HERMETICALLY SEALED

Per MIL-T-27
MIL Designation: TF4S03XX
See Page 31 for MIL Case Dimensions.



FIG. B

FIG. B:
HERMETIC

Height (H) for M8063—.688″; M8069—.938″; M8058, M8075; M8081, M8082—1.438″.
MIL Designation: TF4R03YY

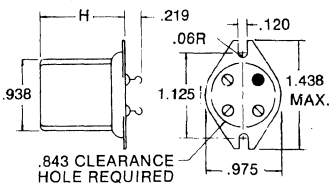




FIG. C

FIG. C:
TOROIDAL MOLDED

Molded with .50″ pins for printed circuit applications.
MIL Designation: TF5S03XX

400 Hz POWER SUPPLY TRANSFORMERS

For Silicon Rectifier Circuitry, and Filament Applications
Primary 105/115/125 Volts MIL Designation: TF4S03XX

Part No.	Secondary AC Volts	Secondary RMS Amps	Rectifier Circuit CT FW DC Volts**	Rectifier Circuit FW Bridge DC Volts**	Fig. A MIL Case XX
M8063†	2.85 2.85	0.045 0.045	1.5 (series)	3	YY Fig. B
M8064†	6.3 CT	0.6	1.9	3.8	AH
M8075†	6.3 CT	0.3	1.9	3.8	YY Fig. B
M8076†	12.6 CT	0.3	4.7	9.4	AH
M8039	12.6 12.6 CT	0.8 0.8	10.5 (series)	21 (series)	AJ
M8077	12.6 12.6 CT	2 2	10.5 (series)	21 (series)	FA
M8038	12.6 12.6 12.6	0.3 0.3 0.3	16 (series)	32 (series)	AJ
M8018	18.5 CT	1	7.4	14.8	EA
M8019	18.5 CT	3	7.4	14.8	FA
M8065	26 CT	1.5	10.8	21.6	EA
M8066	26 CT	3	10.7	21.5	FA
M8079	26 CT	4	10.8	21.6	HA
M8067	30 CT	1.5	12.5	25	FB
M8020	35 CT	3	14.5	29	GA
M8068	40 CT	0.2	17	34	AJ
M8041†	50 CT	0.25	21.5	43	AH
M8080	50 CT	0.20	21.5	43	AJ
M8069†	60 CT	0.003	26	52	YY Fig. B
M8070†	65 CT	0.170	28.4	56.8	AH
M8081†	65 CT	0.030	28.4	56.8	YY Fig. B
M8021	70 CT	1	30	60	FA
M8071	80 CT	0.90	35	70	FA

** DC Output for resistive or inductive loads. Output volts based on approx. 1V drop per rectifier.
† Primary 115V only.

400 Hz ISOLATION POWER TRANSFORMERS

Center Tap Permits Use in Either FW Bridge or FW CT Circuitry.
Electrostatic Shielding MIL Designation: TF4S03XX

Part No.	Primary Volts	Secondary AC Volts	Secondary RMS Amps	VA Rating	Fig. A MIL Case XX
M8082	26	12.6 CT 12.6	0.15 0.15	1.9 1.9	YY (Fig. B)
M8058	115	115 CT	0.017	2	YY (Fig. B)
M8083	115	115 CT 12.6 CT 12.6	0.030 0.25 0.25	10 Total	AJ
M8084	115	115 CT	0.12	14	AJ
M8059	115	115 CT	0.35	40	EB
M8085	115	115 CT	0.7	80	FA
M8060	115	115 CT	1.3	150	GA
M8061*	115	115 CT	2.6	300	JA
M8062*	115	115 CT	4.4	500	KA

* Primary 105/115/125V.

400 Hz TOROIDAL POWER TRANSFORMERS

Toroidal cores permit smaller height and package and greater efficiency. Size and savings up to 30%. Epoxy molded. Printed circuit pins can be bent for chassis mounting. Low phase shift. See Fig. C for illustration.

For Applications Requiring Minimum Size and Weight.
Primary 115 Volts MIL Designation: TF5S03ZZ

Part No.	Secondary AC Volts	Secondary RMS mA	VA	Dimensions OD	Dimensions Height	Nominal Wt. Oz.
M8106	28 CT	320	9	1.156	1.125	2
M8107	28 CT	710	20	1.500	1.250	4
M8108	56 CT	160	9	1.156	1.125	2
M8109	56 CT	356	20	1.500	1.250	4
M8110	115 CT	78	9	1.156	1.125	2
M8111	115 CT	170	20	1.500	1.250	4

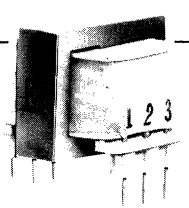
.170 Clearance Hole for #8 Screw.

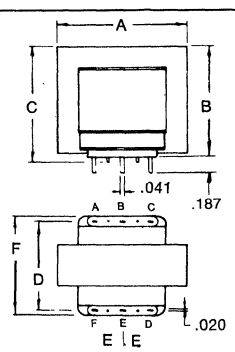
400 Hz PRINTED CIRCUIT POWER

Compact design for miniature solid state circuitry. Precision spaced molded-in terminals for power supplies, control equipment, instrument and similar applications. — Dual secondaries may be connected in series or parallel for varied voltage and current requirements. 115V Primary. See chart to right.

Part No.	Secondary Parallel	Secondary Series
PC4304	3.15V @ .1A	6.3V CT @ .05A
PC4312	12.6V @ .026A	25.2V CT @ .013A
PC4316	28V @ .012A	56V CT @ .006A
PC4320	35V @ .01A	70V CT @ .005A
PC4408	6.3V @ .60A	12.6V CT @ .30A
PC4412	12.6V @ .30A	25.2V CT @ .15A
PC4416	28V @ .14A	56V CT @ .07A
PC4424	40V @ .10A	80V CT @ .05A
PC4428	58V @ .066A	116V CT @ .033A
PC4432	115V @ .010A, 12.6V @ .150A	

DIMENSIONS IN INCHES.





PC4300/PC4400 SERIES

DIMENSIONS

Series	A	B	C	D	E	F	Wt. Oz.
PC4300	.766	.719	†	0.420	0.187	.688	0.5
PC4400	1.016	.844	†	0.781	0.200	.953	1.2

† Do not have standoff.

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CONVERTER TRANSFORMERS

MICROTRAN company, inc.

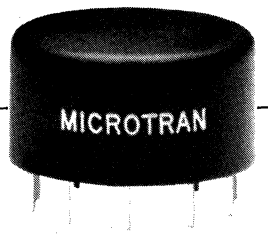
dc to dc converter transformers

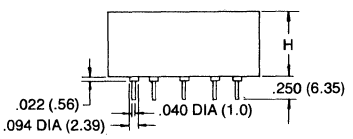
For Military Applications

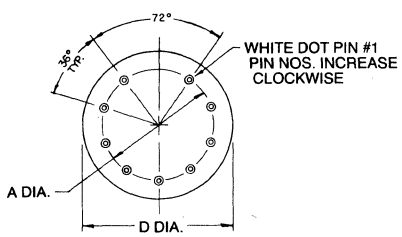
50 KHz—150KHz Switching Frequency

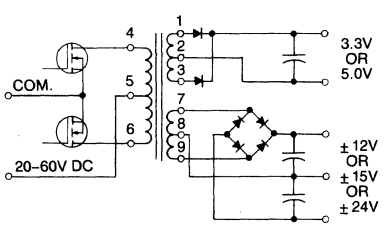
- For military/aerospace and ruggedized industrial applications
- MIL-T-27 Grade 5, Class S, TF5S03ZZ
- Triple Output
- High efficiency—Designed for MOSFET Push-Pull Circuitry
- Low profile PCB construction
- Magnetically shielded
- Schematics and parts list provided with units
- Standoffs permit use of wave soldering

NEW!









SPECIFICATIONS

Input Voltage: 20-60V DC
Dielectric Strength: 500V RMS
Operating Temperature: –55°C to 130°C Class S insulation
Insulation Resistance: Over 10,000 Megohm @ 500V DC
Thermal Shock: MIL-STD-202D, Method 107, Test Condition A-1

Part No.	DC Output #1 Volts	DC Output #1 DC Amps	DC Output #2 Volts	DC Output #2 DC Amps
SPC1 SIZE SERIES — 10 WATTS				
SPC1-312	3.3	1.51	±12	.210
SPC1-315	3.3	1.51	±15	.167
SPC1-324	3.3	1.51	±24	.104
SPC1-512	5.0	1.00	±12	.210
SPC1-515	5.0	1.00	±15	.167
SPC1-524	5.0	1.00	±24	.104
SPC2 SIZE SERIES — 20 WATTS				
SPC2-312	3.3	3.00	±12	.420
SPC2-315	3.3	3.00	±15	.330
SPC2-324	3.3	3.00	±24	.210
SPC2-512	5.0	2.00	±12	.420
SPC2-515	5.0	2.00	±15	.330
SPC2-524	5.0	2.00	±24	.210
SPC3 SIZE SERIES — 30 WATTS				
SPC3-312	3.3	4.55	±12	.625
SPC3-315	3.3	4.55	±15	.500
SPC3-324	3.3	4.55	±24	.310
SPC3-512	5.0	3.00	±12	.625
SPC3-515	5.0	3.00	±15	.500
SPC3-524	5.0	3.00	±24	.310
SPC4 SIZE SERIES — 45 WATTS				
SPC4-312	3.3	6.82	±12	.940
SPC4-315	3.3	6.82	±15	.750
SPC4-324	3.3	6.82	±24	.469
SPC4-512	5.0	4.50	±12	.940
SPC4-515	5.0	4.50	±15	.750
SPC4-524	5.0	4.50	±24	.469
SPC5 SIZE SERIES — 60 WATTS				
SPC5-312	3.3	9.10	±12	1.250
SPC5-315	3.3	9.10	±15	1.000
SPC5-324	3.3	9.10	±24	.625
SPC5-512	5.0	6.00	±12	1.250
SPC5-515	5.0	6.00	±15	1.000
SPC5-524	5.0	6.00	±24	.625

Other ratings and sizes are available on special order.

DIMENSIONS Inches (mm)

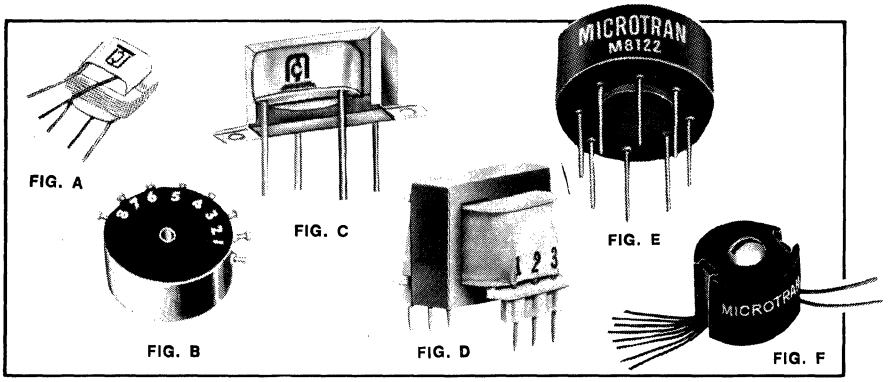
Series	Size	Watts	D Max	H Max	A	Oz. (Gm)
SPC1	1	10	.76 (19.3)	.35 (8.9)	.58 (14.7)	.28 (8)
SPC2	2	20	.87 (22.1)	.45 (11.4)	.69 (15.2)	.50 (14)
SPC3	3	30	1.11 (28.2)	.51 (13.0)	.915 (23.2)	.81 (23)
SPC4	4	45	1.26 (32.0)	.65 (16.5)	1.04 (26.4)	1.31 (37)
SPC5	5	60	1.51 (38.4)	.80 (20.3)	1.23 (31.2)	1.91 (54)

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MICROTRAN company, inc.

CONVERTER TRANSFORMERS

d.c. to d.c. converter transformers



APPLICATIONS:

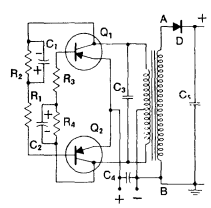
- Portable Radiation Monitors
- Infra-Red Detectors
- Op-Amp Power Supplies
- DC Isolation
- Geodetic-Oceanographic-Medical Equipment
- Mobile Equipment
- High Intensity Flashers
- DC Supply for Modular Equipment

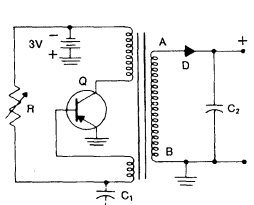
Select Unit to meet your Power and Size Requirements	Part No.	Total VA Output	DC Input Volts	DC Output				Switch Freq. Hz Approx.	Typical Transistor	Dimensions (Inches)					Type of Construction	Fig.	Schematic	Approx. Wt. Oz.
				Bridge		CT Full Wave				L	W	H	Mounting Centers MD	Mounting Centers MW				
				Volts	mA	Volts	mA											
25 mW to 190 mW HIGH VOLTAGE LOW POWER MINIATURE DESIGN	M8149	25 mW	3	1000*	25 μA	—	—	400	2N670	1 1/64	61/64	27/32	—	—	Printed Circuit	D	2	1.25
	M8050	25 mW	3	1000*	25 μA	—	—	400	2N670	1 11/16	13/16	27/32	1 3/8	—	Open Frame	C	2	1.25
	M8073	25 mW	4	425-500*	50 μA	—	—	50-3k†	2N1305	3/8	3/8	3/8	—	—	Open Frame	A	3	0.1
	M8074	50 mW	3	535*	90 μA	—	—	400	2N414	1 11/16	13/16	27/32	1 3/8	—	Open Frame	C	4	1.25
	M8072	190 mW	2.7	480*	400 μA	—	—	800	2N1307	1 11/16	13/16	27/32	1 3/8	—	Open Frame	C	1	1.25
	M8120	190 mW	28	480*	400 μA	—	—	3.5k	2N4355	1 11/16	13/16	27/32	1 3/8	—	Open Frame	C	7	1.25
3 VA	M8121	3	5	190*	15	—	—	20k	2N6121	9/16D x 11/32H—‡					Pot Core	F	8	0.3
5 VA LOW PROFILE ENCAPSULATED	M8115	5	13.8	±250 or 500	10	250	20	6k	2N3054	1 1/4 D x 3/4 H—0.140 Cl. Hole					Molded Toroid	B	6	1.1
	M8117	5	28	±250 or 500	10	250	20	6k	2N3054	1 1/4 D x 3/4 H—0.140 Cl. Hole					Molded Toroid	B	5	1.1
	M8122	5	5	±15 or 30	175	15	350	20k	2N3055	7/8 D x 17/32 H					P.C. Molded Toroid	E	5	1.1
30 VA LOW PROFILE ENCAPSULATED	M8132	30	13.8	±15 or 30	1000	15	2000	20k	2N3055	1 1/4 D x 3/4 H—0.140 Cl. Hole					Molded Toroid	B	5	1.1
	M8133	30	28	±15 or 30	1000	15	2000	20k	2N3055	1 1/4 D x 3/4 H—0.140 Cl. Hole					Molded Toroid	B	5	1.1

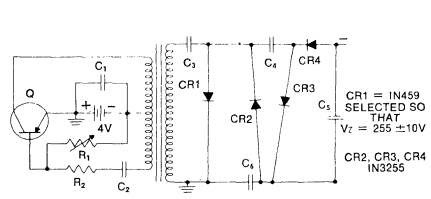
‡ Supplied with 4-40 nylon mtg. screw and nut in center hole. * Output when used with schematic indicated. † Frequency depends on load and bias conditions.

ALL CONVERTER TRANSFORMERS ARE SUPPLIED WITH ENGINEERING BULLETIN LISTING COMPONENT VALUES

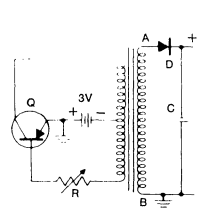
TYPICAL DC-DC CONVERTER TRANSFORMER CIRCUITS

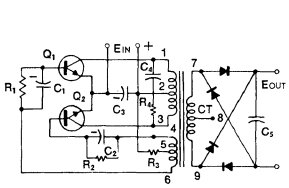

SCHEMATIC 1

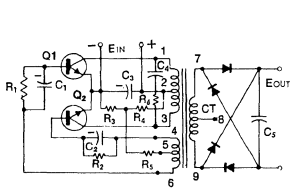

SCHEMATIC 2

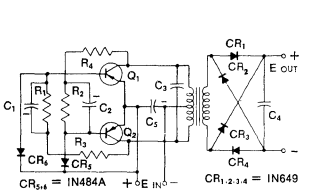


SCHEMATIC 3

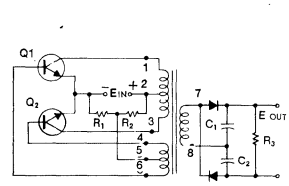

SCHEMATIC 4


SCHEMATIC 5


SCHEMATIC 6



SCHEMATIC 7


SCHEMATIC 8

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TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, inc.

line coupling

FOR INTERCONNECT OF VOICE/DATA MODEM TERMINALS TO TELEPHONE LINES

Provides line isolation and matching—Prevents line imbalance—Wide dynamic signal capability—Low distortion
Permits optimum use of Voice-Grade Telephone Lines for broadband data signals—Designed to meet FCC Part 68

- Frequency Response: 300-3500 Hz ±0.5 dB
- Level: −45 dBm to +7 dBm
- Longitudinal Balance: Per FCC 68.310
- Distortion: 0.5% Max.
- Impedance Matching ±10% over entire frequency range
- Dielectric Strength 1500V RMS

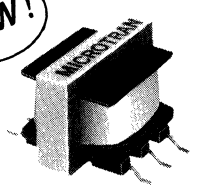
VOICE/DATA COUPLING

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Ins. Loss dB	Pri. DCR	Sec. DCR	Schematic	Fig.	Application Notes
PM32-F	600	600	1.5	1.6	75	105	1	X	Frequency response 300 Hz–100 kHz±2 dB. 0.27" H. 1000V hipot.
PM34-F	600 CT	600 CT	3	1.6	75	105	14	Y	Frequency response 300 Hz–100 kHz±2 dB. 0.27" H. 1000V hipot.
PM32-M	600	600	1.5	1.6	75	105	1	U	Frequency response 300 Hz–100 kHz±2 dB. Molded construction.
PM34-M	600 CT	600 CT	3	1.6	75	105	14	V	Frequency response 300 Hz–100 kHz±2 dB. Molded construction.
T1104	600	600	0	1.0	46	63	1	C	Very low profile.
T1104-M	600	600	0	1.0	46	63	1	D	Very low profile. Molded per MIL-T-27 Grade 5.
TL1104	600	600	0	1.5	66	102	1	T	For dry circuits.
TS1104	600	600	0	1.0	46	63	1	A	Surface mount. Very low profile.
TS1104-M	600	600	0	1.0	46	63	1	B	Surface mount. Very low profile. Molded to meet MIL-T-27 Grade 5.
TL1106	600 CT	600 CT	0	1.5	66	102	6	T	For dry circuits.
TS1106	600 CT	600 CT	0	1.5	46	63	6	A	Surface mount. Very low profile.
TS1106-M	600 CT	600 CT	0	1.5	46	63	6	B	Surface mount. Very low profile. Molded to meet MIL-T-27 Grade 5.
TL1114	600 CT	600 Split	90	1.8	73	134	19	W	Handles loop currents.
T2104	600	600	0	1.0	36	50	1	E	
TH2104	600	600	0	1.0	38	52	1	E	3750V RMS hipot. For International applications.
T2106	600 CT	600 CT	0	1.0	36	50	6	H	
TH2106	600 CT	600 CT	0	1.0	38	52	6	H	3750V RMS hipot. For International applications.
TH9306	600 CT	600 CT	0	1.5	44	56	6	S	3750V RMS hipot between windings, 1250V between windings and core. For International applications.
T2108	600	900	0	1.0	36	77	1	E	
T2110	900	900	0	1.0	55	78	7	F	Electrostatic shield.
T2316	4000	600	0	1.0	340	51	1	E	For bridging applications.
T4113	900/600	600 Split	60/75 Pri.	1.2	62	36/36	2	L	Level −15 to +7 dBm.
T5114	600	600 Split	75	1.7	100	49/49	8	M	
TH5114	600	600 Split	75	2.0	127	76/76	8	M	3750V RMS hipot. For International applications.
T5115	600	600 Split	120	0.8	40	25/25	9	N	
TH5116	600	600 Split	125	1.0	56	37/37	8	M	3750V RMS hipot. For International applications. Longitudinal balance 40 dB min.
T5117	600	600	125	1.1	45	58	1	M	
TH5117	600	600	125	1.1	56	74	1	M	3750V RMS hipot.
TH5118	600 Split	600	125	1.0	28/28	74	8	M	3750V RMS hipot.
T5119	600	600	100	1.5	62	108	1	M	
T6112	600	900/600	100/120 Sec.	0.5	25	126	5	J	Electrostatic shield.
T9116	600 Split	600 Split	80	2.0	95	180	16	P	Low crosstalk, 1500V Pri. to Sec. and core. 1000V Sec. to core.
T9117	600 Split	600 Split	80	1.3	78	92	17	P	Low crosstalk. Return loss 23 dB @ 440Ω + 0.035 µF. Parallel load. 1500V Pri. to Sec. and core. 1000V Sec. to core.

Available on special order with other ratings and constructions.

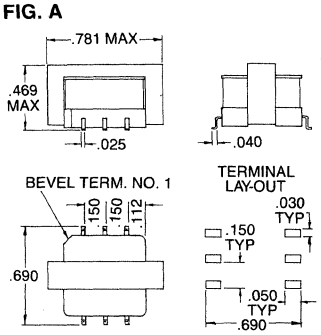
See outline dwgs. and schematic diagrams on following pages.

NEW!



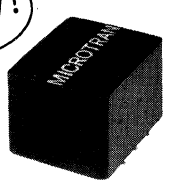
SURFACE MOUNT
Very low profile.
Open construction.
Vacuum varnish impregnated.
Wt. 0.4 oz.

FIG. A



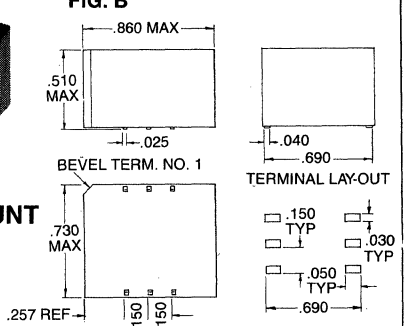
TERMINAL COPLANARITY 0.004 INCHES

NEW!



SURFACE MOUNT
Very low profile.
Molded construction.
MIL-T-27 TF5S21ZZ.
Wt. 0.5 oz.

FIG. B



TERMINAL COPLANARITY 0.004 INCHES

DIMENSIONS IN INCHES.

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MICROTRAN company, inc.

TELEPHONE INTERCONNECT TRANSFORMERS

line coupling—hybrid—holding coils

FOR INTERCONNECT OF VOICE/DATA MODEM TERMINALS TO TELEPHONE LINES

Provides line isolation and matching—Prevents line imbalance—Wide dynamic signal capability—Low distortion
Permits optimum use of Voice-Grade Telephone Lines for broadband data signals—Designed to meet FCC Part 68

- Frequency Response: 300-3500 Hz ±0.5 dB
- Level: −45 dBm to +7 dBm
- Longitudinal Balance: Per FCC 68.310
- Distortion: 0.5% Max.
- Impedance Matching ±10% over entire frequency range
- Dielectric Strength 1500V RMS

DATA MODEM COUPLING—NON-VOICE APPLICATION FOR 300/1200/2400 BPS MODEM BOARD FOR MICROCOMPUTERS

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Ins. Loss dB	Pri. DCR	Sec. DCR	Schematic	Fig.	Application Notes
TL1111	600 CT	600 Split	90	1.6 @ 1.8KHZ	63	103	19	W	Frequency response ±1.3 dB 500-3500 Hz, ±2.5 dB 300-3500 Hz @ 0 dBm. Impedance matching ±15%.
T2111*	600	600	90	2.0	71	117	12	Q	Low profile. Frequency response ±1 dB 660-3500 Hz @ 0 dBm, 2 kHz ref.
T2112*	600	600 CT	90	2.0	71	117	13	Q	Low profile. Frequency response ±1 dB 660-3500 Hz @ 0 dBm, 2 kHz ref.
T2113*	600	600	90	2.0	71	117	12	E	Frequency response ±1 dB 660-3500 Hz @ 0 dBm, 2 kHz ref.
T2114*	600	600 CT	90	2.1	71	117	13	H	Frequency response ±1 dB 660-3500 Hz @ 0 dBm, 2 kHz ref.
T9311	600	600	90	1.8	75	100	1	R	0.50" max. ht. Frequency response ±1.3 dB 500-3500 Hz, ±2.5 dB 300-3500 Hz @ 0 dBm.
T9312	600	600 Split	90	1.8	75	100	8	S	0.50" max. ht. Frequency response ±1.3 dB 500-3500 Hz, ±2.5 dB 300-3500 Hz @ 0 dBm.
T9317	600	600 Split	50	1.6	75	95	8	S	0.50" max. ht. Frequency response ±0.7 dB 500-3500 Hz, ±1.6 dB 300-3500 Hz @ 0 dBm.

*Except sec. to core, hipot 1000V RMS

HOLDING COILS

T4415	2.0 H/1.3 H	60/100	N/A	180	N/A	3	K	
T5415	1.4 H ±20%	120	N/A	90/90	N/A	4	M	Split winding, 1500V windings to core, 1500V between windings.
T7410	1.0 H/0.8 H	0/25	N/A	225	N/A	3	G	Toroidal construction, Low crosstalk, 1000V hipot.
T8410	1.0 H/0.8 H	0/40	N/A	113	N/A	3	G	Toroidal construction, Low crosstalk, 1000V hipot.

HYBRID—TWO REQUIRED FOR CONVENTIONAL HYBRID OPERATION

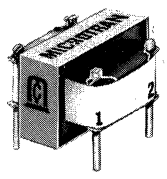
TL1220	600 (4W)	600/600	0	3.7*	39	37/37	10	T	For dry circuits.
TS1220	600 (4W)	600/600	0	3.7*	39	37/37	10	A	Surface mount. Very low profile.
TS1220-M	600 (4W)	600/600	0	3.7*	39	37/37	10	B	Surface mount. Very low profile. Molded to meet MIL-T-27 Grade 5.
TL1320	600 (4W)	600/600	80 (2W)	4.8*	98	78/78	20	W	Handles loop currents. Frequency response ±0.7dB 300-3500 Hz @ 0 dBm. Impedance matching ±15%.
T2220	600 (4W)	600/600	0	4.0*	57	42/42	10	H	Trans-hybrid loss 45 dB typical.
TH2220	600 (4W)	600/600	0	4.2*	60	25/25	2	Z	3750V RMS hipot except 200V between 2 wire and balance windings, Trans-hybrid loss 45dB typical.
T3220	600 (4W)	600/600	0	3.7*	34	25/25	10	I	Trans-hybrid loss 45 dB typical.
T4220	600 (1W)	600/600	60 (2W)	4.0*	61	62/62	11	L	Electrostatic shield.
T5220	600 (4W)	600/600	100 (2W)	3.6*	48	23/23	15	O	Trans-hybrid loss and longitudinal bal. >60 dB. Max. level +20 dBm. Electrostatic shield.
TH5220	600 (4W)	600/600	100 (2W)	3.7*	50	30/30	15	O	3750V RMS hipot except 1500V between 2 wire and balance windings. For Intl. applications. Max level +20 dBm. E.S.S.
T9220	600 (4W)	600/600	80 (2W)	4.6*	100	190	18	P	Low profile. Low crosstalk, DCR values are max.
T9320	600 (4W)	600/600	50 (2W)	4.4*	75	85/85	10	S	.50" max. ht. Frequency response ±0.7 dB 500-3500 Hz, ±1.6 dB 300-3500 Hz @ 0 dBm.

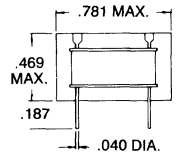
*Hybrid insertion loss includes 3 dB in balance network.

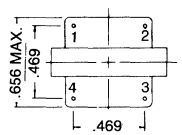
Available on special order with other ratings and constructions.

See outline dwgs. and schematic diagrams on following pages.

FIG. C



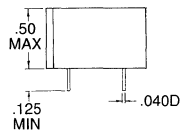


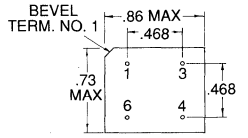


Plug-in printed circuit construction.
Vacuum finish impregnated.
Wt. 0.4 Oz.

FIG. D







Very low profile.
PC epoxy molded construction.
MIL-T-27 TF5S21ZZ.
Wt. 0.5 Oz.

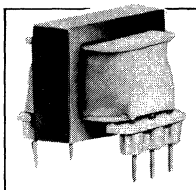
DIMENSIONS IN INCHES.

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TELEPHONE INTERCONNECT TRANSFORMERS

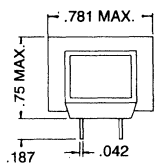
MICROTRAN company, inc.

OUTLINE DRAWINGS – TELEPHONE INTERCONNECT



Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.

FIG. E



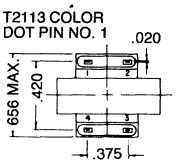
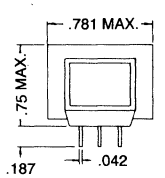
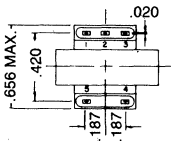
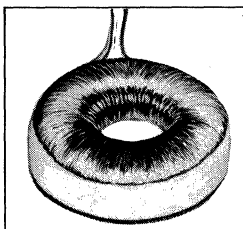


FIG. F

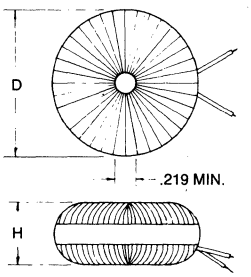




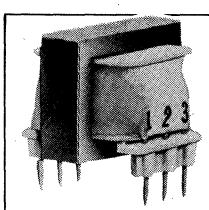


High-Q Toroid.
Microcrystalline wax impregnated.
Supplied with 4" #28 leads.

FIG. G

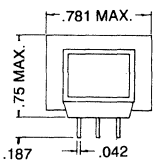


Size Series	D	H	Wt. Oz.
T7400	1	.406	.75
T8400	1.25	.625	2



Plug-in printed circuit construction.
Vacuum varnish impregnated.

FIG. H
Wt. 0.5 Oz.



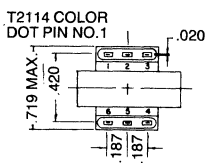
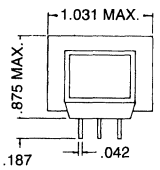
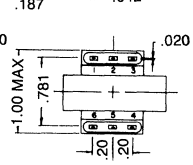
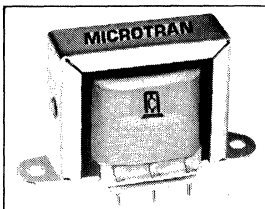


FIG. I
Wt. 1.2 Oz.

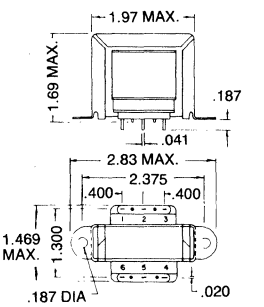


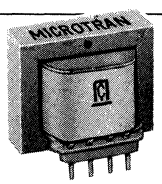




Plug-in printed circuit construction with mounting channel.
Vacuum varnish impregnated. Wt. 9.5 Oz.

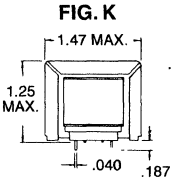
FIG. J





Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 3.5 Oz.
Available with mounting flanges **on Special Order.**
.187 Dia. holes, 1.75 mounting centers.
Add -FB to Part No.

FIG. K



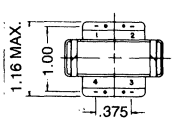
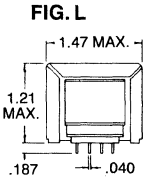
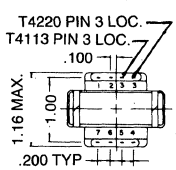
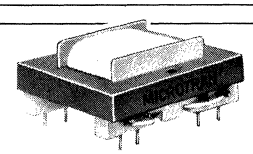


FIG. L



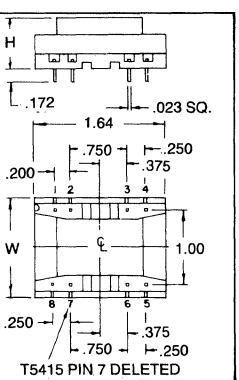


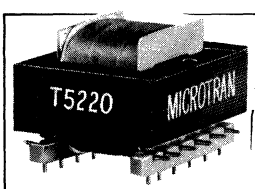


Flat Profile.
Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 2.5 Oz.

Part No.	H	W
T5114, T5415, T5119	.69	1.344
TH5114	.69	1.453
T5117, TH5116-18	.83	1.453

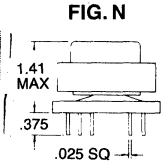
FIG. M





Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 5.5 Oz.

FIG. N



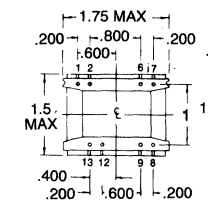
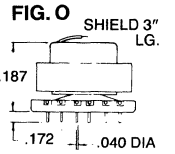
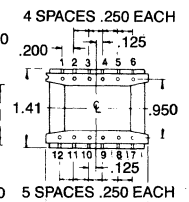
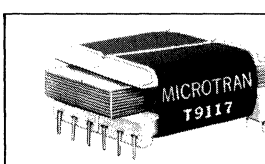


FIG. O

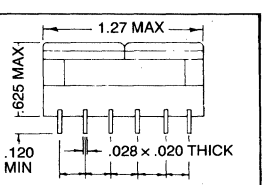


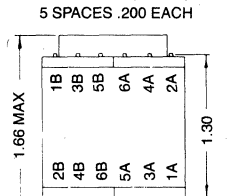




Low profile hum-bucking semi-toroidal construction.
High crosstalk attenuation.
Plug-in printed circuit construction. Vacuum varnish impregnated.
Wt. 2.2 Oz.

FIG. P





DIMENSIONS IN INCHES.

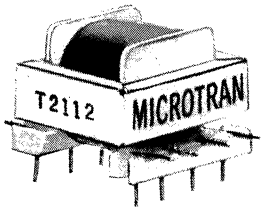
145 EAST MINEOLA AVENUE, P.O. BOX 236, VALLEY STREAM, NEW YORK 11582-0236 • TEL.: 516-561-6050 • FAX: 516-561-1117

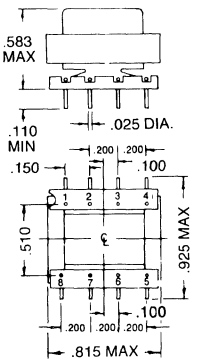
MICROTRAN company, inc.

TELEPHONE INTERCONNECT TRANSFORMERS

OUTLINE DRAWINGS –TELEPHONE INTERCONNECT

FIG. Q





Low-profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.

FIG. R



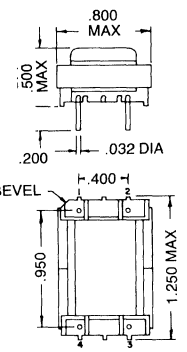
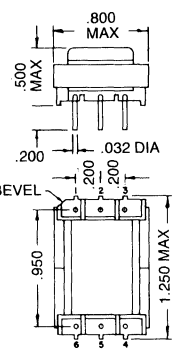
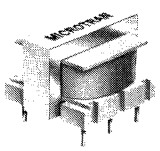


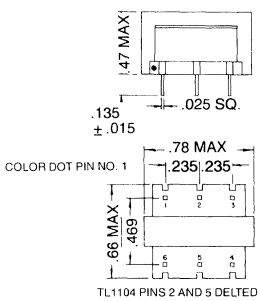
FIG. S



Very low profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.66 oz.

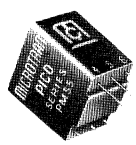
FIG. T





Very low profile.
PC construction.
Vacuum varnish impregnated.
Wt. 0.4 Oz.

FIG. U



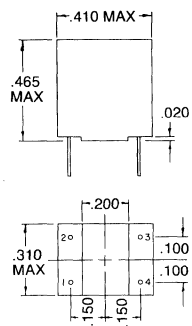
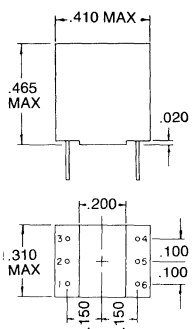
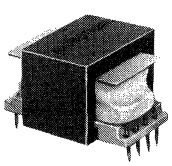


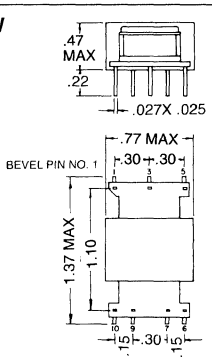
FIG. V



Pico miniature size.
Plug-in printed circuit construction. Epoxy molded to MIL-T-27 TF5S21ZZ. Tinned copperweld leads.
0.020×.75″. Wt. 0.1 Oz.

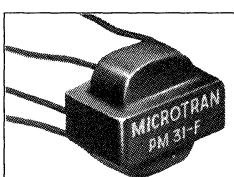
FIG. W





Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.76 oz.

FIG. X



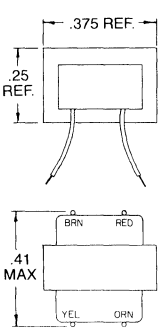
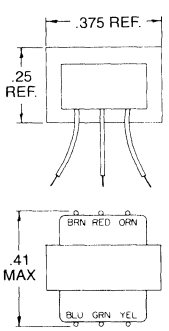
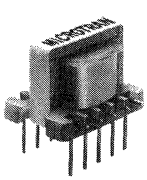


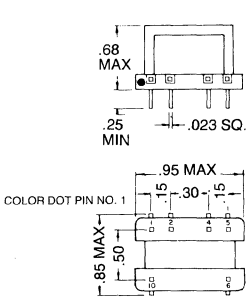
FIG. Y



Pico miniature size.
Open frame construction.
4 inch #30 color coded leads.
Thorough resin impregnation and baking assures reliability.
Wt. .05 oz.
MIL Designation: TF6S21ZZ

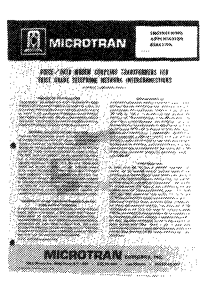
FIG. Z





PC construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.

REQUEST ENGINEERING APPLICATION BULLETIN F232.



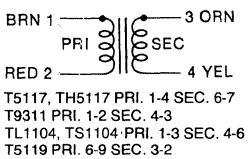
DIMENSIONS IN INCHES.

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TELEPHONE INTERCONNECT TRANSFORMERS

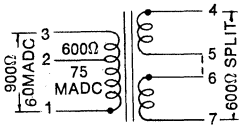
MICROTRAN company, inc.

SCHEMATIC DIAGRAMS FOR TELEPHONE INTERCONNECT

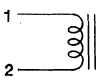


T5117, TH5117 PRI. 1-4 SEC. 6-7
T9311 PRI. 1-2 SEC. 4-3
TL1104, TS1104 PRI. 1-3 SEC. 4-6
T5119 PRI. 6-9 SEC. 3-2

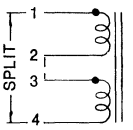
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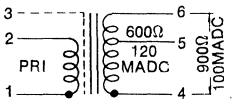
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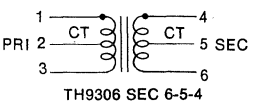
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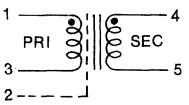


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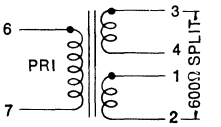


TH9306 SEC 6-5-4

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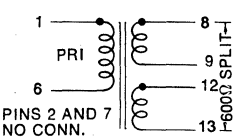


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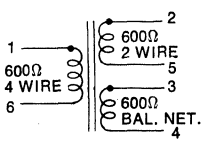


T9312 & T9317 PRI 1-6, SEC 2-5, 3-4
TH5118 PRI 1-2, 3-4 SEC 6-7

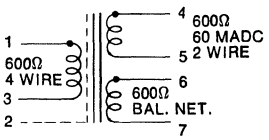
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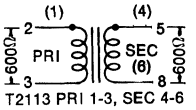
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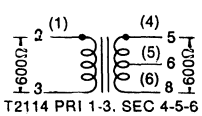


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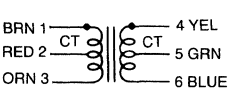
T2113 PRI 1-3, SEC 4-6

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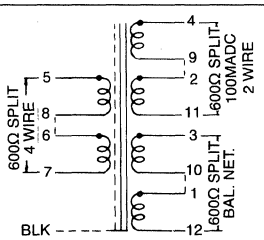


T2114 PRI 1-3, SEC 4-5-6

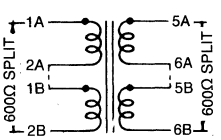
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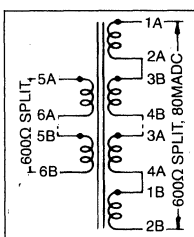
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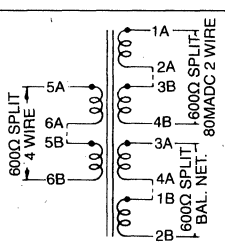


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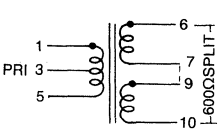


JOIN 2A-3B, 4A-1B

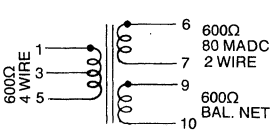
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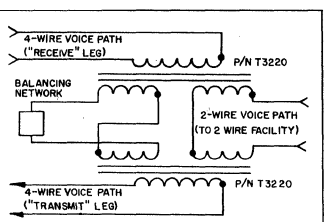
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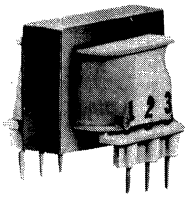


TYPICAL HYBRID APPLICATION

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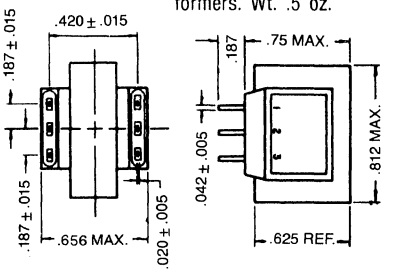
MICROTRAN company, inc.

MINIATURIZED AUDIO TRANSFORMERS



PRINTED CIRCUIT — DCM SERIES

Industrial/Commercial grade miniature printed circuit transformers. Rigid terminals provide fixed mounting centers usually found in expensive molded transformers. Wt. .5 oz.



DECI-MINIATURE TRANSFORMERS DCM SERIES

FREQUENCY RESPONSE 200-15,000 Hz ±2 dB

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Operating Level dBm
DCM1-PC	25,000 CT	1200 CT	2	18
DCM2-PC	15,000 CT	15,000 CT	3	19
DCM3-PC	15,000 CT	600 CT	3	19
DCM4-PC	10,000 CT	5000 CT	4	20
DCM5-PC	10,000	2500/625 Split	2	20
DCM6-PC	10,000 CT	1500 CT	4	20
DCM7-PC	5000 CT	80,000 CT	6	15
DCM8-PC	4000 CT	1200 CT	6	20
DCM9-PC	4000 CT	600 CT	6	20
DCM10-PC	4000	600/150 Split	3	20
DCM11-PC	2500 CT	2500 CT	8	20
DCM12-PC	2500	2500/625 Split	4	20
DCM13-PC	2500 CT	625 CT	8	20
DCM14-PC	2500 CT	200 CT	8	20
DCM18-PC	600 CT	50,000 CT	16	20
DCM19-PC	600	8000/2000 Split	8	20
DCM20-PC	600 CT	200 CT	16	20
DCM21-PC	600 CT	600 CT	16	20
DCM22-PC	250 CT	600 CT	25	20
DCM51-PC	Choke	10H @ 0 mA DC	5H @ 3 mA DC	300 DCR
DCM52-PC	Choke	5H @ 0 mA DC	2H @ 5 mA DC	155 DCR
DCM53-PC	Choke	2.5H @ 0 mA DC	1H @ 7 mA DC	75 DCR

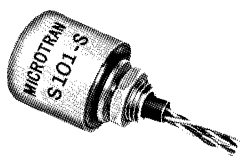


FIG. -S SINGLE THREADED STUD MOUNTING

Double Mu-metal shielding. 3 inch #30 color coded leads. .312″D. Stud provided with nut..625″D×.812″H. Wt. 0.55 oz.

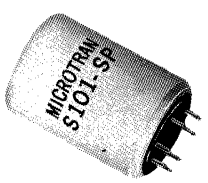


FIG. -SP PRINTED CIRCUIT MOUNTED

Double Mu-metal shielded. .75″D× 1.063″H. 7-.040 pins .125″H. Wt. 0.62 oz.

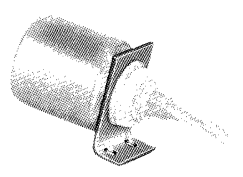


FIG. -FB RIGHT ANGLE MOUNTING BRACKET

For mounting of -S series transformers. M.C. 0.375″.

LOW LEVEL MICROPHONE/TRANSDUCER INPUT TRANSFORMERS

FOR: PROFESSIONAL SOUND STUDIOS — BROADCAST MIXING CONSOLES — CONTROL AND INSTRUMENT AMPLIFIERS

EQUIVALENT TO IMPORTED EUROPEAN STUDIO GRADE TRANSFORMERS

- WIDE BANDWIDTH — BROAD FREQUENCY RESPONSE
- EXTREMELY LOW DISTORTION
- NEGLIGIBLE HUM PICK UP
- SUBMINIATURE SIZE
- EASE OF MOUNTING AND ORIENTATION
- POLARIZING VOLTAGE CONNECTION FOR CONDENSER MICROPHONES
- LOW MICROPHONICS
- ELECTROSTATIC SHIELDING

Part No.	Nom. Turns Ratio Pri:Sec	Nominal Impedance Ratio Primary	Nominal Impedance Ratio Secondary	Typ. Open Circuit Primary Impedance @ 50 Hz†	Frequency Response‡	Fig.	Replaces Beyer Part No.
S101-S	1:20	12.5	5000	100	30-15,000 Hz ±1 dB	-S	TR-BV35704
S101-SP	1:20	12.5	5000	100	30-15,000 Hz ±1 dB	-SP	STR-BV37704
S105-S	1:15	200	45,000	2000	30-15,000 Hz ±1 dB	-S	351.015.006
S105-SP	1:15	200	45,000	2000	30-15,000 Hz ±1 dB	-SP	370.015.006
S107-S	1:15	200/50 split	45,000	2000	30-15,000 Hz ±1 dB	-S	351.215.006
S107-SP	1:15	200/50 split	45,000	2000	30-15,000 Hz ±1 dB	-SP	370.215.006
S108-S	1:10	200	20,000	2000	30-15,000 Hz ±1 dB	-S	351.010.005
S108-SP	1:10	200	20,000	2000	30-15,000 Hz ±1 dB	-SP	370.010.005
S111-S	1:7.1	200	10,000	2000	30-15,000 Hz ±1 dB	-S	351.007.004
S111-SP	1:7.1	200	10,000	2000	30-15,000 Hz ±1 dB	-SP	370.007.004
S116-S	1:5	200	5000	2000	30-15,000 Hz ±1 dB	-S	351.005.003
S116-SP	1:5	200	5000	2000	30-15,000 Hz ±1 dB	-SP	370.005.003
S118-S	1:5	200/50 split	5000	2000	30-15,000 Hz ±1 dB	-S	351.205.003
S118-SP	1:5	200/50 split	5000	2000	30-15,000 Hz ±1 dB	-SP	370.205.003
S126-S	1:1	600 CT	600	3750	30-20,000 Hz ±.5 dB	-S	TR145/BV35508
S126-SP	1:1	600 CT	600	3750	30-20,000 Hz ±.5 dB	-SP	STR-145/BV37508
S130-S	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-S	TR-145/BV35590
S130-SP	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-SP	STR-145/BV37590
S100-FB	Right angle mounting bracket for S100-S series.					-FB	

† Designed for optional bridging termination use to provide additional 6 dB output voltage gain.

‡ Frequency response measured with source equal to nominal primary impedance and with unloaded secondary except 100k load on S105 and S107 series.

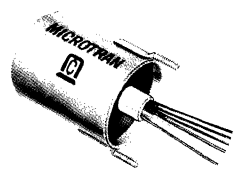


FIG. B TRIPLE MU-METAL CASE

6-32×.375″ mounting studs on 1.500″ centers. Wt. 5 oz. 1.375″D× 1.781″H.

LOW LEVEL CHOPPER INPUT TRANSFORMERS

Used in Servo, measuring, and coupling circuits as an Input Transformer for low level amplifiers. Efficiently transfers 30 to 500 Hz transducer or thermocouple signals to instrument amplifiers at signal levels from 0.5 μV to 0.5V. Low hum pick up assured by three Mu-Metal shields. High permeability core provides high efficiency and low distortion. Resin potted to minimize magnetorestrictive microphonics. Electrostatic shield brought out to external ground connection to eliminate chassis currents.

Part No.	Turns Ratio Full Pri. to Full Sec.	Turns Ratio ½ Pri. to Full Sec.	Induc. of Full Pri. @ 0.5V 60 Hz	Imped. of Full Pri. @ 0.5V 60 Hz	DC Resistance Full Pri.	DC Resistance Sec.	Fig.
M8025	1:7.7	1:15.4	17.5 H	6600	365	4140	B
M8026	1:3.2	1:6.4	60 H	22,500	455	3500	B
M8052	1:4.53	1:9.06	90 H	34,000	760	5220	B
M8053*	1:0.5	1:1	140 H	53,000	920	653	B

* Secondary is center tapped. All units have 90 dB Magnetic Shielding.

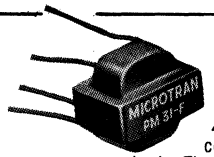
DIMENSIONS IN INCHES.

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MINIATURIZED AUDIO TRANSFORMERS

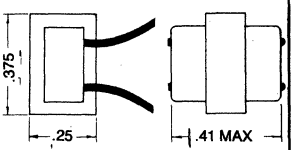
MICROTRAN company, inc.

OPEN FRAME PM-F

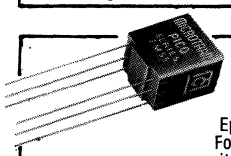


4 inch #30 color coded leads. Thorough resin impregnation and baking assures reliability. To order add -F to Part No., i.e. PM33-F. Wt. .05 oz.

MIL Designation: TF6S21ZZ

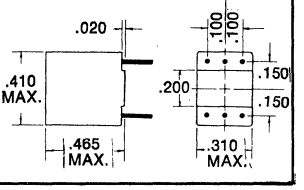


MOLDED PM-M

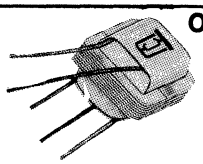


Epoxy molded. For printed circuit application. Tinned copperweld leads .020×.75" for reliable soldered joints and high-density welded lead packaging. Wt. .1 oz. To order add -M to Part No., i.e. PM12-M.

MIL Designation: TF5S21ZZ

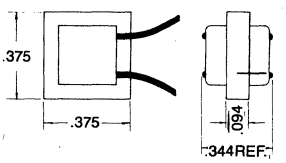


OPEN FRAME UM-F

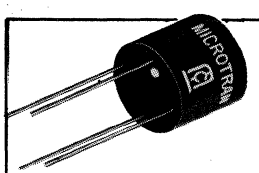


To order add -F to Part No., i.e. UM22-F. Wt. 0.08 oz. 4" #30 color coded leads.

MIL Designation: TF6S21ZZ

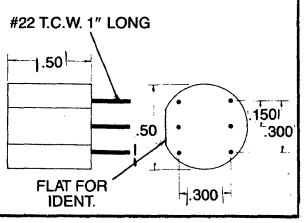


MOLDED UM-M

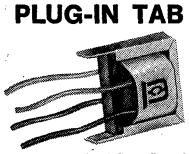


To order add **-M** to Part No., i.e. UM22-M. Wt. 0.14 oz.

MIL Designation: TF5S21ZZ

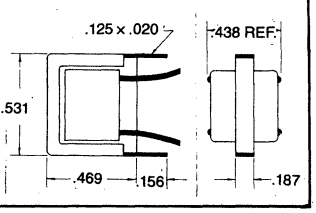


PLUG-IN TAB MOUNTED CHANNEL VM-FPB

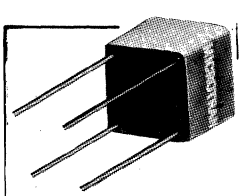


To order add -FPB to Part No., i.e. VM2-FPB. Wt. 0.2 oz. 4" #30 color coded leads.

MIL Designation: TF6S21ZZ

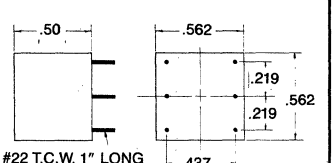


MOLDED VM-M



Epoxy molded. Wt. 0.25 oz. To order add -M to Part No., i.e. VM2-M.

MIL Designation: TF5S21ZZ



DIMENSIONS IN INCHES.

PICO-MINIATURE — PM SERIES

Frequency Response ±2 dB 300 Hz to 100 kHz†

For maximum utilization of space in miniaturized printed circuit board applications. Manufactured per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Power Level mW
PM37-(*)	120 CT	3.2	10	16	0.75	50
PM38-(*)	300 CT	600	7	41	98	50
PM35-(*)	500	50	3	60	8	50
PM36-(*)	500	500/125 split	3	72	85	50
PM32-(*)	600	600	1.5	75	105	50
PM34-(*)	600 CT	600 CT	3	75	105	50
PM33-(*)	1500 CT	600	3	170	95	50
PM31-(*)	2500	2500 CT	1	250	325	50
• PM29(*)	10,000 CT	500 CT	1	1050	80	50
PM27(*)	10,000	1200	0.5	1050	280	50
• PM23(*)	10,000 CT	1200 CT	1	1050	280	50
• PM25(*)	10,000	1200/300 split	0.5	1050	280	50
• PM19(*)	10,000 CT	2000 CT	1	1000	300	50
• PM21(*)	10,000	2000/500 split	0.5	1000	300	50
• PM17(*)	10,000 CT	10,000 CT	1	1000	1300	50
PM15(*)	25,000	1000	0.25	1700	110	40
• PM11(*)	25,000 CT	1000 CT	0.5	1700	110	40
• PM13(*)	25,000	1000/250 split	0.25	1700	110	40
• PM7(*)	50,000 CT	1000 CT	0	3300	75	10
• PM9(*)	50,000	1000/250 split	0	3300	75	10
• PM5(*)	200,000	1000	0	5300	110	10
• PM3(*)	200,000 CT	1000 CT	0	5300	110	10
PM41-(*)	Audio Choke	.3 H	4	43		
PM40-(*)	Audio Choke	3.5 H	2	700		
PM39-(*)	Audio Choke	6 H	2	1800		
PM90	Magnetic Shield Mu-metal slip-on can for PM-M series. 20dB shielding. 0.365" x 0.465" x 0.500" high.					

• These items not available in open frame construction.
* Add either -F, -M to Part No. See photos figures PM-M & PM-F. Frequency response measured as stated power level above.
† PM3 and PM5 — 45 kHz.

ULTRA-MINIATURE — UM SERIES

Frequency Response ±2 dB 300 to 10,000 Hz

Measured at level stated for 300 Hz. Miniaturized design offers a relatively high power level and printed circuit packaging. Response measured at level stated for 300 Hz. Mfd. per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW @ 300 Hz	Level mW @ 1 kHz
UM26-(*)	400	11	3	35	1.5	15	500
UM27-(*)	400 CT	11	6	35	1.5	15	500
UM25-(*)	400	50	3	35	5	15	500
UM29-(*)	600 CT	600 CT	7	45	60	5	400
UM24-(*)	1000	50	3	65	10	5	500
UM33-(*)	1000 CT	600	6	80	65	5	500
UM32-(*)	1500 CT	600	5	135	65	5	500
UM39-(*)	2500 CT	600 CT	2	250	50	5	500
UM34-(*)	10,000 CT	600 CT	2	850	40	5	500
UM31-(*)	10,000 CT	1200 CT	2	850	120	5	500
UM37-(*)	10,000	2000 CT	1	850	200	5	500
UM35-(*)	15,000 CT	15,000 CT	1	930	1210	5	300
UM36-(*)	20,000 CT	800 CT	0.5	1100	80	5	500
UM22-(*)	20,000	1000	0.5	1100	100	5	300
UM23-(*)	20,000	1200 CT	0.5	1100	110	5	300
UM21-(*)	100,000	1000	0	1900	135	5	70
UM30-(*)	Choke	1.5 H (0 mA) 0.7 H (2 mA) 100 DCR					
UM28-(*)	Choke	10 H (0 mA) 8 H (0.5 mA) 650 DCR					
UM90	Magnetic Shield Mu-metal slip-on can for UM-M series. 20 dB shielding. 0.594"D x 0.562" high.						

* Add either -F, or -M to Part No. to designate construction. See Photos. Power levels shown are for 7.5% maximum distortion.

VERI-MINIATURE — VM SERIES

Frequency Response ±2 dB 200 to 10,000 Hz

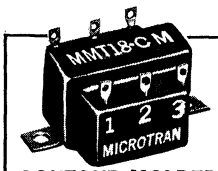
Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW
VM1-(*)	50	600	5.5	7	90	15
VM7-(*)	500	3.4	3.5	50	0.5	15
VM16-(*)	500 CT	250 CT	7.5	50	25	15
VM14-(*)	600 CT	600 CT	7.0	50	65	15
VM8-(*)	1250	3.4	2.0	135	0.5	15
VM9-(*)	1250	50	2.0	135	6.5	15
VM10-(*)	2500	2500 CT	1.5	225	215	3
VM17-(*)	10,000 CT	5000 CT	0	400	300	5
VM12-(*)	20,000	1000	0.16	625	85	5
VM13-(*)	20,000	1000 CT	0.16	625	85	5
VM3-(*)	25,000	600	0.15	720	45	5
VM5-(*)	50,000	600	0.1	830	55	5
VM15-(*)	50,000 CT	50,000 CT	0	2000	2600	5
VM6-(*)	100,000	1200 CT	0.07	2000	150	5
VM2-(*)	200,000	600	0.05	3000	110	2.5
VM4-(*)	200,000	1200	0.035	3100	165	5
VM11-(*)	Choke	20 H (0 mA) 12 H (0.5 mA)		1000		
VM90	Magnetic Shield Mu-metal slip-on can for VM-M series. 20 dB shielding. 0.625" x 0.625" x 0.531" high.					

* Add either -FPB, or -M to Part No. to designate construction. See Photos.

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MINIATURIZED AUDIO TRANSFORMERS



CONTOUR MOLDED

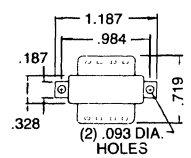
Special Order Only

Designed for chassis mounting with solder terminals on top of transformer. Epoxy contour molding provides greatest resistance to extremes of ambient in smallest possible package.

To order add -CM to Part No., i.e. MM2-CM.

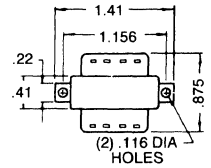
MIL Designation: TF5S21ZZ

MM-CM



Wt. 0.5 Oz.

SM-CM



Wt. 1.25 Oz.



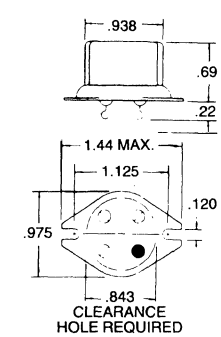
HERMETIC

Grey Enamel Finish. High Compression Glass Terminals.

To order add -H to Part No., i.e. MM2-H.

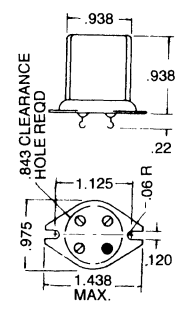
MIL Designation: TF4R21YY

MM-H

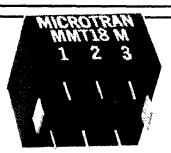


Wt. 0.75 Oz.

SM-H



Wt. 1 Oz.



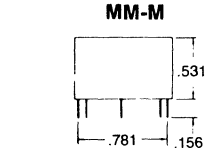
MOLDED

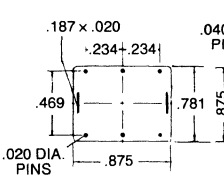
Designed for plug-in printed circuit applications. Cast Epoxy resin provides highest resistance to extremes of ambient.

To order add -M to Part No., i.e. MM2-M.

MIL Designation: TF5S21ZZ

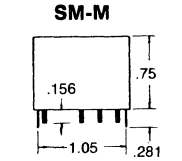
MM-M

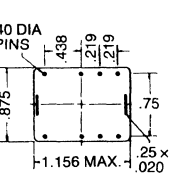




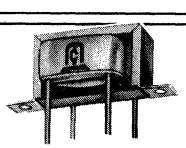
Wt. 0.5 Oz.

SM-M





Wt. 1.5 Oz.

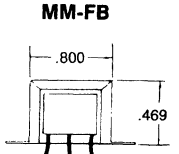


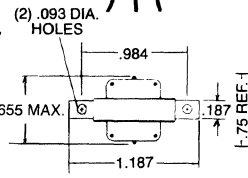
OPEN FRAME WITH CHANNEL

To order add -FB to Part No., i.e. MMT3-FB. 4 inch #28 color coded leads.

MIL Designation: TF6S21ZZ

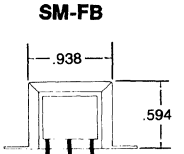
MM-FB

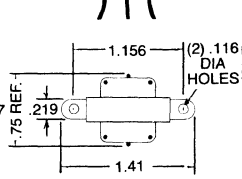




Wt. 0.375 Oz.

SM-FB





Wt. 0.75 Oz.

DIMENSIONS IN INCHES.

MICRO-MINIATURE MM AND MMT SERIES

The low profile design of this series makes them ideal for use in plug-in printed circuit boards.

Available in open frame, hermetic, and molded constructions, all units are manufactured to MIL-T-27.

These units can be used as input, interstage, output, isolation and other impedance matching requirements.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Oper. Level dBm	Freq. Response ±2 dB
MM1-(*)	200/50	250,000/62,500	0	4	200-10,000
MM3-(*)	10,000	200	3	20	150-10,000
MM2-(*)	10,000	90,000	0	4	150-10,000
MM4-(*)	30,000	50	1	20	150-10,000
MM7-(*)	30,000	1200	0.5	20	200-10,000
MM6-(*)	100,000	60	0.5	20	250-10,000
MM5-(*)	Reactor 50 H @ 1 mA DC 4700 DCR				
MMT1-(*)	600	600	8	22	200-15,000
MMT26-(*)	600 CT	600 CT	16	22	200-15,000
MMT33-(*)	600 CT	600/150 split	16	22	200-15,000
MMT9-(*)	600 CT	1200 CT	16	22	200-15,000
MMT32-(*)	600 CT	1200/300 split	16	22	200-15,000
MMT12-(*)	2000	3.4	5	28	200-15,000
MMT31-(*)	2000 CT	500 CT	10	28	200-15,000
MMT19-(*)	2500	2500 CT	2	23	200-15,000
MMT13-(*)	4000 CT	3.4	5	28	200-15,000
MMT11-(*)	4000 CT	600 CT	5	28	200-15,000
MMT21-(*)	4000 CT	600/150 split	5	28	200-15,000
MMT25-(*)	7500 CT	600 CT	4	22	200-15,000
MMT30-(*)	7500 CT	1200 CT	4	22	200-15,000
MMT35-(*)	10,000 CT	150/37.5 split	2	20	200-15,000
MMT17-(*)	10,000 CT	200 CT	6	20	200-15,000
MMT16-(*)	10,000	1500 CT	1	20	200-15,000
MMT28-(*)	10,000 CT	1500 CT	2	20	200-15,000
MMT29-(*)	10,000 CT	10,000 CT	2	20	200-15,000
MMT10-(*)	25,000	600	1	20	200-15,000
MMT27-(*)	25,000 CT	600 CT	2	20	200-15,000
MMT7-(*)	25,000	1200 CT	1	20	200-15,000
MMT18-(*)	25,000 CT	1200 CT	2	20	200-15,000
MMT5-(*)	50,000	6	1	20	200-15,000
MMT3-(*)	50,000	600	0.7	20	200-15,000
MMT4-(*)	50,000 CT	600 CT	1.4	20	200-15,000
MMT8-(*)	50,000 CT	1200 CT	1.4	20	200-15,000

* Add either -H, -M, -CM, or -FB to P/N to designate construction. See photos.

SUB-MINIATURE SM AND SMT SERIES

A variety of compact, low silhouette, constructions makes this series ideal for use in designs requiring maximum space utilization.

Available in open frame, hermetic, and molded constructions, all units are manufactured to MIL-T-27.

These units can be used as input, interstage, output, isolation and other impedance matching requirements.

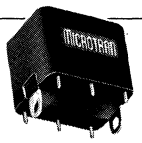
Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Oper. Level dBm	Freq. Response ±2 dB
SM1-(*)	200/50	250,000/62,500	0	6	80-10,000
SM3-(*)	10,000	200	3	21	150-10,000
SM2-(*)	10,000	90,000	0	8	100-10,000
SM4-(*)	30,000	50	1	21	150-10,000
SM6-(*)	100,000	60	0.5	21	150-10,000
SM5-(*)	Reactor 50 H @ 1 mA DC 3000 DCR				
SMT1-(*)	600	600	9	23	200-15,000
SMT26-(*)	600 CT	600 CT	18	23	200-15,000
SMT9-(*)	600 CT	1200 CT	18	23	200-15,000
SMT12-(*)	2000	3.4	5	30	200-15,000
SMT19-(*)	2500	2500 CT	5	26	200-15,000
SMT36-(*)	2500 CT	2500/625 split	10	26	200-15,000
SMT13-(*)	4000 CT	3.4	5	30	200-15,000
SMT17-(*)	10,000 CT	200 CT	6	20	200-15,000
SMT16-(*)	10,000	1500 CT	1	23	200-15,000
SMT10-(*)	25,000	600	2	20	200-15,000
SMT7-(*)	25,000	1200 CT	1.5	20	200-15,000
SMT18-(*)	25,000 CT	1200 CT	3	20	200-15,000
SMT5-(*)	50,000	6	1	20	300-15,000
SMT3-(*)	50,000	600	1	20	300-15,000
SMT4-(*)	50,000 CT	600 CT	2	20	200-15,000
SMT8-(*)	50,000 CT	1200 CT	2	20	200-15,000

* Add either -H, -M, -CM, or -FB to P/N to designate construction. See photo

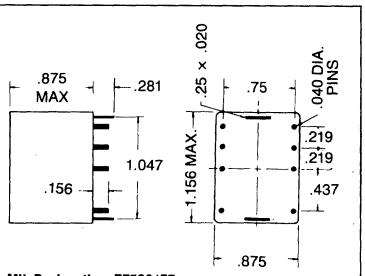
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MINIATURIZED AUDIO TRANSFORMERS

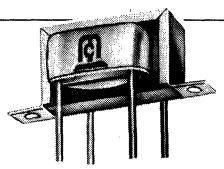
MICROTRAN company, inc.



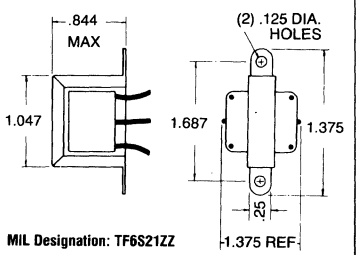
MOLDED M-M
To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. 1.75 oz.



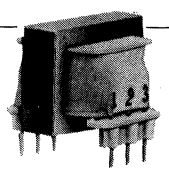
MIL Designation: TF5S21ZZ



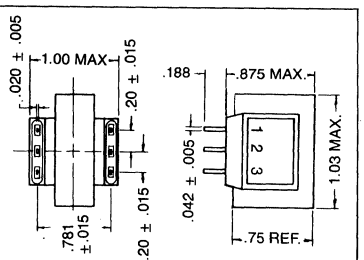
OPEN FRAME WITH CHANNEL M-FB
To order add -FB to Part No. Leads 4″ long. #28 PVC Wt. 1.13 oz.



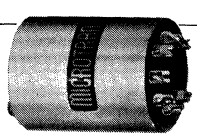
MIL Designation: TF6S21ZZ



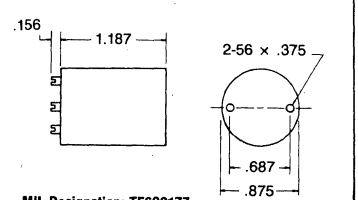
OPEN FRAME PRINTED CIRCUIT M-PC
To order add -PC to Part No. Units with more than 6 pins have 7 or 8 — .025 x .015 pins on .150 centers. Wt. 1.2 oz.



MIL Designation: TF6S21ZZ



ALUMINUM CASED M-A
To order add -A to Part No. Supplied with 2-56 screws. Wt. 1.25 oz.



MIL Designation: TF6S21ZZ

MINIATURE AUDIO M & MT SERIES

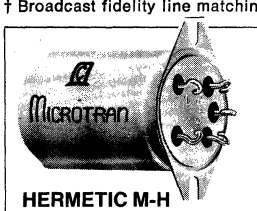
This group of transformers is often referred to as "the designers' series."

In this series, Microtran offers the widest spectrum of electrical and mechanical specifications. All units are manufactured in accordance with the requirements of MIL-T-27. All dimensions shown in inches.

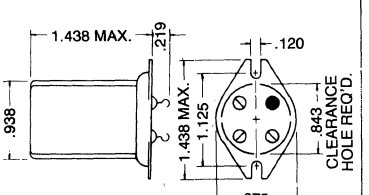
All items shown in charts below are available in any of the mechanical packages shown. Primary and secondary windings may be interchanged to obtain required impedance matching.

Part No.*	Primary Impedance	Secondary Impedance	Primary Unbalance mA DC	Operating Level dBm	Frequency Response ±2 dB
M3-(*)•	7.5/30	50,000	0	5	20-20,000
M12-(*)	50/250 CT	50/250/600 CT	0	8	20-20,000
M1-(*)•	50/250/600 CT	50,000	0	5	20-20,000
M1-S	Same as M1 above – with dual nickel alloy shield				
M2-(*)•	50/250/600 CT	50,000 CT	0	5	20-20,000
M14-(*)	200	½ Megohm	0	9	80-3,000
M15-(*)	10,000	1 Megohm	0	11	100-2,500
M8-(*)	15,000	50/250/600 CT	0	8	20-20,000
M9-(*)	15,000	50/250/600 CT	4	21	150-20,000
M4-(*)	15,000	60,000	0	8	20-15,000
M5-(*)	15,000	60,000	4	14	200-20,000
M6-(*)	15,000	95,000 CT	0	5	20-15,000
M7-(*)	15,000	95,000 CT	4	11	200-20,000
M10-(*)•	30,000 CT	50/250/600 CT	0	8	30-50,000
M11-(*)•	50,000	50/250/600 CT	0	5	20-20,000
M13-(*)	Reactor	300 hy. 0 DC	50 hy. @ 3 mA		6000Ω D.C.R.
M90	Magnetic Shield Mu-Metal slip on can for M-A Series 25 dB shielding				
MT2-(*)	100	10 CT/40 CT	100	27	200-20,000
MT30-(*)	250 CT	500	10	30	200-15,000
MT23-(*)	250 CT	1000	10	30	200-15,000
MT14-(*)	400	10	50	25	200-20,000
MT15-(*)	500 CT	210	30	27	300-20,000
MT1-(*)	600	600	10	23	200-15,000
MT35-(*)‡	600	600 CT & 600 CT	0	5	40-20,000
MT36-(*)†	600 CT	600 CT	0	15	50-15,000
MT26-(*)	600 CT	600 CT	20	23	200-15,000
MT9-(*)	600 CT	1,200 CT	4	23	200-15,000
MT33-(*)	600/150 Split	600/150 Split	20	23	200-20,000
MT22-(*)	600/150 Split	1,200 CT	4	23	200-15,000
MT29-(*)	1600 CT	450	15	30	200-15,000
MT12-(*)	2,000	3.4	10	32	200-15,000
MT24-(*)	2,500	600 CT	10	32	200-15,000
MT13-(*)	4,000 CT	3.4	3	32	200-15,000
MT11-(*)	4,000 CT	600 CT	3	32	200-15,000
MT21-(*)	4,000 CT	600/150 Split	3	32	200-15,000
MT25-(*)	7,500 CT	600 CT	8	32	200-15,000
MT34-(*)	10,000/2500 Split	2000/500 Split	4	20	200-20,000
MT10-(*)•	25,000	600	3	22	200-15,000
MT7-(*)•	25,000	1,200 CT	3	22	200-15,000
MT18-(*)•	25,000 CT	1,200 CT	6	22	200-15,000
MT5-(*)•	50,000	6	3	20	300-15,000
MT3-(*)	50,000	600	3	20	300-15,000
MT8-(*)•	50,000 CT	1,200 CT	3	20	300-15,000
MT20-(*)•	50,000 CT	1200/300 Split	3	20	300-15,000
MT6-(*)•	100,000	1,200 CT	1.4	17	200-15,000

* Add -M, -PC, -A, or -FB to Part No. to designate construction.
• These items not available in -PC construction.
‡ For telephone line coupling or hybrid telephone line.
† Broadcast fidelity line matching transformer. Frequency response ±0.5 dB.

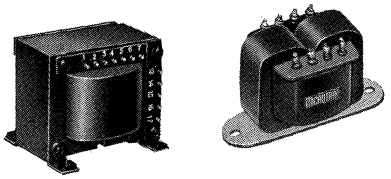


HERMETIC M-H
To order add -H to Part No. Grey Enamel Finish. High Compression Glass Terminals. Wt. 1.25 oz.



MIL Designation: TF4S21YY

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

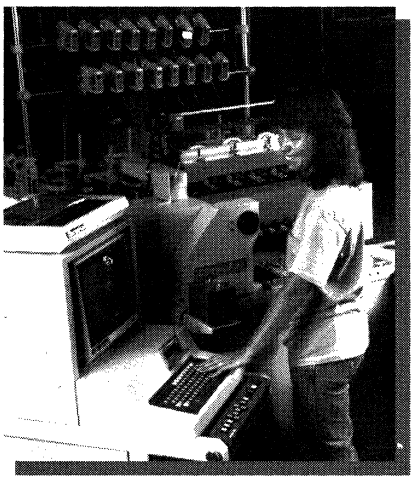
V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Midcom Is Customer Driven.



#1 In Telecommunications Quality And Service.

When it comes to production of telecommunications transformers, Midcom is #1 in the world with a consumer base reaching virtually every corner of the globe. Midcom products are shipped throughout the United States and Canada, to Europe, Japan, the Middle East, Australia and South America.

Midcom customers are our top priority and our best sales people. Our mission has always been to thoroughly satisfy our customer's needs with the highest quality design, production and service. The Midcom name stands above all others in our industry. And our dominant ethical standards and fairness are an integral part of our total team effort.

Midcom Products Are Custom Made.

Our highly skilled design and process engineers are totally committed to the individual needs of our customers. Because of this unmatched skill, dedication and close customer cooperation, our products are tailored exactly to our customer's wishes.

Midcom custom-made transformers are used around the world in analog digital telephone systems, modems, circuit management, networking, multiplexing, D4 channel banks, signaling, automatic call distribution, public data transmission (TV, FAX, MUX), electronic mail, bulletin board services, mobile communications, security systems and a wide variety of amplifiers and recorders for the sound system market. Midcom specializes in voice frequency, high speed data for modems (CCITT), T1, ISDN, CEPT, BABT, LAN and other similar areas.

High Tech Interfaces High Touch.

Midcom's extensive investment in automation is the backbone of our operation. A large, impressive array of thoroughly automated winding machines insures consistent electrical characteristics throughout. This automation capability, along with a sizeable base of semi-automatic winders, is supported by the industry's finest technicians.

The people at Midcom are expertly trained in assembling, finishing and testing. When a Midcom customer asks for problem solving, customer tooling needs, or creation and design, he knows he can count on our engineering staff to meet his needs.

Quality Is Midcom.

Midcom is the world's only supplier of welded telecommunications transformers and the industry's most prominent manufacturer of modem transformers.

Since 1973, Midcom's growth has been truly phenomenal. We have remained at the forefront of a market which has moved from analog to digital. Midcom maintains this position by providing the finest quality, most reliable and lowest priced transformers available.

Quality Delivered On Time.

Midcom possesses a virtually flawless record for product quality as well as on-time delivery. Our shipping department is an integral part of Midcom customer service with a 99%+ success rate in satisfying our customer's delivery dates.

Midcom Is More Than A Supplier. Much More.

At Midcom, we assume the role of partner in our customers' businesses. By offering a full range of design engineering services, we are able to manufacture, test and supply samples and prototypes according to your specifications. Only when the transformer meets or exceeds your specifications have we satisfied your individual needs.

Midcom

1-800-MIDCOM-1

Our toll free hotline ensures continuous service. Use it to tell us your requirements and deadlines. If the product is not an in-house, in-stock design, our design, production and cost analysts will formulate a quotation sure to please you.

To discuss your specific needs with a Midcom design engineer, call us toll free (U.S. and Canada) at 800-643-2661, or 605-886-4385. Or FAX us your requirements at 605-886-4486.



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Midcom Telecom Transformers

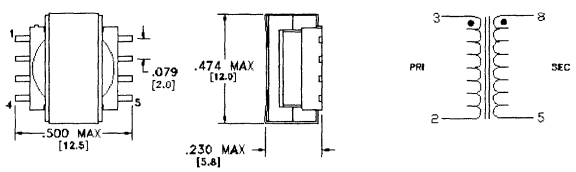
Voiceband Coupler: 671-8234

Features

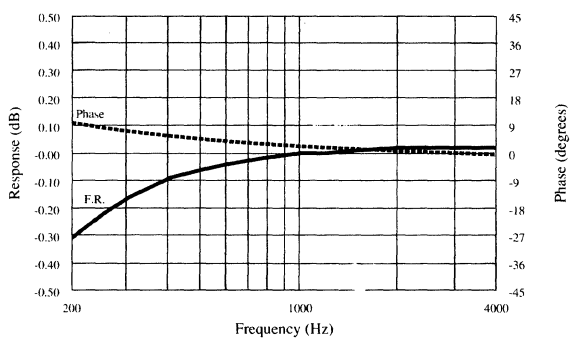
- **Surface mount**
- **Low profile**

Specifications

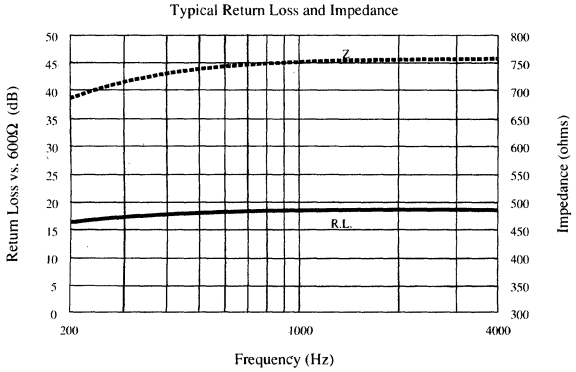
Designed to reflect 600 ohms on PRI with 487 ohms on SEC
Longitudinal Balance: 60 dB minimum, 200Hz to 4kHz
D.C. Resistance: PRI 67.1 ohms ± 6 percent
SEC 85.4 ohms ± 6 percent
Frequency Response: ± 0.5 dB, 300Hz to 4kHz
Dielectric Test: 1500 VAC between PRI and SEC
D.C. in PRI: None
Turns Ratio (PRI:SEC): 1:1 ± 1.0 percent
Insertion Loss: 1.50 dB maximum at 1 kHz



Typical Frequency and Phase Response



Typical Return Loss and Impedance



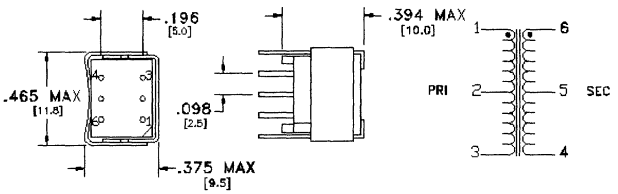
Pulse Transformer: 671-5792

Features

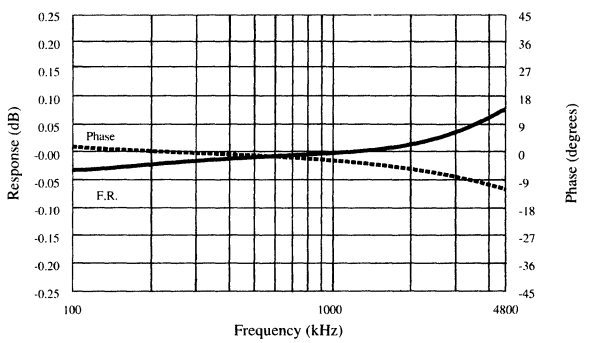
- **T1/ CEPT PCM-30 interface**
- **Dual center taps for DC feed**
- **Small size**

Specifications

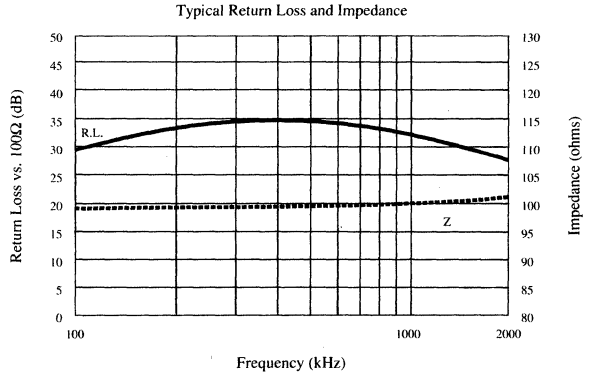
Designed to reflect 100 ohms on PRI with 100 ohms on SEC
Longitudinal Balance: 35 dB minimum to 1.544 MHz
D.C. Resistance: PRI 1.0 ohms maximum (total)
SEC 1.0 ohms maximum (total)
Frequency Response: ± 0.1 dB, 100 kHz to 1.544 MHz
Dielectric Test: 1200 VAC between PRI and SEC
Return Loss: 25 dB or greater (typical), 100kHz - 1.544MHz versus 100 ohms
Turns Ratio (PRI:SEC): 1:1 ± 1 percent
Insertion Loss: 0.2 dB maximum at 772 kHz



Typical Frequency and Phase Response



Typical Return Loss and Impedance



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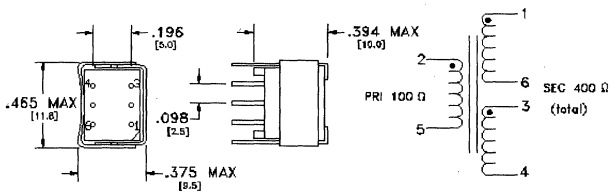
Pulse Transformer: 671-5832

Features

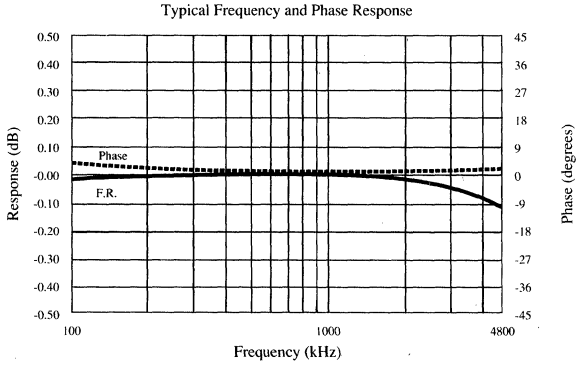
- **Designed for cost-effective use in T1 and CEPT PCM-30 applications**
- **Small size**
- **Low profile**

Specifications

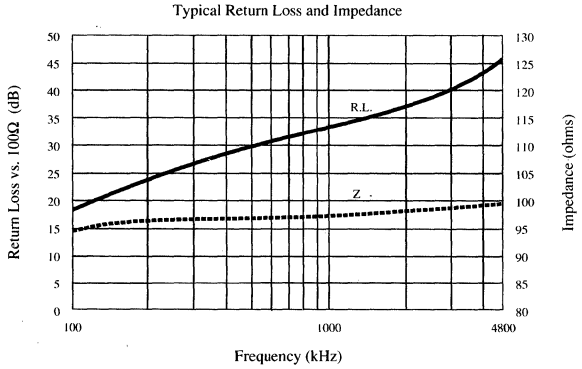
Designed to reflect 100 ohms on PRI with 400 ohms on SEC
Longitudinal Balance: 35 dB minimum at 1.544 MHz
D.C. Resistance: 0.6 ohms maximum (any winding)
Frequency Response: ± 0.25 dB, 100 kHz to 4 MHz
Dielectric Test: 1500 VDC between any two windings
D.C. in PRI: None
Return Loss: 15 dB minimum, 100 kHz to 4.0 MHz vs. 100 ohms
Turns Ratio (PRI:SEC:SEC): 1:1:1 ± 1 percent
Insertion Loss: 0.075 dB ± 0.025 dB at 772 kHz



Typical Frequency and Phase Response



Typical Return Loss and Impedance



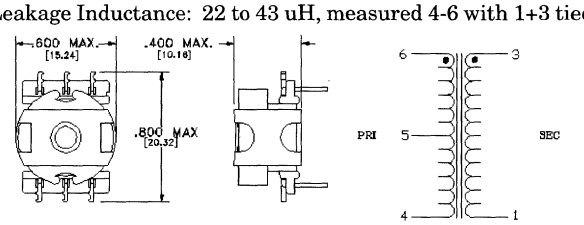
Pulse Transformer: 671-6390

Features

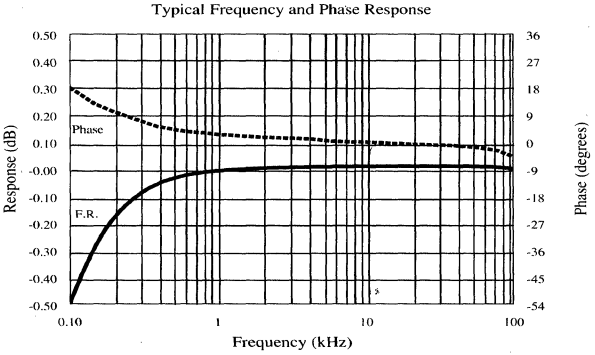
- **Designed for use in DDS applications**
- **Flat frequency response**
- **Low profile**

Specifications

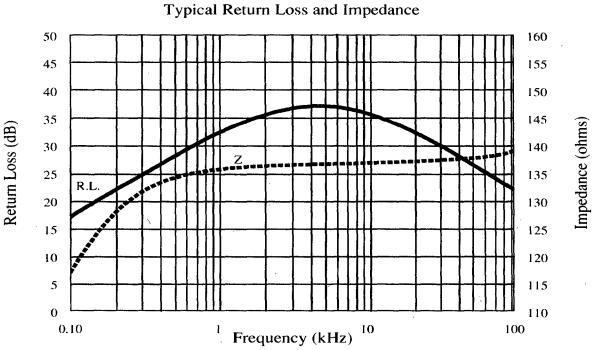
Designed to reflect 135 ohms on PRI with 100 ohms on SEC
D.C. Resistance: PRI 16.0 to 19.5 ohms
SEC 16.0 to 19.5 ohms
Frequency Response: ±1.0 dB, 100 Hz to 112 kHz
Dielectric Test: 1500 VAC between PRI and SEC
PRI Inductance: 200 mH minimum, 1 kHz, 1.0VAC, Ls
D.C. in PRI: Balanced current only
Return Loss: 15 dB typical, 100 Hz to 100 kHz (vs.135ohms)
Turns Ratio (PRI:SEC): 1:1 ± 1%
Insertion Loss: 1.25 ± 0.25 dB at 10 kHz
Leakage Inductance: 22 to 43 uH, measured 4-6 with 1+3 tied



Typical Frequency and Phase Response



Typical Return Loss and Impedance



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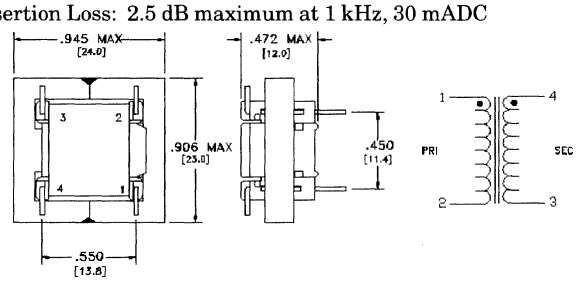
Modem Coupler: 671-8001

Features

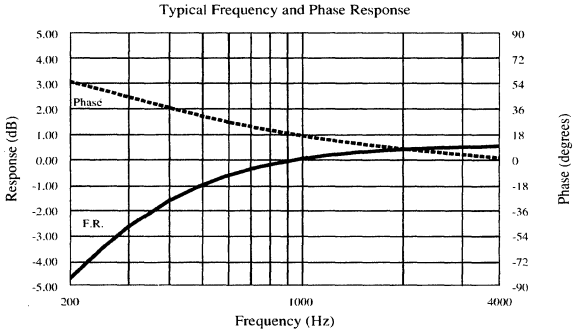
- **Small size, low profile**
- **Cost effective**
- **UL file number E99406**
- **CSA file number LR61218**

Specifications

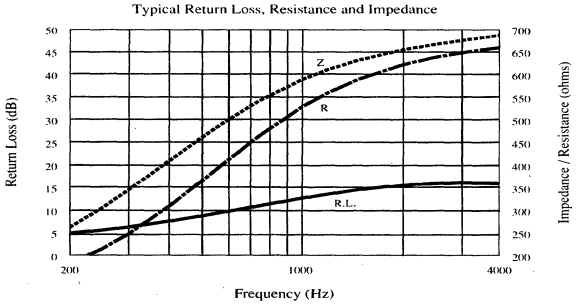
Designed to reflect 600 ohms on PRI with 470 ohms on SEC
Longitudinal Balance:
60 dB minimum, 60 Hz to 1 kHz
40 dB minimum, 1 kHz to 4 kHz
D.C. Resistance:
PRI 108 ohms ± 10 percent
SEC 120 ohms ± 10 percent
Frequency Response: ± 1.0 dB, 600 to 3.5 kHz
(ref. 1 kHz) ± 4.0 dB, 300 to 600 Hz
Dielectric Test: 1250 VAC between PRI and SEC
D.C. in PRI: 100 mADC maximum
Turns Ratio (PRI:SEC): 1:1 ± 2 percent
Insertion Loss: 2.5 dB maximum at 1 kHz, 30 mADC



Typical Frequency and Phase Response



Typical Return Loss, Resistance and Impedance



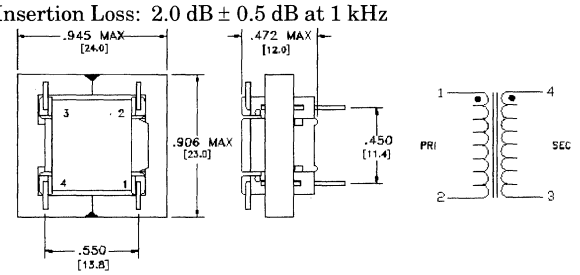
Modem Coupler: 671-8005

Features

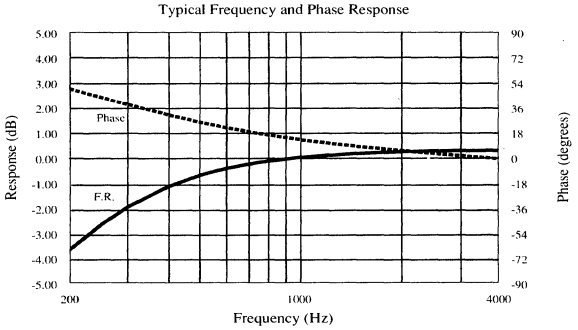
- **High performance**
- **Small size, low profile**
- **UL file number E99406**
- **CSA file number LR61218**
- **Compatible with V.29 facsimile data**

Specifications

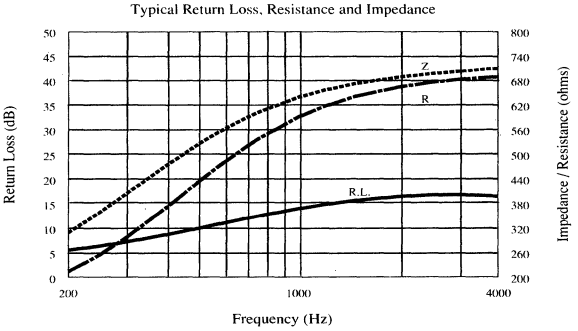
Designed to reflect 600 ohms on PRI with 470 ohms on SEC
Longitudinal Balance:
60 dB minimum, 60 to 1 kHz
40 dB minimum, 1 kHz to 4 kHz
D.C. Resistance:
PRI 108 ohms ± 10 percent
SEC 120 ohms ± 10 percent
Frequency Response: ± 0.65 dB, 600 to 3.5 kHz
(ref. 1 kHz) ± 2.5 dB, 300 to 600 Hz
Dielectric Test: 1250 VAC between PRI and SEC
D.C. in PRI: 100 mADC maximum
Turns Ratio (PRI:SEC): 1:1 ± 2 percent
Insertion Loss: 2.0 dB ± 0.5 dB at 1 kHz



Typical Frequency and Phase Response



Typical Return Loss, Resistance and Impedance



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Telecom Transformers

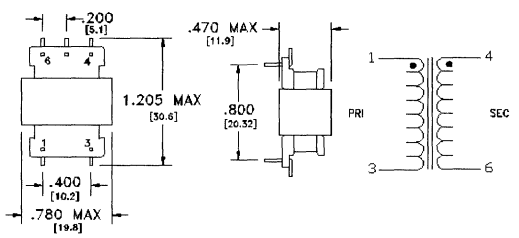
Modem Coupler: 671-1538

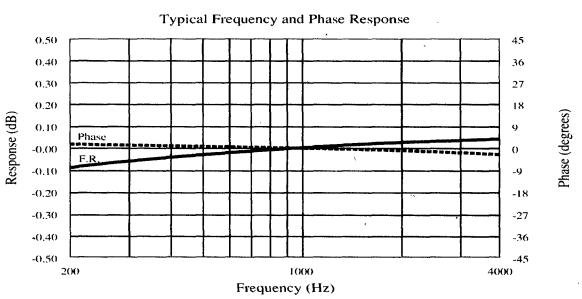
Features

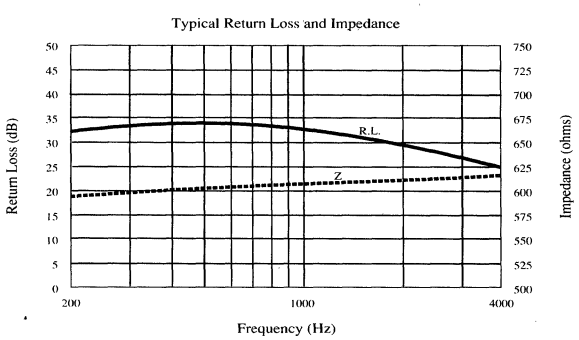
- **Low distortion, specifically for use in V.32 and V.32 bis applications**
- **Low profile**
- **Flat frequency response**

Specifications

Designed to reflect 600 ohms on PRI with 530 ohms on SEC
Longitudinal Balance:
70 dB minimum, 200 Hz to 1 kHz
60 dB minimum, 1 kHz to 4 kHz
D.C. Resistance: PRI 43 ohms ± 10 percent
SEC 43 ohms ± 10 percent
Frequency Response: ± 0.2 dB, 300 to 3 kHz
Dielectric Test: 1500 VAC between PRI and SEC
D.C. in PRI: None
Return Loss: 25 dB minimum, 300 to 3 kHz
Turns Ratio (PRI:SEC): 1:1 ± 1 percent
Insertion Loss: 0.85 dB maximum at 1 kHz
Harmonic Distortion: -71 dB maximum







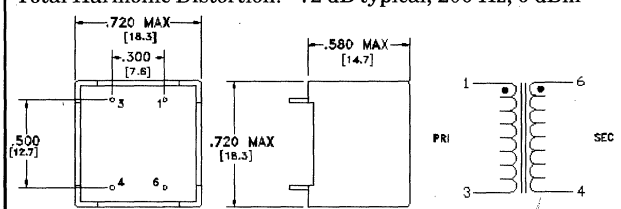
International coupler: 671-8236

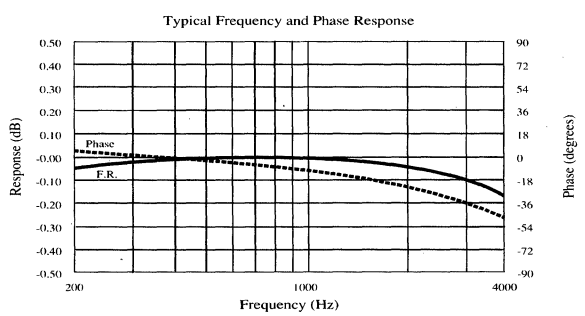
Features

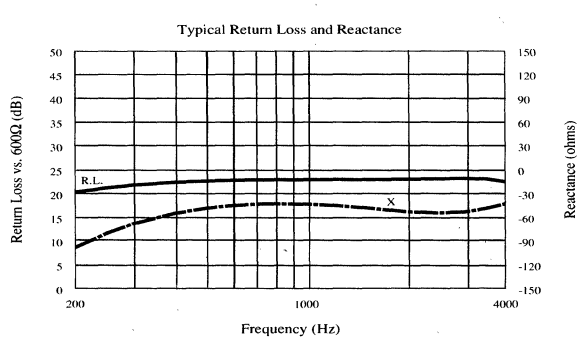
- **BABT C of R number: CR 0075**
- **Reinforced insulation**
- **Low distortion**
- **High dielectric isolation**

Specifications

Designed to reflect 600 ohms on PRI with 560 ohms on SEC
Longitudinal Balance: 60 dB minimum, 200Hz to 1kHz
40 dB minimum, 1 kHz to 4 kHz
D.C. Resistance: PRI 70 ohms ± 10 percent
SEC 70 ohms ± 10 percent
Frequency Response: ± 1.0 dB 200 Hz to 4 kHz
Dielectric Test: 3750 VAC between PRI and SEC
D.C. in PRI: None
Return Loss: 14 dB minimum, 200 Hz to 4 kHz
Turns Ratio (PRI:SEC): 1:1 ± 1 percent
Insertion Loss: 1.2 dB maximum at 1 kHz
Total Harmonic Distortion: -72 dB typical, 200 Hz, 0 dBm







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Midcom Telecom Transformers

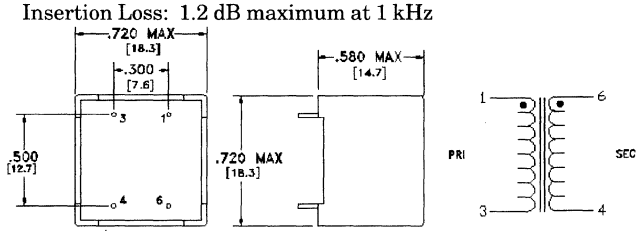
International coupler: 671-8238

Features

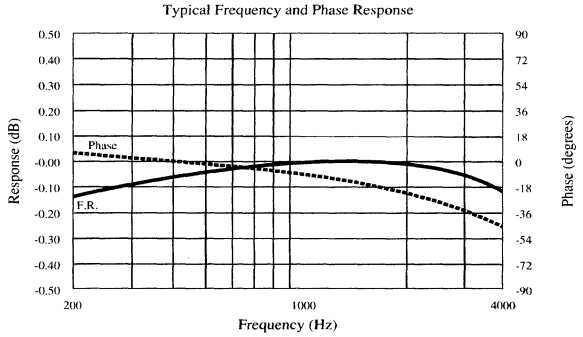
- **BABT C of R number: CR 0075**
- **Reinforced insulation**
- **High dielectric isolation**

Specifications

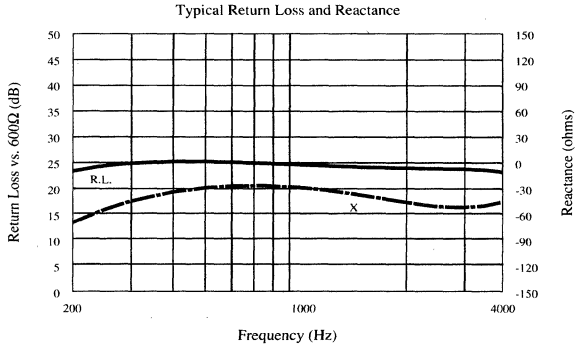
Designed to reflect 600 ohms on PRI with 560 ohms on SEC
Longitudinal Balance: 60 dB minimum, 200 Hz to 1 kHz
40 dB minimum, 1kHz to 4kHz
D.C. Resistance: PRI 70 ohms ± 10 percent
SEC 70 ohms ± 10 percent
Frequency Response: ± 1.0 dB, 200 Hz to 4 kHz
Dielectric Test: 3750 VAC between PRI and SEC
D.C. in PRI: None
Return Loss: 14 dB minimum, 200 Hz to 4 kHz
Turns Ratio (PRI:SEC): 1:1 ± 1.0 percent
Insertion Loss: 1.2 dB maximum at 1 kHz



Typical Frequency and Phase Response



Typical Return Loss and Reactance



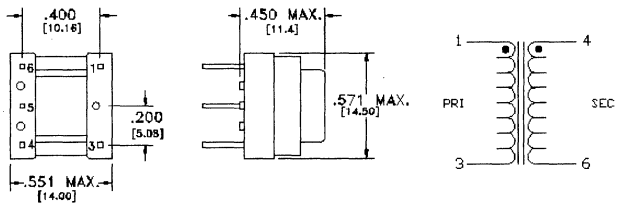
International coupler: 671-8240

Features

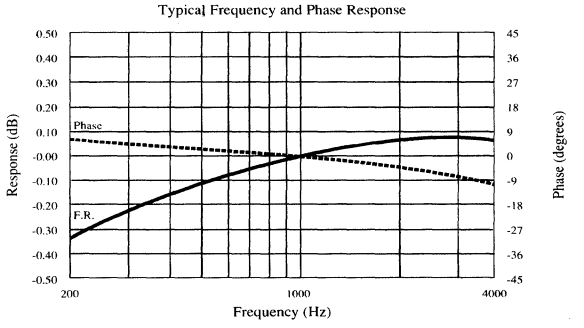
- **BABT C of R number: CR 0076**
- **Supplementary insulation**
- **Small size, low profile**
- **High dielectric isolation**

Specifications

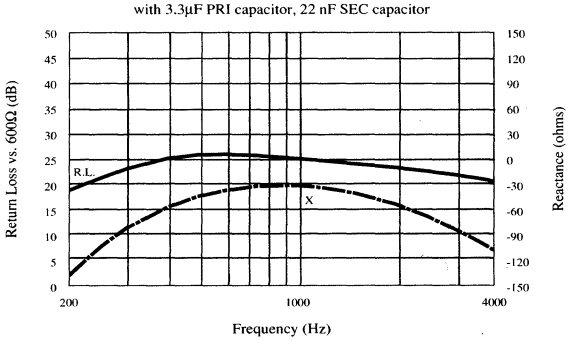
Designed to reflect 600 ohms on PRI with 600 ohms on SEC
Longitudinal Balance: 60 dB minimum, 200 Hz to 4 kHz
D.C. Resistance: PRI 55 ohms ± 15 percent
SEC 60 ohms ± 15 percent
Frequency Response: ± 0.5 dB, 300 Hz to 4 kHz
Dielectric Test: 3750 VAC between PRI and SEC
D.C. in PRI: None
Return Loss: 14 dB minimum, 200 Hz to 4 kHz
Turns Ratio (PRI:SEC): 1:1 ± 1.0 percent
Insertion Loss: 1.5 dB maximum at 1 kHz



Typical Frequency and Phase Response



Typical Return Loss and Reflected Reactance
with 3.3μF PRI capacitor, 22 nF SEC capacitor



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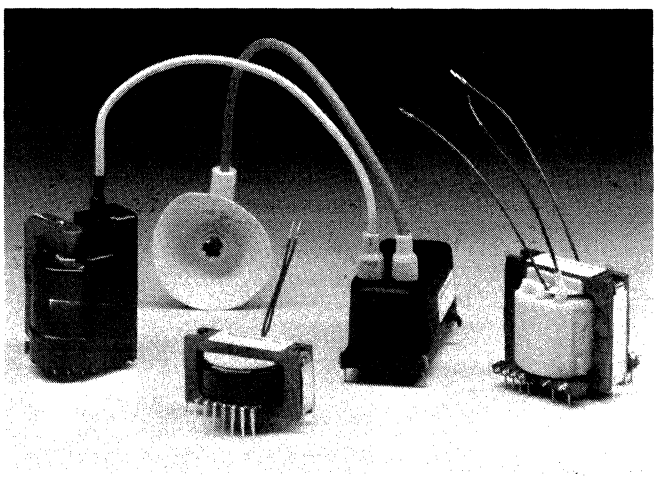
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- MULTIPLIERS

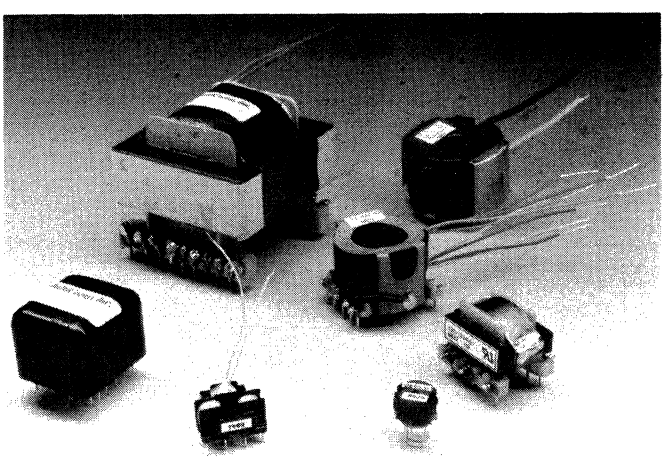
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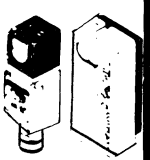
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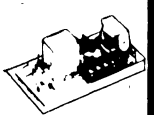
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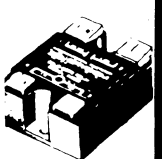
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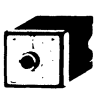

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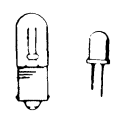
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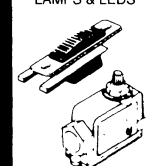
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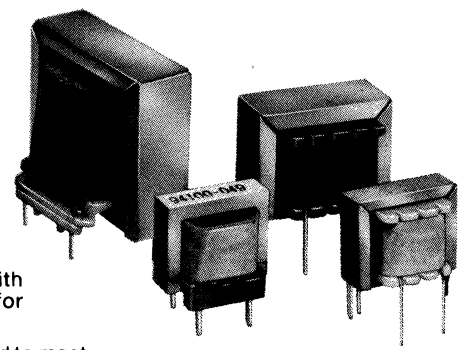
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They feature a frequency response of 300-3500 Hz ± 0.5dB; wide dynamic signal level of -45dBm to +7dBm; low distortion (0.5% max.); impedance matching of ± 10% over entire range; return loss of 16 dB min.

Depending on your requirements, any of several standard cores can be used in the construction of specific high quality designs.

Custom designs for your special requirements necessitating other ratings and construction can be met by our MPI design engineers.

Part No.	Impedance Pri	Impedance Sec	DC Resist. Pri	DC Resist. Sec	Max. Power	Insert. Loss	DC Current	FIG.	Sch.
*A10N-HH-1A/1	600	600	55	69	+7dBm	1.0dB	2mA	3	1A
*A14N-HH-1A/1	600	600	60	46	+6dBm	1.4dB	0mA	3	1A
A16N-HH-1A/1	600	600	52	48	+7dBm	1.2dB	0mA	3	1A
*A19S-HH-1A/1	600	600	35	25	+7dBm	1.1dB	0mA	3	1A
*A19S-MH-1A/2	1500	600	78	67	+5dBm	1.2dB	0mA	3	1A
A19F-HH-1A/1	600	600	45	45	+7dBm	1.0dB	2mA	4	1A
A19H-CC-1A/1	150	150	25	35	+7dBm	1.0dB	2mA	1	1A
A19H-HC-1A/1	600	150	45	35	+7dBm	1.0dB	2mA	1	1A
A19H-MH-1A/1	1500	600	78	67	0dBm	1.7dB	0mA	1	1A
A19H-HK-1A/1	600	900	45	55	+7dBm	1.0dB	2mA	1	1A
A19H-HH-1A/2	600	600	180	80	+1dBm	2.5dB	80mA	1	1A
*A19H-HH-1A/1	600	600	69	95	0dBm	1.9dB	120mA	1	1A
A19H-HH-1C/1	600	600	25	40	+7dBm	1.0dB	2mA	1	1C
*A19H-HH-4C/1	600	600	65	86	+9dBm	2.4dB	100mA	1	4C
A19N-HH-1A/1	600	600	65	85	+7dBm	2.5dB	100mA	3	1A
*A19N-HH-1A/6	600	600	35	45	+7dBm	2.0dB	0mA	3	1A
*A19M-HH-1A/3	600	600	65	86	+9dBm	2.4dB	100mA	2	1A
*A19N-HH-1A/2	600	600	180	75	+5dBm	3.5dB	80mA	3	1A
*A19N-HH-5C/1	600	600	19	26	+6dBm	1.0dB	10mA	3	5C
A28H-HH-1A/1	600	600	36	28	+27dBm	1.0dB	120mA	1	1A

*Indicates stocked items (others available as special order)

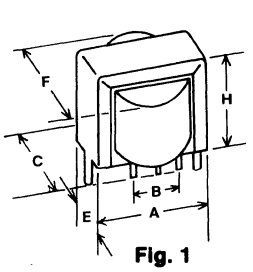


Fig. 1

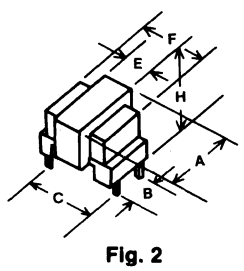


Fig. 2

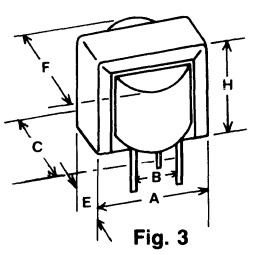


Fig. 3

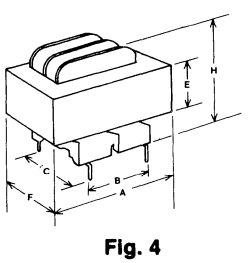
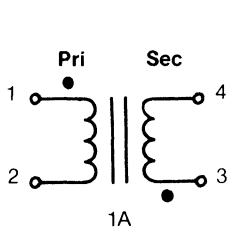


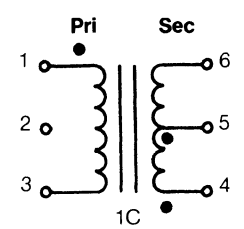
Fig. 4

DIMENSIONS (in millimeters)

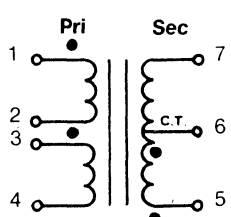
CASE	A	B	C	E	F	H
10N	10.5	4.0	8.4	4.2	11.0	8.5
14N	14.5	5.8	12.0	5.5	13.4	11.0
16N	17.0	6.0	13.0	5.5	17.0	14.7
19S	19.5	7.4	15.0	5.4	14.5	11.5
19F	20.0	15.2	13.0	6.5	16.5	17.5
19N	19.5	9.5	10.7	6.5	17.5	17.5
19M	*19.5*	*9.5*	*16.3*	*6.5*	*17.5*	*17.5*
19H	20.3	8.0	14.5	6.8	15.8	16.0
28N	29.5	12.0	23.5	12.5	28.0	26.5



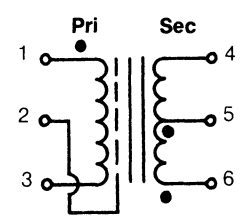
1A



1C



4C



5C

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UNBALANCED TO BALANCED TRANSFORMERS

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50	50	0014	6	0009	25	0010	80	0001	125
	75	0113	6	0104	25	0111	80	0101	125
	90			0203	20	0202	60	0200	125
	100	0315	6	0311	20	0301	60	0300	100
	124	0316		0306	20	0302	60	0307	100
	135			0303	18	0312	60	0310	100
	150			0415	15	0401	60	0400	100
	200	0522	4	0511	15	0520	60	0500	100
	300			0517	12	0521	50	0501	100
	450			0603	10	0602	40	0600	65
	600			0706	8	0703	32	0700	65
	800			0802	7	0801	25	0800	60
	1200			0904	6	0902	15	0900	30
75	50	1003	6	1002	25	1001	60	1000	100
	75	1111	6	1102	25	1112	60	1100	100
	90			1202	20	1201	60	1200	100
	100			1314	20	1310	60	1300	100
	110	1307	6	1318	20	1319	60	1320	100
	124	1309	10	1301	20	1311	60	1302	100
	135			1312	20	1315	60	1317	100
	150	1408	6	1404	16	1405	60	1400	100
	200			1516	15	1513	60	1500	100
	300	1520	4	1502	15	1514	60	1501	100
	450			1602	12	1601	40	1600	60
	600			1704	10	1707	32	1700	60
	800			1802	10	1801	20	1800	30
	1200			1902	9	1905	15	1900	30
	1875			1903	6	1901	8	1906	15

WIDEBAND POWER DIVIDERS/COMBINERS

Series 01 and 10 Power Dividers are designed for applications in the 0.2 to 110 and 3.0 to 225 MHz frequency ranges. Hybrid Junction Techniques are employed to assure superior isolation and minimal insertion loss. VSWR is optimized at all ports. 50 and 75 ohm impedances are standard. Other impedances available on special order. Connectors are BNC.

HIGH POWER SERIES

Power Level	10 W	25 W	100 W	1 kW
Cases	HB	BA,BB	BA,BB	KA
MHz Range	.1-30	.1-30	.5-30	2-32
Unb/Bal	Type No.	Type No.	Type No.	Type No.
50:50	0008	0011	0012	0013
50:75	0108	0109	0105	0107
50:100	0309	0308	0304	0314
50:150	0406	0402	0404	0407
50:200	0519	0512	0516	0515
50:300	0514	0518	0506	0513
50:450	0604	0605	0606	0601
50:600	0705	0701	0704	0702
75:75	1105	1110	1118	1108
75:100	1306	1304	1305	1316
75:150	1406	1401	1403	1407
75:200	1517	1519	1512	1518
75:300	1515	1510	1505	1511
75:450	1603	1604	1605	1606
75:600	1709	1703	1708	1705

ISOLATION TRANFORMERS UNBALANCED TO UNBALANCED

Ground Isolation in 50 and 75 Ohm Coaxial Systems

- Flat frequency, linear phase response
- Insulated BNC Connectors
- 120 dB isolation at power frequencies

Type No.	Impedance Unb/Unb (Ω)	Bandwidth	Case Styles
0005	50:50	1kHz - 25MHz	CC,MA
1103	75:75	1kHz - 25MHz	CC,MA
0112	50:75	1kHz - 25MHz	CC,MA
0017	50:50	10Hz - 5MHz	CC,MA
1117	75:75	10Hz - 5MHz	CC,MA,UA
0016	50:50	20Hz - 20MHz	PA
1116	75:75	20Hz - 20MHz	PA,UA
1121	75:75	3.5Hz - 8MHz	TC
0018	50:50	20kHz - 300MHz	VA
1122	75:75	20kHz - 300MHz	VA
1204	75:93	15Hz - 4MHz	PA
0115	50:75	15Hz-5MHz	PA

10KV ISOLATION FOR PUBLIC UTILITY DATA TRANSMISSION

1 kHz to 6 MHz Bandwidths

1115CD	75 Ω coax to 75 Ω coax
1313CD	75 Ω coax to 124 Ω balanced line

HUMBUCKING CHOKES

75:75 Ohms, insulated BNC Connectors

Type	Bandwidth	Rejection @ 60 Hz
1119PA	DC to 20 MHz	50dB min.
1120CC	DC to 25 MHz	40dB min.

	2-WAY				4-WAY				8-WAY			
Model	50-201RA	75-201RA	50-210RA	75-210RA	50-401RB	75-401RB	50-410RB	75-410RB	50-801SA	75-801SA	50-810SA	75-810SA
Impedance (Ω)	50	75	50	75	50	75	50	75	50	75	50	75
Frequency Range (MHz)	0.2 - 110		3.0 - 225		0.2 - 110		3.0 - 225		0.2 - 110		3.0 - 225	
Insertion Loss (dB)	0.5		1.0		0.5		1.0		1.0		1.5	
Isolation (dB min)	30		25		25		25		25		20	
Amplitude Balance (±dB)	0.5		1.0		0.5		1.0		1.5		1.5	
Phase Balance (±°)	1.0		2.0		1.0		2.0		1.0		3.0	
VSWR	1.2		1.25		1.2		1.2		1.25		1.25	
Input Power (watts)	5		3		5		3		5		3	
Case Style	RA		RA		RB		RB		SA		SA	
Weight (gm)	50		50		65		65		160		160	

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RF Power Dividers • Sum & Difference Hybrids • LAN Coupling Baluns
RF Signal Combiners • Impedance Matching Adapters • Wideband Transformers

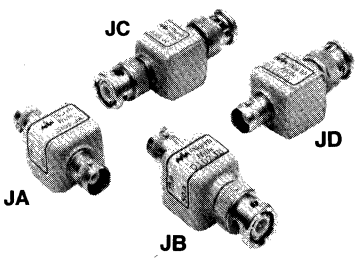
WIDEBAND COAXIAL IMPEDANCE ADAPTERS

For interconnection of unbalanced circuits of different characteristic impedances with low insertion loss.

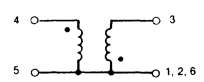
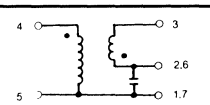
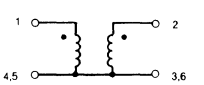
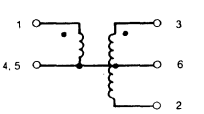
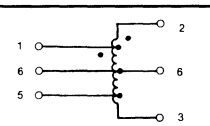
Line of standard models with combinations of type BNC male and female connectors match 50:75, 50:90, and 75:90 ohm circuits. Adapters transfer power bidirectionally and are matched in both directions.

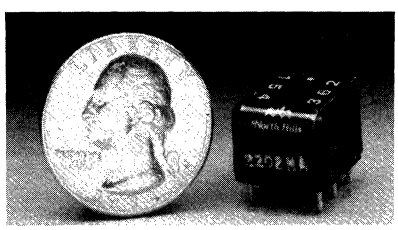
Bandwidths shown correspond to low-end — 3 dB maximum cut-off frequency, and high end frequency at which VSWR does not exceed 1.25.

Model No.	50 Ohms M	50 Ohms F	75 Ohms M	75 Ohms F	90 Ohms M	90 Ohms F	Bandwidth (MHz)
0120-JA		•		•			.05-300
0102-JB	•			•			.05-300
0102-JC	•		•				.05-300
0102-JD		•	•				.05-300
0114-JA		•		•			5-1000
0114-JB	•			•			5-1000
0114-JC	•		•				5-1000
0114-JD		•	•				5-1000
0201-JA		•				•	.05-300
0201-JB	•					•	.05-300
0201-JC	•				•		.05-300
0201-JD		•			•		.05-300
1203-JA				•		•	.2-300
1203-JB			•			•	.2-300
1203-JC			•		•		.2-300
1203-JD				•	•		.2-300



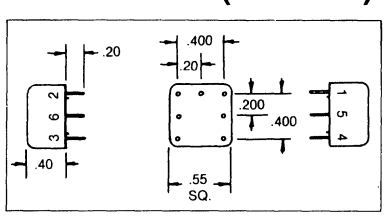
MINIATURE WIDEBAND TRANSFORMERS: NA Series — .10 to 300 MHz

Configuration	Part No.	Impedance Ration • Ohms	Simplified Schematic Diagram
Unbal. to Unbal. Phase Reversing	0003 NA 1106 NA 2200 NA	50:50 75:75 90:90	
Unbal. to Unbal. Phase Reversing DC isolated	0007 NA 1107 NA 2201 NA	50:50 75:75 90:90	
Unbal. to Unbal. Non-inverting	0002 NA 0508 NA 1506 NA	50:12.5 50:200 75:300	
Unbal. to Bal.	0004 NA 0117 NA 0319 NA 0408 NA 0509 NA 1004 NA 1101 NA 1710 NA 1409 NA 1507 NA	50:50 50:75 50:100 50:150 50:200 75:50 75:75 75:100 75:150 75:300	
Bal. to Bal.	0510 NA 1508 NA	50:200 75:300	



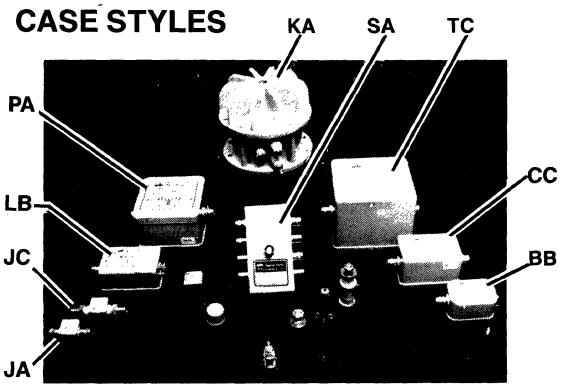
The Model 2202 NA Wideband Transformer shown with a coin to illustrate size.

DIMENSIONS (in inches)



Wt — 4 gms (.14 oz.)
Temp. — 20°C to +80°C

CASE STYLES



APPROXIMATE DIMENSIONS

Type	W	L	H	Mtg Ctrs A	Mtg Ctrs B	Stud Size	Recm. Mtg Hole
BA	1.3	2.3	1.15	.81	1.37	4-40 x .37	.147
BB	1.3	2.6	1.15	.81	1.37	4-40 x .37	.147
HB	.9	.9	.7	—	—	—	.052
LA	1.7	2.8	1.25	1.00	1.50	6-32 x .37	.173
LB	1.7	3.2	1.25	1.00	1.50	6-32 x .37	.173
CC	1.7	3.5	1.55	1.00	1.50	6-32 x .37	.173
PA	3.0	3.9	2.0	1.90	2.30	6-32 x .37	.173
PB	3.0	3.6	2.0	1.90	2.30	6-32 x .37	.173
TC	3.3	4.6	2.9	2.50	2.50	6-32 x .37	.173
MA	2.1	2.1	1.2	0.50	1.65	—	—
UA	3.5	5.0	2.7	2.50	4.00	6-32 x .37	.173
VA	0.8	1.2	0.9	—	—	—	—

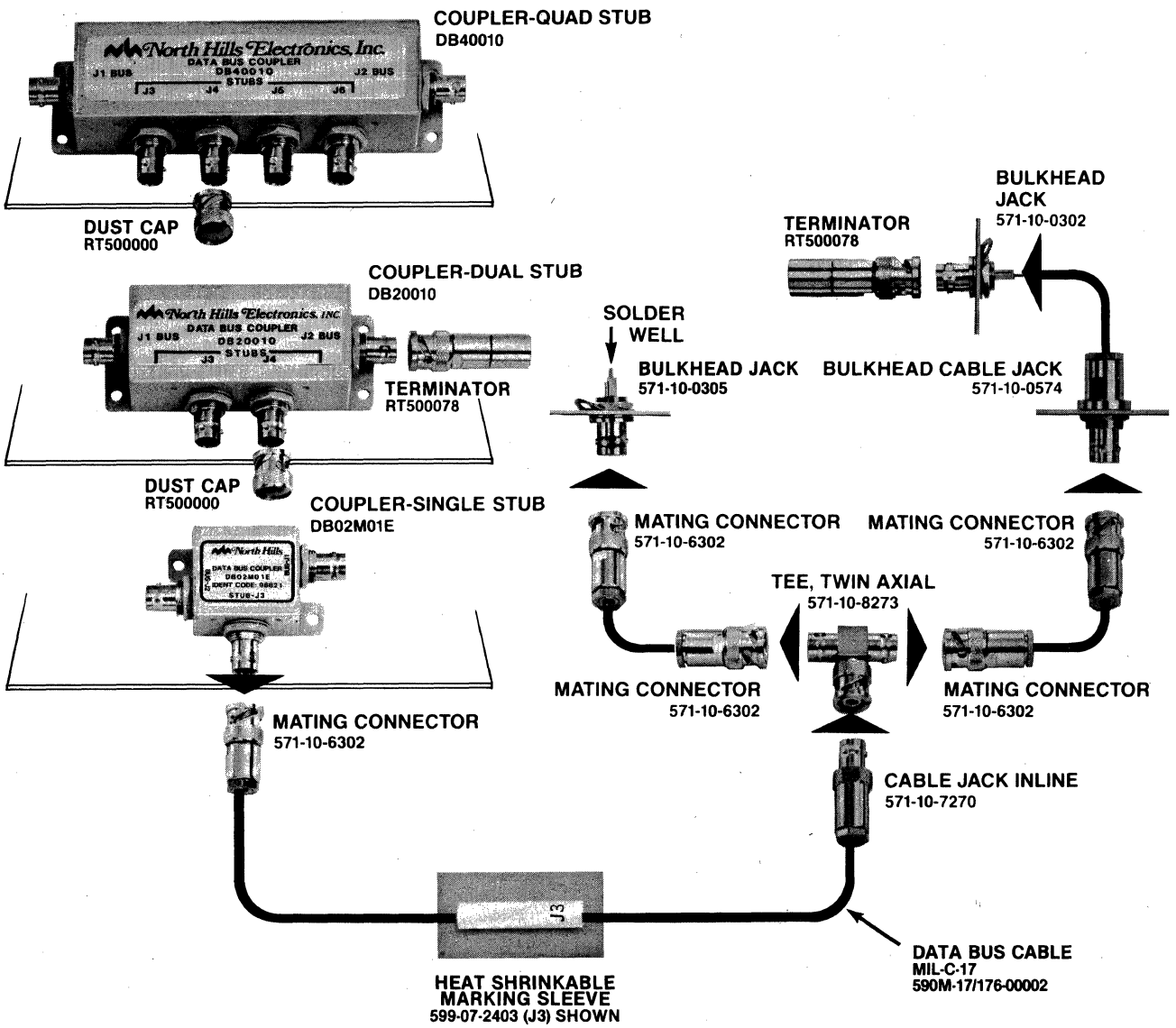
Specifications Subject to Change Without Notice.

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MIL-STD-1553
Data Bus Couplers and Accessories



FEATURES:

- ***Complete assortment of Data Bus interconnect accessories and Data Bus Couplers (Box or In-Line)***
- ***Readily Available From Stock***
- ***Reduced Cost***

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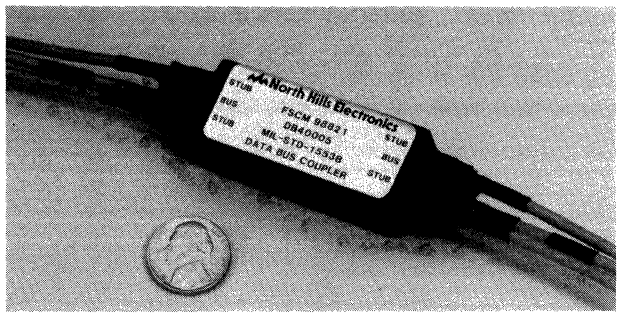
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North Hills Electronics manufactures a full line of MIL-STD-1553 data bus couplers suitable for severe airborne and ground-based applications, as well as test and development systems. They are available in both box and in-line configurations and with a wide variety of connectors. All North Hill Electronics' couplers are manufactured with our own transformers built to MIL-T-21038 and have been qualified on many military programs. Consult us for details and qualification test data.

Couplers are available from stock in configurations ranging from 1 stub to 8 stubs and we would be pleased to provide you with devices to your own specific requirements. Consult us for details.

The tabulation below describes our standard product line of couplers and accessories

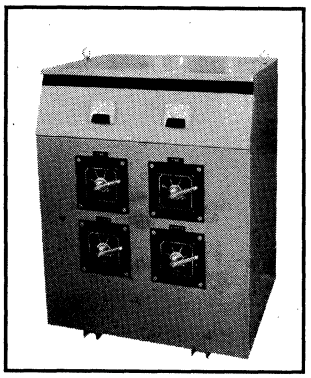


DB40005 4 STUB IN-LINE COUPLER

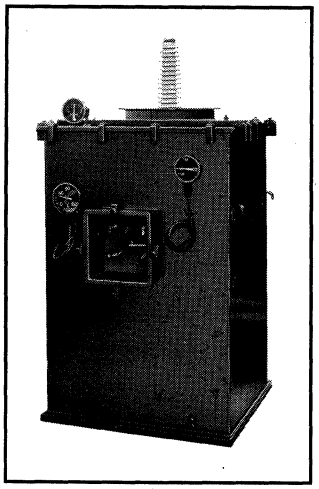
P/N	DESCRIPTION	CASE SIZE (L x W x H)
SINGLE STUB COUPLERS:		
DB01M01E	1553B, FLANGED, D-621/602	1.5 x 1.4 x .9
DB02M01E	1553B, FLANGED, BJ71 (MINIATURE)	1.5 x 1.4 x .9
DB03M01E	1553B, FLANGED, BJ371 (MINIATURE THREADED)	1.5 x 1.4 x .9
DB04M01E	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	1.5 x 1.4 x .9
DB05M01E	1553B, FLANGED, BJ150 (SUB-MINIATURE)	1.5 x 1.4 x .9
DB06M01E	1553B, IN LINE	1.6 x .81 x .52
DB07M01E	1553B, WITH STUDS, BJ77	2.5 x 1.7 x 1.2
DB10005	1553B, MINIATURE IN-LINE	.88 x .39 x .58
NH12824	1553A, FLANGED, USAF #7822056-001	1.5 x 1.15 x 1.0
NH12825	1553A, FLANGED, USAF #7822056-002, WITH TERMINATION	1.5 x 1.15 x 1.0
NH12826	1553B, FLANGED, USAF #7822056-003	1.5 x 1.15 x 1.0
NH12827	1553B, FLANGED, USAF #7822056-004, WITH TERMINATION	1.5 x 1.15 x 1.0
TWO STUB COUPLERS:		
DB20005	1553B, MINIATURE IN-LINE	2.17 x .42 x .77
DB20010	1553B, FLANGED, BJ71 (MINIATURE)	3.125 x 1.5 x 1.0
DB20020	1553B, FLANGED, BJ371 (MINIATURE THREADED)	3.125 x 1.5 x 1.0
DB20030	1553B, FLANGED, BJ150 (SUB-MINIATURE)	3.125 x 1.5 x 1.0
DB20040	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	3.125 x 1.5 x 1.0
THREE STUB COUPLERS:		
DB30005	1553B, MINIATURE IN-LINE	
DB30010	1553B, FLANGED, BJ71 (MINIATURE)	
DB30020	1553B, FLANGED, BJ371 (MINIATURE THREADED)	4.0 x 1.5 x 1.0
DB30030	1553B, FLANGED, BJ150 (SUB-MINIATURE)	4.0 x 1.5 x 1.0
DB30040	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	4.0 x 1.5 x 1.0
FOUR STUB COUPLERS:		
DB40005	1553B, MINIATURE IN-LINE	2.31 x .95 x .84
DB40010	1553B, FLANGED, BJ71 (MINIATURE)	4.87 x 1.5 x 1.0
DB40020	1553B, FLANGED, BJ371 (MINIATURE THREADED)	4.87 x 1.5 x 1.0
DB40030	1553B, FLANGED, BJ150 (SUB-MINIATURE)	4.87 x 1.5 x 1.0
DB40040	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	4.87 x 1.5 x 1.0
FIVE STUB COUPLERS:		
DB50010	1553B, FLANGED, BJ71 (MINIATURE)	5.75 x 1.5 x 1.0
DB50020	1553B, FLANGED, BJ371 (MINIATURE THREADED)	5.75 x 1.5 x 1.0
DB50030	1553B, FLANGED, BJ150 (SUB-MINIATURE)	5.75 x 1.5 x 1.0
DB50040	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	5.75 x 1.5 x 1.0
EIGHT STUB COUPLERS:		
DB80031	1553B, FLANGED, BJ150 (SUB-MINIATURE)	8.25 x 2.0 x 1.0
DB80090	1553B, FLANGED, BJ77 (MINIATURE)	4.88 x 1.5 x 1.9
BUS SWITCHERS:		
DBR1000	1553B, ON-OFF BUS SWITCH, BJ71, DE9 MALE, 28V	1.5 x 1.4 x .9
DBR1001	1553B, ON-OFF BUS SWITCH, BJ71, DE9 MALE, 5V	1.5 x 1.4 x .9
DBR2000	1553B, DPDT BUS SWITCH, BJ71, DE9, 28V	3.125 x 1.5 x 1.0
DBR2001	1553B, DPDT BUS SWITCH, BJ71, DE9, 5V	3.125 x 1.5 x 1.0
MISCELLANEOUS HARDWARE AND ACCESSORIES:		
DB03005	75 OHM TERMINATOR, IN-LINE	1.35 x .44D
RT500000	RFI/DUST CAP, PL75 TYPE	
RT500078	78 OHM TERMINATOR, PL75 TYPE	
RT600000	RFI/DUST CAP, PL375 TYPE	
RT600078	78 OHM TERMINATOR, PL375 TYPE	
RT700000	RFI/DUST CAP, PL155 TYPE	
RT700078	78 OHM TERMINATOR, PL155 TYPE	
RT800000	RFI/DUST CAP, PL3155 TYPE	
RT000078	78 OHM TERMINATOR, PL3155 TYPE	
571-10-6302	CONNECTOR, MATING, PL75-47 TYPE	
571-10-0574	BULKHEAD CABLE JACKS, BJ74-47 TYPE	
571-10-8373	TEE, 2 FEMALE PORTS AND ONE MALE PORT	
571-10-0302	SOLDER WELL BULKHEAD JACK, BJ77 TYPE	
571-10-7270	IN-LINE CABLE JACK, CJ70-47 TYPE	
599-07-2403	HEAT SHRINKABLE MARKING SLEEVE	
590M-17/176-00002	MIL-STD CABLE	
CABLE ASSEMBLIES-CONSULT FACTORY		

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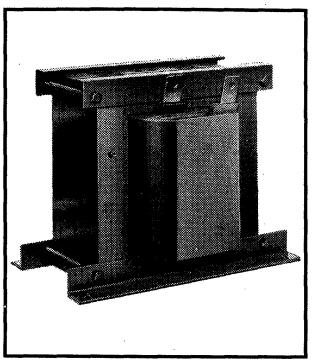
NWL ...the Source for Industrial and Electronic Transformers from WATTS TO MEGAWATTS



Heating transformers for resistance and induction furnaces

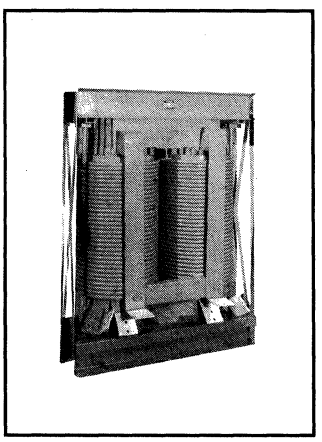


Oil-filled, high voltage Transformer/Rectifier Sets

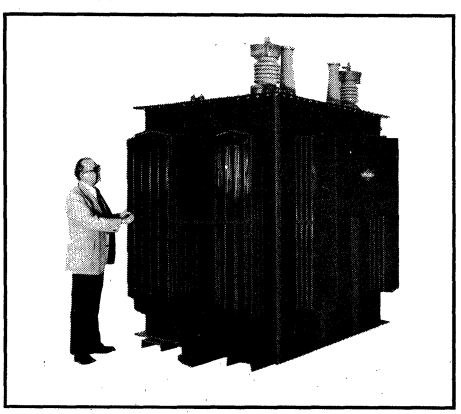


Current limiting reactors

High power and high current water cooled transformers



15 KV Class, 3,000 KVA-equivalent multiple-tapped oil-filled transformer



Since 1929, NWL has consistently been in the forefront of transformer design and manufacture.

High voltage, high frequency and high current transformers are particular strengths at NWL — whether for prototype, standard or special applications.

There's another reason you should look to NWL for solutions to your specific transformer problems. We've never hesitated to tackle the tough design problems head-on. In fact, NWL's technological superiority is a recognized fact in the precipitator, furnace, desalting, nuclear, and other fields requiring high technology.

NWL ... the Source for:

TRANSFORMERS ● Furnace ● Filament ● Heating ● Lighting ● SCR Controls ● Plate ● High Frequency ● Instrument ● Phase Changing ● Welding ● High Voltage ● Testing ● High Reactance ● Output ● Constant Voltage

PLUS ● Saturable Core Reactors ● Chokes ● Packaged Controls ● AC Reactors ● Air Core Reactors

MANUFACTURING RANGE
Up to 300 KV
1 mA to 50,000 AMP
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1 VA to 6,000 KVA
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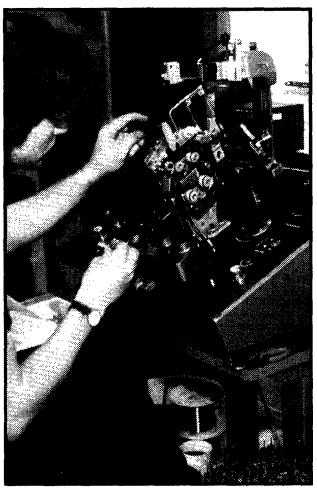
NWL also designs and manufactures custom built AC/DC power supplies,laboratory and industrial types. See our ad under DC POWER SUPPLIES

PTC...Total Transformer Capability from Prototype Development through Production Volume

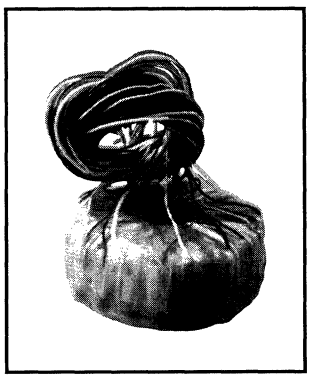
PTC Transformers since 1955, a quality source for a wide range of custom magnetics for Military, Industrial, and Commercial applications.

As a division of NWL Transformers, PTC Transformers is located in the main corporate facility, a modern 155,000 square foot plant in Bordentown, N.J.

PTC has a 35 year tradition of quality and problem-solving. State-of-the-art engineering capabilities are combined with modern design, test and production facilities. PTC also offers designs to the following standards: MIL-T-27, MIL-I-45208, MIL-T-16315, MIL-T-21038, MIL-STD-2000 soldering, UL, VDE, CSA and IEC.



High Speed Toroidal Winder

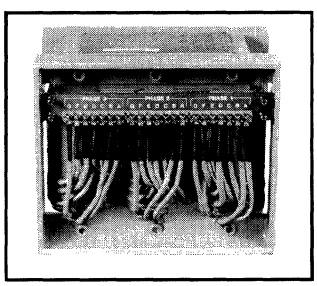


Power Transformer 50/60 Hz 120/240 V Input10 Isolated D.C. Output (Capacitor Input Filters) Electrostatic Shield 6" OD, 3½"Ht.

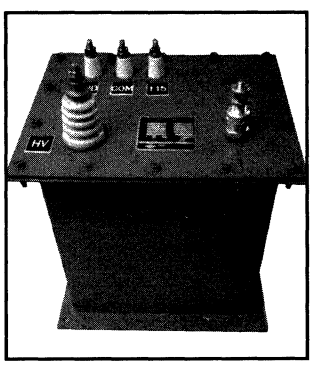
PTC... Products

TRANSFORMERS • High Frequency • Audio • Filament • Toroidal • Constant Voltage (including Power Supplies) • Pulse • High Voltage (Dry, Epoxy, Oil Filled and Low Corona) • Flyback • Inverter • Plate • Surface Mount • Multi-Pulse 3 Phase

OTHER MAGNETICS • Reactors • Chokes • Saturable Core Reactors • Magnetic Amplifiers



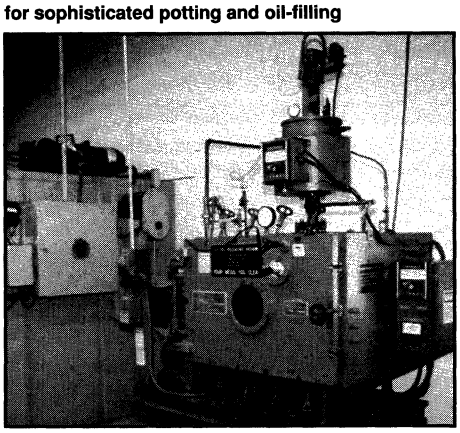
3 Phase "mil-spec" Transformer supplied to the US Navy



High Voltage Power Transformer 2KVA, 19 KV Output Ozone Industry

MANUFACTURING RANGE
Up to 35 KVA @ 60 Hz
Up to 50 KV
From milliamps to over 1,000 amps
From 10 Hz to 500 KHz
Dry, Oil-Filled, Silicone Fluid-Filled, RTV-Filled, Pitch-filled, NEMA Enclosures and Hermetically-Sealed Units, Epoxy Molded, Encapsulated and Potted Units

Hull Vacuum-pressure Chamber for sophisticated potting and oil-filling

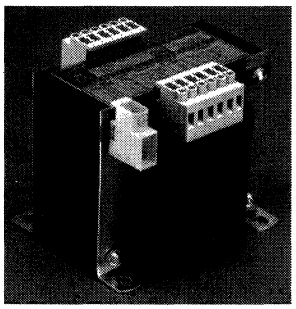


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Industrial • Military • Commercial

Isolation Step-Down Transformers (Low Leakage)



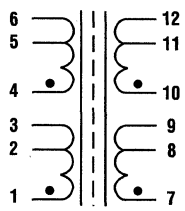
Isolation Step-down Transformers for use at 48-66Hz. Designed to meet requirements UL, CSA, and VDE medical standards. Low-leakage: special safety design provides extra insulation between the primary and secondary windings.

Input voltages: 100, 120, 200, 220, 240.
Output voltages: 100, 120, 200, 220, 240 (±10%)—jumper selectable.
Connections: Line connections are made via screw terminal blocks which are completely insulated and touch-proof for safety. Jumpering connections are made with QDs (no QDs are used on model 82510050; use 14AWG hookup wire); line connections made with screw clamps. Jumper wires (#82110060—16AWG, 1/4" QDs, 4-6") available separately.

SPECIFICATIONS:
Built to: UL 506 (transformers), UL 544 (medical products)
CSA 22.2, No. 66 (transformers), CSA C22.2, No. 125 (medical)
VDE 551 in accordance with VDE 730 (IEC 601–medical)
Approvals: UL (File #E132834, CSA (File #LR 86160-1), VDE pending (File #12344-3320-1001/A1C)

Part Number	Rating
82510010	100VA
82510030	500VA
82510040	1000VA
82510050	2000VA

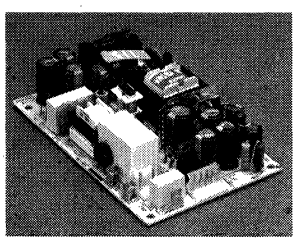
SCHEMATIC:



Connection Information:

Connect	Input To	In/Out Voltage	Output To	Connect
1 to 4, 2 to 5	1 – 2	100	7 – 8	7 to 10, 8 to 11
1 to 4, 3 to 5	1 – 3	120	7 – 9	7 to 10, 9 to 12
2 to 4	1 – 5	200	7 – 11	8 to 10
2 to 4	1 – 6	220	7 – 12	8 to 10
3 to 4	1 – 6	240	7 – 12	9 to 10

Switching Power Supply



#82310010: Switching power supply; specifications at right. Wiring harnesses available separately; contact us for more information.

Surface-mounted switching power supply. Miniature size (5.4" x 3.5"), low profile (1.1" high), high reliability (MTBF 80,000 hours min.). Internally filtered to meet FCC (FCC Docket 20780, part 15, class B) and VDE regulations (VDE 0871, level B) for conducted EMI. Short circuit protection for all outputs; overvoltage protection for ±5 output. 100% dynamic burn-in; 100% computer functional tested both before and after burn-in.

SPECIFICATIONS
Input Characteristics:
Input voltage: 90-132VAC or 180-265VAC
Input frequency range: 47-63Hz, single phase
Voltage selection: jumper selectable
Inrush current (cold start): 25A 5ms max. at nom. line input, full load & 25°C ambient
Efficiency: 70% typical
Holdup time: 1 cycle min. at nominal line, full load condition.
Load transient response: 5% max. for 50% to 100% load change

Output Characteristics:

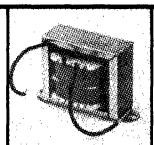
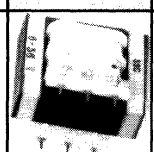
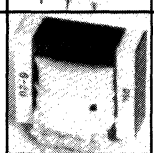
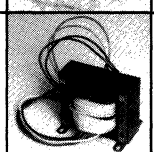
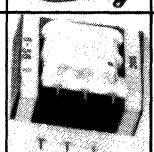
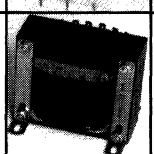
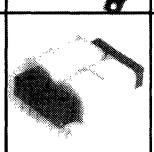
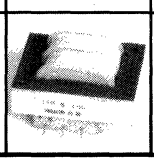
Max. power output (Watts)	Output Voltage V	Load Min. A	Max Current A	Tolerance (%)	Noise Ripple (mv p-p)
40	+5	0.5	2.5	±3	50
	+12	0.4	2.0	±5	120
	-12	0.04	0.3	±10	120

Protection: Overvoltage protection: Standard on +5V output set at 5.25V ± 0.5V
Isolation: Input to output terminals: 1500VAC for 1 minute
Input to safety ground: 1500VAC for 1 minute
Output to safety ground: 500 VAC for 1 minute
Insulation Resistance: Output to safety ground: 50Ω min. at 500 VDC
Safety: Designed to meet UL 478, UL 1012, CSA 22.2 No. 154, VDE 804, VDE 806, IEC 380 and IEC 435
Approvals: UL (File #E87379), CSA (File #LR57908X), TUV (File #R74029)

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SSA SERIES		Primary Voltages Available 115 & 230 VAC, 50/60 HZ. Single Center Tapped Secondaries. Lead Wires or Lugs-Secondary Voltages Ranging from 4 VCT to 230 VCT. Power Ranging from 2 VA to 50 VA.
SSC SERIES		Printed Circuit Types with Single Primary. Available 115 or 230 VAC, 50/60 HZ, with Single Center Tapped Secondaries. Secondary Voltages from 4 to 230 VAC. Power Available from 0.5 to 20 VA.
CSC SERIES		Printed Circuit Types with Single Primary. Available 115 or 230 VAC, 50/60 HZ with Two Equal Secondaries. Secondary Voltages from 4 to 230 Total Series Volts. Power Available from 2 VA to 20 VA.
DSF SERIES		Lead Wires or Lugs with Dual 115 or 230 VAC Primaries, 50/60 HZ. Two Separate and Equal Secondaries. Total Secondary Volts in Series from 6.3 to 480 VAC. Power Available from 50 VA to 450 VA.
TTC SERIES		Telephone Couplers, Hybrids, and Holding Coils. Printed Circuit Types.
MSH SERIES		Dual Primaries for 115/230 VAC, 50/60 HZ Operation. Voltages from 6.3 to 480 VAC. Power from 50-450 VA. Multiple Secondary Types Including Designs for Microprocessor Supplies and Multiple-Tapped Control Types.
DLP SERIES		Low Profile Printed Circuit Types Dual Primaries for 115/230 VAC, 50/60 HZ Operation. Voltages from 6.3 to 230 VAC. Power from 5-50 VA.
MLP SERIES		Low Profile Printed Circuit Types with Multiple Dual 115 VAC Primaries and Secondary Outputs for Logic and OP AMP Supplies.
DHP SERIES		Printed Circuit Types-Compact Design. Single or Dual 115 VAC Primaries 50/60 HZ. Dual Identical Secondaries 5 to 230 VAC. Power from 5-80 VA.

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Isolation Transformers for LAN-ETHERNET Applications

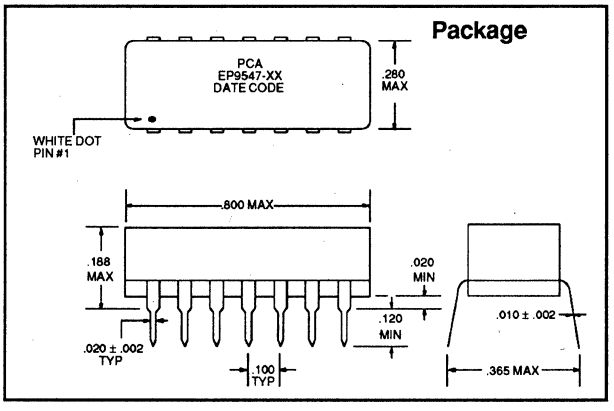
Features

- Designed for IEEE 802.3 (10 Base 2, 10 Base 5) and ECMA Requirements
- Low profile for auto-insertion
- Low leakage inductance (LE) and interwinding capacitance (CW)
  Turns ratio - 1:1 ± 5%
- Available on 14 or 16 pin package
- HIPOT-2000Vrms. (to comply with LANS safety requirements)
  Also available on 500 Vrms, add "X" to the PCA P/N, eg. EP9531-5X.

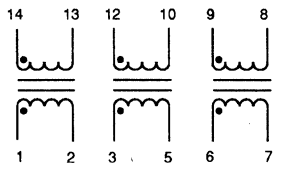
ELECTRICAL SPECIFICATIONS AT 25 °C

PCA PART NO. PKG A	PCA PART NO. PKG B	OCL µH ± 20%	ET-CONSTANT V-µS MIN	RISE TIME nS MAX	CW pF MAX	LE µH MAX	DCR Ω MAX
EP9547-1	EP9531-1	25	2.0	3.0	5	0.15	0.15
EP9547-2	EP9531-2	30	2.0	3.0	5	0.15	0.15
EP9547-3	EP9531-3	35	2.2	3.0	6	0.15	0.20
EP9547-4	EP9531-4	50	2.2	3.0	7	0.20	0.20
EP9547-5	EP9531-5	75	2.5	3.0	8	0.20	0.25
EP9547-6	EP9531-6	100	2.5	3.0	9	0.25	0.30
EP9547-7	EP9531-7	125	3.0	3.0	10	0.25	0.30
EP9547-8	EP9531-8	150	3.0	3.0	11	0.25	0.40
EP9547-9	EP9531-9	175	3.5	3.5	12	0.25	0.50
EP9547-10	EP9531-10	200	3.5	3.5	13	0.30	0.50
EP9547-11	EP9531-11	250	4.0	4.0	14	0.35	0.60
EP9547-12	EP9531-12	300	4.0	4.0	15	0.35	0.60

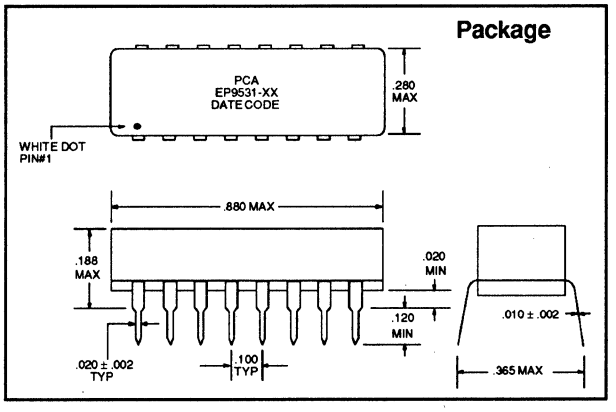
Package



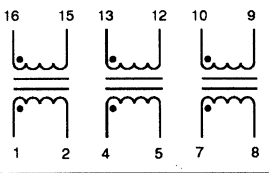
Schematic



Package



Schematic



PCA ELECTRONICS INC.
16799 SCHOENBORN ST.
SEPULVEDA, CA 91343
TEL: (818) 892-0761
FAX: (818) 894-5791
TWX: (910) 496-1525

EP9547 & EP9531 10/90

Token Ring Isolation Transformers

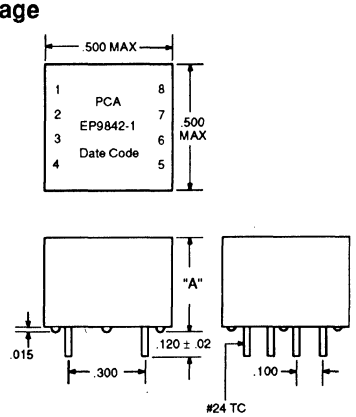
Features

- Available in single and dual low profile packages
- Hipot - 500Vrms (to comply with LAN's International Safety Requirements)
- Designed for IBM and TI token ring for 4 mHz and 16 mHz applications IEEE 802.5 compatible

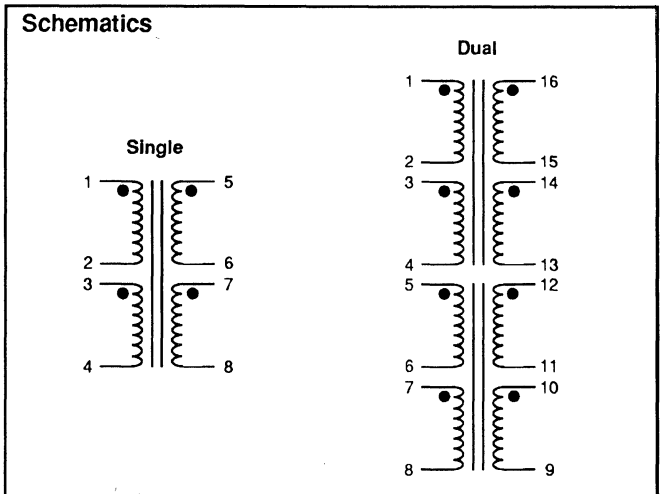
ELECTRICAL SPECIFICATIONS @ 25 °C				
	4 mHz Applications		16 mHz Applications	
PCA P/N	EP9842-1	EP9842-2	EPA1550-3	EPA1550-4
Package Style	Single	Dual	Single	Dual
"A" Dimension	.370 Max.	.385 Max.	.250 Max.	.250 Max..
Open Circuit Inductance @ 100 KHz	1.0 mH Ref.		250 µH Ref.	
Turns Ratio	1:1:2:2 ± 5%		1:1:2:2 ± 5%	
Capacitor Winding	15 pF Max.		15 pF Max.	
Leakage Inductance	.4 µH Max.		.15 µH Max.	
Primary DCR	0.55 Ω Max.		0.55 Ω Max.	
Secondary DCR	0.85 Ω Max.		0.85 Ω Max.	

RATING @ 25 °C	
Parameters	**Specifications**
Insertion Loss @ 10 mHz	0.5 dB max
Common Mode Rejection Ratio @ 1.0 mHz	-60 dB min
Return Loss @ 5 mHz	20 dB min
HIPOT between Pri and Sec and also from coil to coil in the Dual Package	500 Vrms

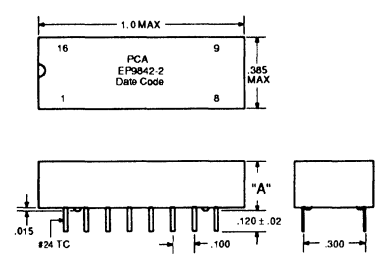
Single Package



Schematics



Dual Package



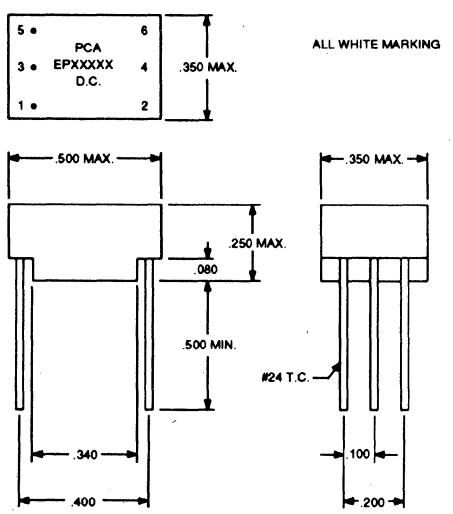
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SEPULVEDA, CA 91343
TEL: (818) 892-0761
FAX: (818) 894-5791
TWX: (910) 496-1525

EP9842 & EPA1550 10/90

Stand - Off Type Pulse Transformer

Turns Ratio (±5%)	Primary Sine Wave OCL (µH Min)	Primary ET Constant (v-µs Min)	Rise Time (nS Max)	Pri Sec Cw / w (pF Max)	Pri Sec Leakage Inductance (µH Max)	Primary DCR (Ω Max)	Secondary DCR (Ω Max)	Tertiary DCR (Ω Max)	PCA Part No.
1:1:1	5000	25.0	10.5	60	1.3	3.9	3.9	3.9	EP15760
	2000	16.0	8.2	37	0.8	2.5	2.5	2.5	EP15761
	500	8.5	5.3	32	0.4	1.3	1.3	1.3	EP15762
	200	5.0	4.2	18	0.3	0.9	0.9	0.9	EP15763
	50	5.2	5.6	18	0.5	1.3	1.3	1.3	EP15764
	20	3.2	4.1	21	0.4	0.9	0.9	0.9	EP15765
	10	3.7	5.1	22	0.5	0.9	0.9	0.9	EP15766
2:1:1	5000	25.0	16.0	33	3.6	3.9	2.0	2.0	EP15767
	2000	16.0	11.0	19	1.8	2.5	1.4	1.4	EP15768
	500	8.5	5.6	11	1.1	1.3	0.7	0.7	EP15769
	200	5.0	3.2	8	0.8	0.9	0.5	0.5	EP15770
	20	5.8	7.5	12	1.5	1.3	0.8	0.8	EP15772
3:1:1	200	5.0	3.6	7	1.1	0.9	0.4	0.4	EP15777
	20	3.2	2.7	6	1.3	0.9	0.4	0.4	EP15779
4:2:1	2000	16.0	13.0	20	2.5	2.5	1.4	0.8	EP15782
	500	8.5	4.7	13	0.9	1.4	0.8	0.5	EP15783
	200	5.0	3.7	8	0.8	0.9	0.5	0.4	EP15784
1ct:1ct	2000	16.0	8.2	37	0.8	2.5	2.5		EP18270
	500	8.5	5.3	32	0.4	1.3	1.3		EP18271
	200	5.0	4.2	18	0.3	0.9	0.9		EP18272
	50	5.2	5.6	18	0.5	1.3	1.3		EP18273
	20	3.2	4.1	21	0.4	0.9	0.9		EP18274
	10	3.7	5.1	22	0.5	0.9	0.9		EP18275
2ct:1ct	2000	16.0	11.0	19	1.8	2.5	1.4		EP18276
	500	8.5	5.6	12	1.2	1.4	0.8		EP18277
	200	5.0	3.2	8	0.8	0.9	0.5		EP18278
	50	5.2	5.2	12	1.3	1.3	0.7		EP18279
	20	5.8	7.5	12	1.5	1.3	0.8		EP18280
	10	3.7	4.5	9	1.5	0.9	0.5		EP18281

Package Dimensions

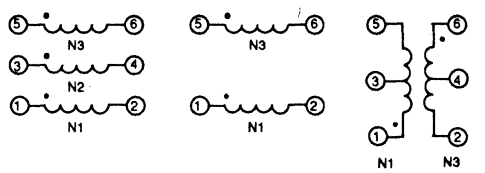


EP15760 2/89

Method of Testing

For primary inductance (OCL): HP4275A, 100KHz, 0.1Vrms
Multi- Freq LCR Meter
For leakage inductance and interwinding capacitance:
Tektronix Type 130 LC Meter
Hipot : 500 Vdc IR : 10 K Meg Ω Min @ 500 Vdc

Schematic



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TEL: (818) 892-0761
FAX: (818) 894-5791
TWX: (910) 496-1525

Toroidal Power Inductors

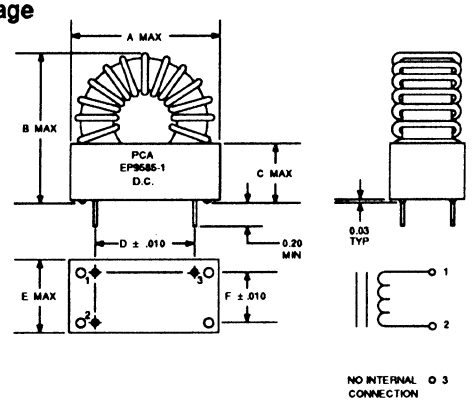
Features

- 2:1 Inductance swing from 0 ADC to max rated DC current
- 40° C max temperature rise
- Available with or without case

PART NUMBER	INDUCTANCE RATED ADC µH MIN	ADC AMPS	TEST LEVEL @ 15.75 KHz VRMS	INDUCTANCE @ 0 ADC µH MIN	DCR OHMS MAX	ET 20 KHz V-µS	ET 40 KHz V-µS	LEAD DIA INCH ± .005	PACKAGE
EP9585-1	17	17	1.1	40	.0065	190	130	.081	3
EP9585-2	32	16	2.2	74	.0092	290	200	.081	4
EP9585-3	60	16	3.9	125	.012	390	270	.081	5
EP9585-4	14	10	0.6	27	.009	135	95	.057	1
EP9585-5	23	11	1.1	46	.012	170	120	.057	2
EP9585-6	43	10	1.7	90	.018	280	195	.057	3
EP9585-7	78	10	3.2	165	.025	430	300	.057	4
EP9585-8	144	10	5.7	275	.032	570	400	.057	5
EP9585-9	32	6.5	0.85	64	.025	200	140	.04	1
EP9585-10	52	7	1.5	97	.032	230	160	.04	2
EP9585-11	98	6	2.4	185	.048	400	280	.04	3
EP9585-12	175	6	4.6	330	.068	620	425	.04	4
EP9585-13	335	6	8.5	600	.095	840	580	.04	5

ADC=Rated DC Current

Package



Dimensions

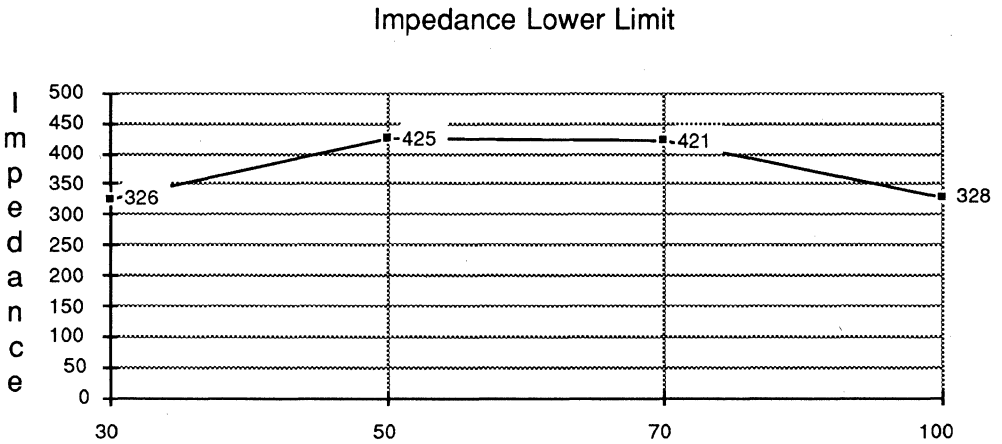
PKG	A	B	C	D	E	F
1	1.20	1.20	.45	.800	.60	.400
2	1.45	1.45	.70	.900	.80	.600
3	1.60	1.75	.70	.900	.80	.600
4	2.00	2.00	.90	1.200	.95	.70
5	2.30	2.30	1.00	1.500	1.20	.900

PCA ELECTRONICS INC.
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SEPULVEDA, CA 91343
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FAX: (818) 894-5791
TWX: (910) 496-1525

EP9585 7/88

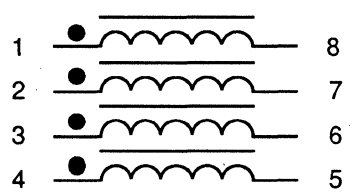
4 Line Common Mode Filter

PCA P/N EPA120 & EPA120G

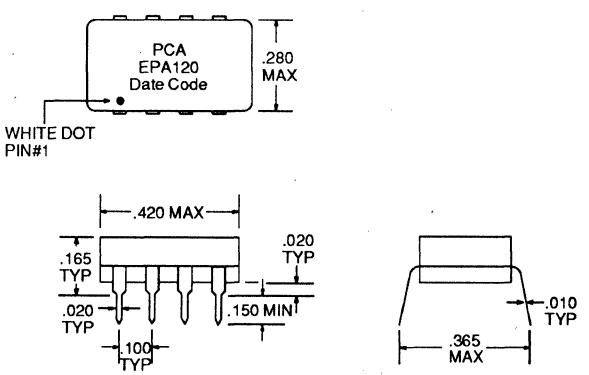


- Impedance limits per chart measured using HP4193A Vector Impedance Meter
- Max Current 1 A DC/Winding
- Temperature rise 45° C Max at 25° C ambient
- Package transfer-molded epoxy suitable for auto-insertion
- Part is symmetrical: May be inserted either way
- 300 Vac Hipot

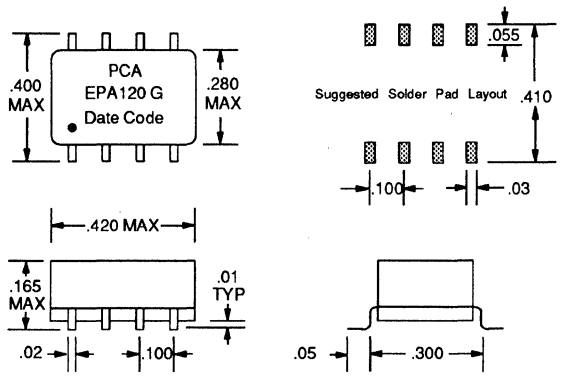
Schematic



DIP Package



SMD Package



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EPA120 & EPA120G Rev. A 4/91

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

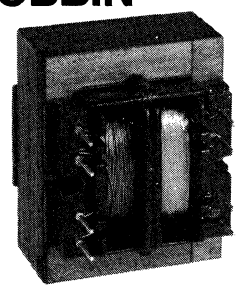
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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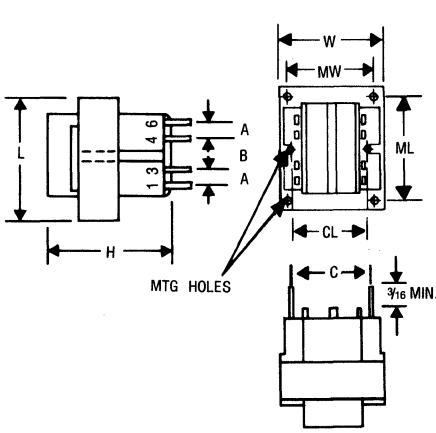
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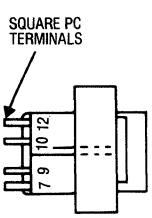
INTERNATIONAL SERIES LOW PROFILE DUAL BOBBIN PRINTED CIRCUIT POWER TRANSFORMERS

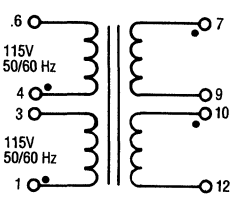


- **Designed to meet UL, VDE, IEC-65, CSA.**
- Dual bobbin construction with insulating shrouds—provides 4000V hipot and results in low interwinding capacitance, eliminating the need for electro-static shielding.
- 130°C insulating system—materials meet UL flammability requirements.
- Dual 115V/230V 50/60 HZ primaries.
- Dual secondaries for variety of utilization.
- Low cost.

Part No.	R.M.S. SECONDARY RATINGS			
	Series	Parallel	Size	VA
VPC3-10	10 VCT @ 0.25A	5 V @ 0.5 A	3	2.5
VPC3-12	12.6VCT @ 0.2 A	6.3V @ 0.4 A	3	2.5
VPC3-16	16 VCT @ 0.15A	8 V @ 0.3 A	3	2.5
VPC3-20	20 VCT @ 0.12A	10 V @ 0.24A	3	2.5
VPC3-24	24 VCT @ 0.1 A	12 V @ 0.2 A	3	2.5
VPC3-28	28 VCT @ 0.09A	14 V @ 0.18A	3	2.5
VPC3-36	36 VCT @ 0.07A	18 V @ 0.14A	3	2.5
VPC4-10	10 VCT @ 0.5 A	5 V @ 1.0 A	4	5.0
VPC4-12	12.6VCT @ 0.4 A	6.3V @ 0.8 A	4	5.0
VPC4-16	16 VCT @ 0.31A	8 V @ 0.62A	4	5.0
VPC4-20	20 VCT @ 0.25A	10 V @ 0.5 A	4	5.0
VPC4-24	24 VCT @ 0.21A	12 V @ 0.42A	4	5.0
VPC4-28	28 VCT @ 0.18A	14 V @ 0.36A	4	5.0
VPC4-36	36 VCT @ 0.14A	18 V @ 0.28A	4	5.0
VPC5-10	10 VCT @ 1.0 A	5 V @ 2.0 A	5	10.0
VPC5-12	12.6VCT @ 0.8 A	6.3V @ 1.6 A	5	10.0
VPC5-16	16 VCT @ 0.62A	8 V @ 1.25A	5	10.0
VPC5-20	20 VCT @ 0.5 A	10 V @ 1.0 A	5	10.0
VPC5-24	24 VCT @ 0.42A	12 V @ 0.84A	5	10.0
VPC5-28	28 VCT @ 0.36A	14 V @ 0.72A	5	10.0
VPC5-36	36 VCT @ 0.28A	18 V @ 0.56A	5	10.0
VPC6-10	10 VCT @ 2.0 A	5 V @ 4.0 A	6	20.0
VPC6-12	12.6VCT @ 1.6 A	6.3V @ 3.2 A	6	20.0
VPC6-16	16 VCT @ 1.25A	8 V @ 2.5 A	6	20.0
VPC6-20	20 VCT @ 1.0 A	10 V @ 2.0 A	6	20.0
VPC6-24	24 VCT @ .83A	12 V @ 1.66A	6	20.0
VPC6-28	28 VCT @ .72A	14 V @ 1.44A	6	20.0
VPC6-36	36 VCT @ .56A	18 V @ 1.12A	6	20.0
VPC7-10	10 VCT @ 3.0 A	5 V @ 6.0 A	7	30.0
VPC7-12	12.6VCT @ 2.4 A	6.3V @ 4.8 A	7	30.0
VPC7-16	16 VCT @ 1.9 A	8 V @ 3.8 A	7	30.0
VPC7-20	20 VCT @ 1.5 A	10 V @ 3.0 A	7	30.0
VPC7-24	24 VCT @ 1.25A	12 V @ 2.5 A	7	30.0
VPC7-28	28 VCT @ 1.06A	14 V @ 2.12A	7	30.0
VPC7-36	36 VCT @ .82A	18 V @ 1.64A	7	30.0
VPC8-10	10 VCT @ 5.6 A	5 V @ 11.2 A	8	56.0
VPC8-12	12.6VCT @ 4.4 A	6.3V @ 8.8 A	8	56.0
VPC8-16	16 VCT @ 3.5 A	8 V @ 7.0 A	8	56.0
VPC8-20	20 VCT @ 2.8 A	10 V @ 5.6 A	8	56.0
VPC8-24	24 VCT @ 2.33A	12 V @ 4.66A	8	56.0
VPC8-28	28 VCT @ 2.0 A	14 V @ 4.0 A	8	56.0
VPC8-36	36 VCT @ 1.56A	18 V @ 3.12A	8	56.0





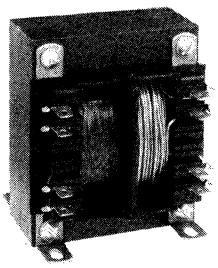


SIZE	VA	L	W	H	A	B	C	PIN	MTG CL	MTG MW	MTG ML	MTG Screw	WT. lbs.
3	2.5	1 5/8	1 5/16	1 1/8	.200	.250	1.000	.025SQ	1 1/16	—	—	#4	0.25
4	5.0	1 5/8	1 5/16	1 3/8	.200	.400	1.000	.025SQ	1 1/16	—	—	#4	0.37
5	10.0	1 7/8	1 9/16	1 3/8	.200	.400	1.140	.038SQ	1 1/4	—	—	#4	0.53
6	20.0	2 1/4	1 7/8	1 5/8	.400	.400	1.460	.038SQ	1 1/2	—	—	#4	0.90
7	30.0	2 5/8	2 3/16	1 9/16	.550	.275	1.680	.045SQ	—	1 3/4	2 3/16	#6	1.15
8	56.0	3	2 1/2	1 13/16	.600	.300	1.900	.045SQ	—	2	2 1/2	#6	1.70

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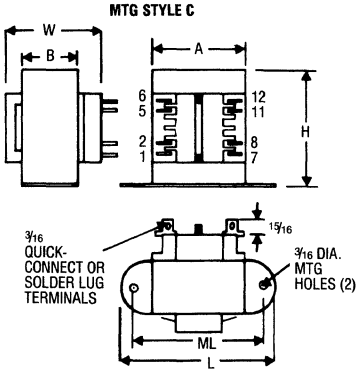
INTERNATIONAL SERIES CHASSIS MOUNT TYPE DUAL BOBBIN POWER TRANSFORMERS



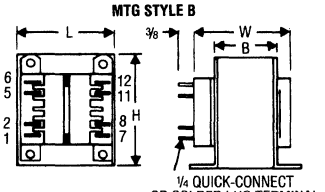
- **Designed to meet UL, VDE, IEC-65, CSA.**
- Dual bobbin construction with insulating shrouds—provides 4000V hipot and results in low interwinding capacitance eliminating the need for electro-static shielding.
- 130°C insulating system—materials meet UL flammability requirements.
- Dual 115V/230V 50/60 HZ primaries.
- Dual secondaries for variety of utilization.
- Low cost.

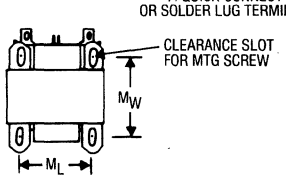
Part No.	R.M.S. SECONDARY RATINGS			
	Series	Parallel	Size	VA
VRP6-10	10 VCT @ 2.5 A	5 V @ 5.0 A	6	25
VRP6-12	12.6VCT @ 2.0 A	6.3V @ 4.0 A	6	25
VRP6-16	16 VCT @ 1.6 A	8 V @ 3.2 A	6	25
VRP6-20	20 VCT @ 1.25A	10 V @ 2.5 A	6	25
VRP6-24	24 VCT @ 1.0 A	12 V @ 2.0 A	6	25
VRP6-28	28 VCT @ 0.9 A	14 V @ 1.8 A	6	25
VRP6-36	36 VCT @ 0.7 A	18 V @ 1.4 A	6	25
VRP6-230	230 VCT @ 0.11A	115 V @ 0.22A	6	25
VRP7-10	10 VCT @ 4.3 A	5 V @ 8.6 A	7	43
VRP7-12	12.6VCT @ 3.4 A	6.3V @ 6.8 A	7	43
VRP7-16	16 VCT @ 2.7 A	8 V @ 5.4 A	7	43
VRP7-20	20 VCT @ 2.2 A	10 V @ 4.4 A	7	43
VRP7-24	24 VCT @ 1.8 A	12 V @ 3.6 A	7	43
VRP7-28	28 VCT @ 1.5 A	14 V @ 3.0 A	7	43
VRP7-36	36 VCT @ 1.2 A	18 V @ 2.4 A	7	43
VRP7-230	230 VCT @ 0.19A	115 V @ 0.38A	7	43
VRP8-10	10 VCT @ 8.0 A	5 V @ 16.0 A	8	80
VRP8-12	12.6VCT @ 6.3 A	6.3V @ 12.6 A	8	80
VRP8-16	16 VCT @ 5.0 A	8 V @ 10.0 A	8	80
VRP8-20	20 VCT @ 4.0 A	10 V @ 8.0 A	8	80
VRP8-24	24 VCT @ 3.3 A	12 V @ 6.6 A	8	80
VRP8-28	28 VCT @ 2.8 A	14 V @ 5.6 A	8	80
VRP8-36	36 VCT @ 2.2 A	18 V @ 4.4 A	8	80
VRP8-230	230 VCT @ 0.35A	115 V @ 0.7 A	8	80
VRP9-10	10 VCT @ 13.0 A	5 V @ 26.0 A	9	130
VRP9-12	12.6VCT @ 10.3 A	6.3V @ 20.6 A	9	130
VRP9-16	16 VCT @ 8.1 A	8 V @ 16.2 A	9	130
VRP9-20	20 VCT @ 6.5 A	10 V @ 13.0 A	9	130
VRP9-24	24 VCT @ 5.4 A	12 V @ 10.8 A	9	130
VRP9-28	28 VCT @ 4.6 A	14 V @ 9.2 A	9	130
VRP9-36	36 VCT @ 3.6 A	18 V @ 7.2 A	9	130
VRP9-230	230 VCT @ 0.57A	115 V @ 1.14A	9	130
VRP10-16	16 VCT @ 11.0 A	8 V @ 22.0 A	10	175
VRP10-20	20 VCT @ 8.8 A	10 V @ 17.6 A	10	175
VRP10-24	24 VCT @ 7.3 A	12 V @ 14.6 A	10	175
VRP10-28	28 VCT @ 6.25A	14 V @ 12.5 A	10	175
VRP10-36	36 VCT @ 4.8 A	18 V @ 9.6 A	10	175
VRP10-230	230 VCT @ 0.76A	115 V @ 1.52A	10	175

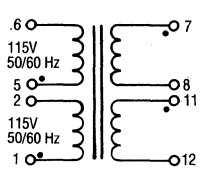
MTG STYLE C



MTG STYLE B





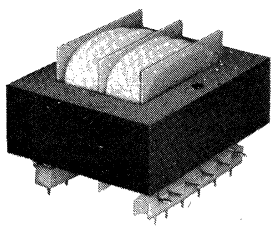


SIZE	VA	L	W	H	A	B	MTG Style	MTG ML	MTG MW	MTG Screw	WT. lbs.
6	25	2 13/16	1 7/8	2 5/16	2	1 1/8	C	2 3/8	—	#6	1.25
7	43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	C	2 13/16	—	#6	1.60
8	80	3 9/16	2 3/8	3 1/16	2 5/8	1 5/16	B	2	2 1/4	#6	2.60
9	130	2 13/16	2 7/8	3 3/8	—	1 5/8	B	2 1/4	2 1/2	#8	4.10
10	175	3 1/8	2 7/8	3 3/4	—	1 5/8	B	2 1/2	2 1/2	#8	6.50

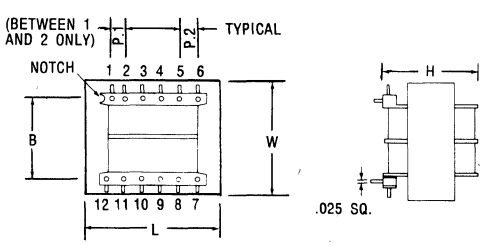
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LOW PROFILE SPLIT BOBBIN PRINTED CIRCUIT POWER TRANSFORMERS

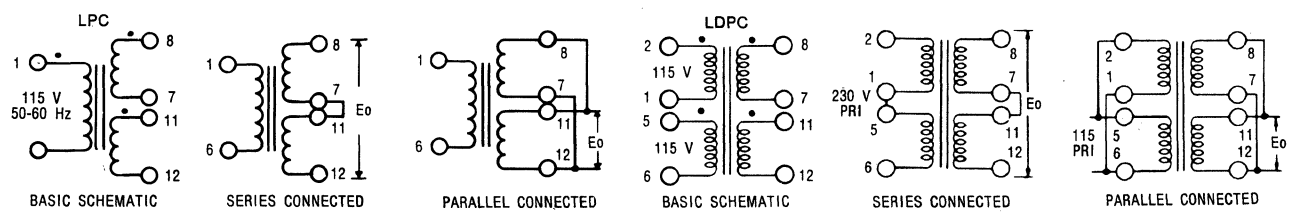
- Low profile — allows closer printed circuit board stacking
- Split bobbin construction — center flange insulation barrier provides 2500 VRMs Hipot — non concentric coil winding results in low interwinding capacitance, eliminates need for electro-static shielding.
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard.
- Dual secondaries for variety of utilization
- 12 pin bobbin design increases available options for multi-winding special orders
- Low regulation



PRIMARY 50/60HZ		R.M.S. SECONDARY RATINGS			
Single 115V	Dual 115V/230V	Series	Parallel	SIZE	VA
LPC3- 12	LDPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
LPC3- 16	LDPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
LPC3- 20	LDPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
LPC3- 24	LDPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
LPC3- 34	LDPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
LPC3- 40	LDPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
LPC3- 56	LDPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
LPC3-120	LDPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
LPC4- 12	LDPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
LPC4- 16	LDPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
LPC4- 20	LDPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
LPC4- 24	LDPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
LPC4- 34	LDPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
LPC4- 40	LDPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
LPC4- 56	LDPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
LPC4-120	LDPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
LPC5- 12	LDPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
LPC5- 16	LDPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
LPC5- 20	LDPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
LPC5- 24	LDPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
LPC5- 34	LDPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
LPC5- 40	LDPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
LPC5- 56	LDPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
LPC5-120	LDPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
LPC6- 12	LDPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
LPC6- 16	LDPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
LPC6- 20	LDPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
LPC6- 24	LDPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
LPC6- 34	LDPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
LPC6- 40	LDPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
LPC6- 56	LDPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
LPC6-120	LDPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0



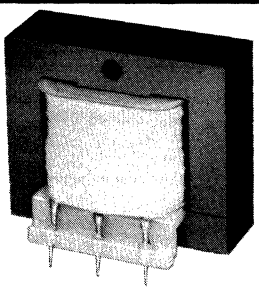
LPC, LDPC SIZE	VA	L″	W″	H″	P-1	P-2	B	WT. (oz.)
3	1.25	1⅜	1 5/16	1 1/16	.150	.200	.862	3
4	4.50	1⅝	1⅜	1 3/16	.200	.250	.950	5
5	10.0	1⅞	1⅝	1 5/16	.200	.300	1.100	9
6	24.0	2¼	1⅞	1 1/16	.200	.300	1.300	14



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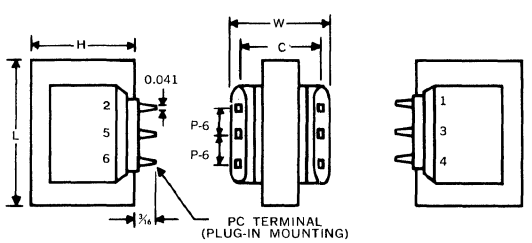
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PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS

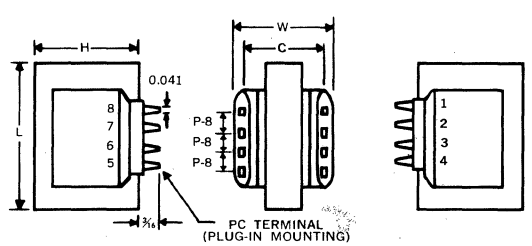


- Packaging flexibility
- Miniaturized construction
- Precision spaced molded-in terminals
- 105°C insulation system
- 1500V Hipot
- Low regulation
- Single 115V and dual 115V/230V primaries are standard
- Dual secondaries for variety of utilization

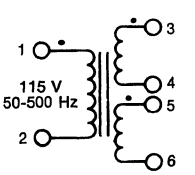
PRIMARY 50/400HZ		R.M.S. SECONDARY RATINGS			
Single 115V	Dual 115V/230V	Series	Parallel	SIZE	VA
PC2- 12	DPC2- 12	12.6VCT @ 70MA	6.3V @ 140MA	2	1.0
PC2- 16	DPC2- 16	16 VCT @ 55MA	8 V @ 110MA	2	1.0
PC2- 20	DPC2- 20	20 VCT @ 45MA	10 V @ 90MA	2	1.0
PC2- 24	DPC2- 24	24 VCT @ 35MA	12 V @ 70MA	2	1.0
PC2- 34	DPC2- 34	34 VCT @ 25MA	17 V @ 50MA	2	1.0
PC2- 40	DPC2- 40	40 VCT @ 20MA	20 V @ 40 MA	2	1.0
PC2- 56	DPC2- 56	56 VCT @ 15MA	28 V @ 30MA	2	1.0
PC3- 12	DPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
PC3- 16	DPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
PC3- 20	DPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
PC3- 24	DPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
PC3- 34	DPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
PC3- 40	DPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
PC3- 56	DPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
PC3-120	DPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
PC4- 12	DPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
PC4- 16	DPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
PC4- 20	DPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
PC4- 24	DPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
PC4- 34	DPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
PC4- 40	DPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
PC4- 56	DPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
PC4-120	DPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
PC5- 12	DPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
PC5- 16	DPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
PC5- 20	DPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
PC5- 24	DPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
PC5- 34	DPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
PC5- 40	DPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
PC5- 56	DPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
PC5-120	DPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
PC6- 12	DPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
PC6- 16	DPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
PC6- 20	DPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
PC6- 24	DPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
PC6- 34	DPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
PC6- 40	DPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
PC6- 56	DPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
PC6-120	DPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0



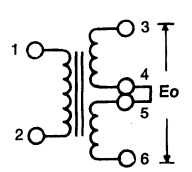
PC-6 PINS



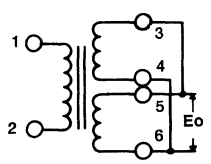
DPC-8 PINS



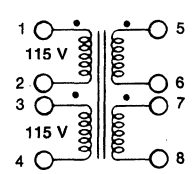
BASIC SCHEMATIC



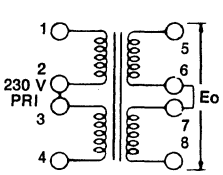
SERIES CONNECTED



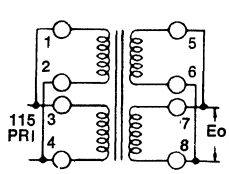
PARALLEL CONNECTED



BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED

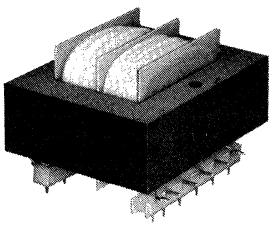
SIZE	VA	L	W	H	P-6 PIN	P-8 PIN	C	WT. (oz.)
2	1.0	1	1⅜	0.83	.250	.200	1.200	2.5
3	1.25	1⅜	1⅛	1 3/16	.312	.200	1.000	3
4	4.50	1⅝	1¼	1⅜	.400	.250	1.100	5
5	10.0	1⅞	1 1/16	1⅝	.400	.250	1.300	9
6	24.0	1⅝	2¼	1⅜	.400	.250	2.100	12

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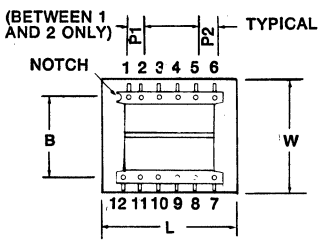
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LOW PROFILE SPLIT BOBBIN MICROPROCESSOR PRINTED CIRCUIT POWER TRANSFORMERS

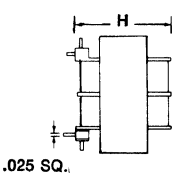
- Low profile — allows closer printed circuit board stacking
- Split bobbin construction—center flange insulation barrier provides 2500 VRMs Hipot—non concentric coil winding results in low inter-winding capacitance, eliminates need for electro-static shielding
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard
- DC output combinations — ±12 and 5V or ±15 and 5V rated at the regulator output with allowance for line variations up to ±13%
- Packaging Flexibility



Primary 50/60 Hz		Regulated DC Ratings		
Single 115V	Dual 115V/230V	IC1	IC2	Size
LM4-12	LDM4-12	5VDC@185mA	±12VDC@35mA	4
LM5-12	LDM5-12	5VDC@365mA	±12VDC@60mA	5
LM6-12	LDM6-12	5VDC@850mA	±12VDC@150mA	6
LM4-15	LDM4-15	5VDC@185mA	±15VDC@30mA	4
LM5-15	LDM5-15	5VDC@365mA	±15VDC@50mA	5
LM6-15	LDM6-15	5VDC@850mA	±15VDC@130mA	6



LM, LDM Size	L"	W"	H"	P-1	P-2	B	WT. (oz.)
4	1⅝	1⅜	1 3/16	.200	.250	.950	5
5	1⅞	1⅝	1 3/16	.200	.300	1.100	9
6	2¼	1⅞	1 3/16	.200	.300	1.300	14

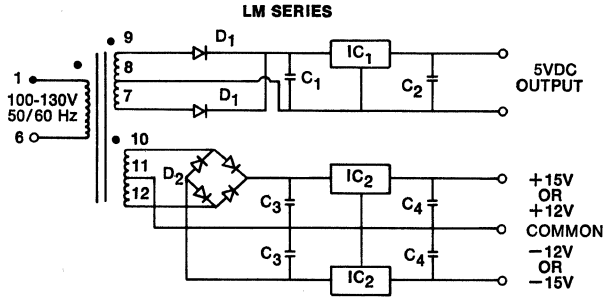


RECOMMENDED COMPONENTS

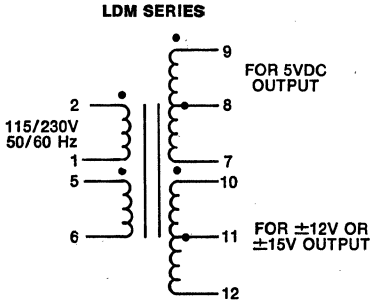
Part Number	C_1		C_2		C_3		C_4		D_1(2)	D_2(4)	IC_1	IC_2
	MFD	V	MFD	V	MFD	V	MFD	V				
LM4-12/LDM4-12	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM326N
LM4-15/LDM4-15	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM325N
LM5-12/LDM5-12	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM326N
LM5-15/LDM5-15	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM325N
LM6-12/LDM6-12	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM326N
LM6-15/LDM6-15	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM325N

SCHEMATIC DIAGRAMS

LM SERIES



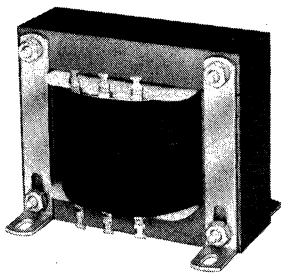
LDM SERIES



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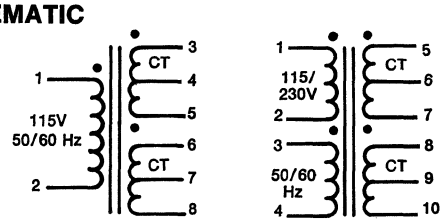
RECTIFIER POWER TRANSFORMERS



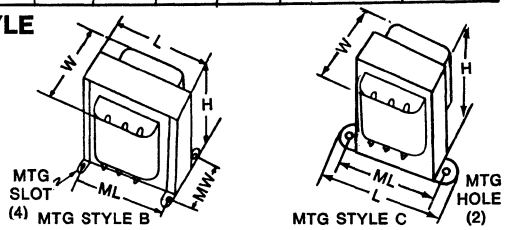
- Single 115V or dual 115V/230V — 50/60 Hz primaries.
- (2) center tapped secondaries provide variety of utilization.
- 1500 VRMS hipot.
- Class 130°C insulation system.
- Rugged construction — only prime raw materials are used.
- Secondary voltage and currents are R.M.S. and are designed for a wide range of rectifier power circuit applications. Our Engineering/Applications staff can assist you with selecting the unit that best suits your rectifier circuit requirements. Custom design and construction is available for your special requirements.

PRIMARY 50/60 Hz		R.M.S. SECONDARY RATINGS		Mtg.						Mtg.	Approx.
Single 115V	Dual 115V/230V	Series	Parallel	Style	L	W	H	ML	MW	Screw	Wt.
RP10- 1	DRP10- 1	10 VCT @ 1A	5 VCT @ 2A	C	2 13/16	1 1/2	1 5/8	2 3/8	—	# 8	.6
RP10- 2	DRP10- 2	10 VCT @ 2A	5 VCT @ 4A	C	3 1/4	1 3/4	1 15/16	2 13/16	—	# 8	1.0
RP10- 4	DRP10- 4	10 VCT @ 4A	5 VCT @ 8A	C	3 11/16	2	2 1/4	3 1/8	—	# 8	1.5
RP10- 6	DRP10- 6	10 VCT @ 6A	5 VCT @ 12A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP10- 8	DRP10- 8	10 VCT @ 8A	5 VCT @ 16A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP10-10	DRP10-10	10 VCT @ 10A	5 VCT @ 20A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP10-12	DRP10-12	10 VCT @ 12A	5 VCT @ 24A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP12.8- 1	DRP12.8- 1	12.8 VCT @ 1A	6.4 VCT @ 2A	C	2 13/16	1 5/8	1 5/8	2 3/8	—	# 8	.7
RP12.8- 2	DRP12.8- 2	12.8 VCT @ 2A	6.4 VCT @ 4A	C	3 1/4	2	1 15/16	2 13/16	—	# 8	1.1
RP12.8- 4	DRP12.8- 4	12.8 VCT @ 4A	6.4 VCT @ 8A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP12.8- 6	DRP12.8- 6	12.8 VCT @ 6A	6.4 VCT @ 12A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP12.8- 8	DRP12.8- 8	12.8 VCT @ 8A	6.4 VCT @ 16A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP12.8-10	DRP12.8-10	12.8 VCT @ 10A	6.4 VCT @ 20A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP12.8-12	DRP12.8-12	12.8 VCT @ 12A	6.4 VCT @ 24A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP16- 1	DRP16- 1	16 VCT @ 1A	8 VCT @ 2A	C	3 1/4	1 3/4	1 15/16	2 13/16	—	# 8	1.0
RP16- 2	DRP16- 2	16 VCT @ 2A	8 VCT @ 4A	C	3 11/16	2	2 1/4	3 1/8	—	# 8	1.5
RP16- 4	DRP16- 4	16 VCT @ 4A	8 VCT @ 8A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP16- 6	DRP16- 6	16 VCT @ 6A	8 VCT @ 12A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP16- 8	DRP16- 8	16 VCT @ 8A	8 VCT @ 16A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP16-10	DRP16-10	16 VCT @ 10A	8 VCT @ 20A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP16-12	DRP16-12	16 VCT @ 12A	8 VCT @ 24A	B	4 1/8	3	3 7/16	3 7/16	2 3/8	#10	5.5
RP24- 1	DRP24- 1	24 VCT @ 1A	12 VCT @ 2A	C	3 1/4	1 3/4	1 15/16	2 13/16	—	# 8	1.0
RP24- 2	DRP24- 2	24 VCT @ 2A	12 VCT @ 4A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP24- 4	DRP24- 4	24 VCT @ 4A	12 VCT @ 8A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP24- 6	DRP24- 6	24 VCT @ 6A	12 VCT @ 12A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP24- 8	DRP24- 8	24 VCT @ 8A	12 VCT @ 16A	B	4 1/8	3	3 7/16	3 7/16	2 3/8	#10	5.5
RP24-10	DRP24-10	24 VCT @ 10A	12 VCT @ 20A	B	4 1/2	3 1/4	3 3/4	3 3/4	2 1/2	#10	7.0
RP24-12	DRP24-12	24 VCT @ 12A	12 VCT @ 24A	B	4 1/2	3 1/2	3 3/4	3 3/4	2 3/4	#10	8.7
RP36- 1	DRP36- 1	36 VCT @ 1A	18 VCT @ 2A	C	3 11/16	2	2 1/4	3 1/8	—	# 8	1.5
RP36- 2	DRP36- 2	36 VCT @ 2A	18 VCT @ 4A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP36- 4	DRP36- 4	36 VCT @ 4A	18 VCT @ 8A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP36- 6	DRP36- 6	36 VCT @ 6A	18 VCT @ 12A	B	4 1/8	3	3 7/16	3 7/16	2 3/8	#10	5.5
RP36- 8	DRP36- 8	36 VCT @ 8A	18 VCT @ 16A	B	4 1/2	3 1/2	3 3/4	3 3/4	2 3/4	#10	8.7
RP36-10	DRP36-10	36 VCT @ 10A	18 VCT @ 20A	B	4 1/2	3 3/4	3 3/4	3 3/4	3	#10	9.4
RP36-12	DRP36-12	36 VCT @ 12A	18 VCT @ 24A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP56- 1	DRP56- 1	56 VCT @ 1A	28 VCT @ 2A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP56- 2	DRP56- 2	56 VCT @ 2A	28 VCT @ 4A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP56- 4	DRP56- 4	56 VCT @ 4A	28 VCT @ 8A	B	4 1/8	3	3 7/16	3 7/16	2 3/8	#10	5.5
RP56- 6	DRP56- 6	56 VCT @ 6A	28 VCT @ 12A	B	4 1/2	3 3/4	3 3/4	3 3/4	3	#10	9.4
RP56- 8	DRP56- 8	56 VCT @ 8A	28 VCT @ 16A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP56-10	DRP56-10	56 VCT @ 10A	28 VCT @ 20A	B	5 1/4	4 1/4	4 3/8	4 3/8	3 1/8	1/4	13.4
RP56-12	DRP56-12	56 VCT @ 12A	28 VCT @ 24A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 5/8	1/4	15.8
RP68- 1	DRP68- 1	68 VCT @ 1A	34 VCT @ 2A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP68- 2	DRP68- 2	68 VCT @ 2A	34 VCT @ 4A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP68- 4	DRP68- 4	68 VCT @ 4A	34 VCT @ 8A	B	4 1/2	3 1/2	3 3/4	3 3/4	2 3/4	#10	8.7
RP68- 6	DRP68- 6	68 VCT @ 6A	34 VCT @ 12A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP68- 8	DRP68- 8	68 VCT @ 8A	34 VCT @ 16A	B	5 1/4	4 1/4	4 3/8	4 3/8	3 1/8	1/4	13.4
RP68-10	DRP68-10	68 VCT @ 10A	34 VCT @ 20A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 5/8	1/4	15.8
RP68-12	DRP68-12	68 VCT @ 12A	34 VCT @ 24A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0
RP80- 1	DRP80- 1	80 VCT @ 1A	40 VCT @ 2A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP80- 2	DRP80- 2	80 VCT @ 2A	40 VCT @ 4A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP80- 4	DRP80- 4	80 VCT @ 4A	40 VCT @ 8A	B	4 1/2	3 3/4	3 3/4	3 3/4	3	#10	9.4
RP80- 6	DRP80- 6	80 VCT @ 6A	40 VCT @ 12A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP80- 8	DRP80- 8	80 VCT @ 8A	40 VCT @ 16A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 5/8	1/4	15.8
RP80-10	DRP80-10	80 VCT @ 10A	40 VCT @ 20A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0
RP80-12	DRP80-12	80 VCT @ 12A	40 VCT @ 24A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0

SCHEMATIC



MTG. STYLE

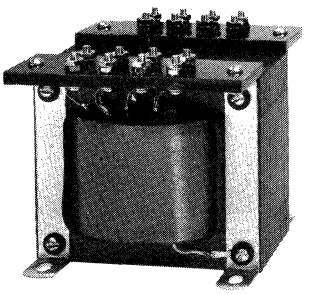


PCT TRANSFORMER CORP.
64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300 / FAX 516-491-3689

OUR SPECIALTY!
ONE WEEK DELIVERY
FOR CUSTOM PROTOTYPES

ISOLATION POWER TRANSFORMERS STEP-UP/STEP-DOWN VARIABLE VOLTAGE RATINGS

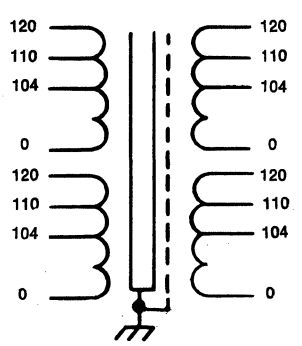
- The IPS Series features (4) identical windings; (2) primaries and (2) secondaries; each rated at 0/104/110/120 volts allowing for rating combinations of 104V, 110V, 120V, 208V, 214V, 220V, and 240V with primary and secondary isolated from each other. Step-down of 440V to 220V or step-up of 220V to 440V can be achieved by inter-connecting primaries and secondaries in an Auto-Transformer configuration. This eliminates isolation but a doubling of the power rating can be realized.
- The DIPS series is similar to the IPS series except the dual secondaries are each rated 0/208/220/240 volts.
- 50 Hz to 500 Hz operating frequency range.
- Electrostatically shielded with shield grounded to the core. This connection can be opened for floating shield.
- ¼ inch thick phenolic terminal boards with nickel plated brass hardware (#10-32 on 250 VA and 500 VA; ¼-20 on 1000 VA and 2000 VA). Voltage rating can be varied with easy to make interconnections.
- Completely varnish impregnated and ruggedly constructed with prime raw materials.
- Well insulated and designed to withstand 2500 VRMS hipot.
- 55°C temperature rise above ambient



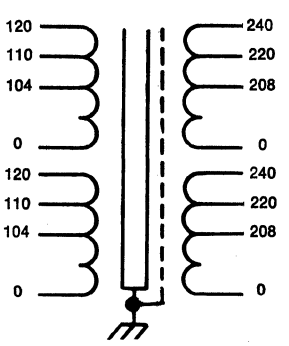
Part No.	Power Volt-Amps	Secondary Ratings				Mechanical Dimensions					Mtg. & Term. Screw	Approx. Wt. (lbs.)
		Series Volts	Max. Amps	Parallel Volts	Max. Amps	L	W	H	ML	MW		
IPS-250	250	0/208/220/240	1.1	0/104/110/120	2.2	5 5/16	4 1/4	5 1/4	4 3/8	2 1/2	#10	12
IPS-500	500	0/208/220/240	2.3	0/104/110/120	4.6	5 5/16	5 5/16	5 1/4	4 3/8	3 5/8	#10	18
IPS-1000	1000	0/208/220/240	4.5	0/104/110/120	9.0	7 7/16	7	7 3/8	6 3/4	3 1/8	¼	33
IPS-2000	2000	0/208/220/240	9.0	0/104/110/120	18.0	7 7/16	9	7 3/8	6 3/4	5 1/8	¼	56
DIPS-250	250	0/416/440/480	0.55	0/208/220/240	1.1	5 5/16	4 1/4	5 1/4	4 3/8	2 1/2	#10	12
DIPS-500	500	0/416/440/480	1.15	0/208/220/240	2.3	5 5/16	5 5/16	5 1/4	4 3/8	3 5/8	#10	18
DIPS-1000	1000	0/416/440/480	2.25	0/208/220/240	4.5	7 7/16	7	7 3/8	6 3/4	3 1/8	¼	33
DIPS-2000	2000	0/416/440/480	4.50	0/208/220/240	9.0	7 7/16	9	7 3/8	6 3/4	5 1/8	¼	56

SCHEMATIC DIAGRAMS

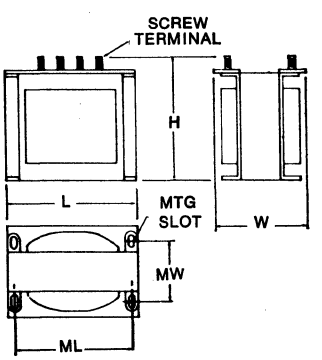
IPS SCHEMATIC



DIPS SCHEMATIC



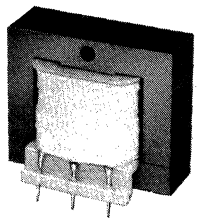
MECHANICAL OUTLINE



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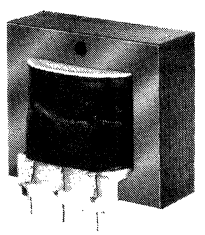
PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS



Designed for Input, Interstage, Output and Isolation Circuits. ±2db 200 Hz-15,000 Hz Frequency Response and 20dbm Power Rating for Entire Series.

P/N	PRI Z	Sec Z	Idc	Schematic
APC1-1	600Ω	600Ω	8mA	1
APC1-2	600Ω C.T.	600Ω C.T.	16mA	2
APC1-3	600Ω	8000/2000Ω Split	8mA	4
APC1-4	2500Ω	600Ω	4mA	1
APC1-5	2500Ω C.T.	600Ω C.T.	8mA	2
APC1-6	2500Ω C.T.	2500Ω C.T.	8mA	2
APC1-7	4000Ω	600Ω/150Ω Split	3mA	4
APC1-8	4000Ω C.T.	600Ω C.T.	6mA	2
APC1-9	4000Ω C.T.	1200Ω C.T.	6mA	2

PLUG-IN PRINTED CIRCUIT TELEPHONE COUPLING TRANSFORMERS

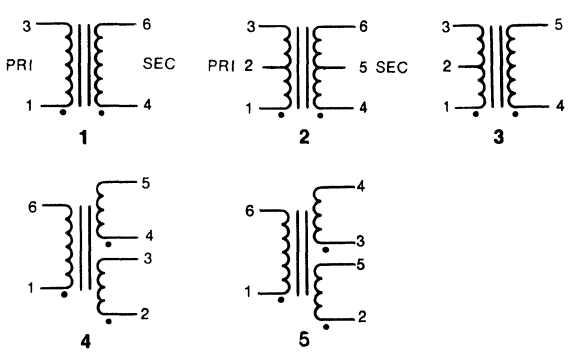


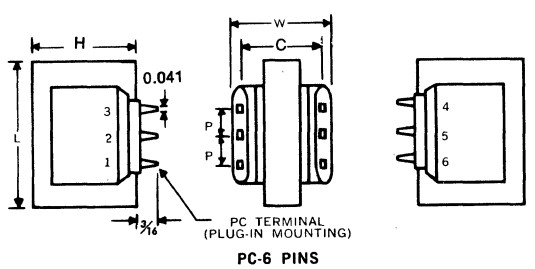
Designed for Interconnection of Voice/Data Modem Terminals to Telephone Lines.

- Frequency response ±0.5dB 300Hz-3500Hz
- Power level −45dbm to +7dbm
- Longitudinal balance — per FCC Part 68
- Distortion — 0.5% max.
- Impedance matching ±10% over frequency range
- Return loss — 26dB min.

P/N	PRI Z	Sec Z	Application	Schematic
TPC1-1	600Ω	600Ω	Coupling	1
TPC1-2	600Ω C.T.	600Ω C.T.	Coupling	2
TPC1-3	600Ω	900Ω	Coupling	1
TPC1-4	900Ω	900Ω	Coupling	1
TPC1-5	900Ω/600Ω	600Ω	Coupling	3
TPC1-6	4000Ω	600Ω	Bridging	1
TPC1-7	600Ω (4W)	600Ω/600Ω	Hybrid (2) Req'd	5

APC & TPC SCHEMATICS AND MECHANICAL LAYOUT

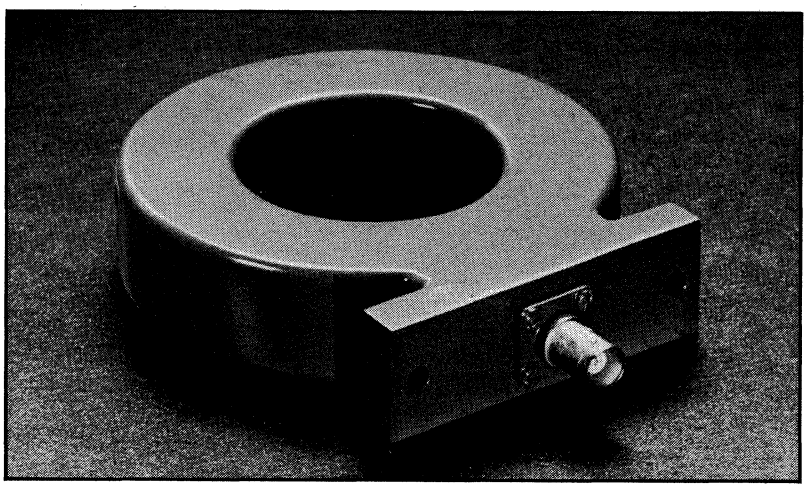


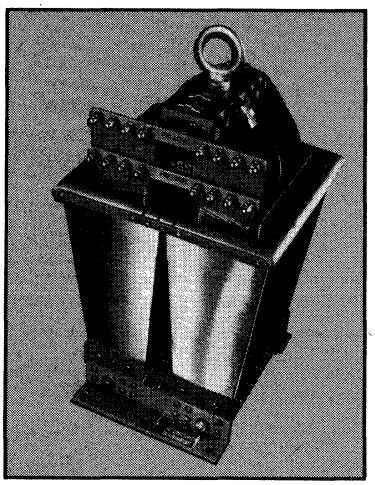


L	W	H	P	C	Wt. (oz.)
13/16	19/32	3/4	.187	.420	.5

Other ratings and configurations are available on special order for your custom requirements.

PEARSON ELECTRONICS, INC.





Wide Band, Precision Current Monitor Transformers

With a Pearson current monitor and an oscilloscope, you can measure pulse or ac currents from milliamperes to kiloamperes, in any conductor or beam of charged particles, at any voltage level up to a million volts, at frequencies up to 200 MHz or down to below 1 Hz.

The monitor is physically isolated from the circuit. It is a current transformer capable of highly precise measurement of pulse amplitude and waveshape. The one shown above, for example, offers pulse-amplitude accuracy of + 1%, − 0% (typical of all Pearson current monitors), 20 nanosecond rise time, and droop of only 0.8% per millisecond. Three db bandwidth is 1 Hz to 20 MHz. Whether you wish to measure current in a conductor, an electron device or a particle accelerator, it is likely that one of our off-the-shelf models (ranging from ¼" to 10¾" ID) will do the job. In addition to our standard models, we build many custom designed current transformers to meet special needs and applications.

Very High Voltage & Very High Current Pulse Transformers

Pearson Electronics specializes in the development, design and manufacture of high and super high voltage pulse transformers. Typical of the applications for which we have designed and manufactured pulse transformers are units for supplying beam power to high power microwave tubes such as klystrons and traveling wave tubes, units providing pulse voltage to particle accelerator injection systems, pulsed x-ray tubes and high power lasers.

Pearson Current Monitor Transformers

Model Number	Output † (volts/amp.)	Hole Dia. (inches)	Maximum Peak Curr. (amps)	Maximum RMS Curr. (amps)	Droop (%/microsec.)	Useable Rise Time (nanosec.)	IT Max. (amp-sec.)	Approx. Low Freq. 3db pt. (Hz)	I/f (peak amps/ Hz)	Connector
2877	1.0	0.25	100	2.5	0.2	2	0.0004**	300	0.0024	SMA
4100	1.0	0.5	500	5	0.09	10	0.002**	140	0.006	UG-290A/U
2100	1.0	2	500	7.5	0.08	20	0.005**	125	0.017	UG-290A/U
3100	1.0	3.5	500	12	0.04	50	0.03**	40	0.1	SO-239
150	0.5	2	1,000	15	0.02	20	0.02**	40	0.07	UG-290A/U
325	0.25	3.5	2,000	60	0.1	30	0.09	160	0.06	SO-239
2878	0.1	0.25	400	10	0.02	5	0.004**	30	0.025	SMA
410	0.1	0.5	5,000	50	0.06	20	0.25	120	1.7	UG-290A/U
411	0.1	0.5	5,000	50	0.0009	20	0.2**	1	0.6	UG-290A/U
110	0.1	2	5,000	65	0.0008	20	0.5**	1	1.5	UG-290A/U
110A	0.1	2	10,000	65	0.0008	20	0.5**	1	1.5	UG-568/U
310*	0.1	3.5	5,000	140	0.02	40	0.6	40	3.6	SO-239
1010*	0.1	10.75	5,000	120	0.25	50	0.7	400	4.4	SO-239
1025	0.025	2	20,000	100	0.1	100	0.5	160	3.0	UG-290A/U
3025*	0.025	3.5	20,000	325	0.004	100	3.0	7	20	SO-239
2879	0.01	0.25	2,000	25	0.002	20	0.04**	3	0.25	SMA
101	0.01	2	50,000	200	0.0001	100	2.5**	0.25	12	UG-290A/U
301X*	0.01	3.5	50,000	400	0.003	200	22.	5	140.0	SO-239

† Initial pulse response with one megohm in parallel with 20 pF load impedance. A 50 ohm termination will cut the output in half.
* Double shielded **May need small bias current through secondary for maximum rating.

Contact us and we will send you engineering data.

PEARSON ELECTRONICS, INC.
1860 Embarcadero Road, Palo Alto, California 94303 U.S.A. · Telephone (415) 494-6444 · Telex 171-412 · FAX (415) 494-6716

PICO Catalog Contents

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	.35" X .32" TRANSFORMERS; 2 OHM TO 40K OHM; 400 Hz TO 100 KHz; 400 MILLIWATT AT 1 KHz	A•2338-39
New	**SURFACE MOUNT TRANSFORMERS;** 2 OHM TO 40K OHM; 400 Hz TO 100 KHz; 400 MILLIWATT AT 1 KHz	A•2340-41
	.35" X .46" TRANSFORMERS; 2 OHM TO 100K OHM; 300 Hz TO 100 KHz; 600 MILLIWATT AT 1 KHz	A•2342-43
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	.75" X .375" TRANSFORMERS; 2 OHM TO 135K OHM; 75 Hz TO 30 KHz; 1.5 WATT AT 1 KHz	A•2348-49
	.75" X .52" TRANSFORMERS; 2 OHM TO 135K OHM; 50 Hz TO 30 KHz; 2 WATT AT 1 KHz	A•2350-51
	.75" X .82" TRANSFORMERS; 2 OHM TO 80K OHM; 20 Hz TO 25 KHz; 3 WATT AT 1 KHz	A•2352-53
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New	MINIATURE FLYBACK CONVERTER TRANSFORMERS; ***50 KHz-100 KHz/10 Watts-50 Watts***	A•2362-63
	400 Hz POWER TRANSFORMERS. PRIMARY VOLTAGES OF 115V OR 26V. PLUG-IN CONSTRUCTION. ULTRA-MINIATURE SIZE.	A•2364
	MICROPHONE/TRANSDUCER AUDIO INPUT TRANSFORMERS ***Interchangeable with transformers made by Beyer Dynamic of Germany.***	A•2365
	MIL-STD-1553 INTERFACE TRANSFORMERS/MULTIPLEX DATA BUS PULSE TRANSFORMERS	A•2366

See EEM Section 1800: Coils Chokes & Inductors for PICO's latest line of:

• Mini High "Q" Inductors • Mini Power Inductors (Surface Mount, Plug-In & Axial Leads)

• EMI Common Mode Suppression Inductors

Pages **A**•1236 through **A**•1246

See EEM Section 4000: Power Supplies DC for PICO's new line of:

• Over 850 High Reliability Ultra-Miniature DC-DC Converters 0.2" ht., up to 30 Watts

Pages **D**•1919 through **D**•1952

• New AC-DC Power Supplies 0.5" ht., up to 55 Watts

Pages **D**•1953 through **D**•1959

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in New York Phone 914-699-5514

FAX: 914-699-5565

Delivery: Stock to one week

PICO Electronics, Inc.

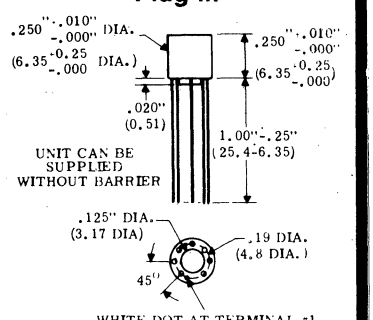
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

1/4"x1/4"

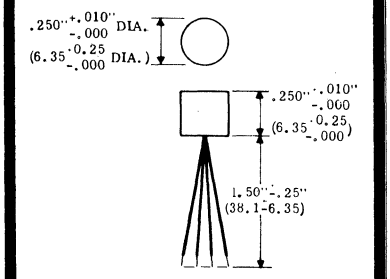
PICO's ultra-miniature transformers

For Surface Mount Versions of this series, see pages A•2336 A•2337

F SERIES Plug-In



G SERIES Insulated Leads



DIMENSIONS ARE IN INCHES (MM)

PART NUMBER F Series Plug-In	PART NUMBER G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER MILLIWATTS 1 KHz and higher	POWER MILLIWATTS 400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PRICES 1-9*** F-Series	PRICES 1-9*** G-Series
F-28003	G-29003	10 ct	10 ct	2.5	125	20	11.5	1.1	1.35	.34	1:1	2:1	27.67	26.32
F-28005	G-29005	20 ct	8 ct	2	125	20	8	2.1	1.28	.32	1.58:1	3.16:1	27.67	26.32
F-28010	G-29010	20 ct	20 ct	5	125	20	8	2.1	2.56	.64	1:1	2:1	27.67	26.32
F-28015	G-29015	32 ct	32 ct	8	125	20	6.5	3.52	4.32	1.08	1:1	2:1	27.67	26.32
F-28020	G-29020	40 ct	40 ct	10	125	20	5.6	4	4.77	1.19	1:1	2:1	27.46	26.32
F-28025	G-29025	48 ct	16 ct	4	125	20	5.2	4.3	2.3	.58	1.73:1	3.46:1	25.16	23.94
F-28030	G-29030	50 ct	50 ct	12.5	125	20	5	5.5	6.6	1.65	1:1	2:1	25.16	23.94
F-28035	G-29035	80 ct	32 ct	8	125	20	4	8.5	4.25	1.06	1.58:1	3.16:1	27.46	23.94
F-28040	G-29040	100 ct	40 ct	10	125	20	3.6	12.1	4.85	1.21	1.58:1	3.16:1	27.46	23.94
F-28045	G-29045	100 ct	100 ct	25	125	20	3.6	12.1	12	3	1:1	2:1	25.16	23.94
F-28050	G-29050	120 ct	12.8 ct	3.2	125	20	3.3	13.2	1.6	.4	3.06:1	6.12:1	25.16	23.94
F-28055	G-29055	120 ct	60 ct	15	125	20	3.3	13.2	7.3	1.83	1.41:1	2.83:1	30.07	23.94
F-28060	G-29060	120 ct	120 ct	30	125	20	3.3	13.2	16	4	1:1	2:1	30.07	28.54
F-28065	G-29065	150 ct	12 ct	3	125	20	3	15	1.56	.39	3.54:1	7.07:1	27.32	26.01
F-28070	G-29070	150 ct	50 ct	12.5	125	20	3	15	6.6	1.65	1.73:1	3.46:1	30.07	31.73
F-28075	G-29075	150 ct	100 ct	25	125	20	3	15	14.5	3.63	1.22:1	2.45:1	30.07	28.54
F-28080	G-29080	150 ct	150 ct	37.5	125	20	3	15	18.3	4.58	1:1	2:1	30.07	28.54
F-28085	G-29085	150 ct	600 ct	150	125	20	3	15	72	18	1:2	1:1	30.07	28.54
F-28090	G-29090	200 ct	200 ct	50	125	20	2.5	22	26.8	6.7	1:1	2:1	30.07	28.54
F-28095	G-29095	300 ct	12 ct	3	125	20	2	33	1.56	.39	5:1	10:1	30.07	28.54
F-28100	G-29100	300 ct	50 ct	12.5	125	20	2	33	6.6	1.65	2.45:1	4.9:1	30.07	28.54
F-28105	G-29105	300 ct	150 ct	37.5	125	20	2	33	18.3	4.58	1.41:1	2.83:1	30.07	28.54
F-28110	G-29110	300 ct	300 ct	75	125	20	2	33	40.3	10.08	1:1	2:1	27.32	28.54
F-28115	G-29115	300 ct	600 ct	150	125	20	2	33	72	18	1:1.41	1.41:1	32.24	26.01
F-28120	G-29120	320 ct	12.8 ct	3.2	125	20	2	34	1.6	0.4	5:1	10:1	32.24	30.62
F-28125	G-29125	400 ct	40 ct	10	125	20	1.8	49	4.7	1.18	3.16:1	6.32:1	32.24	30.62
F-28130	G-29130	400 ct	120 ct	30	125	20	1.8	49	16.3	4.08	1.83:1	3.65:1	32.24	30.62
F-28135	G-29135	400 ct	200 ct	50	125	20	1.8	49	27.3	6.83	1.41:1	2.83:1	32.24	30.62
F-28140	G-29140	400 ct	400 ct	100	125	20	1.8	49	49	12.25	1:1	2:1	29.31	27.90
F-28145	G-29145	400 ct	1000 ct	250	125	20	1.8	49	120	30	1:1.58	1.26:1	32.24	30.62
F-28150	G-29150	400 ct	2000 ct	500	125	20	1.8	49	270	67.5	1:2.24	1:1.12	32.24	30.62
F-28155	G-29155	400 ct	4000 ct	1000	125	20	1.8	49	476	119	1:3.16	1:1.58	32.24	30.62
F-28160	G-29160	500 ct	12.8 ct	3.2	125	20	1.6	54	1.6	0.4	6.25:1	12.5:1	29.31	27.90
F-28165	G-29165	500 ct	16 ct	4	125	20	1.6	54	2.3	0.58	5.6:1	11.2:1	29.31	27.90
F-28170	G-29170	500 ct	50 ct	12.5	125	20	1.6	54	6.6	1.65	3.16:1	6.32:1	29.31	27.90
F-28175	G-29175	500 ct	150 ct	37.5	125	20	1.6	54	18.3	4.58	1.83:1	3.65:1	29.31	27.90
F-28180	G-29180	500 ct	500 ct	125	125	20	1.6	54	65	16.3	1:1	2:1	32.24	30.62
F-28185	G-29185	*500 ct	500 ct	-	125	20	1.6	54	65	-	1:1	-	32.24	30.62
F-28190	G-29190	500 ct	600 ct	150	125	20	1.6	54	72	18	1:1.1	1.83:1	32.24	30.62
F-28195	G-29195	600 ct	12.8 ct	3.2	125	20	1.5	59	1.6	0.4	6.85:1	13.7:1	32.24	30.59
F-28200	G-29200	600 ct	30 ct	7.5	125	20	1.5	59	4.1	1.03	4.47:1	8.94:1	29.31	27.90
F-28205	G-29205	600 ct	48 ct	12	125	20	1.5	59	5.2	1.3	3.54:1	7.07:1	29.31	27.90
F-28210	G-29210	600 ct	200 ct	50	125	20	1.5	59	26.5	6.63	1.73:1	3.46:1	29.31	27.90
F-28215	G-29215	600 ct	600 ct	150	125	20	1.5	59	72	18	1:1	2:1	29.31	27.90
F-28220	G-29220	*600 ct	600 ct	-	125	20	1.5	59	72	-	1:1	-	32.24	30.59
F-28225	G-29225	600 ct	1200 ct	300	125	20	1.5	59	160	40	1:1.41	1.41:1	29.31	27.90
F-28230	G-29230	640 ct	12.8 ct	3.2	125	20	1.5	62	1.6	0.4	7.07:1	14.14:1	29.31	27.90
F-28235	G-29235	700 ct	100 ct	25	125	20	1.35	65	12	3	2.65:1	5.29:1	29.31	27.90
F-28240	G-29240	800 ct	12.8 ct	3.2	125	20	1.3	88	16	4	7.9:1	15.8:1	32.24	30.59
F-28245	G-29245	800 ct	48 ct	12	125	20	1.3	88	6.7	1.68	4.08:1	8.16:1	30.07	27.90
F-28250	G-29250	800 ct	800 ct	200	125	20	1.3	88	106	26.5	1:1	2:1	30.07	27.90
F-28255	G-29255	900 ct	600 ct	150	125	20	1.2	93	74	18.5	1.22:1	2.45:1	30.07	27.90
F-28260	G-29260	1000 ct	12 ct	3	125	20	1.2	120	1.55	0.39	9.13:1	18.3:1	33.10	31.42
F-28265	G-29265	1000 ct	50 ct	12.5	125	20	1.2	120	6.6	1.65	4.47:1	8.94:1	33.10	31.42
F-28270	G-29270	1000 ct	1000 ct	250	125	20	1.2	120	120	30	1:1	2:1	30.07	27.90
F-28275	G-29275	1060 ct	12.8 ct	3.2	125	20	1.2	125	1.6	0.4	9.1:1	18.2:1	33.10	31.42
F-28280	G-29280	1200 ct	12.8 ct	3.2	125	20	1	133	1.6	0.4	9.68:1	19.4:1	33.10	31.42
F-28285	G-29285	1200 ct	500 ct	125	125	20	1	133	65	16.25	1.55:1	3.1:1	33.10	31.42
F-28290	G-29290	1200 ct	1200 ct	300	125	20	1	133	160	40	1:1	2:1	33.10	31.42
F-28295	G-29295	*1200 ct	1200 ct	-	125	20	1	133	160	-	1:1	-	33.10	31.42
F-28300	G-29300	1500 ct	12 ct	3	125	20	1	180	1.55	0.39	11.2:1	22.4:1	33.10	31.42
F-28305	G-29305	1500 ct	500 ct	125	125	20	1	180	65	16.3	1.73:1	3.46:1	30.07	27.90
F-28310	G-29310	*1500 ct	600 ct	-	125	20	1	180	73	-	1.58:1	-	30.07	27.90
F-28315	G-29315	*1500 ct	1500 ct	-	125	20	1	180	215	-	1:1	-	33.10	31.42
F-28320	G-29320	1600 ct	12.8 ct	3.2	125	20	1	190	1.6	0.4	11.2:1	22.4:1	33.10	31.42
F-28325	G-29325	2000 ct	8 ct	2	125	20	0.8	218	1	.25	15.8:1	31.6:1	33.10	31.42
F-28330	G-29330	2000 ct	2000 ct	500	125	20	0.8	218	260	65	1:1	2:1	33.10	31.42
F-28335	G-29335	*2000 ct	2000 ct	-	125	20	0.8	218	260	-	1:1	-	33.10	31.42
F-28340	G-29340	2000 ct	8000 ct	2000	125	20	0.8	218	830	207.5	1:2	1:1	32.24	30.70

*INCLUDES ELETROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- MIL-T-27: ..... All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- FREQUENCY RESPONSE: ..... ±3dB, 400 Hz-250 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: ..... 5% With Rated Power Level at 1 KHz and 400 Hz.
- DIELECTRIC STRENGTH: ..... All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: ..... Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: ..... 1.1 Grams.
- OPERATING TEMPERATURE: ..... −55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°c).
- TERMINALS: ..... Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: ..... 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

PART NUMBER F Series Plug-In	PART NUMBER G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER MILIWATTS 1 KHz and higher	POWER MILIWATTS 400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PRICES 1-9*** F-Series	PRICES 1-9*** G-Series
F-28345	G-29345	2500 ct	2500 ct	625	125	20	0.75	280	280	70	1:1	2:1	32.24	30.70
F-28350	G-29350	3000 ct	3000 ct	725	125	20	0.65	330	330	82.5	1:1	2:1	32.24	30.70
F-28355	G-29355	*3000 ct	3000 ct	-	125	20	0.65	330	330	-	1:1	-	33.10	31.42
F-28360	G-29360	3600 ct	3600 ct	900	125	20	0.6	370	450	112.5	1:1	2:1	32.24	30.70
F-28365	G-29365	4000 ct	16 ct	4	125	20	0.57	400	2.3	0.58	15.8:1	31.6:1	32.24	30.70
F-28370	G-29370	4000 ct	600 ct	150	125	20	0.57	400	73	18.25	2.58:1	5.16:1	32.24	30.70
F-28375	G-29375	4000 ct	1000 ct	250	125	20	0.57	400	120	30	2:1	4:1	32.24	30.70
F-28380	G-29380	*4000 ct	8000 ct	-	125	20	0.57	400	1070	-	1:1.41	-	35.48	33.69
F-28385	G-29385	5000 ct	500 ct	125	125	20	0.5	540	65	16.25	3.16:1	6.32:1	32.24	30.70
F-28390	G-29390	5000 ct	5000 ct	1250	125	20	0.5	540	650	162.5	1:1	2:1	35.48	33.69
F-28395	G-29395	7500 ct	50 ct	12.5	125	20	0.5	835	6.6	1.65	12.2:1	24.5:1	35.48	33.69
F-28400	G-29400	7500 ct	100 ct	25	125	20	0.4	835	12	3	8.66:1	17.3:1	33.00	31.44
F-28405	G-29405	7500 ct	600 ct	150	125	20	0.4	835	72	18	3.54:1	7.07:1	33.00	31.44
F-28410	G-29410	7500 ct	2500 ct	625	125	20	0.4	835	280	70	1.73:1	3.46:1	33.00	31.44
F-28415	G-29415	*7500 ct	7500 ct	-	125	20	0.4	835	1020	-	1:1	-	33.00	31.44
F-28420	G-29420	8000 ct	12.8 ct	3.2	125	20	0.4	865	1.6	0.4	25:1	50:1	35.48	33.69
F-28425	G-29425	8000 ct	1000 ct	250	125	20	0.4	865	120	30	2.83:1	5.66:1	35.48	33.69
F-28430	G-29430	*8000 ct	1200 ct	-	125	20	0.4	865	160	-	2.58:1	-	35.48	33.69
F-28435	G-29435	*9000 ct	9000 ct	-	125	20	0.4	1160	1160	-	1:1	-	35.48	33.69
F-28440	G-29440	10,000 ct	12.8 ct	3.2	125	20	0.36	1200	1.6	0.4	28:1	56:1	35.48	33.69
F-28445	G-29445	10,000 ct	16 ct	4	125	20	0.36	1200	1.77	0.44	25:1	50:1	33.00	31.44
F-28450	G-29450	10,000 ct	100 ct	25	125	20	0.36	1200	12	3	10:1	20:1	33.00	31.44
F-28455	G-29455	10,000 ct	200 ct	50	125	20	0.36	1200	27	6.75	7.07:1	14.14:1	33.00	31.44
F-28460	G-29460	10,000 ct	500 ct	125	125	20	0.36	1200	65	16.25	4.47:1	8.94:1	33.00	31.44
F-28465	G-29465	10,000 ct	600 ct	150	125	20	0.36	1200	72	18	4.08:1	8.16:1	33.00	31.44
F-28470	G-29470	10,000 ct	1000 ct	250	125	20	0.36	1200	120	30	3.16:1	6.32:1	33.00	31.44
F-28475	G-29475	10,000 ct	1200 ct	300	125	20	0.36	1200	160	40	2.88:1	5.77:1	33.00	31.44
F-28480	G-29480	10,000 ct	1500 ct	375	125	20	0.36	1200	215	53.8	2.58:1	5.16:1	33.10	33.69
F-28485	G-29485	10,000 ct	2000 ct	500	125	20	0.36	1200	260	65	2.24:1	4.47:1	33.10	31.44
F-28490	G-29490	10,000 ct	5000 ct	1250	125	20	0.36	1200	650	162.5	1.41:1	2.83:1	33.10	31.44
F-28495	G-29495	10,000 ct	7500 ct	1875	125	20	0.36	1200	1020	255	1.15:1	2.3:1	33.10	31.44
F-28500	G-29500	10,000 ct	10,000 ct	2500	125	20	0.36	1200	1200	300	1:1	2:1	30.07	28.64
F-28505	G-29505	*10,000 ct	10,000 ct	-	125	20	0.36	1200	1440	-	1:1	-	35.48	33.69
F-28510	G-29510	15,000 ct	400 ct	100	100	15	0.35	1420	43	10.75	6.12:1	12.24:1	33.10	31.44
F-28515	G-29515	15,000 ct	500 ct	125	100	15	0.35	1420	49	12.25	5.48:1	10.95:1	33.10	31.44
F-28520	G-29520	15,000 ct	600 ct	150	100	15	0.35	1420	68	17	5:1	10:1	33.10	31.44
F-28525	G-29525	15,000 ct	10,000 ct	2500	100	15	0.35	1420	1100	275	1.22:1	2.45:1	33.10	31.44
F-28530	G-29530	*15,000 ct	15,000 ct	-	100	15	0.35	1420	1730	-	1:1	-	35.48	33.69
F-28535	G-29535	15,000 ct	15,000 ct	3750	100	15	0.35	1420	1730	433	1:1	2:1	33.10	31.44
F-28540	G-29540	16,000 ct	1000 ct	250	100	15	0.35	1500	115	28.75	4:1	8:1	33.10	31.44
F-28545	G-29545	20,000 ct	500 ct	125	100	15	0.3	1600	60	15	6.33:1	12.65:1	35.48	33.69
F-28550	G-25550	20,000 ct	600 ct	150	100	15	0.3	1600	66	16.5	5.77:1	11.55:1	35.48	33.69
F-28555	G-29555	20,000 ct	800 ct	200	100	15	0.3	1600	94	23.5	5:1	10:1	35.48	33.69
F-28560	G-29560	20,000 ct	1000 ct	250	100	15	0.3	1600	106	26.5	4.47:1	8.94:1	35.48	33.69
F-28565	G-29565	20,000 ct	5000 ct	1250	100	15	0.3	1600	600	150	2:1	4:1	35.48	33.69
F-28570	G-29570	20,000 ct	10,000 ct	2500	100	15	0.3	1600	1100	275	1.41:1	2.83:1	35.48	33.69
F-SHIELD	MU-METAL SHIELD .285" d × .268" h (7.24 mm d × 6.73 mm h) SINGLE SHIELD												3.50	
FYY-SHIELD	MU-METAL SHIELD .315" d × .275" h (8.0 mm d × 6.99 mm h) USE WITH F-SHIELD FOR DOUBLE SHIELDING												3.50	
G-SHIELD	MU-METAL SHIELD .285" d × .335" h (7.24 mm d × 8.51 mm h) SINGLE SHIELD													3.50
GYY-SHIELD	MU-METAL SHIELD .315" d × .40" h (8.00 mm d × 10.16 mm h) USE WITH G-SHIELD FOR DOUBLE SHIELDING													3.50
GXX-SHIELD	MU-METAL SHIELD .35" d × .465" h (8.89 mm d × 11.81 mm h) USE WITH G-SHIELD AND GYY SHIELD FOR TRIPLE SHIELDING													3.50

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

INDUCTORS

PART NUMBER F-SERIES	PART NUMBER G-SERIES	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9*** F SERIES	PRICES 1-9*** G SERIES
F-5825	G-6125	SERIES 10.0	0	2250	27.32	26.01
		SERIES 2.75	2			
		PARALLEL 2.5	0	560		
		PARALLEL .65	4			
F-5830	G-6130	SERIES 5.5	0	1000	27.32	26.01
		SERIES 1.5	2			
		PARALLEL 1.3	0	250		
		PARALLEL .40	4			
F-5835	G-6135	SERIES .85	1	240	27.32	26.01
		SERIES .25	6			
		PARALLEL .21	2	60		
		PARALLEL .06	12			
F-5840	G-6140	SERIES .6	0	144	27.32	26.01
		SERIES .15	5			
		PARALLEL .15	0	36		
		PARALLEL .04	10			

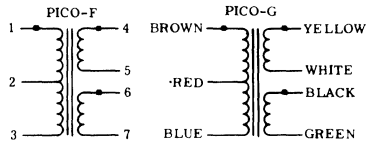
F SERIES Plug-In

G SERIES Insulated Leads

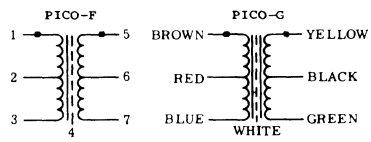




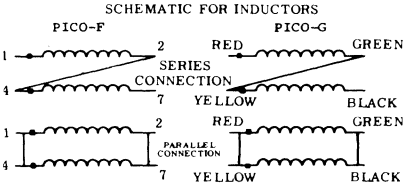
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Delivery— stock to one week

PICO Electronics, Inc.

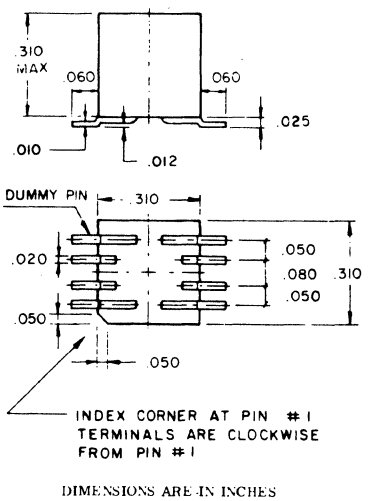
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

SURFACE MOUNT

PICO's ultra-miniature transformers



70000 SERIES



DIMENSIONS ARE IN INCHES

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER MILLIWATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
70003	10 ct	10 ct	2.5	125	20	11.5	1.1	1.35	.34	1:1	2:1	29.01
70005	20 ct	8 ct	2	125	20	8	2.1	1.28	.32	1.58:1	3.16:1	29.01
70010	20 ct	20 ct	5	125	20	8	2.1	2.56	.64	1:1	2:1	29.01
70015	32 ct	32 ct	8	125	20	6.5	3.52	4.32	1.08	1:1	2:1	29.01
70020	40 ct	40 ct	10	125	20	5.6	4	4.77	1.19	1:1	2:1	28.78
70025	48 ct	16 ct	4	125	20	5.2	4.3	2.3	.58	1.73:1	3.46:1	26.37
70030	50 ct	50 ct	12.5	125	20	5	5.5	6.6	1.65	1:1	2:1	26.37
70035	80 ct	32 ct	8	125	20	4	8.5	4.25	1.06	1.58:1	3.16:1	28.78
70040	100 ct	40 ct	10	125	20	3.6	12.1	4.85	1.21	1.58:1	3.16:1	28.78
70045	100 ct	100 ct	25	125	20	3.6	12.1	12	3	1:1	2:1	26.37
70050	120 ct	12.8 ct	3.2	125	20	3.3	13.2	1.6	.4	3.06:1	6.12:1	26.37
70055	120 ct	60 ct	15	125	20	3.3	13.2	7.3	1.83	1.41:1	2.83:1	31.54
70060	120 ct	120 ct	30	125	20	3.3	13.2	16	4	1:1	2:1	31.54
70065	150 ct	12 ct	3	125	20	3	15	1.56	.39	3.54:1	7.07:1	30.53
70070	150 ct	50 ct	12.5	125	20	3	15	6.6	1.65	1.73:1	3.46:1	31.54
70075	150 ct	100 ct	25	125	20	3	15	14.5	3.63	1.22:1	2.45:1	31.54
70080	150 ct	150 ct	37.5	125	20	3	15	18.3	4.58	1:1	2:1	31.54
70085	150 ct	600 ct	150	125	20	3	15	72	18	1:2	1:1	31.54
70090	200 ct	200 ct	50	125	20	2.5	22	25.8	6.7	1:1	2:1	31.54
70095	300 ct	12 ct	3	125	20	2	33	1.56	.39	5:1	10:1	31.54
70100	300 ct	50 ct	12.5	125	20	2	33	6.6	1.65	2.45:1	4.9:1	31.54
70105	300 ct	150 ct	37.5	125	20	2	33	18.3	4.58	1:1.41	2.83:1	31.54
77110	300 ct	300 ct	75	125	20	2	33	40.3	10.08	1:1	2.1	31.54
70115	300 ct	600 ct	150	125	20	2	33	72	18	1:1.41	1.41:1	28.67
70120	320 ct	12.8 ct	3.2	125	20	2	34	1.6	0.4	5:1	10:1	33.82
70125	400 ct	40 ct	10	125	20	1.8	49	4.7	1.18	3.16:1	6.32:1	33.82
70130	400 ct	120 ct	30	125	20	1.8	49	16.3	4.08	1.83:1	3.65:1	33.82
70135	400 ct	200 ct	50	125	20	1.8	49	27.3	6.83	1.41:1	2.83:1	33.82
70140	400 ct	400 ct	100	125	20	1.8	49	49	12.25	1:1	2:1	30.75
70145	400 ct	1000 ct	250	125	20	1.8	48	120	30	1:1.58	1.26:1	33.82
70150	400 ct	2000 ct	500	125	20	1.8	49	270	67.5	1:2.24	1:1.12	33.82
70155	400 ct	4000 ct	1000	125	20	1.8	49	476	119	1:3.16	1:1.58	33.82
70160	500 ct	12.8 ct	3.2	125	20	1.6	54	1.6	0.4	6.25:1	12.5:1	30.75
70165	500 ct	16 ct	4	125	20	1.6	54	2.3	0.58	5.6:1	11.2:1	30.75
70170	500 ct	50 ct	12.5	125	20	1.6	54	6.6	1.65	3.16:1	6.32:1	30.75
70175	500 ct	150 ct	37.5	125	20	1.6	54	18.3	4.58	1.83:1	3.65:1	30.75
70180	500 ct	500 ct	125	125	20	1.6	54	65	16.3	1:1	2:1	33.82
70185	*500 ct	500 ct	–	125	20	1.6	54	65	–	1:1	–	33.82
70190	500 ct	600 ct	150	125	20	1.6	54	72	18	1:1.1	1.83:1	33.82
70195	600 ct	12.8 ct	3.2	125	20	1.5	59	1.6	0.4	6.85:1	13.7:1	33.82
70200	600 ct	30 ct	7.5	125	20	1.5	59	4.1	1.03	4.47:1	8.94:1	30.75
70205	600 ct	48 ct	12	125	20	1.5	59	5.2	1.3	3.54:1	7.07:1	30.75
70210	600 ct	200 ct	50	125	20	1.5	59	26.5	6.63	1.73:1	3.46:1	30.75
70215	600 ct	600 ct	150	125	20	1.5	59	72	18	1:1	2:1	30.75
70220	*600 ct	600 ct	–	125	20	1.5	59	72	–	1:1	–	33.82
70225	600 ct	1200 ct	300	125	20	1.5	59	160	40	1:1.41	1.41:1	31.54
70230	640 ct	12.8 ct	3.2	125	20	1.5	62	1.6	0.4	7.07:1	14.14:1	31.54
70235	700 ct	100 ct	25	125	20	1.35	65	12	3	2.65:1	5.29:1	31.54
70240	800 ct	12.8 ct	3.2	125	20	1.3	88	15	4	7.9:1	15.8:1	33.82
70245	800 ct	48 ct	12	125	20	1.3	88	6.7	1.68	4.08:1	8.16:1	30.75
70250	800 ct	800 ct	200	125	20	1.3	88	106	26.5	1:1	2:1	30.75
70255	900 ct	600 ct	150	125	20	1.2	93	74	18.5	1.22:1	2.45:1	30.75
70260	1000 ct	12 ct	3	125	20	1.2	120	1.55	0.39	9.13:1	18.3:1	34.71
70265	1000 ct	50 ct	12.5	125	20	1.2	120	6.6	1.65	4.47:1	8.94:1	34.71
70270	1000 ct	1000 ct	250	125	20	1.2	120	120	30	1:1	2:1	31.54
70275	1060 ct	12.8 ct	3.2	125	20	1.2	125	1.6	0.4	9.1:1	18.2:1	34.71
70280	1200 ct	12.8 ct	3.2	125	20	1	133	1.6	0.4	9.68:1	19.4:1	34.71
70285	1200 ct	500 ct	125	125	20	1	133	65	16.25	1.55:1	3.1:1	34.71
70290	1200 ct	1200 ct	300	125	20	1	133	160	40	1:1	2:1	34.71
70295	*1200 ct	1200 ct	–	125	20	1	133	160	–	1:1	–	34.71
70300	1500 ct	12 ct	3	125	20	1	180	1.55	0.39	11.2:1	22.4:1	34.71
70305	1500 ct	500 ct	125	125	20	1	180	65	16.3	1.73:1	3.46:1	31.54
70310	*1500 ct	600 ct	–	125	20	1	180	73	–	1.58:1	–	31.54
70315	*1500 ct	1500 ct	–	125	20	1	180	215	–	1:1	–	34.71
70320	1600 ct	12.8 ct	3.2	125	20	1	190	1.6	0.4	11.2:1	22.4:1	34.71
70325	2000 ct	8 ct	2	125	20	0.8	218	1	.25	15.8:1	31.6:1	34.71
70330	2000 ct	2000 ct	500	125	20	0.8	218	260	65	1:1	2:1	34.71
70335	*2000 ct	2000 ct	–	125	20	0.8	218	260	–	1:1	–	34.71
70340	2000 ct	8000 ct	2000	125	20	0.8	218	830	207.5	1:2	1:1	33.82

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** ..... ±3db, 400 Hz-250 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:**..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ..... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 1.5 Grams
- **OPERATING TEMPERATURE:**.. -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:**..... 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

*For immediate engineering assistance or to place an order—***Call Toll Free 800-431-1064***

Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER MILLIWATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
70345	2500 ct	2500 ct	625	125	20	0.75	280	280	70	1:1	2:1	33.82
70350	3000 ct	3000 ct	725	125	20	0.65	330	330	82.5	1:1	2:1	33.82
70355	*3000 ct	3000 ct	–	125	20	0.65	330	330	–	1:1	–	33.82
70360	3600 ct	3600 ct	900	125	20	0.6	370	450	112.5	1:1	2:1	33.82
70365	4000 ct	16 ct	4	125	20	0.57	400	2.3	0.58	15.8:1	31.6:1	33.82
70370	4000 ct	600 ct	150	125	20	0.57	400	73	18.25	2.58:1	5.16:1	33.82
70375	4000 ct	1000 ct	250	125	20	0.57	400	120	30	2:1	4:1	33.82
70380	*4000 ct	8000 ct	–	125	20	0.57	400	1070	–	1:1.41	–	37.18
70385	5000 ct	500 ct	125	125	20	0.5	540	65	16.25	3.16:1	6.32:1	33.82
70390	5000 ct	5000 ct	1250	125	20	0.5	540	650	162.5	1:1	2:1	33.82
70395	7500 ct	50 ct	12.5	125	20	0.5	835	6.6	1.65	12.2:1	24.5:1	37.18
70400	7500 ct	100 ct	25	125	20	0.4	835	12	3	8.66:1	17.3:1	34.16
70405	7500 ct	600 ct	150	125	20	0.4	835	72	18	3.54:1	7.07:1	34.16
70410	7500 ct	2500 ct	625	125	20	0.4	835	280	70	1.73:1	3.46:1	34.16
70415	*7500 ct	7500 ct	–	125	20	0.4	835	1020	–	1:1	–	34.16
70420	8000 ct	12.8 ct	3.2	125	20	0.4	865	1.6	0.4	25:1	50:1	37.18
70425	8000 ct	1000 ct	250	125	20	0.4	865	120	30	2.83:1	5.66:1	37.18
70430	*8000 ct	1200 ct	–	125	20	0.4	865	160	–	2.58:1	–	37.18
70435	*9000 ct	9000 ct	–	125	20	0.4	1160	1160	–	1:1	–	37.18
70440	10,000 ct	12.8 ct	3.2	125	20	0.36	1200	1.6	0.4	28:1	56:1	37.18
70445	10,000 ct	16 ct	4	125	20	0.36	1200	1.77	0.44	25:1	50:1	34.16
70450	10,000 ct	100 ct	25	125	20	0.36	1200	12	3	10:1	20:1	34.16
70455	10,000 ct	200 ct	50	125	20	0.36	1200	27	6.75	7.07:1	14.14:1	34.16
70460	10,000 ct	500 ct	125	125	20	0.36	1200	65	16.25	4.47:1	8.94:1	34.16
70465	10,000 ct	600 ct	150	125	20	0.36	1200	72	18	4.08:1	8.16:1	34.16
70470	10,000 ct	1000 ct	250	125	20	0.36	1200	120	30	3.16:1	6.32:1	34.16
70475	10,000 ct	1200 ct	300	125	20	0.36	1200	160	40	2.88:1	5.77:1	34.16
70480	10,000 ct	1500 ct	375	125	20	0.36	1200	215	53.8	2.58:1	5.16:1	34.71
70485	10,000 ct	2000 ct	500	125	20	0.36	1200	260	65	2.24:1	4.47:1	34.71
70490	10,000 ct	5000 ct	1250	125	20	0.36	1200	650	162.5	1.41:1	2.83:1	34.71
70495	10,000 ct	7500 ct	1875	125	20	0.36	1200	1020	255	1.15:1	2.3:1	34.71
70500	10,000 ct	10,000 ct	2500	125	20	0.36	1200	1200	300	1:1	2:1	31.54
70505	*10,000 ct	10,000 ct	–	125	20	0.36	1200	1440	–	1:1	–	37.18
70510	15,000 ct	400 ct	100	100	15	0.35	1420	43	10.75	6.12:1	12.24:1	34.16
70515	15,000 ct	500 ct	125	100	15	0.35	1420	49	12.25	5.48:1	10.95:1	34.16
70520	15,000 ct	600 ct	150	100	15	0.35	1420	68	17	5:1	10:1	34.16
70525	15,000 ct	10,000 ct	2500	100	15	0.35	1420	1100	275	1.22:1	2.45:1	34.16
70530	*15,000 ct	15,000 ct	–	100	15	0.35	1420	1730	–	1:1	–	37.18
70535	15,000 ct	15,000 ct	3750	100	15	0.35	1420	1730	433	1:1	2:1	34.71
70540	16,000 ct	1000 ct	250	100	15	0.35	1500	115	28.75	4:1	8:1	34.71
70545	20,000 ct	500 ct	125	100	15	0.3	1600	60	15	6.33:1	12.65:1	37.18
70550	20,000 ct	600 ct	150	100	15	0.3	1600	66	16.5	5.77:1	11.55:1	37.18
70555	20,000 ct	800 ct	200	100	15	0.3	1600	94	23.5	5:1	10:1	37.18
70560	20,000 ct	1000 ct	250	100	15	0.3	1600	106	26.5	4.47:1	8.94:1	37.18
70565	20,000 ct	5000 ct	1250	100	15	0.3	1600	600	150	2:1	4:1	37.18
70570	20,000 ct	10,000 ct	2500	100	15	0.3	1600	1100	275	1.41:1	2.83:1	37.18

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1–9 Net: 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100–499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

INDUCTORS

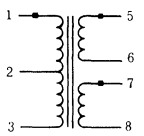
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70825	SERIES	10.0	0	2250	30.02
		2.75	2		
	PARALLEL	2.5	0	560	
		.65	4		
70830	SERIES	5.5	0	1000	30.02
		1.5	2		
	PARALLEL	1.3	0	250	
		.40	4		
70835	SERIES	.85	1	240	30.02
		.25	6		
	PARALLEL	.21	2	60	
		.06	12		
70840	SERIES	.6	0	144	30.02
		.15	5		
	PARALLEL	.15	0	36	
		.04	10		

SURFACE MOUNT

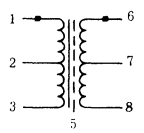
70000 SERIES



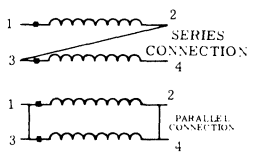
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELD DESIGN AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

THIS PRODUCT IS PATENTED

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery—stock to one week

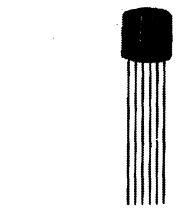
PICO Electronics, Inc.

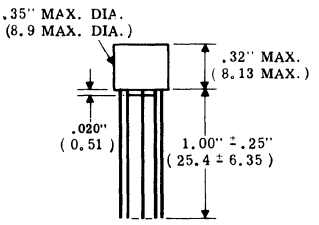
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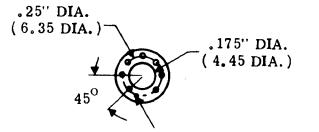
PICO's ultra-miniature transformers

For Surface Mount Versions of this series, see pages A•2340 A•2341

W SERIES Plug-In







WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

DIMENSIONS ARE IN INCHES (MM)

PICO PART NUMBER W Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** W-Series
W-26003	10 ct	10 ct	2.5	.4	.075	31.6	1.1	1.3	.33	1:1	2:1	20.41
W-26005	20 ct	8 ct	2	.4	.075	22.3	2.2	1	.25	1.58:1	3.16:1	20.41
W-26010	20 ct	20 ct	5	.4	.075	22.3	2.2	2.6	.65	1:1	2:1	20.41
W-26015	32 ct	32 ct	8	.4	.075	17.6	3.5	4.2	1.05	1:1	2:1	20.41
W-26020	40 ct	40 ct	10	.4	.075	15.8	4	4.5	1.2	1:1	2:1	20.41
W-26025	48 ct	16 ct	4	.4	.075	14.4	5.3	1.9	.48	1.73:1	3.46:1	21.64
W-26030	50 ct	50 ct	12.5	.4	.075	14.1	5.6	6.5	1.6	1:1	2:1	21.64
W-26035	80 ct	32 ct	8	.4	.075	11.1	8	4	1	1.58:1	3.16:1	25.72
W-26040	100 ct	40 ct	10	.4	.075	10	10	4.5	1.2	1.58:1	3.16:1	21.64
W-26045	100 ct	100 ct	25	.4	.075	10	10	12	3	1:1	2:1	21.64
W-26050	120 ct	12.8 ct	3.2	.4	.075	9.1	12	1.5	.38	3.06:1	6.12:1	19.47
W-26055	120 ct	60 ct	15	.4	.075	9.1	12	7.2	1.8	1.41:1	2.83:1	25.72
W-26060	120 ct	120 ct	30	.4	.075	9.1	12	14.5	3.6	1:1	2:1	25.72
W-26065	150 ct	12 ct	3	.4	.075	8.2	15	1.5	.38	3.54:1	7.08:1	19.47
W-26070	150 ct	50 ct	12.5	.4	.075	8.2	15	6	1.5	1.73:1	3.46:1	21.64
W-26075	150 ct	100 ct	25	.4	.075	8.2	15	12	3	1.22:1	2.45:1	21.64
W-26080	150 ct	150 ct	37.5	.4	.075	8.2	15	16.8	4.2	1:1	2:1	25.72
W-26085	150 ct	600 ct	150	.4	.075	8.2	15	70	17.5	1:2	1:1	21.64
W-26090	200 ct	200 ct	50	.4	.075	7	20	24	6	1:1	2:1	21.64
W-26095	300 ct	12ct	3	.4	.075	5.8	30	1.5	.38	5:1	10:1	19.47
W-26100	300 ct	50 ct	12.5	.4	.075	5.8	30	6	1.5	2.45:1	4.9:1	21.64
W-26105	300 ct	150 ct	37.5	.4	.075	5.8	30	18	4.5	1.41:1	2.83:1	21.64
W-26110	300 ct	300 ct	75	.4	.075	5.8	30	36	9	1:1	2:1	25.72
W-26115	300 ct	600 ct	150	.4	.075	5.8	30	72	18	1:1.41	1.41:1	19.47
W-26120	320 ct	12.8 ct	3.2	.4	.075	5.6	32	1.5	.38	5:1	10:1	19.47
W-26125	400 ct	40 ct	10	.4	.075	5	40	4.5	1:1	3.16:1	6.32:1	25.72
W-26130	400 ct	120 ct	30	.4	.075	5	40	14	3.5	1.83:1	3.65:1	25.72
W-26135	400 ct	200 ct	50	.4	.075	5	40	24	6	1.41:1	2.83:1	21.64
W-26140	400 ct	400 ct	100	.4	.075	5	40	48	12	1:1	2:1	25.72
W-26145	400 ct	1000 ct	250	.4	.075	5	40	120	30	1:1.58	1.26:1	29.49
W-26150	400 ct	2000 ct	500	.4	.075	5	40	240	60	1:2.24	1:1.12	29.49
W-26155	400 ct	4000 ct	1000	.4	.075	5	40	480	120	1:3.16	1:1.58	26.65
W-26160	500 ct	12.8 ct	3.2	.4	.075	4.5	50	1.5	.38	6.25:1	12.5:1	22.57
W-26165	500 ct	16 ct	4	.4	.075	4.5	50	2	.5	5.6:1	11.2:1	22.57
W-26170	500 ct	50 ct	12.5	.4	.075	4.5	50	6	1.5	3.16:1	6.32:1	22.57
W-26175	500 ct	150 ct	37.5	.4	.075	4.5	50	18	4.5	1.83:1	3.65:1	22.57
W-26180	500 ct	500 ct	125	.4	.075	4.5	50	60	15	1:1	2:1	22.57
W-26185	*500 ct	500 ct	–	.4	.075	4.5	50	60	–	1:1	–	22.57
W-26190	500 ct	600 ct	150	.4	.075	4.5	50	72	18	1:1.1	1.83:1	22.57
W-26195	600 ct	12.8 ct	3.2	.4	.075	4.1	60	1.5	.38	6.85:1	13.7:1	19.47
W-26200	600 ct	30 ct	7.5	.4	.075	4.1	60	3.6	.9	4.47:1	8.94:1	20.41
W-26205	600 ct	48 ct	12	.4	.075	4.1	60	5.8	1.45	3.54:1	7.07:1	20.41
W-26210	600 ct	200 ct	50	.4	.075	4.1	60	24	6	1.73:1	3.46:1	20.41
W-26215	600 ct	600 ct	150	.4	.075	4.1	60	72	18	1:1	2:1	20.41
W-26220	*600 ct	600 ct	–	.4	.075	4.1	60	72	–	1:1	–	22.58
W-26225	600 ct	1200 ct	300	.4	.075	4.1	60	144	36	1:1.41	1.41:1	20.41
W-26230	640 ct	12.8 ct	3.2	.4	.075	3.9	64	1.5	.38	7.07:1	14.14:1	20.41
W-26235	700 ct	100 ct	25	.4	.075	3.8	70	12	3	2.65:1	5.29:1	20.41
W-26240	800 ct	12.8 ct	3.2	.4	.075	3.5	80	1.5	.38	7.9:1	15.8:1	20.41
W-26245	800 ct	48 ct	12	.4	.075	3.5	80	5.8	1.45	4.08:1	8.16:1	22.58
W-26250	800 ct	800 ct	200	.4	.075	3.5	80	96	24	1:1	2:1	20.41
W-26255	900 ct	600 ct	150	.4	.075	3.3	90	72	18	1.22:1	2.45:1	20.41
W-26260	1000 ct	12 ct	3	.4	.075	3.2	100	1.5	.38	9.13:1	18.3:1	20.41
W-26265	1000 ct	50 ct	12.5	.4	.075	3.2	100	6	1.5	4.47:1	8.94:1	22.58
W-26270	1000 ct	1000 ct	250	.4	.075	3.2	100	120	30	1:1	2:1	22.58
W-26275	1060 ct	12.8 ct	3.2	.4	.075	3.1	106	1.5	.38	9.1:1	18.2:1	20.41
W-26280	1200 ct	12.8 ct	3.2	.4	.075	2.9	120	1.5	.38	9.68:1	19.4:1	18.38
W-26285	1200 ct	500 ct	125	.4	.075	2.9	120	60	15	1.55:1	3.1:1	18.38
W-26290	1200 ct	1200 ct	300	.4	.075	2.9	120	140	35	1:1	2:1	18.38
W-26295	*1200 ct	1200 ct	–	.4	.075	2.9	120	140	–	1:1	–	25.15
W-26300	1500 ct	12 ct	3	.4	.075	2.6	150	1.5	.38	11.2:1	22.4:1	20.41
W-26305	1500 ct	500 ct	125	.4	.075	2.6	150	60	15	1.73:1	3.46:1	22.58
W-26310	*1500 ct	600 ct	–	.4	.075	2.6	150	72	–	1.58:1	–	22.58
W-26315	*1500 ct	1500 ct	–	.4	.075	2.6	150	180	–	1:1	–	22.58
W-26320	1600 ct	12.8 ct	3.2	.4	.075	2.5	160	1.5	.38	11.2:1	22.4:1	20.41
W-26325	2000 ct	8 ct	2	.4	.075	2.2	200	1	.25	15.8:1	31.6:1	26.65
W-26330	2000 ct	2000 ct	500	.4	.075	2.2	200	240	60	1:1	2:1	26.65
W-26335	*2000 ct	2000 ct	–	.4	.075	2.2	200	240	–	1:1	–	29.49
W-26340	2000 ct	8000 ct	2000	.4	.075	2.2	200	960	240	1:2	1:1	26.65
W-26345	2500 ct	2500 ct	625	.4	.075	2	250	300	75	1:1	2:1	26.65

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%
50-99 less 23%; 100-499 less 30%

*INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** ..... ±3db, 400 Hz-100 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 2.5 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solid .016 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per Mil-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** W-Series
W-26350	3000 ct	3000 ct	725	.4	.075	1.8	300	360	90	1:1	2:1	21.64
W-26355	*3000 ct	3000 ct	–	.4	.075	1.8	300	360	–	1:1	–	29.49
W-26360	3600 ct	3600 ct	900	.4	.075	1.7	360	432	108	1:1	2:1	21.64
W-26365	4000 ct	16 ct	4	.4	.075	1.6	400	1.9	.47	15.8:1	31.6:1	26.65
W-26370	4000 ct	600 ct	150	.4	.075	1.6	400	72	18	2.58:1	5.16:1	26.65
W-26375	4000 ct	1000 ct	250	.4	.075	1.6	400	120	30	2:1	4:1	29.49
W-26380	*4000 ct	8000 ct	–	.4	.075	1.6	400	960	–	1:1.41	–	29.49
W-26385	5000 ct	500 ct	125	.4	.075	1.4	500	60	15	3.16:1	6.32:1	22.58
W-26390	5000 ct	5000 ct	1250	.4	.075	1.4	500	600	150	1:1	2:1	22.58
W-26395	7500 ct	50 ct	12.5	.33	.075	1.2	750	6	1.5	12.2:1	24.5:1	22.58
W-26400	7500 ct	100 ct	25	.33	.075	1.2	750	12	3	8.66:1	17.3:1	22.58
W-26405	7500 ct	600 ct	150	.33	.075	1.2	750	72	18	3.54:1	7.07:1	25.14
W-26410	7500 ct	2500 ct	625	.33	.075	1.2	750	300	75	1.73:1	3.46:1	25.14
W-26415	*7500 ct	7500 ct	–	.33	.075	1.2	750	900	–	1:1	–	29.49
W-26420	8000 ct	12.8 ct	3.2	.3	.075	1.1	800	1.5	.38	25:1	50:1	22.58
W-26425	8000 ct	1000 ct	250	.3	.075	1.1	800	120	30	2.83:1	5.66:1	25.14
W-26430	*8000 ct	1200 ct	–	.3	.075	1.1	800	144	–	2.58:1	–	29.49
W-26435	*9000 ct	9000 ct	–	.27	.075	1.1	900	1080	–	1:1	–	29.49
W-26440	10,000 ct	12.8 ct	3.2	.25	.075	1.0	1000	1.5	.38	28:1	56:1	20.41
W-26445	10,000 ct	16 ct	4	.25	.075	1.0	1000	1.92	.48	25:1	50:1	20.41
W-26450	10,000 ct	100 ct	25	.25	.075	1.0	1000	12	3	10:1	20:1	22.58
W-26455	10,000 ct	200 ct	50	.25	.075	1.0	1000	24	6	7.07:1	14.14:1	22.58
W-26460	10,000 ct	500 ct	125	.25	.075	1.0	1000	60	15	4.47:1	8.94:1	22.58
W-26465	10,000 ct	600 ct	150	.25	.075	1.0	1000	72	18	4.08:1	8.16:1	22.58
W-26470	10,000 ct	1000 ct	250	.25	.075	1.0	1000	120	30	3.16:1	6.32:1	22.58
W-26475	10,000 ct	1200 ct	300	.25	.075	1.0	1000	144	36	2.89:1	5.77:1	26.65
W-26480	10,000 ct	1500 ct	375	.25	.075	1.0	1000	180	45	2.58:1	5.16:1	26.65
W-26485	10,000 ct	2000 ct	500	.25	.075	1.0	1000	240	60	2.24:1	4.47:1	26.09
W-26490	10,000 ct	5000 ct	1250	.25	.075	1.0	1000	600	150	1.41:1	2.83:1	26.091
W-26495	10,000 ct	7500 ct	1875	.25	.075	1.0	1000	900	225	1.15:1	2.3:1	26.65
W-26500	10,000 ct	10,000 ct	2500	.25	.075	1.0	1000	1200	300	1:1	2:1	25.72
W-26505	*10,000 ct	10,000 ct	–	.25	.075	1.0	1000	1200	–	1:1	–	29.49
W-26510	15,000 ct	400 ct	100	.16	.075	.82	1500	48	12	6.12:1	12.24:1	25.72
W-26515	15,000 ct	500 ct	125	.16	.075	.82	1500	60	15	5.48:1	10.95:1	25.72
W-26520	15,000 ct	600 ct	150	.16	.075	.82	1500	72	18	5:1	10:1	25.72
W-26525	15,000 ct	10,000 ct	2500	.16	.075	.82	1500	1200	300	1.22:1	2.45:1	25.72
W-26530	*15,000 ct	15,000 ct	–	.16	.075	.82	1500	1800	–	1:1	–	29.49
W-26535	15,000 ct	15,000 ct	3750	.16	.075	.82	1500	1800	450	1:1	2:1	26.55
W-26540	16,000 ct	1,000 ct	250	.15	.075	.8	1600	120	30	4:1	8:1	26.55
W-26545	20,000 ct	500 ct	125	.125	.075	.7	2000	60	15	6.33:1	12.65:1	25.72
W-26550	20,000 ct	600 ct	150	.125	.075	.7	2000	72	18	5.77:1	11.55:1	25.72
W-26555	20,000 ct	800 ct	200	.125	.075	.7	2000	96	24	5:1	10:1	23.51
W-26560	20,000 ct	1000 ct	250	.125	.075	.7	2000	120	30	4.47:1	8.94:1	29.49
W-26565	20,000 ct	5000 ct	1250	.125	.075	.7	2000	600	150	2:1	4:1	25.72
W-26570	20,000 ct	10,000 ct	2500	.125	.075	.7	2000	1200	300	1.41:1	2.83:1	25.72
W-26575	*20,000 ct	20,000 ct	–	.125	.075	.7	2000	2400	–	1:1	–	29.49
W-26580	25,000 ct	500 ct	125	.1	.075	.63	2500	60	15	7.07:1	14.14:1	26.65
W-26585	25,000 ct	1000 ct	250	.1	.075	.63	2500	120	30	5:1	10:1	26.65
W-26590	30,000 ct	50 ct	12.5	.083	.075	.58	3000	6	1.5	24.5:1	49:1	26.65
W-26595	30,000 ct	1200 ct	300	.083	.075	.58	3000	144	36	5:1	10:1	26.65
W-26600	30,000 ct	500 ct	125	.083	.075	.58	3000	60	15	7.75:1	15.5:1	26.65
W-26605	30,000 ct	200 ct	50	.083	.075	.58	3000	24	6	12.25:1	24.5:1	26.65
W-26610	30,000 ct	5,000 ct	1250	.083	.075	.58	3000	600	150	2.45:1	4.9:1	26.65
W-26615	30,000 ct	10,000 ct	2500	.083	.075	.58	3000	1200	300	1.73:1	3.46:1	26.65
W-26620	*30,000 ct	30,000 ct	–	.083	.075	.58	3000	3600	–	1:1	–	29.49
W-26625	40,000 ct	400 ct	100	.062	.062	.5	4000	48	12	10:1	20:1	29.49
W–SHIELD MU–METAL SHIELD .37"D x .32"H (9.4mmD x 8.1mmH) SINGLE SHIELD												3.52
WXX–SHIELD MU–METAL SHIELD .395"D x .33"H (10mmD x 8.4mmH) USE WITH W SHIELD FOR DOUBLE SHIELDING												3.52

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1–9 Net;
10–24 less 10%; 25–49 less 16%;
50–99 less 23%; 100-499 less 30%

Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York.

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ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

PICO PART NUMBER	INDUCTANCE SERIES		DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1–9***
W-26705	SERIES	0.1	4	25	20.41
		.08	10		
	PARALLEL	.025	8	6.5	
		.02	20		
W-26710	SERIES	0.9	2	105	20.41
		0.5	6		
	PARALLEL	.23	4	26	
		.13	12		
W-26715	SERIES	2.5	2	630	20.41
		0.9	4		
	PARALLEL	0.6	4	160	
		0.23	8		
W-26720	SERIES	4.5	2	2300	21.67
		1.2	4		
	PARALLEL	1.1	4	575	
		0.3	8		

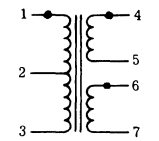
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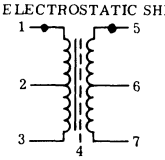
PICO's ultra-miniature transformers

W SERIES Plug-In

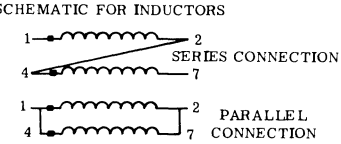
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FEATURES

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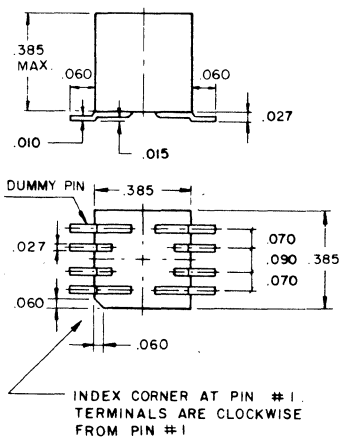
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SURFACE MOUNT

PICO's ultra-miniature transformers



71000 SERIES



DIMENSIONS ARE IN INCHES (MM)

PICO PART NUMBER	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
71003	10 ct	10 ct	2.5	.4	.075	31.6	1.1	1.3	.33	1:1	2:1	21.41
71005	20 ct	8 ct	2	.4	.075	22.3	2.2	1	.25	1.58:1	3.16:1	21.41
71010	20 ct	20 ct	5	.4	.075	22.3	2.2	2.6	.65	1:1	2:1	21.41
71015	32 ct	32 ct	8	.4	.075	17.6	3.5	4.2	1.05	1:1	2:1	21.41
71020	40 ct	40 ct	10	.4	.075	15.8	4	4.5	1.2	1:1	2:1	21.41
71025	48 ct	16 ct	4	.4	.075	14.4	5.3	1.9	.48	1.73:1	3.46:1	22.72
71030	50 ct	50 ct	12.5	.4	.075	14.1	5.6	6.5	1.6	1:1	2:1	22.72
71035	80 ct	32 ct	8	.4	.075	11.1	8	4	1	1.58:1	3.16:1	26.97
71040	100 ct	40 ct	10	.4	.075	10	10	4.5	1.2	1.58:1	3.16:1	22.72
71045	100 ct	100 ct	25	.4	.075	10	10	12	3	1:1	2:1	20.43
71050	120 ct	12.8 ct	3.2	.4	.075	9.1	12	1.5	.38	3.06:1	6.12:1	20.43
71055	120 ct	60 ct	15	.4	.075	9.1	12	7.2	1.8	1.41:1	2.83:1	26.97
71060	120 ct	120 ct	30	.4	.075	9.1	12	14.5	3.6	1:1	2:1	26.97
71065	150 ct	12 ct	3	.4	.075	8.2	15	1.5	.38	3.54:1	7.08:1	20.43
71070	150 ct	50 ct	12.5	.4	.075	8.2	15	6	1.5	1.73:1	3.46:1	22.72
71075	150 ct	100 ct	25	.4	.075	8.2	15	12	3	1.22:1	2.45:1	22.72
71080	150 ct	150 ct	37.5	.4	.075	8.2	15	16.8	4.2	1:1	2:1	26.97
71085	150 ct	600 ct	150	.4	.075	8.2	15	70	17.5	1:2	1:1	22.72
71090	200 ct	200 ct	50	.4	.075	7	20	24	6	1:1	2:1	22.72
71095	300 ct	12 ct	3	.4	.075	5.8	30	1.5	.38	5:1	10:1	20.43
71100	300 ct	50 ct	12.5	.4	.075	5.8	30	6	1.5	2.45:1	4.9:1	22.72
71105	300 ct	150 ct	37.5	.4	.075	5.8	30	18	4.5	1.41:1	2.83:1	22.72
71110	300 ct	300 ct	75	.4	.075	5.8	30	36	9	1:1	2:1	26.97
71115	300 ct	600 ct	150	.4	.075	5.8	30	72	18	1:1.41	1.41:1	20.43
71120	320 ct	12.8 ct	3.2	.4	.075	5.6	32	1.5	.38	5:1	10:1	20.43
71125	400 ct	40 ct	10	.4	.075	5	40	4.5	1.1	3.16:1	6.32:1	26.97
71130	400 ct	120 ct	30	.4	.075	5	40	14	3.5	1.83:1	3.65:1	26.97
71135	400 ct	200 ct	50	.4	.075	5	40	24	6	1.41:1	2.83:1	22.72
71140	400 ct	400 ct	100	.4	.075	5	40	48	12	1:1	2:1	26.97
71145	400 ct	1000 ct	250	.4	.075	5	40	120	30	1:1.58	1.26:1	30.94
71150	400 ct	2000 ct	500	.4	.075	5	40	240	60	1:2.24	1:1.12	30.94
71155	400 ct	4000 ct	1000	.4	.075	5	40	480	120	1:3.16	1:1.58	27.94
71160	500 ct	12.8 ct	3.2	.4	.075	4.5	50	1.5	.38	6.25:1	12.5:1	23.68
71165	500 ct	16 ct	4	.4	.075	4.5	50	2	.5	5.6:1	11.2:1	23.68
71170	500 ct	50 ct	12.5	.4	.075	4.5	50	6	1.5	3.16:1	6.32:1	23.68
71175	500 ct	150 ct	37.5	.4	.075	4.5	50	16	4.5	1.83:1	3.65:1	23.68
71180	500 ct	500 ct	125	.4	.075	4.5	50	60	15	1:1	2:1	23.68
71185	*500 ct	500 ct	–	.4	.075	4.5	50	60	–	1:1	–	23.68
71190	500 ct	600 ct	150	.4	.075	4.5	50	72	18	1:1.1	1.83:1	23.68
71195	600 ct	12.8 ct	3.2	.4	.075	4.1	60	1.5	.38	6.85:1	13.7:1	20.43
71200	600 ct	30 ct	7.5	.4	.075	4.1	60	3.6	.9	4.47:1	8.94:1	21.41
71205	600 ct	48 ct	12	.4	.075	4.1	60	5.8	1.45	3.54:1	7.07:1	21.41
71210	600 ct	200 ct	50	.4	.075	4.1	60	24	6	1.73:1	3.46:1	21.41
71215	600 ct	600ct	150	.4	.075	4.1	60	72	18	1:1	2:1	21.41
71220	*600 ct	600 ct	–	.4	.075	4.1	60	72	–	1:1	–	23.68
71225	600 ct	1200 ct	300	.4	.075	4.1	60	144	36	1:1.41	1.41:1	21.41
71230	640 ct	12.8 ct	3.2	.4	.075	3.9	64	1.5	.38	7.07:1	14.4:1	21.41
71235	700 ct	100 ct	25	.4	.075	3.8	70	12	3	2.65:1	5.29:1	21.41
71240	800 ct	12.8 ct	3.2	.4	.075	3.5	80	1.5	.38	7.9:1	15.8:1	21.41
71245	800 ct	48 ct	12	.4	.075	3.5	80	5.8	1.45	4.08:1	8.16:1	31.95
71250	800 ct	800 ct	200	.4	.075	3.5	80	96	24	1:1	2:1	21.41
71255	900 ct	600 ct	150	.4	.075	3.3	90	72	18	1.22:1	2.45:1	21.41
71260	1000 ct	12 ct	3	.4	.075	3.2	100	1.5	.38	9.13:1	18.3:1	21.41
71265	1000 ct	50 ct	12.5	.4	.075	3.2	100	6	1.5	4.47:1	8.94:1	23.68
71270	1000 ct	1000 ct	250	.4	.075	3.2	100	120	30	1:1	2:1	23.68
71275	1060 ct	12.8 ct	3.2	.4	.075	3.1	106	1.5	.38	9.1:1	18.2:1	21.41
71280	1200 ct	12.8 ct	3.2	.4	.075	2.9	120	1.5	.38	9.68:1	19.4:1	19.28
71285	1200 ct	500 ct	125	.4	.075	2.9	120	60	15	1.55:1	3.1:1	19.28
71290	1200 ct	1200 ct	300	.4	.075	2.9	120	140	35	1:1	2:1	19.28
71295	*1200 ct	1200 ct	–	.4	.075	2.9	120	140	–	1:1	–	26.36
71300	1500 ct	12 ct	3	.4	.075	2.6	150	1.5	.38	11.2:1	22.4:1	21.41
71305	1500 ct	500 ct	125	.4	.075	2.6	150	60	15	1.73:1	3.46:1	23.68
71310	*1500 ct	600 ct	–	.4	.075	2.6	150	72	–	1.58:1	–	23.68
71315	*1500 ct	1500 ct	–	.4	.075	2.6	150	180	–	1:1	–	23.68
71320	1600 ct	12.8 ct	3.2	.4	.075	2.5	160	1.5	.38	11.2:1	22.4:1	21.41
71325	2000 ct	8 ct	2	.4	.075	2.2	200	1	.25	15.8:1	31.6:1	27.94
71330	2000 ct	2000 ct	500	.4	.075	2.2	200	240	60	1:1	2:1	27.94
71335	*2000 ct	2000 ct	–	.4	.075	2.2	200	240	–	1:1	–	30.94
71340	2000 ct	8000 ct	2000	.4	.075	2.2	200	960	240	1:2	1:1	27.94
71345	2500 ct	2500 ct	625	.4	.075	2	250	300	75	1:1	2:1	27.94

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** ..... ±3db, 400 Hz-100 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:**..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ..... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 3 Grams
- **OPERATING TEMPERATURE:**.. -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per Mil-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:**..... 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

PICO PART NUMBER	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
71350	3000 ct	3000 ct	725	.4	.075	1.8	300	360	90	1:1	2:1	22.73
71355	*3000 ct	3000 ct	–	.4	.075	1.8	300	360	–	1:1	–	30.94
71360	3600 ct	3600 ct	900	.4	.075	1.7	360	432	108	1:1	2:1	22.73
71365	4000 ct	16 ct	4	.4	.075	1.6	400	1.9	.47	15.8:1	31.6:1	27.94
71370	4000 ct	600 ct	150	.4	.075	1.6	400	72	18	2.58:1	5.16:1	27.94
71375	4000 ct	1000 ct	250	.4	.075	1.6	400	120	30	2:1	4:1	30.94
71380	*4000 ct	8000 ct	–	.4	.075	1.6	400	960	–	1:1.41	–	30.94
71385	5000 ct	500 ct	125	.4	.075	1.4	500	60	15	3.16:1	6.32:1	23.68
71390	5000 ct	5000 ct	1250	.4	.075	1.4	500	600	150	1:1	2:1	23.68
71395	7500 ct	50 ct	12.5	.33	.075	1.2	750	6	1.5	12.2:1	24.5:1	23.68
71400	7500 ct	100 ct	25	.33	.075	1.2	750	12	3	8.66:1	17.3:1	23.68
71405	7500 ct	600 ct	150	.33	.075	1.2	750	72	18	3.54:1	7.07:1	26.36
71410	7500 ct	2500 ct	625	.33	.075	1.2	750	300	75	1.73:1	3.46:1	26.36
71415	*7500 ct	7500 ct	–	.33	.075	1.2	750	900	–	1:1	–	30.94
71420	8000 ct	12.8 ct	3.2	.3	.075	1.1	800	1.5	.38	25:1	50:1	23.68
71425	8000 ct	1000 ct	250	.3	.075	1.1	800	120	30	2.83:1	5.66:1	26.36
71430	*8000 ct	1200 ct	–	.3	.075	1.1	800	144	–	2.58:1	–	30.94
71435	*9000 ct	9000 ct	–	.27	.075	1.1	900	1080	–	1:1	–	30.94
71440	10,000 ct	12.8 ct	3.2	.25	.075	1.0	1000	1.5	.38	28:1	56:1	21.41
71445	10,000 ct	16 ct	4	.25	.075	1.0	1000	1.92	.48	25:1	50:1	21.41
71450	10,000 ct	100 ct	25	.25	.075	1.0	1000	12	3	10:1	20:1	23.68
71455	10,000 ct	200 ct	50	.25	.075	1.0	1000	24	6	7.07:1	14.14:1	23.68
71460	10,000 ct	500 ct	125	.25	.075	1.0	1000	60	15	4.47:1	8.94:1	23.68
71465	10,000 ct	600 ct	150	.25	.075	1.0	1000	72	18	4.08:1	8.16:1	23.68
71470	10,000 ct	1000 ct	250	.25	.075	1.0	1000	120	30	3.16:1	6.32:1	23.68
71475	10,000 ct	1200 ct	300	.25	.075	1.0	1000	144	36	2.89:1	5.77:1	27.94
71480	10,000 ct	1500 ct	375	.25	.075	1.0	1000	180	45	2.58:1	5.16:1	27.94
71485	10,000 ct	2000 ct	500	.25	.075	1.0	1000	240	60	2.24:1	4.47:1	27.38
71490	10,000 ct	5000 ct	1250	.25	.075	1.0	1000	600	150	1.41:1	2.83:1	27.85
71495	10,000 ct	7500 ct	1875	.25	.075	1.0	1000	900	225	1.15:1	2.3:1	27.94
71500	10,000 ct	10,000 ct	2500	.25	.075	1.0	1000	1200	300	1:1	2:1	26.93
71505	*10,000 ct	10,000 ct	–	.25	.075	1.0	1000	1200	–	1:1	–	30.94
71510	15,000 ct	400 ct	100	.16	.075	.82	1500	48	12	6.12:1	12.24:1	26.93
71515	15,000 ct	500 ct	125	.16	.075	.82	1500	60	15	5.48:1	10.95:1	26.93
71520	15,000 ct	600 ct	150	.16	.075	.82	1500	72	18	5:1	10:1	26.93
71525	15,000 ct	10,000 ct	2500	.16	.075	.82	1500	1200	300	1.22:1	2.45:1	26.93
71530	*15,000 ct	15,000 ct	–	.16	.075	.82	1500	1800	–	1:1	–	30.94
71535	15,000 ct	15,000 ct	3750	.16	.075	.82	1500	1800	450	1:1	2:1	27.94
71540	16,000 ct	1,000 ct	250	.15	.075	.8	1600	120	30	4:1	8:1	27.94
71545	20,000 ct	500 ct	125	.125	.075	.7	2000	60	15	6.33:1	12.65:1	25.79
71550	20,000 ct	600 ct	150	.125	.075	.7	2000	72	18	5.77:1	11.55:1	25.79
71555	20,000 ct	800 ct	200	.125	.075	.7	2000	96	24	5:1	10:1	24.65
71560	20,000 ct	1000 ct	250	.125	.075	.7	2000	120	30	4.47:1	8.94:1	30.94
71565	20,000 ct	5000 ct	1250	.125	.075	.7	2000	600	150	2:1	4:1	26.93
71570	20,000 ct	10,000 ct	2500	.125	.075	.7	2000	1200	300	1.41:1	2.83:1	26.93
71575	*20,000 ct	20,000 ct	–	.125	.075	.7	2000	2400	–	1:1	–	30.94
71580	25,000 ct	500 ct	125	.1	.075	.63	2500	60	15	7.07:1	14.14:1	27.94
71585	25,000 ct	1000 ct	250	.1	.075	.63	2500	120	30	5:1	10:1	27.94
71590	30,000 ct	50 ct	12.5	.083	.075	.58	3000	6	1.5	24.5:1	49:1	27.94
71595	30,000 ct	1200 ct	300	.083	.075	.58	3000	144	36	5:1	10:1	27.94
71600	30,000 ct	500 ct	125	.083	.075	.58	3000	60	15	7.75:1	15.5:1	27.95
71605	30,000 ct	200 ct	50	.083	.075	.58	3000	24	6	12.25:1	24.5:1	27.95
71610	30,000 ct	5,000 ct	1250	.083	.075	.58	3000	600	150	2.45:1	4.9:1	27.95
71615	30,000 ct	10,000 ct	2500	.083	.075	.58	3000	1200	300	1.73:1	3.46:1	27.95
71620	*30,000 ct	30,000 ct	–	.083	.075	.58	3000	3600	–	1:1	–	30.41
71625	40,000 ct	400 ct	100	.062	.062	.5	4000	48	12	10:1	20:1	30.41

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%;50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

PICO PART NUMBER	INDUCTANCE SERIES		DC CURRENT	DC RESISTANCE	PRICES 1-9***
71705	SERIES	0.1 .08	4 10	25	21.41
	PARALLEL	.025 .02	8 20	6.5	
71710	SERIES	.9 .5	2 6	105	21.41
	PARALLEL	.23 .13	4 12	26	
71715	SERIES	2.5 0.9	2 4	630	21.41
	PARALLEL	0.6 0.23	4 8	160	
71720	SERIES	4.5 1.2	2 4	2300	22.73
	PARALLEL	1.1 0.3	4 8	575	

For immediate engineering assistance or to place an order—

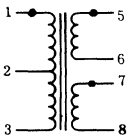
Call Toll Free 800-431-1064

SURFACE MOUNT

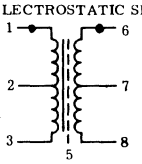
71000 SERIES



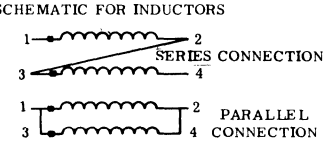
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SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELD DESIGN AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

THIS PRODUCT IS PATENTED

Delivery— stock to one week

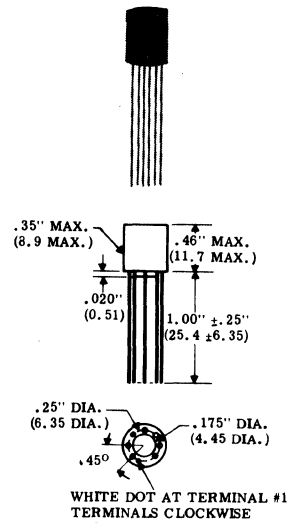
PICO Electronics, Inc.

453 N. MacQuesten Pkwy
Mt. Vernon, N.Y. 10552
914-699-5514

FAX 914-699-5565

PICO's ultra-miniature transformers

Y SERIES Plug-In



DIMENSIONS ARE IN INCHES (MM)

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** ..... ±3db, 300 Hz-100 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz and 400 Hz and 300 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ..... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 3 Grams
- **OPERATING TEMPERATURE:** ..... -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solid .016 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per Mil-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552
914-699-5514 • FAX 914-699-5565

Delivery— stock to one week

PICO PART NUMBER Y-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	TURNS RATIO PRIME/SEC SEC PAR CONN	PICO PRICES 1-9 *** Y-Series
Y-27003	10 ct	10 ct	2.5	.6	.2	.1	31.6	1	1.25	.32	1:1	2:1	20.42
Y-27005	20 ct	8 ct	2	.6	.2	.1	22.3	2	.9	.23	1.58:1	3.16:1	20.42
Y-27010	20 ct	20 ct	5	.6	.2	.1	22.3	2.1	2.25	.56	1:1	2:1	20.42
Y-27015	32 ct	32 ct	8	.6	.2	.1	17.6	3.4	4	1	1:1	2:1	20.42
Y-27020	40 ct	40 ct	10	.6	.2	.1	15.8	4.2	4.5	1.13	1:1	2:1	20.42
Y-27025	48 ct	16 ct	4	.6	.2	.1	14.4	5	1.8	.45	1.73:1	3.46:1	20.42
Y-27030	50 ct	50 ct	12.5	.6	.2	.1	14.1	5.25	5.6	1.4	1:1	2:1	20.42
Y-27035	80 ct	32 ct	8	.6	.2	.1	11.1	8.4	4	1	1.58:1	3.16:1	26.86
Y-27040	100 ct	40 ct	10	.6	.2	.1	10	10	4.5	1.13	1.58:1	3.16:1	26.86
Y-27045	100 ct	100 ct	25	.6	.2	.1	10	11	11.25	2.8	1:1	2:1	26.86
Y-27050	120 ct	12.8 ct	3.2	.6	.2	.1	9.1	14.4	1.8	.45	3.06:1	6.12:1	19.46
Y-27055	120 ct	60 ct	15	.6	.2	.1	9.1	14.4	8.4	2.1	1.41:1	2.83:1	25.71
Y-27060	120 ct	120 ct	30	.6	.2	.1	9.1	14.4	16.8	4.2	1:1	2:1	25.71
Y-27065	150 ct	12 ct	3	.6	.2	.1	8.2	15	1.5	.38	3.54:1	7.08:1	19.46
Y-27070	150 ct	50 ct	12.5	.6	.2	.1	8.2	15	6	1.5	1.73:1	3.46:1	21.64
Y-27075	150 ct	100 ct	25	.6	.2	.1	8.2	15	12	3	1.22:1	2.45:1	21.64
Y-27080	150 ct	150 ct	37.5	.6	.2	.1	8.2	15	18	4.5	1:1	2:1	25.33
Y-27085	150 ct	600 ct	150	.6	.2	.1	8.2	15	72	18	1:2	1:1	21.64
Y-27090	200 ct	200 ct	50	.6	.2	.1	7	22	24	6	1:1	2:1	21.64
Y-27095	300 ct	12 ct	3	.6	.2	.1	5.8	30	1.4	.35	5:1	10:1	19.46
Y-27100	300 ct	50 ct	12.5	.6	.2	.1	5.8	30	6	1.5	2.45:1	4.9:1	21.64
Y-27105	300 ct	150 ct	37.5	.6	.2	.1	5.8	30	18	4.5	1.41:1	2.83:1	21.64
Y-27110	300 ct	300 ct	75	.6	.2	.1	5.8	30	36	9	1:1	2:1	25.71
Y-27115	300 ct	600 ct	150	.6	.2	.1	5.8	30	72	18	1:1.41	1.41:1	20.42
Y-27120	320 ct	12.8 ct	3.2	.6	.2	.1	5.6	36	1.8	.45	5:1	10:1	19.46
Y-27125	400 ct	40 ct	10	.6	.2	.1	5	40	4.8	1.2	3.16:1	6.32:1	25.71
Y-27130	400 ct	120 ct	30	.6	.2	.1	5	40	14.5	3.6	1.83:1	3.65:1	25.71
Y-27135	400 ct	200 ct	50	.6	.2	.1	5	40	24	6	1.4:1	2.83:1	21.46
Y-27140	400 ct	400 ct	100	.6	.2	.1	5	40	48	12	1:1	2:1	25.71
Y-27145	400 ct	1000 ct	250	.6	.2	.1	5	40	125	31	1:1.58	1.26:1	29.49
Y-27150	400 ct	2000 ct	500	.6	.2	.1	5	40	240	60	1:2.24	1:1.12	29.49
Y-27155	400 ct	4000 ct	1000	.6	.2	.1	5	40	480	120	1:3.16	1:1.58	26.64
Y-27160	500 ct	12.8 ct	3.2	.6	.2	.1	4.5	50	1.5	.38	6.25:1	12.5:1	22.88
Y-27165	500 ct	16 ct	4	.6	.2	.1	4.5	50	1.9	.48	5.6:1	11.2:1	22.88
Y-27170	500 ct	50 ct	12.5	.6	.2	.1	4.5	50	6	1.5	3.16:1	6.32:1	22.88
Y-27175	500 ct	150 ct	37.5	.6	.2	.1	4.5	50	18	4.5	1.83:1	3.65:1	22.88
Y-27180	500 ct	500 ct	125	.6	.2	.1	4.5	50	60	15	1:1	2:1	22.88
Y-27185	*500 ct	500 ct	–	.6	.2	.1	4.5	50	60	–	1:1	–	22.88
Y-27190	500 ct	600 ct	150	.6	.2	.1	4.5	50	72	18	1:1.1	1.83:1	20.42
Y-27195	600 ct	12.8 ct	3.2	.6	.2	.1	4.1	60	1.5	.38	6.85:1	13.7:1	18.38
Y-27200	600 ct	30 ct	7.5	.6	.2	.1	4.1	60	3.6	.9	4.47:1	8.94:1	20.42
Y-27205	600 ct	48 ct	12	.6	.2	.1	4.1	60	5.8	1.45	3.54:1	7.07:1	20.42
Y-27210	600 ct	200 ct	50	.6	.2	.1	4.1	60	24	6	1.73:1	3.46:1	20.42
Y-27215**	600 ct	600 ct	150	.6	.2	.1	4.1	60	72	18	1:1	2:1	20.42
Y-27220**	*600 ct	600 ct	–	.6	.2	.1	4.1	60	72	–	1:1	–	20.42
Y-27225**	600 ct	1200 ct	300	.6	.2	.1	4.1	60	144	36	1:1.41	1.41:1	20.42
Y-27230	640 ct	12.8 ct	3.2	.6	.2	.1	3.9	64	1.5	.38	7.07:1	14.14:1	20.42
Y-27235	700 ct	100 ct	25	.6	.2	.1	3.8	70	12	3	2.65:1	5.29:1	20.42
Y-27240	800 ct	12.8 ct	3.2	.6	.2	.1	3.5	80	1.5	.38	7.9:1	15.8:1	20.42
Y-27245	800 ct	48 ct	12	.6	.2	.1	3.5	80	5.8	1.45	4.08:1	8.16:1	22.88
Y-27250	800 ct	800 ct	200	.6	.2	.1	3.5	80	96	24	1:1	2:1	22.88
Y-27255	900 ct	600 ct	150	.6	.2	.1	3.3	90	72	18	1.22:1	2.45:1	20.42
Y-27260	1000 ct	12 ct	3	.6	.2	.1	3.2	100	1.4	.35	9.13:1	18.3:1	20.42
Y-27265	1000 ct	50 ct	12.5	.6	.2	.1	3.2	100	6	1.5	4.47:1	8.94:1	22.88
Y-27270	1000 ct	1000 ct	250	.6	.2	.1	3.2	100	120	30	1:1	2:1	22.88
Y-27275	1060 ct	12.8 ct	3.2	.6	.2	.1	3.1	106	1.5	.38	9.1:1	18.2:1	20.42
Y-27280	1200 ct	12.8 ct	3.2	.6	.2	.1	2.9	120	1.5	.38	9.68:1	19.4:1	18.38
Y-27285	1200 ct	500 ct	125	.6	.2	.1	2.9	120	60	15	1.55:1	3.1:1	18.38
Y-27290	1200 ct	1200 ct	300	.6	.2	.1	2.9	120	144	36	1:1	2:1	18.38
Y-27295	*1200 ct	1200 ct	–	.6	.2	.1	2.9	120	144	–	1:1	–	20.42
Y-27300	1500 ct	12 ct	3	.6	.2	.1	2.6	150	1.44	.36	11.2:1	22.4:1	20.42
Y-27305	1500 ct	500 ct	125	.6	.2	.1	2.6	150	60	15	1.73:1	3.46:1	22.88
Y-27310	*1500 ct	600 ct	–	.6	.2	.1	2.6	150	72	–	1.58:1	–	29.49
Y-27315	*1500 ct	1500 ct	–	.6	.2	.1	2.6	150	180	–	1:1	–	22.88
Y-27320	1600 ct	12.8 ct	3.2	.6	.2	.1	2.5	160	1.5	.38	11.2:1	22.4:1	20.42
Y-27325	2000 ct	8 ct	2	.6	.2	.1	2.2	200	.96	.24	15.8:1	31.6:1	22.88
Y-27330	2000 ct	2000 ct	500	.6	.2	.1	2.2	200	240	60	1:1	2:1	26.64
Y-27335	*2000 ct	2000 ct	–	.6	.2	.1	2.2	200	240	–	1:1	–	29.49
Y-27340	2000 ct	8000 ct	2000	.6	.2	.1	2.2	200	960	240	1:2	1:1	26.64
Y-27345	2500 ct	2500 ct	625	.6	.2	.1	2	250	300	75	1:1	2:1	26.64
Y-27350	3000 ct	3000 ct	725	.6	.2	.1	1.8	300	360	90	1:1	2:1	21.41
Y-27355	*3000 ct	3000 ct	–	.6	.2	.1	1.8	300	360	–	1:1	–	29.49
Y-27360	3600 ct	3600 ct	900	.6	.2	.1	1.7	360	432	108	1:1	2:1	26.64
Y-27365	4000 ct	16 ct	4	.6	.2	.1	1.6	400	1.92	.48	15.8:1	31.6:1	26.64
Y-27370**	4000 ct	600 ct	150	.6	.2	.1	1.6	400	72	18	2.58:1	5.16:1	26.64
Y-27375	4000 ct	1000 ct	250	.6	.2	.1	1.6	400	120	30	2:1	4:1	26.64
Y-27380	*4000 ct	8000 ct	–	.6	.2	.1	1.6	400	960	–	1:1.41	–	26.64
Y-27385	5000 ct	500 ct	125	.5	.2	.1	1.4	500	60	15	3.16:1	6.32:1	21.41
Y-27390	5000 ct	5000 ct	1250	.5	.2	.1	1.4	500	600	150	1:1	2:1	21.41
Y-27395	7500 ct	50 ct	12.5	.33	.2	.1	1.2	750	6	1.5	12.2:1	24.5:1	21.41
Y-27400	7500 ct	100 ct	25	.33	.2	.1	1.2	750	12	3	8.66:1	17.3:1	22.66
Y-27405	7500 ct	600 ct	150	.33	.2	.1	1.2	750	72	18	3.54:1	7.07:1	25.15

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

PICO PART NUMBER Y-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	SEC OAR CONN	PICO PRICES 1-9 *** Y-Series
Y-27410	7500 ct	2500 ct	625	.33	.2	.1	1.2	750	300	75	1.73:1	3.46:1	25.15
Y-27415	*7500 ct	7500 ct	-	.33	.2	.1	1.2	750	900	-	1:1	-	29.49
Y-27420	8000 ct	12.8 ct	3.2	.3	.2	.1	1.1	800	1.5	.38	25:1	50:1	21.41
Y-27425	8000 ct	1000 ct	250	.3	.2	.1	1.1	800	120	30	2.83:1	5.66:1	21.41
Y-27430	*8000 ct	1200 ct	-	.3	.2	.1	1.1	800	144	-	2.58:1	-	26.64
Y-27435	*9000 ct	9000 ct	-	.27	.2	.1	1.1	900	1080	-	1:1	-	27.69
Y-27440	10,000 ct	12.8 ct	3.2	.25	.2	.1	1.0	1000	1.5	.38	28:1	56:1	20.42
Y-27445	10,000 ct	16 ct	4	.25	.2	.1	1.0	1000	1.92	.48	25:1	50:1	22.57
Y-27450	10,000 ct	100 ct	25	.25	.2	.1	1.0	1000	12	3	10:1	20:1	22.57
Y-27455	10,000 ct	200 ct	50	.25	.2	.1	1.0	1000	24	6	7.07:1	14.14:1	22.57
Y-27460	10,000 ct	500 ct	125	.25	.2	.1	1.0	1000	60	15	4.47:1	8.94:1	22.57
Y-27465	10,000 ct	600 ct	150	.25	.2	.1	1.0	1000	72	18	4.08:1	8.16:1	22.57
Y-27470	10,000 ct	1000 ct	250	.25	.2	.1	1.0	1000	120	30	3.16:1	6.32:1	22.57
Y-27475	10,000 ct	1200 ct	300	.25	.2	.1	1.0	1000	144	36	2.89:1	5.77:1	22.57
Y-27480	10,000 ct	1500 ct	375	.25	.2	.1	1.0	1000	180	45	2.58:1	5.16:1	24.60
Y-27485	10,000 ct	2000 ct	500	.25	.2	.1	1.0	1000	240	60	2.24:1	4.47:1	24.60
Y-27490	10,000 ct	5000 ct	1250	.25	.2	.1	1.0	1000	600	150	1.41:1	2.83:1	26.33
Y-27495	10,000 ct	7500 ct	1875	.25	.2	.1	1.0	1000	900	225	1.15:1	2.3:1	26.33
Y-27500	10,000 ct	10,000 ct	2500	.25	.2	.1	1.0	1000	1200	300	1:1	2:1	25.71
Y-27505	*10,000 ct	10,000 ct	-	.25	.2	.1	1.0	1000	1200	-	1:1	-	28.67
Y-27510	15,000 ct	400 ct	100	.16	.16	.1	.82	1500	48	12	6.12:1	12.24:1	25.71
Y-27515	15,000 ct	500 ct	125	.16	.16	.1	.82	1500	60	15	5.48:1	10.95:1	25.71
Y-27520	15,000 ct	600 ct	150	.16	.16	.1	.82	1500	72	18	5.1	10:1	25.71
Y-27525	15,000 ct	10,000 ct	2500	.16	.16	.1	.82	1500	1200	300	1.22:1	2.45:1	28.67
Y-27530	*15,000 ct	15,000 ct	-	.16	.16	.1	.82	1500	1800	-	1:1	-	28.67
Y-27535	15,000 ct	15,000 ct	3750	.16	.16	.1	.82	1500	1800	450	1:1	2.1	28.67
Y-27540	16,000 ct	1000 ct	250	.15	.15	.1	.8	1600	120	30	4:1	8.1	26.64
Y-27545	20,000 ct	500 ct	125	.125	.125	.1	.7	2000	60	15	6.33:1	12.65:1	25.71
Y-27550	20,000 ct	600 ct	150	.125	.125	.1	.7	2000	72	18	5.77:1	11.55:1	25.71
Y-27555	20,000 ct	800 ct	200	.125	.125	.1	.7	2000	96	24	5:1	10:1	20.42
Y-27560	20,000 ct	1000 ct	250	.125	.125	.1	.7	2000	120	30	4.47:1	8.94:1	25.71
Y-27565	20,000 ct	5000 ct	1250	.125	.125	.1	.7	2000	600	150	2:1	4:1	25.71
Y-27570	20,000 ct	10,000 ct	2500	.125	.125	.1	.7	2000	1200	300	1.41:1	2.83:1	25.71
Y-27575	*20,000 ct	20,000 ct	-	.125	.125	.1	.7	2000	2400	-	1:1	-	25.71
Y-27580	25,000 ct	500 ct	125	.1	.1	.1	.63	2500	60	15	7.07:1	14.14:1	25.71
Y-27585	25,000 ct	1000 ct	250	.1	.1	.1	.63	2500	120	30	5:1	10:1	25.71
Y-27590	30,000 ct	50 ct	12.5	.08	.08	.08	.58	3000	6	1.5	24.5:1	49:1	25.71
Y-27595	30,000 ct	1200 ct	300	.08	.08	.08	.58	3000	144	36	5:1	10:1	25.71
Y-27600	30,000 ct	500 ct	125	.08	.08	.08	.58	3000	60	15	7.75:1	15.5:1	25.71
Y-27605	30,000 ct	200 ct	50	.08	.08	.08	.58	3000	24	6	12.25:1	24.5:1	25.71
Y-27610	30,000 ct	5000 ct	1250	.08	.08	.08	.58	3000	600	150	2.45:1	4.9:1	28.65
Y-27615	30,000 ct	10,000 ct	2500	.08	.08	.08	.58	3000	1200	300	1.73:1	3.46:1	28.65
Y-27620	*30,000 ct	30,000 ct	-	.08	.08	.08	.58	3000	3600	-	1:1	-	28.65
Y-27625	40,000 ct	400 ct	100	.06	.06	.06	.5	4000	48	12	10:1	20:1	28.65
Y-27630	40,000 ct	2.000 ct	500	.06	.06	.06	.5	4000	240	60	4.47:1	8.94:1	28.65
Y-27635	40,000 ct	4.000 ct	1000	.06	.06	.06	.5	4000	480	120	3.16:1	6.32:1	29.72
Y-27640	40,000 ct	20,000 ct	5000	.06	.06	.06	.5	4000	2400	600	1.41:1	2.83:1	28.65
Y-27645	*40,000 ct	40,000 ct	-	.06	.06	.06	.5	4000	4800	-	1:1	-	28.65
Y-27650	50,000 ct	200 ct	50	.05	.05	.05	.45	5000	24	6	15.8:1	31.6:1	29.72
Y-27655	50,000 ct	500 ct	125	.05	.05	.05	.45	5000	60	15	10:1	20:1	29.72
Y-27660	50,000 ct	600 ct	150	.05	.05	.05	.45	5000	72	18	9.13:1	18.26:1	29.72
Y-27665	60,000 ct	15.000 ct	3750	.04	.04	.04	.41	6000	1800	450	2:1	4:1	29.72
Y-27670	62,500 ct	50 ct	12.5	.04	.04	.04	.4	6250	6	1.5	35.4:1	70:7:1	29.72
Y-27675	80,000 ct	15.000 ct	3750	.03	.03	.03	.35	8000	1800	450	2.3:1	4.6:1	29.72
Y-27680	90,000 ct	10.000 ct	2500	.028	.028	.028	.33	9000	1200	300	3:1	6:1	29.72
Y-27685	95,000 ct	15.000 ct	3750	.026	.026	.026	.32	9500	1800	450	2.52:1	5.03:1	29.72
Y-27690	100,000 ct	60 ct	15	.025	.025	.025	.31	10,000	7.2	1.8	40.8:1	81.6:1	32.90
Y-27695	100,000 ct	100 ct	25	.025	.025	.025	.31	10,000	12	3	31.6:1	63.2:1	32.90
Y-27700	100,000 ct	500 ct	125	.025	.025	.025	.31	10,000	60	15	14.1:1	28.3:1	32.90
Y-27705	100,000 ct	10.000 ct	2500	.025	.025	.025	.31	10,000	1200	300	3.16:1	6.32:1	32.90
Y-SHIELD MU-METAL SHIELD .37" DIA. X .46" HT. (9.4MM DIA. X 11.7MM HT.) SINGLE SHIELD													3.51
YXX-SHIELD MU-METAL SHIELD .395" DIA. X .47" HT. (10.1MM DIA. X 11.9"MM HT.) USE WITH Y-SHIELD FOR DOUBLE SHIELDING													3.51

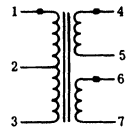
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Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

*INCLUDES ELECTROSTATIC SHIELD

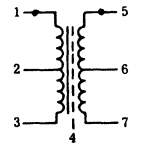
PICO's ultra-miniature transformers

Y SERIES Plug-In

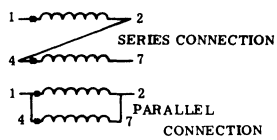
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

THIS PRODUCT IS PATENTED

Delivery— stock to one week

PICO Electronics, Inc

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Mt. Vernon, N.Y. 10552

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INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS.

TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF DC CURRENT, ARE LISTED FOR EACH INDUCTOR.

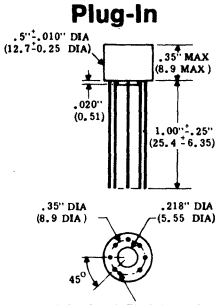
Y-Series Plug-In	INDUCTANCE SERIES		DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9***
Y-27750	SERIES	.075	10	10.5	19.48
		.06	30		
	PARALLEL	.018	20	2.6	
		.015	60		
Y-27760	SERIES	.3	4	25	21.65
		.15	20		
	PARALLEL	.075	8	6.2	
		.04	40		
Y-27770	SERIES	3.5	2	560	21.65
		1.0	5		
	PARALLEL	0.9	4	140	
		0.25	10		
Y-27780	SERIES	6.0	2	2100	21.65
		1.5	5		
	PARALLEL	1.5	4	525	
		0.38	10		
Y-27790	SERIES	20	1	5100	26.64
		8	3		
	PARALLEL	5	2	1275	
		2	6		

For immediate engineering assistance or to place an order— Call Toll Free 800-431-1064

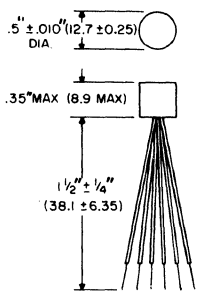
PICO's ultra-miniature transformers

These units can be manufactured and tested to MIL-T-27/357. Contact factory for price and delivery information and appropriate part numbers (MIL-T-27/357-01 thru MIL-T-27/357-114).

L SERIES Plug-In



P SERIES Insulated Leads



Dimensions are in inches (MM)

PICO PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS					SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***	
L-Series Plug-in	P-Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	L-Series	P-Series
L-8203	P-9203	20 ct	8 ct	2	.6	.4	.3	30.0	2	1.2	.3	1.58:1	3.16:1	24.26	23.21
L-8205	P-9205	20 ct	20 ct	5	.6	.4	.3	30.0	2	2.8	.7	1:1	2:1	24.26	23.21
L-8210	P-9210	32 ct	32 ct	8	.6	.4	.3	23.0	3.3	4.5	1.13	1*1	2:1	24.26	23.21
L-8215	P-9215	40 ct	40ct	10	.6	.4	.3	21.0	3.7	5	1.25	1:1	2:1	24.26	23.21
L-8218	P-9218	48 ct	16 ct	4	.6	.4	.3	19.0	3.75	3	.75	1.73:1	3.46:1	24.26	23.21
L-8220	P-9220	50 ct	50 ct	12.5	.6	.4	.3	19.0	5	7	1.75	1:1	2:1	24.26	23.21
L-8225	P-9225	80 ct	32 ct	8	.6	.4	.3	15.0	7.5	4.3	1.13	1.58:1	3.16:1	24.26	23.21
L-8228	P-9228	100 ct	40 ct	10	.6	.4	.3	13.0	10.8	5	1.25	1.58:1	3.16:1	24.26	23.21
L-8230	P-9230	100 ct	100 ct	25	.6	.4	.3	13.0	10.8	12	3	1:1	2:1	24.26	23.21
L-8235	P-9235	120 ct	12.8 ct	3.2	.6	.4	.3	12.0	9.3	2.2	.55	3.06:1	6.12:1	24.26	23.21
L-8240	P-9240	120 ct	60 ct	15	.6	.4.	.3	12.0	9	7.2	1.8	1.41:1	2.83:1	24.26	23.21
L-8245	P-9245	120 ct	120 ct	30	.6	.4	.3	12.0	11.6	13	3.3	1:1	2:1	24.26	23.21
L-8250	P-9250	150 ct	12 ct	3	.6	.4	.3	11.0	11.2	2.2	.55	3.54:1	7.08:1	24.26	23.21
L-8255	P-9255	150 ct	50 ct	12.5	.6	.4	.3	11.0	13	6.8	1.7	1.73:1	3.46:1	24.26	23.21
L-8260	P-9260	150 ct	100 ct	25	.6	.4	.3	11.0	13	11.8	3	1.22:1	2.45:1	24.26	23.21
L-8265	P-9265	150 ct	150 ct	37.5	.6	.4	.3	11.0	12	18.3	4.6	1:1	2:1	24.26	23.21
L-8270	P-9270	150 ct	600 ct	150	.6	.4	.3	11.0	13	75	19	1:2	1:1	24.26	23.21
L-8275	P-9275	200 ct	200 ct	50	.6	.4	.3	10.0	19	21.3	5.4	1:1	2 :1	24.26	23.21
L-8280	P-9280	300 ct	12 ct	3	.6	.4	.3	8.0	24	1.7	.43	5:1	10:1	24.26	23.21
L-8285	P-9285	300 ct	50 ct	12.5	.6	.4	.3	8.0	30	6.8	1.7	2.45:1	4.9:1	24.26	23.21
L-8290	P-9290	300 ct	150 ct	37.5	.6	.4	.3	8.0	30	18	4.6	1.41:1	2.83:1	24.26	23.21
L-8295	P-9295	300 ct	300 ct	75	.6	.4	.3	8.0	30	34	8.5	1:1	2:1	24.26	23.21
L-8300	P-9300	300 ct	600 ct	150	.6	.4	.3	8.0	30	60	15	1:1.41	1.41:1	24.26	23.21
L-8305	P-9305	320 ct	12.8 ct	3.2	.6	.4	.3	7.5	31	1.7	.43	5:1	10:1	24.26	23.21
L-8310	P-9310	400 ct	40 ct	10	.6	.4	.3	7.0	41	4.5	1.13	3.16:1	6.32:1	24.26	23.21
L-8315	P-9315	400 ct	120 ct	30	.6	.4	.3	7.0	41	12	3	1.83:1	3.65:1	24.26	23.21
L-8320	P-9320	400 ct	200 ct	50	.6	.4.	.3	7.0	41	21.3	5.4	1.41:1	2.83:1	24.26	23.21
L-8325	P-9325	400 ct	400 ct	100	.6	.4.	.3	7.0	41	37.5	9.4	1:1	2:1	24.26	23.21
L-8330	P-9330	400 ct	1000 ct	250	.6	.4	.3	7.0	41	96	24	1:1.58	1.26:1	24.26	23.21
L-8335	P-9335	400 ct	2000 ct	500	.6	.4	.3	7.0	41	212	53	1:2.24	1:1.12	24.26	23.21
L-8340	P-9340	400 ct	4000 ct	1000	.6	.4	.3	7.0	41	375	94	1:3.16	1:1.58	24.26	23.21
L-8342	P-9342	500 ct	12.8 ct	3.2	.6	.4	.3	6.0	48	1.7	.43	6.25:1	12.5:1	24.26	23.21
L-8344	P-9344	500 ct	16 ct	4	.6	.4	.3	6.0	48	1.9	.5	5.6:1	11.2:1	24.26	23.21
L-8345	P-9345	500 ct	50 ct	12.5	.6	.4	.3	6.0	39	6.8	1.7	3.16:1	6.32:1	24.26	23.21
L-8347	P-9347	500 ct	150 ct	37.5	.6	.4	.3	6.0	48	18	4.6	1.83:1	3.65:1	24.26	23.21
L-8350	P-9350	500 ct	500 ct	125	.6	.4	.3	6.0	48	54	13.5	1:1	2:1	24.26	23.21
L-8355	P-9355	*500 ct	500 ct	–	.6	.4	.3	6.0	48	68	–	1:1	–	25.26	24.26
L-8360	P-9360	500 ct	600 ct	150	.6	.4	.3	6.0	48	59	15	1:1.1	1.83:1	24.26	24.26
L-8365	P-9365	600 ct	12.8 ct	3.2	.6	.4	.3	5.5	53	1.7	.43	6.85:1	13.7:1	24.26	24.26
L-8367	P-9367	600 ct	30 ct	7.5	.6	.4	.3	5.5	53	4.2	1.1	4.47:1	8.94:1	24.26	24.26
L-8370	P-9370	600 ct	48 ct	12	.6	.4	.3	5.5	53	6.8	1.7	3.54:1	7.07:1	24.26	24.26
L-8375	P-9375	600 ct	200 ct	50	.6	.4	.3	5.5	53	21.3	5.3	1.73:1	3.46:1	24.26	23.44
L-8380**	P-9380	600 ct	600 ct	150	.6	.4	.3	5.5	57	79	20	1:1	2:1	24.26	23.44
L-8385**	P-9385	*600 ct	600 ct	–	.6	.4	.3	5.5	53	75	–	1:1	–	25.26	24.26
L-8387**	P-9387	600 ct	1200 ct	300	.6	.4	.3	5.5	53	105	26	1:1.41	1.41:1	24.26	23.44
L-8390	P-9390	640 ct	12.8 ct	3.2	.6	.4	.3	5.5	66	1.7	.43	7.07:1	14.14:1	24.26	23.44
L-8395	P-9395	700 ct	100 ct	25	.6	.4	.3	5.,0	69	12	3	2.65:1	5.29:1	24.26	23.44
L-8400	P-9400	800 ct	12.8 ct	3.2	.6	.4	.3	5.0	75	1.7	.43	7.9:1	15.8:1	24.26	23.44
L-8405	P-9405	800 ct	48 ct	12	.6	.4	.3	5.0	75	6.8	1.7	4.08:1	8.16:1	24.26	23.44
L-8410	P-9410	800 ct	800 ct	200	.6	.4	.3	5.0	75	105	26	1:1	2:1	24.26	23.44
L-8415	P-9415	900 ct	600 ct	150	.6	.4	.3	4.5	79	75	19	1.22:1	2.45:1	24.26	23.44
L-8420	P-9420	1000 ct	12 ct	3	.6	.4	.3	4.5	103	1.6	.4	9.13:1	18.3:1	24.26	23.44
L-8425	P-9425	1000 ct	50 ct	12.5	.6	.4	.3	4.5	103	6.4	1.6	4.47:1	8.94:1	24.26	23.44
L-8430	P-9430	1000 ct	1000 ct	250	.6	.4	.3	4.5	103	115	28	1:1	2:1	24.26	23.44
L-8435	P-9435	1060 ct	12.8 ct	3.2	.6	.4	.3	4.0	108	1.7	.43	9.1:1	18.2:1	24.26	23.44
L-8440	P-9440	1200 ct	12.8 ct	3.2	.6	.4	.3	4.0	113	1.7	.43	9.68:1	19.4:1	24.26	23.44
L-8445	P-9445	1200 ct	500 ct	125	.6	.4	.3	4.0	113	54	13.5	1.55:1	3.1:1	24.26	23.44
L-8450	P-9450	1200 ct	1200 ct	300	.6	.4	.3	4.0	113	126	31.6	1:1	2:1	24.26	23.44
L-8455	P-9455	*1200 ct	1200 ct	–	.6	.4	.3	4.0	111	125	–	1:1	–	25.26	24.26
L-8460	P-9460	1500 ct	12 ct	3	.6	.4	.3	3.5	126	1.6	.4	11.2:1	22.4:1	24.26	23.44
L-8465	P-9465	1500 ct	500 ct	125	.6	.4	.3	3.5	126	68	17	1.73:1	3.46:1	24.26	23.44
L-8470	P-9470	*1500 ct	600 ct	–	.6	.4	.3	3.5	126	94	–	1.58:1	–	25.26	24.26
L-8475	P-9475	*1500 ct	1500 ct	–	.6	.4	.3	3.5	126	176	–	1:1	–	25.26	24.26
L-8480	P-9480	1600 ct	12.8 ct	3.2	.6	.4	.3	3.5	130	1.7	.43	11.2:1	22.4:1	24.26	23.44
L-8483	P-9483	2000 ct	8 ct	2	.6	.4	.3	3.0	210	1.2	.3	15.8:1	31.6:1	24.26	23.44
L-8485	P-9485	2000 ct	2000 ct	500	.6	.4	.3	3.0	198	218	55	1:1	2:1	24.26	23.44
L-8490	P-9490	*2000 ct	2000 ct	–	.6	.4	.3	3.0	198	218	–	1:1	–	24.26	23.44
L-8495	P-9495	2000 ct	8000 ct	2000	.6	.4	.3	3.0	198	850	213	1:2	1:1	24.26	23.44
L-8497	P-9497	2500 ct	2500 ct	625	.6	.4	.3	2.5	220	305	76	1:1	2:1	24.26	23.44
L-8500	P-9500	3000 ct	3000 ct	750	.6	.4	.3	2.5	243	335	84	1:1	2:1	24.26	23.44

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-29 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** ..... ±3db, 300 Hz-75 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 5 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solid .016 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per Mil-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.,
Mt. Vernon, N.Y. 10552

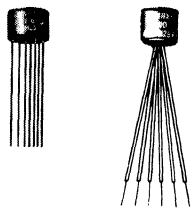
914-699-5514
FAX 914-699-5565

PICO PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT	PRIMARY DC RESISTANCE	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***	
L-Series Plug-In	P-Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher	ma	OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	L-Series	P-Series
L-8505	P-9505	*3000 ct	3000 ct	–	.6	.4	.3	2.5	304	335	–	1:1	–	25.26	24.26
L-8510	P-9510	3600 ct	3600 ct	900	.6	.4	.3	2.5	330	366	92	1:1	2:1	24.26	23.44
L-8512	P-9512	4000 ct	16 ct	4	.6	.4	.3	2.0	350	3	.75	15.8:1	31.6:1	24.26	23.44
L-8514	P-9514	4000 ct	600 ct	150	.6	.4	.3	2.0	350	76	19	2.58:1	5.16:1	24.26	23.44
L-8515	P-9515	4000 ct	1000 ct	250	.6	.4	.3	2.0	350	115	29	2:1	4:1	24.26	23.44
L-8520	P-9520	*4000 ct	8000 ct	–	.6	.4	.3	2.0	350	1062	–	1:1.41	–	25.26	24.26
L-8525	P-9525	5000 ct	500 ct	125	.6	.4	.3	2.0	350	67	17	3.16:1	6.32:1	24.26	23.44
L-8530	P-9530	5000 ct	5000 ct	1250	.6	.4	.3	2.0	390	538	135	1:1	2:1	24.26	23.44
L-8535	P-9535	7500 ct	50 ct	12.5	.6	.4	.3	1.5	600	7	1.75	12.2:1	24.5:1	26.92	26.12
L-8540	P-9540	7500 ct	100 ct	25	.6	.4	.3	1.5	600	12	3	8.66:1	17.3:1	26.92	26.12
L-8545	P-9545	7500 ct	600 ct	150	.6	.4	.3	1.5	600	78	19.5	3.54:1	7.07:1	26.92	26.12
L-8550	P-9550	7500 ct	2500 ct	625	.6	.4	.3	1.5	600	305	77	1.73:1	3.46:1	26.92	26.14
L-8555	P-9555	*7500 ct	7500 ct	–	.6	.4	.3	1.5	750	828	–	1:1	–	28.82	26.91
L-8560	P-9560	8000 ct	12.8 ct	3.2	.6	.4	.3	1.5	750	1.7	.43	25:1	50:1	26.92	26.14
L-8565	P-9565	8000 ct	1000 ct	250	.6	.4	.3	1.5	750	115	29	2.83:1	5.66:1	26.92	26.14
L-8570	P-9570	*8000 ct	1200 ct	–	.6	.4	.3	1.5	750	158	–	2.58:1	–	28.82	26.91
L-8575	P-9575	*9000 ct	9000 ct	–	.6	.4	.3	1.4	796	1100	–	1:1	–	28.82	26.91
L-8580	P-9580	10,000 ct	12.8 ct	3.2	.6	.4	.3	1.4	1048	1.7	.43	28:1	56:1	26.92	26.14
L-8585	P-9585	10,000 ct	16 ct	4	.6	.4	.3	1.4	1048	3	.75	25:1	50:1	26.92	26.14
L-8590	P-9590	10,000 ct	100 ct	25	.6	.4	.3	1.4	839	12	3	10:1	20:1	26.92	26.14
L-8595	P-9595	10,000 ct	200 ct	50	.6	.4	.3	1.4	839	27	6.7	7.07:1	14.14:1	26.92	26.14
L-8600	P-9600	10,000 ct	500 ct	125	.6	.4	.3	1.4	850	67	17	4.47:1	8.94:1	26.92	26.14
L-8605	P-9605	10,000 ct	600 ct	150	.6	.4	.3	1.4	850	74	18.5	4.08:1	8.16:1	26.92	26.14
L-8610	P-9610	10,000 ct	1000 ct	250	.6	.4	.3	1.4	850	115	29	3.16:1	6.32:1	26.92	26.14
L-8615	P-9615	10,000 ct	1200 ct	300	.6	.4	.3	1.4	850	158	39.5	2.89:1	5.77:1	26.92	26.14
L-8620	P-9620	10,000 ct	1500 ct	375	.6	.4	.3	1.4	850	177	44	2.58:1	5.16:1	26.92	26.14
L-8625	P-9625	10,000 ct	2000 ct	500	.6	.4	.3	1.4	850	255	64	2.24:1	4.47:1	26.92	26.14
L-8630	P-9630	10,000 ct	5000 ct	1250	.6	.4	.3	1.4	850	630	158	1.41:1	2.83:1	26.92	26.14
L-8635	P-9635	10,000 ct	7500 ct	1875	.6	.4	.3	1.4	850	772	193	1.15:1	2.3:1	26.92	26.14
L-8640	P-9640	10,000 ct	10,000 ct	2500	.6	.4	.3	1.4	866	1215	304	1:1	2:1	26.92	26.14
L-8645	P-9645	*10,000 ct	10,000 ct	–	.6	.4	.3	1.4	1060	1215	–	1:1	–	28.82	26.91
L-8650	P-9650	15,000 ct	400 ct	100	.6	.4	.3	1.0	1305	47	12	6.12:1	12.24:1	26.92	26.14
L-8652	P-9652	15,000 ct	500 ct	125	.6	.4	.3	1.0	1305	53	13	5.48:1	10.95:1	26.92	26.14
L-8655	P-9655	15,000 ct	600 ct	150	.6	.4	.3	1.0	1305	72.5	18	5:1	10:1	26.92	26.14
L-8660	P-9660	15,000 ct	10,000 ct	2500	.6	.4	.3	1.0	1305	1215	304	1.22:1	2.45:1	26.92	26.14
L-8665	P-9665	*15,000 ct	15,000 ct	–	.6	.4	.3	1.0	1305	1800	–	1:1	–	28.82	26.91
L-8670	P-9670	15,000 ct	15,000 ct	3750	.6	.4	.3	1.0	1305	1800	450	1:1	2:1	26.92	26.14
L-8675	P-9675	16,000 ct	1000 ct	250	.6	.4	.3	1.0	1343	115	29	4:1	8:1	26.92	26.14
L-8680	P-9680	20,000 ct	500 ct	125	.5	.4	.3	1.0	1560	68	17	6.33:1	12.65:1	28.82	26.91
L-8685	P-9685	20,000 ct	600 ct	150	.5	.4	.3	1.0	1560	75	19	5.77:1	11.55:1	28.82	26.91
L-8690	P-9690	20,000 ct	800 ct	200	.5	.4	.3	1.0	1560	108	27	5:1	10:1	28.82	26.91
L-8695	P-9695	20,000 ct	1000 ct	250	.5	.4	.3	1.0	1560	121	30.5	4.47:1	8.94:1	28.82	26.91
L-8700	P-9700	20,000 ct	5000 ct	1250	.5	.4	.3	1.0	1560	672	168	2:1	4:1	28.82	26.91
L-8705	P-9705	20,000 ct	10,000 ct	2500	.5	.4	.3	1.0	1560	1520	380	1.41:1	2.83:1	28.82	26.91
L-8710	P-9710	*20,000 ct	20,000 ct	–	.5	.4	.3	1.0	1560	2727	682	1:1	–	29.98	28.82
L-8715	P-9715	25,000 ct	500 ct	125	.4	.4	.3	0.8	2170	68	17	7.07:1	14.14:1	28.82	26.91
L-8720	P-9720	25,000 ct	1000 ct	250	.4	.4	.3	0.8	2170	120	30	5:1	10:1	28.82	26.91
L-8725	P-9725	30,000 ct	50 ct	12.5	.33	.33	.3	0.8	2400	7	1.75	24.5:1	49:1	29.98	28.82
L-8730	P-9730	30,000 ct	1200 ct	300	.33	.33	.3	0.8	2400	156	39	5:1	10:1	29.98	28.82
L-8732	P-9732	30,000 ct	500 ct	125	.33	.33	.3	0.8	2400	68	17	7.75:1	15.5:1	29.98	28.82
L-8734	P-9734	30,000 ct	200 ct	50	.33	.33	.3	0.8	2400	29	7.2	12.25:1	24.5:1	29.98	28.82
L-8735	P-9735	30,000 ct	5000 ct	1250	.33	.33	.3	0.8	2400	673	169	2.45:1	4.9:1	29.98	28.82
L-8740	P-9740	30,000 ct	10,000 ct	2500	.33	.33	.3	0.8	2400	1520	380	1.73:1	3.46:1	29.98	28.82
L-8745	P-9745	*30,000 ct	30,000 ct	–	.33	.33	.3	0.8	3000	3310	–	1:1	–	32.19	30.27
L-8750	P-9750	40,000 ct	400 ct	100	.25	.25	.25	0.7	3400	57	14.3	10:1	20:1	32.19	30.27
L-8755	P-9755	40,000 ct	2000 ct	500	.25	.25	.25	0.7	3400	268	67	4.47:1	8.94:1	32.19	30.27
L-8760	P-9760	40,000 ct	4000 ct	1000	.25	.25	.25	0.7	3400	476	119	3.16:1	6.32:1	32.19	30.27
L-8765	P-9765	40,000 ct	20,000 ct	5000	.25	.25	.25	0.7	3400	2700	675	1.41:1	2.83:1	32.19	30.27
L-8770	P-9770	*40,000 ct	40,000 ct	–	.25	.25	.25	0.7	3400	4750	–	1:1	–	35.90	34.32
L-8775	P-9775	50,000 ct	200 ct	50	.2	.2	.2	0.6	4850	27	6.7	15.8:1	31.6:1	35.90	34.32
L-8777	P-9777	50,000 ct	500 ct	125	.2	.2	.2	0.6	4850	68	17	10:1	20:1	35.90	34.32
L-8779	P-9779	50,000 ct	600 ct	150	.2	.2	.2	0.6	4850	75	18.5	9.13:1	18.26:1	35.90	34.32
L-8780	P-9780	60,000 ct	15,000 ct	3750	.16	.16	.16	0.5	5275	2250	563	2:1	4:1	38.71	37.76
L-8785	P-9785	62,500 ct	50 ct	12.5	.16	.16	.16	0.5	5445	8.7	2.2	35.4:1	70.7:1	38.71	37.76
L-8787	P-9787	80,000 ct	15,000 ct	3750	.12	.12	.12	0.4	6130	2250	563	2.3:1	4.6:1	38.71	37.76
L-8790	P-9790	90,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8140	1520	380	3:1	6:1	40.67	39.18
L-8795	P-9795	95,000 ct	15,000 ct	3750	.1	.1	.1	0.4	8400	2250	563	2.52:1	5.03:1	40.67	39.18
L-8800	P-9800	100,000 ct	60 ct	15	.1	.1	.1	0.4	8750	9.2	2.3	40.8:1	81.6:1	40.67	39.18
L-8805	P-9805	100,000 ct	100 ct	25	.1	.1	.1	0.4	8750	15	3.8	31.6:1	63.2:1	40.67	39.18
L-8810	P-9810	100,000 ct	500 ct	125	.1	.1	.1	0.4	8750	68	17	14.1:1	28.3:1	40.67	39.18
L-8815	P-9815	100,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8750	1535	385	3.16:1	6.32:1	40.67	39.18
L-SHIELD		MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)												3.50	
P-SHIELD		MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)													3.50

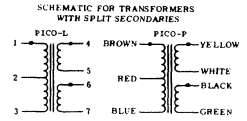
*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

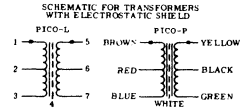
L SERIES Plug-In P SERIES Insulated Leads



SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy
Mt. Vernon, N.Y. 10552

914-699-5514

FAX 914-699-5565

Delivery— stock to one week

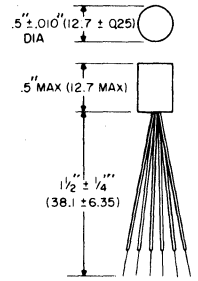
For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

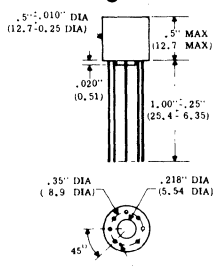
PICO's ultra-miniature transformers

These units can be manufactured and tested to MIL-T-27/358. Contact factory for price and delivery information and appropriate parts numbers (MIL-T-27/358-01 thru MIL-T-27/358-123).

K SERIES
Insulated Leads



N SERIES
Plug-In



Dimensions are in inches (MM)

PICO PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT	PRIMARY DC RESISTANCE	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***	
K-Series Insulated Leads	N-Series Plug-In	PRIMARY IMPEDANCE OHMS	SER	PAR	1KHz and higher	400 Hz and higher	150 Hz and higher	ma	OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7203	N-6203	20 ct	8 ct	2	1.0	.75	.11	22.0	1.75	1.0	.25	1.58:1	3.16:1	23.44	24.26
K-7205	N-6205	20 ct	20 ct	5	1.0	.75	.11	22.0	1.75	2.5	.63	1:1	2:1	23.44	24.26
K-7210	N-6210	32 ct	32 ct	8	1.0	.75	.11	18.0	2.7	3.7	.93	1:1	2:1	23.44	24.26
K-7215	N-6215	40 ct	40 ct	10	1.0	.75	.11	16.0	3	5.2	1.3	1:1	2:1	23.44	24.26
K-7218	N-6218	48 ct	16ct	4	1.0	.75	.11	13.0	4.5	2.4	.6	1.73:1	3.46:1	23.44	24.26
K-7220	N-6220	50 ct	50 ct	12.5	1.0	.75	.11	13.0	4.5	6.2	1.6	1:1	2:1	23.44	24.26
K-7225	N-6225	80 ct	32 ct	8	1.0	.75	.11	11.0	6.6	3.7	.93	1.58:1	3.16:1	23.44	24.26
K-7228	N-6228	100 ct	40 ct	10	1.0	.75	.11	10.0	9.7	5.6	1.4	1.58:1	3.16:1	23.44	24.26
K-7230	N-6230	100 ct	100 ct	25	1.0	.75	.11	10.0	9.7	11	2.8	1:1	2:1	23.44	24.26
K-7235	N-6235	120 ct	12.8 ct	3.2	1.0	.75	.11	9.0	10.8	1.6	.4	3.06:1	6.12:1	23.44	24.26
K-7240	N-6240	120 ct	60 ct	15	1.0	.75	.11	9.0	10.8	8.5	2.2	1.41:1	2.83:1	23.44	24.26
K-7245	N-6245	120 ct	120 ct	30	1.0	.75	.11	9.0	10.8	15	3.8	1:1	2:1	23.44	24.26
K-7250	N-6250	150 ct	12 ct	3	1.0	.75	.11	8.0	13.5	1.75	.44	3.54:1	7.08:1	23.44	24.26
K-7255	N-6255	150 ct	50 ct	12.5	1.0	.75	.11	8.0	12	5.8	1.5	1.73:1	3.46:1	23.44	24.26
K-7260	N-6260	150 ct	100 ct	25	1.0	.75	.11	8.0	12	13	3.3	1.22:1	2.44:1	23.44	24.26
K-7265	N-6265	150 ct	150 ct	37.5	1.0	.75	.11	8.0	12	20	5	1:1	2:1	23.44	24.26
K-7270	N-6270	150 ct	600 ct	150	1.0	.75	.11	8.0	12	82	20.5	1:2	1:1	23.44	24.26
K-7275	N-6275	200 ct	200 ct	50	1.0	.75	.11	7.0	17	24	6.0	1:1	2:1	23.44	24.26
K-7280	N-6280	300 ct	12 ct	3	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	23.44	24.26
K-7285	N-6285	300 ct	50 ct	12.5	1.0	.75	.11	5.0	27	6.2	1.6	2.45:1	4.9:1	23.44	24.26
K-7290	N-6290	300 ct	150 ct	37.5	1.0	.75	.11	5.0	26	21	5.3	1.41:1	2.83:1	23.44	24.26
K-7295	N-6295	300 ct	300 ct	75	1.0	.75	.11	5.0	27	38	9.5	1:1	2:1	23.44	24.26
K-7300	N-6300	300 ct	600 ct	150	1.0	.75	.11	5.0	27	66	17	1.41:1	1.41:1	23.44	24.26
K-7305	N-6305	320 ct	12.8 ct	3.2	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	23.44	24.26
K-7310	N-6310	400 ct	40 ct	10	1.0	.75	.11	5.0	39	4.3	1.1	3.16:1	6.32:1	23.44	24.26
K-7315	N-6315	400 ct	120 ct	30	1.0	.75	.11	5.0	30	14	3.5	1.83:1	3.65:1	23.44	24.26
K-7320	N-6320	400 ct	200 ct	50	1.0	.75	.11	5.0	39	24	6	1.41:1	2.83:1	23.44	24.26
K-7325	N-6325	400 ct	400 ct	100	1.0	.75	.11	5.0	39	42	10.5	1:1	2:1	23.44	24.26
K-7330	N-6330	400 ct	1000 ct	250	1.0	.75	.11	5.0	39	109	28	1:1.58	1:2.6:1	23.44	24.26
K-7335	N-6335	400 ct	2000 ct	500	1.0	.75	.11	5.0	39	198	49	1:2.24	1:1.12	23.44	24.26
K-7340	N-6340	400 ct	4000 ct	1000	1.0	.75	.11	5.0	39	436	109	1:3.16	1:1.58	23.44	24.26
K-7342	N-6342	500 ct	12.8 ct	3.2	1.0	.75	.11	4.5	43	1.6	.4	6.25:1	12.5:1	23.44	24.26
K-7344	N-6344	500 ct	16 ct	4	1.0	.75	.11	4.5	43	2.3	.56	5.6:1	11.2:1	23.44	24.26
K-7345	N-6345	500 ct	50 ct	12.5	1.0	.75	.11	4.5	43	5.8	1.5	3.16:1	6.32:1	23.44	24.26
K-7347	N-6347	500 ct	150 ct	37.5	1.0	.75	.11	4.5	43	19.8	5	1.83:1	3.65:1	23.44	24.26
K-7350	N-6350	500 ct	500 ct	125	1.0	.75	.11	4.5	43	60	15	1:1	2:1	23.44	24.26
K-7355	N-6355	*500 ct	500 ct	–	1.0	.75	.11	4.5	43	60	–	1:1	–	24.26	25.26
K-7360	N-6360	500 ct	600 ct	150	1.0	.75	.11	4.5	43	66	17	1:1.1	1.83:1	23.44	24.26
K-7365	N-6365	600 ct	12.8 ct	3.2	1.0	.75	.11	4.0	68	1.75	.44	6.85:1	13.7:1	23.44	24.26
K-7367	N-6367	600 ct	30 ct	7.5	1.0	.75	.11	4.0	60	3.7	.93	4.47:1	8.94:1	23.44	24.26
K-7370	N-6370	600 ct	48 ct	12	1.0	.75	.11	4.0	60	5.9	1.5	3.54:1	7.07:1	23.44	24.26
K-7375	N-6375	600 ct	200 ct	50	1.0	.75	.11	4.0	60	25	6.3	1.73:1	3.46:1	23.44	24.26
K-7380**	N-6380**	600 ct	600 ct	150	1.0	.75	.11	4.0	60	66	17	1:1	2:1	23.44	24.26
K-7385**	N-6385**	*600 ct	600 ct	–	1.0	.75	.11	4.0	60	68	–	1:1	–	24.26	25.26
K-7386**	N-6386**	*600 ct	900 ct	–	1.0	.75	.11	4.0	60	104	–	1:1.22	–	24.26	25.26
K-7387**	N-6387**	600 ct	1200 ct	300	1.0	.75	.11	4.0	60	116	29	1:1.41	1.41:1	23.44	24.26
K-7390	N-6390	640 ct	12.8 ct	3.2	1.0	.75	.11	4.0	69	1.75	.44	7.07:1	14.14:1	23.44	24.26
K-7395	N-6395	700 ct	100 ct	25	1.0	.75	.11	4.0	62	10.6	2.7	2.65:1	5.29:1	23.44	24.26
K-7400	N-6400	800 ct	12.8 ct	3.2	1.0	.75	.11	3.5	78	1.75	.44	7.91:1	15.8:1	23.44	24.26
K-7405	N-6405	800 ct	48 ct	12	1.0	.75	.11	3.5	74	6	1.5	4.08:1	8.16:1	23.44	24.26
K-7410	N-6410	800 ct	800 ct	200	1.0	.75	.11	3.5	74	102	26	1:1	2:1	23.44	24.26
K-7415	N-6415	900 ct	600 ct	150	1.0	.75	.11	3.0	90	66	17	1.23:1	2.45:1	23.44	24.26
K-7417**	N-6417**	*900 ct	900 ct	–	1.0	.75	.11	3.0	90	102	–	1:1	–	24.26	25.26
K-7420	N-6420	1000 ct	12 ct	3	1.0	.75	.11	3.0	115	1.75	.44	9.13:1	18.26:1	23.44	24.26
K-7425	N-6425	1000 ct	50 ct	12.5	1.0	.75	.11	3.0	100	5.8	1.5	4.47:1	8.94:1	23.44	24.26
K-7430	N-6430	1000 ct	1000 ct	250	1.0	.75	.11	3.0	75	103	26	1:1	2:1	23.44	24.26
K-7435	N-6435	1060 ct	12.8 ct	3.2	1.0	.75	.11	3.0	115	1.75	.44	9.1:1	18.2:1	23.44	24.26
K-7440	N-6440	1200 ct	12.8 ct	3.2	1.0	.75	.11	3.0	122	1.75	.44	9.68:1	19.4:1	23.44	24.26
K-7445	N-6445	1200 ct	500 ct	125	1.0	.75	.11	3.0	113	63	16	1.55:1	3.1:1	23.44	24.26
K-7450	N-6450	1200 ct	1200 ct	300	1.0	.75	.11	3.0	113	155	39	1:1	2:1	23.44	24.26
K-7455	N-6455	*1200 ct	1200 ct	–	1.0	.75	.11	3.0	109	150	–	1:1	–	24.26	25.26
K-7460	N-6460	1500 ct	12 ct	3	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	23.44	24.26
K-7465	N-6465	1500 ct	500 ct	125	1.0	.75	.11	2.5	150	60	15	1.73:1	3.46:1	23.44	24.26
K-7470	N-6470	*1500 ct	600 ct	–	1.0	.75	.11	2.5	150	66	–	1.58:1	–	24.26	25.26
K-7475	N-6475	*1500 ct	1500 ct	–	1.0	.75	.11	2.5	150	168	–	1:1	–	24.26	25.26
K-7480	N-6480	1600 ct	12.8 ct	3.2	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	23.44	24.26
K-7483	N-6483	2000 ct	8 ct	2	1.0	.75	.11	2.0	250	1.0	.25	15.8:1	31.6:1	23.44	24.26
K-7485	N-6485	2000 ct	2000 ct	500	1.0	.75	.11	2.0	185	255	64	1:1	2:1	23.44	24.26
K-7490	N-6490	*2000 ct	2000 ct	–	1.0	.75	.11	2.0	175	240	–	1:1	–	24.26	25.26
K-7495	N-6495	2000 ct	8000 ct	2000	1.0	.75	.11	2.0	185	1015	254	1:2	1:1	23.44	24.26
K-7497	N-6497	2500 ct	2500 ct	625	1.0	.75	.11	2.0	245	268	68	1:1	2:1	23.44	24.26
K-7500	N-6500	3000 ct	3000 ct	750	1.0	.75	.11	1.8	267	295	74	1:1	2:1	23.44	24.26
K-7505	N-6505	*3000ct	3000 ct	–	1.0	.75	.11	1.8	267	368	–	1:1	–	24.26	25.26
K-7510	N-6510	3600 ct	3600 ct	900	1.0	.75	.11	1.5	300	413	103	1:1	2:1	23.44	24.26
K-7512	N-6512	4000 ct	16 ct	4	1.0	.75	.11	1.5	395	2.5	.65	15.8:1	31.6:1	23.44	24.26
K-7514**	N-6514**	4000 ct	600 ct	150	1.0	.75	.11	1.5	395	66	17	2.58:1	5.16:1	23.44	24.26

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, and are Hermetically Sealed in a Metal Case. Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** ..... ±3db, 150 Hz-75 KHz at 1.0 Milliwatt. (When Primary Impedance ≥ 50K Ohms, ±3 db 150 Hz to 20 KHz)
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz, 400 Hz and 150 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ..... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 7.5 Grams
- **OPERATING TEMPERATURE:** .. -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solid .016 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per Mil-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

Delivery: Stock to one week

THIS PRODUCT IS PATENTED

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 Less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

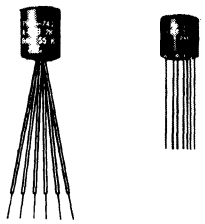
PICO PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT	PRIMARY DC RESISTANCE	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***	
K-Series Insulated Leads	N-Series Plug-In	PRIMARY IMPEDANCE OHMS	SER	PAR	1KHz and higher	400 Hz and higher	150 Hz and higher	ma	OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7515	N-6515	4000 ct	1000 ct	250	1.0	.75	.11	1.5	395	108	27	2:1	4:1	23.49	24.26
K-7520	N-6520	*4000 ct	8000 ct	–	1.0	.75	.11	1.5	390	955	–	1:1.41	–	24.26	25.26
K-7525	N-6525	5000 ct	500 ct	125	1.0	.75	.11	1.3	450	62	16	3.16:1	6.32:1	23.44	24.26
K-7530	N-6530	5000 ct	5000 ct	1250	1.0	.75	.11	1.3	450	620	155	1:1	2:1	23.44	24.27
K-7535	N-6535	7500 ct	50 ct	12.5	1.0	.75	.11	1.0	670	6	1.5	12.25:1	24.5:1	26.14	26.93
K-7540	N-6540	7500 ct	100 ct	25	1.0	.75	.11	1.0	670	11	2.8	8.66;1	17.32:1	26.14	26.93
K-7545	N-6545	7500 ct	600 ct	150	1.0	.75	.11	1.0	670	66	16.5	3.54:1	7.07:1	26.14	26.93
K-7550	N-6550	7500 ct	2500 ct	625	1.0	.75	.11	1.0	670	268	67	1.73:1	3.46:1	26.14	26.93
K-7555	N-6555	*7500 ct	7500 ct	–	1.0	.75	.11	1.0	670	925	–	1:1	–	26.91	29.69
K-7560	N-6560	8000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	765	1.75	.44	25:1	50:1	26.14	26.93
K-7565	N-7565	8000 ct	1000 ct	250	1.0	.75	.11	1.0	695	106	26.5	2.83:1	5.66:1	26.14	26.93
K-7570	N-6570	*8000 ct	1200 ct	–	1.0	.75	.11	1.0	715	153	–	2.58:1	–	26.91	29.69
K-7575	N-6575	*9000 ct	9000 ct	–	1.0	.75	.11	1.0	925	1020	–	1:1	–	26.91	29.69
K-7580	N-6580	10,000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	768	1.6	.4	28:1	56:1	26.14	26.93
K-7585	N-6585	10,000 ct	16 ct	4	1.0	.75	.11	1.0	756	1.7	.43	25:1	50:1	26.14	26.93
K-7590	N-6590	10,000 ct	100 ct	25	1.0	.75	.11	1.0	780	10	2.5	10:1	20:1	26.14	26.93
K-7595	N-6595	10,000 ct	200 ct	50	1.0	.75	.11	1.0	780	24	6	7.07:1	14.14:1	26.14	26.93
K-7600	N-6600	10,000 ct	500 ct	125	1.0	.75	.11	1.0	780	60	15	4.47:1	8.94:1	26.14	26.93
K-7605	N-6605	10,000 ct	600 ct	150	1.0	.75	.11	1.0	780	83	21	4.08:1	8.16:1	26.14	26.93
K-7610	N-6610	10,000 ct	1000 ct	250	1.0	.75	.11	1.0	780	106	27	3.16:1	6.32:1	26.14	26.93
K-7615	N-6615	10,000 ct	1200 ct	300	1.0	.75	.11	1.0	780	145	36	2.89:1	5.77:1	26.14	26.93
K-7620	N-6620	10,000 ct	1500 ct	375	1.0	.75	.11	1.0	780	160	40	2.58:1	5.16:1	26.14	26.93
K-7625	N-6625	10,000 ct	2000 ct	500	1.0	.75	.11	1.0	780	300	75	2.24:1	4.47:1	26.14	26.93
K-7630	N-6630	10,000 ct	5000 ct	1250	1.0	.75	.11	1.0	780	610	153	1.41:1	2.83:1	26.14	26.93
K-7635	N-6635	10,000 ct	7500 ct	1875	1.0	.75	.11	1.0	780	932	233	1.16:1	2.31:1	26.14	26.93
K-7640	N-6640	10,000 ct	10,000 ct	2500	1.0	.75	.11	1.0	780	1075	269	1:1	2:1	26.14	26.93
K-7645	N-6645	*10,000 ct	10,000 ct	–	1.0	.75	.11	1.0	715	985	–	1:1	–	26.91	29.69
K-7650	N-6650	15,000 ct	400 ct	100	.66	.66	.11	0.8	1165	52	13	6.12:1	12.25:1	26.14	26.93
K-7652	N-6652	15,000 ct	500 ct	125	.66	.66	.11	0.8	1165	60	15	5.48:1	10.95:1	26.14	26.93
K-7655	N-6655	15,000 ct	600 ct	150	.66	.66	.11	0.8	1165	80	20	5:1	10:1	26.14	26.93
K-7660	N-6660	15,000 ct	10,000 ct	2500	.66	.66	.11	0.8	1165	1050	263	1.22:1	2.45:1	26.14	26.93
K-7665	N-6665	*15,000 ct	15,000 ct	–	.66	.66	.11	0.8	1165	1600	–	1:1	–	26.91	29.69
K-7670	N-6670	15,000 ct	15,000 ct	3750	.66	.66	.11	0.8	1165	1600	400	1:1	2:1	26.14	26.93
K-7675	N-6675	16,000 ct	1000 ct	250	.62	.62	.11	0.8	1560	108	27	4:1	8:1	26.14	26.93
K-7680	N-6680	20,000 ct	500 ct	125	.5	.5	.11	0.7	1750	60	15	6.32:1	12.65:1	26.14	25.93
K-7685	N-6685	20,000 ct	600 ct	150	.5	.5	.11	0.7	1750	82	20.5	5.77:1	11.55:1	26.14	29.69
K-7690	N-6690	20,000 ct	800 ct	200	.5	.5	.11	0.7	1750	98	24.5	5:1	10:1	26.14	29.69
K-7695	N-6695	20,000 ct	1000 ct	250	.5	.5	.11	0.7	1750	135	34	4.47:1	8.94:1	26.14	29.69
K-7700	N-6700	20,000 ct	5000 ct	1250	.5	.5	.11	0.7	1750	610	153	2:1	4:1	26.14	29.69
K-7705	N-6705	20,000 ct	10,000 ct	2500	.5	.5	.11	0.7	1750	1075	269	1.41:1	2.83:1	26.14	29.69
K-7710	N-6710	*20,000 ct	20,000 ct	–	.5	.5	.11	0.7	1715	2370	–	1:1	–	28.82	29.69
K-7715	N-6715	25,000 ct	500 ct	125	.4	.4	.11	0.6	2470	60	15	7.07:1	14.14:1	26.14	29.98
K-7720	N-6720	25,000 ct	1000 ct	250	.4	.4	.11	0.6	2470	106	27	5:1	10:1	26.14	29.69
K-7725	N-6725	30,000 ct	50 ct	12.5	.33	.33	.11	0.5	2730	6.2	1.6	24.5:1	49:1	28.82	29.69
K-7730	N-6730	30,000 ct	1200 ct	300	.33	.33	.11	0.5	2815	156	39	5:1	10:1	28.82	29.98
K-7732	N-6732	30,000 ct	500 ct	125	.33	.33	.11	0.5	2730	61	15.3	7.7:1	15.5:1	28.82	29.98
K-7734	N-6734	30,000 ct	200 ct	50	.33	.33	.11	0.5	2730	24	6	12.2:1	24.5:1	28.82	29.98
K-7735	N-6735	30,000 ct	5000 ct	1250	.33	.33	.11	0.5	2730	620	155	2.45:1	4.9:1	28.82	29.98
K-7740	N-6740	30,000 ct	10,000 ct	2500	.33	.33	.11	0.5	2730	1090	272	1.73:1	3.46:1	28.82	29.98
K-7745	N-6745	*30,000 ct	30,000 ct	–	.33	.33	.11	0.5	2730	3740	–	1:1	–	30.27	32.19
K-7750	N-6750	40,000 ct	400 ct	100	.25	.25	.11	0.5	3150	53	13	10:1	20:1	30.27	32.19
K-7755	N-6755	40,000 ct	2000 ct	500	.25	.25	.11	0.5	3150	300	75	4.47:1	8.94:1	30.27	32.19
K-7760	N-6760	40,000 ct	4000 ct	1000	.25	.25	.11	0.5	3150	548	137	3.16:1	6.32:1	30.27	32.19
K-7765	N-6765	40,000 ct	20,000 ct	5000	.25	.25	.11	0.5	3150	3075	769	1.41:1	2.83:1	30.27	32.19
K-7770	N-6770	*40,000 ct	40,000 ct	–	.25	.25	.11	0.5	3940	4350	–	1:1	–	34.33	35.90
K-7775	N-6775	50,000 ct	200 ct	50	.2	.2	.11	0.4	4275	24	6	15.8:1	31.6:1	34.33	35.90
K-7777	N-6777	50,000 ct	500 ct	125	.2	.2	.11	0.4	4275	60	15	0:1	20:1	34.33	35.90
K-7778	N-6778	50,000 ct	600 ct	150	.2	.2	.11	0.4	4275	82	21	9.13:1	18.26:1	34.33	35.90
K-7779	N-6779	50,000 ct	50,000 ct	12,500	.2	.2	.11	0.4	4500	6270	1568	1:1	2:1	34.33	35.90
K-7780	N-6780	60,000 ct	15,000 ct	3750	.16	.16	.11	0.4	5960	1650	412	2:1	4:1	37.76	38.87
K-7785	N-6785	62,500 ct	50 ct	12.5	.16	.16	.11	0.4	5960	6	1.5	35.4:1	70.7:1	37.76	38.87
K-7787	N-6787	80,000 ct	15,000 ct	3750	.12	.12	.11	0.3	7200	1690	423	2.3:1	4.6:1	37.76	38.87
K-7789	N-6789	80,000 ct	80,000 ct	20,000	.12	.12	.11	0.3	7200	9920	2480	1:1	2:1	37.76	38.87
K-7790	N-6790	90,000 ct	10,000 ct	2500	.11	.11	.11	0.3	7500	1350	338	3:1	6:1	42.36	40.64
K-7795	N-6795	95,000 ct	15,000 ct	3750	.1	.1	.10	0.3	9550	1635	410	2.5:1	5:1	42.36	40.64
K-7800	N-6800	100,000 ct	60 ct	15	.1	.1	.10	0.3	10,000	8.5	2.2	40.8:1	81.6:1	42.36	40.64
K-7805	N-6805	100,000 ct	100 ct	25	.1	.1	.10	0.3	10,000	14	3.5	31.6:1	63.2:1	42.36	40.64
K-7810	N-6810	100,000 ct	500 ct	125	.1	.1	.10	0.3	10,000	62	15.5	14.1:1	28.3:1	42.36	40.64
K-7813	N-6813	100,000ct	1000 ct	250	.1	.1	.10	0.3	10,000	140	35	10:1	20:1	42.36	40.64
K-7814	N-6814	100,000 ct	2000 ct	500	.1	.1	.10	0.3	10,000	248	62	7.07:1	14.14:1	42.36	40.64
K-7815	N-6815	100,000 ct	10,000 ct	2500	.1	.1	.10	0.3	10,000	1075	270	3.16:1	6.32:1	42.36	40.64
K-7820	N-6820	135,000 ct	82 ct	20.5	.074	.074	.074	0.25	13,700	9.5	2.4	40.6:1	81.2:1	41.26	42.51
K-7823	N-6823	200,000 ct	500 ct	125	.05	.05	.05	0.2	17,340	75	19	20:1	40:1	41.26	42.51
K-7825	N-6825	200,000 ct	1000 ct	250	.05	.05	.05	0.2	17,340	133	33	14.1:1	28.3:1	41.26	42.51
K-7830	N-6830	200,000 ct	10,000 ct	2500	.05	.05	.05	0.2	17,340	1350	336	4.47:1	8.94:1	41.26	42.51
K-7835	N-6835	200,000 ct	20,000 ct	5000	.05	.05	.05	0.2	17,340	3000	750	3.16:1	6.32:1	41.26	43.58
K-7837	N-6837	250,000 ct	200 ct	50	.04	.04	.04	0.2	17,340	28	7	35.4:1	70.7:1	42.48	43.58
K-7840	N-6840	250,000 ct	1000 ct	250	.04	.04	.04	0.2	17,340	118	30	15.8:1	31.6:1	42.48	19.72
K-SHIELD	MU-METAL SHIELD	.53" d X .56" h (13.46 mm d X 14.22 mm h)												3.50	
N-SHIELD	MU-METAL SHIELD	.53" d X .56" h (13.46 mm d X 14.22 mm h)													3.52

* INCLUDES ELECTROSTATIC SHIELD

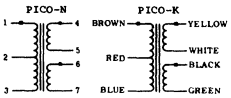
*** Discount prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

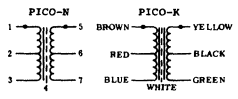
K SERIES Insulated Leads N SERIES Plug-In



SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

914-699-5514

FAX 914-699-5565

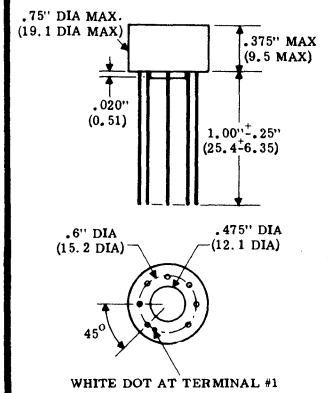
For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

PICO's ultra-miniature transformers

R SERIES Plug-In





Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, and are Hermetically Sealed in a Metal Case, Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** ..... ±3db, 75 Hz-30 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz, 300 kHz and 75 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 12 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c maximum).
- **TERMINALS:** ..... Solid .016 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per Mil-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

Delivery— stock to one week

PICO PART NUMBER	PRIMARY IMPEDANCE	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT	PRIMARY DC RESIST	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIME/SEC		PICO PRICES 1-9 ***
R-Series Plug-In	OHMS	SER	PAR	1KHz and higher	300 Hz and higher	75 Hz and higher	ma	OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	R-Series
R-20003	20 ct	8 ct	2	1.5	.9	.03	22	1.6	.76	.19	1.58:1	3.16:1	32.63
R-20005	20 ct	20 ct	5	1.5	.9	.03	22	1.6	1.9	.48	1:1	2:1	32.63
R-20010	32 ct	32 ct	8	1.5	.9	.03	17.5	2.56	3	.75	1:1	2:1	32.63
R-20015	40 ct	40 ct	10	1.5	.9	.03	16	3.2	3.8	.95	1:1	2:1	32.63
R-20018	48 ct	16 ct	4	1.5	.9	.03	14.5	3.84	1.52	.38	1.73:1	3.46:1	32.63
R-20020	50 ct	50 ct	12.5	1.5	.9	.03	14	4	4.75	1.19	1:1	2:1	32.63
R-20025	80 ct	32 ct	8	1.5	.9	.03	11	6.4	3	.75	1.58:1	3.16:1	32.63
R-20028	100 ct	40 ct	10	1.5	.9	.03	10	8	3.8	.95	1.58:1	3.16:1	32.63
R-20030	100 ct	100 ct	25	1.5	.9	.03	10	8	9.5	2.38	1:1	2:1	32.63
R-20035	120 ct	12.8 ct	3.2	1.5	.9	.03	9	9.6	1.22	.3	3.06:1	6.12:1	32.63
R-20040	120 ct	60 ct	15	1.5	.9	.03	9	9.6	5.7	1.4	1.41:1	2.83:1	32.63
R-20045	120 ct	120 ct	30	1.5	.9	.03	9	9.6	11.4	2.85	1:1	2:1	32.63
R-20050	150 ct	12 ct	3	1.5	.9	.03	8	12	1.14	.29	3.54:1	7.08:1	32.63
R-20055	150 ct	50 ct	12.5	1.5	.9	.03	8	12	4.75	1.19	1.73:1	3.46:1	32.63
R-20060	150 ct	100 ct	25	1.5	.9	.03	8	12	9.5	2.38	1.22:1	2.44:1	32.63
R-20065	150 ct	150 ct	37.5	1.5	.9	.03	8	12	14.3	3.56	1:1	2:1	32.63
R-20070	150 ct	600 ct	150	1.5	.9	.03	8	12	57	14.3	1:2	1:1	32.63
R-20075	200 ct	200 ct	50	1.5	.9	.03	7	16	19	4.75	1:1	2:1	32.63
R-20080	300 ct	12 ct	3	1.5	.9	.03	5.5	24	1.14	.29	5:1	10:1	32.63
R-20085	300 ct	50 ct	12.5	1.5	.9	.03	5.5	24	4.75	1.19	2.45:1	4.9:1	32.63
R-20090	300 ct	150 ct	37.5	1.5	.9	.03	5.5	24	14.25	3.56	1.41:1	2.83:1	32.63
R-20095	300 ct	300 ct	75	1.5	.9	.03	5.5	24	28.5	7.13	1:1	2:1	32.63
R-20100	300 ct	600 ct	150	1.5	.9	.03	5.5	24	57	14.25	1:1.41	1.41:1	32.63
R-20105	320 ct	12.8 ct	3.2	1.5	.9	.03	5.5	25.6	1.22	.3	5:1	10:1	32.63
R-20110	400 ct	40 ct	10	1.5	.9	.03	5	32	3.8	.95	3.16:1	6.32:1	32.63
R-20115	400 ct	120 ct	30	1.5	.9	.03	5	32	11.4	2.85	1.83:1	3.65:1	32.63
R-20120	400 ct	200 ct	50	1.5	.9	.03	5	32	19	4.75	1.41:1	2.83:1	32.63
R-20125	400 ct	400 ct	100	1.5	.9	.03	5	32	38	9.5	1:1	2:1	32.63
R-20130	400 ct	1000 ct	250	1.5	.9	.03	5	32	95	23.8	1:1.58	1.26:1	32.63
R-20135	400 ct	2000 ct	500	1.5	.9	.03	5	32	190	47.5	1:2.24	1:1.12	32.63
R-20140	400 ct	4000 ct	1000	1.5	.9	.03	5	32	380	95	1:3.16	1:1.58	32.63
R-20142	500 ct	12.8 ct	3.2	1.5	.9	.03	4.5	40	1.22	.3	6.25:1	12.5:1	32.63
R-20144	500 ct	16 ct	4	1.5	.9	.03	4.5	40	1.52	.38	5.6:1	11.2:1	32.63
R-20145	500 ct	50 ct	12.5	1.5	.9	.03	4.5	40	4.75	1.19	3.16:1	6.32:1	32.63
R-20147	500 ct	150 ct	37.5	1.5	.9	.03	4.5	40	14.25	3.56	1.83:1	3.65:1	32.63
R-20150	500 ct	500 ct	125	1.5	.9	.03	4.5	40	47.5	11.88	1:1	2:1	32.63
R-20155	*500 ct	500 ct	–	1.5	.9	.03	4.5	40	47.5	–	1:1	–	33.98
R-20160	500 ct	600 ct	150	1.5	.9	.03	4.5	40	57	14.25	1:1.1	1.83:1	32.63
R-20165	600 ct	12.8 ct	3.2	1.5	.9	.03	4	48	1.22	.3	6.85:1	13.7	28.50
R-20167	600 ct	30 ct	7.5	1.5	.9	.03	4	48	2.85	.71	4.47:1	8.94:1	28.50
R-20170	600 ct	48 ct	12	1.5	.9	.03	4	48	4.56	1.14	3.54:1	7.07:1	28.50
R-20175	600 ct	200 ct	50	1.5	.9	.03	4	48	19	4.75	1.73:1	3.46:1	28.50
R-20180**	600 ct	600 ct	150	1.5	.9	.03	4	48	57	14.25	1:1	2:1	32.63
R-20185**	*600 ct	600 ct	–	1.5	.9	.03	4	48	57	–	1:1	–	29.68
R-20186**	*600 ct	900 ct	–	1.5	.9	.03	4	48	85.5	–	1:1.22	–	29.68
R-20187**	600 ct	1200 ct	300	1.5	.9	.03	4	48	114	28.5	1:1.41	1.41:1	28.50
R-20190	640 ct	12.8 ct	3.2	1.5	.9	.03	4	51.2	1.22	.3	7.07:1	14.14:1	28.50
R-20195	700 ct	100 ct	25	1.5	.9	.03	3.5	56	9.5	2.38	2.65:1	5.29:1	28.50
R-20200	800 ct	12.8 ct	3.2	1.5	.9	.03	3.5	64	1.22	.3	7.91:1	15.8:1	28.50
R-20205	800 ct	48 ct	12	1.5	.9	.03	3.5	64	4.56	1.14	4.08:1	8.16:1	28.50
R-20210	800 ct	800 ct	200	1.5	.9	.03	3.5	64	76	19	1:1	2:1	28.50
R-20215	900 ct	600 ct	150	1.5	.9	.03	3	72	57	14.3	1.23:1	2.45:1	28.50
R-20217**	*900 ct	900 ct	–	1.5	.9	.03	3	72	85.5	–	1:1	–	29.68
R-20220	1000 ct	12 ct	3	1.5	.9	.03	3	80	1.14	.29	9.13:1	18.26:1	28.50
R-20225	1000 ct	50 ct	12.5	1.5	.9	.03	3	80	4.75	1.19	4.47:1	8.94:1	28.50
R-20230	1000 ct	1000 ct	250	1.5	.9	.03	3	80	95	23.8	1:1	2:1	28.50
R-20235	1060 ct	12.8 ct	3.2	1.5	.9	.03	3	85	1.22	.3	9.1:1	18.2:1	28.50
R-20240	1200 ct	12.8 ct	3.2	1.5	.9	.03	3	96	1.22	.3	9.68:1	19.4:1	28.50
R-20245	1200 ct	500 ct	125	1.5	.9	.03	3	96	47.5	11.88	1.55:1	3.1:1	28.50
R-20250	1200 ct	1200 ct	300	1.5	.9	.03	3	96	114	28.5	1:1	2:1	28.50
R-20255	*1200 ct	1200 ct	–	1.5	.9	.03	3	96	114	–	1:1	–	29.68
R-20260	1500 ct	12 ct	3	1.5	.9	.03	2.5	120	1.14	.29	11.18:1	22.36:1	28.50
R-20265	1500 ct	500 ct	125	1.5	.9	.03	2.5	120	47.5	11.88	1.73:1	3.46:1	28.50
R-20270	*1500 ct	600 ct	–	1.5	.9	.03	2.5	120	57	–	1.58:1	–	29.68
R-20275	*1500 ct	1500 ct	–	1.5	.9	.03	2.5	120	142	–	1:1	–	29.68
R-20280	1600 ct	12.8 ct	3.2	1.5	.9	.03	2.5	128	1.22	3	11.18:1	22.36:1	28.50
R-20283	2000 ct	8 ct	2	1.5	.9	.03	2.2	160	.76	.19	15.8:1	31.6:1	28.50
R-20285	2000 ct	2000 ct	500	1.5	.9	.03	2.2	160	190	47.5	1:1	2:1	28.50
R-20290	*2000 ct	2000 ct	–	1.5	.9	.03	2.2	160	190	–	1:1	–	29.68
R-20295	2000 ct	8000 ct	2000	1.5	.9	.03	2.2	160	760	190	1:2	1:1	28.50
R-20297	2500 ct	2500 ct	625	1.5	.9	.03	2	200	238	59.5	1:1	2:1	28.50
R-20300	3000 ct	3000 ct	750	1.5	.9	.03	1.8	240	285	71.3	1:1	2:1	28.50
R-20305	*3000 ct	3000 ct	–	1.5	.9	.03	1.8	240	285	–	1:1	–	29.68

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION
***Discount Prices: 1–9 Net; 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100–499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO PART NUMBER R-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	75 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1–9 *** R-Series
R-20310	3600 ct	3600 ct	900	1.5	.9	.03	1.7	288	342	86	1:1	2:1	32.63
R-20312	4000 ct	16 ct	4	1.5	.9	.03	1.6	320	1.52	.38	15.8:1	31.6:1	32.63
R-20314**	4000 ct	600 ct	150	1.5	.9	.03	1.6	320	57	14.3	2.58:1	5.16:1	32.63
R-20315	4000 ct	1000 ct	250	1.5	.9	.03	1.6	320	95	23.8	2:1	4:1	32.63
R-20320	*4000 ct	8000 ct	–	1.5	.9	.03	1.6	320	760	–	1:1.41	–	33.98
R-20325	5000 ct	500 ct	125	1.5	.9	.03	1.4	400	47.5	11.88	3.16:1	6.32:1	32.63
R-20330	5000 ct	5000 ct	1250	1.5	.9	.03	1.4	400	475	119	1:1	2:1	32.63
R-20335	7500 ct	50 ct	12.5	1.3	.9	.03	1.2	600	4.75	1.19	12.25:1	24.5:1	36.34
R-20340	7500 ct	100 ct	25	1.3	.9	.03	1.2	600	9.5	2.38	8.66:1	17.32:1	36.34
R-20345	7500 ct	600 ct	150	1.3	.9	.03	1.2	600	57	14.3	3.54:1	7.07:1	36.34
R-20350	7500 ct	2500 ct	625	1.3	.9	.03	1.2	600	238	59.5	1.73:1	3.46:1	36.34
R-20355	*7500 ct	7500 ct	–	1.3	.9	.03	1.2	600	713	–	1:1	–	38.75
R-20360	8000 ct	12.8 ct	3.2	1.2	.9	.03	1.1	640	1.22	.3	25:1	50:1	36.34
R-20365	8000 ct	1000 ct	250	1.2	.9	.03	1.1	640	95	23.8	2.83:1	5.66:1	36.34
R-20370	*8000 ct	1200 ct	–	1.2	.9	.03	1.1	640	114	–	2.58:1	–	38.75
R-20375	*9000 ct	9000 ct	–	1.1	.9	.03	1.1	720	855	–	1:1	–	38.75
R-20380	10,000 ct	12.8 ct	3.2	1.0	.9	.03	1	800	1.22	.3	28:1	56:1	36.34
R-20385	10,000 ct	16 ct	4	1.0	.9	.03	1	800	1.52	.38	25:1	50:1	36.34
R-20390	10,000 ct	100 ct	25	1.0	.9	.03	1	800	9.5	2.38	10:1	20:1	36.34
R-20395	10,000 ct	200 ct	50	1.0	.9	.03	1	800	19	4.75	7.07:1	14.14:1	36.34
R-20400	10,000 ct	500 ct	125	1.0	.9	.03	1	800	47.5	11.88	4.47:1	8.94:1	36.34
R-20405	10,000 ct	600 ct	150	1.0	.9	.03	1	800	57	14.25	4.08:1	8.16:1	36.34
R-20410	10,000 ct	1000 ct	250	1.0	.9	.03	1	800	95	23.8	3.16:1	6.32:1	36.34
R-20415	10,000 ct	1200 ct	300	1.0	.9	.03	1	800	114	28.5	2.89:1	5.77:1	36.34
R-20420	10,000 ct	1500 ct	375	1.0	.9	.03	1	800	143	35.8	2.58:1	5.16:1	36.34
R-20425	10,000 ct	2000 ct	500	1.0	.9	.03	1	800	190	47.5	2.24:1	4.47:1	36.34
R-20430	10,000 ct	5000 ct	1250	1.0	.9	.03	1	800	475	119	1.41:1	2.83:1	36.34
R-20435	10,000 ct	7500 ct	1875	1.0	.9	.03	1	800	713	178	1.16:1	2.31:1	36.34
R-20440	10,000 ct	10,000 ct	2500	1.0	.9	.03	1	800	950	238	1:1	2:1	36.34
R-20445	*10,000 ct	10,000 ct	–	1.0	.9	.03	1	800	950	–	1:1	–	38.75
R-20450	15,000 ct	400 ct	100	.66	.66	.03	.8	1200	38	9.5	6.12:1	12.25:1	36.34
R-20452	15,000 ct	500 ct	125	.66	.66	.03	.8	1200	48	12	5.48:1	10.95:1	36.34
R-20455	15,000 ct	600 ct	150	.66	.66	.03	.8	1200	57	14.3	5:1	10:1	36.34
R-20460	15,000 ct	10,000 ct	2500	.66	.66	.03	.8	1200	950	238	1.22:1	2.45:1	36.34
R-20465	*15,000 ct	15,000 ct	–	.66	.66	.03	.8	1200	1430	–	1:1	–	38.75
R-20470	15,000 ct	15,000 ct	3750	.66	.66	.03	.8	1200	1430	357	1:1	2:1	36.34
R-20475	16,000 ct	1000 ct	250	.62	.62	.03	.8	1280	95	23.8	4:1	8:1	36.34
R-20480	20,000 ct	500 ct	125	.5	.5	.03	.7	1600	47.5	11.88	6.32:1	12.65:1	38.75
R-20485	20,000 ct	600 ct	150	.5	.5	.03	.7	1600	57	14.25	5.77:1	11.55:1	38.75
R-20490	20,000 ct	800 ct	200	.5	.5	.03	.7	1600	76	19	5:1	10:1	38.75
R-20495	20,000 ct	1000 ct	250	.5	.5	.03	.7	1600	95	23.8	4.47:1	8.94:1	38.75
R-20500	20,000 ct	5000 ct	1250	.5	.5	.03	.7	1600	475	119	2:1	4:1	38.75
R-20505	20,000 ct	10,000 ct	2500	.5	.5	.03	.7	1600	950	238	1.41:1	2.83:1	38.75
R-20510	*20,000 ct	20,000 ct	–	.5	.5	.03	.7	1600	1900	–	1:1	–	40.29
R-20515	25,000 ct	500 ct	125	.4	.4	.03	.6	2000	47.5	11.88	7.07:1	14.14:1	38.75
R-20520	25,000 ct	1000 ct	250	.4	.4	.03	.6	2000	95	23.8	5:1	10:1	38.75
R-20525	30,000 ct	50 ct	12.5	.33	.33	.03	.6	2400	4.75	1.19	24.5:1	49:1	40.29
R-20530	30,000 ct	1200 ct	300	.33	.33	.03	.6	2400	114	28.5	5:1	10:1	40.28
R-20532	30,000 ct	500 ct	125	.33	.33	.03	.6	2400	47.5	11.88	7.7:1	15.5:1	40.28
R-20534	30,000 ct	200 ct	50	.33	.33	.03	.6	2400	19	4.75	12.2:1	24.5:1	40.28
R-20535	30,000 ct	5000 ct	1250	.33	.33	.03	.6	2400	475	119	2.45:1	4.9:1	40.28
R-20540	30,000 ct	10,000 ct	2500	.33	.33	.03	.6	2400	950	238	1.73:1	3.46:1	40.28
R-20545	*30,000 ct	30,000 ct	–	.33	.33	.03	.6	2400	2850	–	1:1	–	43.40
R-20550	40,000 ct	400 ct	100	.25	.25	.03	.5	3200	38	9.5	10:1	20:1	43.40
R-20555	40,000 ct	2000 ct	500	.25	.25	.03	.5	3200	190	47.5	4.47:1	8.94:1	43.40
R-20560	40,000 ct	4000 ct	1000	.25	.25	.03	.5	3200	380	95	3.16:1	6.32:1	43.40
R-20565	40,000 ct	20,000 ct	5000	.25	.25	.03	.5	3200	1900	475	1.41:1	2.83:1	43.40
R-20570	*40,000 ct	40,000 ct	–	.25	.25	.03	.5	3200	3800	–	1:1	–	48.18
R-20575	50,000 ct	200 ct	50	.2	.2	.03	.4	4000	19	4.75	15.8:1	31.6:1	48.18
R-20577	50,000 ct	500 ct	125	.2	.2	.03	.4	4000	47.5	11.88	10:1	20:1	48.18
R-20578	50,000 ct	600 ct	150	.2	.2	.03	.4	4000	57	14.3	9.13:1	18.26:1	48.18
R-20579	50,000 ct	50,000 ct	12,500	.2	.2	.03	.4	4000	4750	1190	1:1	2:1	48.18
R-20580	60,000 ct	15,000 ct	3750	.16	.16	.03	.4	4800	1430	358	2:1	4:1	52.05
R-20585	62,500 ct	50 ct	12.5	.16	.16	.03	.4	5000	4.75	1.19	35.4:1	70.7:1	52.05
R-20587	80,000 ct	15,000 ct	3750	.12	.12	.03	.3	6400	1430	358	2.3:1	4.6:1	52.05
R-20590	90,000 ct	10,000 ct	2500	.11	.11	.03	.3	7200	950	238	3:1	6:1	52.05
R-20595	95,000 ct	15,000 ct	3750	.1	.1	.03	.3	7600	1430	358	2.5:1	5:1	54.63
R-20600	100,000 ct	60 ct	15	.1	.1	.03	.3	8000	5.7	1.43	40.8:1	81.6:1	54.63
R-20605	100,000 ct	100 ct	25	.1	.1	.03	.3	8000	9.5	2.38	31.6:1	63.2:1	54.63
R-20610	100,000 ct	500 ct	125	.1	.1	.03	.3	8000	47.5	11.88	14.1:1	28.3:1	54.63
R-20613	100,000 ct	1000 ct	250	.1	.1	.03	.3	8000	95	23.8	10:1	20:1	54.63
R-20614	100,000 ct	2000 ct	500	.1	.1	.03	.3	8000	190	47.5	7.07:1	14.14:1	54.63
R-20615	100,000 ct	10,000 ct	2500	.1	.1	.03	.3	8000	950	238	3.16:1	6.32:1	54.63
R-20620	135,000 ct	82 ct	20.5	.07	.07	.03	.2	10,800	7.8	1.9	40.6:1	81.2:1	57.07

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION
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Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

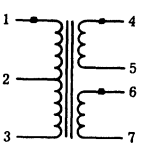
PICO's ultra-miniature transformers

R SERIES Plug-In

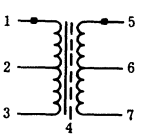
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552
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For immediate engineering assistance or to place an order—

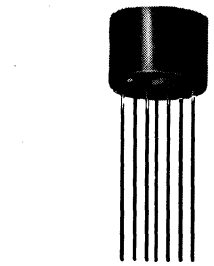
Delivery—stock to one week

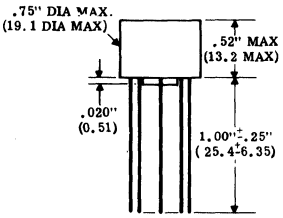
Call Toll Free 800-431-1064

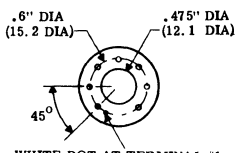
PICO's ultra-miniature transformers

These units can be manufactured and tested to MIL-T-27/359. Contact factory for price and delivery information and appropriate parts numbers (MIL-T-27/359-01 thru MIL-T-27/359-147).

S SERIES Plug-In







WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

Dimensions are in inches (MM)

PICO PART NUMBER S-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	300 Hz and higher	50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 *** S-Series
S-21003	20 ct	8 ct	2	2.0	1.5	.05	22	1.6	.88	.22	1.58:1	3.16:1	26.62
S-21005	20 ct	20 ct	5	2.0	1.5	.05	22	1.6	2.2	.55	1:1	2:1	26.62
S-21010	32 ct	32 ct	8	2.0	1.5	.05	17.5	2.56	3.52	.88	1:1	2:1	26.62
S-21015	40 ct	40 ct	10	2.0	1.5	.05	16	3.2	4.4	1.1	1:1	2:1	26.62
S-21018	48 ct	16ct	4	2.0	1.5	.05	14.5	3.84	1.76	.44	1.73:1	3.46:1	26.62
S-21020	50 ct	50 ct	12.5	2.0	1.5	.05	14	4	5.5	1.38	1:1	2:1	26.62
S-21025	80 ct	32 ct	8	2.0	1.5	.05	11	6.4	3.52	.88	1.58:1	3.16:1	26.62
S-21028	100 ct	40 ct	10	2.0	1.5	.05	10	8	4.4	1.1	1.58:1	3.16:1	26.62
S-21030	100 ct	100 ct	25	2.0	1.5	.05	10	8	11	2.75	1:1	2:1	26.62
S-21035	120 ct	12.8 ct	3.2	2.0	1.5	.05	9	9.6	1.41	.35	3.06:2	6.12:1	26.62
S-21040	120 ct	60 ct	15	2.0	1.5	.05	9	9.6	6.6	1.65	1.41:1	2.83:1	26.62
S-21045	120 ct	120 ct	30	2.0	1.5	.05	9	9.6	13.2	3.3	1:1	2:1	26.62
S-21050	150 ct	12 ct	3	2.0	1.5	.05	8	12	1.32	.33	3.54:1	7.08:1	26.62
S-21055	150 ct	50 ct	12.5	2.0	1.5	.05	8	12	5.5	1.38	1.73:1	3.46:1	26.62
S-21060	150 ct	100 ct	25	2.0	1.5	.05	8	12	11	2.75	1.22:1	2.44:1	26.62
S-21065	150 ct	150 ct	37.5	2.0	1.5	.05	8	12	16.5	4.13	1:1	2:1	26.62
S-21070	150 ct	600 ct	150	2.0	1.5	.05	8	12	66	16.5	1:2	1:1	26.62
S-21075	200 ct	200 ct	50	2.0	1.5	.05	7	16	22	5.5	1:1	2:1	26.62
S-21080	300 ct	12 ct	3	2.0	1.5	.05	5.5	24	1.32	.33	5:1	10:1	26.62
S-21085	300 ct	50 ct	12.5	2.0	1.5	.05	5.5	24	5.5	1.38	2.45:1	4.9:1	26.62
S-21090	300 ct	150 ct	37.5	2.0	1.5	.05	5.5	24	16.5	4.13	1.41:1	2.83:1	26.62
S-21095	300 ct	300 ct	75	2.0	1.5	.05	5.5	24	33	8.25	1:1	2:1	26.62
S-21100	300 ct	600 ct	150	2.0	1.5	.05	5.5	24	66	16.5	1:1.41	1.41:1	26.62
S-21105	320 ct	12.8 ct	3.2	2.0	1.5	.05	5.5	25.6	1.41	.35	5:1	10:1	26.62
S-21110	400 ct	40 ct	10	2.0	1.5	.05	5	32	4.4	1.1	3.16:1	6.32:1	26.62
S-21115	400 ct	120 ct	30	2.0	1.5	.05	5	32	13.2	3.3	1.83:1	3.65:1	26.62
S-21120	400 ct	200 ct	50	2.0	1.5	.05	5	32	22	5.5	1.41:1	2.83:1	26.62
S-21125	400 ct	400 ct	100	2.0	1.5	.05	5	32	44	11	1:1	2:1	26.62
S-21130	400 ct	1000 ct	250	2.0	1.5	.05	5	32	110	27.5	1:1.58	1.26:1	26.62
S-21135	400 ct	2000 ct	500	2.0	1.5	.05	5	32	220	55	1:2.24	1:1.12	26.62
S-21140	400 ct	4000 ct	1000	2.0	1.5	.05	5	32	440	110	1:3.16	1:1.58	26.62
S-21142	500 ct	12.8 ct	3.2	2.0	1.5	.05	4.5	40	1.41	.35	6.25:1	12.5:1	26.62
S-21144	500 ct	16 ct	4	2.0	1.5	.05	4.5	40	1.76	.44	5.6:1	11.2:1	26.62
S-21145	500 ct	50 ct	12.5	2.0	1.5	.05	4.5	40	5.5	1.38	3.16:1	6.32:1	26.62
S-21147	500 ct	150 ct	37.5	2.0	1.5	.05	4.5	40	16.5	4.13	1.83:1	3.65:1	26.62
S-21150	500 ct	500 ct	125	2.0	1.5	.05	4.5	40	55	13.75	1:1	2:1	26.62
S-21155	*500 ct	500 ct	–	2.0	1.5	.05	4.5	40	55	–	1:1	–	27.68
S-21160	500 ct	600 ct	150	2.0	1.5	.05	4.5	40	66	16.5	1:1.1	1.83:1	26.62
S-21165	600 ct	12.8 ct	3.2	2.0	1.5	.05	4	48	1.41	.35	6.85:1	13.7	26.62
S-21167	600 ct	30 ct	7.5	2.0	1.5	.05	4	48	3.3	.83	4.47:1	8.94:1	26.62
S-21170	600 ct	48 ct	12	2.0	1.5	.05	4	48	5.28	1.37	3.54:1	7.07:1	26.62
S-21175	600 ct	200 ct	50	2.0	1.5	.05	4	48	22	5.5	1.73:1	3.46:1	26.62
S-21180**	600 ct	600 ct	150	2.0	1.5	.05	4	48	66	16.5	1:1	2:1	26.62
S-21185**	*600 ct	600 ct	–	2.0	1.5	.05	4	48	66	–	1:1	–	27.68
S-21186**	*600 ct	900 ct	–	2.0	1.5	.05	4	48	99	–	1:1.22	–	27.68
S-21187**	600 ct	1200 ct	300	2.0	1.5	.05	4	48	132	33	1:1.41	1.41:1	26.62
S-21190	640 ct	12.8 ct	3.2	2.0	1.5	.05	4	51	1.41	.35	7.07:1	14.14:1	26.62
S-21195	700 ct	100 ct	25	2.0	1.5	.05	3.5	56	11	2.75	2.65:1	5.29:1	26.62
S-21200	800 ct	12.8 ct	3.2	2.0	1.5	.05	3.5	64	1.41	.35	7.91:1	15.8:1	26.62
S-21205	800 ct	48 ct	12	2.0	1.5	.05	3.5	64	5.28	1.32	4.08:1	8.16:1	26.62
S-21210	800 ct	800 ct	200	2.0	1.5	.05	3.5	64	88	22	1:1	2:1	26.62
S-21215	900 ct	600 ct	150	2.0	1.5	.05	3	72	66	16.5	1.23:1	2.45:1	26.62
S-21217**	*900 ct	900 ct	–	2.0	1.5	.05	3	72	99	–	1:1	–	27.68
S-21220	1000 ct	12 ct	3	2.0	1.5	.05	3	80	1.32	.33	9.13:1	18.26:1	26.62
S-21225	1000 ct	50 ct	12.5	2.0	1.5	.05	3	80	5.5	1.38	4.47:1	8.94:1	26.62
S-21230	1000 ct	1000 ct	250	2.0	1.5	.05	3	80	110	27.5	1:1	2:1	26.62
S-21235	1060 ct	12.8 ct	3.2	2.0	1.5	.05	3	85	1.41	.35	9.1:1	18.2:1	26.62
S-21240	1200 ct	12.8 ct	3.2	2.0	1.5	.05	3	96	1.41	.35	9.68:1	19.4:1	26.62
S-21245	1200 ct	500 ct	125	2.0	1.5	.05	3	96	55	13.75	1.55:1	3.1:1	26.62
S-21250	1200 ct	1200 ct	300	2.0	1.5	.05	3	96	132	33	1:1	2:1	26.62
S-21255	*1200 ct	1200 ct	–	2.0	1.5	.05	3	96	132	–	1:1	–	27.68
S-21260	1500 ct	12 ct	3	2.0	1.5	.05	2.5	120	1.32	.33	11.18:1	22.36:1	26.62
S-21265	1500 ct	500 ct	125	2.0	1.5	.05	2.5	120	55	13.75	1.73:1	3.46:1	26.62
S-21270	*1500 ct	600 ct	–	2.0	1.5	.05	2.5	120	66	–	1.58:1	–	27.68
S-21275	*1500 ct	1500 ct	–	2.0	1.5	.05	2.5	120	165	–	1:1	–	27.68
S-21280	1600 ct	12.8 ct	3.2	2.0	1.5	.05	2.5	128	1.41	.35	11.18:1	22.36:1	26.62
S-21283	2000 ct	8 ct	2	2.0	1.5	.05	2.2	160	.88	.22	15.8:1	31.6:1	26.62
S-21285	2000 ct	2000 ct	500	2.0	1.5	.05	2.2	160	220	55	1:1	2:1	26.62
S-21290	*2000 ct	2000 ct	–	2.0	1.5	.05	2.2	160	220	–	1:1	–	27.68
S-21295	2000 ct	8000 ct	2000	2.0	1.5	.05	2.2	160	880	220	1:2	1:1	27.68
S-21297	2500 ct	2500 ct	625	2.0	1.5	.05	2	200	275	69	1:1	2:1	27.68
S-21300	3000 ct	3000 ct	750	2.0	1.5	.05	1.8	240	330	83	1:1	2:1	27.68
S-21305	*3000 ct	3000 ct	–	2.0	1.5	.05	1.8	240	330	–	1:1	–	27.68

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION
***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, and are Hermetically Sealed in a Metal Case, Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** ..... ±3db, 50 Hz-30 KHz at 1.0 Milliwatt. (±0.5 db, 300 Hz-5 KHz)
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz, 300 Hz and 50 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 17 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solid .020 Conductor,Tinned 100%. Electroplated Per Mil-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552
914-699-5514
FAX 914-699-5565

PICO PART NUMBER S-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** S-Series
S-21310	3600 ct	3600 ct	900	2.0	1.5	.05	1.7	288	396	99	1:1	2:1	27.68
S-21312	4000 ct	16 ct	4	2.0	1.5	.05	1.6	320	1.76	.44	15.8:1	31.6:1	27.68
S-21314**	4000 ct	600 ct	150	2.0	1.5	.05	1.6	320	66	16.5	2.58:1	5.16:1	27.68
S-21315	4000 ct	1000 ct	250	2.0	1.5	.05	1.6	320	110	27.5	2:1	4:1	27.68
S-21320	*4000 ct	8000 ct	–	2.0	1.5	.05	1.6	320	880	–	1:1.41	–	27.68
S-21325	5000 ct	500 ct	125	2.0	1.5	.05	1.4	400	55	13.8	3.16:1	6.32:1	26.62
S-21330	5000 ct	5000 ct	1250	2.0	1.5	.05	1.4	400	550	138	1:1	2:1	26.62
S-21335	7500 ct	50 ct	12.5	1.3	1.3	.05	1.2	600	5.5	1.38	12.25:1	24.5:1	29.48
S-21340	7500 ct	100 ct	25	1.3	1.3	.05	1.2	600	11	2.75	8.66:1	17.32:1	29.48
S-21345	7500 ct	600 ct	150	1.3	1.3	.05	1.2	600	66	16.5	3.54:1	7.07:1	29.48
S-21350	7500 ct	2500 ct	625	1.3	1.3	.05	1.2	600	275	69	1.73:1	3.46:1	29.48
S-21355	*7500 ct	7500 ct	–	1.3	1.3	.05	1.2	600	825	–	1:1	–	31.87
S-21360	8000 ct	12.8 ct	3.2	1.2	1.2	.05	1.1	640	1.4	.35	25:1	50:1	29.48
S-21365	8000 ct	1000 ct	250	1.2	1.2	.05	1.1	640	110	27.5	2.83:1	5.66:1	29.48
S-21370	*8000 ct	1200 ct	–	1.2	1.2	.05	1.1	640	132	–	2.58:1	–	31.87
S-21375	*9000 ct	9000 ct	–	1.1	1.1	.05	1.1	720	990	–	1:1	–	31.87
S-21380	10,000 ct	12.8 ct	3.2	1.0	1.0	.05	1	800	1.4	.35	28:1	56:1	29.48
S-21385	10,000 ct	16 ct	4	1.0	1.0	.05	1	800	1.76	.44	25:1	50:1	29.48
S-21390	10,000 ct	100 ct	25	1.0	1.0	.05	1	800	11	2.75	10:1	20:1	29.48
S-21395	10,000 ct	200 ct	50	1.0	1.0	.05	1	800	22	5.5	7.07:1	14.14:1	29.48
S-21400	10,000 ct	500 ct	125	1.0	1.0	.05	1	800	55	13.75	4.47:1	8.94:1	29.48
S-21405	10,000 ct	600 ct	150	1.0	1.0	.05	1	800	66	16.5	4.08:1	8.16:1	29.48
S-21410	10,000 ct	1000 ct	250	1.0	1.0	.05	1	800	110	27.5	3.16:1	6.32:1	29.48
S-21415	10,000 ct	1200 ct	300	1.0	1.0	.05	1	800	132	33	2.89:1	5.77:1	29.48
S-21420	10,000 ct	1500 ct	375	1.0	1.0	.05	1	800	165	41.3	2.58:1	5.16:1	29.48
S-21425	10,000 ct	2000 ct	500	1.0	1.0	.05	1	800	220	55	2.24:1	4.47:1	29.48
S-21430	10,000 ct	5000 ct	1250	1.0	1.0	.05	1	800	550	138	1.41:1	1.83:1	29.48
S-21435	10,000 ct	7500 ct	1875	1.0	1.0	.05	1	800	825	206	1.16:1	2.31:1	29.48
S-21440	10,000 ct	10,000 ct	2500	1.0	1.0	.05	1	800	1100	275	1:1	2:1	29.48
S-21445	*10,000 ct	10,000 ct	–	1.0	1.0	.05	1	800	1100	–	1:1	–	31.87
S-21450	15,000 ct	400 ct	100	.65	.65	.05	.8	1200	44	11	6.12:1	12.25.1	29.48
S-21452	15,000 ct	500 ct	125	.65	.65	.05	.8	1200	55	13.8	5.48:1	10.95:1	29.48
S-21455	15,000 ct	600 ct	150	.65	.65	.05	.8	1200	66	16.5	5:1	10.:1	29.48
S-21460	15,000 ct	10,000 ct	2500	.65	.65	.05	.8	1200	1100	275	1.22:1	2.45:1	29.48
S-21465	*15,000 ct	15,000 ct	–	.65	.65	.05	.8	1200	1650	–	1:1	–	31.87
S-21470	15,000 ct	15,000 ct	3750	.65	.65	.05	.8	1200	1650	413	1:1	2:1	29.48
S-21475	16,000 ct	1000 ct	250	.62	.62	.05	.8	1280	110	27.5	4:1	8:1	29.48
S-21480	20,000 ct	500 ct	125	.5	.5	.05	.7	1600	55	13.8	6.32:1	12.65:1	31.87
S-21485	20,000 ct	600 ct	150	.5	.5	.05	.7	1600	66	16.5	5.77:1	11.55:1	31.87
S-21490	20,000 ct	800 ct	200	.5	.5	.05	.7	1600	88	22	5:1	10:1	31.87
S-21495	20,000 ct	1000 ct	250	.5	.5	.05	.7	1600	110	27.5	4.47:1	8.94:1	31.87
S-21500	20,000 ct	5000 ct	1250	.5	.5	.05	.7	1600	550	138	2:1	4:1	31.87
S-21505	20,000 ct	10,000 ct	2500	.5	.5	.05	.7	1600	1100	275	1:41:1	2.83:1	31.87
S-21510	*20,000 ct	20,000 ct	–	.5	.5	.05	.7	1600	2200	–	1:1	–	32.82
S-21515	25,000 ct	500 ct	125	.4	.4	.05	.6	2000	55	13.8	7.07:1	14.14:1	31.87
S-21520	25,000 ct	1000 ct	250	.4	.4	.05	.6	2000	110	27.5	5:1	10:1	31.87
S-21525	30,000 ct	50 ct	12.5	.33	.33	.05	.6	2400	5.5	1.38	24.5:1	49:1	32.83
S-21530	30,000 ct	1200 ct	300	.33	.33	.05	.6	2400	132	33	5:1	10:1	32.83
S-21532	30,000 ct	500 ct	125	.33	.33	.05	.6	2400	55	13.8	7.7:1	15.5:1	32.83
S-21534	30,000 ct	200 ct	50	.33	.33	.05	.6	2400	22	5.5	12.2:1	24.5:1	32.83
S-21535	30,000 ct	5000 ct	1250	.33	.33	.05	.6	2400	550	137.5	2.45:1	4.9:1	32.83
S-21540	30,000 ct	10,000 ct	2500	.33	.33	.05	.6	2400	1100	275	1.73:1	3.46:1	32.83
S-21545	*30,000 ct	30,000 ct	–	.33	.33	.05	.6	2400	3300	–	1:1	–	35.29
S-21550	40,000 ct	400 ct	100	.25	.25	.05	.5	3200	44	11	10:1	20:1	35.29
S-21555	40,000 ct	2000 ct	500	.25	.25	.05	.5	3200	220	55	4.47:1	8.94:1	35.29
S-21560	40,000 ct	4000 ct	1000	.25	.25	.05	.5	3200	440	110	3.16:1	6.32:1	35.29
S-21565	40,000 ct	20,000 ct	5000	.25	.25	.05	.5	3200	2200	550	1.41:1	2.83:1	35.29
S-21570	*40,000 ct	40,000 ct	–	.25	.25	.05	.5	3200	4400	–	1:1	–	39.29
S-21575	50,000 ct	200 ct	50	.2	.2	.05	.4	4000	22	5.5	15.8:1	31.6:1	39.29
S-21577	50,000 ct	500 ct	125	.2	.2	.05	.4	4000	55	13.8	10:1	20:1	39.29
S-21578	50,000 ct	600 ct	150	.2	.2	.05	.4	4000	66	16.5	9.13:1	18.26:1	39.29
S-21579	50,000 ct	50,000 ct	12,500	.2	.2	.05	.4	4000	5500	1380	1:1	2:1	39.29
S-21580	60,000 ct	15,000 ct	3750	.16	.16	.05	.4	4800	1650	413	2:1	4:1	39.65
S-21585	62,500 ct	50 ct	12.5	.16	.16	.05	.4	5000	5.5	1.38	35.4:1	70.7:1	39.65
S-21587	80,000 ct	15,000 ct	3750	.12	.12	.05	.3	6400	1650	413	2.3:1	4.6:1	39.65
S-21590	90,000 ct	10,000 ct	2500	.11	.11	.05	.3	7200	1100	275	3:1	6:1	44.54
S-21595	95,000 ct	15,000 ct	3750	.1	.1	.05	.3	7600	1650	413	2.5:1	5:1	44.54
S-21600	100,000 ct	60 ct	15	.1	.1	.05	.3	8000	6.6	1.65	40.8:1	81.6:1	44.54
S-21605	100,000 ct	100 ct	25	.1	.1	.05	.3	8000	11	2.75	31.6:1	63.2:1	44.54
S-21610	100,000 ct	500 ct	125	.1	.1	.05	.3	8000	55	13.8	14.1:1	28.3:1	44.54
S-21613	100,000 ct	1000 ct	250	.1	.1	.05	.3	8000	110	27.5	10:1	20:1	44.54
S-21614	100,000 ct	2000 ct	500	.1	.1.	.05	.3	8000	220	55	7.07:1	14.14:1	44.54
S-21615	100,000 ct	10,000 ct	2500	.1	.1	.05	.3	8000	1100	275	3.16:1	6.32:1	44.54
S-21620	135,000 ct	82 ct	20.5	.07	.07	.05	.2	10,800	9	2.25	40.6:1	81.2:1	46.54

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30 %
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

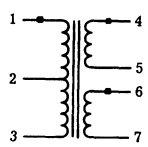
PICO's ultra-miniature transformers

S SERIES Plug-In

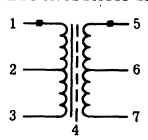
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
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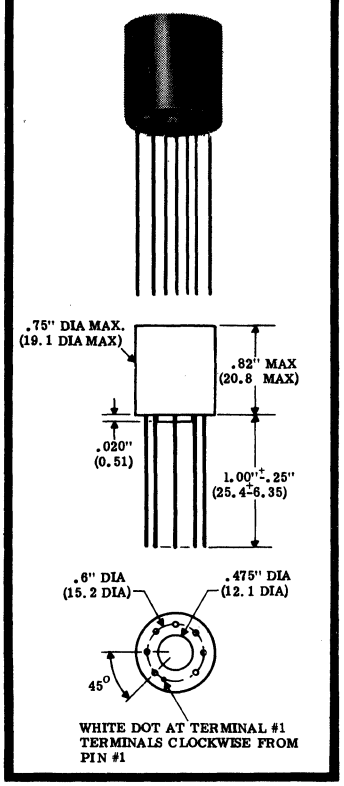


PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552
914-699-5514
FAX 914-699-5565

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Delivery— stock to one week

PICO's ultra-miniature transformers

T SERIES Plug-In



Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-27:**..... All units manufactured to MIL-T-27, and are Hermetically Sealed in a Metal Case, Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:**..... ±3db, 20 Hz-25 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:**..... 5% With Rated Power Level at 1 KHz and 300 Hz. 10% Distortion at 20 Hz.
- **DIELECTRIC STRENGTH:**..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:**... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:**..... 28 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:**..... Solid .020 Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per Mil-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:**..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

Delivery— stock to one week

PICO PART NUMBER T-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1–9 *** T-Series
T-22003	20 ct	8 ct	2		3.0	2.0	.006	22	1.6	.8	.2	1.58:1	3.16:1	29.23
T-22005	20 ct	20 ct	5		3.0	2.0	.006	22	1.6	2	.5	1:1	2:1	29.23
T-22010	32 ct	32 ct	8		3.0	2.0	.006	17.5	2.56	3.2	.8	1:1	2:1	29.23
T-22015	40 ct	40 ct	10		3.0	2.0	.006	16	3.2	4	1	1:1	2:1	29.23
T-22018	48 ct	16 ct	4		3.0	2.0	.006	14.5	3.84	1.6	.4	1.73:1	3.46:1	29.23
T-22020	50 ct	50 ct	12.5		3.0	2.0	.006	14	4	5	1.25	1:1	2:1	29.23
T-22025	80 ct	32 ct	8		3.0	2.0	.006	11	6.4	3.2	.8	1.58:1	3.16:1	29.23
T-22028	100 ct	40 ct	10		3.0	2.0	.006	10	8	4	1	1.58:1	3.16:1	29.23
T-22030	100 ct	100 ct	25		3.0	2.0	.006	10	8	10	2.5	1:1	2:1	29.23
T-22035	120 ct	12.8 ct	3.2		3.0	2.0	.006	9	9.6	1.3	.32	3.06:1	26.12:1	29.23
T-22040	120 ct	60 ct	15		3.0	2.0	.006	9	9.6	6	1.5	1.41:1	2.83:1	29.23
T-22045	120 ct	120 ct	30		3.0	2.0	.006	9	9.6	12	3	1:1	2:1	29.23
T-22050	150 ct	12 ct	3		3.0	2.0	.006	8	12	1.2	.3	3.54:1	7.08:1	29.23
T-22055	150 ct	50 ct	12.5		3.0	2.0	.006	8	12	5	1.25	1.73:1	3.46:1	29.23
T-22060	150 ct	100 ct	25		3.0	2.0	.006	8	12	10	2.5	1.22:1	2.44:1	29.23
T-22065	150 ct	150 ct	37.5		3.0	2.0	.006	8	12	15	3.75	1:1	2:1	29.23
T-22070	150 ct	600 ct	150		3.0	2.0	.006	8	12	60	15	1:2	1:1	29.23
T-22075	200 ct	200 ct	50		3.0	2.0	.006	7	16	20	5	1:1	2:1	29.23
T-22080	300 ct	12 ct	3		3.0	2.0	.006	5.5	24	1.2	.3	5:1	10:1	29.23
T-22085	300 ct	50 ct	12.5		3.0	2.0	.006	5.5	24	5	1.25	2.45:1	4.9:1	29.23
T-22090	300 ct	150 ct	37.5		3.0	2.0	.006	5.5	24	15	3.75	1.41:1	2.83:1	29.23
T-22095	300 ct	300 ct	75		3.0	2.0	.006	5.5	24	30	7.5	1:1	2:1	29.23
T-22100	300 ct	600 ct	150		3.0	2.0	.006	5.5	24	60	15	1:1.41	1.41:1	29.23
T-22105	320 ct	12.8 ct	3.2		3.0	2.0	.006	5.5	25.6	1.3	.32	5:1	10:1	29.23
T-22110	400 ct	40 ct	10		3.0	2.0	.006	5	32	4	1	3.16:1	16.32:1	29.23
T-22115	400 ct	120 ct	30		3.0	2.0	.006	5	32	12	3	1.83:1	3.65:1	29.23
T-22120	400 ct	200 ct	50		3.0	2.0	.006	5	32	20	5	1.41:1	2.83:1	29.23
T-22125	400 ct	400 ct	100		3.0	2.0	.006	5	32	40	10	1:1	2:1	29.23
T-22130	400 ct	1000 ct	250		3.0	2.0	.006	5	32	100	25	1:1.58	1.26:1	29.23
T-22135	400 ct	2000 ct	500		3.0	2.0	.006	5	32	200	50	1:2.24	1:1.12	29.23
T22140	400 ct	4000 ct	1000		3.0	2.0	.006	5	32	400	100	1:3.16	1:1.58	29.23
T-22142	500 ct	12.8 ct	3.2		3.0	2.0	.006	4.5	40	1.3	.32	6.25:1	12.5:1	29.23
T-22144	500 ct	16 ct	4		3.0	2.0	.006	4.5	40	1.6	.4	5.6:1	11.2:1	29.23
T-22145	500 ct	50 ct	12.5		3.0	2.0	.006	4.5	40	5	1.25	3.16:1	6.32:1	29.23
T-22147	500 ct	150 ct	37.5		3.0	2.0	.006	4.5	40	15	3.75	1.83:1	3.65:1	29.23
T-22150	500 ct	500 ct	125		3.0	2.0	.006	4.5	40	50	12.5	1:1	2:1	29.23
T-22155	*500 ct	500 ct	–		3.0	2.0	.006	4.5	40	50	–	1:1	–	30.46
T-22160	500 ct	600 ct	150		3.0	2.0	.006	4.5	40	60	15	1:1.1	1.83:1	29.23
T-22165	600 ct	12.8 ct	3.2		3.0	2.0	.006	4	48	1.3	.32	6.85:1	13.7:1	29.23
T-22167	600 ct	30 ct	7.5		3.0	2.0	.006	4	48	3	.75	4.47:1	8.94:1	29.23
T-22170	600 ct	48 ct	12		3.0	2.0	.006	4	48	4.8	1.2	3.54:1	7.07:1	29.23
T-22175	600 ct	200 ct	50		3.0	2.0	.006	4	48	20	5	1.73:1	3.46:1	29.23
T-22180**	600 ct	600 ct	150		3.0	2.0	.006	4	48	60	15	1:1	2:1	29.23
T-22185**	*600 ct	600 ct	–		3.0	2.0	.006	4	48	60	–	1:1	–	30.46
T-22186**	*600 ct	900 ct	–		3.0	2.0	.006	4	48	90	–	1:1.22	–	30.46
T-22187**	600 ct	1200 ct	300		3.0	2.0	.006	4	48	120	30	1:1.41	1.41:1	29.23
T-22190	640 ct	12.8 ct	3.2		3.0	2.0	.006	4	51	1.3	.32	7.07:1	14.14:1	29.23
T-22195	700 ct	100 ct	25		3.0	2.0	.006	3.5	56	10	2.5	2.65:1	5.29:1	29.23
T-22200	800 ct	12.8 ct	3.2		3.0	2.0	.006	3.5	64	1.3	.32	7.91:1	15.8:1	29.23
T-22205	800 ct	48 ct	12		3.0	2.0	.006	3.5	64	4.8	1.2	4.08:1	8.16:1	29.23
T-22210	800 ct	800 ct	200		3.0	2.0	.006	3.5	64	80	20	1:1	2:1	29.23
T-22215	900 ct	600 ct	150		3.0	2.0	.006	3	72	60	15	1.22:1	2.45:1	29.23
T-22217**	*900 ct	900 ct	–		3.0	2.0	.006	3	72	90	–	1:1	–	30.46
T-22220	1000 ct	12 ct	3		3.0	2.0	.006	3	80	1.2	.3	9.13:1	18.26:1	29.23
T-22225	1000 ct	50 ct	12.5		3.0	2.0	.006	3	80	5	1.25	4.47:1	8.94:1	29.23
T-22230	1000 ct	1000 ct	250		3.0	2.0	.006	3	80	100	25	1:1	2:1	29.23
T-22235	1060 ct	12.8 ct	3.2		3.0	2.0	.006	3	85	1.3	.32	9.1:1	18.2:1	29.23
T-22240	1200 ct	12.8 ct	3.2		3.0	2.0	.006	3	96	1.3	.32	9.68:1	19.4:1	29.23
T-22245	1200 ct	500 ct	125		3.0	2.0	.006	3	96	50	12.5	1.55:1	3.1:1	29.23
T-22250	1200 ct	1200 ct	300		3.0	2.0	.006	3	96	120	30	1:1	2:1	29.23
T-22255	*1200 ct	1200 ct	–		3.0	2.0	.006	3	96	120	–	1:1	–	30.46
T-22260	1500 ct	12 ct	3		3.0	2.0	.006	2.5	120	1.2	.3	11.18:1	22.36:1	29.23
T-22265	1500 ct	500 ct	125		3.0	2.0	.006	2.5	120	50	12.5	1.73:1	3.46:1	29.23
T-22270	*1500 ct	600 ct	–		3.0	2.0	.006	2.5	120	60	–	1.58:1	–	30.46
T-22275	*1500 ct	1500 ct	–		3.0	2.0	.006	2.5	120	150	–	1:1	–	30.46
T-22280	1600 ct	12.8 ct	3.2		3.0	2.0	.006	2.5	128	1.3	.32	11.18:1	22.36:1	29.23
T-22283	2000 ct	8 ct	2		3.0	2.0	.006	2.2	160	.8	.2	15.8:1	31.6:1	29.23
T-22285	2000 ct	2000 ct	500		3.0	2.0	.006	2.2	160	200	50	1:1	2:1	29.23
T-22290	*2000 ct	2000 ct	–		3.0	2.0	.006	2.2	160	200	–	1:1	–	30.46
T-22295	2000 ct	8000 ct	2000		3.0	2.0	.006	2.2	160	800	200	1:2	1:1	29.23
T-22297	2500 ct	2500 ct	625		3.0	2.0	.006	2	200	250	63	1:1	2:1	29.23
T-22300	3000 ct	3000 ct	750		3.0	2.0	.006	1.8	240	300	75	1:1	2:1	29.23
T-22305	*3000 ct	3000 ct	–		3.0	2.0	.006	1.8	240	300	–	1:1	–	29.23

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PICO PART NUMBER T-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** T-Series
T-22310	3600 ct	3600 ct	900	2.7	2.0	.006	1.7	288	360	90	1:1	2:1	29.23
T-22312	4000 ct	16 ct	4	2.5	2.0	.006	1.6	320	1.6	.4	15.8:1	31.6:1	29.23
T-22314**	4000 ct	600 ct	150	2.5	2.0	.006	1.6	320	60	15	2.58:1	5.16:1	29.23
T-22315	4000 ct	1000 ct	250	2.5	2.0	.006	1.6	320	100	25	2:1	4:1	29.23
T-22320	*4000 ct	8000 ct	–	2.5	2.0	.006	1.6	320	800	–	1:1.41	–	30.46
T-22325	5000 ct	500 ct	125	2.0	2.0	.006	1.4	400	50	12.5	3.16:1	6.32:1	29.32
T-22330	5000 ct	5000 ct	1250	2.0	2.0	.006	1.4	400	500	125	1:1	2:1	29.32
T-22335	7500 ct	50 ct	12.5	1.3	1.3	.006	1.2	600	5	1.25	12.25:1	24.5:1	32.42
T-22340	7500 ct	100 ct	25	1.3	1.3	.006	1.2	600	10	2.5	8.66:1	17.32:1	32.42
T-22345	7500 ct	600 ct	150	1.3	1.3	.006	1.2	600	60	15	3.54:1	7.07:1	32.42
T-22350	7500 ct	2500 ct	625	1.3	1.3	.006	1.2	600	250	63	1.73:1	3.46:1	32.42
T-22355	*7500 ct	7500 ct	–	1.3	1.3	.006	1.2	600	750	–	1:1	–	34.76
T-22360	8000 ct	12.8 ct	3.2	1.2	1.2	.006	1.1	640	1.3	.32	25:1	50:1	32.42
T-22365	8000 ct	1000 ct	250	1.2	1.2	.006	1.1	640	100	25	2.83:1	5.66:1	32.42
T-22370	*8000 ct	1200 ct	–	1.2	1.2	.006	1.1	640	120	–	2.58:1	–	34.76
T-22375	*9000 ct	9000 ct	–	1.1	1.1	.006	1.1	720	900	–	1:1	–	34.76
T-22380	10,000 ct	12.8 ct	3.2	1.0	1.0	.006	1	800	1.3	.32	28:1	56:1	32.42
T-22385	10,000 ct	16 ct	4	1.0	1.0	.006	1	800	1.6	.4	25:1	50:1	32.42
T-22390	10,000 ct	100 ct	25	1.0	1.0	.006	1	800	10	2.5	10:1	20:1	32.42
T-22395	10,000 ct	200 ct	50	1.0	1.0	.006	1	800	20	5	7.07:1	14.14:1	32.42
T-22400	10,000 ct	500 ct	125	1.0	1.0	.006	1	800	50	12.5	4.47:1	8.94:1	32.42
T-22405	10,000 ct	600 ct	150	1.0	1.0	.006	1	800	60	15	4.08:1	8.16:1	32.42
T-22410	10,000 ct	1000 ct	250	1.0	1.0	.006	1	800	100	25	3.16:1	6.32:1	32.42
T-22415	10,000 ct	1200 ct	300	1.0	1.0	.006	1	800	120	30	2.89:1	5.77:1	32.42
T-22420	10,000 ct	1500 ct	375	1.0	1.0	.006	1	800	150	38	2.58:1	5.16:1	32.42
T-22425	10,000 ct	2000 ct	500	1.0	1.0	.006	1	800	200	50	2.24:1	4.47:1	32.42
T-22430	10,000 ct	5000 ct	1250	1.0	1.0	.006	1	800	500	125	1.41:1	2.83:1	32.42
T-22435	10,000 ct	7500 ct	1875	1.0	1.0	.006	1	800	750	188	1.16:1	2.31:1	32.42
T-22440	10,000 ct	10,000 ct	2500	1.0	1.0	.006	1	800	1000	250	1:1	2:1	32.42
T-22445	*10,000 ct	10,000 ct	–	1.0	1.0	.006	1	800	1000	–	1:1	–	34.76
T-22450	15,000 ct	400 ct	100	.66	.66	.006	.8	1200	40	10	6.12:1	12.25:1	32.42
T-22452	15,000 ct	500 ct	125	.66	.66	.006	.8	1200	50	12.5	5.48:1	10.95:1	32.42
T-22455	15,000 ct	600 ct	150	.66	.66	.006	.8	1200	60	15	5:1	10:1	32.42
T-22460	15,000 ct	10,000 ct	2500	.66	.66	.006	.8	1200	1000	250	1.22:1	2.45:1	32.42
T-22465	*15,000 ct	15,000 ct	–	.66	.66	.006	.8	1200	1500	–	1:1	–	34.76
T-22470	15,000 ct	15,000 ct	3750	.66	.66	.006	.8	1200	1500	375	1:1	2:1	32.42
T-22475	16,000 ct	1000 ct	250	.62	.62	.006	.8	1280	100	25	4:1	8:1	32.42
T-22480	20,000 ct	500 ct	125	.5	.5	.006	.7	1600	50	12.5	6.32:1	12.6:1	34.76
T-22485	20,000 ct	600 ct	150	.5	.5	.006	.7	1600	60	15	5.77:1	11.55:1	34.76
T-22490	20,000 ct	800 ct	200	.5	.5	.006	.7	1600	80	20	5:1	10:1	34.76
T-22495	20,000 ct	1000 ct	250	.5	.5	.006	.7	1600	100	25	4.47:1	8.94:1	34.76
T-22500	20,000 ct	5000 ct	1250	.5	.5	.006	.7	1600	500	125	2:1	4:1	34.76
T-22505	20,000 ct	10,000 ct	2500	.5	.5	.006	.7	1600	1000	250	1.41:1	2.83:1	34.76
T-22510	*20,000 ct	20,000 ct	–	.5	.5	.006	.7	1600	2000	–	1:1	–	36.12
T-22515	25,000 ct	500 ct	125	.4	.4	.006	.6	2000	50	12.5	7.07:1	14.14:1	34.76
T-22520	25,000 ct	1000 ct	250	.4	.4	.006	.6	2000	100	25	5:1	10:1	34.76
T-22525	30,000 ct	50 ct	12.5	.33	.33	.006	.6	2400	5	1.25	24.5:1	49:1	36.12
T-22530	30,000 ct	1200 ct	300	.33	.33	.006	.6	2400	120	30	5:1	10:1	36.12
T-22532	30,000 ct	500 ct	125	.33	.33	.006	.6	2400	50	12.5	7.7:1	15.5:1	36.12
T-22534	30,000 ct	200 ct	50	.33	.33	.006	.6	2400	20	5	12.2:1	24.5:1	36.12
T-22535	30,000 ct	5000 ct	1250	.33	.33	.006	.6	2400	500	125	2.45:1	4.9:1	36.12
T-22540	30,000 ct	10,000 ct	2500	.33	.33	.006	.6	2400	1000	250	1.73:1	3.46:1	36.12
T-22545	*30,000 ct	30,000 ct	–	.33	.33	.006	.6	2400	3000	–	1:1	–	38.73
T-22550	40,000 ct	400 ct	100	.25	.25	.006	.5	3200	40	10	10:1	20:1	38.73
T-22555	40,000 ct	2000 ct	500	.25	.25	.006	.5	3200	200	50	4.47:1	8.94:1	38.73
T-22560	40,000 ct	4000 ct	1000	.25	.25	.006	.5	3200	400	100	3.16:1	6.32:1	38.73
T-22565	40,000 ct	20,000 ct	5000	.25	.25	.006	.5	3200	2000	500	1.41:1	2.83:1	38.73
T-22570	*40,000 ct	40,000 ct	–	.25	.25	.006	.5	3200	4000	–	1:1	–	43.19
T-22575	50,000 ct	200 ct	50	.2	.2	.006	.4	4000	20	5	15.8:1	31.6:1	43.19
T-22577	50,000 ct	500 ct	125	.2	.2	.006	.4	4000	50	12.5	10:1	20:1	43.19
T-22578	50,000 ct	600 ct	150	.2	.2	.006	.4	4000	60	15	9.13:1	18.26:1	43.19
T-22579	50,000 ct	50,000 ct	12,500	.2	.2	.006	.4	4000	5000	1250	1:1	2:1	43.19
T-22580	60,000 ct	15,000 ct	3750	.16	.16	.006	.4	4800	1500	375	2:1	4:1	46.64
T-22585	62,500 ct	50 ct	12.5	.16	.16	.006	.4	5000	5	1.25	35.4:1	70.7:1	46.64
T-22587	80,000 ct	15,000 ct	3750	.12	.12	.006	.3	6400	1500	375	2.3:1	4.6:1	46.64

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 Less 23%; 100-499 Less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

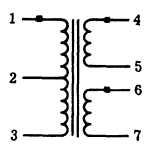
PICO's ultra-miniature transformers

T SERIES Plug-In

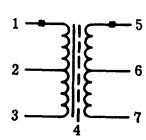
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

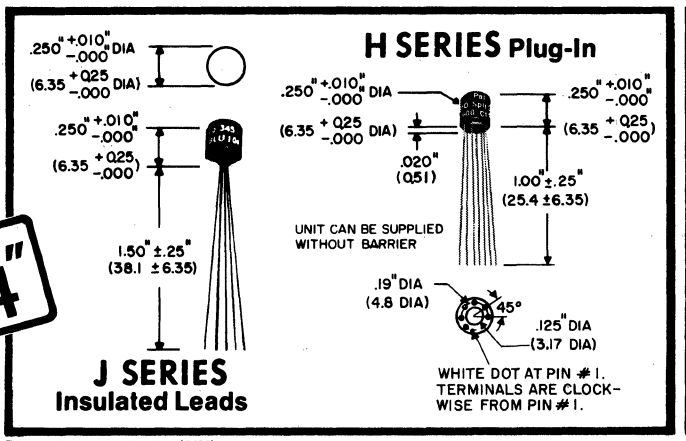
Delivery— stock to one week

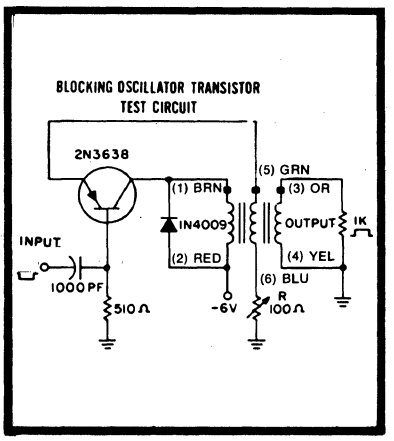
PICO Electronics, Inc.

453 N. MacQuesten Pkwy.. Mt. Vernon. N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

PICO's ultra-miniature PULSE transformers

1/4" x 1/4"





Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T021038:** ..... All units manufactured to MIL-T-21038 and are Hermetically Sealed in a Metal Case
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 1.1 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c maximum).
- **TERMINALS:** ..... Solid .012 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per Mil-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

THIS PRODUCT IS PATENTED

MILITARY DESIGNATION TP7RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS							BLOCKING OSCILLATOR CIRCUIT					PICO PRICES 1–9 *	
H-Series Plug-In	J-Series Insulated Leads	P Width µSec	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp* in-out,	P Width µSec	Rise Time	% Over Shoot	Droop %	% Back Swing	H-Series	J-Series
H-5400	J-5600	0.05	0.2	0.01	0	0	20	50	0.05	0.01	0	0	35	22.94	20.44
H-5405	J-5605	0.1	0.5	0.015	0	0	20	50	0.1	0.012	0	0	25	22.94	20.44
H-5410	J-5610	0.2	1.2	0.02	0	0	20	100	0.2	0.02	0	0	15	22.94	20.44
H-5415	J-5615	0.5	1.5	0.023	0	5	25	100	0.5	0.023	0	5	15	22.94	20.44
H-5420	J-5620	1	1.5	0.025	0	20	28	100	1	0.03	0	10	15	22.94	20.44
H-5425	J-5625	2	1.5	0.028	0	15	23	100	2	0.035	0	10	15	22.94	20.44
H-5430	J-5630	3	1.5	0.030	0	15	28	100	3	0.04	0	10	15	22.94	20.44
H-5435	J-5635	5	2	0.035	0	20	20	200	5	0.040	0	15	15	22.94	20.44
H-5440	J-5640	10	2	0.05	0	25	25	200	10	0.060	0	15	10	22.94	20.44
H-5445	J-5645	15	2	0.06	0	25	18	200	15	0.07	0	15	15	22.94	20.44
H-5450	J-5650	25	3	0.1	0	30	30	500	25	0.08	0	15	15	22.94	20.44
H-5455	J-5655	50	3	0.3	0	20	20	500	50	0.2	0	10	5	22.94	20.44
H-5460	J-5660	100	6	0.4	0	15	18	500	100	0.35	0	10	15	22.94	20.44

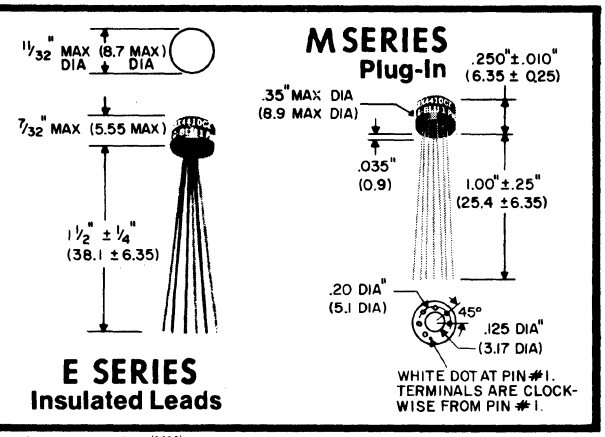
Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1 V

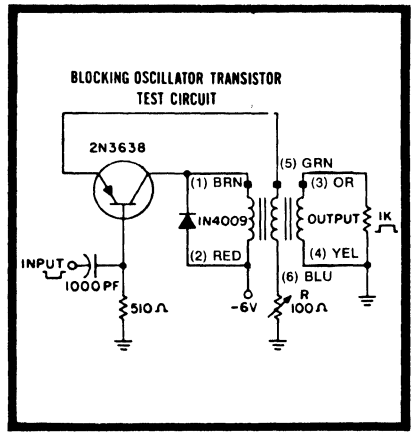
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Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

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Delivery— stock to one week

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565





PICO's ultra-miniature PULSE transformers

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-21038: All units manufactured to MIL-T-21038 and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH: All Units tested AT 200 V RMS
- INSULATION RESISTANCE: and ASTM CCS B452.
- WEIGHT: 1/20 Ounce
- OPERATING TEMPERATURE: -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- TERMINALS:..... Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A Greater than 10,000 Megohms at 300 V DC
- THERMAL SHOCK: 25 Cycles, Method 107C, MIL-STD-202D Test Conduction A-1

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

THIS PRODUCT IS PATENTED

MILITARY DESIGNATION TP7RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS								BLOCKING OSCILLATOR CIRCUIT					D. C. RESISTANCE			PICO PRICES 1–9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH µSEC.	VOLT OUT	RISE TIME µSEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 3 DB	P. WIDTH µSEC.	RISE TIME µSEC.	% OVER SHOOT	DROOP %	% BACK SWING	4 TNS BRN RED	4 TNS OR YEL	1 TURN GRN BLU	E-Series	M-Series
E5020	M5300	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.05	0.02	0	0	35	0.21	0.23	0.13	15.87	17.66
E5040	M5305	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.1	0.025	0	0	25	0.47	0.56	0.17	15.87	17.66
E5060	M5310	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	0.2	0.030	0	0	15	1.0	1.25	0.37	15.87	17.66
E5080	M5315	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	0.5	0.05	0	0	15	1.5	1.80	0.54	15.87	17.66
E5100	M5320	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	1	0.08	0	0	15	2.5	3.1	0.9	15.87	17.66
E5120	M5325	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	2	0.10	0	0	15	3.0	3.7	1.1	15.87	17.66
E5140	M5330	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	3	0.20	0	0	15	4.9	6.0	1.8	15.87	17.66
E5160	M5335	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	5	0.30	0	0	3	8.0	9.7	2.9	15.87	17.66
E5180	M5340	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	10	0.35	0	5	10	13.0	15.8	4.7	15.87	17.66

MILITARY DESIGNATION TP7RX5310CZ TURNS RATIO 5:3:1

															5 TURNS	3 TURNS	1 TURN		
E5200	M3545	0.1	8	0.01	0	0	5	140/50	170 KHz-32 MHz	0.1	0.01	0	0	20	0.55	0.40	0.15	15.93	17.66
E5220	M5350	1	8	0.05	0	6	10	280/100	12.5 KHz-3.3MHz	1	0.02	5	5	5	3.0	2.2	0.9	15.93	17.66
E5240	M5355	5	8	0.09	0	12	25	560/200	15 KHz-4 MHz	5	0.05	0	10	10	9.5	7.0	2.6	15.93	17.66

MILITARY DESIGNATION TP7RX4440CZ TURNS RATIO 4:4:4

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS											PICO PRICES 1–9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH µSEC.	VOLT OUT	RISE TIME µSEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 3 DB	4 TNS BRN RED	4 TNS OR YEL	4 TURNS GRN BLU	E-Series	M-Series
E5181	M-5356	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.21	0.23	0.25	17.66	17.66
E5182	M-5357	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.47	0.56	0.67	17.66	17.66
E5183	M-5358	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	1.0	1.25	1.56	17.66	17.66
E5184	M-5359	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	1.5	1.80	2.2	17.66	17.66
E5185	M-5360	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	2.5	3.1	3.9	17.66	17.66
E5186	M-5361	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	3.0	3.7	4.6	17.66	17.66
E5187	M-5362	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	4.9	6.0	7.4	17.66	17.66
E5188	M-5363	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	8.0	9.7	11.8	17.66	17.66
E5189	M-5364	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	13.0	15.8	19.2	17.66	17.66

Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1 V

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

Delivery— stock to one week

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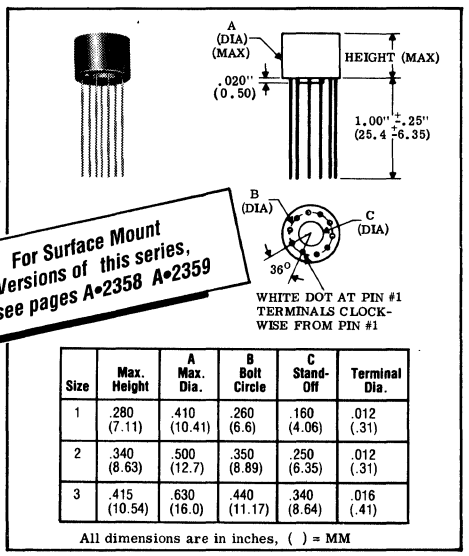
Ultra Miniature DC-DC Converter Transformers

Input Voltages of: 5V, 12V, 24V and 48V

Power Levels up to 40 Watts

All units are magnetically shielded

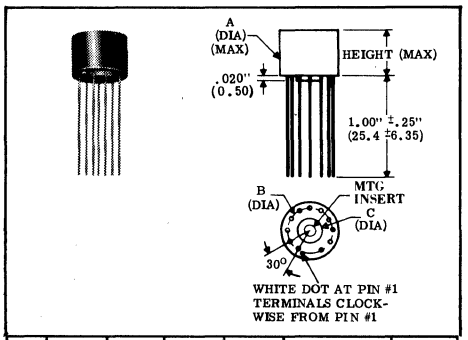
All units can be supplied with higher or lower output voltages. Delivery- stock to one week, special voltages 9 days.



For Surface Mount Versions of this series, see pages A•2358 A•2359

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Terminal Dia.
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)	.012 (.31)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)	.012 (.31)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)	.016 (.41)

All dimensions are in inches, ( ) = MM



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert	Terminal Dia.
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	—	.016 (.41)
5	.650 (16.51)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep	.020 (.51)
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	6-32 UNC 8 Threads Deep	.020 (.51)

All dimensions are in inches, ( ) = MM
Note: Sizes 5 and 6 - pins 5, 8 and 9 are omitted

FEATURES

1) Units can be used as self-saturating or for linear switching applications. Operation over ambient temperature range from —55° to +105°c. All units manufactured to the requirements of MIL-T-27 (TF5S40ZZ)
2) All units can be supplied with higher or lower secondary voltages at the same power levels.
3) Secondary can be connected for full-wave bridge or dual bridge.
4) All units are magnetically shielded.

INPUT 5 VOLTS

PART NUMBER	D. C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	- 55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31021	10	5	±5	1.5W	3W	15K	30K TO 60K	1	37.77
31041	12	6	±6	1.5W	3W	15K	30K TO 60K	1	37.77
31061	28	14	±14	1.5W	3W	15K	30K TO 60K	1	37.77
31081	48	24	±24	1.5W	3W	20K	40K TO 60K	1	37.77
31101	100	50	±50	1.5W	3W	20K	40K TO 60K	1	37.77
32106	10	5	±5	3W	4.5W	15K	30K TO 60K	2	37.77
32126	12	6	±6	3W	4.5W	15K	30K TO 60K	2	37.77
32146	28	14	±14	3W	4.5W	15K	30K TO 60K	2	37.77
32166	48	24	±24	3W	4.5W	20K	40K TO 60K	2	37.77
32186	100	50	±50	3W	4.5W	20K	40K TO 60K	2	37.77
32189	150	75	±75	3W	–	10K	30K TO 60K	2	43.50
32192	200	100	±100	3W	–	10K	30K TO 60K	2	43.50
32195	300	150	±150	3W	–	10K	30K TO 60K	2	43.50
33104	10	5	±5	5W	7.5W	10K	20K TO 50K	3	37.77
33124	12	6	±6	5W	7.5W	10K	20K TO 50K	3	37.77
33144	28	14	±14	5W	7.5W	10K	20K TO 50K	3	37.77
33164	48	24	±24	5W	7.5W	10K	20K TO 50K	3	37.77
33184	100	50	±50	5W	7.5W	10K	20K TO 50K	3	37.77
33187	150	75	±75	5W	–	10K	30K TO 60K	3	43.50
33190	200	100	±100	5W	–	10K	30K TO 60K	3	43.50
33193	300	150	±150	5W	–	10K	30K TO 60K	3	43.50
34501	10	5	±5	10W	14W	10K	20K TO 40K	4	37.77
34521	28	14	±14	10W	14W	10K	20K TO 40K	4	37.77
34541	40	24	±24	10W	14W	10K	20K TO 40K	4	37.77

** Lower switching frequency may be used at lower output power.

INPUT 12 VOLTS

PART NUMBER	D. C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	- 55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31121	12	6	±6	1.5W	3W	15K	30K TO 60K	1	37.77
31141	24	12	±12	1.5W	3W	15K	30K TO 60K	1	37.77
31161	28	14	±14	1.5W	3W	15K	30K TO 60K	1	37.77
31181	48	24	±24	1.5W	3W	20K	40K TO 60K	1	37.77
31201	100	50	±50	1.5W	3W	20K	40K TO 60K	1	37.77
32206	12	6	±6	3W	4.5W	15K	30K TO 60K	2	37.77
32226	24	12	±12	3W	4.5W	15K	30K TO 60K	2	37.77
32246	28	14	±14	3W	4.5W	15K	30K TO 60K	2	37.77
32266	48	24	±24	3W	4.5W	20K	40K TO 60K	2	37.77
32286	100	50	±50	3W	4.5W	20K	40K TO 60K	2	37.77
32289	150	75	±75	3W	–	10K	30K TO 60K	2	43.50
32292	200	100	±100	3W	–	10K	30K TO 60K	2	43.50
32295	300	150	±150	3W	–	10K	30K TO 60K	2	43.50
33204	12	6	±6	5W	7.5W	15K	30K TO 60K	3	37.77
33224	28	14	±14	5W	7.5W	15K	30K TO 60K	3	37.77
33244	48	24	±24	5W	7.5W	20K	40K TO 60K	3	37.77
33264	100	50	±50	5W	7.5W	20K	40K TO 60K	3	37.77
33267	150	75	±75	5W	–	10K	30K TO 60K	3	43.50
33270	200	100	±100	5W	–	10K	30K TO 60K	3	43.50
33273	300	150	±150	5W	–	10K	30K TO 60K	3	43.50
34561	24	12	±12	10W	14W	15K	30K TO 50K	4	37.77
34581	28	14	±14	10W	14W	15K	30K TO 50K	4	37.77
34601	48	24	±24	10W	14W	15K	30K TO 50K	4	37.77
34604	100	50	±50	7.5W	–	10K	30K TO 60K	4	43.50
34607	150	75	±75	7.5W	–	10K	30K TO 60K	4	43.50
34610	200	100	±100	7.5W	–	10K	30K TO 60K	4	43.50
34613	300	150	±150	7.5W	–	10K	30K TO 60K	4	43.50
35110	24	12	±12	17W	25W	–	30K TO 60K	5	54.34
35130	28	14	±14	17W	25W	–	30K TO 60K	5	54.34
35150	48	24	±24	17W	25W	–	30K TO 60K	5	54.34

** Lower switching frequency may be used at lower output power.

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INPUT 24 VOLTS

PART NUMBER	D. C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	- 55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31221	10	5	±5	1.5W	3W	15K	30K TO 60K	1	37.77
31241	28	14	±14	1.5W	3W	15K	30K TO 60K	1	37.77
31261	48	24	±24	1.5W	3W	20K	40K TO 60K	1	37.77
31281	100	50	±50	1.5W	3W	20K	40K TO 60K	1	37.77
32306	10	5	±5	3W	4.5W	15K	30K TO 60K	2	37.77
32326	28	14	±14	3W	4.5W	15K	30K TO 60K	2	37.77
32346	48	24	±24	3W	4.5W	20K	40K TO 60K	2	37.77
32366	100	50	±50	3W	4.5W	20K	40K TO 60K	2	37.77
32369	150	75	±75	3W	–	10K	30K TO 60K	2	43.50
32372	200	100	±100	3W	–	10K	30K TO 60K	2	43.50
32375	300	150	±150	3W	–	10K	30K TO 60K	2	43.50
33284	10	5	±5	5W	7.5W	15K	30K TO 60K	3	37.77
33304	28	14	±14	5W	7.5W	15K	30K TO 60K	3	37.77
33324	48	24	±24	5W	7.5W	20K	40K TO 60K	3	37.77
33344	100	50	±50	5W	7.5W	20K	40K TO 60K	3	37.77
33347	150	75	±75	5W	–	10K	30K TO 60K	3	43.50
33350	200	100	±100	5W	–	10K	30K TO 60K	3	43.50
33353	300	150	±150	5W	–	10K	30K TO 60K	3	43.50
34621	28	14	±14	10W	14W	15K	30K TO 50K	4	37.77
34641	48	24	±24	10W	14W	15K	30K TO 50K	4	37.77
34644	100	50	±50	7.5W	–	10K	30K TO 60K	4	43.50
34647	150	75	±75	7.5W	–	10K	30K TO 60K	4	43.50
34650	200	100	±100	7.5W	–	10K	30K TO 60K	4	43.50
34653	300	150	±150	7.5W	–	10K	30K TO 60K	4	43.50
35170	24	12	±12	17W	25W	–	30K TO 60K	5	54.34
35190	28	14	±14	17W	25W	–	30K TO 60K	5	54.34
35210	48	24	±24	17W	25W	–	30K TO 60K	5	54.34
36710	48	24	±24	25W	40W	–	30K TO 60K	6	65.39
36730	56	28	±28	25W	40W	–	30K TO 60K	6	65.39

** Lower switching frequency may be used at lower output power.

INPUT 48 VOLTS

PART NUMBER	D. C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	- 55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31301	24	12	±12	1.5W	3W	15K	30K TO 60K	1	32.99
31321	48	24	±24	1.5W	3W	20K	40K TO 60K	1	32.99
31341	100	50	±50	1.5W	3W	20K	40K TO 60K	1	32.99
31361	150	75	±75	1.5W	3W	20K	40K TO 60K	1	32.99
32386	24	12	±12	3W	4.5W	15K	30K TO 60K	2	32.99
32406	48	24	±24	3W	4.5W	20K	40K TO 60K	2	32.99
32426	100	50	±50	3W	4.5W	20K	40K TO 60K	2	32.99
32446	150	75	±75	3W	4.5W	20K	40K TO 60K	2	32.99
32449	200	100	±100	3W	4.5W	10K	30K TO 60K	2	38.00
32452	300	150	±150	3W	4.5W	10K	30K TO 60K	2	38.00
33364	24	12	±12	5W	7.5W	15K	30K TO 60K	3	32.99
33384	48	24	±24	5W	7.5W	20K	40K TO 60K	3	32.99
33404	100	50	±50	5W	7.5W	20K	40K TO 60K	3	32.99
33424	150	75	±75	5W	7.5W	20K	40K TO 60K	3	32.99
33427	200	100	±100	5W	–	10K	30K TO 60K	3	38.00
33430	300	150	±150	5W	–	10K	30K TO 60K	3	38.00
34661	24	12	±12	10W	14W	15K	30K TO 50K	4	32.99
34681	48	24	±24	10W	14W	15K	30K TO 50K	4	32.99
34701	56	28	±28	10W	14W	15K	30K TO 50K	4	32.99
34704	100	50	±50	7.5W	–	10K	30K TO 60K	4	38.00
34707	150	75	±75	7.5W	–	10K	30K TO 60K	4	38.00
34710	200	100	±100	7.5W	–	10K	30K TO 60K	4	38.00
34713	300	150	±150	7.5W	–	10K	30K TO 60K	4	38.00
35230	24	12	±12	17W	25W	–	30K TO 60K	5	47.47
35250	48	24	±24	17W	25W	–	30K TO 60K	5	47.47
35270	56	28	±28	17W	25W	–	30K TO 60K	5	47.47
36750	48	24	±24	25W	40W	–	30K TO 60K	6	57.12
36770	56	28	±28	25W	40W	–	30K TO 60K	6	57.12
36790	100	50	±50	25W	40W	–	30K TO 60K	6	57.12

** Lower switching frequency may be used at lower output power.

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

SCHEMATIC FOR SIZES 1, 2 & 3 USING TRANSFORMERS AS SELF-SATURATING

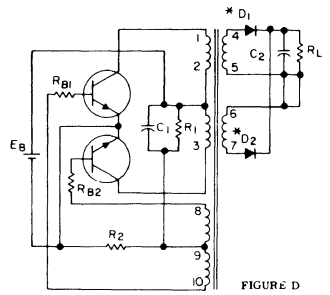


FIGURE D

SCHEMATIC FOR SIZES 1, 2, AND 3 USING TRANSFORMERS AS LINEAR SWITCHING

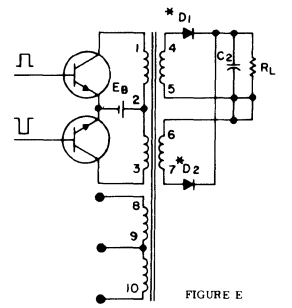


FIGURE E

* D1 AND D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZE 4 USING TRANSFORMER AS SELF-SATURATING

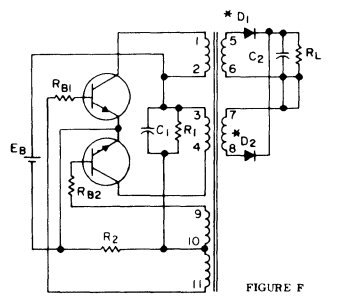


FIGURE F

SCHEMATIC FOR SIZE 4 USING TRANSFORMERS AS LINEAR SWITCHING.

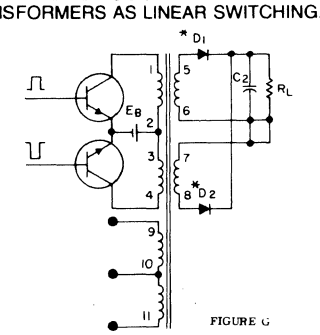


FIGURE G

*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZES 5 & 6 USING TRANSFORMERS AS LINEAR SWITCHING.

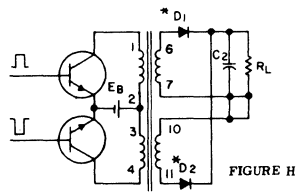


FIGURE H

*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

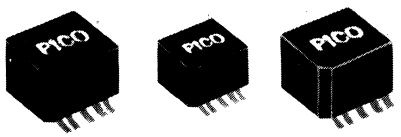
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PICO SURFACE MOUNT

Ultra-Miniature DC-DC Converter Transformers

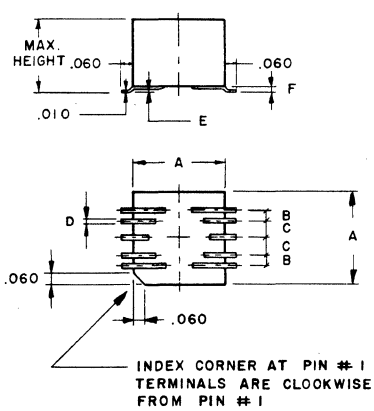
- **These units can be used as self saturated or square wave driven**
- **Input voltages of: 5V, 12V, 24V and 48V**
- **Output voltages up to 300 Volts**
- **Power levels up to 40 Watts**
- **All units are magnetically shielded**

All units can be supplied with higher or lower output voltages. Delivery- stock to one week, special voltages 9 days.



Size	Max. Height	A	B	C	D	E	F
1	.310 (7.87)	.400 (10.16)	.050 (1.27)	.075 (1.91)	.020 (.51)	.012 (.30)	.025 (.64)
2	.365 (9.27)	.495 (12.45)	.055 (1.40)	.095 (2.41)	.020 (.51)	.012 (.30)	.025 (.64)
3	.460 (11.68)	.615 (15.62)	.075 (1.91)	.125 (3.18)	.027 (.69)	.020 (.51)	.033 (.84)

All dimensions are in inches, ( ) = MM



INPUT 5 VOLTS

Part Number	D.C. OUT VOLTS Bridge	Full Wave	Dual Bridge	MAX. POWER OUT −55°c-+105°c	−55°c-+70°c	APPROX. SWITCH FREQ. Self-Saturated	Square-Wave Driven**	SIZE	*** PRICE 1-9
31420	10	5	±5	1.5W	3W	15K	30K TO 60K	1	41.54
31440	12	6	±6	1.5W	3W	15K	30K TO 60K	1	41.54
31460	28	14	±14	1.5W	3W	15K	30K TO 60K	1	41.54
31480	48	24	±24	1.5W	3W	20K	40K TO 60K	1	41.54
31500	100	50	±50	1.5W	3W	20K	40K TO 60K	1	41.54
32505	10	5	±5	3W	4.5W	15K	30K TO 60K	2	41.54
32525	12	6	±6	3W	4.5W	15K	30K TO 60K	2	41.54
32545	28	14	±14	3W	4.5W	15K	30K TO 60K	2	41.54
32565	48	24	±24	3W	4.5W	20K	40K TO 60K	2	41.54
32585	100	50	±50	3W	4.5W	20K	40K TO 60K	2	41.54
32588	150	75	±75	3W	-	10K	30K TO 60K	2	47.86
32591	200	100	±100	3W	-	10K	30K TO 60K	2	47.86
32594	300	150	±150	3W	-	10K	30K TO 60K	2	47.86
33503	10	5	±5	5W	7.5W	10K	20K TO 50K	3	41.54
33523	12	6	±6	5W	7.5W	10K	20K TO 50K	3	41.54
33543	28	14	±14	5W	7.5W	10K	20K TO 50K	3	41.54
33563	48	24	±24	5W	7.5W	10K	20K TO 50K	3	41.54
33583	100	50	±50	5W	7.5W	10K	20K TO 50K	3	41.54
33586	150	75	±75	5W	-	10K	30K TO 60K	3	47.86
33589	200	100	±100	5W	-	10K	30K TO 60K	3	47.86
33592	300	150	±150	5W	-	10K	30K TO 60K	3	47.86

** Lower switching frequency may be used at lower output power.

INPUT 12 VOLTS

Part Number	D.C. OUT VOLTS Bridge	Full Wave	Dual Bridge	MAX. POWER OUT −55°c-+105°c	−55°c-+70°c	APPROX. SWITCH FREQ. Self Saturated	Square-Wave Driven**	Size	*** Price 1-9
31520	12	6	±6	1.5W	3W	15K	30K TO 60K	1	41.54
31440	24	12	±12	1.5W	3W	15K	30K TO 60K	1	41.54
31560	28	14	±14	1.5W	3W	15K	30K TO 60K	1	41.54
31580	48	24	±24	1.5W	3W	20K	40K TO 60K	1	41.54
31600	100	50	±50	1.5W	3W	20K	40K TO 60K	1	41.54
32605	12	6	±6	3W	4.5W	15K	30K TO 60K	2	41.54
32625	24	12	±12	3W	4.5W	15K	30K TO 60K	2	41.54
32645	28	14	±14	3W	4.5W	15K	30K TO 60K	2	41.54
32665	48	24	±24	3W	4.5W	20K	40K TO 60K	2	41.54
32685	100	50	±50	3W	4.5W	20K	40K TO 60K	2	41.54
32688	150	75	±75	3W	-	10K	30K TO 60K	2	47.86
32691	200	100	±100	3W	-	10K	30K TO 60K	2	47.86
32694	300	150	±150	3W	-	10K	30K TO 60K	2	47.86
33603	12	6	±6	5W	7.5W	15K	30K TO 60K	3	41.25
33623	28	14	±14	5W	7.5W	15K	30K TO 60K	3	41.25
33643	48	24	±24	5W	7.5W	20K	40K TO 60K	3	41.25
33663	100	50	±50	5W	7.5W	20K	40K TO 60K	3	41.25
33666	150	75	±75	5W	-	10K	30K TO 60K	3	47.86
33669	200	100	±100	5W	-	10K	30K TO 60K	3	47.86
33672	300	150	±150	5W	-	10K	30K TO 60K	3	47.86

**Lower switching frequency may be used at lower output power.

*** Discount prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

FEATURES

1) Units can be used as self-saturating or for linear switching applications. Operation over ambient temperature range from −55° to +105°c. All units manufactured to the requirements of MIL-T-27 (TF5S40ZZ)
2) All units can be supplied with higher or lower secondary voltages at the same power levels.
3) Secondary can be connected for full-wave bridge or dual bridge.
4) All units are magnetically shielded.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

INPUT 24 VOLTS

Part Number	D.C. OUT VOLTS Bridge	Full Wave	Dual Bridge	MAX. POWER OUT −55°c-+105°c	−55°c-−70°c	APPROX. SWITCH FREQ. Self Saturated	Square-Wave Driven**	Size	*** Price 1-9
31620	10	5	±5	1.5W	3W	15K	30K TO 60K	1	41.54
31640	28	14	±14	1.5W	3W	15K	30K TO 60K	1	41.54
31660	48	24	±24	1.5W	3W	20K	40K TO 60K	1	41.54
31680	100	50	±50	1.5W	3W	20K	40K TO 60K	1	41.54
32705	10	5	±5	3W	4.5W	15K	30K TO 60K	2	41.54
32725	28	14	±14	3W	4.5W	15K	30K TO 60K	2	41.54
32745	48	24	±24	3W	4.5W	20K	40K TO 60K	2	41.54
32765	100	50	±50	3W	4.5W	20K	40K TO 60K	2	41.54
32768	150	75	±75	3W	-	10K	30K TO 60K	2	47.86
32771	200	100	±100	3W	-	10K	30K TO 60K	2	47.86
32774	300	150	±150	3W	-	10K	30K TO 60K	2	47.86
33683	10	5	±5	5W	7.5W	15K	30K TO 60K	3	41.54
33703	28	14	±14	5W	7.5W	15K	30K TO 60K	3	41.54
33723	48	24	±24	5W	7.5W	20K	40K TO 60K	3	41.54
33743	100	50	±50	5W	7.5W	20K	40K TO 60K	3	41.54
33746	150	75	±75	5W	-	10K	30K TO 60K	3	47.86
33749	200	100	±100	5W	-	10K	30K TO 60K	3	47.86
33752	300	150	±150	5W	-	10K	30K to 60K	3	47.86

**Lower switching frequency may be used at lower output power.

INPUT 48 VOLTS

Part Number	D.C. OUT VOLTS Bridge	Full Wave	Dual Bridge	MAX. POWER OUT −55°c-+105°c	−55°c-−70°c	APPROX. SWITCH FREQ. Self Saturated	Square-Wave Driven**	Size	*** Price 1-9
31700	24	12	±12	1.5W	3W	15K	30K TO 60K	1	41.54
31720	48	24	±24	1.5W	3W	20K	40K TO 60K	1	41.54
31740	100	50	±50	1.5W	3W	20K	40K TO 60K	1	41.54
31760	150	75	±75	1.5W	3W	20K	40K TO 60K	1	41.54
32785	24	12	±12	3W	4.5W	15K	30K TO 60K	2	41.54
32805	48	24	±24	3W	4.5W	20K	40K TO 60K	2	41.54
32825	100	50	±50	3W	4.5W	20K	40K TO 60K	2	41.54
32845	150	75	±75	3W	4.5W	20K	40K TO 60K	2	41.54
32848	200	100	±100	3W	4.5W	10K	30K TO 60K	2	47.86
32851	300	150	±150	3W	4.5W	10K	30K TO 60K	2	47.86
33763	24	12	±12	5W	7.5W	15K	30K TO 60K	3	47.86
33783	48	24	±24	5W	7.5W	20K	40K TO 60K	3	47.86
33803	100	50	±50	5W	7.5W	20K	40K TO 60K	3	47.86
33823	150	75	±75	5W	7.5W	20K	40K TO 60K	3	47.86
33826	200	100	±100	5W	-	10K	30K TO 60K	3	47.86
33829	300	150	±150	5W	-	10K	30K TO 60K	3	47.86

**Lower switching frequency may be used at lower output power.

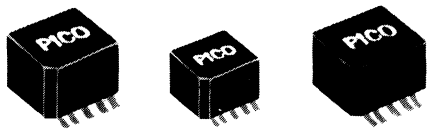
*** Discount prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

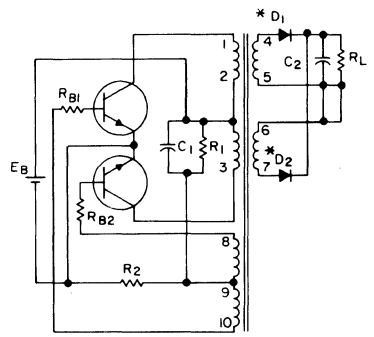
PICO

SURFACE MOUNT

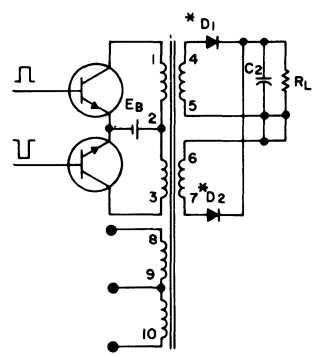
Ultra-Miniature DC-DC Converter Transformers



SCHEMATIC USING TRANSFORMERS AS SELF-SATURATING



SCHEMATIC USING TRANSFORMERS AS LINEAR SWITCHING



* D1 AND D2 USE SCHOTTKY OR FAST SWITCHING DIODES

Delivery— stock to one week

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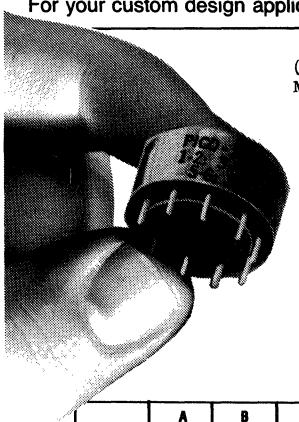
MINIATURIZED SWITCH MODE INVERTER TRANSFORMERS

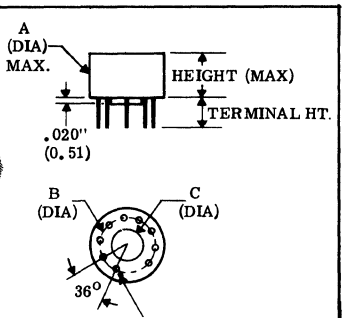
50KHz-150KHz / 10 Watts-60 Watts

Engineers are increasing the frequency of operation in DC-DC Converters for higher power applications. The availability of power MOSFETS which do not exhibit some of the problems encountered with the bi-polar transistors help to ease the Designer's task. For this reason Pico has developed a series of standard 50KHz to 150KHz transformers for use in push-pull circuits.

For low power applications please consider our self saturating transformers shown on pages 20 and 21 which offer many advantages.

For your custom design applications please contact the Factory.





Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Terminal Dia.	Terminal Ht.	Wt. Nominal (Grams)
A	.350 (8.9)	.760 (19.3)	.580 (14.7)	.470 (11.9)	.028 (.71)	.150 (3.8)	8
B	.450 (11.4)	.870 (22.1)	.690 (17.5)	.590 (15.0)	.028 (.71)	.150 (3.8)	14
C	.510 (13.0)	1.110 (28.2)	.915 (23.2)	.750 (19.1)	.035 (.89)	.250 (6.4)	23
D	.650 (16.5)	1.260 (32.0)	1.040 (26.4)	.900 (22.9)	.035 (.89)	.250 (6.4)	37
E	.800 (20.3)	1.510 (38.4)	1.230 (31.2)	1.060 (26.9)	.035 (.89)	.250 (6.4)	54

All dimensions are in inches, ( ) = MM

FEATURES:

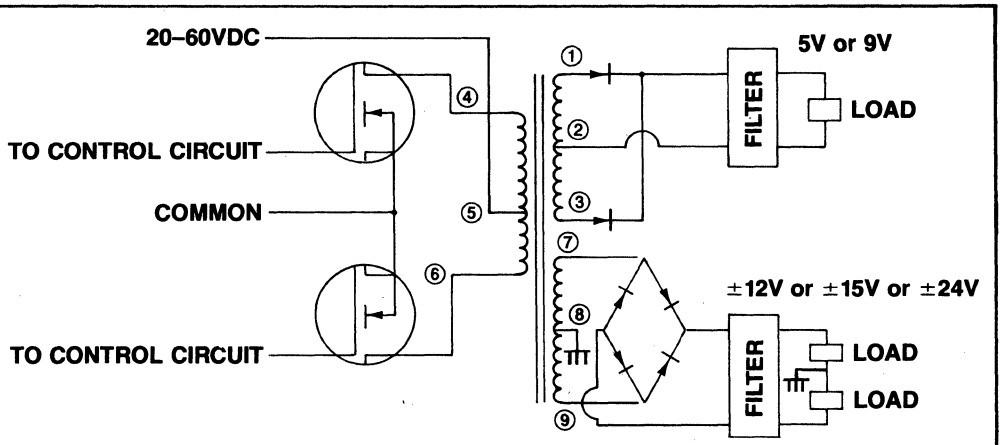
- ***Frequency Range 50KHz–150KHz***
- ***Ultra-Miniature Size***
- ***MIL-T-27E***
- ***Can be used for both MOSFET and Bi-Polar drives***
- ***Magnetically Shielded***
- ***LITZ Wire for Maximum Efficiency***
- ***Special units can be supplied with higher or lower secondary voltages, addition of extra windings and taps, smaller size***

SPECIFICATIONS:

- Frequency Range 50KHz–150KHz
- 20 volt input corresponds to 45% duty cycle (i.e. 4.5μsec on time per pulse for 100KHz operation). Units have been designed with an additional 1 volt output to account for losses in switchers, transformer, rectifier and filter.
- MIL-T-27E
  All units manufactured to MIL-T-27E and are hermetically sealed in a metal case, Type TF5S03ZZ
- Magnetically Shielded
- Operating Temperature ..... −55°C to +90°C
- Dielectric Strength ..... 500V RMS
- Insulation Resistance ..... Greater than 10,000 Megohms at 500V DC
- Thermal Shock ..... 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

PUSH PULL CONVERTER

20 Volt input corresponds to 45% duty cycle (i.e. 4.5μsec on time per pulse for 100KHz operation). Units have been designed with an additional 1 Volt output to account for losses in switcher, transformer, rectifier and filter.



*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery–stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

POWER = 10 WATTS SIZE 0.76″ DIAM. × 0.35″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67010	20–60	5	±12	2	3.5	A	37.70
67030	20–60	5	±15	2	3.5	A	37.70
67050	20–60	5	±24	2	3.5	A	37.70
67070	20–60	9	±12	2	3.5	A	37.70
67090	20–60	9	±15	2	3.5	A	37.70
67110	20–60	9	±24	2	3.5	A	37.70

POWER = 20 WATTS SIZE 0.87″ DIAM. × 0.45″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67130	20–60	5	±12	2.5	4	B	44.35
67150	20–60	5	±15	2.5	4	B	44.35
67170	20–60	5	±24	2.5	4	B	44.35
67190	20–60	9	±12	2.5	4	B	44.35
67210	20–60	9	±15	2.5	4	B	44.35
67230	20–60	9	±24	2.5	4	B	44.35

POWER = 30 WATTS SIZE 1.11″ DIAM. × 0.51″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67250	20–60	5	±12	1	1	C	52.18
67270	20–60	5	±15	1	1	C	52.18
67290	20–60	5	±24	1	1	C	52.18
67310	20–60	9	±12	1	1	C	52.18
67330	20–60	9	±15	1	1	C	52.18
67350	20–60	9	±24	1	1	C	52.18

POWER = 45 WATTS SIZE 1.26″ DIAM. × 0.65″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67370	20–60	5	±12	0.7	0.35	D	61.40
67390	20–60	5	±15	0.7	0.35	D	61.40
67410	20–60	5	±24	0.7	0.35	D	61.40
67430	20–60	9	±12	0.7	0.35	D	61.40
67450	20–60	9	±15	0.7	0.35	D	61.40
67470	20–60	9	±24	0.7	0.35	D	61.40

POWER = 60 WATTS SIZE 1.51″ DIAM. × 0.80″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67490	20–60	5	±12	0.6	0.4	E	72.23
67510	20–60	5	±15	0.6	0.4	E	72.23
67530	20–60	5	±24	0.6	0.4	E	72.23
67550	20–60	9	±12	0.6	0.4	E	72.23
67570	20–60	9	±15	0.6	0.4	E	72.23
67590	20–60	9	±24	0.6	0.4	E	72.23

*MEASURED AT TERMINALS 4-6 WITH 5 VOLTS RMS-100KHz
**MEASURED AT TERMINALS 4-6 WITH 1-3 AND 7-9 SHORTED (0.IV RMS-300 KHz)
***DISCOUNT PRICES: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery—stock to one week

PICO Electronics, Inc.

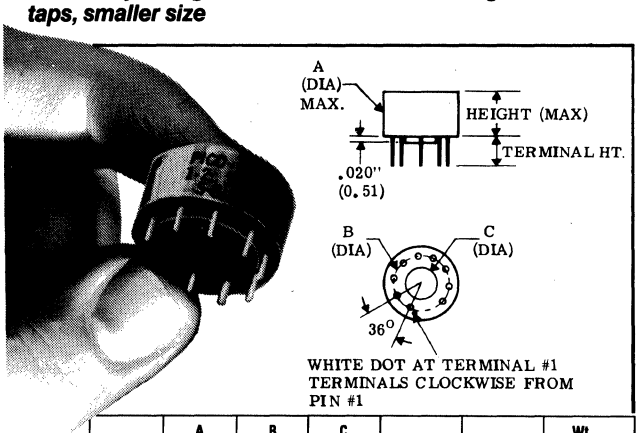
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • FAX 914-699-5565

MINIATURE FLYBACK CONVERTER TRANSFORMERS

10 Watts - 50 Watts / 50KHz - 100KHz

FEATURES:

- ***Frequency Range 50KHz–100KHz***
- ***Ultra-Miniature Size***
- ***MIL-T-27E***
- ***Magnetically Shielded***
- ***Special units can be supplied with higher or lower secondary voltages, addition of extra windings and taps, smaller size***



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-off	Terminal Dia.	Terminal Ht.	Wt. Nominal (Grams)
A	.450 (11.4)	.870 (22.1)	.690 (17.5)	.590 (15.0)	.028 (.71)	.150 (3.8)	14
B	.510 (13.0)	1.110 (28.2)	.915 (23.2)	.750 (19.1)	.035 (.89)	.250 (6.4)	23
C	.650 (16.5)	1.260 (32.0)	1.040 (26.4)	.900 (22.9)	.035 (.89)	.250 (6.4)	37
D	.800 (20.3)	1.510 (38.4)	1.230 (31.2)	1.060 (26.9)	.035 (.89)	.250 (6.4)	54
E	.950 (24.13)	1.750 (44.45)	1.400 (35.56)	1.060 (26.92)	.035 (.89)	.250 (6.4)	80

All dimensions are in inches. ( ) = MM

These Transformers are used in flyback converters where from a wide range of input variation a regulated output is obtained. Circuit simplicity and multiple isolated outputs are some of the advantages of this topology.

All units can be supplied with higher or lower secondary voltages. Additional windings, taps or lower power are also available.

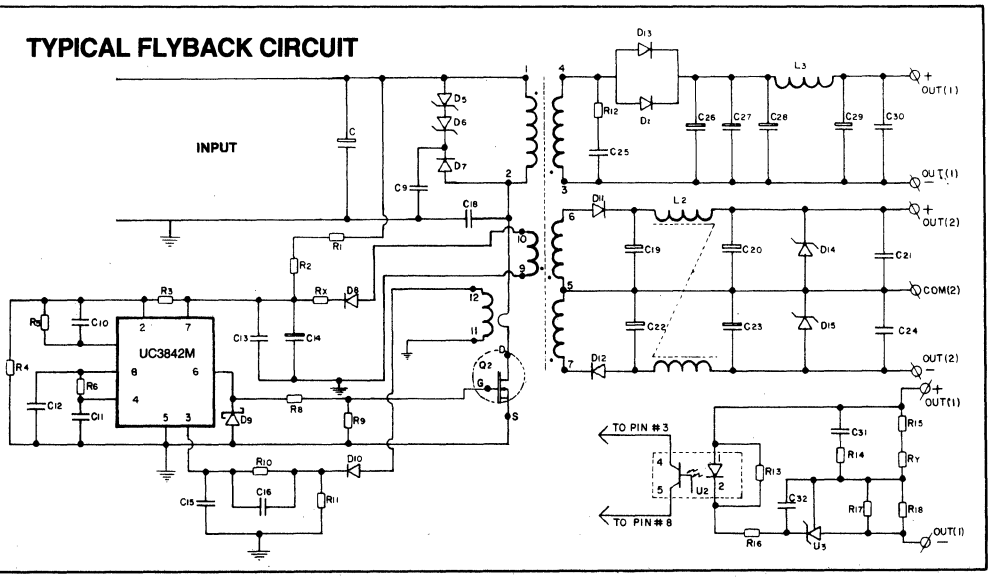
For low power applications please consider our self saturating transformers shown on pages 24 and 25 which offer many advantages.

For your custom design applications please contact the factory.

SPECIFICATIONS:

- Frequency Range 50KHz–100KHz
- MIL-T-27E
  All units manufactured to MIL-T-27 and are hermetically sealed in a metal case, Type TF5S03ZZ
- Magnetically Shielded
- Operating Temperature .... −55°C to +130°C
- Ambient Temperature ..... −55°C to +90°C (full power)
- Dielectric Strength ..... 500V RMS
- Insulation Resistance ..... Greater than 10,000 Megohms at 500V DC
- Thermal Shock ..... 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

TYPICAL FLYBACK CIRCUIT



Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

914-699-5514
FAX 914-699-5565

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

POWER = 10 WATTS SIZE .870″ DIAM. × .450″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (VOLTS)	SECONDARY OUTPUT #1 (VOLTS)	SECONDARY OUTPUT #2 (VOLTS)	TYPICAL* PRIMARY INDUCTANCE (MICROHENRY)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (MICROHENRY)	SIZE	*** PRICE 1–9
67600	8–24	5	±12	12.5	175	A	37.50
67605	8–24	5	±15	12.5	175	A	37.50
67610	8–24	5	±24	12.5	175	A	37.50
67615	18–36	5	±12	50	700	A	37.50
67620	18–36	5	±15	50	700	A	37.50
67725	18–36	5	±24	50	700	A	37.50
67730	36–72	5	±12	200	2800	A	37.50
67735	36–72	5	±15	200	2800	A	37.50
67740	36–72	5	±24	200	2800	A	37.50

POWER = 20 WATTS SIZE 1.110″ DIAM. × .510″ HT.

67745	8-24	5	±12	6.25	55	B	44.35
67750	8-24	5	±15	6.25	55	B	44.35
67755	8-24	5	±24	6.25	55	B	44.35
67760	18-36	5	±12	25	215	B	44.35
67765	18-36	5	±15	25	215	B	44.35
67770	18-36	5	±24	25	215	B	44.35
67775	36-72	5	±12	100	860	B	44.35
67780	36-72	5	±15	100	860	B	44.35
67785	36-72	5	±24	100	860	B	44.35

POWER = 30 WATTS SIZE 1.260″ DIAM. × .650″ HT.

67790	8-24	5	±12	3.75	30	C	52.18
67795	8-24	5	±15	3.75	30	C	52.18
67800	8-24	5	±24	3.75	30	C	52.18
67805	18-36	5	±12	15	120	C	52.18
67810	18-36	5	±15	15	120	C	52.18
67815	18-36	5	±24	15	120	C	52.18
67820	36-72	5	±12	60	480	C	52.18
67825	36-72	5	±15	60	480	C	52.18
67830	36-72	5	±24	60	480	C	52.18

POWER = 40 WATTS SIZE 1.510″ DIAM. × .800″ HT.

67835	8-24	5	±12	2.5	20	D	61.40
67840	8-24	5	±15	2.5	20	D	61.40
67845	8-24	5	±24	2.5	20	D	61.40
67850	18-36	5	±12	10	70	D	61.40
67855	18-36	5	±15	10	70	D	61.40
67860	18-36	5	±24	10	70	D	61.40
67865	36-72	5	±12	40	280	D	61.40
67870	36-72	5	±15	40	280	D	61.40
67875	36-72	5	±24	40	280	D	61.40

POWER = 50 WATTS SIZE 1.750″ DIAM. × .950″ HT.

67880	8-24	5	±12	02	15	E	72.23
67885	8-24	5	±15	02	15	E	72.23
67890	8-24	5	±24	02	15	E	72.23
67895	18-36	5	±12	08	60	E	72.23
67900	18-36	5	±15	08	60	E	72.23
67905	18-36	5	±24	08	60	E	72.23
67910	36-72	5	±12	32	240	E	72.23
67915	36-72	5	±15	32	240	E	72.23
67920	36-72	5	±24	32	240	E	72.23

*MEASURED AT TERMINALS 4-6 WITH 5 VOLTS RMS-100KHz
**MEASURED AT TERMINALS 4-6 WITH 1-3 AND 7-9 SHORTED (0.IV RMS-300 KHz)
***DISCOUNT PRICES: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

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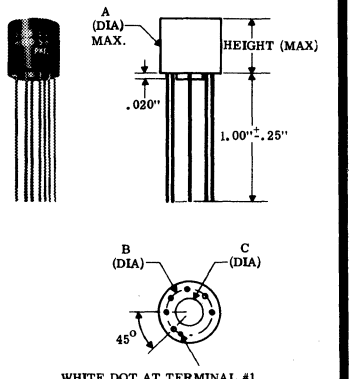
Delivery— stock to one week

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PICO's miniature 400 Hz transformers

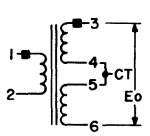
115V/26V Primary Printed Circuit Construction



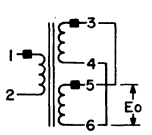
Case Size	Height (Max.)	A (Dia.) Max.	B (Dia.)	C (Dia.)	Terminal Dia.
L	.35	.51	.35	.218	.016 (.41)
N	.5	.51	.35	.218	.016 (.41)
R	.375	.75	.6	.475	.016 (.41)
S	.52	.75	.6	.475	.020 (.51)
T	.82	.75	.6	.475	.020 (.51)

FEATURES
- 400 Hz Aerospace Application
- Smallest Possible Size
- Printed Circuit Plug-In Construction
- Secondary Has Split Winding (Secondary can Be Used at Half Voltage Twice the Current.)

SPECIFICATIONS
- Manufactured to MIL-T-27 (TF5S03ZZ)
- 90°c Ambient
- Input Primary 115v-400 Hz ±20 Hz or 26V-400HZ-±20 Hz (Your Choice-Just Choose The Proper Part No.)
- Regulation is 24% (T Units Have Regulation of 17%)
- Secondary Voltage Adjusted to Nominal Value at Half Load.



SERIES CONNECTED SECONDARY



PARALLEL CONNECTED SECONDARY

This Product is Patented

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1–9*
5.0 CT	75	L	L-8948	L-8951	32.19
	150	N	N-6948	N-6951	32.19
	204	R	R-20650	R-20815	47.54
	338	S	S-21650	S-21815	42.28
	480	T	T-22650	T-22815	44.09
6.3 CT	59.5	L	L-8947	L-8952	32.19
	119	N	N-6947	N-6952	32.19
	162	R	R-20655	R-20820	47.54
	268	S	S-21655	S-21820	42.28
	381	T	T-22655	T-22820	44.09
8.0 CT	47	L	L-8946	L-8953	32.19
	94	N	N-6946	N-6953	32.19
	128	R	R-20660	R-20825	47.54
	211	S	S-21660	S-21825	42.28
	300	T	T-22660	T-22825	44.09
10 CT	37.5	L	L-8945	L-8954	32.19
	75	N	N-6945	N-6954	32.19
	102	R	R-20665	R-20830	47.54
	169	S	S-21665	S-21830	42.28
	240	T	T-22665	T-22830	44.09
12.8 CT	29	L	L-8940	L-8956	32.19
	58.6	N	N-6940	N-6956	32.19
	79.7	R	R-20670	R-20835	47.54
	132	S	S-21670	S-21835	42.28
	188	T	T-22670	T-22835	44.09
14 CT	26.8	L	L-8937	L-8957	32.19
	53.6	N	N-6937	N-6957	32.19
	72.9	R	R-20675	R-20840	47.54
	121	S	S-21675	S-21840	42.28
	171	T	T-22675	T-22840	44.09
16 CT	23	L	L-8935	L-8958	32.19
	47	N	N-6935	N-6958	32.19
	63.8	R	R-20680	R-20845	47.54
	106	S	S-21680	S-21845	42.28
	150	T	T-22680	T-22845	44.091
18 CT	20.8	L	L-8934	L-8959	32.19
	41.7	N	N-6934	N-6959	32.19
	56.7	R	R-20685	R-20850	47.54
	93.9	S	S-21685	S-21850	42.28
	133	T	T-22685	T-22850	44.09
20 CT	18.8	L	L-8933	L-8961	32.19
	37.5	N	N-6933	N-6961	32.19
	51	R	R-20690	R-20855	47.54
	84.5	S	S-21690	S-21855	42.28
	120	T	T-22690	T-22855	44.09
22 CT	17	L	L-8932	L-8962	32.19
	34	N	N-6932	N-6962	32.19
	46.4	R	R-20695	R-20860	47.54
	76.8	S	S-21695	S-21860	42.28
	109	T	T-22695	T-22860	44.09
24 CT	15.5	L	L-8930	L-8963	32.19
	31	N	N-6930	N-6963	32.19
	42.5	R	R-20700	R-20865	47.54
	70.4	S	S-21700	S-21865	42.28
	100	T	T-22700	T-22865	44.09
28 CT	13.4	L	L-8929	L-8964	32.19
	26.8	N	N-6929	N-6964	32.19
	36.4	R	R-20705	R-20870	47.54
	60.4	S	S-21705	S-21870	42.28
	85.7	T	T-22705	T-22870	44.09
31 CT	12	L	L-8927	L-8966	32.19
	24	N	N-6927	N-6966	32.19
	32.9	R	R-20710	R-20875	47.54
	54.5	S	S-21710	S-21875	42.28
	77.4	T	T-22710	T-22875	44.09
36 CT	10.4	L	L-8925	L-8967	32.19
	20.8	N	N-6925	N-6967	32.19
	28.3	R	R-20715	R-20880	47.54
	46.9	S	S-21715	S-21880	42.28
	66.7	T	T-22715	T-22880	44.09
39 CT	9.6	L	L-8924	L-8968	32.19
	19.2	N	N-6924	N-6968	32.19
	26.2	R	R-20720	R-20885	47.54
	43.3	S	S-21720	S-21885	42.28
	61.5	T	T-22720	T-22885	44.09

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1–9*
43 CT	8.7	L	L-8923	L-8969	32.19
	17.4	N	N-6923	N-6969	32.19
	23.7	R	R-20725	R-20890	47.54
	39.3	S	S-21725	S-21890	42.28
	55.8	T	T-22725	T-22890	44.09
48 CT	7.8	L	L-8922	L-8971	32.19
	15.6	N	N-6922	N-6971	32.19
	21.1	R	R-20730	R-20895	47.54
	35.2	S	S-21730	S-21895	42.28
	50	T	T-22730	T-22895	44.09
56 CT	6.6	L	L-8920	L-8972	32.19
	13.2	N	N-6920	N-6972	32.19
	18.2	R	R-20735	R-20900	47.54
	30.2	S	S-21735	S-21900	42.28
	42.9	T	T-22735	T-22900	44.09
63 CT	6	L	L-8917	L-8973	32.19
	11.9	N	N-6917	N-6973	32.19
	16.2	R	R-20740	R-20905	47.54
	26.9	S	S-21740	S-21905	42.28
	38.2	T	T-22740	T-22905	44.09
68 CT	5.5	L	L-8915	L-8974	32.19
	11	N	N-6915	N-6974	32.19
	15	R	R-20745	R-20910	47.54
	24.9	S	S-21745	S-21910	42.28
	35.3	T	T-22745	T-22910	44.09
80 CT	4.6	L	L-8910	L-8976	32.19
	9.4	N	N-6910	N-6976	32.19
	12.1	R	R-20750	R-20915	47.54
	21.1	S	S-21750	S-21915	42.28
	30	T	T-22750	T-22915	44.09
88 CT	4.2	L	L-8905	L-8977	32.19
	8.5	N	N-6905	N-6977	32.19
	11.6	R	R-20755	R-20920	47.54
	19.2	S	S-21755	S-21920	42.28
	27.3	T	T-22755	T-22920	44.09
100 CT	3.7	L	L-8902	L-8978	32.19
	8.5	N	N-6902	N-6978	32.19
	10.2	R	R-20760	R-20925	47.54
	16.9	S	S-21760	S-21925	42.28
	24	T	T-22760	T-22925	44.09
115 CT	3.2	L	L-8900	L-8979	32.19
	6.5	N	N-6900	N-6979	32.19
	8.9	R	R-20765	R-20930	47.54
	14.7	S	S-21765	S-21930	42.28
	20.9	T	T-22765	T-22930	44.09
123 CT	8.3	R	R-20770	R-20935	47.54
	13.7	S	S-21770	S-21935	42.28
	19.5	T	T-22770	T-22935	44.09
138 CT	7.4	R	R-20775	R-20940	47.54
	12.2	S	S-21775	S-21940	42.28
	17.4	T	T-22775	T-22940	44.09
157 CT	6.5	R	R-20780	R-20945	47.54
	10.8	S	S-21780	S-21945	42.28
	15.3	T	T-22780	T-22945	44.09
175 CT	5.8	R	R-20785	R-20950	47.54
	9.6	S	S-21785	S-21950	42.28
	13.7	T	T-22785	T-22950	44.09
200 CT	5.1	R	R-20790	R-20955	47.54
	8.4	S	S-21790	S-21955	42.28
	12	T	T-22790	T-22955	44.09
220 CT	7.7	S	S-21795	S-21960	44.43
	10.9	T	T-22795	T-22960	46.32
250 CT	6.8	S	S-21800	S-21965	46.54
	9.6	T	T-22800	T-22965	48.53
275 CT	6.1	S	S-21805	S-21970	48.85
	8.7	T	T-22805	T-22970	52.95
310 CT	5.4	S	S-21810	S-21975	50.79
	7.7	T	T-22810	T-22975	57.00

Ordering Instructions: No minimum. Net 30 days
F.O.B. Mt. Vernon, New York

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery— stock to one week

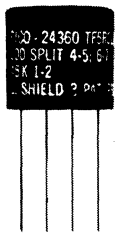
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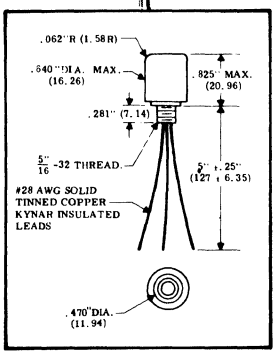
PICO Microphone/Transducer Audio Input Transformers

Used for Professional Sound Studios/Broadcast Mixing Consoles/Control and Instrument Amplifiers.

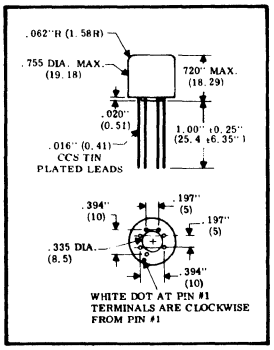
Interchangeable with transformers made by Beyer Dynamic of Germany.







NOTE:
ALL DIMENSIONS ARE IN INCHES, ( ) = MM



NOTES:
ALL DIMENSIONS ARE IN INCHES, ( ) MM.
CCS-COPPER CLAD STEEL, TINNED 100°c.
ELECTROPLATED PER MIL-T-10727A AND ASTM CCS B452.

- ***Large step-up ratios with flat frequency response over the entire audio range.***
- ***Gapless laminations provide wide bandwidth with extremely low distortion. Use of two magnetic shields made with extra thick mu-metal and gapless core provide negligible hum pick up. All units provided with electrostatic shield.***
- ***Your choice of two package styles, stud mounting with flying leads or low profile plug-in. Identical electrical performance regardless of package style.***
- ***Frequency response ±1 dB, 30 Hz – 15 kHz.***
- ***Low profile plug-in (24000 series) manufactured to MIL-T-27 (TF5R21ZZ).***
- ***Because of gapless laminations, unbalanced DC current should be avoided.***
- ***Typical distortion of 1% at power level of 0 dBm (1 Milliwatt), 30 Hz – 15 kHz. If the low frequency is raised, the power level for 1% distortion is as follows:***

50 Hz - 3 Milliwatts (4.7 dBm)
100 Hz - 10 Milliwatts (10 dBm)
300 Hz - 150 Milliwatts (21.7 dBm)

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

All units have two extra thick mu-metal shields.

Delivery-Stock to 1 week

Modification of standards 9 days!

THIS PRODUCT IS PATENTED

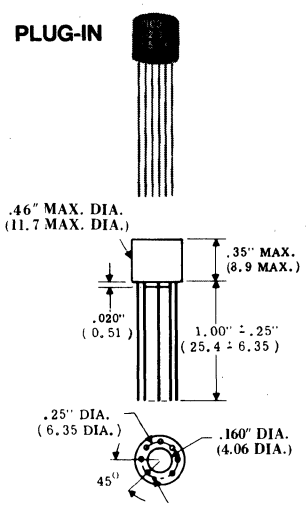
PART NUMBER		IMPEDANCE OHMS		TURNS RATIO PRIM/SEC		D.C. RESISTANCE			TYPICAL PRIM OPEN CIRCUIT IMPEDANCE AT 50 Hz	REPLACES BEYER/GERMANY PART NUMBER		PRICES 1–9***	
COMMERCIAL STUD MOUNTING	MILITARY PLUG-IN	PRIM	SEC	PRIM SERIES CONN	PRIM PAR CONN	PRIM SERIES CONN	PRIM PAR CONN	SEC		STUD MOUNTING (23000 SERIES)	PLUG-IN (24000 SERIES)	COMMERCIAL STUD MOUNTING	MILITARY PLUG-IN
23120	24120	12.5	5K	1:20	–	4.6	–	1K	125	TR-BV35704	STR-BV37704	36.07	43.34
23140	24140	200	200	1:1	–	50	–	75	2K	351 001 001	370 001 001	34.13	39.81
23160	24160	200 ct/50 SPLIT	200	1:1	1:2	50	12.5	75	2K	351 201 001	370 201 001	33.64	40.92
23180	24180	200	2K	1:3.16	–	50	–	580	2K	351 003 002	370 003 002	34.13	39.81
23200	24200	200 ct/50 SPLIT	2K	1:3.16	1:6.33	50	12.5	580	2K	351 203 002	370 203 002	33.64	40.92
23220	24220	200	5K	1:5	–	50	–	1.45K	2K	351 005 003	370 005 003	34.05	39.81
23240	24240	200 ct/50 SPLIT	5K	1:5	1:10	50	12.5	1.45K	2K	351 205 003	370 205 003	34.05	44.65
23260	24260	200	10K	1:7.07	–	50	–	3.45K	2K	351 007 004	370 007 004	33.64	40.92
23280	24280	200 ct/50 SPLIT	10K	1:7.07	1:14.14	50	12.5	3.45K	2K	351 207 004	370 207 004	38.49	45.77
23300	24300	200	20K	1:10	–	85	–	4.75K	2K	351 010 005	370 010 005	35.01	42.24
23320	24320	200 ct/50 SPLIT	20K	1:10	1:20	85	21	4.75K	2K	351 210 005	370 210 005	39.81	47.08
23340	24340	200	45K	1:15	–	85	–	10.4 K	2K	351 015 006	370 015 006	41.65	48.17
23360	24360	200 ct/50 SPLIT	45K	1:15	1:30	85	21	10.4 K	2K	351 215 006	370 215 006	45.77	52.99
23380	24380	200	80K	1:20	–	115	–	13.5 K	2K	351 020 007	370 020 007	43.34	50.57
23400	24400	200 ct/50 SPLIT	80K	1:20	1:40	115	29	13.5 K	2K	351 220 007	370 220 007	48.17	55.40
23420	24420	600 ct	600	1:1	–	140	–	190	6K	TR-145/BV35508 351 101 031	STR-145/BV37508 370 101 031	33.64	40.92
23440	24440	600 ct/150 SPLIT	600	1:1	1:2	140	35	190	6K	351 201 031	370 201 031	41.65	43.34
23460	24460	600 ct/150 SPLIT	2.4K	1:2	1:4	140	35	575	6K	351 202 032	370 202 032	38.49	45.77
23480	24480	600 ct/150 SPLIT	6K	1:3.16	1:6.33	140	35	1.45 K	6K	351 203 033	370 203 033	40.94	46.02
23500	24500	600 ct/150 SPLIT	15K	1:5	1:10	140	35	3.9 K	6K	351 205 034	370 205 034	43.34	50.57
23520	24520	600 ct/150 SPLIT	30K	1:7.07	1:14.14	140	35	7.05 K	6K	351 207 035	370 207 035	45.77	52.99
23540	24540	600 ct/150 SPLIT	60K	1:10	1:20	199	50	11 K	6K	351 210 036	370 210 036	48.17	55.40
23560	24560	1.2K ct/300 SPLIT	1.2K	1:1	1:2	310	78	430	12K	351 201 061	370 201 061	36.07	43.34
23580	24580	1.2K ct/300 SPLIT	5K	1:2.04	1:4.08	310	78	1.4 K	12K	351 202 062	370 202 062	38.49	45.77
23600	24600	1.2K ct/300 SPLIT	12K	1:3.16	1:6.33	310	78	3.75 K	12K	351 203 063	370 203 063	40.94	46.02
23620	24620	1.2K ct/300 SPLIT	30K	1:5	1:10	475	119	8.45 K	12K	351 205 064	370 205 064	43.34	50.57
23640	24640	10K	10K	1:1	–	2.5 K	–	3.1 K	100K	TR-145/BV35590	STR-145/BV37590	34.13	39.81

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

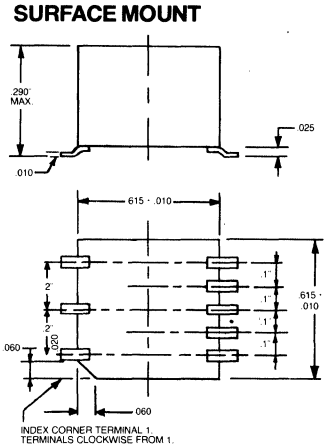
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MIL-STD-1553 Interface Transformers Multiplex Data BUS Pulse Transformers

PLUG-IN



SURFACE MOUNT

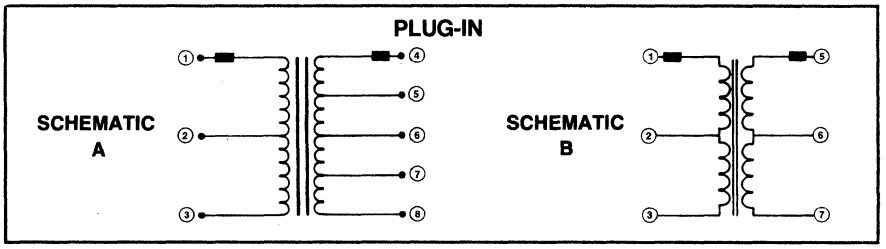


These pulse transformers manufactured to MIL-STD-1553 COMMAND/RESPONSE MULTIPLEX DATA BUS requirements. They also are manufactured to MIL-T-21038 specifications and are designed to meet MAC AIR SPECIFICATIONS A3818, A5690, A5232 and A4905.

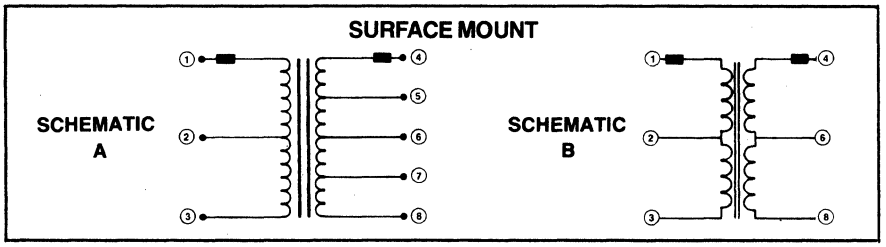
All of these transformers exhibit superior electrical performance. Common mode rejection ratio is greater than 45dB at 1 MHz. Input impedance is greater than 3000 ohms over the band from 75 kHz to 1mHz at 1V rms. This series possesses exceptional waveform integrity: Rise time and fall time is less than 100 nanoseconds. Overshoot and ringing is less than ± 1V peak. Droop is less than 20%.

PICO PART NUMBER PLUG-IN	PICO PART NUMBER SURFACE MOUNT	TURNS RATIO	PRIMARY	SECONDARY	% DROOP (Typical)	CMR dB (Typical)	SCHEMATIC	PRICE (1–9)
68010	68110	1CT : 1CT 1CT : .707CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68020	68120	1.4CT : 1CT 2CT : 1CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68030	68130	1.25CT : 1CT 1.66CT : 1CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68040	68140	2.3CT : 1CT 3.2CT : 1 CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68050	68150	1CT : 1CT	1–3	5–7	10	50	B	27.76
68060	68160	1CT : 1.41CT	1–3	5–7	10	50	B	27.76
68070	68170	1CT : 1.66CT	1–3	5–7	10	50	B	27.76
68080	68180	1CT : 2CT	1–3	5–7	10	50	B	27.76

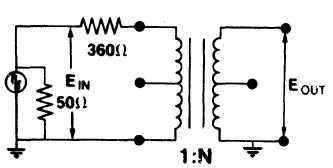
PLUG-IN



SURFACE MOUNT

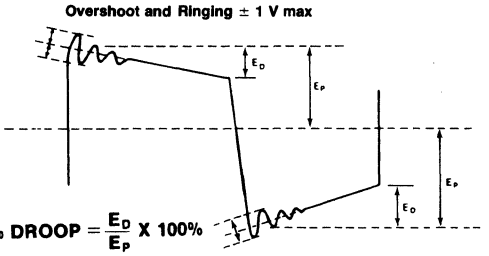


DROOP MEASUREMENT



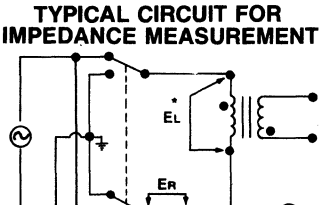
$E_{IN} = 27V_{P-P}$
Freq. = 250 KHz
T_{RIN} = 100 ns max

Overshoot and Ringing ± 1 V max



$$\% \text{ DROOP} = \frac{E_D}{E_P} \times 100\%$$

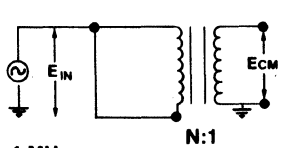
TYPICAL CIRCUIT FOR IMPEDANCE MEASUREMENT



$$Z = \frac{E_L \times 100\Omega}{E_R}$$

*Across high turn side

COMMON MODE REJECTION MEASUREMENT



f = 1 MHz
E_{IN} = 10V_{RMS}
$CMR = 20 \log_{10} \frac{E_{IN}}{E_{CM}}$

SPECIFICATIONS:

- Units manufactured to MIL-T-21038 and MIL STD 1553
- IMPEDANCE ..... greater than 3KΩ over the band from 75kHz to 1MHz
- DROOP ..... 20% max.
- OVERSHOOT ..... 1V peak
- COMMON MODE REJECTION (CMR) greater than 45dB.
- DIELECTRIC STRENGTH: ..... All Units Tested at 200 V RMS.
- INSULATION RESISTANCE ..... Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: ... PLUG-IN 4 Grams. SURFACE MOUNT 5 Grams.
- OPERATING TEMPERATURE: ..... −55°c to +130°c).
- TERMINALS: Meet solderability per MIL- STD-202 Method 208
  PLUG-IN: Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
  SURFACE MOUNT: Conductor is copper clad steel, Tin Dipped.

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eem MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

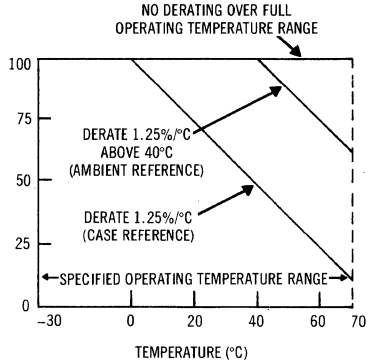


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

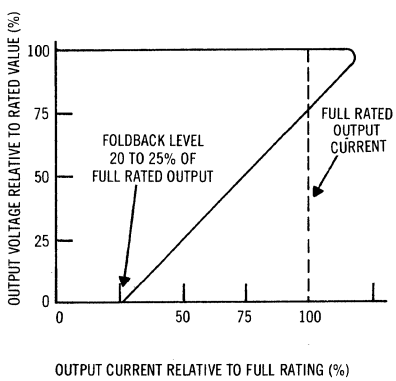


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

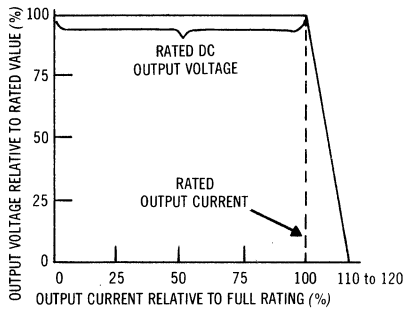


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

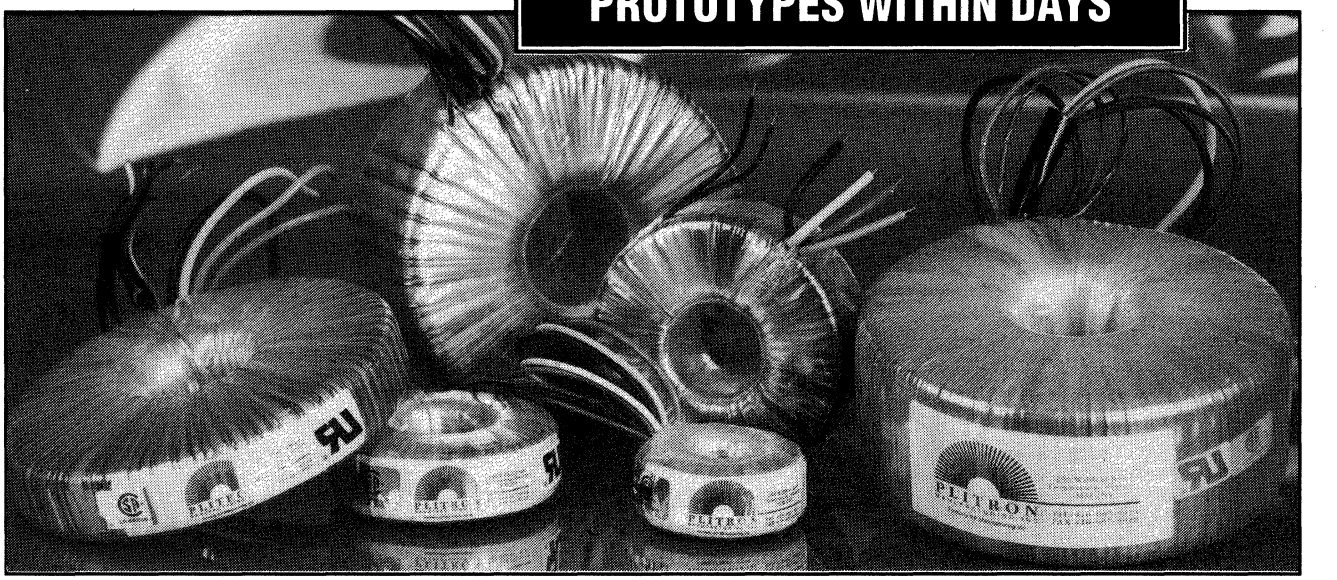
Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

PLITRON
MANUFACTURING INC

TOROIDAL TRANSFORMERS

CUSTOM QUOTES WITHIN HOURS
PROTOTYPES WITHIN DAYS



THE TOROIDAL ADVANTAGE

HIGH ELECTRICAL EFFICIENCY

The continuously wound core of the toroidal transformer has no air gap, resulting in a stacking factor of 95% of its theoretical weight. Since all the windings are symmetrically spread over the entire round gapless core, a higher flux density is possible (toroidal transformers operate at flux densities of 16 to 18 kilogauss, while traditional laminated transformers operate at 12 to14 kilogauss). The magnetic flux is in the same direction as the grain oriented silicon steel core, thus achieving very high electrical efficiencies. Typical efficiency figures for toroidal transformers are 95%. Also, because of low magnetizing current, a toroid requires only 10% of the off load power required by conventional transformers.

SMALL SIZE AND WEIGHT

A product of the high efficiency of toroidal transformers is reduced size and weight. Typically 50% lighter and smaller than conventional laminated transformers. Furthermore, the diameter to height ratio of a toroid can easily be varied (as long as the cross sectional is held constant) to suit the mechanical design - great for low profile equipment.

LOW STRAY MAGNETIC FIELDS

Toroids have no air gaps, and windings are uniformly wound around the core, which results in insignificant amounts of magnetic radiation. This eliminates the need for special shielding and makes toroidal transformers especially suitable for applications in sensitive electronic equipment, such as: low level amplifiers, medical equipment, and CRTs.

REDUCED TRANSFORMER HUM

The absence of an air gap typically provides an 8:1 reduction of induced noise. In addition, the windings enveloping the core effectively reduce magnetostriction — the main source of the familiar 'hum' found in standard vertically laminated transformers.

LOW OPERATING TEMPERATURE

PLITRON toroids have Fe losses measured typically as 1.1 w/Kg. These low losses provide cooler operating temperatures and low magnetizing current.

EASY TO MOUNT

A single center screw quickly and easily mounts a toroidal transformer. Compared to laminated transformer mounting, this cuts down on parts as well as assembly time in your product.

PLITRON PRODUCTS

STANDARD POWER TRANSFORMER LINE

A broad range of high quality, UL and CSA approved, toroidal transformers. Designed for general purpose applications (specifications on facing page).

OEM POWER TRANSFORMER LINE

An economy version of the Standard Line. UL and CSA approved. Single, dual or multi-tapped primaries. 50 to 1500 VA.

ISOLATION TRANSFORMERS

A standard line of transformers to electrically isolate equipment from line. Medical (UL544, IEC601) and Commercial series.

AUDIO OUTPUT TRANSFORMERS

A standard line of output transformers for sound distribution. PLITRON has also developed a wide range of custom audio output transformers, including tube output.

CUSTOM TRANSFORMERS

Computer-aided design solutions for your demanding applications. To 10kVA.

PLITRON 250 Wildcat Road, Downsview, ON, Canada M3J 2N5 Tel. 416-667-9914 FAX 416-667-8928

TOROIDAL TRANSFORMERS

UL Recognized and CSA Approved

STANDARD POWER TRANSFORMER LINE

PLITRON MANUFACTURING INC

DESCRIPTION

The Standard Power Transformer Line of toroids is characterized by its tight regulation, for applications where off load voltages are a concern; and very low temperature rise, which is useful for high ambient operating conditions, or where instantaneous power - in excess of rating- is required.

APPROVALS

All standard line products are UL recognized and CSA approved, and carry the respective labels.
UL file number E110277 for class A insulation systems. CSA file number LR-84566 to C22.2 #66-1982, General Requirements, Canadian Electrical Code, part II; and C22.2 #66-1988, Specialty Transformers Standard.
In addition, 50 Hz transformers are constructed to the commercial requirements of European approval agencies, such as VDE. Primary leadouts are double insulated.

INPUTS

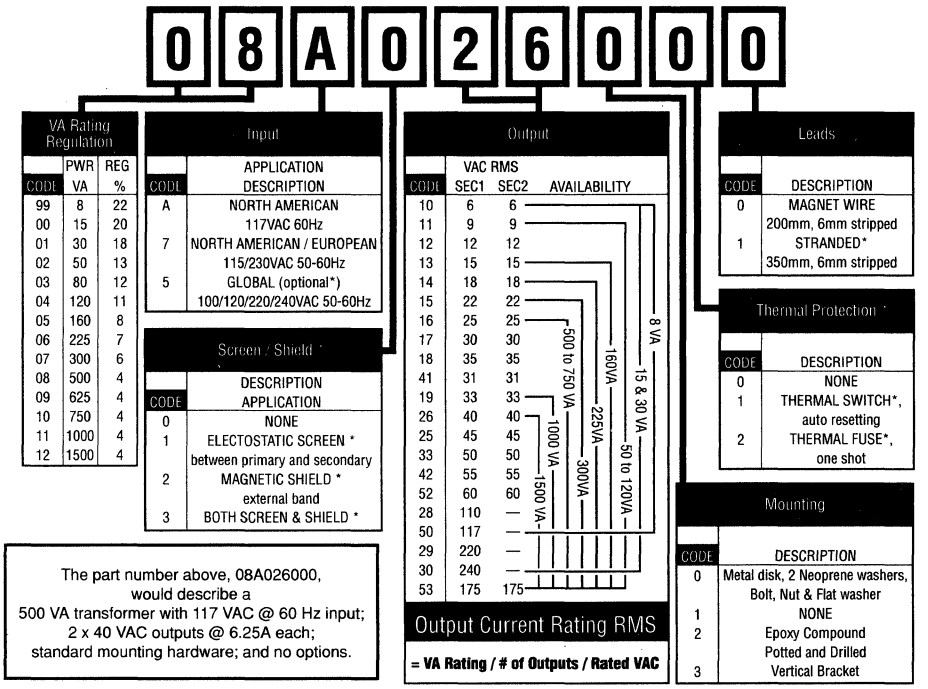
Type A: 117 VAC at 60 Hz.
Type 7: Dual 115 VAC windings, series or parallel connected for 115 or 230 VAC at 50 / 60 Hz.
Type 5: Dual 0-100-120 VAC windings, series or parallel connected for 100, 120, 220 or 240 VAC at 50 / 60 Hz.

INSULATION

Primary to secondary: Polyester tape - class B (130°C), three layers minimum. Meets the test requirement of >2.5 kV for 1 minute, 50 Hz transformers: >4 kV.
Interwinding secondary (where required) and outer insulation: Polyester tape, two layers minimum.

TEMPERATURE RISE

Maximum 40°C. At maximum rated load, continuous.



The part number above, 08A026000, would describe a 500 VA transformer with 117 VAC @ 60 Hz input; 2 x 40 VAC outputs @ 6.25A each; standard mounting hardware; and no options.

OUTPUTS

See output table of part number code.
Dual secondaries are bifilar wound where possible for optimum coupling, and theoretically perfect balancing.

OUTPUT TOLERANCE

Better than 3%, at full load.

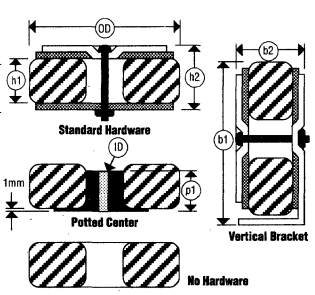
LOAD REGULATION

See VA rating / Regulation chart in figure 3, part number code. Figures given are for 60 Hz operation, for 50 Hz operation figures increase slightly. Consult factory.

MOUNTING

Standard: supplied with 1 steel cup disk, 2 neoprene washers, a bolt, nut and flat washer.

PWR	TYP. SIZE (mm) & WEIGHT				OTHER MOUNTING			
VA	OD	h1	h2	Kg	p1	ID	b1	b2
8	55	25	30	0.25	15	5	60	32
15	63	33	37	0.35	23	5	75	39
30	70	33	38	0.45	23	5	75	40
50	80	38	45	0.90	28	5	100	47
80	97	35	39	1.00	25	5	100	42
120	95	43	47	1.20	33	5	100	49
160	110	45	50	1.80	35	5	116	52
225	110	50	55	2.20	40	5	116	57
300	110	57	62	2.60	47	5	116	64
500	135	63	67	4.00	53	6.6	150	69
625	145	78	83	5.00	68	6.6	150	85
750	150	80	85	5.50	70	6.6	150	87
1000	160	80	85	6.30	70	12	170	87
1500	200	75	80	11.70	65	12	210	83



OTHER MOUNTING

Potted Center: Epoxy compound potted center, drilled. Supplied with base insulating washer.
Vertical Bracket: supplied mounted to a steel bracket with standard hardware.

LEADS

Standard: Magnet wire self leads are PVC sleeved (surface printed UL VW-1, CSA 105°C) .031 wall. Stripped 6mm. Finished length: 200mm.
Optional*: Stranded tinned copper wire (CSA TEW, UL-1015, 105°C). Stripped 6mm. Finished length: 350mm.

THERMAL PROTECTION

Optional*: Normally closed thermal switch in series with primary, auto resetting, *or* a one shot thermal fuse. In series with primary for 60 Hz transformers. Separate lead outs for 50 Hz units, insulated stranded wire (yellow/green). Both open at 120°C core temperature. UL, CSA listed components.

ELECTROSTATIC SCREEN

Optional*: To reduce capacitive coupling, and/or create a physical barrier, between primary and secondary. Copper foil laminated between polyester tape. Wound over primary. Terminated at one end by insulated stranded wire (green / yellow).

MAGNETIC SHIELD

Optional*: To attenuate stray magnetic fields. Multiple layers of grain oriented silicon steel laminated between insulation. Wrapped around circumference of transformer. Increases OD by approx. 1mm.

* OPTIONS

Items marked * (screens, shields, thermal switch, and stranded leads) are subject to a minimum order of 10 units.

MECHANICAL

Typical size and weights listed in the chart left are for 117 VAC 60 Hz transformers. For 50 Hz transformers, size and weight increase slightly.

PART NUMBER CODE

Call PLITRON for assistance in structuring part numbers.

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MICROTRAN

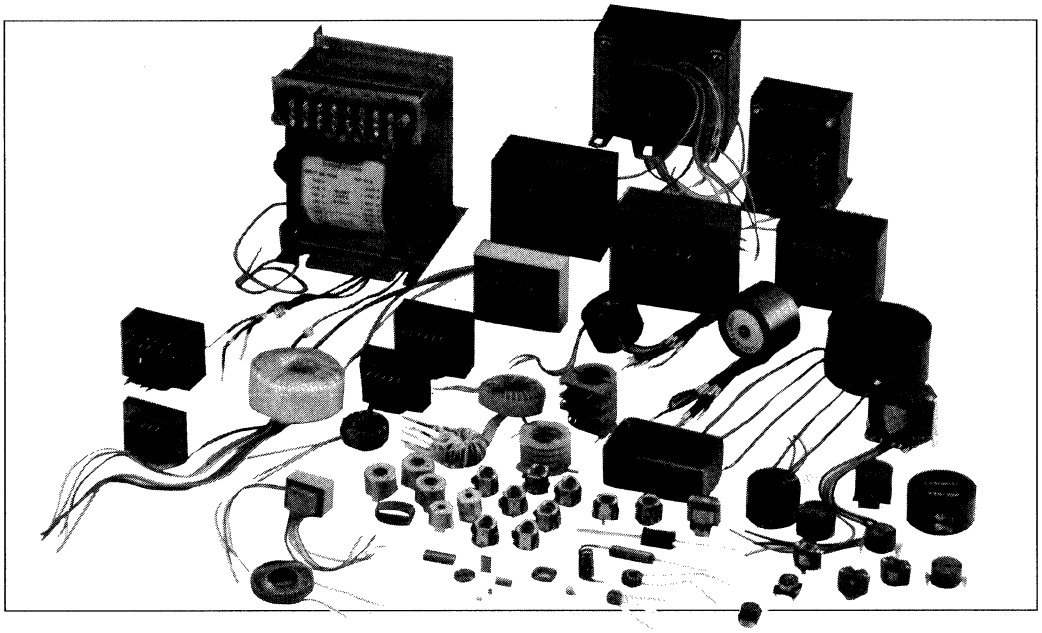


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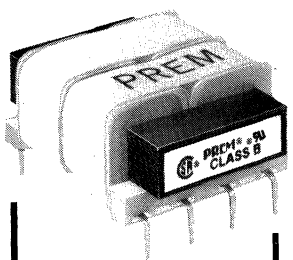
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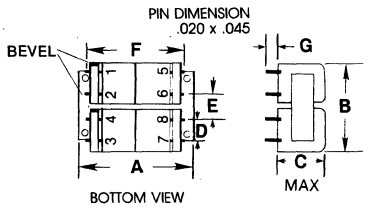
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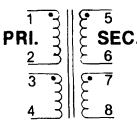
Other primary and secondary voltages may be custom-designed to your specifications. Since 12 terminals are available, tapped primaries or secondaries may also be utilized.

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	SPW 050	SPW 100	SPW 150	SPW 300
VA	2.5	6	9	12
A	1.875	1.875	1.875	2.500
B	1.562	1.562	1.562	2.000
C	.660	.850	1.080	1.065
D	.375	.375	.375	.500
E	.375	.375	.375	.500
F	1.600	1.600	1.600	2.000
G	.200	.200	.200	.200





EXTERNAL CONNECTIONS
PARALLEL
1-3, 2-4, 5-7, 6-8
SERIES
2-3, 6-7

LOW PROFILE POWER TRANSFORMERS

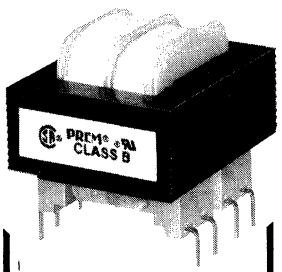
VA	115/230V Dual Primaries Part No.	Secondary Parallel	Secondary Series
2.5	SPW-050	5V @ 500 mA	10V CT @ 250 mA
	SPW-051	6.3V @ 400 mA	12.6V CT @ 200 mA
	SPW-052	8V @ 300 mA	16V CT @ 150 mA
	SPW-053	10V @ 250 mA	20V CT @ 125mA
	SPW-054	12V @ 200 mA	24V CT @ 100 mA
	SPW-055	17V @ 150 mA	34V CT @ 75 mA
	SPW-056	20V @ 120 mA	40V CT @ 60 mA
	SPW-057	28V @ 90 mA	56V CT @ 45 mA
	SPW-058	44V @ 56 mA	88V CT @ 28 mA
	SPW-059	60V @ 40 mA	120V CT @ 20 mA
	SPW-060	115V @ 20 mA	230V CT @ 10 mA
	SPW-061	15V @ 170 mA	30V CT @ 85 mA
6.0	SPW-100	5V @ 1.2A	10V CT @ 600 mA
	SPW-101	6.3V @ 900 mA	12.6V CT @ 450 mA
	SPW-102	8V @ 700 mA	16V CT @ 350 mA
	SPW-103	10V @ 600 mA	20V CT @ 300 mA
	SPW-104	12V @ 500 mA	24V CT @ 250 mA
	SPW-105	17V @ 340 mA	34V CT @ 170 mA
	SPW-106	20V @ 300 mA	40V CT @ 150 mA
	SPW-107	28V @ 200 mA	56V CT @ 100 mA
	SPW-108	44V @ 130 mA	88V CT @ 65 mA
	SPW-109	60V @ 100 mA	120V CT @ 50 mA
	SPW-110	115V @ 50 mA	230V CT @ 25 mA
	SPW-111	15V @ 400 mA	30V CT @ 200 mA
9.0	SPW-150 **New**	5V @ 1.80A	10V CT @ 900 mA
	SPW-151 **New**	6.3V @ 1.43A	12.6V CT @ 715 mA
	SPW-152 **New**	8.0V @ 1.125A	16.0V CT @ 562 mA
	SPW-153 **New**	10.0V @ 900 mA	20.0V CT @ 450 mA
	SPW-154 **New**	12.0V @ 750 mA	24.0V CT @ 375 mA
	SPW-155 **New**	17.0V @ 530 mA	34.0V CT @ 265 mA
	SPW-156 **New**	20.0V @ 450 mA	40.0V CT @ 225 mA
	SPW-157 **New**	28.0V @ 322 mA	56.0V CT @ 161 mA
	SPW-158 **New**	44.0V @ 204 mA	88.0V CT @ 102 mA
	SPW-159 **New**	60.0V @ 150 mA	120.0V CT @ 75 mA
	SPW-160 **New**	115.0V @ 78 mA	230.0V CT @ 39 mA
	SPW-161 **New**	15.0V @ 600 mA	30.0V CT @ 300 mA
12.0	SPW-300	5V @ 2.4A	10V CT @ 1.2A
	SPW-301	6.3V @ 1.8A	12.6V CT @ 900 mA
	SPW-302	8V @ 1.4A	16V CT @ 700 mA
	SPW-303	10V @ 1.2A	20V CT @ 600 mA
	SPW-304	12V @ 1.0A	24V CT @ 500 mA
	SPW-305	17V @ 680 mA	34V CT @ 340 mA
	SPW-306	20V @ 600 mA	40V CT @ 300 mA
	SPW-307	28V @ 400 mA	56V CT @ 200 mA
	SPW-308	44V @ 260 mA	88V CT @ 130 mA
	SPW-309	60V @ 200 mA	120V CT @ 100 mA
	SPW-310	115V @ 100 mA	230V CT @ 50 mA
	SPW-311	15V @ 800 mA	30V CT @ 400 mA

Prem PC Power Transformers

	SPW-350	SPW-400	SPW-500	SPW-600	SPW-610	SPW-620
VA	1.1	2.4	6.0	12.0	20.0	36.0
A	1.375	1.375	1.625	1.875	2.250	2.625
B	1.125	1.125	1.312	1.5625	1.875	2.187
C	.9375	1.187	1.290	1.4375	1.410	1.562
D	.250	.250	.250	.300	.300	.400
E	.250	.250	.350	.400	.400	.400
F	1.200	1.200	1.270	1.410	1.600	1.850
G	N/A	N/A	1.0625	1.250	1.50	NOTE
Screw Size	N/A	N/A	#4	#4	#4	#6
H	.20	.20	.20	.20	.20	.20

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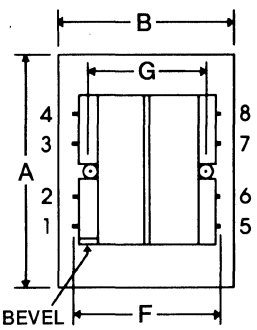
Certified Component
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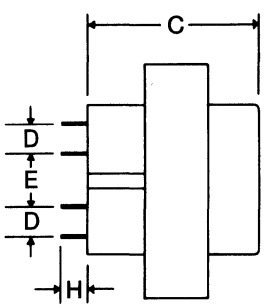


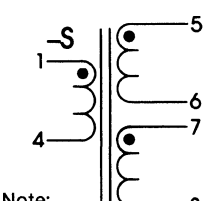
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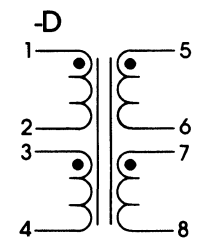
PIN DIMENSION
.020 x .041







Note:
Pins 2 & 3 Omitted



VA	Part Number* Single 115V 6 pin	Part Number* Dual 115/230V 8 pin	Secondary RMS Rating Parallel	Secondary RMS Rating Series
1.1	SPW-350-S	SPW-350-D	5V @ 220 mA	10V CT @ 110 mA
	SPW-351-S	SPW-351-D	6.3V @ 180 mA	12.6V CT @ 90 mA
	SPW-352-S	SPW-352-D	8V @ 140 mA	16V CT @ 70 mA
	SPW-353-S	SPW-353-D	10V @ 110 mA	20V CT @ 55 mA
	SPW-354-S	SPW-354-D	12V @ 90 mA	24V CT @ 45 mA
	SPW-355-S	SPW-355-D	14V @ 80 mA	28V CT @ 40 mA
	SPW-356-S	SPW-356-D	18V @ 60 mA	36V CT @ 30 mA
	SPW-357-S	SPW-357-D	24V @ 46 mA	48V CT @ 23 mA
	SPW-358-S	SPW-358-D	28V @ 40 mA	56V CT @ 20 mA
	SPW-359-S	SPW-359-D	60V @ 20 mA	120V CT @ 10mA
2.4	SPW-400-S	SPW-400-D	5V @ 500 mA	10V CT @ 250 mA
	SPW-401-S	SPW-401-D	6.3V @ 400 mA	12.6V CT @ 200 mA
	SPW-402-S	SPW-402-D	8V @ 300 mA	16V CT @ 150 mA
	SPW-403-S	SPW-403-D	10V @ 240 mA	20V CT @ 120 mA
	SPW-404-S	SPW-404-D	12V @ 200 mA	24V CT @ 100 mA
	SPW-405-S	SPW-405-D	14V @ 170 mA	28V CT @ 85 mA
	SPW-406-S	SPW-406-D	18V @ 130 mA	36V CT @ 65 mA
	SPW-407-S	SPW-407-D	24V @ 100 mA	48V CT @ 50 mA
	SPW-408-S	SPW-408-D	28V @ 90 mA	56V CT @ 45 mA
	SPW-409-S	SPW-409-D	60V @ 40 mA	120V CT @ 20 mA
6.0	SPW-500-S	SPW-500-D	5V @ 1.2A	10V CT @ 600 mA
	SPW-501-S	SPW-501-D	6.3V @ 1.0A	12.6V CT @ 500 mA
	SPW-502-S	SPW-502-D	8V @ 800 mA	16V CT @ 400 mA
	SPW-503-S	SPW-503-D	10V @ 600 mA	20V CT @ 300 mA
	SPW-504-S	SPW-504-D	12V @ 500 mA	24V CT @ 250 mA
	SPW-505-S	SPW-505-D	14V @ 400 mA	28V CT @ 200 mA
	SPW-506-S	SPW-506-D	18V @ 340 mA	36V CT @ 170 mA
	SPW-507-S	SPW-507-D	24V @ 250 mA	48V CT @ 125 mA
	SPW-508-S	SPW-508-D	28V @ 220 mA	56V CT @ 110 mA
	SPW-509-S	SPW-509-D	60V @ 100 mA	120V CT @ 50 mA
12.0	SPW-600-S	SPW-600-D	5V @ 2.4A	10V CT @ 1.2A
	SPW-601-S	SPW-601-D	6.3V @ 2.0A	12.6V CT @ 1.0A
	SPW-602-S	SPW-602-D	8V @ 1.6A	16V CT @ 800 mA
	SPW-603-S	SPW-603-D	10V @ 1.2A	20V CT @ 600 mA
	SPW-604-S	SPW-604-D	12V @ 1.0A	24V CT @ 500 mA
	SPW-605-S	SPW-605-D	14V @ 850 mA	28V CT @ 420 mA
	SPW-606-S	SPW-606-D	18V @ 700 mA	36V CT @ 350 mA
	SPW-607-S	SPW-607-D	24V @ 500 mA	48V CT @ 250 mA
	SPW-608-S	SPW-608-D	28V @ 440 mA	56V CT @ 220 mA
	SPW-609-S	SPW-609-D	60V @ 200 mA	120V CT @ 100 mA
20.0	SPW-610-S	SPW-610-D	5V @ 4.0A	10V CT @ 2.0A
	SPW-611-S	SPW-611-D	6.3V @ 3.2A	12.6V CT @ 1.6A
	SPW-612-S	SPW-612-D	8V @ 2.5A	16V CT @ 1.25A
	SPW-613-S	SPW-613-D	10V @ 2.0A	20V CT @ 1.0A
	SPW-614-S	SPW-614-D	12V @ 1.6A	24V CT @ 800 mA
	SPW-615-S	SPW-615-D	14V @ 1.4A	28V CT @ 700 mA
	SPW-616-S	SPW-616-D	18V @ 1.1A	36V CT @ 550 mA
	SPW-617-S	SPW-617-D	24V @ 800 mA	48V CT @ 400 mA
	SPW-618-S	SPW-618-D	28V @ 700 mA	56V CT @ 350 mA
	SPW-619-S	SPW-619-D	60V @ 320 mA	120V CT @ 160 mA
36.0	SPW-620-S	SPW-620-D	5V @ 7.2A	10V CT @ 3.6A
	SPW-621-S	SPW-621-D	6.3V @ 5.7A	12.6V CT @ 2.85A
	SPW-622-S	SPW-622-D	8V @ 4.5A	16V CT @ 2.25A
	SPW-623-S	SPW-623-D	10V @ 3.6A	20V CT @ 1.8A
	SPW-624-S	SPW-624-D	12V @ 3.0A	24V CT @ 1.5A
	SPW-625-S	SPW-625-D	14V @ 2.6A	28V CT @ 1.3A
	SPW-626-S	SPW-626-D	18V @ 2.0A	36V CT @ 1.0A
	SPW-627-S	SPW-627-D	24V @ 1.5A	48V CT @ 750 mA
	SPW-628-S	SPW-628-D	28V @ 1.3A	56V CT @ 650 mA
	SPW-629-S	SPW-629-D	60V @ 600 mA	120V CT @ 300 mA

*Primary Voltage — S (115V) — D (115/230V)

NOTE: 4 corner mounting holes 2.187 x 1.750 centers.

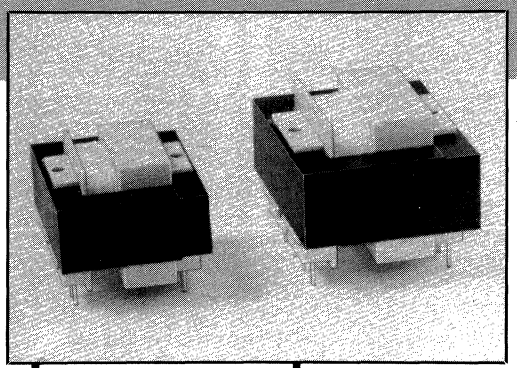
For further information and pricing, contact Prem's Customer Service Department.

PREM®
MAGNETICS, INCORPORATED
3521 North Chapel Hill Road
McHenry, Illinois 60050
Tel. 815-385-2700
FAX 815-385-8578

Prem PC Power Transformers

International Series

(Listed by UL, CSA, IEC and VDE)



- **More domestic and international approvals!**
- **Better construction!**
- **Usable virtually anywhere in the world!**
- **More transformer for your money!**

Approvals

Prem's International Series has more approvals than our competition:

UL # 114 # 478 #1950 #1446 #1585 Class II

VDE #0806

IEC # 380 # 435 # 950

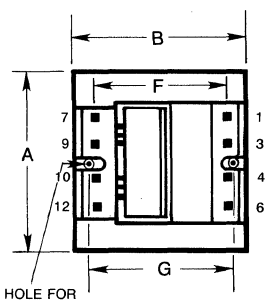
CSA 22.2 No. 66-1988 General Purpose

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Construction

We never compromise on any design feature that might cause you quality problems down the road. This new series of Prem PC Power Transformers has anchor, insulating and crossover tapes as well as shrouded primaries. Our transformers are not bifilar wound, but have two distinct, separate windings for each primary and each secondary assuring an excellent dielectric HIPOT capability between these dual windings. Prem units are totally immersed in 100% solids epoxy, resulting in a capability to withstand aqueous and solvent cleaning systems. All this at a price below our competition means more value for your money!



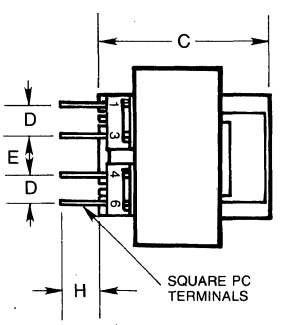
Testing

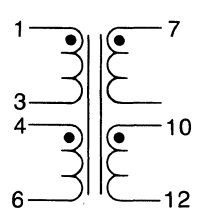
All of Prem units are 100% final tested on automated panels for induced voltage (shorted turns), exciting current, open circuit voltage (turns ratio), polarity (phasing) and dielectric. This International Series also undergoes a **4500 VRMS Dielectric Strength (HIPOT) test.**

	SPW 1100	SPW 1200	SPW1300
VA	5.0	10.0	20.0
A	1-5/8	1-7/8	2-1/4
B	1-5/16	1-9/16	1-7/8
C	1-3/8	1-3/8	1-5/8
D	.200	.200	.400
E	.400	.400	.400
F	1.000*	1.140	1.460
G	1-1/16	1-1/4	1-1/2
Screw Size	#4	#4	#4
H	.187 min	.187 min	.187 min
Pin Size	.025 sq.	.036 sq.	.036 sq.

*NOTE: Prem's row-to-row pin dimension on this unit is identical to our competitors' units and is listed as such at 1.0". However, due to the construction of this item, we recommend an actual row-to-row dimension of 1.03" center to center for our own as well as our competitors' units.

NOTE: Primary and secondary windings are designed to be used as one primary and one secondary winding with either parallel or series connection only.





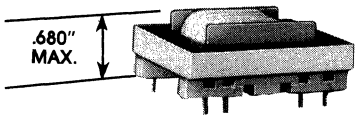
VA	Part Number	Secondary RMS Rating Parallel	Series
5.0	SPW 1100	5V@ 1.0A	10V @ 500 mA
	SPW 1101	6.3V@ 800 mA	12.6V CT @ 400 mA
	SPW 1102	8V@ 620 mA	16V CT @ 310 mA
	SPW 1103	10V@ 500 mA	20V CT @ 250mA
	SPW 1104	12V@ 420 mA	24V CT @ 210 mA
	SPW 1105	14V@ 360 mA	28V CT @ 180 mA
	SPW 1106	18V@ 280 mA	36V CT @ 140 mA
10.0	SPW 1200	5V@ 2.0A	10V CT @ 1.0A
	SPW 1201	6.3V@ 1.6A	12.6V CT @ 800 mA
	SPW 1202	8V@ 1.25A	16V CT @ 620 mA
	SPW 1203	10V@ 1.0A	20V CT @ 500 mA
	SPW 1204	12V@ 840 mA	24V CT @ 420 mA
	SPW 1205	14V@ 720 mA	28V CT @ 360 mA
	SPW 1206	18V@ 560 mA	36V CT @ 280 mA
20.0	SPW 1300	5V@ 4.0A	10V CT @ 2.0A
	SPW 1301	6.3V@ 3.2A	12.6V CT @ 1.6A
	SPW 1302	8V@ 2.5A	16V CT @ 1.25A
	SPW 1303	10V@ 2.0A	20V CT @ 1.0A
	SPW 1304	12V@ 1.66A	24V CT @ 830 mA
	SPW 1305	14V@ 1.44A	28V CT @ 720 mA
	SPW 1306	18V@ 1.12A	36V CT @ 560 mA

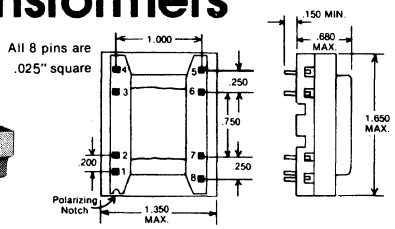
Primary Voltages: Pins 1-3 4-6
115/230 Volts 50/60 Hz

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Coupling Transformers

Voice and Data



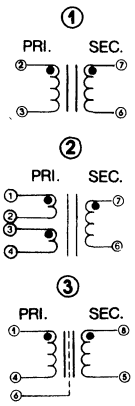


FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

SCHEMATIC



SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN.@300Hz	HARM. DIST. @300Hz.	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO
	SPT-109	600	600	1:1	80mA	1.15dB	11.5dB ①	.1% TYP.	60Ω	72 Ω	1
ECONOMY	SPT-190	600	600	1:1	80mA	1.20dB	11.0dB	.3% TYP.	60Ω	72 Ω	1
	SPT-110	600	600	1:1.127	80mA	1.15dB	14.5dB ①	.1% TYP.	67Ω	75.5Ω	2
ECONOMY	SPT-191	600	600	1:1.127	80mA	1.30dB	12.5dB	.3% TYP.	67Ω	75.5Ω	2
	SPT-111	900	600	1:.8168	80mA	1.55dB	11.0dB ①	.1% TYP.	76Ω	92 Ω	1
ECONOMY	SPT-192	900	600	1:.8168	80mA	1.60dB	10.5dB	.3% TYP.	76Ω	92 Ω	1
	SPT-112	900	600	1:.942	80mA	1.20dB	12.5dB ①	.1% TYP.	83Ω	126Ω	2
ECONOMY	SPT-193	900	600	1:.942	80mA	1.30dB	11.0dB	.3% TYP.	83Ω	126Ω	2
②	SPT-127	600	600	1:1	120mA	1.30dB	11.0dB	.1% TYP.	62Ω	100 Ω	3

① OTHER OPTIMIZED VALUES OBTAINABLE
② DIELECTRIC STRENGTH 2400VDC (PRI-SEC-CORE)

Fig. 1

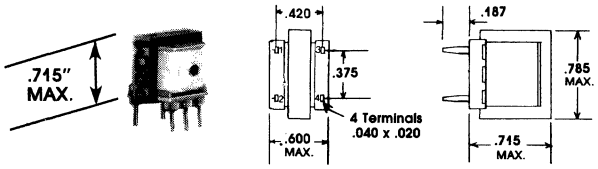
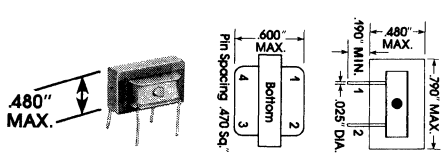


Fig. 3



SCHEMATIC

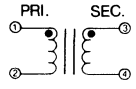


Fig. 2

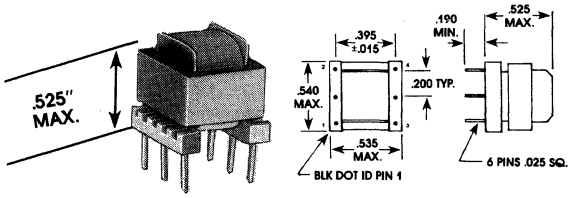
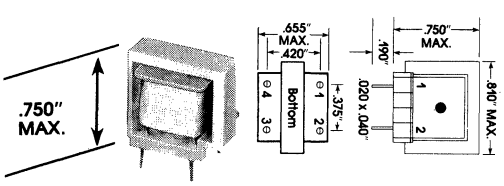


Fig. 4



LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

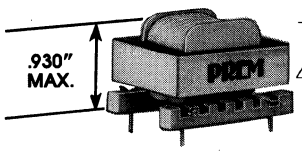
SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	FIG. NO.	DIELECTRIC STRENGTH PRE-SEC-CORE	FREQUENCY RESPONSE 300-3500Hz
	SPT-128	600	600	1:1	0mA	1.00dB	14.5dB	20.5dB	.3% TYP.	35Ω	35Ω	1	1500VAC	±.5dB
†	SPT-2104	600	600	1:1.037	0mA	.90dB	23.0dB	26.0dB	.15% TYP.	36Ω	50Ω	4	1500VAC	±.5dB
	SPT-2105	600	600	1:1	80mA	2.30dB	6.0dB	9.0dB	.15% TYP.	180Ω	75Ω	4	1500VAC	*
†	SPT-1104	600	600	1:1.028	0mA	1.00dB	23.0dB	26.0dB	.5% TYP.	39Ω	50Ω	3	1500VAC	±.5dB
	SPT-2106	600	600	1:1.0523	0mA	1.25dB	21.0dB	25.0dB	.2% TYP.	49Ω	65Ω	2	1000VAC	±.25dB

*FREQUENCY RESPONSE 600-3.5KHz ±1.0dB, 300-600Hz ±3.0dB
†IMPEDANCE MATCHING:: ±10% OVER ENTIRE FREQUENCY RANGE.

For further information, pricing and delivery, contact Prem's Sales Services Department

Available from stock.



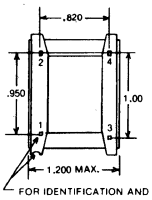
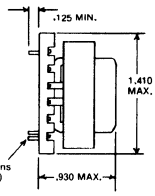


Fig. 1



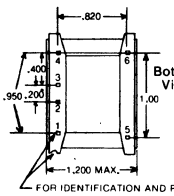
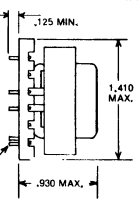
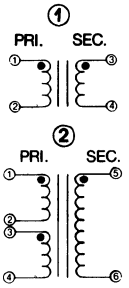


Fig. 2



SCHEMATIC



FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.	FIG. NO.
ECONOMY	SPT-116	600	600	1:1	80mA	1.20dB	13.0dB ①	.3% TYP.	66.2Ω	82.2Ω	1	1
	SPT-117	600	600	1:1.125	80mA	1.25dB	16.0dB ①	.1% TYP.	76Ω	86Ω	2	2
ECONOMY	SPT-118	900	600	1:.8163	80mA	1.50dB	9.5dB ①	.3% TYP.	82.8Ω	85.4Ω	1	1
ECONOMY	SPT-119	900	600	1:.946	80mA	1.55dB	12.0dB	.3% TYP.	90Ω	110Ω	2	2
ECONOMY	SPT-124	600	600	1:1	80mA	1.20dB	13.0dB ①	.3% TYP.	66Ω	82Ω	2	2

① OTHER OPTIMIZED VALUES OBTAINABLE

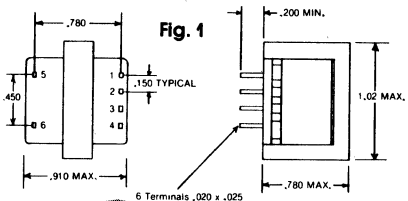
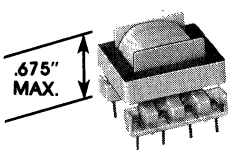


Fig. 1



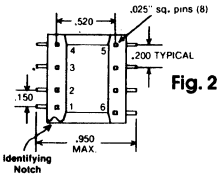
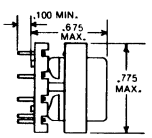
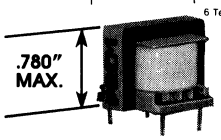


Fig. 2



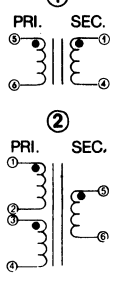


FREQUENCY RESPONSE
(300-3500Hz) ±.5dB

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

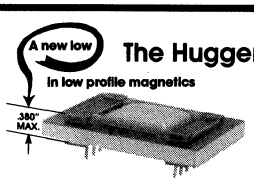
SCHEMATIC



SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.	FIG. NO.
	SPT-113	600	600	1:1	50mA	1.25dB	12.5dB ①	.13% TYP.	75Ω	76Ω	2	1
ECONOMY	SPT-196	600	600	1:1	50mA	1.30dB	11.0dB	.3% TYP.	75Ω	76Ω	2	1
	SPT-115	600	600	1:1	60mA	1.30dB	10.5dB ①	.3% TYP.	63Ω	88Ω	1	1
	SPT-131	600	600	1:1	0mA	1.00dB	18.0dB	.15% TYP.	24.5Ω	31Ω	2	2
ECONOMY	SPT-197	600	600	1:1	0mA	1.15dB	12.5dB	.3% TYP.	24.5Ω	31Ω	2	2

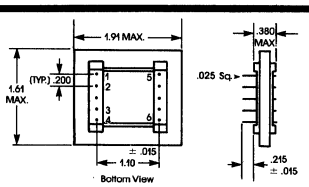
① OTHER OPTIMIZED VALUES OBTAINABLE



The Hugger Concept

The Hugger is an extremely low profile package used primarily as a coupling transformer or feed bridge inductor.

This device is easily adaptable to card spacings of 1/2 inch



FREQUENCY RESPONSE
±.5dB (300-3500Hz)

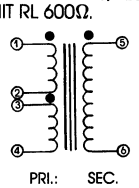
DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

Coupling Transformer

SECONDARY LOAD 600Ω W/D.C. PRI

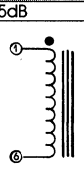
PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	ECHO RETURN LOSS MIN	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
SPT-172	600	600	1:1	50mA	1.5dB	11.5dB	16.5dB	.1% TYP.	73Ω	103Ω



SCHEMATIC

Feed Bridge Inductor

PREM PT. NO.	RESISTANCE ±15%	DIELECTRIC STRENGTH (WINDING-CORE)	INDUCTANCE
SPT-169	114Ω	1500 VAC	@0mA D.C. .90Hy min. 80mA D.C. .75Hy min. 120mA D.C. .60Hy min.



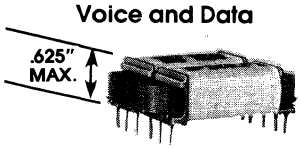
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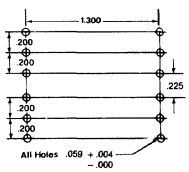
Coupling Transformers

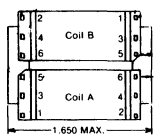
Mini-1 Series HIGH CROSSTALK ATTENUATION

Voice and Data

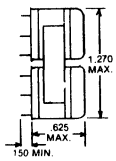


Note: This unit is symmetrical and can be rotated 180° without changing the pin-out or electrical performance.





Bottom View



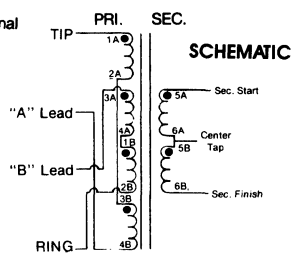
FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

Necessary External Connections:
Short 2A-3B
4A-1B
6A-5B

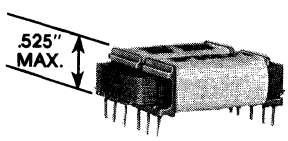
SCHEMATIC



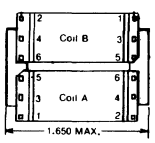
SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
	SPT-125	600	600	1:1	90mA	1.35dB	13.0dB	.1% TYP.	80Ω	100Ω
ECONOMY	SPT-194	600	600	1:1	90mA	1.40dB	12.0dB	.3% TYP.	80Ω	100Ω

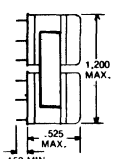
Mini-2 Series HIGH CROSSTALK ATTENUATION

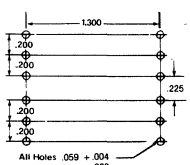


Note: This unit is symmetrical and can be rotated 180° without changing the pin-out or electrical performance.



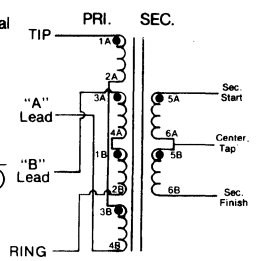
Bottom View





Necessary External Connections:
Short 2A-3B
4A-1B
6A-5B

SCHEMATIC



LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

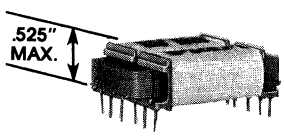
FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

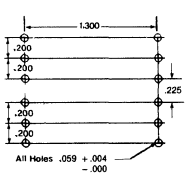
SECONDARY LOAD 600Ω W/D.C. PRI

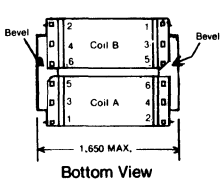
	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
	SPT-123	600	600	1:1	90mA	1.85dB	12.0dB	.1% TYP.	95Ω	180Ω
ECONOMY	SPT-126	600	600	1:1	80mA	2.00dB	11.5dB	.3% TYP.	95Ω	180Ω

Mini-2 Series HIGH CROSSTALK ATTENUATION

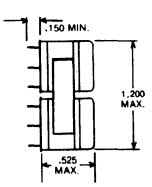


Note: This unit is symmetrical and can be rotated 180° without changing the pin-out or electrical performance.





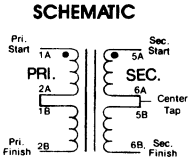
Bottom View



FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

SCHEMATIC



Necessary External Connections:
Short 2A-1B
and 6A-5B

SECONDARY LOAD 600Ω W/D.C. PRI

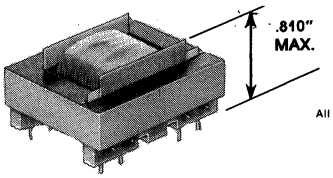
	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
	SPT-101	600	600	1:1	90mA	1.80dB	11.0dB	.1% TYP.	95Ω	180 Ω
ECONOMY	SPT-195	600	600	1:1	80mA	2.10dB	11.0dB	.3% TYP.	95Ω	180 Ω

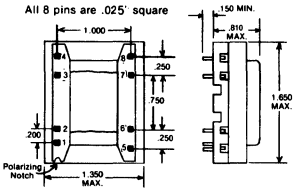
PREM®
MAGNETICS, INCORPORATED
3521 North Chapel Hill Road
McHenry, Illinois 60050
Tel. 815-385-2700
FAX 815-385-8578

Single Hybrid* Transformers and Feed-Bridge Inductors

operating level -45 to +7dBm

*CAN BE CONNECTED AS A DUAL-HYBRID FOR HIGHER PERFORMANCE . . . CONTACT PREM SALES DEPT.



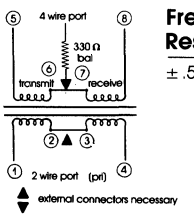


Single-Hybrids

PT#	Primary Impedance	Secondary Impedance	Primary Return Loss	Long Bal.	Hybrid Loss	Trans-Hybrid Balance	Primary mA DC	Turns Ratio ±2%	Harm. Dist. @ 300Hz	Resistance PRI	± 10% SEC
SPT 176	600Ω	600/600Ω	>11dB 300Hz >22dB* 1KHz	60dB	4.5dB	>15dB 300Hz >31dB* * 1KHz	120	1:1.429	.1% Typ.	38.53Ω	63.84Ω
SPT 177	900Ω	600/600Ω	>10dB 300Hz >21dB* 1KHz	60dB	4.5dB	>14dB 300Hz >28dB* * 1KHz	120	1:1.158	.1% Typ.	47.55Ω	65.62Ω

* * .012μf capacitor across 5-8 for optimum transhybrid balance and primary return loss
Dielectric Strength: 1500 VAC (PRI-SEC-CORE)

SCHEMATIC



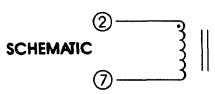
Frequency Response

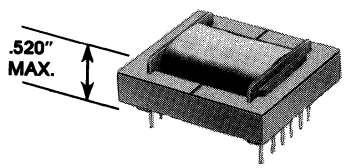
± .5dB (300-3500Hz)

Feed-Bridge Inductors

PT#			
SPT 175	INDUCTANCE AT	0 DC:	1.7HY
		80mA DC	1.5HY
		120mA DC	1.3HY
	DC Resistance: 95Ω ±15%		
	Dielectric Strength: 1500 VAC (Winding to Core)		

SCHEMATIC





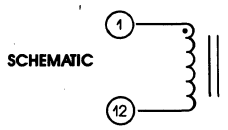
Frequency Response

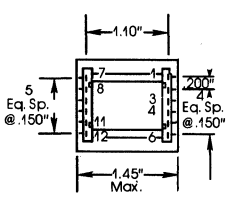
± .5dB (300-3500Hz)

Feed-Bridge Inductors

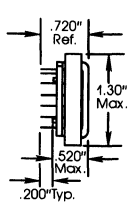
PT#			
SPT 178	INDUCTANCE AT	0 DC:	.95HY
		50mA DC	.90HY
		75mA DC	.88HY
		100mA DC	.85HY
	DC Resistance: 88Ω ±15%		
	Dielectric Strength: 1500 VAC (Winding to Core)		
SPT 179	INDUCTANCE AT	0 DC:	1.4HY
		50mA DC	1.3HY
		90mA DC	1.2HY
	DC Resistance: 142Ω ±15%		
	Dielectric Strength: 1500 VAC (Winding to Core)		

SCHEMATIC





All 12 Pins .020"x .027"

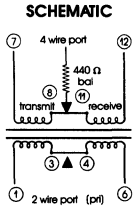


Single-Hybrids

PT#	Primary Impedance	Secondary Impedance	Primary Return Loss	Long Bal.	Hybrid Loss	Trans-Hybrid Balance	Primary mA DC	Turns Ratio ±2%	Harm. Dist. @ 300Hz	Resistance PRI	± 10% SEC
SPT 180	600Ω	600/600Ω	>20dB-300Hz >25dB-1KHz >28dB-4KHz	60dB	4.5dB	>25dB 300Hz >34dB 1KHz	0	1:1.60	.1% Typ.	74.0Ω	138.0Ω
SPT 181	900Ω	600/600Ω	>20dB-300Hz >25dB-1KHz >28dB-4KHz	60dB	4.5dB	>23dB 300Hz >32dB 1KHz	0	1:1.257	.1% Typ.	120.0Ω	137.0Ω
SPT 182	600Ω	600/600Ω	>14dB-300Hz >23dB-1KHz >28dB-4KHz	60dB	4.5dB	>18dB 300Hz >28dB 1KHz	50	1:1.60	.1% Typ.	74.0Ω	138.0Ω
SPT 183	900Ω	600/600Ω	>12dB-300Hz >20dB-1KHz >26dB-4KHz	58dB	4.5dB	>17dB 300Hz >27dB 1KHz	50	1:1.257	.1% Typ.	120.0Ω	137.0Ω

Dielectric Strength: 1500 VAC (PRI-SEC-CORE)

SCHEMATIC



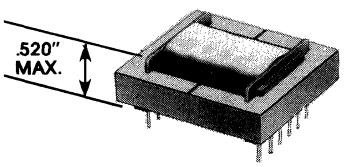
For further information, pricing and delivery, contact Prem's Sales Services Department

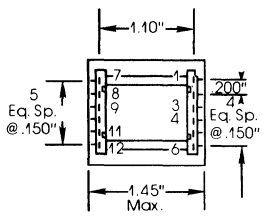
Available from stock.

Very Low Profile Coupling Transformers

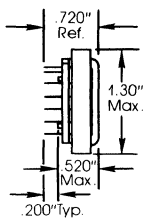
for British Standard and Domestic Applications

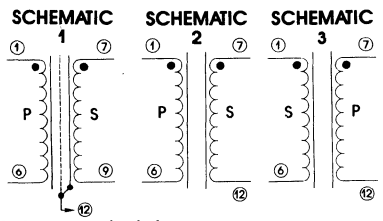
-45 to +7dBm OPERATING LEVEL





All 12 Pins .020"x .027"





Note: Screen constructed with solid copper foil. Ends overlap > 5mm.

INSULATION RESISTANCE
>100MΩ @500 V.D.C.
(BRITISH STANDARD)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a)
REQUIREMENTS, TEST
UNIT RL 600Ω.

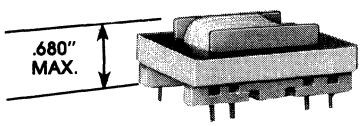
SECONDARY LOAD 600Ω W/D.C. PRI

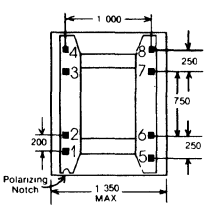
Application	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.	FREQUENCY RESPONSE 300-3500Hz	DIELECTRIC STRENGTH P-S-CORE	
BRITISH STANDARD	SPT-186*	600	600	1:1	70mA	1.20dB	10.0dB	16.5dB	.1% TYP.	66Ω	66Ω	1	± .6dB	2200VDC ①	
	SPT-1106	600	600	1:1	70mA	1.30dB	8.5dB	15.0dB	.3% TYP.	66Ω	66Ω	1	±1.0dB	2200VDC ①	ECONOMY
	SPT-187*	600	600	1:1.08	70mA	1.20dB	11.0dB	19.0dB	.1% TYP.	66Ω	72Ω	1	± .5dB	2200VDC ①	
	SPT-1107	600	600	1:1.08	70mA	1.30dB	10.0dB	18.0dB	.3% TYP.	66Ω	72Ω	1	±1.0dB	2200VDC ①	ECONOMY
DOMESTIC	SPT-188	600	600	1:1	70mA	1.30dB	12.0dB	16.0dB	.1% TYP.	70Ω	81Ω	2	± .5dB	1500VAC	
	SPT-189	600	600	1:1	60mA	2.00dB	12.0dB	16.5dB	.3% TYP.	75Ω	80Ω	3	± .5dB	1500VAC	
	SPT-1105	600	600	1:1.045	80mA	1.30dB	9.5dB	17.0dB	.5% TYP.	62.4Ω	60.1Ω	2	±1.0dB	1500VAC	

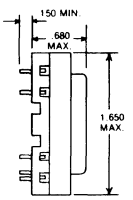
* Prem has supplied SPT 186 and 187 configurations to customers who have BPO approval on their systems; however, usage of SPT 186 and 187 will not guarantee BPO or BSI approval for your specific equipment.
SPT 186 and 187 are also applicable for domestic use.

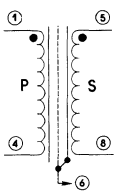
① DIELECTRIC STRENGTH
2200 VDC
(1 MINUTE MIN.)
PRI, CORE, SCREEN-SEC
SEC, CORE, SCREEN-PRI

All 8 pins are .025" square









Note: Screen constructed with solid copper foil. Ends overlap > 5mm.

DIELECTRIC STRENGTH
2200 VDC
(1 MINUTE MIN.)
PRI, CORE, SCREEN-SEC
SEC, CORE, SCREEN-PRI

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a)
REQUIREMENTS, TEST
UNIT RL 600Ω.

INSULATION RESISTANCE
>100MΩ @500 V.D.C.
(BRITISH STANDARD)

SECONDARY LOAD 600Ω W/D.C. PRI

	PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX D.C. UNBAL.	INS. LOSS REF.@1KHz	RETURN LOSS MIN@300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	FREQUENCY RESPONSE 300-3500Hz	
BRITISH STANDARD	SPT-184*	600	600	1:1	120mA	1.30dB	10.0dB	15.0dB	.1% TYP.	63.5Ω	99Ω	±.5dB	
	SPT-198	600	600	1:1	120mA	1.50dB	9.0dB	12.5dB	.3% TYP.	63.5Ω	99Ω	±1.0dB	ECONOMY VERSION
	SPT-185*	600	600	1:1.1036	120mA	1.30dB	11.0dB	18.0dB	.1% TYP.	57.5Ω	99Ω	±.5dB	
	SPT-199	600	600	1:1.1036	120mA	1.50dB	10.0dB	14.5dB	.3% TYP.	57.5Ω	99Ω	±1.0dB	ECONOMY VERSION

* Prem has supplied SPT 184 and 185 configurations to customers who have BPO approval on their systems; however, usage of SPT 184 and 185 will not guarantee BPO or BSI approval for your specific equipment.
SPT 184 and 185 are also applicable for domestic use.

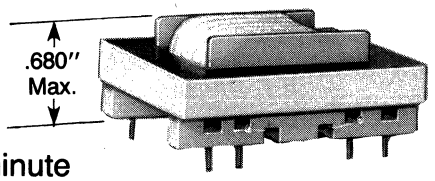
For further information, pricing and delivery, contact Prem's Sales Services Department

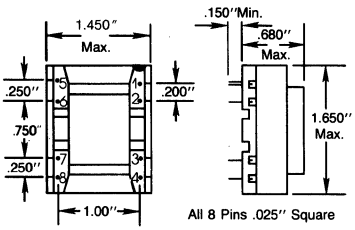
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Low Profile Coupling Transformers

Telecom Australia Approved • Approval #RA-87/117

Voice and Data Transformers for Telephone Interconnect Systems.





3750 VAC Dielectric for 1 minute
PRI.—SEC. & PRI.—CORE
>100MΩ Insulation Resistance
—45 to +7dBm Operating Level

LONGITUDINAL BALANCE

MEETS FCC PART 68.310 (a) REQUIREMENTS

SECONDARY LOAD 600Ω W/D.C. PRI.

Prem Part No.	IMPEDANCE Pri.	IMPEDANCE Sec.	Turns Ratio ±2%	Max. D.C. Unbal.	Ins. Loss Ref. @1KHz	Return Loss Min. @ 300Hz	Echo Return Loss Min.	Typ. Harm. Dist. @ 300Hz	Resistance ±10% Pri.	Resistance ±10% Sec.	Sch. No.	Frequency Response 300-3500Hz
SPT-1108	600	600	1:1	120mA	1.3dB	10.0dB	14.0dB	.1%	66Ω	105Ω	1	± .5dB
SPT-1109	600	600	1:1	120mA	1.4dB	9.0dB	12.5dB	.3%	66Ω	105Ω	1	±1.0dB
SPT-1110	600	600	1:1	80mA	1.2dB	11.0dB	16.0dB	.1%	67Ω	80Ω	2	± .5dB
SPT-1111	600	600	1:1	80mA	1.3dB	10.0dB	15.0dB	.3%	67Ω	80Ω	2	±1.0dB
SPT-1112	600	600	1:1	80mA	1.2dB	11.0dB	16.0dB	.1%	67Ω	80Ω	1	± .5dB
SPT-1113	600	600	1:1	80mA	1.3dB	10.0dB	15.0dB	.3%	67Ω	80Ω	1	±1.0dB
SPT-1114	600	600	1:1	120mA	1.3dB	10.0dB	14.0dB	.1%	66Ω	105Ω	2	± .5dB
SPT-1115	600	600	1:1	120mA	1.4dB	9.0dB	12.5dB	.3%	66Ω	105Ω	2	±1.0dB

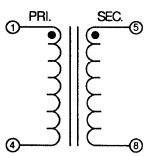


FIG. 1

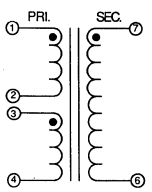
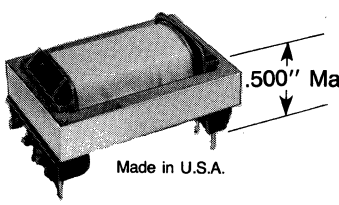
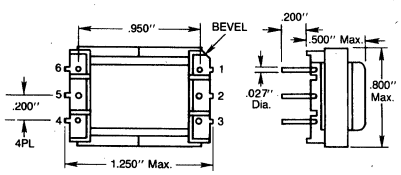


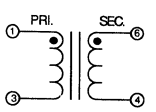
FIG. 2

Very Low Profile-Condensed Board Space Coupling and Hybrid Transformers



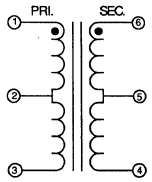


SCHEMATIC

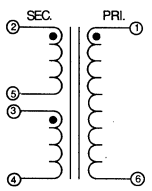


Pins 2 & 5 omitted

①



②



③

FREQUENCY RESPONSE

500 - 3500Hz ±1.3dB
300 - 3500Hz ±2.5dB
* 500 - 3500Hz + .3dB, − .7dB
* 300 - 3500Hz + .3dB, −1.6dB

DIELECTRIC STRENGTH

1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE

MEETS FCC PART 68.310 (a) REQUIREMENTS.

*MEASUREMENTS FOR SPT-2110 HYBRID TRANSFORMER WITH TOTAL SECONDARY LOADED WITH 1200Ω AND RATED D.C. IN PRIMARY.

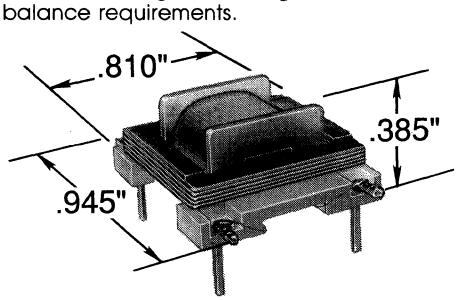
SECONDARY LOAD 600Ω W/D.C. PRI.

Prem Part No.	IMPEDANCE Pri.	IMPEDANCE Sec.	Turns Ratio ±2%	Max.D.C. Unbal.	Ins. Loss Ref. @1.8KHz	Return Loss Min. @1.8KHz	Max. Harm. Dist. @ 300Hz	Resistance ± 10% Pri.	Resistance ± 10% Sec.	Sch. No.
SPT-2107	600	600	1:1.04	90mA	1.7dB	14.0dB	.5%	75Ω	100Ω	1
SPT-2108	600	600	1:1.04	90mA	1.7dB	14.0dB	.5%	75Ω	100Ω	2
SPT-2109	600	600	1:1.04	90mA	1.7dB	14.0dB	.5%	75Ω	100Ω	3
SPT-2110	600	600/600	1:1.41	50mA	1.6dB Max. @1KHz	14.0dB @1KHz	.5%	75Ω	170Ω	3

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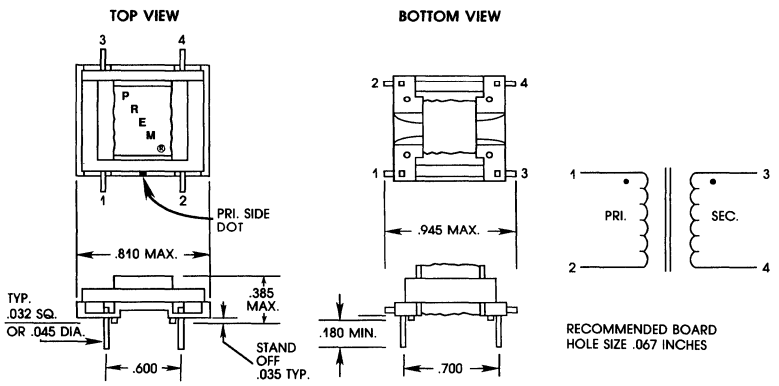
New Sub-Miniature Voice/Data Coupling Transformers

These transformers are ideal for applications requiring minimal use of pc board area and very low above-board height. The SPT-010 and SPT-011 are both dry [ODC 600Ω:600Ω] coupling transformers with excellent performance for voice and data applications. The SPT-012 has an impedance ratio of 600Ω:600Ω with a dc current rating of 30mA for data applications. The SPT-020 is for data applications only. All four parts meet FCC Part 68 dielectric strength and longitudinal balance requirements.



Prem® SPT 010 thru 012

SCHEMATIC

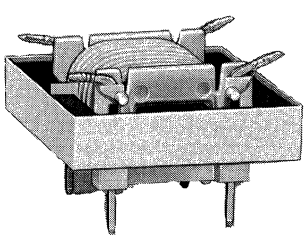


DIELECTRIC STRENGTH

1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE

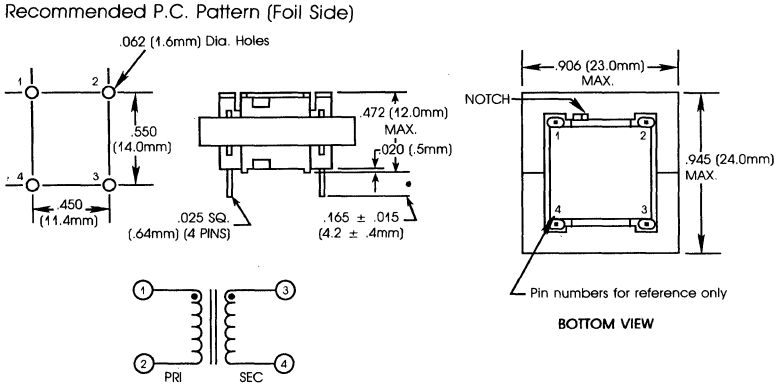
MEETS FCC PART 68.310(a) REQUIREMENTS, SPT-010 AND SPT-011 TESTED AT 0mA dc with SEC Load of 600Ω, SPT-012 TESTED AT 30mA dc with SEC Load of 470Ω.



SPT-020

SCHEMATIC

Recommended P.C. Pattern (Foil Side)



SECONDARY LOAD ON THE SPT-010 and 011 600Ω, SPT-012 and 020 470Ω with D.C. PRI

PREM PT. NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO (±2%)	MAX dc UNBAL. (mA)	INS. LOSS @ 1KHz	RETURN LOSS MIN.	ECHO RETURN LOSS MIN.	HARM. DIST. @ 300 Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	FREQUENCY RESPONSE
SPT-010	600	600	1:1.0428	0	1.5dB ref.	18.5dB @ 300Hz	23.5dB	.3% TYP.	59.3Ω	74.4Ω	300-3500Hz ±0.5dB
SPT-011	600	600	1:1.100	0	1.3dB ref.	25.0dB @ 300Hz	28.0dB	.2% TYP.	62.5Ω	84.5Ω	300-3500Hz ±0.25dB
SPT-012	600	600	1:1	30	2.0dB ±.5dB	16.0dB @ 1800Hz	15.0dB	.1% TYP.**	108.0Ω	131.3Ω	300-600Hz ±2.0dB 600-3500Hz ±0.65dB
SPT-020	600	600	1:1	100	2.5dB max.*	15.0dB @ 1800Hz	12.0dB	0.5% TYP.	108.0Ω	120.0Ω	600-3500Hz ±1.0dB 300-600Hz ±2.5dB

*NOTE: Value taken with 600Ω load with 30mA dc on primary. **THD measured @ 1KHz

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For further information, pricing and delivery, contact Prem's Sales Services Department

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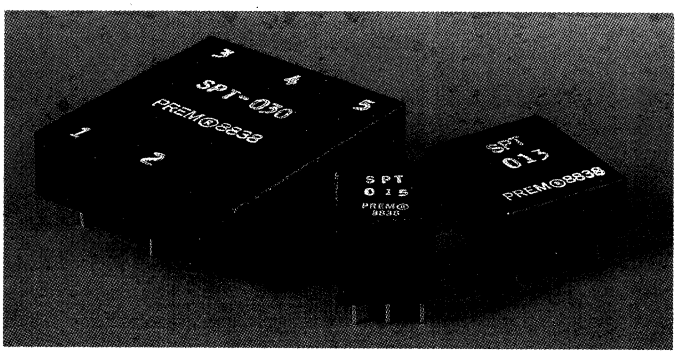
Prem's New Line of British Standard Institute (B.S.I.) Approved Telephone Interconnect Transformers

Other manufacturers may offer to ***design for*** B.S.I., but our new series of telephone interconnect transformers is ***already approved by*** the British Standards Institute (B.S.I.).

Prem is the only U.S. manufacturer to offer B.S.I. approved dry (no dc) interconnectors. In addition, the new B.S.I. approved SPT 030 for use in wet (dc) applications up to 125mA is the only unit worldwide that has B.S.I. approval within this height restriction.*

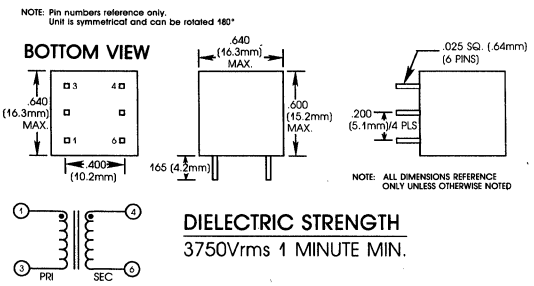
Designed for voice and data applications in the British market, these transformers also meet Canadian (D.O.C.) and United States (F.C.C.) requirements.

*B.S.I., January, 1989



SPT-015

B.S.I. CERTIFICATE NUMBER 6935



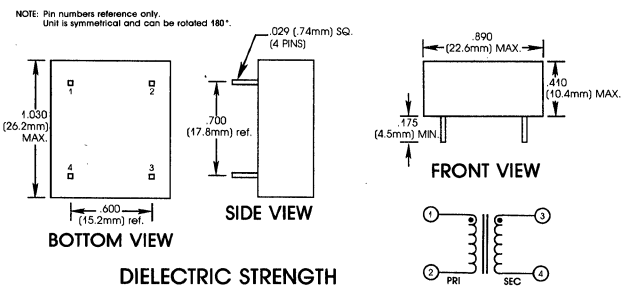
DIELECTRIC STRENGTH
3750Vrms 1 MINUTE MIN.

LONGITUDINAL BALANCE
60dB/MIN. 200-4000Hz PER IEEE STD. 455-1985

HARM. DIST. @ 0dBm 350 Hz FUNDAMENTAL
2ND - -60dB MIN. @ 700Hz
3RD - -65dB MIN. @ 1050Hz

SPT-013

B.S.I. CERTIFICATE NUMBER 6919

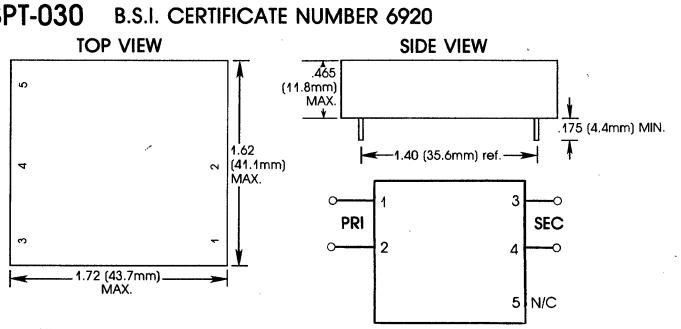


DIELECTRIC STRENGTH
3750Vrms 1 MINUTE MIN.

LONGITUDINAL BALANCE
60dB/MIN. 200-4000Hz PER IEEE STD. 455-1985

HARM. DIST. @ 0dBm 350 Hz FUNDAMENTAL
2ND - -65dB MIN. @ 700Hz
3RD - -70dB MIN. @ 1050Hz

SPT-030 B.S.I. CERTIFICATE NUMBER 6920



PC PINS ARE .032" (.8mm) DIA. TINNED PC TERMINALS

DIELECTRIC STRENGTH
3750Vrms 1 MINUTE MIN.

LONGITUDINAL BALANCE
60dB/MIN. 200-4000Hz PER IEEE STD. 455-1985

HARM. DIST. @ 0dBm 350 Hz FUNDAMENTAL
2ND - -65dB MIN. @ 700Hz
3RD - -65dB MIN. @ 1050Hz

NOTE: (1) 0dBm @ 110 0mA dc or -9dBm @ 125mA dc
(2) DC IMPEDENCE (OFF HOOK)
(3) MINIMUM OF 20mA dc NEEDED FOR OPERATION

PREM PT. NO.	IMPEDENCE TURNS PRI	SEC	TURNS RATIO (± 2%)	MAX dc UNBAL. (mA)	INS. LOSS REF @ 1KHz	RETURN LOSS MIN.	INSULATION RESISTANCE @ 500V dc	RESISTANCE ± 10% PRI	SEC	FREQUENCY RESPONSE
SPT-013	600	600 nom.	1:1	0	1.2dB	14.0dB @ 200-4000Hz	>100 MΩ	58Ω	58Ω	200-4000Hz ± .25dB
SPT-015	600	600	1:1	0	1.3dB	14.0dB @ 200-4000Hz	>100 MΩ	70Ω	70Ω	200-4000Hz ± .25dB
SPT-030	600	600	1:1	125mA(1)(3)	1.4dB	14.0dB @ 200-4000Hz	>100 MΩ	100<R<300 (2)	57Ω	200-4000Hz ± 0.5dB

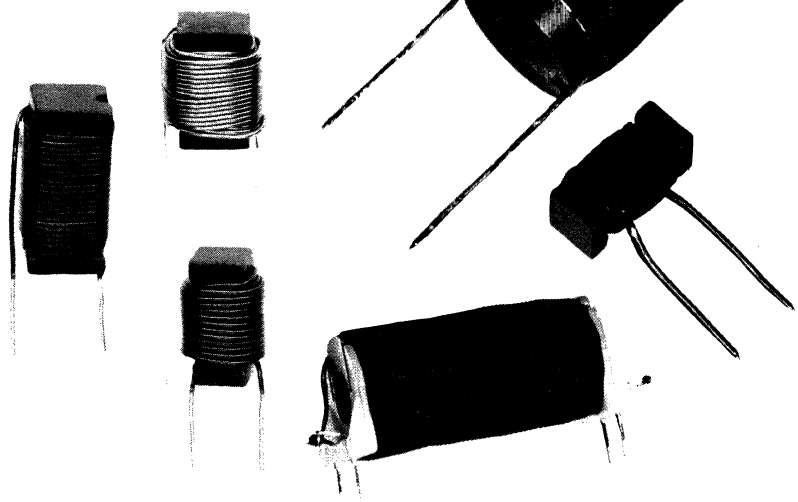
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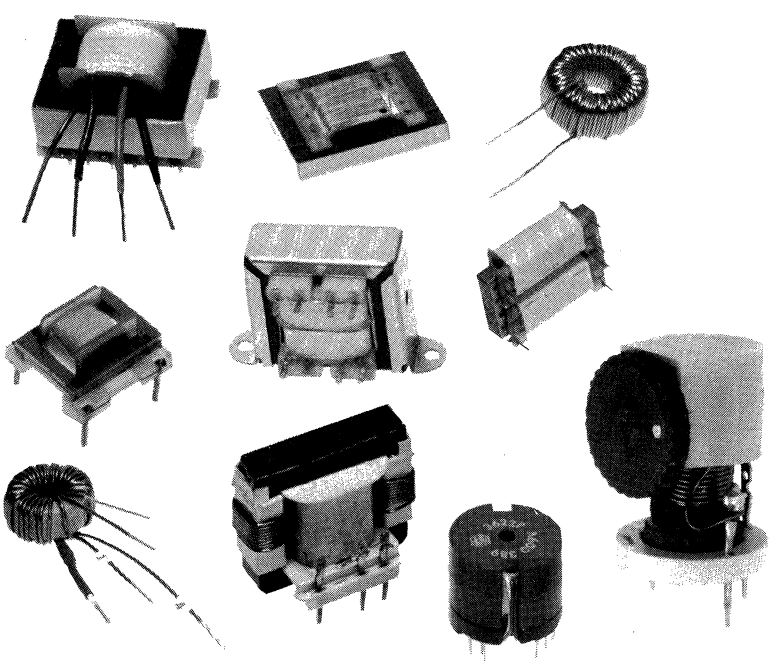
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Custom Designed Transformers and Inductors

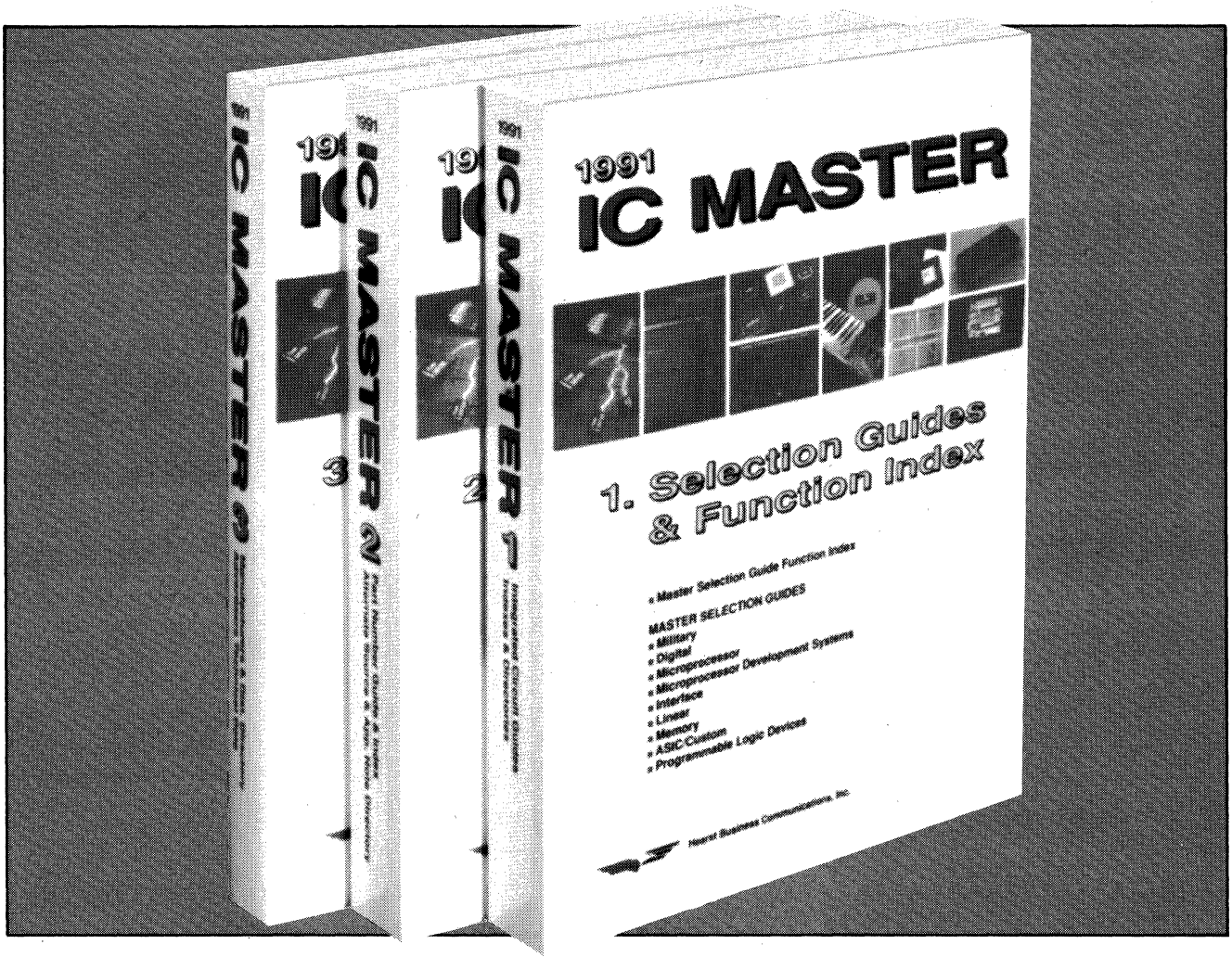
Any Prem standard component can be modified to fit your needs. Or, our experienced engineering staff can create a custom design just for you. Send for our Custom Quotation Specification Sheet or call our engineering staff to discuss a component that will meet your needs economically.

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- Telephone coupling transformers
- High current inductors
- Specialty power transformers
- Linearity and width coils for CRT applications
- PC power transformers
- Pot core assemblies
- Horizontal oscillator and driver transformers for CRT applications
- Toroidal assemblies
- Miniature transformers
- RF Coils



For more details, see our catalog in EEM Coils, Chokes and Inductors, Section 1800.

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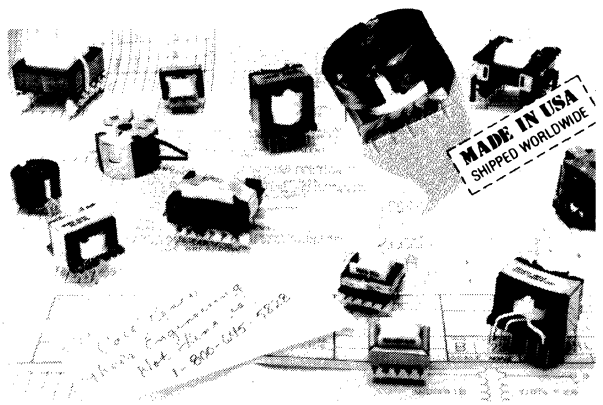
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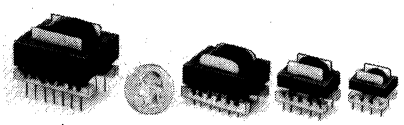
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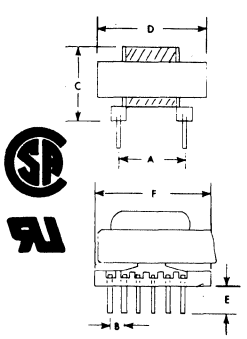
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DIM. (IN)	A	B	C	D	E	F
RL1287-1	0.515	0.200	0.660	0.650	0.175	0.780
RL1287-2	0.630	0.200	0.830	0.770	0.175	1.030
RL1287-3	0.800	0.200	0.915	1.140	0.175	1.375
RL1287-4	1.000	0.200	1.050	1.325	0.375	1.700
RL1287-5	1.100	0.300	1.300	1.700	0.185	1.000
RL1287-6	1.300	0.300	1.500	2.000	0.250	2.300

NUMBER OF TERMINALS — SIZE 0.025 SQ.		
RL1287-1 (#8)	RL1287-2 (#10)	RL1287-3 (#12)
RL1287-4 (1#14)	RL1287-5 (#12)	RL1287-6 (#12)

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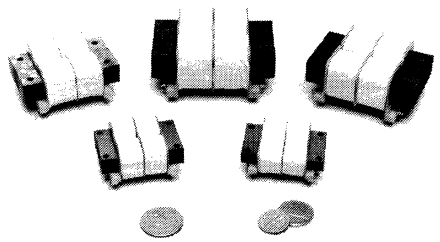
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1992 OUR 37TH YEAR

FLAT/TRAN™ TRANSFORMERS PCB PLUG-IN

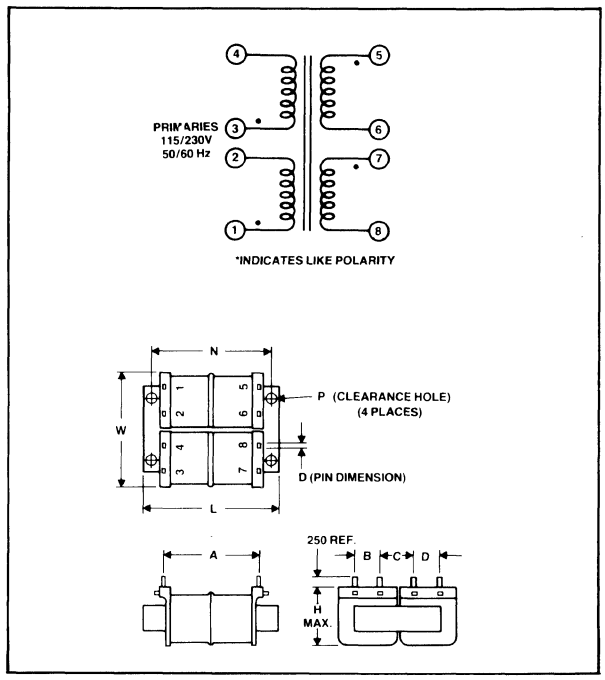
RENCO ELECTRONICS, INC.
Since 1955
"Precisely Your Best Choice"
MADE IN USA
SHIPPED WORLDWIDE



This series of rugged low profile transformers is specifically designed for convenient pc board mounting. The low overall height permits close spacing of adjacent pc boards to obtain maximum system density.

Using nonconcentric side-by-side windings reduces the interwinding capacitance and eliminates the need for electrostatic shielding. Semi-toroidal hum bucking construction results in balanced windings reducing EMI. Dual primary windings permit designs for 115/230VAC, 50/60Hz applications. The two independent secondary windings offer the flexibility of series, parallel or two isolated outputs.

These transformers are HIPOT tested at 1500 Volts RMS and are manufactured to Class B 130°C insulation. All transformers are designed to meet UL and CSA specifications.



Size	A	B	C	L	W
2	1.600	0.375	0.375	1.87	1.56
6	1.600	0.375	0.375	1.87	1.56
12	2.000	0.500	0.500	2.50	2.00
24	1.900	0.600	0.530	2.87	2.25
48	2.180	0.600	0.660	3.12	2.50

Size	H	N	D	P	Oz.
2	0.650	N/A	.041 × .020	N/A	5
6	0.850	N/A	.041 × .020	N/A	7
12	1.065	N/A	.041 × .020	N/A	11
24	1.250	2.41	.041 Sq.	CLEARANCE HOLE FOR #6 SCREW	15
48	1.375	2.62	.041 Sq.	CLEARANCE HOLE FOR #4 SCREW	21

Part No.	Size	SECONDARY* Series	SECONDARY* Parallel
RL-2230-10-50	2	10V C.T. @ 250MA	5V @ 500MA
RL-2230-10-600	6	10V C.T. @ 600MA	5V @ 1.2A
RL-2230-10-1200	12	10V C.T. @ 1200MA	5V @ 2.4A
RL-2230-10-2400	24	10V C.T. @ 2.40A	5V @ 4.80A
RL-2230-10-4800	48	10V C.T. @ 4.80A	5V @ 9.60A
RL-2230-12-200	2	12.6V C.T. @ 200MA	6.3V @ 400MA
RL-2230-12-450	6	12.6V C.T. @ 450MA	6.3V @ 900MA
RL-2230-12-900	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
RL-2230-12-1900	24	12.6V C.T. @ 1.90MA	6.3V @ 2.80A
RL-2230-12-3800	48	12.6V C.T. @ 3.80MA	6.3V @ 7.60A
RL-2230-16-150	2	16V C.T. @ 150MA	8V @ 300MA
RL-2230-16-350	6	16V C.T. @ 350MA	8V @ 700MA
RL-2230-16-700	12	16V C.T. @ 700MA	8V @ 1.4A
RL-2230-16-1500	24	16V C.T. @ 1.50A	8V @ 3.00A
RL-2230-16-3000	48	16V C.T. @ 3.00A	8V @ 6.00A
RL-2230-20-125	2	20V C.T. @ 125MA	10V @ 250MA
RL-2230-20-300	6	20V C.T. @ 300MA	10V @ 600MA
RL-2230-20-600	12	20V C.T. @ 600MA	10V @ 1.2A
RL-2230-20-1200	24	20V C.T. @ 1.20A	10V @ 2.40A
RL-2230-20-2400	48	20V C.T. @ 2.40A	10V @ 4.80A
RL-2230-24-100	2	24V C.T. @ 100MA	12V @ 200MA
RL-2230-24-250	6	24V C.T. @ 250MA	12V @ 500MA
RL-2230-24-500	12	24V C.T. @ 500MA	12V @ 1A
RL-2230-24-1000	24	24V C.T. @ 1.00A	12V @ 2.00A
RL-2230-24-2000	48	24V C.T. @ 2.00A	12V @ 4.00A
RL-2230-30-85	2	30V C.T. @ 85MA	15V @ 170MA
RL-2230-30-200	6	30V C.T. @ 200MA	15V @ 400MA
RL-2230-30-400	12	30V C.T. @ 400MA	15V @ 800MA
RL-2230-30-800	24	30V C.T. @ 800MA	15V @ 1.60A
RL-2230-30-1600	48	30V C.T. @ 1.60A	15V @ 3.20A
RL-2230-34-75	2	34V C.T. @ 75MA	17V @ 150MA
RL-2230-34-170	6	34V C.T. @ 170MA	17V @ 340MA
RL-2230-34-340	12	34V C.T. @ 340MA	17V @ 680MA
RL-2230-34-700	24	34V C.T. @ 700MA	17V @ 1.40A
RL-2230-34-1400	48	34V C.T. @ 1.40A	17V @ 2.80A
RL-2230-40-60	2	40V C.T. @ 60MA	20V @ 120MA
RL-2230-40-150	6	40V C.T. @ 150MA	20V @ 300MA
RL-2230-40-300	12	40V C.T. @ 300MA	20V @ 600MA
RL-2230-40-600	24	40V C.T. @ 600MA	20V @ 1.20A
RL-2230-40-1200	48	40V C.T. @ 1.20A	20V @ 2.40A
RL-2230-56-45	2	56V C.T. @ 45MA	28V @ 90MA
RL-2230-56-100	6	56V C.T. @ 100MA	28V @ 200MA
RL-2230-56-200	12	56V C.T. @ 200MA	28V @ 400MA
RL-2230-56-425	24	56V C.T. @ 425MA	28V @ 850MA
RL-2230-56-850	48	56V C.T. @ 850MA	28V @ 1.70A
RL-2230-88-28	2	88V C.T. @ 28MA	44V @ 56MA
RL-2230-88-65	6	88V C.T. @ 65MA	44V @ 130MA
RL-2230-88-130	12	88V C.T. @ 130MA	44V @ 260MA
RL-2230-120-20	2	120V C.T. @ 20MA	60V @ 40MA
RL-2230-120-50	6	120V C.T. @ 50MA	60V @ 100MA
RL-2230-120-100	12	120V C.T. @ 100MA	60VV @ 200MA
RL-2230-230-10	2	230V C.T. @ 10MA	115V @ 20MA
RL-2230-230-25	6	230V C.T. @ 25MA	115V @ 50MA
RL-2230-230-50	12	230V C.T. @ 50MA	115V @ 100MA

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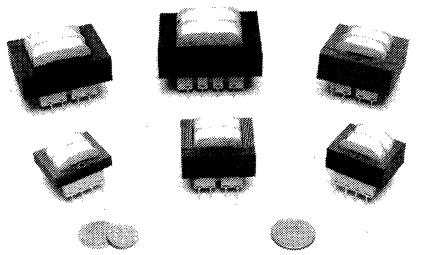
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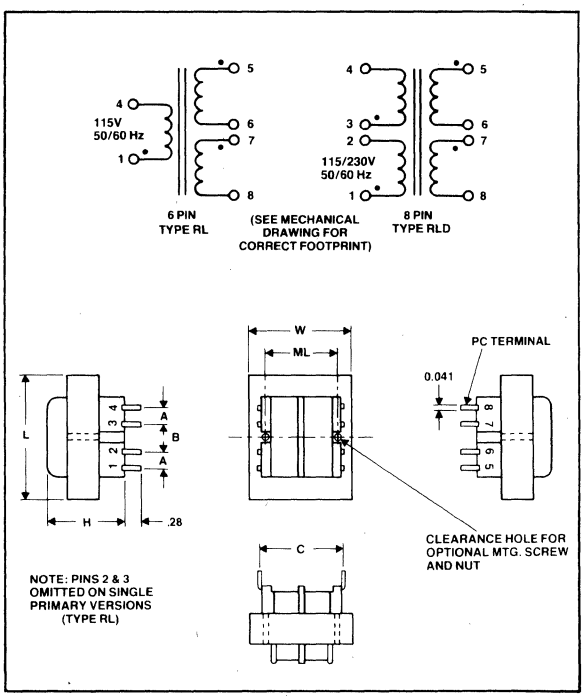
MADE IN USA SHIPPED WORLDWIDE



The advanced design and manufacturing techniques of using split bobbins and nonconcentric winding of the primary and secondary results in low interwinding capacitive coupling and eliminates the need for electrostatic shielding. It also avoids crossover of primary and secondary leads.

These transformers can be used in a wide variety of applications since they can be supplied with single 115VAC or dual 115/230VAC primaries for 50/60Hz operation. Their split secondary windings allow them to be hooked-up in series, in parallel or they can be used as independent and isolated outputs.

The RL2240 Series is HIPOT tested at 2500VAC and are manufactured to Class B 130° insulation. All transformers are designed to meet UL and CSA specifications.



Size	VA	L	W	H	ML
2	1.1	1-3/8	1-1/8	15/16	—
3	2.4	1-3/8	1-1/8	1-3/16	—
4	6.0	1-5/8	1-5/16	1-5/16	1-1/16
5	12.0	1-7/8	1-9/16	1-7/16	1-1/4
6	20.0	2-1/4	1-7/8	1-7/16	1-1/2
7	36.0	2-5/8	2-3/16	1-9/16	†

Size	A	B	C	Optional Mtg. Screw Nut*	Lbs.
2	.250	.250	1.200	None	0.17
3	.250	.250	1.200	None	0.25
4	.250	.350	1.280	4-40 × 1-3/8 Nylon	0.44
5	.300	.400	1.410	4-40 × 1-38 Nylon	0.70
6	.300	.400	1.600	4-40 × 1-3/8 Nylon	0.80
7	.400	.400	1.850	†	1.10

†Size 7 has 4 mounting holes on 2-3/16" × 1-3/4" centers for a #6 screw. Need not be nylon.

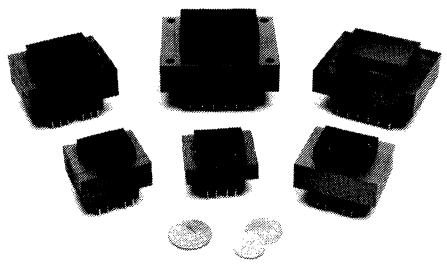
PART NUMBER*		SECONDARY RMS RATING	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parellel
RL-2240-2-10	RLD-2240-2-10	10V C.T. @ 0.11A	5V @ 0.22A
RL-2240-3-10	RLD-2240-3-10	10V C.T. @ 0.25A	5V @ 0.5A
RL-2240-4-10	RLD-2240-4-10	10V C.T. @ 0.6A	5V @ 1.2A
RL-2240-5-10	RLD-2240-5-10	10V C.T. @ 1.2A	5V @ 2.4A
RL-2240-6-10	RLD-2240-6-10	10V C.T. @ 2A	5V @ 4A
RL-2240-7-10	RLD-2240-7-10	10V C.T. @ 3.6A	5V @ 7.2A
RL-2240-2-12	RLD-2240-2-12	12.6V C.T. @ 0.09A	6.3V @ 0.18A
RL-2240-3-12	RLD-2240-3-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
RL-2240-4-12	RLD-2240-4-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
RL-2240-5-12	RLD-2240-5-12	12.6V C.T. @ 1.0A	6.3V @ 2.0
RL-2240-6-12	RLD-2240-6-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
RL-2240-7-12	RLD-2240-7-12	12.6V C.T. @ 2.85A	6.3V @ 5.71A
RL-2240-2-16	RLD-2240-2-16	16V C.T. @ 0.07A	8V @ 0.14A
RL-2240-3-16	RLD-2240-3-16	16V C.T. @ 0.15A	8V @ 0.3A
RL-2240-4-16	RLD-2240-4-16	16V C.T. @ 0.4A	8V @ 0.8A
RL-2240-5-16	RLD-2240-5-16	16V C.T. @ 0.8A	8V @ 1.6A
RL-2240-6-16	RLD-2240-6-16	16V C.T. @ 1.25A	8V @ 2.5A
RL-2240-7-16	RLD-2240-7-16	16V C.T. @ 2.25A	8V @ 4.5A
RL-2240-2-20	RLD-2240-2-20	20V C.T. @ 0.005A	10V @ 0.11A
RL-2240-3-20	RLD-2240-3-20	20V C.T. @ 0.12A	10V @ 0.24A
RL-2240-4-20	RLD-2240-4-20	20V C.T. @ 0.3A	10V @ 0.6A
RL-2240-5-20	RLD-2240-5-20	20V C.T. @ 0.6A	10V @ 1.2A
RL-2240-6-20	RLD-2240-6-20	20V C.T. @ 1A	10V @ 2A
RL-2240-7-20	RLD-2240-7-20	20V C.T. @ 1.8A	10V @ 3.6A
RL-2240-2-24	RLD-2240-2-24	24V C.T. @ 0.045A	12V @ 0.09A
RL-2240-3-24	RLD-2240-3-24	24V C.T. @ 0.1A	12V @ 0.2A
RL-2240-4-24	RLD-2240-4-24	24V C.T. @ 0.25A	12V @ 0.5A
RL-2240-5-24	RLD-2240-5-24	24V C.T. @ 0.5A	12V @ 1.0A
RL-2240-6-24	RLD-2240-6-24	24V C.T. @ 0.8A	12V @ 1.6A
RL-2240-7-24	RLD-2240-7-24	24V C.T. @ 1.5A	12V @ 3.0A
RL-2240-2-28	RLD-2240-2-28	28V C.T. @ 0.04A	14V @ 0.08A
RL-2240-3-28	RLD-2240-3-28	28V C.T. @ 0.085A	14V @ 0.17A
RL-2240-4-28	RLD-2240-4-28	28V C.T. @ 0.2A	14V @ 0.4A
RL-2240-5-28	RLD-2240-5-28	28V C.T. @ 0.42A	14V @ 0.84A
RL-2240-6-28	RLD-2240-6-28	28V C.T. @ 0.7A	14V @ 1.4A
RL-2240-7-28	RLD-2240-7-28	28V C.T. @ 1.3A	14V @ 2.6A
RL-2240-2-36	RLD-2240-2-36	36V C.T. @ 0.03A	18V @ 0.06A
RL-2240-3-36	RLD-2240-3-36	36V C.T. @ 0.065A	18V @ 0.13A
RL-2240-4-36	RLD-2240-4-36	36V C.T. @ 0.17A	18V @ 0.34A
RL-2240-5-36	RLD-2240-5-36	36V C.T. @ 0.35A	18V @ 0.7A
RL-2240-6-36	RLD-2240-6-36	36V C.T. @ 0.55A	18V @ 1.1A
RL-2240-7-36	RLD-2240-7-36	36V C.T. @ 1A	18V @ 1A
RL-2240-2-48	RLD-2240-2-48	48V C.T. @ 0.023A	24V @ 0.046A
RL-2240-3-48	RLD-2240-3-48	48V C.T. @ 0.05A	24V @ 0.1A
RL-2240-4-48	RLD-2240-4-48	48V C.T. @ 0.125A	24V @ 0.25A
RL-2240-5-48	RLD-2240-5-48	48V C.T. @ 0.25A	24V @ 0.5A
RL-2240-6-48	RLD-2240-6-48	48V C.T. @ 0.4A	24V @ 0.8A
RL-2240-7-48	RLD-2240-7-48	48V C.T. @ 0.75A	24V @ 1.5A
RL-2240-2-56	RLD-2240-2-56	56V C.T. @ 0.02A	28V @ 0.04A
RL-2240-3-56	RLD-2240-3-56	56V C.T. @ 0.045A	28V @ 0.09A
RL-2240-4-56	RLD-2240-4-56	56V C.T. @ 0.11A	28V @ 0.22A
RL-2240-5-56	RLD-2240-5-56	56V C.T. @ 0.22A	28V @ 0.44A
RL-2240-6-56	RLD-2240-6-56	56V C.T. @ 0.35A	28V @ 0.7A
RL-2240-7-56	RLD-2240-7-56	56V C.T. @ 0.65A	28V @ 1.3A
RL-2240-2-120	RLD-2240-2-120	120V C.T. @ 0.01A	60V @ 0.02A
RL-2240-3-120	RLD-2240-3-120	120V C.T. @ 0.02A	60V @ 0.04A
RL-2240-4-120	RLD-2240-4-120	120V C.T. @ 0.05A	60V @ 0.1A
RL-2240-5-120	RLD-2240-5-120	120V C.T. @ 0.1A	60V @ 0.2A
RL-2240-6-120	RLD-2240-6-120	120V C.T. @ 0.16A	60V @ 0.32A
RL-2240-7-120	RLD-2240-7-120	120V C.T. @ 0.3A	60V @ 0.6A

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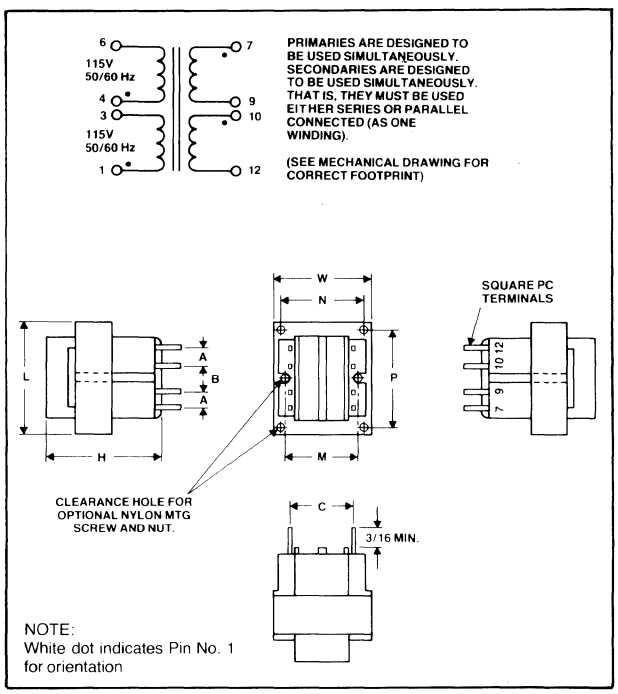
ALL/TRAN ™ INTERNATIONAL SPLIT-BOBBIN TRANSFORMERS

RENCO ELECTRONICS, INC.
Since 1955
"Precisely Your Best Choice"
MADE IN USA
SHIPPED WORLDWIDE



This series of transformers is specifically manufactured to meet or exceed UL, CSA, VDE and IEC specifications. These transformers incorporate advanced dual bobbin nonconcentric design that reduces interwinding capacitance and eliminates the need for electrostatic shielding. Since the windings are balanced no primary circulating currents are present. Use of high temperature, high stability materials results in excellent interwinding insulation and insulation between windings and core.

Slots in the bobbin flanges eliminate lead crossovers and the need for insulating pads resulting in improved lead termination. This series is PC plug-in mount in power ranges from 2.5 to 56 Volt/Amps. The transformers are HIPOT tested at 4000 Volts RMS and are manufactured to Class B 130° insulation.



Part No.	VA (Size)	SECONDARY RMS RATING Series	Parallel
RL-2250-2.5-10	2.5	10V C.T. @ 0.25A	5V @ 0.5A
RL-2250-5.0-10	5.0	10V C.T. @ 0.5A	5V @ 1.0A
RL-2250-10-10	10.0	10V C.T. @ 1.0A	5V @ 2.0A
RL-2250-20-10	20.0	10V C.T. @ 2.0A	5V @ 4.0A
RL-2250-30-10	3.0	10V C.T. @ 3.0A	5V @ 6.0A
RL-2250-56-10	56.0	10V C.T. @ 5.6A	5V @ 11.2A
RL-2250-2.5-12	2.5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
RL-2250-5.0-12	5.0	12.6V C.T. @ 0.4A	6.3V @ 0.8A
RL-2250-10-12	10.0	12.6V C.T. @ 0.8A	6.3V @ 1.6A
RL-2250-20-12	20.0	12.6V C.T. @ 1.6A	6.3V @ 3.2A
RL-2250-30-12	30.0	12.6V C.T. @ 2.4A	6.3V @ 4.8A
RL-2250-56-12	56.0	12.6V C.T. @ 4.4A	6.3V @ 8.8A
RL-2250-2.5-16	2.5	16V C.T. @ 0.15A	8V @ 0.3A
RL-2250-5.0-16	5.0	16V C.T. @ 0.31A	8V @ 0.62A
RL-2250-10-16	10.0	16V C.T. @ 0.62A	8V @ 1.25A
RL-2250-20-16	20.0	16V C.T. @ 1.25A	8V @ 2.5A
RL-2250-30-16	30.0	16V C.T. @ 1.9A	8V @ 3.8A
RL-2250-56-16	56.0	16V C.T. @ 3.5A	8V @ 7.0A
RL-2250-2.5-20	2.5	20V C.T. @ 0.12A	10V @ 0.24A
RL-2250-5.0-20	5.0	20V C.T. @ 0.25A	10V @ 0.5A
RL-2250-10-20	10.0	20V C.T. @ 0.5A	10V @ 1.0A
RL-2250-20-20	20.0	20V C.T. @ 1.0A	10V @ 2.0A
RL-2250-30-20	30.0	20V C.T. @ 1.5A	10V @ 3.0A
RL-2250-56-20	56.0	20V C.T. @ 2.8A	10V @ 5.6A
RL-2250-2.5-24	2.5	24V C.T. @ 0.1A	12V @ 0.2A
RL-2250-5.0-24	5.0	24V C.T. @ 0.21A	12V @ 0.42A
RL-2250-10-24	10.0	24V C.T. @ 0.42	12V @ 0.84A
RL-2250-20-24	20.0	24V C.T. @ 0.83A	12V @ 1.66A
RL-2250-30-24	30.0	24V C.T. @ 1.25A	12V @ 2.50A
RL-2250-56-24	56.0	24V C.T. @ 2.33A	12V @ 4.66A
RL-2250-2.5-28	2.5	28V C.T. @ 0.09A	14V @ 0.18A
RL-2250-5.0-28	5.0	28V C.T. @ 0.18A	14V @ 0.36A
RL-2250-10-28	10.0	28V C.T. @ 0.36A	14V @ 0.72A
RL-2250-20-28	20.0	28V C.T. @ 0.72A	14V @ 1.44A
RL-2250-30-28	30.0	28V C.T. @ 1.06A	14V @ 2.12A
RL-2250-56-28	56.0	28V C.T. @ 2.0A	14V @ 4.0A
RL-2250-2.5-36	2.5	36V C.T. @ 0.07A	18V @ 0.14A
RL-2250-5.0-36	5.0	36V C.T. @ 0.14A	18V @ 0.28A
RL-2250-10-36	10.0	36V C.T. @ 0.28A	18V @ 0.56A
RL-2250-20-36	20.0	36V C.T. @ 0.56A	18V @ 1.12A
RL-2250-30-36	30.0	36V C.T. @ 0.82A	18V @ 1.64A
RL-2250-56-36	56.0	36V C.T. @ 1.56A	18V @ 3.12A

	Dimensions					
VA	L	W	H	A	B	C
2.5	1-5/8	1-5/16	1-1/8	.200	.250	1.000
5.0	1-5/8	1-5/16	1-3/8	.200	.400	1.000
10.0	1-7/8	1-9/16	1-3/8	.200	.400	1.140
20.0	2-1/4	1-7/8	1-5/8	.400	.400	1.460
30.0	2-5/8	2-3/16	1-9/16	.550	.275	1.680
56.0	3	2-1/2	1-13/16	.600	.300	1.900

	Pin	Mtg.			Mtg. Screw		
VA	Dimensions	M	N	P	Size	Quantity	Lbs.
2.5	0.025SQ	1-1/16	—	—	#4	2	0.25
5.0	0.025SQ	1-1/16	—	—	#4	2	0.37
10.0	0.038SQ	1-1/4	—	—	#4	2	0.53
20.0	0.038SQ	1-1/2	—	—	#4	2	0.90
30.0	0.045SQ	—	1-3/4	2-3/16	#6	4	1.15
56.0	0.045SQ	—	2	2-1/2	#6	4	1.70

VDE
SP UL

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SHOGYO TRANSFORMERS AND ADAPTERS

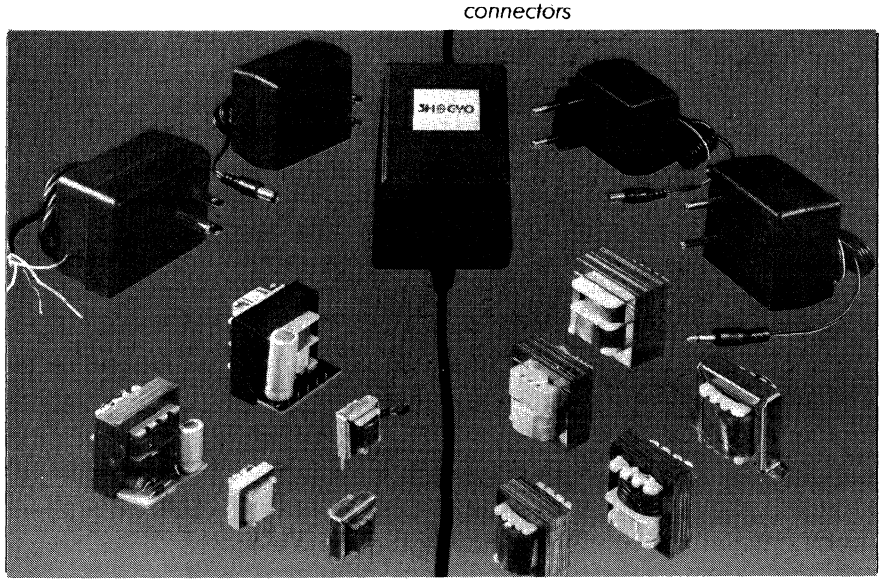
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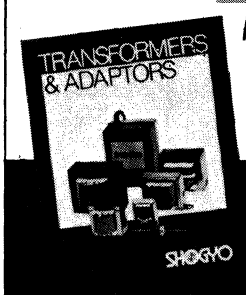
Including a diverse offering of UL/CSA approved:

- *Power transformers:*
  standard core sizes from EI-28 to EI-86, Nylon 66, PBT or Phinolic bobbin materials, channel frame or PCB mounting, enclosures with or without endbells, and UL recognized AWM, terminal, or pin connections
- *Double protection power transformers:*
  conform with UL 1411 seven hours construction and abnormal test requirements, 3500V dielectric test voltage
- *Line matching transformers:*
  70.7 and 25 volt, maximum power levels from 2 to 16 watts, standard core sizes from EI-41 to EI-66, and a secondary impedance of 8 ohms
- *Telephone coupling transformers:*
  high quality low insertion loss, core sizes from EI-19 to EI-35, frequency response of 300–3500Hz ± 3dBa, and a secondary impedance of 500, 600, or 900 ohms
- *Lamp ballast transformers:*
  UL 935 listed simple reactance coil type
- *Wall-mount, plug-in adapters:*
  European or American, 120V, 50/60Hz inputs, outputs from 3VDC to 24VDC, 100mA to 1.7Amp, and 0.3 to 14.4 watts

And featuring:

- *PC pin, solder leg mount or lead wire connections*
- *A complete line of mating cords and terminating plug connectors*





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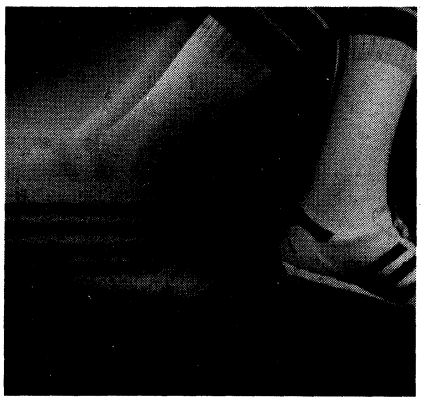
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SHOGYO

THE SIGNAL WAY OF DOING BUSINESS



PRONTO 24-Hour Shipment

We have long recognized that, in most instances, engineers and buyers need immediate delivery of transformers and chokes. To meet this challenge, Signal maintains an extensive inventory of every item in this catalog – over 1,000 different transformers and chokes. More importantly, we're dedicated to shipping out each and every order (moderate quantities) within 24 hours: and we can usually fill your entire order. We call this service "PRONTO." Last year we shipped over 20,000 such orders and we didn't disappoint anyone.

How and Why We Are Able to Maintain Our Low Price Policy

At Signal, we sell direct. There are no salesmen, or distributors – no middlemen, no extra mark-ups. We pass the savings on to you. We answer your questions directly. There is no chance of misinterpretation and you get fast, accurate answers. We maintain larger inventories than any distributors could. We're able to react to your order requirements more quickly and efficiently. These savings have enabled us to install modern machinery, specify better materials and continuously invest in new R & D. In this manner, our prices are kept as low as possible. We both profit from this policy.

Advanced Technology and Innovation

Signal has always been the leader in recognizing future trends in the industry. And we have successfully pioneered the development of revolutionary new products such as:

■ **SPLIT/TRAN®** Split bobbin PC Board Transformers featuring non-concentric windings

■ **FLATHEAD®** Low profile, split bobbin designs for low height and closer board stacking

■ **2-4-1™ Series** Lower cost/more efficient power transformers.

All of these have subsequently become industry standards. Now we are pleased and proud to announce two new series of transformers designed to meet all international standards as well as the new, emerging generation of UL standards. Our VDE certified **ONE-4-ALL™** Series, uses dual bobbins and an insulating shroud to meet international standards. It withstands a 4,000 VRMS test voltage and gives even better isolation and performance than our previous split bobbin types. At lower cost.

The same principal has been extended to our **MORE-4-LESS™** line featured on the opposite page. Our FLATHEAD Series has been expanded to higher power levels to accommodate the demand for higher PC board power densities. All of this is renewed confirmation of Signal's leadership in setting the standards for the entire electronic transformer industry.

CUSTOM ORDERS

We also recognize that no matter how hard we try, it is impossible to anticipate everyone's needs. Therefore, we are eager to discuss and evaluate your transformer and choke requirements. If we can't recommend a standard product that will do the job and save you money and time, we'll gladly quote on your requirement. Many times all that is needed is a modification of one of our standards. Again, you will get consistently high quality and very competitive prices, whether your order is for 10 or 10,000 pieces.

We don't have anyone out in the field telling you how good we are. We have to prove it to you by deed. Thank you for considering Signal.

JIT Experts

Signal pioneered direct marketing of transformers long before the expression JIT was coined. Signal welcomes the opportunity to program JIT shipments to your most stringent production requirements.

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Contents (see following pages)

- International Series with Lower Cost & Better Performance
  - More-4-Less® High Power
  - One-4-All® P.C.B. and All-4-One® Chassis Mount
- Triple Output & Regulated Supplies in µp Applications
  - One-4-All® P.C.B. and All-4-One® Chassis Mount

Class 2

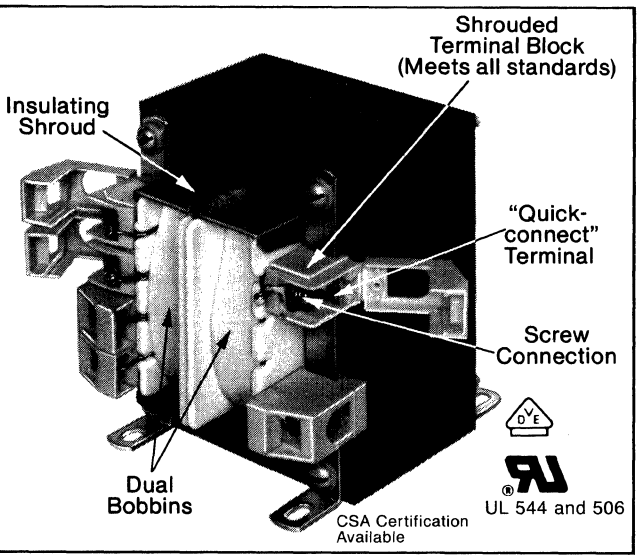
- P.C. Board Power Transformers
  - FLATHEAD® Low Profile
  - Miniature P.C.B.
  - SPLIT/TRAN® - High Isolation
- Lightweight/Low-Cost Small Power Transformers
  - 2-4-1 Series
- Transformers for Triple-Output Regulated D.C. Supplies
- Rectifier Power Transformers
- Chokes
  - Filter
  - Dual
- Step-Down Auto Transformers
- Industrial Grade Power Isolation Transformers
- Custom Transformers

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GET MUCH MORE PERFORMANCE IN LESS SPACE WITH
more-4-less™ high power transformers



Signal's M4L Line is designed with the following "ingredients":

- Grain-Oriented Low Loss, High Saturation Steel
- High Temperature Magnet Wire
- Dual High Temperature Bobbins & Insulating Shroud
- Rugged Dual Terminals (Screw or Quick-Connect) that have international approvals (VDE, IEC, etc.) **AND**
- Superior Electrical & Manufacturing Engineering meeting UL, CSA, VDE, IEC and all international standards.

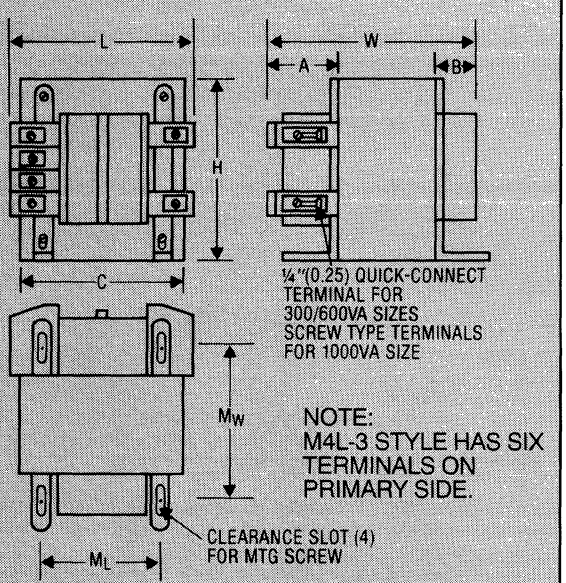
Which accomplish further savings by:

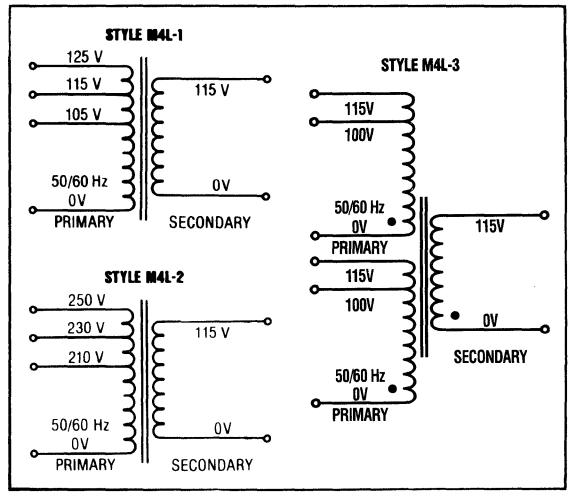
- Reducing the amount of steel and copper required for a given power rating
- Eliminating hand applied tapes, pads or cross-over insulation
- Reducing winding & lead terminating time.

All of which leads to more:

- Efficiency
- Isolation (4000v RMS TEST)
- Safety Standards (meets UL, VDE, CSA, IEC, etc.)

AND Approximately ⅓ less space & weight. Hence, we call it the More-4-Less Series.





Part Number 115V Nominal	Part Number 230V Nominal	Part Number 100-115/200-230V Nominal	VA	Secondary RMS Rating	L	W	H	A	B	C	Mtg. ML	Mtg. MW	Mtg. Screw	Lbs.
M4L-1-3	M4L-2-3	M4L-3-3	300	115V @ 2.6A	3½	3⅞	3¾	1⅛	⅝	3⅛	2½	3⅛	#10	7.0
M4L-1-6	M4L-2-6	M4L-3-6	600	115V @ 5.2A	3⅞	4 15/16	4½	1 3/16	¾	3¾	3	4 1/16	#10	14.3
M4L-1-10	M4L-2-10	M4L-3-10	1000	115V @ 8.7A	5⅜	5⅞	5¼	1½	⅞	4⅜	3½	4 11/16	¼	22.0

*Less expensive versions with wire leads that do not meet VDE are available on special order.

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Because we are America's largest stocking manufacturer of power magnetics (over 1000 part numbers), we promise to ship a minimum of 24 pieces in 24 hours.

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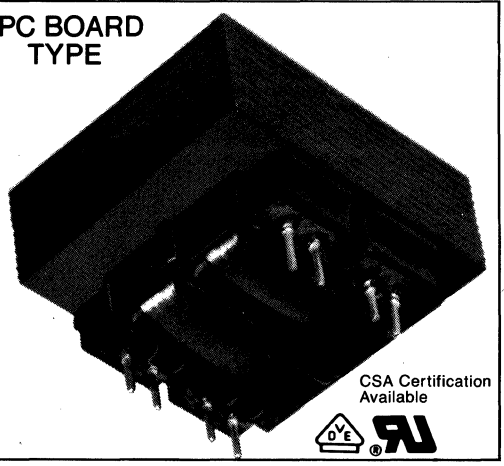
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one-4-all™ international

MEETS UL, VDE, IEC, CSA AND ALL COST & BETTER PERFORMANCE THAN

PC BOARD TYPE



CSA Certification Available

Signal's International Series of transformers is designed and constructed to meet all U.S. and international standards such as UL, VDE, IEC and CSA. This is accomplished by two factors:

1. The dual bobbin construction including an overall insulating shroud as indicated in the exploded view of constructional details.
2. The use of highly stable, high temperature material which more than meets UL flammability requirements.

The insulation system results in very high isolation between primary and secondary windings and from either to the core (or ground). **Hipot Test is 4000v RMS.** The dual bobbin non-concentric design reduces capacitance and eliminates the need for an electrostatic-shield.

These parts are available in both PC Board and Chassis Mount types from 2.5 to 175 va. Coil winding and wire termination are simplified by the bobbin construction and the method of winding. The dual windings, when possible, are wound "bifilar" so that **all anchor and insulating tapes are eliminated.**

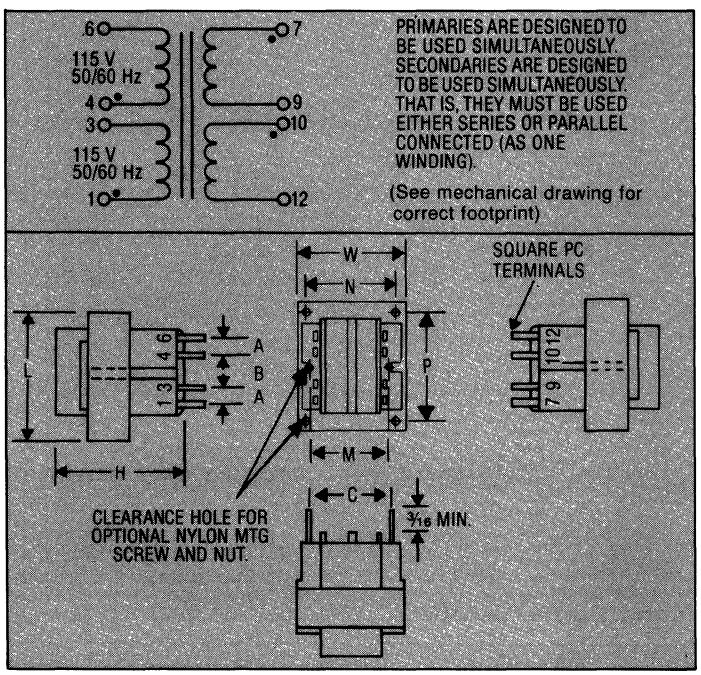
Also, since the windings are electrically balanced, there are no primary circulating currents and, if the secondaries are series-connected for a FWCT rectifier, the balance makes filtering easier.

The bobbin wall slots allow for all leads to be brought out of the winding area for termination. As a result, **all wire crossovers and insulating pads are eliminated.** The insulating shroud positions both bobbins accurately for core stacking and also provides the barriers for the 4000v RMS Test Voltage.

These design improvements lower manufacturing costs. As a result, the series is truly universal and can be sold at lower prices than previous "split bobbin" and "PC" types.

Again, Signal is there first – with the best – and at lower cost.

Part No.	VA (Size)	Secondary RMS Rating	
		Series	Parallel
14A-2.5-10	2.5	10V C.T. @ 0.25A	5V @ 0.5A
14A-5.0-10	5.0	10V C.T. @ 0.5A	5V @ 1.0A
14A-10-10	10.0	10V C.T. @ 1.0A	5V @ 2.0A
14A-20-10	20.0	10V C.T. @ 2.0A	5V @ 4.0A
14A-30-10	30.0	10V C.T. @ 3.0A	5V @ 6.0A
14A-56-10	56.0	10V C.T. @ 5.6A	5V @ 11.2A
14A-2.5-12	2.5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
14A-5.0-12	5.0	12.6V C.T. @ 0.4A	6.3V @ 0.8A
14A-10-12	10.0	12.6V C.T. @ 0.8A	6.3V @ 1.6A
14A-20-12	20.0	12.6V C.T. @ 1.6A	6.3V @ 3.2A
14A-30-12	30.0	12.6V C.T. @ 2.4A	6.3V @ 4.8A
14A-56-12	56.0	12.6V C.T. @ 4.4A	6.3V @ 8.8A
14A-2.5-16	2.5	16V C.T. @ 0.15A	8V @ 0.3A
14A-5.0-16	5.0	16V C.T. @ 0.31A	8V @ 0.62A
14A-10-16	10.0	16V C.T. @ 0.62A	8V @ 1.25A
14A-20-16	20.0	16V C.T. @ 1.25A	8V @ 2.5A
14A-30-16	30.0	16V C.T. @ 1.9A	8V @ 3.8A
14A-56-16	56.0	16V C.T. @ 3.5A	8V @ 7.0A
14A-2.5-20	2.5	20V C.T. @ 0.12A	10V @ 0.24A
14A-5.0-20	5.0	20V C.T. @ 0.25A	10V @ 0.5A
14A-10-20	10.0	20V C.T. @ 0.5A	10V @ 1.0A
14A-20-20	20.0	20V C.T. @ 1.0A	10V @ 2.0A
14A-30-20	30.0	20V C.T. @ 1.5A	10V @ 3.0A
14A-56-20	56.0	20V C.T. @ 2.8A	10V @ 5.6A
14A-2.5-24	2.5	24V C.T. @ 0.1A	12V @ 0.2A
14A-5.0-24	5.0	24V C.T. @ 0.21A	12V @ 0.42A
14A-10-24	10.0	24V C.T. @ 0.42A	12V @ 0.84A
14A-20-24	20.0	24V C.T. @ 0.83A	12V @ 1.66A
14A-30-24	30.0	24V C.T. @ 1.25A	12V @ 2.50A
14A-56-24	56.0	24V C.T. @ 2.33A	12V @ 4.66A
14A-2.5-28	2.5	28V C.T. @ 0.09A	14V @ 0.18A
14A-5.0-28	5.0	28V C.T. @ 0.18A	14V @ 0.36A
14A-10-28	10.0	28V C.T. @ 0.36A	14V @ 0.72A
14A-20-28	20.0	28V C.T. @ 0.72A	14V @ 1.44A
14A-30-28	30.0	28V C.T. @ 1.06A	14V @ 2.12A
14A-56-28	56.0	28V C.T. @ 2.0A	14V @ 4.0A
14A-2.5-36	2.5	36V C.T. @ 0.07A	18V @ 0.14A
14A-5.0-36	5.0	36V C.T. @ 0.14A	18V @ 0.28A
14A-10-36	10.0	36V C.T. @ 0.28A	18V @ 0.56A
14A-20-36	20.0	36V C.T. @ 0.56A	18V @ 1.12A
14A-30-36	30.0	36V C.T. @ 0.82A	18V @ 1.64A
14A-56-36	56.0	36V C.T. @ 1.56A	18V @ 3.12A



Dimensions							Pin	Mtg.			Mtg. Screw		
VA	L	W	H	A	B	C	Dimensions	M	N	P	Size	Quantity	Lbs.
2.5	1 5/8	1 5/16	1⅛	.200	.250	1.000	0.025SQ	1 1/16	—	—	#4	2	0.25
5.0	1 5/8	1 5/16	1⅜	.200	.400	1.000	0.025SQ	1 1/16	—	—	#4	2	0.37
10.0	1 7/8	1 9/16	1⅜	.200	.400	1.140	0.038SQ	1 ¼	—	—	#4	2	0.53
20.0	2 ¼	1 7/8	1⅝	.400	.400	1.460	0.038SQ	1 ½	—	—	#4	2	0.90
30.0	2 5/8	2 3/16	1 9/16	.550	.275	1.680	0.045SQ	—	1¾	2 3/16	#6	4	1.15
56.0	3	2 ½	1 13/16	.600	.300	1.900	0.045SQ	—	2	2 ½	#6	4	1.70

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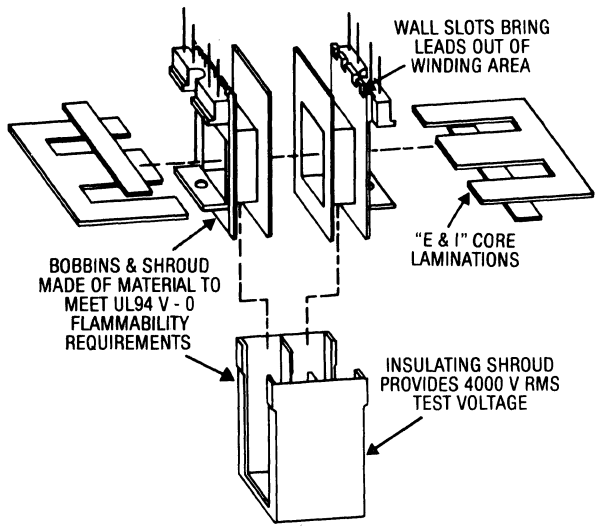
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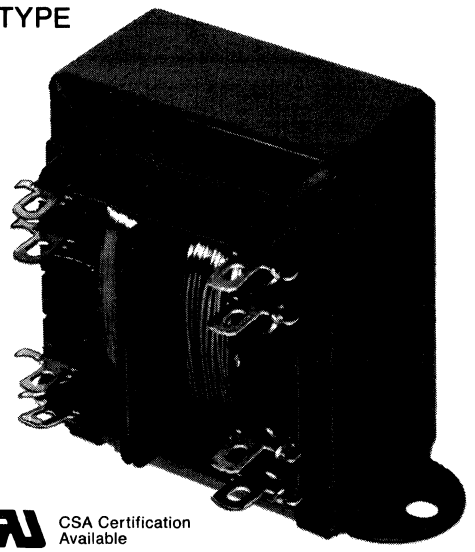
...series transformers

INTERNATIONAL STANDARDS AT LOWER EXISTING SPLIT-BOBBIN TYPES!

EXPLODED VIEW OF CONSTRUCTION

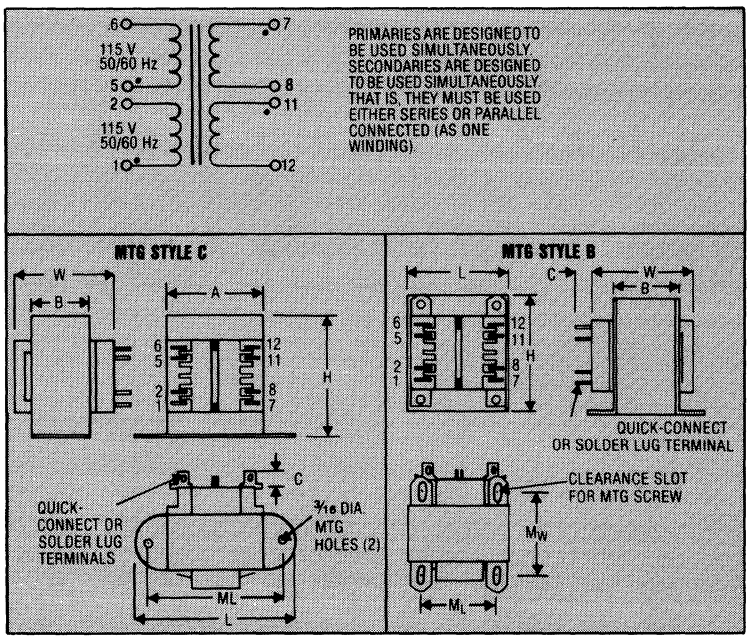


CHASSIS MOUNT TYPE



CSA Certification Available

Part No.	VA (Size)	Secondary RMS Rating	
		Series	Parallel
A41-25-10	25	10V C.T. @ 2.5A	5V @ 5.0A
A41-43-10	43	10V C.T. @ 4.3A	5V @ 8.6A
A41-80-10	80	10V C.T. @ 8.0A	5V @ 16.0A
A41-130-10	130	10V C.T. @ 13.0A	5V @ 26.0A
A41-175-10	175	10V C.T. @ 17.5A	5V @ 35.0A
A41-25-12	25	12.6V C.T. @ 2.0A	6.3V @ 4.0A
A41-43-12	43	12.6V C.T. @ 3.4A	6.3V @ 6.8A
A41-80-12	80	12.6V C.T. @ 6.3A	6.3V @ 12.6A
A41-130-12	130	12.6V C.T. @ 10.3A	6.3V @ 20.6A
A41-175-12	175	12.6V C.T. @ 14.0A	6.3V @ 28.0A
A41-25-16	25	16V C.T. @ 1.6A	8V @ 3.2A
A41-43-16	43	16V C.T. @ 2.7A	8V @ 5.4A
A41-80-16	80	16V C.T. @ 5.0A	8V @ 10.0A
A41-130-16	130	16V C.T. @ 8.1A	8V @ 16.2A
A41-175-16	175	16V C.T. @ 11.0A	8V @ 22.0A
A41-25-20	25	20V C.T. @ 1.25A	10V @ 2.5A
A41-43-20	43	20V C.T. @ 2.2A	10V @ 4.4A
A41-80-20	80	20V C.T. @ 4.0A	10V @ 8.0A
A41-130-20	130	20V C.T. @ 6.5A	10V @ 13.0A
A41-175-20	175	20V C.T. @ 8.8A	10V @ 17.6A
A41-25-24	25	24V C.T. @ 1A	12V @ 2A
A41-43-24	43	24V C.T. @ 1.8A	12V @ 3.6A
A41-80-24	80	24V C.T. @ 3.3A	12V @ 6.6A
A41-130-24	130	24V C.T. @ 5.4A	12V @ 10.8A
A41-175-24	175	24V C.T. @ 7.3A	12V @ 14.6A
A41-25-28	25	28V C.T. @ 0.9A	14V @ 1.86A
A41-43-28	43	28V C.T. @ 1.5A	14V @ 3.0A
A41-80-28	80	28V C.T. @ 2.8A	14V @ 5.6A
A41-130-28	130	28V C.T. @ 4.6A	14V @ 9.2A
A41-175-28	175	28V C.T. @ 6.25A	14V @ 12.5A
A41-25-36	25	36V C.T. @ 0.7A	18V @ 1.4A
A41-43-36	43	36V C.T. @ 1.2A	18V @ 2.4A
A41-80-36	80	36V C.T. @ 2.2A	18V @ 4.4A
A41-130-36	130	36V C.T. @ 3.6A	18V @ 7.2A
A41-175-36	175	36V C.T. @ 4.8A	18V @ 9.6A
A41-25-230	25	230V C.T. @ 0.11A	115V @ 0.22A
A41-43-230	43	230V C.T. @ 0.19A	115V @ 0.38A
A41-80-230	80	230V C.T. @ 0.35A	115V @ 0.7A
A41-130-230	130	230V C.T. @ 0.57A	115V @ 1.14A
A41-175-230	175	230V C.T. @ 0.76A	115V @ 1.52A



Dimensions							Terminals	Mtg. Style	Mtg.		Mtg. Screw	Lbs.
VA	L	W	H	A	B	C			ML	MW		
25	2 13/16	1 7/8	2 5/16	2	1 1/8	5/16	3/16 (.187)	C	2 3/8	–	#6	1.25
43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	5/16	3/16 (.187)	C	2 13/16	–	#6	1.6
80	2 1/2	2 3/8	3	–	1 3/8	5/16	3/16 (.187)	B	2	2 3/16	#6	2.8
130	2 13/16	2 7/8	3 3/8	–	1 5/8	3/8	1/4 (0.25)	B	2 1/4	2 1/2	#8	4.1
175	3 1/8	2 7/8	3 3/4	–	1 5/8	3/8	1/4 (0.25)	B	2 1/2	2 1/2	#8	5.5

THE PRONTO™ PLEDGE

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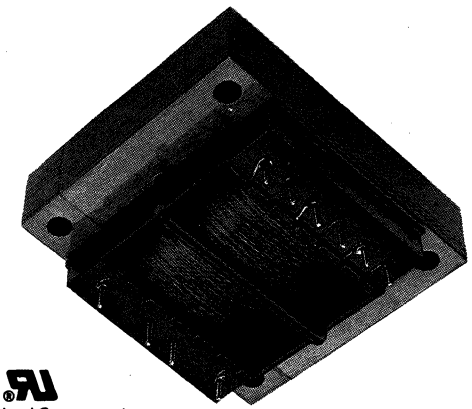
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The American Original.

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Fax: (516) 239-7208

one-4-all transformers... p.c. board for triple-output regulated supplies in (μp) applications

PC BOARD TYPE

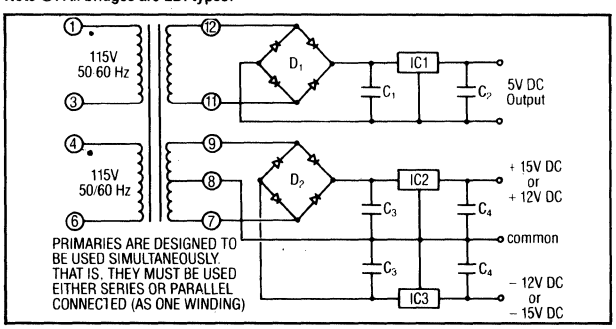


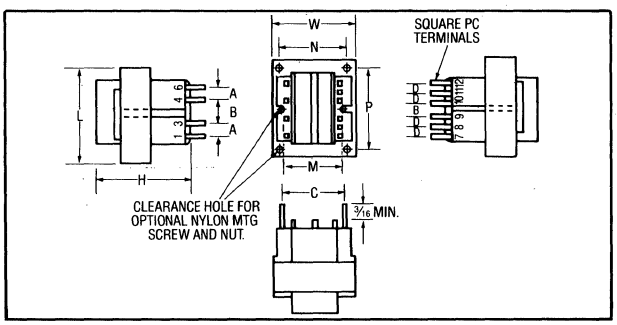
Recognized Component
Underwriters Labs Inc.

- Dual complementary outputs–with your regulators, ± 12 VDC and ± 15 VDC.
- Additional isolated single output gives you 5VDC after regulation.
- Low noise alternative to multi-output switchers.
- PC board mount has the advantages of Signals one-4-all International Series–isolation and dual bobbin construction
- UL recognized UL506.
- Designed to meet VDE, IEC, CSA.

PART NUMBER PRIMARY 50/60 Hz	DC OUTPUT		VA	SUGGESTED COMPONENTS					C_2 C_4 See Note ①	
115/230V	Regulator 1	Regulator 2		C_1	C_3	IC1③	IC2③	IC3③	D1④	D2④
14A-20-512	5V @ 750MA	±12V @ 200MA	20	2.3 KMFD @ 50 VDC	600 MFD @ 50 VDC	LM-323K-5	LM-340K-12	LM-320K-12	PE20	PF20
14A-20-515	5V @ 750MA	±15V @ 175MA	20			LM-323K-5	LM-340K-15	LM-320K-15	PE20	PF20
14A-30-512	5V @ 1.25A	±12V @ 250MA	30	4.1 KMFD @ 15 VDC	1.1 KMFD @ 50 VDC	LM-323K-5	LM-340K-12	LM-320K-12	PE20	PF20
14A-30-515	5V @ 1.25A	±15V @ 200MA	30		600 MFD @ 50 VDC	LM-323K-5	LM-340K-15	LM-320K-15	PE20	PF20
14A-56-512	5V @ 3A	±12V @ 300MA	56	10.0 KMFD @ 15 VDC	1.1 KMFD @ 50 VDC	LM-338②	LM-340K-12	LM-320K-12	PP20	PF20
14A-56-515	5V @ 3A	±15V @ 250MA	56			LM-338②	LM-340K-15	LM-320K-15	PP20	PF20

Note ①: Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic. 20V min.
Note ②: LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③: All IC's are National Semiconductor types.
Note ④: All bridges are EDI types.





Dimensions								Pin	Mtg.			Mtg. Screw		
VA	L	W	H	A	B	C	D	Dimensions	M	N	P	Size	Quantity	Lbs.
20.0	2¼	1⅞	1⅝	.400	.400	1.460	.200	0.038SQ	1½	–	–	#4	2	0.90
30.0	2⅝	2³⁄₁₆	1⁹⁄₁₆	.550	.275	1.680	.275	0.045SQ	–	1¾	2³⁄₁₆	#6	4	1.15
56.0	3	2½	1¹³⁄₁₆	.600	.300	1.900	.300	0.045SQ	–	2	2½	#6	4	1.70

THE PRONTO™ PLEDGE

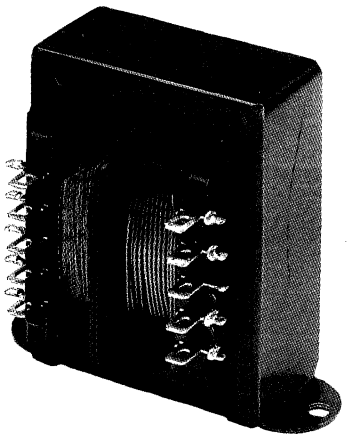
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Inwood, NY 11696
Fax: (516) 239-7208

all-4-one™ transformers... chassis mount for triple-output regulated supplies in (μp) applications

CHASSIS MOUNT TYPE

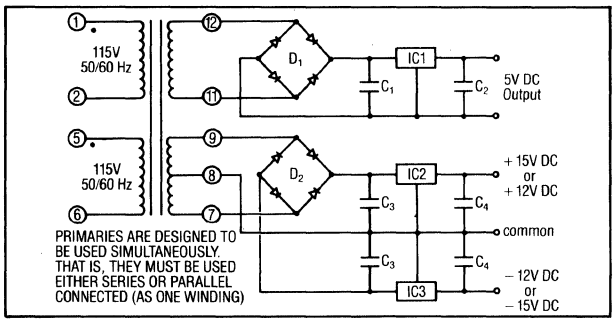


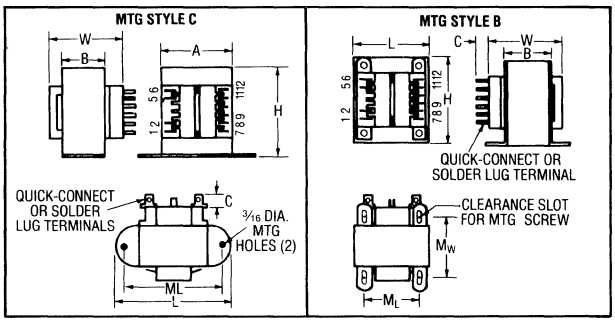
Recognized Component
Underwriters Labs Inc.

- Dual complementary outputs – with your regulators, ± 12 VDC and ± 15 VDC.
- Additional isolated single output gives you 5VDC after regulation.
- Low noise alternative to multi-output switchers.
- Chassis mount has the advantages of Signals all-4-one International Series – isolation dual bobbin construction.
- UL recognized UL506.
- Designed to meet VDE, IEC, CSA.

PART NUMBER PRIMARY 50/60 Hz	DC OUTPUT		VA	SUGGESTED COMPONENTS					C_2 C_4 See Note ①	
115/230V	Regulator 1	Regulator 2		C_1	C_3	IC1③	IC2③	IC3③	D1④	D2④
A41-25-512	5V @ 1.25A	±12V @ 150MA	25	4.1 KMFD @ 15 VDC	600 MFD @ 50 VDC	LM-323K-5	LM-340K-12	LM-320K-12	PE20	PF20
A41-25-515	5V @ 1.25A	±15V @ 130MA	25			LM-323K-5	LM-340K-15	LM-320K-15	PE20	PF20
A41-43-512	5V @ 2A	±12V @ 300MA	43	8 KMFD @ 15 VDC	1.1 KMFD @ 50 VDC	LM-323K-5	LM-340K-12	LM-320K-12	PE20	PF20
A41-43-515	5V @ 2A	±15V @ 250MA	43			LM-323K-5	LM-340K-15	LM-320K-15	PE20	PF20
A41-80-512	5V @ 3.5A	±12V @ 600MA	80	10 KMFD @ 15 VDC	2.1 KMFD @ 50 VDC	LM-338②	LM-340K-12	LM-320K-12	PP20	PF20
A41-80-515	5V @ 3.5A	±15V @ 500MA	80			LM-338②	LM-340K-15	LM-320K-15	PP20	PF20

Note ①: Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic. 20V min.
Note ②: LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③: All IC's are National Semiconductor types.
Note ④: All bridges are EDI types.





Dimensions							Terminals	Mtg. Style	Mtg.		Mtg. Screw	Lbs.
VA	L	W	H	A	B	C			ML	MW		
25	2 13/16	1 7/8	2 5/16	2	1 1/8	5/16	3/16 (.187)	C	2 3/8	–	#6	1.25
43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	5/16	3/16 (.187)	C	2 13/16	–	#6	1.6
80	2 1/2	2 3/8	3	–	1 3/8	5/16	3/16 (.187)	B	2	2 3/16	#6	2.8

THE PRONTO™ PLEDGE

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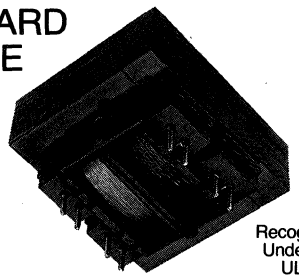
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class 2 transformers

- Available in ratings of 2.5 through 80VA
- Choose between inherently limited and non-inherently limited.
- Designed with the same dual bobbin construction as our International Series.
- 4000 VRMS Primary and Secondary isolation.

PC BOARD TYPE

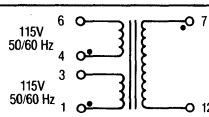


Recognized Component
Underwriters Labs Inc.
UL1585 CLASS 2

Specifications

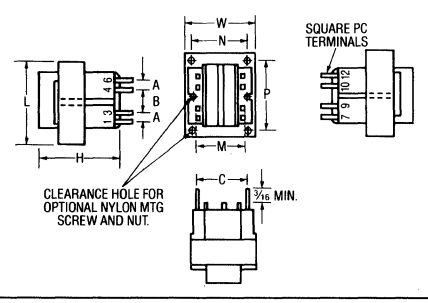
PART NO.	SECONDARY RMS RATING	SECONDARY FUSE REQD.
CL2-2.5-12	12V @ .20A	N/A*
CL2-2.5-24	24V @ .10A	N/A*
CL2-5.0-12	12V @ .42A	N/A*
CL2-5.0-24	24V @ .20A	N/A*
CL2-10-12	12V @ .83A	N/A*
CL2-10-24	24V @ .42A	N/A*
CL2-20-12	12V @ 1.66A	N/A*
CL2-20-24	24V @ .833A	N/A*
CL2-30-12	12V @ 2.50A	3.0A**
CL2-30-24	24V @ 1.25A	N/A*
CL2-50-12	12V @ 4.20A	5.0A**
CL2-50-24	24V @ 2.10A	2.5A**

SCHEMATIC



PRIMARIES ARE DESIGNED TO BE USED SIMULTANEOUSLY. THAT IS, THEY MUST BE USED EITHER SERIES OR PARALLEL CONNECTED (AS ONE WINDING).

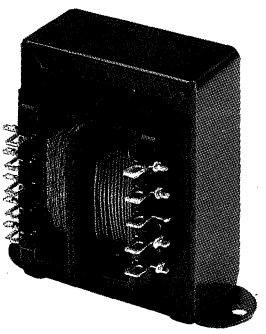
(See mechanical drawing for correct footprint)



DIMENSIONS

Dimensions							Pin	Mtg.			Mtg. Screw		
VA	L	W	H	A	B	C	Dimensions	M	N	P	Size	Quantity	Lbs.
2.5	1 5/8	1 5/16	1 1/8	.200	.250	1.000	0.025SQ	1 1/16	–	–	#4	2	0.25
5.0	1 5/8	1 5/16	1 3/8	.200	.400	1.000	0.025SQ	1 1/16	–	–	#4	2	0.37
10.0	1 7/8	1 9/16	1 3/8	.200	.400	1.140	0.038SQ	1 1/4	–	–	#4	2	0.53
20.0	2 1/4	1 7/8	1 5/8	.400	.400	1.460	0.038SQ	1 1/2	–	–	#4	2	0.90
30.0	2 5/8	2 3/16	1 9/16	.550	.275	1.680	0.045SQ	–	1 3/4	2 3/16	#6	4	1.15
50.0	3	2 1/2	1 13/16	.600	.300	1.900	0.045SQ	–	2	2 1/2	#6	4	1.70

CHASSIS MOUNT TYPE



Recognized Component
Underwriters Labs Inc.
UL1585 CLASS 2

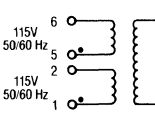
Specifications

*INHERENTLY LIMITED
**NON-INHERENTLY LIMITED
MAXIMUM SECONDARY FUSE VALUE SPECIFIED

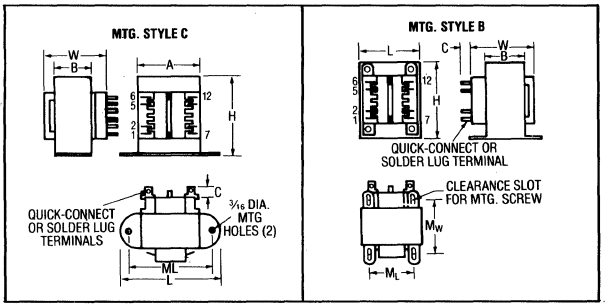
ALL PRIMARIES ARE 115/230 VOLT 50/60 HZ

PART NO.	SECONDARY RMS RATING	SECONDARY FUSE REQD.
CL2-25-12	12V @ 2.10A	2.5A**
CL2-25-24	24V @ 1.05A	N/A*
CL2-40-12	12V @ 3.33A	4.0A**
CL2-40-24	24V @ 1.66A	2.0A**
CL2-80-24	24V @ 3.33A	4.0**

SCHEMATIC



PRIMARIES ARE DESIGNED TO BE USED SIMULTANEOUSLY. THAT IS, THEY MUST BE USED EITHER SERIES OR PARALLEL CONNECTED (AS ONE WINDING).



DIMENSIONS

Dimensions							Terminals	Mtg. Style	Mtg.		Mtg. Screw	Lbs.
VA	L	W	H	A	B	C			ML	MW		
25	2 13/16	1 7/8	2 5/16	2	1 1/8	5/16	3/16 (.187)	C	2 3/8	–	#6	1.25
40	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	5/16	3/16 (.187)	C	2 13/16	–	#6	1.6
80	2 1/2	2 3/8	3	–	1 3/8	5/16	3/16 (.187)	B	2	2 3/16	#6	2.8

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flathead® plug in power transformers ...in 2 new larger sizes

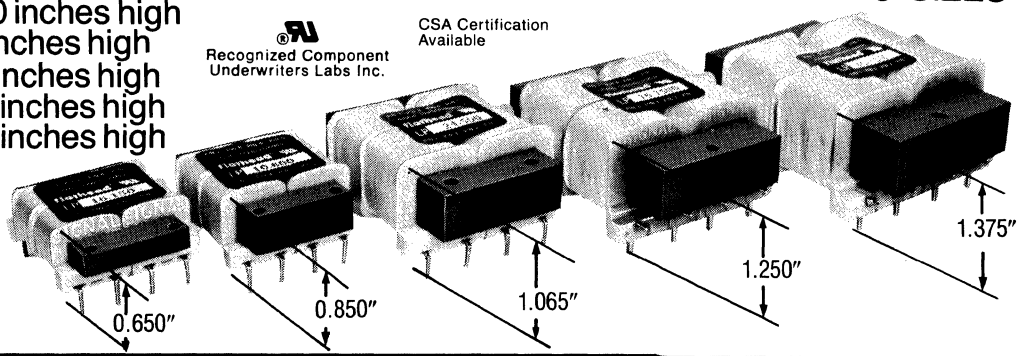
FOR PRINTED CIRCUIT APPLICATIONS

5 SIZES

2.5VA – 0.650 inches high
6VA – 0.850 inches high
12VA – 1.065 inches high
24 VA – 1.250 inches high
48 VA – 1.375 inches high

Recognized Component Underwriters Labs Inc.

CSA Certification Available

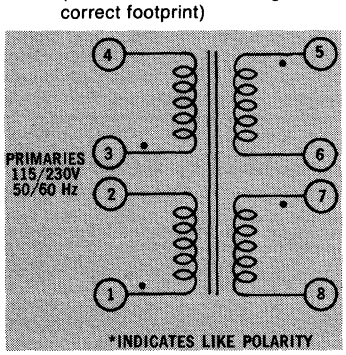


Part No.	Size	SECONDARY* Series	Parallel
LP 10-250	2	10V C.T. @ 250MA	5V @ 500MA
LP 10-600	6	10V C.T. @ 600MA	5V @ 1.2A
LP 10-1200	12	10V C.T. @ 1200MA	5V @ 2.4A
LP 10-2400	24	10V C.T. @ 2.40A	5V @ 4.80A
LP 10-4800	48	10V C.T. @ 4.80A	5V @ 9.60A
LP 12-200	2	12.6V C.T. @ 200MA	6.3V @ 400MA
LP 12-450	6	12.6V C.T. @ 450MA	6.3V @ 900MA
LP 12-900	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
LP 12-1900	24	12.6V C.T. @ 1.90MA	6.3V @ 3.80A
LP 12-3800	48	12.6V C.T. @ 3.80MA	6.3V @ 7.60A
LP 16-150	2	16V C.T. @ 150MA	8V @ 300MA
LP 16-350	6	16V C.T. @ 350MA	8V @ 700MA
LP 16-700	12	16V C.T. @ 700MA	8V @ 1.4A
LP 16-1500	24	16V C.T. @ 1.50A	8V @ 3.00A
LP 16-3000	48	16V C.T. @ 3.00A	8V @ 6.00A
LP 20-125	2	20V C.T. @ 125MA	10V @ 250MA
LP 20-300	6	20V C.T. @ 300MA	10V @ 600MA
LP 20-600	12	20V C.T. @ 600MA	10V @ 1.2A
LP 20-1200	24	20V C.T. @ 1.20A	10V @ 2.40A
LP 20-2400	48	20V C.T. @ 2.40A	10V @ 4.80A
LP 24-100	2	24V C.T. @ 100MA	12V @ 200MA
LP 24-250	6	24V C.T. @ 250MA	12V @ 500MA
LP 24-500	12	24V C.T. @ 500MA	12V @ 1A
LP 24-1000	24	24V C.T. @ 1.00A	12V @ 2.00A
LP 24-2000	48	24V C.T. @ 2.00A	12V @ 4.00A
LP 30-85	2	30V C.T. @ 85MA	15V @ 170MA
LP 30-200	6	30V C.T. @ 200MA	15V @ 400MA
LP 30-400	12	30V C.T. @ 400MA	15V @ 800MA
LP 30-800	24	30V C.T. @ 800MA	15V @ 1.60A
LP 30-1600	48	30V C.T. @ 1.60A	15V @ 3.20A
LP 34-75	2	34V C.T. @ 75MA	17V @ 150MA
LP 34-170	6	34V C.T. @ 170MA	17V @ 340MA
LP 34-340	12	34V C.T. @ 340MA	17V @ 680MA
LP 34-700	24	34V C.T. @ 700MA	17V @ 1.40A
LP 34-1400	48	34V C.T. @ 1.40A	17V @ 2.80A
LP 40-60	2	40V C.T. @ 60MA	20V @ 120MA
LP 40-150	6	40V C.T. @ 150MA	20V @ 300MA
LP 40-300	12	40V C.T. @ 300MA	20V @ 600MA
LP 40-600	24	40V C.T. @ 600MA	20V @ 1.20A
LP 40-1200	48	40V C.T. @ 1.20A	20V @ 2.40A
LP 56-45	2	56V C.T. @ 45MA	28V @ 90MA
LP 56-100	6	56V C.T. @ 100MA	28V @ 200MA
LP 56-200	12	56V C.T. @ 200MA	28V @ 400MA
LP 56-425	24	56V C.T. @ 425MA	28V @ 850MA
LP 56-850	48	56V C.T. @ 850MA	28V @ 1.70A
LP 88-28	2	88V C.T. @ 28MA	44V @ 56MA
LP 88-65	6	88V C.T. @ 65MA	44V @ 130MA
LP 88-130	12	88V C.T. @ 130MA	44V @ 260MA
LP 120-20	2	120V C.T. @ 20MA	60V @ 40MA
LP 120-50	6	120V C.T. @ 50MA	60V @ 100MA
LP 120-100	12	120V C.T. @ 100MA	60V @ 200MA
LP 230-10	2	230V C.T. @ 10MA	115V @ 20MA
LP 230-25	6	230V C.T. @ 25MA	115V @ 50MA
LP 230-50	12	230V C.T. @ 50MA	115V @ 100MA

Signal expanded its Flathead® Series because of the trend toward higher power usage on PC boards. Two larger sizes (24 and 48 VA) are now available.

Basic design, layout and construction specifications have not changed. The only exception is that more rugged plug-in pins, using square wire, have been incorporated in order to properly handle the weights and currents required.

(See mechanical drawing for correct footprint)



Regulation of size 2 and 6 units is 30%; size 12 units is 20%; size 24 and 48 units is 15%; i.e., no load-secondary voltage is 15% higher than full load.

LOW PROFILE: Allows ¾″ card spacing for 2.5va units, 1 inch card spacing for 6va units, or 1¼″ inch card spacing for 12va units, 1½″ inch card spacing for 24va and 1⅝″ inch card spacing for 48va.

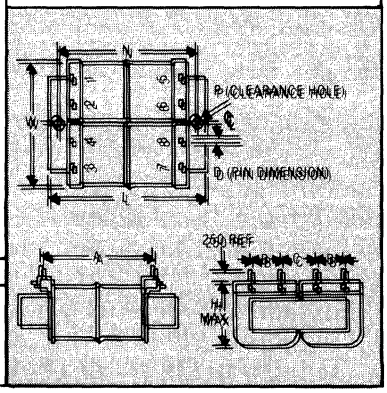
DUAL PRIMARIES: 115/230v, 50/60 Hz.

NON-CONCENTRIC WINDING: Where secondary is wound alongside primary rather than directly over it. This added isolation reduces inter-winding capacitance and **eliminates the need for an electro-static shield.**

1500V. RMS HIPOT: Is standard because of the advantage of non-concentric windings.

HUM-BUCKING CONSTRUCTION: (Semi-toroidal) results in reduced radiated magnetic field and balanced windings.

The LP line of transformers is ideal for low height, critical pc board power applications in semi-conductor control and instrumentation. They are used extensively in single or dual output dc supplies and isolated control circuit and reference supplies.



Size	A	B	C	L	W	H	N	D	P	Oz.
2	1.600	0.375	0.375	1.87	1.56	0.650	—	.041 x .020	—	5
6	1.600	0.375	0.375	1.87	1.56	0.850	—	.041 x .020	—	7
12	2.000	0.500	0.500	2.50	2.00	1.065	—	.041 x .020	—	11
24	1.900	0.600	0.530	2.87	2.25	1.250	2.41	.041 Sq.	CLEARANCE HOLE FOR # 4 SCREW	15
48	2.180	0.600	0.660	3.12	2.50	1.375	2.62	.041 Sq.	CLEARANCE HOLE FOR # 6 SCREW	21

THE PRONTO™ PLEDGE

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Signal Transformer.

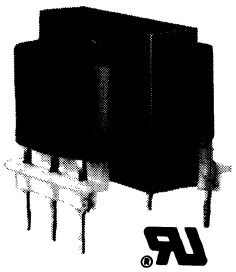
The American Original.

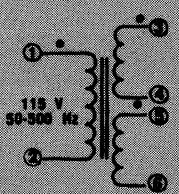
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miniature plug in power transformers

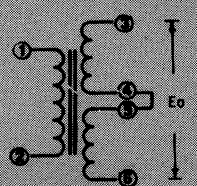
SINGLE 115V PRIMARY TYPE PC 6 PINS

CSA Certification Available

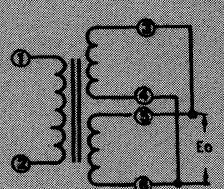




BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED

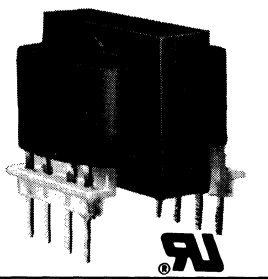
(See mechanical drawing for correct footprint)

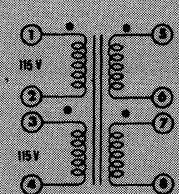
PRIMARY 50/500 Hz		SECONDARY RMS RATING*		
Single 115V (6 Pin)	Dual 115/230V (8 Pin)	Series	Parallel	Size (VA)
PC 10-90	DPC 10-90	10V C.T. @ 90MA	5V @ 180MA	1.0
PC 10-120	DPC 10-120	10V C.T. @ 120MA	5V @ 240MA	1.2
PC 10-440	DPC 10-440	10V C.T. @ 440MA	5V @ 880MA	4.4
PC 10-1000	DPC 10-1000	10V C.T. @ 1A	5V @ 2A	10
PC 10-2400	DPC 10-2400	10V C.T. @ 2.4A	5V @ 4.8A	24
PC 12-70	DPC 12-70	12.6V C.T. @ 70MA	6.3V @ 140MA	1.0
PC 12-100	DPC 12-100	12.6V C.T. @ 100MA	6.3V @ 200MA	1.2
PC 12-350	DPC 12-350	12.6V C.T. @ 350MA	6.3V @ 700MA	4.4
PC 12-800	DPC 12-800	12.6V C.T. @ 800MA	6.3V @ 1.6A	10
PC 12-2000	DPC 12-2000	12.6V C.T. @ 2A	6.3V @ 4A	24
PC 16-55	DPC 16-55	16V C.T. @ 55MA	8V @ 110MA	1.0
PC 16-75	DPC 16-75	16V C.T. @ 75MA	8V @ 150MA	1.2
PC 16-260	DPC 16-260	16V C.T. @ 260MA	8V @ 520MA	4.4
PC 16-640	DPC 16-640	16V C.T. @ 640MA	8V @ 1.28A	10
PC 16-1500	DPC 16-1500	16V C.T. @ 1.5A	8V @ 3A	24
PC 20-45	DPC 20-45	20V C.T. @ 45MA	10V @ 90MA	1.0
PC 20-60	DPC 20-60	20V C.T. @ 60MA	10V @ 120MA	1.2
PC 20-220	DPC 20-220	20V C.T. @ 220MA	10V @ 440MA	4.4
PC 20-500	DPC 20-500	20V C.T. @ 500MA	10V @ 1A	10
PC 20-1200	DPC 20-1200	20V C.T. @ 1.2A	10V @ 2.4A	24
PC 24-35	DPC 24-35	24V C.T. @ 35MA	12V @ 70MA	1.0
PC 24-50	DPC 24-50	24V C.T. @ 50MA	12V @ 100MA	1.2
PC 24-180	DPC 24-180	24V C.T. @ 180MA	12V @ 360MA	4.4
PC 24-450	DPC 24-450	24V C.T. @ 450MA	12V @ 900MA	10
PC 24-1000	DPC 24-1000	24V C.T. @ 1A	12V @ 2A	24
PC 28-30	DPC 28-30	28V C.T. @ 30MA	14V @ 60MA	1.0
PC 28-40	DPC 28-40	28V C.T. @ 40MA	14V @ 80MA	1.2
PC 28-160	DPC 28-160	28V C.T. @ 160MA	14V @ 320MA	4.4
PC 28-360	DPC 28-360	28V C.T. @ 360MA	14V @ 720MA	10
PC 28-800	DPC 28-800	28V C.T. @ 800MA	14V @ 1.6A	24
PC 34-25	DPC 34-25	34V C.T. @ 25MA	17V @ 50MA	1.0
PC 34-35	DPC 34-35	34V C.T. @ 35MA	17V @ 70MA	1.2
PC 34-125	DPC 34-125	34V C.T. @ 125MA	17V @ 250MA	4.4
PC 34-300	DPC 34-300	34V C.T. @ 300MA	17V @ 600MA	10
PC 34-700	DPC 34-700	34V C.T. @ 700MA	17V @ 1.4A	24
PC 40-20	DPC 40-20	40V C.T. @ 20MA	20V @ 40MA	1.0
PC 40-30	DPC 40-30	40V C.T. @ 30MA	20V @ 60MA	1.2
PC 40-110	DPC 40-110	40V C.T. @ 110MA	20V @ 220MA	4.4
PC 40-250	DPC 40-250	40V C.T. @ 250MA	20V @ 500MA	10
PC 40-600	DPC 40-600	40V C.T. @ 600MA	20V @ 1.2A	24
PC 56-15	DPC 56-15	56V C.T. @ 15MA	28V @ 30MA	1.0
PC 56-20	DPC 56-20	56V C.T. @ 20MA	28V @ 40MA	1.2
PC 56-80	DPC 56-80	56V C.T. @ 80MA	28V @ 160MA	4.4
PC 56-180	DPC 56-180	56V C.T. @ 180MA	28V @ 360MA	10
PC 56-420	DPC 56-420	56V C.T. @ 420MA	28V @ 840MA	24
PC 120-8	DPC 120-8	120V C.T. @ 8MA	60V @ 16MA	1.0
PC 120-10	DPC 120-10	120V C.T. @ 10MA	60V @ 20MA	1.2
PC 120-35	DPC 120-35	120V C.T. @ 35MA	60V @ 70MA	4.4
PC 120-85	DPC 120-85	120V C.T. @ 85MA	60V @ 170MA	10
PC 120-200	DPC 120-200	120V C.T. @ 200MA	60V @ 400MA	24

* See Table on opposite page for method of determining RMS Secondary Current.

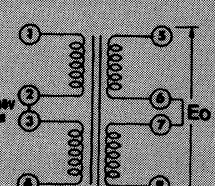
DUAL 115/230V PRIMARY TYPE DPC 8 PINS

CSA Certification Available

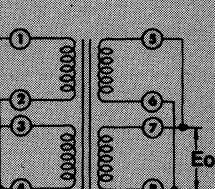




BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED

(See mechanical drawing for correct footprint)

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. . . for printed circuits applications

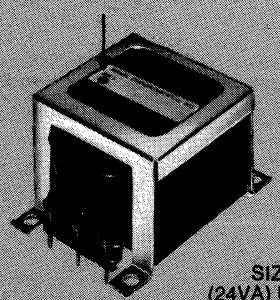
Signal has the most complete and diversified selection of miniature plug-in power transformers.

Primary ratings of 115V (Style PC - 6 Pin) or Dual 115/230V (Style DPC -8 Pin) are standard for the entire line. 1500V. Hipot is standard.

Size 1.0 is used extensively where height is a limiting factor since its height of 0.83 inches allows 1 inch spacing of PC boards. Size 24 is unusual since 24 watt PC transformers are not readily available, especially with a height of 1⅜ inches.

The RMS current ratings are based on a load regulation of 15-20% and not on temperature rise (except for the largest item, size 24). Therefore, these ratings may be exceeded without overheating, if the additional drop in full load voltage is acceptable. There is, of course, a limit and it would be best to check with our engineering department on specific units.

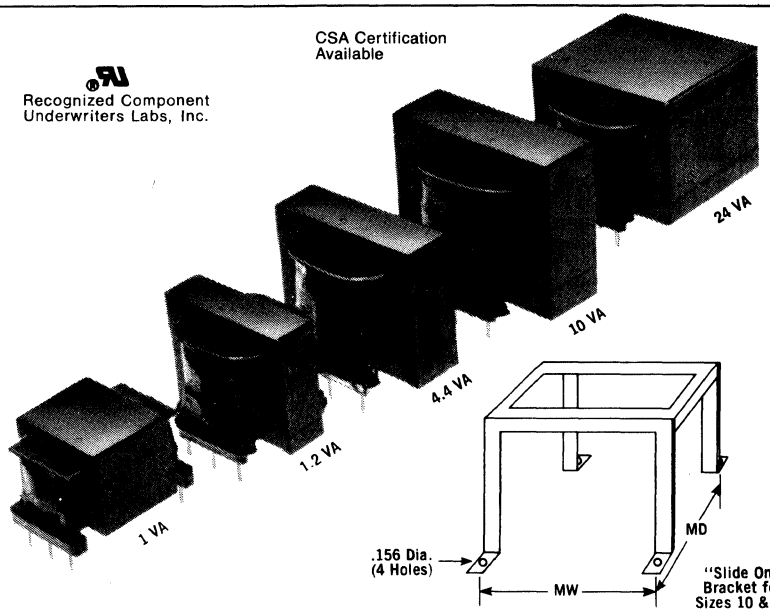
BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.



SIZE 24 (24VA) UNIT WITH 24-BR SLIDE-ON MOUNTING BRACKET

CSA Certification Available

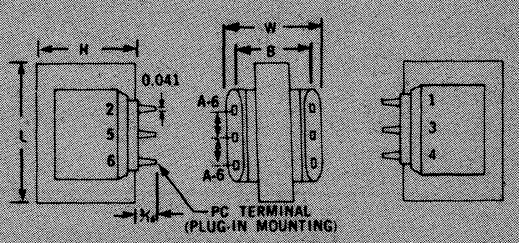
Recognized Component Underwriters Labs, Inc.



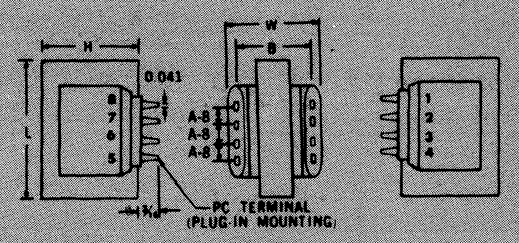
DIMENSIONS

Size (VA)	L	W	H	A-6 (6 Pin)	A-8 (8 Pin)	B	WT. (oz.)	OPTIONAL BRACKET* No.	MW	MD
1.0	1	1⅜	0.83	0.250	0.200	1.200	2.5	—	—	—
1.2	1⅜	1⅛	1 3/16	0.312	0.200	1.000	3	—	—	—
4.4	1⅝	1¼	1⅜	0.400	0.250	1.100	5	—	—	—
10	1⅞	1 7/16	1⅝	0.400	0.250	1.300	9	10-BR	1 41/64	1⅛
24	1⅝	2¼	1⅜	0.400	0.250	2.100	12	24-BR	1⅜	2

* An optional "Slide On" Mounting Bracket is available for sizes 10 and 24. The brackets do not use up any extra "Floor Space" but add 1/32" to the height of the transformer.



TYPE PC 6 PINS



TYPE DPC 8 PINS

METHOD OF DETERMINING SECONDARY CURRENT RATINGS

The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

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cut size and weight with "2-4-1"™ . . . .

The 2-4-1 series is an illustration of the use of creative design applied to small power transformers. The result is a line where, for a given va rating, size and weight are reduced almost 50%. Hence the name "241" series.

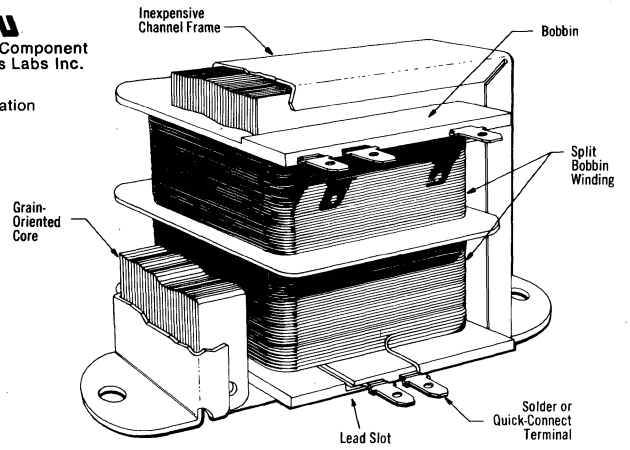
- BOBBIN WOUND — Maximum Utilization of Winding Area — Space and Size Reduced.
- SPLIT BOBBIN — NON-CONCENTRIC WINDING — Lower Capacitance — Better Insulation — 2500V RMS Hipot — No need for Electro-Static Shield — High Isolation and Insulation Resistance. No Cross-Overs of Primary and Secondary Leads.
- SPECIAL TERMINAL — Solder or Quick-Connect.

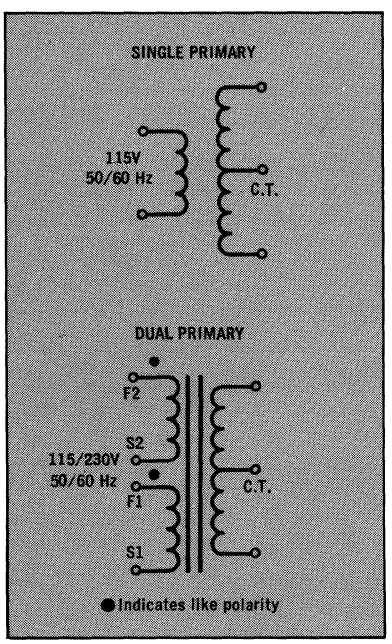
The series is available with single 115V or dual 115/230V primary, rated 50/60 Hz. Class S insulation is used for a maximum total temperature rating of 130°C continuous.

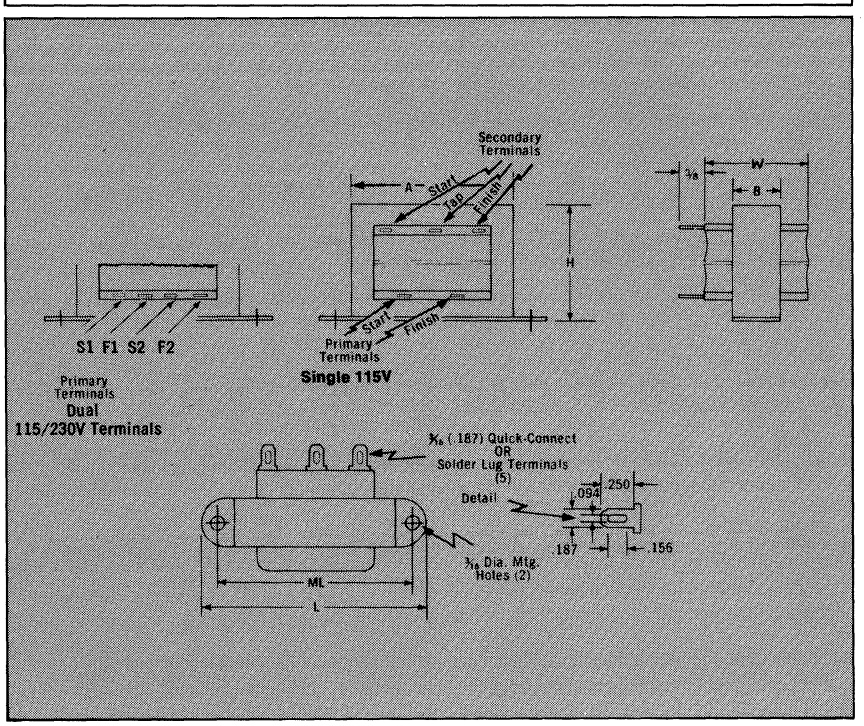
AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

Recognized Component Underwriters Labs Inc.

CSA Certification Available







DIMENSIONS

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	9/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

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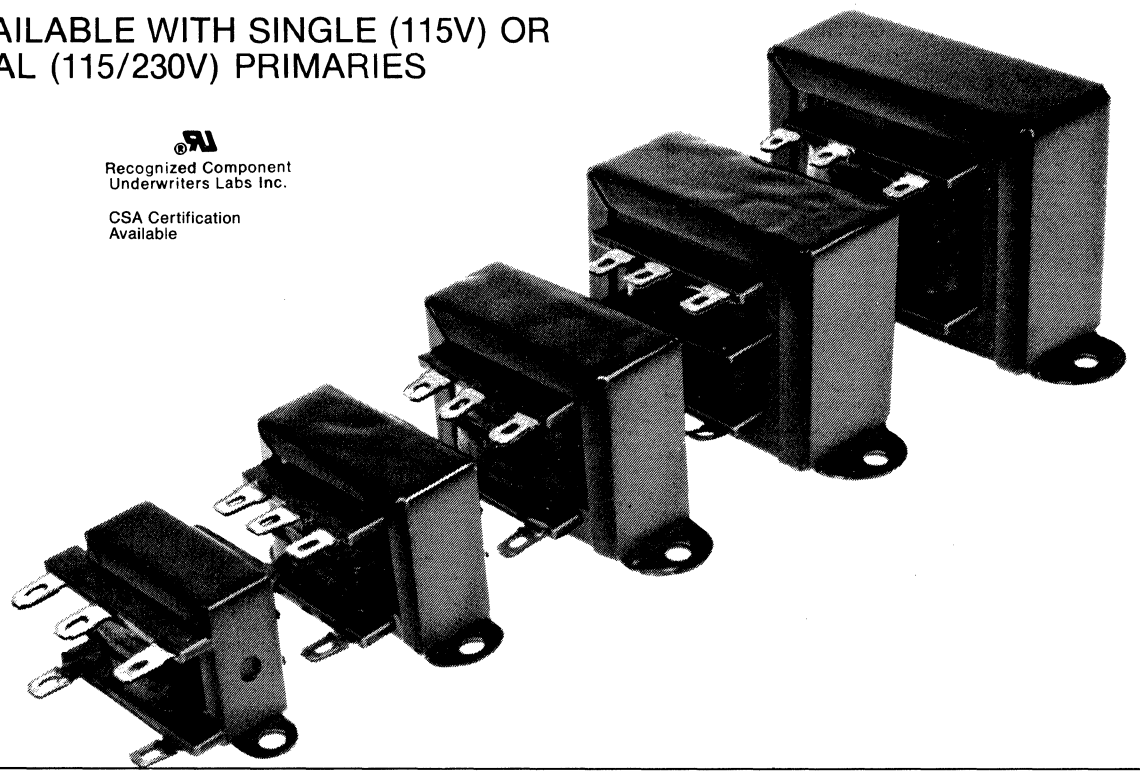
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series of small power transformers

AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

Recognized Component
Underwriters Labs Inc.

CSA Certification
Available



METHOD OF DETERMINING SECONDARY CURRENT RATINGS

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Rectifier Type	Filter Type	RMS Secondary Current Is
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For example, in a F. W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

CUSTOM VARIATIONS

Signal is equipped to quote on Custom Variations of "241" types. The secondary combinations are restricted by the number of secondary terminals available, as follows:

Size	Maximum Number of Secondary Terminals	VA Rating
3	3	2.4
4	4	6
5	4	12
6	5	30
7	5	56
8	5	100

We answer requests promptly and can deliver prototypes in one to three weeks. Production lead times can be scheduled with very reasonable lead times.

Part Number Single 115V	Part Number Dual 115/230V	Secondary RMS Ratng	Part Number Single 115V	Part Number Dual 115/230V	Secondary RMS Rating
241-3-10	Not Available	10V C.T. @ 0.25A	241-3-28	Not Available	28V C.T. @ 0.085A
241-4-10	DP 241-4-10	10V C.T. @ 0.6A	241-4-28	DP 241-4-28	28V C.T. @ 0:2A
241-5-10	DP 241-5-10	10V C.T. @ 1.2A	241-5-28	DP 241-5-28	28V C.T. @ 0.42A
241-6-10	DP 241-6-10	10V C.T. @ 3.0A	241-6-28	DP 241-6-28	28V C.T. @ 1.1A
241-7-10	DP 241-7-10	10V C.T. @ 5.0A	241-7-28	DP 241-7-28	28V C.T. @ 2.0A
241-8-10	DP 241-8-10	10V C.T. @ 10A	241-8-28	DP 241-8-28	28V C.T. @ 3.6A
241-3-12	Not Available	12.6V C.T. @ 0.2A	241-3-36	Not Available	36V C.T. @ 0.065A
241-4-12	DP 241-4-12	12.6V C.T. @ 0.5A	241-4-36	DP 241-4-36	36V C.T. @ 0.17A
241-5-12	DP 241-5-12	12.6V C.T. @ 1.0A	241-5-36	DP 241-5-36	36V C.T. @ 0.35A
241-6-12	DP 241-6-12	12.6V C.T. @ 2.5A	241-6-36	DP 241-6-36	36V C.T. @ 0.85A
241-7-12	DP 241-7-12	12.6V C.T. @ 4.0A	241-7-36	DP 241-7-36	36V C.T. @ 1.5A
241-8-12	DP 241-8-12	12.6V C.T. @ 8.0A	241-8-36	DP 241-8-36	36V C.T. @ 2.8A
241-3-16	Not Available	16V C.T. @ 0.15A	241-3-48	Not Available	48V C.T. @ 0.05A
241-4-16	DP 241-4-16	16V C.T. @ 0.4A	241-4-48	DP 241-4-48	48V C.T. @ 0.125A
241-5-16	DP 241-5-16	16V C.T. @ 0.8A	241-5-48	DP 241-5-48	48V C.T. @ 0.25A
241-6-16	DP 241-6-16	16V C.T. @ 2.0A	241-6-48	DP 241-6-48	48V C.T. @ 0.63A
241-7-16	DP 241-7-16	16V C.T. @ 3.5A	241-7-48	DP 241-7-48	48V C.T. @ 1.2A
241-8-16	DP 241-8-16	16V C.T. @ 6.25A	241-8-48	DP 241-8-48	48V C.T. @ 2.0A
241-3-20	Not Available	20V C.T. @ 0.12A	241-3-56	Not Available	56V C.T. @ 0.045A
241-4-20	DP 241-4-20	20V C.T. @ 0.3A	241-4-56	DP 241-4-56	56V C.T. @ 0.11A
241-5-20	DP 241-5-20	20V C.T. @ 0.6A	241-5-56	DP 241-5-56	56V C.T. @ 0.22A
241-6-20	DP 241-6-20	20V C.T. @ 1.5A	241-6-56	DP 241-6-56	56V C.T. @ 0.54A
241-7-20	DP 241-7-20	20V C.T. @ 2.8A	241-7-56	DP 241-7-56	56V C.T. @ 1.0A
241-8-20	DP 241-8-20	20V C.T. @ 5.0A	241-8-56	DP 241-8-56	56V C.T. @ 1.8A
241-3-24	Not Available	24V C.T. @ 0.1A	241-3-120	Not Available	120V C.T. @ 0.02A
241-4-24	DP 241-4-24	24V C.T. @ 0.25A	241-4-120	DP 241-4-120	120V C.T. @ 0.05A
241-5-24	DP 241-5-24	24V C.T. @ 0.5A	241-5-120	DP 241-5-120	120V C.T. @ 0.1A
241-6-24	DP 241-6-24	24V C.T. @ 1.25A	241-6-120	DP 241-6-120	120V C.T. @ 0.25A
241-7-24	DP 241-7-24	24V C.T. @ 2.4A	241-7-120	DP 241-7-120	120V C.T. @ 0.5A
241-8-24	DP 241-8-24	24V C.T. @ 4.0A	241-8-120	DP 241-8-120	120V C.T. @ 0.85A

Explanation of part number series 241 Size-4 Sec. Volts - 36 Prefix "DP" used for dual primary versions

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p.c. board transformers for triple-output regulated supplies

IDEAL FOR MICROPROCESSOR APPLICATIONS

"MP" types have been developed specifically for use in triple-output regulated DC supplies that are commonly used in **Microprocessor Circuits** and other logic, op-amp combinations. Two output combinations have been provided, namely 5V and ±12V, and 5V and ±15V.

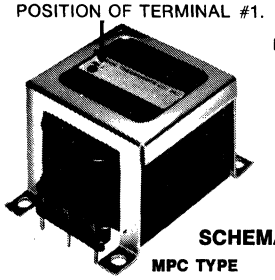
All "MP" units are rated in terms of the final **DC** output after a standard three terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100 to 130V 50/60 Hz (or 200 to 260V for nominal 230V lines).

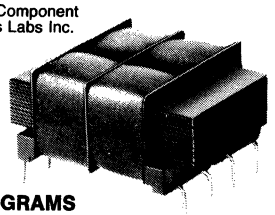
Two basic mechanical configurations are available. Standard PC types (MPC or DMPC) are tested to pass 1500V RMS hipot. Optional mounting brackets are available. MPL types are based on Signal's "flat-head" style and feature low profile, 115/230V primaries, hum-bucking construction, 1500V RMS hipot and the advantages of non-concentric winding (low inter-winding capacitance, high isolation, and no need for an electro-static shield).

All MP's are stocked in depth for immediate delivery. In addition, special variations can be supplied with reasonable delivery times.

BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.

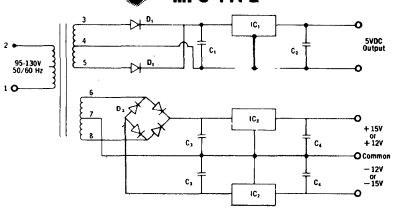
Recognized Component Underwriters Labs Inc.



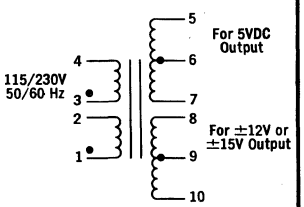


SCHEMATIC DIAGRAMS

MPC TYPE



DMPC & MPL TYPES



(See mechanical drawing for correct footprint)

MPC & DMPC TYPES

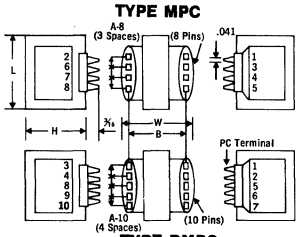
PART NUMBER PRIMARY 50/60 Hz 115V (8 Pin)	115/230V (10 Pin)	DC OUTPUT Regulator I	Regulator II	Size	SUGGESTED COMPONENTS C_1	C_2	C_3	C_4	D_1(2)	D_2(4)	IC_1*	IC_2*
MPC-X-12	DMPC-X-12	5VDC 360ma	±12VDC 60ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPC-X-15	DMPC-X-15	5VDC 360ma	±15VDC 50ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N
MPC-Y-12	DMPC-Y-12	5VDC 835ma	±12VDC 150ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM326N
MPC-Y-15	DMPC-Y-15	5VDC 835ma	±15VDC 130ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM325N

MPL TYPES (Dual 115/230V Primary is Standard)

MPL- 6-12	5VDC 135ma	±12VDC 40ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM326N
MPL- 6-15	5VDC 135ma	±15VDC 35ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM325N
MPL-12-12	5VDC 270ma	±12VDC 85ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPL-12-15	5VDC 270ma	±15VDC 70ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N

*National Semiconductor

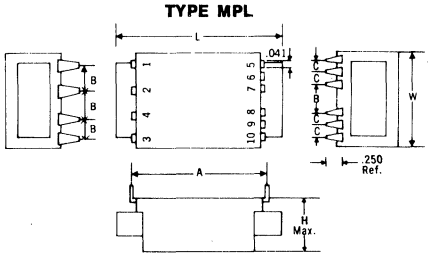
TYPE MPC



TYPE DMPC

Size	L	W	H	A-8 (8 Pin)	A-10 (10 Pin)	B	Lbs.	Optional Bracket No.	MW	MD
X	1⅞	1 7/16	1⅝	.250	.200	1.300	.56	10-BR	1 41/64	1⅛
Y	1⅝	2¼	1⅜	.250	.200	2.100	.75	24-BR	1⅜	2

TYPE MPL



Size	L	W	H	A	B	C	Lbs.
6	1⅞	1 9/16	0.850	1.600	0.375	0.187	.43
12	2½	2	1.065	2.000	0.500	0.250	.68

THE PRONTO™ PLEDGE

Because we are America's largest stocking manufacturer of power magnetics (over 1000 part numbers), we promise to ship a minimum of 24 pieces in 24 hours.

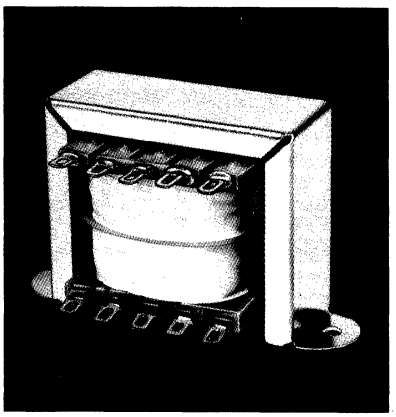
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The American Original.

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Inwood, NY 11696
Fax: (516) 239-7208

"2-4-1"™ style split-bobbin transformers for triple-output (µp) applications (type MT)



Signal has extended its line of triple-output transformers for microprocessor applications with three new sizes rated to 100VA (35 watts DC regulated). Similar to the split-bobbin design used in Signal's "2-4-1" series, the chassis-mounted style allows for these new higher power applications.

Two output combinations are provided: 5V and ±12V; and 5V and ±15V. Designated "MT" (single primary) and "DMT" (dual primary), these transformers are rated in terms of the final DC output after a 3-terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100-130V, 50/60 Hz (or 200-260V for nominal 230V lines). All auxiliary components required to complete the DC supply are tabulated.

All MT types are stocked in depth for immediate delivery. In addition, custom variations can be supplied with minimal turnaround time.

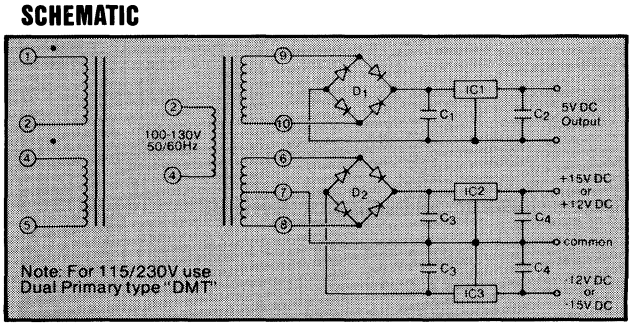
Specifications

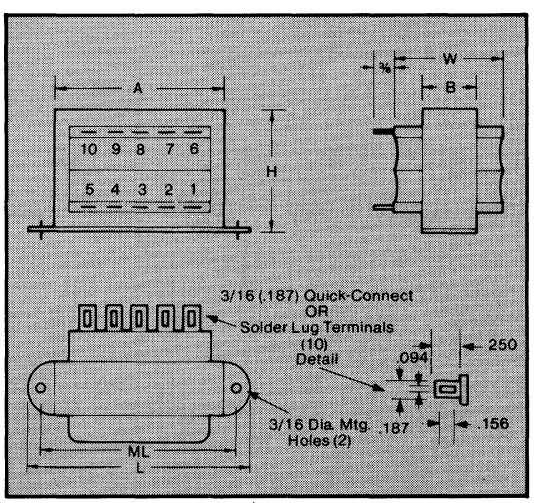
®UL Recognized Component Underwriters Labs Inc.

PART NUMBER PRIMARY 50/60Hz		DC OUTPUT		SIZE	SUGGESTED COMPONENTS C_2 C_4 See Note ①						
115V	115/230V	Regulator 1	Regulator 2		C_1	C_3	IC1③	IC2③	IC3③	D1④	D2④
MT-6-12	DMT-6-12	5V @ 1.75A	±12V @ 210MA	6	10 KMFD @ 20V DC	1.5 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
MT-6-15	DMT-6-15	5V @ 1.75A	±15V @ 175MA	6			LM-323K-5	LM-340K-15	LM-320K-15	3N253	3N247
MT-7-12	DMT-7-12	5V @ 2.8A	±12V @ 350MA	7	15 KMFD @ 20V DC	2 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	MDA-400	3N247
MT-7-15	DMT-7-15	5V @ 2.8A	±15V @ 280MA	7			LM-323K-5	LM-340K-15	LM-320K-15	MDA-400	3N247
MT-8-12	DMT-8-12	5V @ 4A	±12V @ 600MA	8	26 KMFD @ 20V DC	3.1 KMFD @ 50V DC	LM-338②	LM-340K-12	LM-320K-12	MDA-800	3N247
MT-8-15	DMT-8-15	5V @ 4A	±15V @ 500MA	8			LM-338②	LM-340K-15	LM-320K-15	MDA-800	3N247

Note ① : Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic, 20V min.
Note ② : LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③ : All IC's are National Semiconductor types.
Note ④ : All diodes are Motorola types.

SCHEMATIC





DIMENSIONS

Size	L	W	H	A	B	ML	Lbs.
6	3 1/4	1 1/4	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

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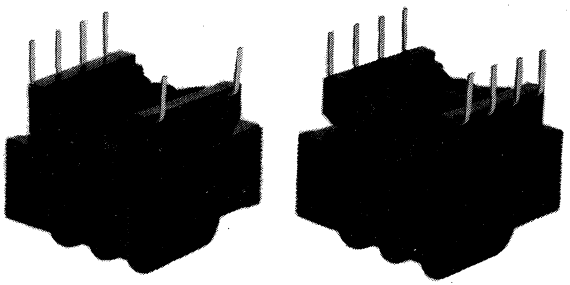
500 Bayview Ave.
Inwood, NY 11696
Fax: (516) 239-7208

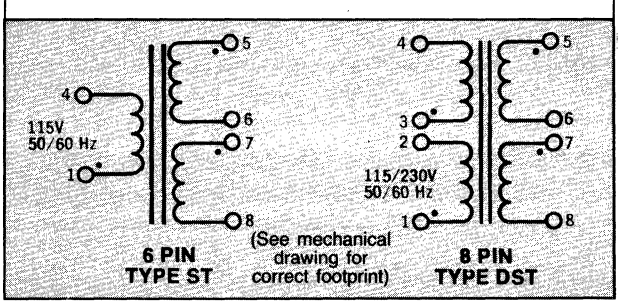
split/tran® p.c. board transformers

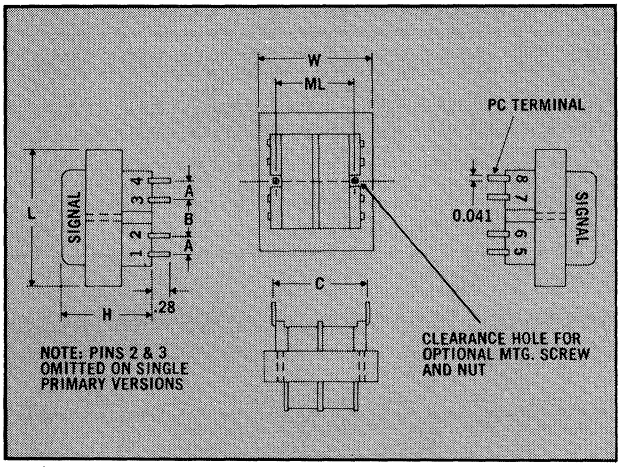
SPLIT BOBBIN—HIGHLY ISOLATED

CSA Certification Available

Recognized Component Underwriters Labs Inc.







Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut*	Lbs.
2	1.1	1 3/8	1 1/8	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1 3/8	1 1/8	1 3/16	—	.250	.250	1.200	None	0.25
4	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	4-40 x 1 3/8 Nylon	0.44
5	12	1 7/8	1 9/16	1 7/16	1 1/4	.300	.400	1.410	4-40 x 1 3/8 Nylon	0.70
6	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	4-40 x 1 3/8 Nylon	0.80
7	36	2 5/8	2 3/16	1 9/16	†	.400	.400	1.850	†	1.1

* Available from Signal: Part No. ST-MS (Screw) & Part No. ST-MN (Nut).
† Size 7 has 4 mtg. holes on 2 3/16 x 1 3/4 centers for a #6 screw. Need not be nylon.

"Split-Tran" transformers combine the best features of our "2-4-1" Series and Signal's pioneering line of pc board miniature transformers.

The use of a "split bobbin" allows the primaries and secondaries to be wound non-concentrically, i.e., side by side rather than one over the other. This results in cost savings and superior performance, namely:

- High isolation — **2500V** hipot is standard.
- Low capacitive coupling — no electro-static shield necessary.
- Less manufacturing time — no cross-overs of primary and secondary leads.
- PC pins — allow direct insertion in PC boards.
- Class S insulation — 130°C.

Each transformer is available with single 115V or dual 115/230V primaries. In addition, secondaries are split so that they can be series or parallel connected.

Special variations will be quoted and shipped promptly.

PART NUMBER*		SECONDARY RMS RATING	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10	DST 2-10	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10	DST 3-10	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10	DST 4-10	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10	DST 5-10	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10	DST 6-10	10V C.T. @ 2A	5V @ 4A
ST 7-10	DST 7-10	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12	DST 2-12	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12	DST 3-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12	DST 4-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12	DST 5-12	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12	DST 6-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12	DST 7-12	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16	DST 2-16	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16	DST 3-16	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16	DST 4-16	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16	DST 5-16	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16	DST 6-16	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16	DST 7-16	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20	DST 2-20	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20	DST 3-20	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20	DST 4-20	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20	DST 5-20	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20	DST 6-20	20V C.T. @ 1A	10V @ 2A
ST 7-20	DST 7-20	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24	DST 2-24	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24	DST 3-24	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24	DST 4-24	24V C.T. @ 0.25A	12V @ 0.5A
ST 5-24	DST 5-24	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24	DST 6-24	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24	DST 7-24	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28	DST 2-28	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28	DST 3-28	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28	DST 4-28	28V C.T. @ 0.2A	14V @ 0.4A
ST 5 28	DST 5-28	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28	DST 6-28	28V C.T. @ 0.7A	14V @ 1.4A
ST 7-28	DST 7-28	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36	DST 2-36	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36	DST 3-36	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36	DST 4-36	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36	DST 5-36	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36	DST 6-36	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36	DST 7-36	36V C.T. @ 1A	18V @ 2A
ST 2-48	DST 2-48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48	DST 3-48	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48	DST 4-48	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48	DST 5-48	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48	DST 6-48	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48	DST 7-48	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56	DST 2-56	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56	DST 3-56	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56	DST 4-56	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56	DST 5-56	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56	DST 6-56	56V C.T. @ 0.35A	28V @ 0.7A
ST 7-56	DST 7-56	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120	DST 2-120	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120	DST 3-120	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120	DST 4-120	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120	DST 5-120	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120	DST 6-120	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120	DST 7-120	120V C.T. @ 0.3A	60V @ 0.6A

* Explanation of Part Number: Series - ST; Size 4; Series Secondary Volts - 36

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rectifier power transformers

CHOICE OF SINGLE 115V OR DUAL 115/230V PRIMARIES

Primary 50/60 Hz		Secondary RMS Rating*									
Single 115V.	Dual* 115/230V.	Series	Parallel	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
10-1	DL 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	2 7/8	1 3/4	2 5/16	2 3/8	—	#8	1.0
10-2	DL 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	3 1/8	2 1/8	2 3/4	2 13/16	—	#8	1.5
10-4	DL 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	3 5/16	2 3/8	3 1/16	3 1/8	—	#8	2.3
10-6	DL 10-6	10V C.T. @ 6A	5V C.T. @ 12A	B	3 3/8	2 3/4	2 13/16	2 13/16	2 1/8	#8	3.3
10-8	DL 10-8	10V C.T. @ 8A	5V C.T. @ 16A	B	3 3/8	3 1/8	2 13/16	2 13/16	2 1/2	#8	4.0
10-12	DL 10-12	10V C.T. @ 12A	5V C.T. @ 24A	B	3 3/4	3 1/4	3 1/8	3 1/8	2 1/2	#8	5.0
10-25	DL 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	4 1/2	3 3/4	3 3/4	3 3/4	2 3/4	#10	8.7
10-50‡	DL 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	5 1/4	5 1/2	4 3/8	4 3/8	3 5/8	1/4	17.0
10-100‡	DL 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	6 3/8	7 1/4	5 5/16	5 5/16	4 3/8	1/4	34.5
12.8-1	DL 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	2 7/8	2	2 5/16	2 3/8	—	#8	1.2
12.8-2	DL 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	B	3	2 1/2	2 1/2	2 1/2	2	#8	2.3
12.8-4	DL 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	B	3	2 7/8	2 1/2	2 1/2	2 3/8	#8	2.8
12.8-6	DL 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	B	3 3/8	3 1/16	2 13/16	2 13/16	2 1/2	#8	4.0
12.8-8	DL 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	B	3 3/4	3 1/8	3 1/8	3 1/8	2 1/4	#8	4.5
12.8-12	DL 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	4 1/8	3 1/4	3 7/16	3 7/16	2 3/8	#10	6.0
12.8-25	DL 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	5 1/4	4 1/4	4 3/8	4 3/8	2 7/8	#10	12.5
12.8-50‡	DL 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	5 1/4	6	4 3/8	4 3/8	4 1/8	1/4	20.7
12.8-100‡	DL 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	6 3/8	7 1/4	5 5/16	5 5/16	4 3/8	1/4	34.5
16-1	DL 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	2 7/8	2	2 5/16	2 3/8	—	#8	1.2
16-2	DL 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	3 1/8	2 1/4	2 3/4	2 13/16	—	#8	1.7
16-4	DL 16-4	16V C.T. @ 4A	8V C.T. @ 8A	B	3 3/8	2 3/4	2 13/16	2 13/16	2 1/8	#8	3.3
16-6	DL 16-6	16V C.T. @ 6A	8V C.T. @ 12A	B	3 3/4	3 1/8	3 1/8	3 1/8	2 1/4	#10	4.5
16-8	DL 16-8	16V C.T. @ 8A	8V C.T. @ 16A	B	3 3/4	3 1/2	3 1/8	3 1/8	2 5/8	#10	5.4
16-12	DL 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	4 1/8	3 7/8	3 7/16	3 7/16	3	#10	7.9
16-25	DL 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	4 1/2	5 3/8	3 3/4	3 3/4	4	#10	14.5
16-50‡	DL 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	6 3/8	5 3/4	5 5/16	5 5/16	3 3/4	1/4	26.5
16-100‡	DL 16-100	16V C.T. @ 100A	8V C.T. @ 200A	B	7 1/2	7 1/2	6 3/8	6 3/4	4 5/8	1/4	50.0
24-1	DL 24-1	24V C.T. @ 1A	12V C.T. @ 2A	B	3	2 1/2	2 1/2	2 1/2	2	#8	2.3
24-2	DL 24-2	24V C.T. @ 2A	12V C.T. @ 4A	B	3	2 7/8	2 1/2	2 1/2	2 3/8	#8	2.9
24-4	DL 24-4	24V C.T. @ 4A	12V C.T. @ 8A	B	3 3/4	3 1/8	3 1/8	3 1/8	2 1/4	#8	4.5
24-6	DL 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	4 1/8	3 1/4	3 7/16	3 7/16	2 3/8	#10	5.8
24-8	DL 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	4 1/8	3 7/8	3 7/16	3 7/16	3	#10	7.9
24-12‡	DL 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	4 1/2	4 1/2	3 3/4	3 3/4	3 3/8	#10	11.0
24-20‡	DL 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 3/8	1/4	15.3
24-25‡	DL 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	5 1/4	5 5/8	4 3/8	4 3/8	4 1/8	1/4	19.5
24-50‡	DL 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	6 3/8	6 1/4	5 5/16	5 5/16	4 3/8	1/4	31.3
——	24-100 △	24V C.T. @ 100A	12V C.T. @ 200A	B	7 1/2	7	6 3/4	6 3/4	4 1/8	1/4	43.0
36-1	DL 36-1	36V C.T. @ 1A	18V C.T. @ 2A	B	3	2 3/4	2 1/2	2 1/2	2 1/4	#8	2.6
36-2	DL 36-2	36V C.T. @ 2A	18V C.T. @ 4A	B	3 3/8	2 15/16	2 13/16	2 13/16	2 3/8	#8	3.8
36-4	DL 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	4 1/8	3 3/8	3 7/16	3 7/16	2 5/8	#10	6.8
36-6	DL 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	4 1/2	3 3/4	3 3/4	3 3/4	2 3/4	#10	8.7
36-8‡	DL 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	4 1/2	4 1/2	3 3/4	3 3/4	3 3/8	#10	11.0
36-12‡	DL 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	5 1/4	5	4 3/8	4 3/8	3 3/8	1/4	15.0
36-20‡	DL 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	6 3/8	5 3/8	5 5/16	5 5/16	3 3/8	1/4	22.8
36-25‡	DL 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	6 3/8	5 3/4	5 5/16	5 5/16	3 3/4	1/4	26.5
36-30‡	DL 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	6 3/8	6	5 5/16	5 5/16	4 3/8	1/4	31.5
——	36-50△	36V C.T. @ 50A	18V C.T. @ 100A	B	6 3/8	7 1/4	5 5/16	5 5/16	5 1/8	1/4	40.0
56-1	DL 56-1	56V C.T. @ 1A	28V C.T. @ 2A	B	3 3/8	2 7/8	2 13/16	2 13/16	2 1/4	#8	3.5
56-2	DL 56-2	56V C.T. @ 2A	28V C.T. @ 4A	B	3 3/4	3 1/4	3 1/8	3 1/8	2 1/2	#8	5.0
56-4	DL 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	4 1/8	3 3/4	3 7/16	3 7/16	3	#10	7.7
56-6	DL 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	5 1/4	4 1/4	4 3/8	4 3/8	2 7/8	#10	12.0
56-8‡	DL 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	5 1/4	5	4 3/8	4 3/8	3 5/8	1/4	17.0
56-12‡	DL 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 3/8	1/4	22.0
56-25‡	DL 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	6 3/8	7 1/8	5 5/16	5 5/16	5 1/8	1/4	38.0
——	56-50△	56V C.T. @ 50A	28V C.T. @ 100A	B	7 1/2	7 1/2	6 1/4	6 3/4	4 7/8	1/4	56.3
68-1	DL 68-1	68V C.T. @ 1A	34V C.T. @ 2A	B	3 3/8	2 15/16	2 13/16	2 13/16	2 3/8	#8	3.8
68-2	DL 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	4 1/8	3 3/8	3 7/16	3 7/16	2 5/8	#10	6.8
68-4	DL 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	4 1/2	4 1/2	3 3/4	3 3/4	3 3/8	#10	11.5
68-6‡	DL 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	5 1/4	5	4 3/8	4 3/8	3 3/8	1/4	15.0
68-8‡	DL 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	5 1/4	5 1/2	4 3/8	4 3/8	3 7/8	1/4	19.0
68-12‡	DL 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	6 3/8	5 3/4	5 5/16	5 5/16	3 3/4	1/4	26.5
——	68-25△	68V C.T. @ 25A	34V C.T. @ 50A	B	6 3/8	7 1/4	5 5/16	5 5/16	5 1/8	1/4	39.7
80-1	DL 80-1	80V C.T. @ 1A	40V C.T. @ 2A	B	3 3/8	3 1/16	2 13/16	2 13/16	2 1/2	#8	4.0
80-2	DL 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	4 1/8	3 3/8	3 7/16	3 7/16	2 5/8	#10	6.8
80-4	DL 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	5 1/4	4 1/4	4 3/8	4 3/8	2 7/8	1/4	12.3
80-6‡	DL 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	5 1/4	5 1/2	4 3/8	4 3/8	3 7/8	1/4	19.0
80-8‡	DL 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	20.5
80-12‡	DL 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	6 3/8	6	5 5/16	5 5/16	4 1/8	1/4	29.0
——	80-25△	80V C.T. @ 25A	40V C.T. @ 50A	B	7 1/2	6 1/2	6 1/4	6 3/4	3 7/8	1/4	40.3

△Available with dual primary only. Therefore, prefix "DL" is not required.
‡ Nominal 115V primary has added taps, I.E., 105/115/125V, Dual (DL) version is 115/230V only.

Items shown in shaded area are not normally in stock. They are standard designs generally available in 3-4 weeks.

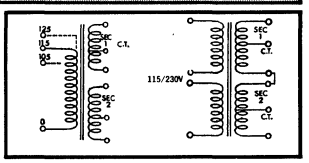
All transformers are designed conservatively and are rated for 50/60 Hz. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss varnish. The transformers and chokes are rugged in construction, well insulated, and have a consistently uniform appearance. All ratings are at full load current continuous operation. Hipot rating of 1500V RMS is standard.

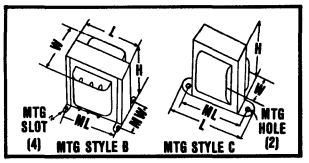
Electrical ratings have been chosen to cover a wide range of applications. All transformers have two center-tapped secondary windings, which may be series or parallel connected as indicated in rating chart.

*The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.





Signal Transformer, 500 Bayview Avenue, Inwood, New York 11696 (516) 239-5777 • Fax: (516) 239-7208

filter chokes

1.0 TO 200 AMPS

Signal's line of filter chokes is the most extensive available. It is designed to complement the selection of Rectifier Power Transformers so that a set may be specified for power supplies using inductive filters.

The inductance ratings given are minimum values guaranteed at full DC current. All resistance ratings are maximum values. Special variations or intermediate values of inductance, current, or resistance can be supplied promptly and accurately.

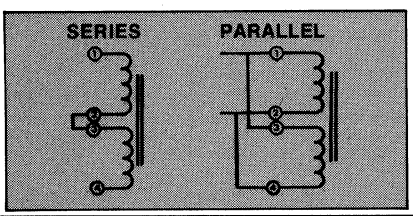


FOR MECHANICAL DIMENSIONS REFER TO TRANSFORMER OUTLINES ON PREVIOUS PAGE

Part No.	Inductance (MHY)	Current (Amps)	Resistance (Ohms)	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
CH-1	100	1	1.5	B	3	2½	2½	2½	2	#8	2.3
CH-2	70	2	0.9	B	3⅜	2¾	2⅞	2 1/16	2⅛	#8	3.2
CH-4	70	4	0.6	B	3¾	3⅛	3¼	3⅛	2½	#8	5.3
CH-6	40	6	0.4	B	3¾	3⅝	3¼	3⅛	3	#8	6.5
CH-8	30	8	0.3	B	4⅛	3⅝	3½	3 7/16	3	#10	8
CH-12	15	12	0.1	B	5¼	4	4 7/16	4⅜	3⅛	#10	13.7
CH-16	15	16	0.08	B	5¼	4⅝	4 7/16	4⅜	3⅝	#10	17.5
CH-20	7	20	0.05	B	5¼	4	4 7/16	4⅜	3⅛	#10	13.3
CH-25	5	25	0.025	B	5¼	4¾	4 7/16	4⅜	3⅞	#10	17.8
CH-30	4	30	0.01	B	6⅜	5	5⅜	5 5/16	3⅜	¼	24.4
CH-50	1.4	50	0.01	B	6⅜	5¼	5⅜	5 5/16	3¾	¼	26.7
CH-100	0.5	100	0.005	B	6⅜	6¼	5⅜	5 5/16	4⅛	¼	31.4
CH-200	0.3	200	0.001	B	7½	7½	6¼	6¾	4⅛	¼	48.0

dual chokes

FOR LOWER INDUCTANCE APPLICATIONS

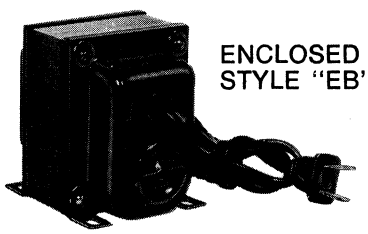


Part No.	Series Connected Ind. (MHY)	Series Connected Curr. (Amps)	Series Connected Res. Ω	Parallel Connected Ind. (MHY)	Parallel Connected Curr. (Amps)	Parallel Connected Res. Ω	Mtg. Style	Dimensions L	W	H	ML	MW	Mtg. Screw	Appr. Lbs.
CL-1-2	72	1	1.4	18	2	0.35	C	2⅞	1¾	2 5/16	2⅜	—	#8	0.9
CL-2-4	40	2	0.7	10	4	0.18	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
CL-4-8	20	4	0.3	5	8	0.075	B	3	2⅞	2½	2½	2½	#8	3.0
CL-6-12	12	6	0.15	3	12	0.038	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
CL-12-24	4.8	12	0.052	1.2	24	0.013	B	3⅜	3 1/16	2 13/16	2 13/16	3	#8	5.3
CL-25-50	1.2	25	0.012	0.3	50	0.003	B	3¾	3⅜	3⅜	3⅛	2¾	#8	6.0
CL-50-100	0.5	50	0.0043	0.12	100	0.0011	B	4½	3¾	3¾	3¾	2½	#8	8.0

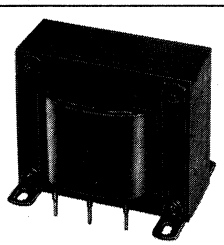
Signal's Dual Chokes are supplied with 2 windings which may be series or parallel connected with rating shown on chart. This line is basically designed for application requiring lower inductance value at high currents, such as low voltage, DC supplies or SCR filters.

step down auto transformers

50/60 Hz 100-2000 VA — 230/115V



ENCLOSED STYLE "EB"



OPEN FRAME STYLE "OF"

(May be used step-up or step-down)

UL APPROVED 2 PRONG LINE CORD RECEPTACLE — LOW REGULATION
BLACK ENAMEL FINISH

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110	1⅞	2⅜	2½	1½ x 1 11/16	1.5
120	112	2⅞	2⅛	3½	2¼ x 1¾	3.0
150	115	2⅞	3⅜	3½	2¼ x 2	3.5
200	120	2⅞	3½	3½	2¼ x 2⅛	4.0
250	125	2⅞	3⅞	3½	2¼ x 2½	4.8
300	130	3¼	3⅞	3⅞	2½ x 2 7/16	5.5
500	150	3¼	4⅞	3⅞	2½ x 3 7/16	8
750	175	3¼	5⅞	3⅞	2½ x 4 7/16	11
1000	1100	4½	5⅛	5½	3½ x 3½	14
1500	1150	4½	6⅛	5½	3½ x 4½	20
2000	1200	4½	7⅛	5½	3½ x 5½	26

BLACK ENAMEL FINISH. 8" LEADS
INEXPENSIVE VERSION FOR USE IN EQUIPMENT

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110-OF	2¼	2	1 15/16	2 13/16*	1.3
120	112-OF	3⅜	2½	2⅞	2 13/16 x 1⅞	2.5
150	115-OF	3⅜	2¾	2⅞	2 13/16 x 2⅛	3.0
200	120-OF	3⅜	2⅞	2⅞	2 13/16 x 2¼	3.5
250	125-OF	3⅜	3¼	2⅞	2 13/16 x 2⅝	4.2
300	130-OF	3¾	3¼	3⅛	3⅛ x 2½	5.0
500	150-OF	3¾	4¼	3⅛	3⅛ x 3½	8.0
750	175-OF	3¾	5¼	3⅛	3⅛ x 4½	11
1000	1100-OF	5¼	4½	4⅜	4⅜ x 3⅛	14
1500	1150-OF	5¼	5½	4⅜	4⅜ x 4⅛	19
2000	1200-OF	5¼	6½	4⅜	4⅜ x 5⅛	25

* Part 110-OF is mounted by means of a channel with 2 mtg. tabs.

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Because we are America's largest stocking manufacturer of power magnetics (over 1000 part numbers), we promise to ship a minimum of 24 pieces in 24 hours.

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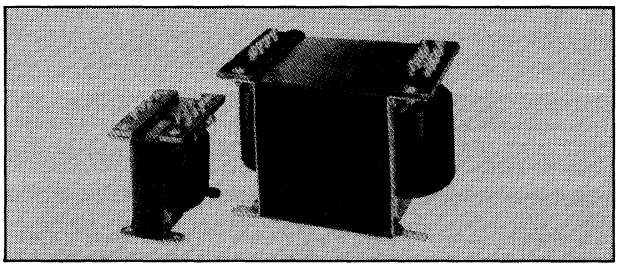
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power isolation transformers

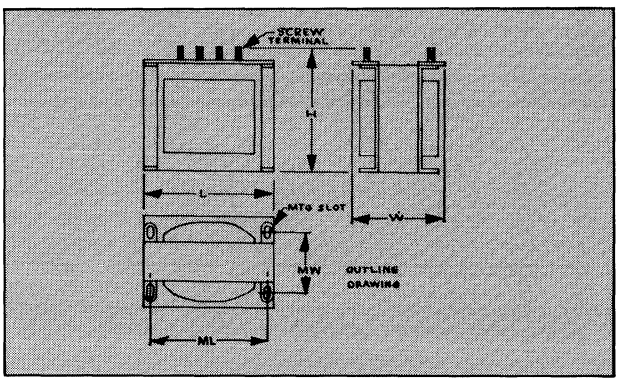
INDUSTRIAL GRADE/STEP-UP OR STEP-DOWN. MANY POSSIBLE VOLTAGE RATINGS.



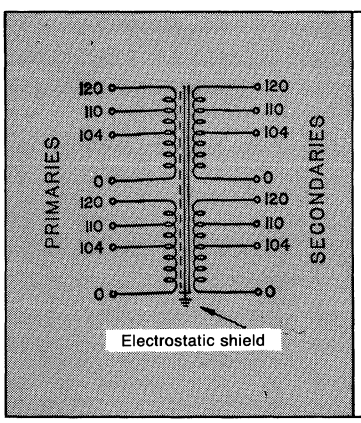
AVAILABLE FROM STOCK FOR IMMEDIATE SHIPMENT

The "DU" and "SU" lines are designed for a maximum of 55°C rise above ambient for use on standard power lines from 50 to 500 Cps. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers are rugged in construction, well-insulated and have a consistently uniform appearance. All ratings are at full load current, continuous operation. 2500V. RMS Hipot is standard.

Heavy ¼ inch phenolic terminal boards are provided with plated brass screws and flat washers (10-32 on ¼ and ½ KVA, ¼-20 on larger sizes). Connections can be easily made with a nut driver. It is also simple to alter the interconnections to change transformer ratings. **Electrostatic shields are provided grounded to the core.** The connection is made with a lug to ground and may be opened if an ungrounded shield is desired.



DU SERIES 110/220 Dual Primary to 110/220V. Dual Sec. (Primary & Secondary may be reversed)

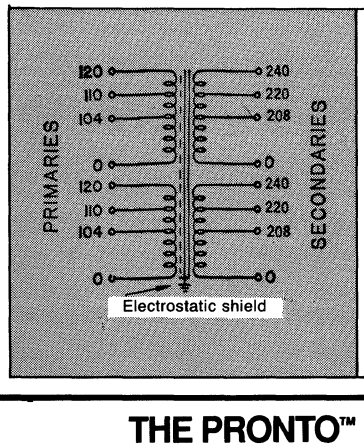


As shown on the schematic diagram the "DU" line is designed with dual primaries and secondaries. All four windings are identically rated at 0/104/110/120 volts. This permits series or parallel connections on either primary or secondary. Therefore, a nominal 110 to 110 volt, 220 to 220 volt, 110 to 220 volt, or 220 to 110 volt transformer can be set up. The winding taps permit intermediate series ratings such as 208, 214, or 230 volts. It is also possible to make auto-transformer connections by connecting a primary group in series with a secondary group. Such nominal ratings as 440 to 220 volts or 220 to 440 volts can be set-up, in addition to the standard ratings described above. A further advantage to auto-transformer connection is the fact that the KVA rating of a particular type is doubled.

Part No.	KVA	Series Secondaries Volts	Series Secondaries Max. Amps	Parallel Secondaries Volts	Parallel Secondaries Max. Amps	Mechanical Dimensions L *	W *	H *	ML †	MW ‡	Mtg. & Term. Screw	Appr. Lbs.
DU-¼	¼	0/208/220/240	1.1	0/104/110/120	2.2	5 5/16	4¼	5¼	4⅜	2½	#10	12
DU-½	½	0/208/220/240	2.3	0/104/110/120	4.6	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
DU-1	1	0/208/220/240	4.5	0/104/110/120	9	7 5/16	6¼	7⅜	6¾	4⅛	¼	33
DU-2	2	0/208/220/240	9	0/104/110/120	18	7 5/16	8¼	7⅜	6¾	6	¼	56
DU-3	3	0/208/220/240	14	0/104/110/120	28	7 5/16	9¼	7⅜	6¾	7	¼	70
DU-5	5	0/208/220/240	23	0/104/110/120	46	7 5/16	10¾	7⅜	6¾	8½	¼	89
DU-7.5	7.5	0/208/220/240	31	0/104/110/120	62	9	10¾	8	7½	6½	¼	105
DU-10	10	0/208/220/240	41	0/104/110/120	83	9	13	8	7½	9	¼	150

* Maximum. † ±1/16 ‡ ±⅛

SU SERIES 110/220 Dual Primary to 220/440V. Dual Sec. (Primary & Secondary may be reversed)



"SU" transformers are similar to "DU" types except that a 220/240V secondary is provided.

Part No.	KVA	Series Secondaries Volts	Series Secondaries Max. Amps	Parallel Secondaries Volts	Parallel Secondaries Max. Amps	Mechanical Dimensions L *	W *	H *	ML †	MW ‡	Mtg. & Term. Screw	Appr. Lbs.
SU-¼	¼	0/416/440/480	0.55	0/208/220/240	1.1	5 5/16	4¼	5¼	4⅜	2½	#10	12
SU-½	½	0/416/440/480	1.15	0/208/220/240	2.3	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
SU-1	1	0/416/440/480	2.25	0/208/220/240	4.5	7 5/16	6¼	7¼	6¾	4⅛	¼	33
SU-2	2	0/416/440/480	4.5	0/208/220/240	9	7 5/16	8¼	7¼	6¾	6	¼	56
SU-3	3	0/416/440/480	7	0/208/220/240	14	7 5/16	9¼	7¼	6¾	7	¼	70
SU-5	5	0/416/440/480	11.5	0/208/220/240	23	7 5/16	10¾	7¼	6¾	8½	¼	89
SU-7.5	7.5	0/416/440/480	15.5	0/208/220/240	31	9	10¾	8	7½	6½	¼	105
SU-10	10	0/416/440/480	20.5	0/208/220/240	41	9	13	8	7½	9	¼	150

* Maximum. † ±1/16 ‡ ±⅛

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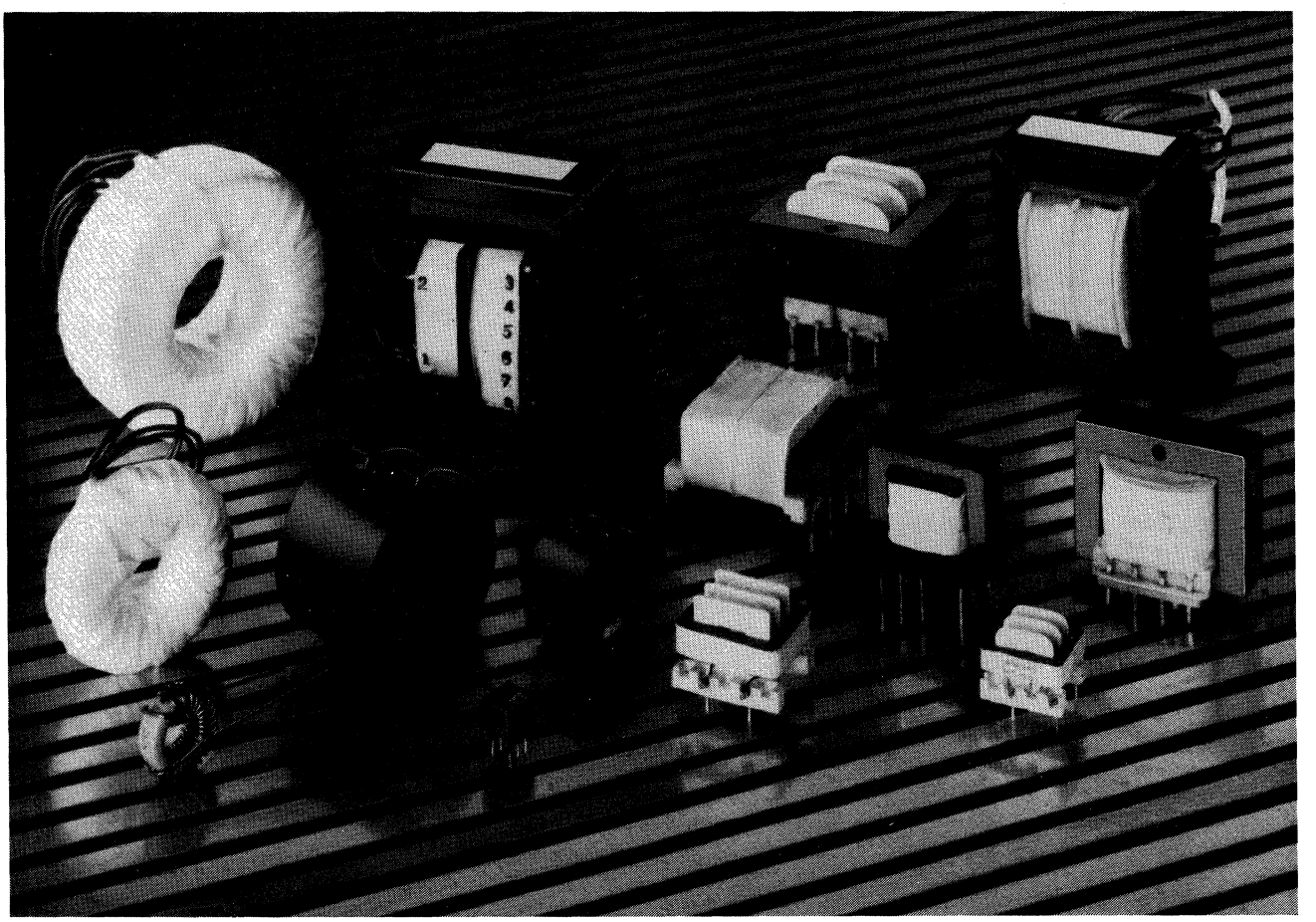
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LAMINATED CORE TRANSFORMERS	Come to Signal for our experience as the industry leader in 50/60 Hz laminated transformers.
TOROID CORE TRANSFORMERS	Tape wound core, powdered iron core, ferrite core – let us quote to your print or specs.
POT CORE, EE AND EI FERRITE CORE TRANSFORMERS	Signal can fill your high frequency magnetics needs – let us build your next prototype.



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PEM MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

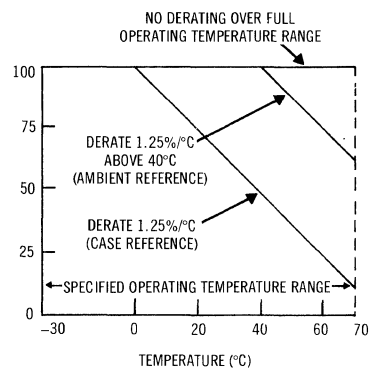


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

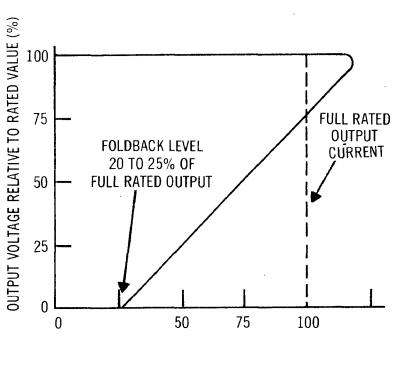


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

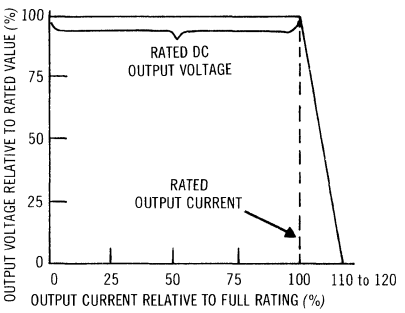


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

STACO ENERGY PRODUCTS CO. variable



FIG. A

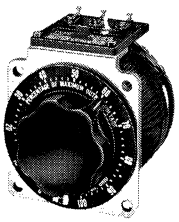


FIG. B

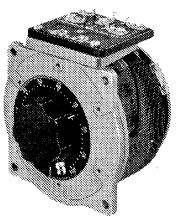


FIG. C

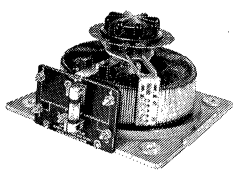


FIG. D

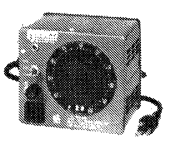


FIG. E

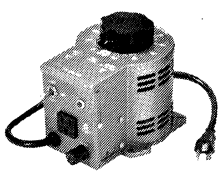


FIG. F

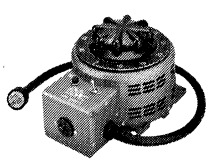


FIG. G



FIG. H

Staco variable transformers offer versatility and reliability unmatched by solid state voltage controls. Staco controls are used worldwide for industrial and laboratory applications to control voltage, current, power, heat, speed, light and electro-mechanical force. Staco variable transformers provide continuously adjustable output voltage from AC power sources without wave form distortions or SCR generated noise. Outstanding features include gold-plated commutators, precise regulation, high efficiency, conservative ratings and rugged construction.

You can select from panel mounted types, cord and plug types, ganged and/or motor driven types, metered types, and fully portable power supplies with or without meters, and ratings from 0.8 amps to 540 amps, 40 volts to 560 volts for single or three phase applications.

Staco has a nationwide network of distributors qualified to offer technical assistance whenever you need it. Additionally, the Staco Engineering Staff is available to help you with special or non-standard applications. Staco's Variable Voltage Controls handbook will be sent to you upon request ... it's loaded with illustrations, engineering data, specifications and ordering information on standard voltage controls. Prices shown are list prices at press time and are subject to change.

PANEL OR BENCH MOUNTING MODELS *120 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
171	A	*0-120/132	1.75	0.23	2 13/16 x 1 7/8	3.0	$ 40.00
201	A	*0-120/132	2.0	0.26	2 13/16 x 1 7/8	3.0	41.50
221-B	A	*0-120/132	2.5	0.33	2 13/16 x 2 1/8	3.2	43.00
291	A	*0-120/132	3.0	0.40	2 13/16 x 2 5/16	3.5	47.00
501	B	0-120/140	5.0	0.70	3 3/4 x 3 3/4 x 3 5/16	6.0	77.00
1010	B	0-120/140	10.0	1.4	5 5/16 x 5 x 4 3/16	12.0	95.00
1010CT	J	0-120/140	10.0	1.4	6 7/8 x 5 x 4 7/16	12.0	147.00
SQ1010	B	0-120/140	10.0	1.4	5 3/16 x 4 1/4 x 4 5/32	12.0	100.00
1210	B	**0-120	12.0	1.44	5 5/16 x 5 x 4 3/16	12.0	106.00
1210CT	J	**0-120	12.0	1.44	6 7/8 x 5 x 4 7/16	12.0	145.00
SQ1210	B	**0-120	12.0	1.44	5 3/16 x 4 1/4 x 4 5/32	12.0	118.00
1510	C	0-120/140	15.0	2.1	6 1/8 x 6 5/8 x 4 3/8	20.0	183.00
1510CT	C	0-120/140	15.0	2.1	8 31/32 x 6 3/16 x 4 1/2	20.0	244.00
2510	C	0-120/140	25.0	3.5	8 3/16 x 7 5/8 x 4 1/8	23.0	265.00
2510CT	K	0-120/140	25.0	3.5	9 5/8 x 7 5/8 x 4 1/8	26.0	327.00
6010	D	0-120/140	60.0	8.4	15 3/8 x 13 7/8 x 5 1/4	67.0	752.00
6010C	D	0-120/140	60.0	8.4	15 3/8 x 13 7/8 x 7 1/8	67.0	791.00
6010CT	D	0-120/140	60.0	8.4	17 15/16 x 14 x 7 1/8	67.0	865.00

PANEL OR BENCH MOUNTING MODELS *240 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
252	A	0-240/264	0.8	0.21	2 13/16 x 2 7/16	3.5	$ 63.00
1020	B	0-240/280	3.5	0.98	5 5/16 x 5 x 4 3/16	12.0	126.00
1020CT	J	0-240/280	3.5	0.98	6 7/8 x 5 x 4 7/16	12.0	159.00
SQ1020	B	0-240/280	3.5	0.98	5 3/16 x 4 1/4 x 4 5/32	12.0	126.00
1220	B	**0-240	5.0	1.2	5 5/16 x 5 x 4 3/16	12.0	131.00
1220CT	J	**0-240	5.0	1.2	6 7/8 x 5 x 4 7/16	12.0	165.00
SQ1220	B	**0-240	5.0	1.2	5 3/16 x 4 1/4 x 4 5/32	12.0	131.00
1520	C	0-240/280	9.5	2.66	6 1/8 x 6 5/8 x 4 13/16	20.0	183.00
1520CT	K	0-240/280	9.5	2.66	6 3/8 x 9 1/8 x 5	23.0	229.00
2520	C	0-240/280	10.0	2.8	8 3/16 x 7 5/8 x 4 1/8	23.0	265.00
2520CT	K	0-240/280	10.0	2.8	9 5/8 x 7 5/8 x 4 1/8	26.0	327.00
6020	D	0-240/280	35.0	9.8	15 3/8 x 13 7/8 x 5 1/4	63.0	752.00
6020C	D	0-240/280	35.0	9.8	15 3/8 x 13 7/8 x 7 1/8	63.0	791.00
6020CT	D	0-240/280	35.0	9.8	17 15/16 x 14 x 7 1/8	63.0	865.00

PORTABLE MODELS *120 VOLT INPUT SINGLE PHASE*

Cord, matching receptacle, switch, pilot light, fuse, connected for clockwise knob rotation.

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
3PN171	E	**0-132	1.75	0.23	3 15/16 x 3 15/16 x 3 1/2	3.5	$111.00
3PN501	E	0-120/140	5.0	0.70	5 3/8 x 6 1/16 x 5 5/8	9.0	133.00
3PN1010	F	0-120/140	10.0	1.4	5 x 6 7/8 x 5 5/8	12.0	147.00
3PN1210†	F	**0-120	12.0	1.44	5 x 6 7/8 x 5 5/8	12.0	177.00
3PN1510†	G	0-120/140	15.0	2.1	5 7/8 x 6 3/8 x 9	21.0	270.00
3PN2210†	G	0-140	22.0	3.08	5 5/8 x 7 5/8 x 10 3/4	24.0	392.00

PORTABLE MODELS *240 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
3PN1020	F	0-240/280	3.5	0.98	5 x 6 7/8 x 5 5/8	12.0	$175.00
3PN1220†	F	**0-240	5.0	1.2	5 x 6 7/8 x 5 5/8	12.0	201.00
3PN1520†	G	0-240/280	9.5	2.66	5 7/8 x 6 3/8 x 9	21.0	278.00
3PN2520†	G	0-280	10.0	2.8	5 5/8 x 7 5/8 x 10 3/4	24.0	393.00

CT refers to enclosed coil and terminals *60 HZ Only on Overvoltage Connection
**60 HZ operation only C refers to enclosed coil only

transformers



FIG. J



FIG. K



FIG. L



FIG. M



FIG. N

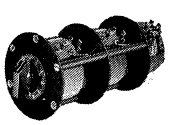


FIG. O

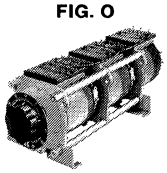


FIG. P

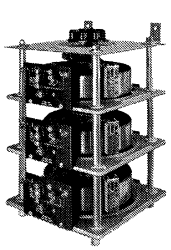


FIG. Q

METERED PORTABLE MODELS *120V & 240V SINGLE PHASE*

As above with an accurate, high quality pivot and jewel meter conveniently located atop the enclosure for easy, accurate readout. 120V models have 0-150V meter, 240V models have 0-300V meter.

MFG. TYPE No.	FIG.	INPUT VOLTS	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
3PN1010V	H	120	0-140	10.0	1.4	5 x 6⅞ x 5⅝	12.0	$242.00
3PN1510V	—	120	0-140	15.0	2.1	5⅞ x 6⅜ x 9	21.0	377.00
3PN1020V	H	240	0-280	3.5	9.8	5 x 6⅞ x 5⅝	12.0	277.00
3PN1520V	—	240	0-280	9.5	2.66	5⅞ x 6⅜ x 9	21.0	389.00

Ammeter equipped models available. Change suffix V to A.

VARIABLE ISOLATION TRANSFORMERS *120 VOLT INPUT SINGLE PHASE*

An exclusive by STACO, for use where the safety of isolation is required. The output voltage is completely isolated from the power line (input voltage). On uncased models, when proper external connections are made between windings, it is possible to increase the voltage or current output or input through non-isolated, voltage doubler, or series connection.

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
J201	B	0-140	2.0	0.28	5 5/16 x 5 x 4¾	13.0	$192.00
J401	B	0-140	4.0	0.56	6⅛ x 6⅝ x 4 7/16	20.0	296.00
J901	C	0-140	9.0	1.26	8 3/16 x 7⅝ x 4¾	32.0	517.00

ISOLATED PORTABLE MODELS *120 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	METER	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
3PNJ201	F	0-140	2.0	0.28	NO	5 x 6⅞ x 5⅝	11.0	$238.00
3PNJ201V	H	0-140	2.0	0.28	0-150	5 x 6⅞ x 5⅝	11.0	316.00
3PNJ401	G	0-140	4.0	0.56	NO	5⅞ x 6⅜ x 9	20.0	376.00
3PNJ401V	—	0-140	4.0	0.56	0-150	5⅞ x 6⅜ x 9	20.0	463.00

Ammeter equipped 3PNJ201A and 3PNJ401A available.

AC POWER SUPPLIES *120 VOLT SINGLE PHASE*

Portable AC Power Supplies are ideal for labs or test bench use. Totally enclosed in an aluminum enclosure with carrying handle, each model is complete with a three-conductor line cord, plug & matching receptacle, pilot light, switch and circuit breaker. Metered models are available with Voltmeter, Ammeter or a Wattmeter (or a combination of meters).

MFG. TYPE NO.	FIG.	INPUT VOLTS	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
L221	L	**120	0-132	1.75	0.23	6 5/32 x 5 x 4¼	5.0	$131.00
L501	L	120	0-140	4.5	0.63	7 23/32 x 5⅜ x 5⅞	12.0	171.00
L1010	L	120	0-140	10.0	1.4	9 13/32 x 6½ x 6¼	20.0	200.00
L501V	N	120	0-120/140	5.0	0.7	12⅜ x 10¾ x 6¼	12.0	368.00
L501VA	M	120	0-120/140	5.0	0.7	12⅜ x 10¾ x 6¼	12.0	539.00
L501VW	M	120	0-120/140	5.0	0.7	12⅜ x 10¾ x 6¼	12.0	673.00
L1010V	N	120	0-120/140	10.0	1.4	12⅜ x 10¾ x 6¼	10.0	418.00
L1010VA	M	120	0-120/140	10.0	1.4	12⅜ x 10¾ x 6¼	10.0	713.00
L1010VW	M	120	0-120/140	10.0	1.4	12⅜ x 10¾ x 6¼	10.0	885.00

E Series Models E171, E501 and E1010, without meters are also available.

THREE PHASE MODELS *240 VOLTS OR 480 VOLTS INPUT*

Three phase types are three individual units driven by a common shaft and electrically connected in three-phase wye configuration.

MFG. TYPE NO.	FIG.	INPUT VOLTS	INPUT FREQ. HZ	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
221-B-3	O	240	60	0-240	2.50	1.00	3⅞ x 3⅞ x 8⅛	9	$ 219.00
1010-3	P	240	50/60*	0-240/280	10.0	4.85	6⅛ x 5 x 14 19/32	36	372.00
1510-3	P	240	50/60*	0-240/280	15.0	7.26	7 1/16 x 6⅛ x 14 21/32	56	668.00
2510-3	P	240	50/60*	0-240/280	25.0	12.10	8⅝ x 7⅝ x 14⅝	72	957.00
5010-3Y	Q	240	60	0-280	50.0	24.2	15 7/16 x 13⅞ x 19⅝	225	2174.00
6010-3Y	Q	240	60	0-240/280	60.0	29.1	15 5/16 x 13⅞ x 19⅝	242	2718.00
252-3	O	480	56/60*	0-480/528	0.8	0.73	3⅞ x 3⅞ x 8⅛	9	274.00
1020-3	P	480	50/60*	0-480/560	3.5	3.40	6⅛ x 5 x 14 19/32	36	442.00
1520-3	P	480	50/60*	0-480/560	9.5	9.20	7 1/16 x 6⅛ x 15 11/16	56	659.00
2520-3	P	480	56/60*	0-480/560	10.0	9.70	8⅝ x 7⅝ x 14⅝	72	989.00
5020-3Y	Q	480	50/60*	0-480/560	28.0	27.2	15 7/16 x 13⅞ x 19⅝	225	2174.00
6020-3Y	Q	480	50/60	0-480/560	35.0	33.9	15 5/16 x 13⅞ x 19⅝	240	2718.00

V = Voltmeter VA = Voltmeter-Ammeter V W = Voltmeter, Wattmeter **60 HZ operation only

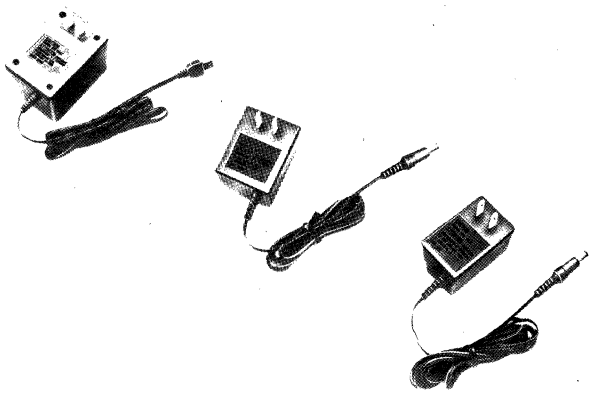
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WALL PLUG-IN POWER SOURCES—EUROPEAN AND DOMESTIC

UL-CSA SERIES



Reliable power sources for modems, data communication terminals, security systems, LED displays, power tools, home or personal computers, microprocessors, telecommunications products, battery power systems, medical products and test equipment. Choice of AC-DC regulated or unregulated models or AC-AC models. Wall plug-in power sources are the perfect solution for:

- Gaining agency approval: UL, CSA, VDE
- Reducing size and weight of product; allows low-profile design
- Removing heat from sensitive circuitry
- Eliminating need for cooling devices
- Reducing design time for product
- Providing a secure, tamperproof power source
- Providing safer, low power to any application

Stancor Wall Plug-In Power Sources have output termination compatible with Switchcraft® PC-722A or 722A with 6-ft. output cord. Other terminations available on special order.

AC-DC MODELS—UL/CSA UNREGULATED SERIES 120 VAC INPUT (ALL MODELS)

Stancor No.	Rated Output (DC) V	mA	CSA
W30DUH50-1	3.0	500	Listed
W45DUF35-1	4.5	350	Comply
W60DUH20-1	6.0	200	Listed
W60DUH30-1	6.0	300	Listed
W60DUH40-1	6.0	400	Listed
W60DUJ60-1	6.0	600	Listed
W60DUH120-1	6.0	1200	Comply
W60DUH200-1	6.0	2000	N/A
W75DUJ50-1	7.5	500	Listed
W85DUH10-1	8.5	100	Listed
W90DUM90-1	9.0	900	Comply
W100DUJ50-1	10.0	500	Listed
W120DUH20-1	12.0	200	Listed
W120DUJ30-1	12.0	300	Listed
W120DUJ50-1	12.0	500	Listed
W120DUM70-1	12.0	700	Comply
W140DUJ35-1	14.0	350	Listed
W180DUJ10-1	18.0	100	Comply
W200DUJ28-1	20.0	280	Listed
W240DUH05-1	24.0	50	Listed

N/A = Not Available

AC-DC MODELS—ULCSA REGULATED SERIES 120 VAC INPUT (ALL MODELS)

Stancor No.	Rated Output (DC) V	Reg.	mA	CSA
W50DRL60-1	5.0	0.2	600	Comply
W60DRJ40-1	6.0	0.5	400	Comply
W90DRL40-1	9.0	0.2	400	Comply
W120DRL30-1	12.0	0.2	300	Comply

AC-AC MODELS—UL CSA CLASS II TRANSFORMERS 120 VAC, 60 Hz INPUT (ALL MODELS)

Stancor No.	Rated Output VAC	mA RMS	CSA
W120AUH11-1	12.0	110	Comply
W170AUK50-2*	17.0#	500	Listed
W180AUM88-1	18.0	880	N/A
W240AUJ45-1	24.0	450	Comply
W240AUM66-1	24.0	660	N/A

***Termination:** 6-ft. cord with AMP connector: mates with AMP 3-102202-4 or 3-102203-4. #Center tapped. N/A = Not Available.

EUROPEAN MODELS 220 VAC, 50 Hz INPUT (ALL MODELS)

Stancor No.	Rated Output (DC) V	mA	VDE

EUROPEAN UNREGULATED SERIES

W60DUK40-X1	6.0	400	Comply
W90DUK50-X1	9.0	500	Comply
W120DUK50-X1	12.0	500	Comply

EUROPEAN REGULATED SERIES

W60DRK40-X1	6.0	400	Comply
W90DRK30-X1	9.0	300	Comply
W120DRK25-X1	12.0	250	Comply

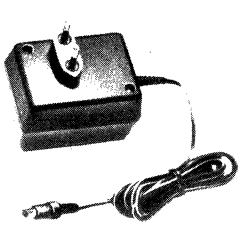
VDE AC-AC MODELS

Stancor No.	Rated Output (DC) VAC	mA	VDE
W95AUG15-X1	9.5	150	Comply
W120AUG10-X1	12.0	100	Comply

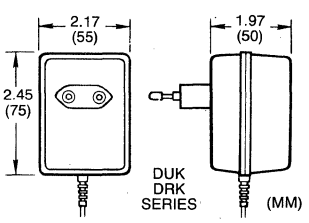
UL—CSA SERIES DIMENSIONS INCHES (MM)

Model Series	L	W	H
DUF	2.09 (53)	1.42 (36)	1.50 (38)
DUH, AUH	2.36 (60)	1.77 (45)	1.65 (42)
DUJ, DRJ, AUJ	2.40 (61)	2.17 (55)	1.61 (41)
DRL, AUK	3.19 (81)	2.32 (59)	2.05 (52)
DUM, AUM	3.23 (82)	2.36 (60)	1.89 (48)

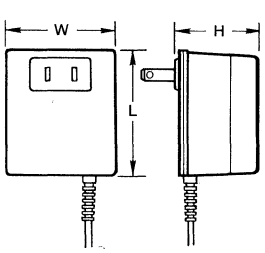
EUROPEAN VDE SERIES



EUROPEAN SERIES DIMENSIONS INCHES (MM)



UL—CSA SERIES SEE DIMENSIONS TABLE



STANCOR®

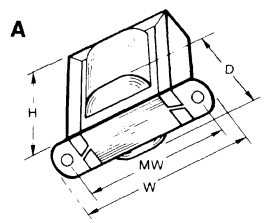
Transformers

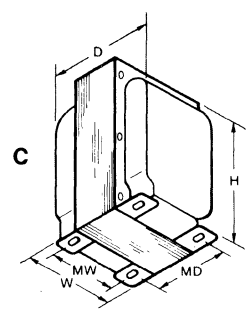
RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS
WITH SINGLE SECONDARY

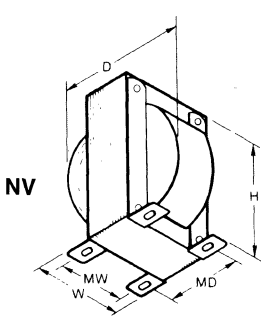
All primaries 50-60 Hz. May be operated from a 400 Hz source with no change in output rating. All secondary voltages ±3%. Insulation test voltage is twice allowable rms working voltage plus 1000 volts.

Stancor Number	Secondary V	Secondary A	Insul. Test V_{rms}	Pri. Volts	Termination Pri.	Termination Sec.	Mtg.	Size Inches H. × W. × D.
P-8385	6.3 CT	0.3	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 1 3/8
P-6465	6.3 CT	0.6	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 1/2
P-8705	6.3 CT	0.6	1500	230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 1/2
P-8389	6.3	1.0	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8
P-6134	6.3 CT	1.2	3000	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 7/8
P-8190	6.3	1.2	5000	117	Leads	Leads	A	2 × 3 1/4 × 1 7/8
P-6466	6.3 CT	3.0	2500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8
P-8648	6.3 CT	4.0	1500	117	Leads	Leads	A	2 3/8 × 3 3/4 × 2 1/8
P-8651	6.3 CT	8.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/4
P-6464	6.3 CT	10.0	2000	117	Leads	Leads	C	3 1/2 × 2 13/16 × 3 1/4
P-6309	6.3 CT	20.0	2500	117/107	Leads	Leads	NV	4 9/16 × 3 3/4 × 3 3/5
P-5015*	7.5 CT	4.0	2500	117	Lugs	Lugs	NV	3 1/8 × 2 1/2 × 2 1/4
P-8652	10.0 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 5/8
P-8653	10.0 CT	2.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2
P-8380	10.0 CT	3.0	1500	117	Leads	Leads	A	2 3/8 × 3 3/4 × 2 1/4
P-8654	10.0 CT	4.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/8
P-8655	10.0 CT	6.0	1500	117	Leads	Leads	NV	3 1/8 × 2 1/2 × 2 3/4
P-8656	10.0 CT	8.0	1500	117	Leads	Leads	NV	3 7/16 × 2 13/16 × 3
P-6461	10.0 CT	10.0	2000	117	Leads	Leads	C	3 7/8 × 3 1/4 × 3 9/16
P-8390	12.0	0.15	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4
P-8391	12.0	0.35	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8
P-8392	12.0	0.70	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8
P-8393	12.0	1.2	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 5/8
P-8657	12.0	2.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8
P-8658	12.0	4.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/4
P-8659	12.0	6.0	1500	117	Leads	Leads	NV	3 7/16 × 2 13/16 × 2 5/8
P-8660	12.0	8.0	1500	117	Leads	Leads	NV	3 13/16 × 3 1/8 × 2 3/4
P-8384	12.6 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 3/4
P-8550	12.6 CT	1.5	1500	115	Leads	Leads	A	1 15/16 × 3 5/16 × 2
P-8130	12.6 CT	2.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8
P-8358	12.6 CT	3.0	1500	117	Leads	Leads	A	2 3/8 × 3 3/4 × 2 1/4
P-8641	12.6 CT	4.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 3/8
P-8716	12.6 CT	4.0	2500	230	Leads	Leads	A	2 5/8 × 4 × 2 3/8
P-8642	12.6 CT	6.0	1500	117	Leads	Leads	C	3 1/2 × 2 13/16 × 3 3/8
P-8643	12.6 CT	8.0	1500	117	Leads	Leads	C	3 7/8 × 3 1/8 × 3 5/8
P-8644	12.6 CT	10.0	1500	117	Leads	Leads	C	4 1/4 × 3 7/16 × 3 7/8
P-8577	14.0 CT	0.25	1500	115/230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 1/2
P-8553	14.0 CT	0.25	1500	115	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8
P-8555	14.0 CT	1.0	1500	115	Leads	Leads	A	1 15/16 × 3 1/4 × 1 3/4
P-8556	14.0 CT	2.0	1500	115	Leads	Leads	A	2 1/4 × 3 11/16 × 1 15/16
P-8557	14.0 CT	4.0	1500	115	Leads	Leads	NV	3 × 2 1/2 × 2 7/16
P-8558	14.0 CT	6.0	1500	115	Leads	Leads	NV	3 3/8 × 2 13/16 × 2 7/8
P-8690	18.0 CT	0.75	1500	115	Leads	Leads	A	1 15/16 × 3 5/16 × 2
P-8691	18.0 CT	1.0	1500	115	Leads	Leads	A	1 15/16 × 3 5/16 × 2 1/8
P-8692	18.0 CT	1.5	1500	115	Leads	Leads	A	2 9/32 × 3 3/4 × 2 1/8
P-8693	18.0 CT	2.0	1500	115	Leads	Leads	A	2 9/32 × 3 3/4 × 2 1/4
P-8500	20.0 CT	0.05	2500	115/230	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4
P-8504	20.0 CT	0.25	2500	115/230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8
P-8505	20.0 CT	0.3	2500	115/230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8
P-8507	20.0 CT	0.5	2500	115/230	Leads	Leads	A	1 5/8 × 2 7/8 × 1 1/2
P-8508	20.0 CT	1.0	2500	115/230	Leads	Leads	A	2 × 3 1/4 × 2 1/4
P-8604	20.0 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8
P-8559	20.0 CT	2.0	1500	115	Leads	Leads	NV	2 9/16 × 4 × 2 1/4
P-8560	20.0 CT	4.0	1500	115	Leads	Leads	NV	3 3/8 × 2 13/16 × 2 7/8
P-8551#	24.0	1.0	1500	115	Leads	Leads	A	1 15/16 × 3 1/4 × 2 1/8
P-8694#	24.0	2.0	1500	115	Leads	Leads	A	2 9/16 × 4 × 2
P-8394	24.0 CT	0.09	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4
P-8720	24.0 CT	0.09	1500	230	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4
P-8395	24.0 CT	0.2	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8
P-8578	24.0 CT	0.2	1500	115/230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 1/2
P-8396	24.0 CT	0.4	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8
P-8397	24.0 CT	0.7	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 3/4
P-8661	24.0 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/16
P-8575	24.0 CT	1.0	1500	115/230	Leads	Leads	A	1 15/16 × 3 5/16 × 2
P-8662	24.0 CT	2.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 3/8
P-8863	24.0 CT	4.0	1500	117	Leads	Leads	NV	3 13/16 × 3 1/8 × 2 13/16
P-8664	24.0 CT	6.0	1500	117	Leads	Leads	NV	4 3/16 × 3 7/16 × 2 13/16
P-8665	24.0 CT	8.0	1500	117	Leads	Leads	NV	4 3/16 × 3 7/16 × 3 3/8
P-8695	24.0 CT	10.0	1500	115	Leads	Leads	NV	4 1/8 × 3 7/16 × 3 3/4
P-8666	24.0 CT	12.0	1500	117	Leads	Leads	NV	4 9/16 × 3 3/4 × 4 5/8
P-6469	25.2	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8
P-8707	25.2	1.0	1500	230	Leads	Leads	A	2 × 3 1/4 × 2 1/8
P-8180	25.2 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/4
P-8357	25.2 CT	2.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/4
P-8574	25.2 CT	2.0	1500	115/230	Leads	Leads	A	2 19/32 × 4 × 2 1/4
P-8388	25.2 CT	2.8	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/4
P-8645	25.2 CT	5.0	1500	117	Leads	Leads	C	4 1/4 × 3 7/16 × 3 7/8
P-8646	25.2 CT	7.5	1500	117	Leads	Leads	C	4 1/4 × 3 1/2 × 4 1/4
P-8609	26.8 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8
P-8600	28.0 CT	0.09	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4
P-8601	28.0 CT	0.18	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8
P-8602	28.0 CT	0.3	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8
P-8603	28.0 CT	0.8	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8
P-8667	28.0 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8
P-8668	28.0 CT	2.0	1500	117	Leads	Leads	NV	3 1/8 × 2 1/2 × 2 1/2

*Has electrostatic shield. #60 Hz only.







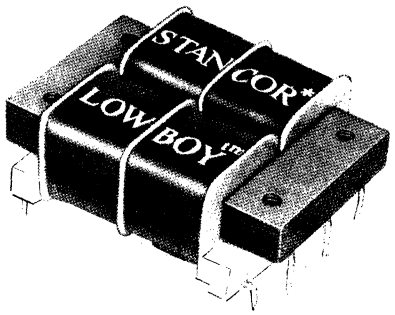
STANCOR®

Transformers

RECTIFIER, CONTROL, AND FILAMENT TRANSFORMERS (CONT'D)

WITH SINGLE SECONDARY

Stancor Number	Secondary V	Secondary A	Insul. Test V_{rms}	Prf. Volts	Termination Pri.	Termination Sec.	Mtg.	Size, Inches H. × W. × D.
P-8669	28.0 CT	4.0	1500	117	Leads	Leads	NV	3 13/16 × 3 1/8 × 3 1/4
P-8670	28.0 CT	6.0	1500	117	Leads	Leads	NV	4 3/16 × 3 7/16 × 3 1/2
P-8610	36.0 CT	0.07	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 2 1/4
P-8611	36.0 CT	0.14	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8
P-8612	36.0 CT	0.3	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8
P-8613	36.0 CT	0.55	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 7/8
P-8671	36.0 CT	1.0	1500	117	Leads	Leads	A	2 3/8 × 3 3/4 × 2 1/4
P-8672	36.0 CT	2.0	1500	117	Leads	Leads	NV	3 7/16 × 2 13/16 × 2 3/4
P-8673	36.0 CT	4.0	1500	117	Leads	Leads	NV	4 3/16 × 3 1/16 × 2 7/8
P-8674	36.0 CT	6.0	1500	117	Leads	Leads	NV	4 9/16 × 3 3/4 × 3 1/2
P-8542	40.0 CT	0.25	2500	115/230	Leads	Leads	A	1 5/8 × 2 7/8 × 1 1/2
P-8564	40.0 CT	1.0	1500	115	Leads	Leads	A	2 9/16 × 4 × 2 1/4
P-8566	40.0 CT	4.0	1500	115	Leads	Leads	NV	3 3/4 × 3 1/8 × 3 1/2
P-8605	48.0 CT	1.0	2500	117+	Leads	Leads	A	2 5/8 × 4 × 2 3/8



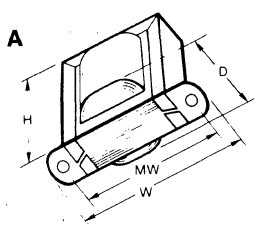
+ Primary tapped to provide secondary voltages of 45CT, or 51CT, or 54CT

CONTROL TRANSFORMERS

PRIMARY 115/230V

For 50/60 Hz. but may be operated from a 400 Hz source with no change in output ratings. By connecting primaries in series (for 230 volts) but using only 115 V input, a series of half-voltage output raings becomes available at full rated current from each secondary. Solder lug termination.

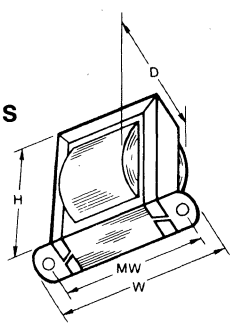
Stancor Number	Mtg. Style	Secondary Parallel	Secondary Series	VA
P-6375	S	6.0 V at 2.0 A	12.0 VCT at 1.0 A	12
P-6376	S	6.0 V at 4.0 A	12.0 VCT at 2.0 A	24
P-6377	S	12.0 V at 4.0 A	24.0 VCT at 2.0 A	48
P-6378	NV	12.0 V at 8.0 A	24.0 VCT at 4.0 A	96
P-6379	NV	12.0 V at 16.0 A	24.0 VCT at 8.0 A	192
P-8615	S	24.0 V at 0.5 A	48.0 VCT at 0.25 A	12
P-8616	S	24.0 V at 1.0 A	48.0 VCT at 0.5 A	24
P-8617	S	24.0 V at 2.0 A	48.0 VCT at 1.0 A	48
P-8618	NV	24.0 V at 4.0 A	48.0 VCT at 2.0 A	96
P-8619	NV	24.0 V at 8.0 A	48.0 VCT at 4.0 A	192

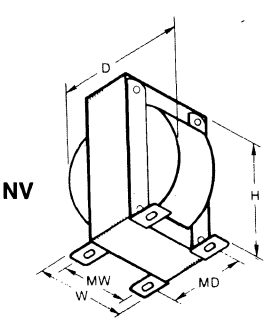


LOW BOY™ LOW-PROFILE POWER TRANSFORMERS

Case style. LB. Primaries are dual 115/230 volts. 50/60 Hz.

Stancor Number	Secondary Series	Secondary Parallel	VA	Size, Inches H. × W. × D.
LB210	10.0 VCT @ 0.2 A	5.0 V @ 0.4 A	2	0.625 × 1.562 × 1.875
LB310	10.0 VCT @ 0.3 A	5.0 V @ 0.6 A	3	0.625 × 1.562 × 1.875
LB215	15.0 VCT @ 0.15 A	7.5 V @ 0.3 A	2	0.625 × 1.562 × 1.875
LB240	40.0 VCT @ 0.06 A	20.0 V @ 0.12 A	2	0.625 × 1.562 × 1.875
LB256	56.0 VCT @ 0.045 A	28.0 V @ 0.09 A	2	0.625 × 1.562 × 1.875
LB288	88.0 VCT @ 0.028 A	44.0 V @ 0.056 A	2	0.625 × 1.562 × 1.875
LB2120	120.0 VCT @ 0.02 A	60.0 V @ 0.04 A	2	0.625 × 1.562 × 1.875
LB2230	230 VCT @ 0.01 A	115 V @ 0.02 A	2	0.625 × 1.562 × 1.875
LB315	15.0 VCT @ .225 A	7.5 V @ 0.45 A	3	0.625 × 1.562 × 1.875
LB410	10.0 VCT @ 0.4 A	5.0 V @ 0.8 A	4	0.875 × 1.562 × 1.875
LB510	10.0 VCT @ 0.5 A	5.0 V @ 1.0 A	5	0.875 × 1.562 × 1.875
LB412	12.0 VCT @ 0.333 A	6.0 V @ 0.667 A	4	0.875 × 1.562 × 1.875
LB512	12.0 VCT @ 0.417 A	6.0 V @ .0833 A	5	0.875 × 1.562 × 1.875
LB420	20.0 VCT @ 0.2 A	10.0 V @ 0.4 A	4	0.875 × 1.562 × 1.875
LB520	20.0 VCT @ 0.25 A	10.0 V @ 0.5 A	5	0.875 × 1.562 × 1.875
LB424	24.0 VCT @ 0.167 A	12.0 V @ 0.333 A	4	0.875 × 1.562 × 1.875
LB524	24.0 VCT @ 0.208 A	12.0 V @ 0.417 A	5	0.875 × 1.562 × 1.875
LB4120	120.0 VCT @ 0.033 A	60.0 V @ 0.066 A	4	0.875 × 1.562 × 1.875
LB5120	120.0 VCT @ 0.042 A	60.0 V @ 0.084 A	5	0.875 × 1.562 × 1.875
LB610	10.0 VCT @ 0.6 A	5.0 V @ 1.2 A	6	0.875 × 1.562 × 1.875
LB1210	10.0 VCT @ 1.2 A	5.0 V @ 2.4 A	12	1.062 × 2.000 × 2.500
LB612	12.6 VCT @ 0.45 A	6.3 V @ 0.9 A	6	0.875 × 1.562 × 1.875
LB1212	12.6 VCT @ 0.9 A	6.3 V @ 1.8 A	12	1.062 × 2.000 × 2.500
LB616	16.0 VCT @ 0.35 A	8.0 V @ 0.7 A	6	0.875 × 1.562 × 1.875
LB1216	16.0 VCT @ 0.7 A	8.0 V @ 1.4 A	12	1.062 × 2.000 × 2.500
LB620	20.0 VCT @ 0.3 A	10.0 V @ 0.6 A	6	0.875 × 1.562 × 1.875
LB1220	20.0 VCT @ 0.6 A	10.0 V @ 1.2 A	12	1.062 × 2.000 × 2.500
LB624	24.0 VCT @ 0.25 A	12.0 V @ 0.5 A	6	0.875 × 1.562 × 1.875
LB1224	24.0 VCT @ 0.5 A	12.0 V @ 1.0 A	12	1.062 × 2.000 × 2.500
LB634	34.0 VCT @ 0.17 A	17.0 V @ 0.34 A	6	0.875 × 1.562 × 1.875
LB1234	34.0 VCT @ 0.34 A	17.0 V @ 0.68 A	12	1.062 × 2.000 × 2.500
LB640	40.0 VCT @ 0.15 A	20.0 V @ 0.3 A	6	0.875 × 1.562 × 1.875
LB1240	40.0 VCT @ 0.3 A	20.0 V @ 0.6 A	12	1.062 × 2.000 × 2.500
LB656	56.0 VCT @ 0.1 A	28.0 V @ 0.2 A	6	0.875 × 1.562 × 1.875
LB1256	56.0 VCT @ 0.2 A	28.0 V @ 0.4 A	12	1.062 × 2.000 × 2.500
LB688	88.0 VCT @ 0.065 A	44.0 V @ 0.13 A	6	0.875 × 1.562 × 1.875
LB1288	88.0 VCT @ 0.13 A	44.0 V @ 0.26 A	12	1.062 × 2.000 × 2.500
LB6120	120.0 VCT @ 0.05 A	60.0 V @ 0.1 A	6	0.875 × 1.562 × 1.875
LB12120	120.0 VCT @ 0.1 A	60.0 V @ 0.2 A	12	1.062 × 2.000 × 2.500
LB6230	230.0 VCT @ 0.025 A	115 V @ 0.05 A	6	0.875 × 1.562 × 1.875
LB12230	230.0 VCT @ 0.05 A	115 V @ 0.1 A	12	1.062 × 2.000 × 2.500





STANCOR

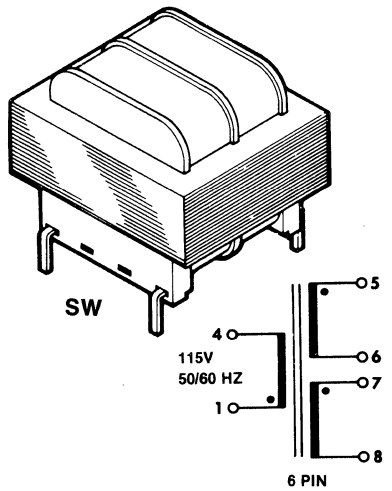
Transformers

"SIDE WINDER" SPLIT BOBBIN PC MOUNT POWER TRANSFORMERS

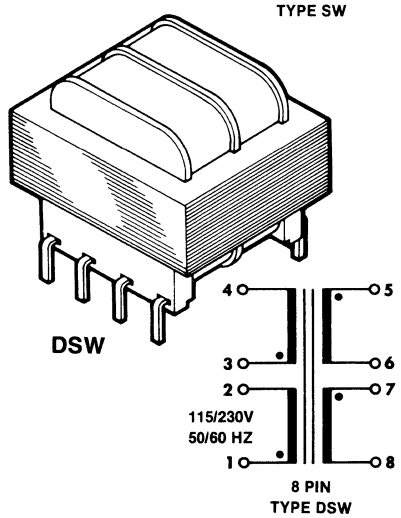
PRIMARY 115/230V 50/60Hz

Case style SW or DSW

Secondary Ratings		Size Inches H. x W. x D.	115 V Primary	115/230 V Primary
Series	Parallel		Stancor No.	Stancor No.
10.0 VCT at 0.11 A	5.0 V at 0.22 A	15/16 x 1 1/8 x 1 3/8	SW-210	DSW-210
10.0 VCT at 0.25 A	5.0 V at 0.5 A	13/16 x 1 1/8 x 1 3/8	SW-310	DSW-310
10.0 VCT at 0.6 A	5.0 V at 1.2 A	15/16 x 15/16 x 1 5/8	SW-410	DSW-410
10.0 VCT at 1.2 A	5.0 V at 2.4 A	17/16 x 1 9/16 x 1 7/8	SW-510	DSW-510
10.0 VCT at 2.0 A	5.0 V at 4.0 A	17/16 x 1 7/8 x 2 1/4	SW-610	DSW-610
12.6 VCT at 0.09 A	6.3 V at 0.18 A	15/16 x 1 1/8 x 1 3/8	SW-212	DSW-212
12.6 VCT at 0.2 A	6.3 V at 0.4 A	13/16 x 1 1/8 x 1 3/8	SW-312	DSW-312
12.6 VCT at 0.5 A	6.3 V at 1.0 A	15/16 x 15/16 x 1 5/8	SW-412	DSW-412
12.6 VCT at 1.0 A	6.3 V at 2.0 A	17/16 x 1 9/16 x 1 7/8	SW-512	DSW-512
12.6 VCT at 1.6 A	6.3 V at 3.2 A	17/16 x 1 7/8 x 2 1/4	SW-612	DSW-612
16.0 VCT at 0.07 A	8.0 V at 0.14 A	15/16 x 1 1/8 x 1 3/8	SW-216	DSW-216
16.0 VCT at 0.15 A	8.0 V at 0.3 A	13/16 x 1 1/8 x 1 3/8	SW-316	DSW-316
16.0 VCT at 0.4 A	8.0 V at 0.8 A	15/16 x 15/16 x 1 5/8	SW-416	DSW-416
16.0 VCT at 0.8 A	8.0 V at 1.6 A	17/16 x 1 9/16 x 1 7/8	SW-516	DSW-516
16.0 VCT at 1.25 A	8.0 V at 2.5 A	17/16 x 1 7/8 x 2 1/4	SW-616	DSW-616
20.0 VCT at 0.055 A	10.0 V at 0.11 A	15/16 x 1 1/8 x 1 3/8	SW-220	DSW-220
20.0 VCT at 0.12 A	10.0 V at 0.24 A	13/16 x 1 1/8 x 1 3/8	SW-320	DSW-320
20.0 VCT at 0.3 A	10.0 V at 0.6 A	15/16 x 15/16 x 1 5/8	SW-420	DSW-420
20.0 VCT at 0.6 A	10.0 V at 1.2 A	17/16 x 1 9/16 x 1 7/8	SW-520	DSW-520
20.0 VCT at 1.0 A	10.0 V at 2.0 A	17/16 x 1 7/8 x 2 1/4	SW-620	DSW-620
24.0 VCT at 0.045 A	12.0 V at 0.09 A	15/16 x 1 1/8 x 1 3/8	SW-224	DSW-224
24.0 VCT at 0.1 A	12.0 V at 0.2 A	13/16 x 1 1/8 x 1 3/8	SW-324	DSW-324
24.0 VCT at 0.25 A	12.0 V at 0.5 A	15/16 x 15/16 x 1 5/8	SW-424	DSW-424
24.0 VCT at 0.5 A	12.0 V at 1.0 A	17/16 x 1 9/16 x 1 7/8	SW-524	DSW-524
24.0 VCT at 0.8 A	12.0 V at 1.6 A	17/16 x 1 7/8 x 2 1/4	SW-624	DSW-624
28.0 VCT at 0.04 A	14.0 V at 0.08 A	15/16 x 1 1/8 x 1 3/8	SW-228	DSW-228
28.0 VCT at 0.085 A	14.0 V at 0.17 A	13/16 x 1 1/8 x 1 3/8	SW-328	DSW-328
28.0 VCT at 0.2 A	14.0 V at 0.4 A	15/16 x 15/16 x 1 5/8	SW-428	DSW-428
28.0 VCT at 0.42 A	14.0 V at 0.84 A	17/16 x 1 9/16 x 1 7/8	SW-528	DSW-528
28.0 VCT at 0.7 A	14.0 V at 1.4 A	17/16 x 1 7/8 x 2 1/4	SW-628	DSW-628
32.0 VCT at 0.035 A	16.0 V at 0.07 A	15/16 x 1 1/8 x 1 3/8	SW-232	DSW-232
32.0 VCT at 0.075 A	16.0 V at 0.15 A	13/16 x 1 1/8 x 1 3/8	SW-332	DSW-232
32.0 VCT at 0.188 A	16.0 V at 0.376 A	15/16 x 15/16 x 1 5/8	SW-432	DSW-432
32.0 VCT at 0.375 A	16.0 V at 0.750 A	17/16 x 1 9/16 x 1 7/8	SW-532	DSW-532
32.0 VCT at 0.625 A	16.0 V at 1.25 A	17/16 x 1 7/8 x 2 1/4	SW-632	DSW-632
36.0 VCT at 0.03 A	18.0 V at 0.06 A	15/16 x 1 1/8 x 1 3/8	SW-236	DSW-236
36.0 VCT at 0.065 A	18.0 V at 0.13 A	13/16 x 1 1/8 x 1 3/8	SW-336	DSW-336
36.0 VCT at 0.17 A	18.0 V at 0.34 A	15/16 x 15/16 x 1 5/8	SW-436	DSW-436
36.0 VCT at 0.35 A	18.0 at 0.7 A	17/16 x 1 9/16 x 1 7/8	SW-536	DSW-536
36.0 VCT at 0.55 A	18.0 V at 1.1 A	17/16 x 1 7/8 x 2 1/4	SW-636	DSW-636
48.0 VCT at 0.023 A	24.0 V at 0.046 A	15/16 x 1 1/8 x 1 3/8	SW-248	DSW-248
48.0 VCT at 0.05 A	24.0 V at 0.1 A	13/16 x 1 1/8 x 1 3/8	SW-348	DSW-348
48.0 VCT at 0.125 A	24.0 V at 0.25 A	15/16 x 15/16 x 1 5/8	SW-448	DSW-448
48.0 VCT at 0.25 A	24.0 V at 0.5 A	17/16 x 1 9/16 x 1 7/8	SW-548	DSW-548
48.0 VCT at 0.4 A	24.0 V at 0.8 A	17/16 x 1 7/8 x 2 1/4	SW-648	DSW-648
56.0 VCT at 0.02 A	28.0 V at 0.04 A	15/16 x 1 1/8 x 1 3/8	SW-256	DSW-256
56.0 VCT at 0.045 A	28.0 V at 0.09 A	13/16 x 1 1/8 x 1 3/8	SW-358	DSW-356
56.0 VCT at 0.11 A	28.0 V at 0.22 A	15/16 x 15/16 x 1 5/8	SW-456	DSW-456
56.0 VCT at 0.22 A	28.0 V at 0.44 A	17/16 x 1 9/16 x 1 7/8	SW-556	DSW-556
56.0 VCT at 0.35A	28.0 V at 0.7 A	17/16 x 1 7/8 x 2 1/4	SW-656	DSW-656
120 VCT at 0.01 A	60.0 V at 0.02 A	15/16 x 1 1/8 x 1 3/8	SW-2120	DSW-2120
120 VCT at 0.02 A	60.0 V at 0.04 A	13/16 x 1 1/8 x 1 3/8	SW-3120	DSW-3120
120 VCT at 0.05 A	60.0 V at 0.1 A	15/16 x 15/16 x 1 5/8	SW-4120	DSW-4120
120 VCT at 0.1 A	60.0 V at 0.2 A	17/16 x 1 9/16 x 1 7/8	SW-5120	DSW-5120
120 VCT at 0.16 A	60.0 V at 0.32 A	17/16 x 1 7/8 x 2 1/4	SW-6120	DSW-6120



6 PIN
TYPE SW



8 PIN
TYPE DSW

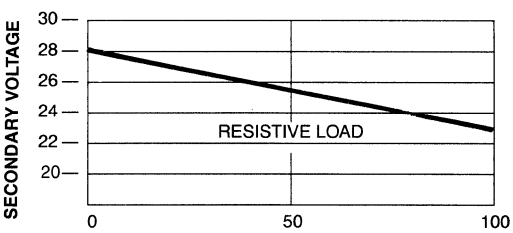
TYPE P-591 ENERGY-LIMITING TRANSFORMER

U.L. RECOGNIZED (File E-52313)

CSA CERTIFIED (LR 68068)

GENERAL DATA

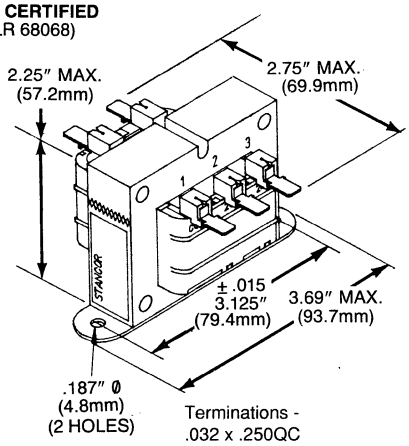
STANCOR Part No.	Volt-Amperes (VA)	Frequency (Hertz)	Primary Input (Volts)	Wt. Lbs.
P-591-900 P-591-901 P-591-902	30	50/60	120 240 208/240	1.20 .54Kg
P-591-910 P-591-911 P-591-912	40	50/60	120 240 208/240	1.30 .59Kg



% RATED SECONDARY CURRENT

Composite of 30 and 40 VA Regulation Curves.

Notes: Inductive loads produce slighly different voltages. Above curves subject to 2% manufacturing tolerance.



TERMINAL #2 AND CAVITY OMITTED ON 120 AND 240V TRANSFORMERS

STANCOR®

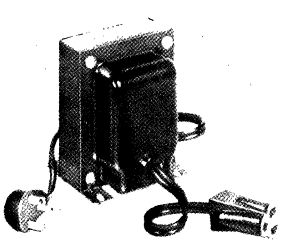
Transformers

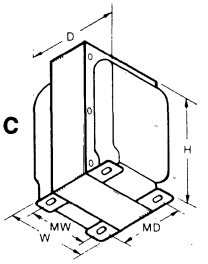
ISOLATION TRANSFORMERS

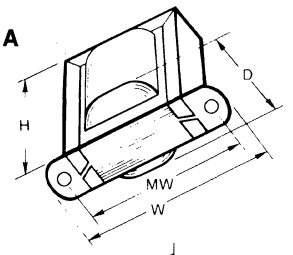
Transformers have NEMA standard line cord for primary and female receptacle for secondary, except where noted.

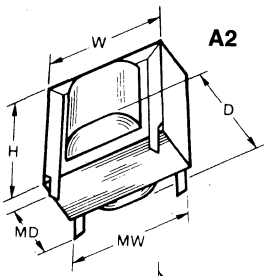
Stancor Number	Input Volts	Output Volts	Mtg. Style	VA	Size. Inches W. x D. x H.
STRAIGHT ISOLATION					
Case, core, and electrostatic shield connected to third conductor of line cord for safety.					
GIS-100	115	115	C	100	2 13/16 x 3 9/16 x 3 1/2
GIS-150	115	115	C	150	3 3/16 x 4 3/16 x 3 7/8
GIS-250	115	115	C	250	3 1/4 x 4 3/8 x 4 11/16
GIS-500	115	115	C	500	3 3/4 x 6 x 4 11/16
GIS-1000	115	115	C	1000	4 9/16 x 8 1/8 x 5 1/2
STEP-DOWN ISOLATION					
Case, core, and electrostatic shield connected to third conductor of line cord for safety.					
GISD-100	230	115	C	100	2 13/16 x 3 9/16 x 3 1/2
GISD-150	230	115	C	150	3 3/8 x 4 3/16 x 3 7/8
GISD-250	230	115	C	250	3 1/4 x 4 1/4 x 4 11/16
GISD-500	230	115	C	500	3 3/4 x 6 x 4 11/16
GISD-1000	230	115	C	1000	4 9/16 x 8 1/8 x 5 1/2
STRAIGHT ISOLATION					
Electrostatic shield grounded to core.					
P-6413*	115	115	A	0.6	2 1/8 x 1 1/4 x 1 1/4
P-6411*	115	115	A	15	3 1/4 x 1 7/8 x 2
P-6412*	115	115	A	35	3 3/4 x 2 x 2 3/8
P-6410	115	115	C	50	2 13/16 x 3 1/8 x 3 1/2
P-6160	105/115/125 *	115	C	100	3 3/4 x 3 3/4 x 4 11/16
P-6161	105/115/125 *	115	C	250	3 3/4 x 5 1/2 x 4 11/16
ISOLATION/TESTING					
Electrostatic shields grounded to core. Secondary has three female receptacles, each connected to a different voltage.					
P-6415	117	105/115/125	C	350	4 5/8 x 5 13/16 x 5 1/2

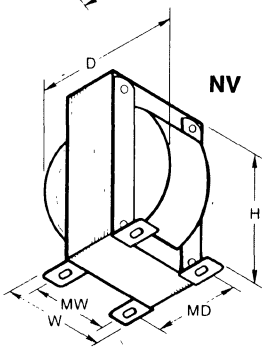
*Has lead wires. # Has selector Switch.

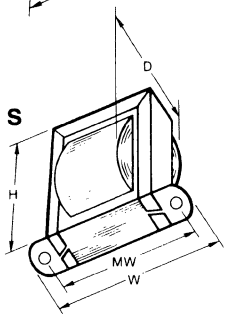












HIGH-CURRENT FILTER CHOKES

Inductance measured at 1 volt. 60 Hz. Insulation test voltage is twice allowable rms working voltage plus 1000 volts. Lead wire termination.

Stancor Number	Induc-tance mH	DC Amps	DC Resis. Ohms	Insul. Test V rms	Mtg. Style	Size Inches W. x D. x H.
TC-1	3.0	1.0	0.25	1000	A2	1 1/2 x 1 1/8 x 1 3/16
TC-2	11.0	1.0	0.75	1000	A2	1 1/2 x 1 1/8 x 1 3/16
C-2685	35.0	2.0	0.75	1500	NH	2 5/8 x 2 1/8 x 2 5/16
C-2686	25.0	4.0	0.43	1500	NH	3 3/8 x 2 5/8 x 2 7/8
C-2687	10.0	8.0	0.15	1500	NH	3 3/4 x 3 x 3 3/16
C-2688	10.0	12.5	0.11	1500	NH	4 1/8 x 3 1/8 x 3 1/2

CONTROL TRANSFORMERS

Designed for microprocessor power and logic circuits.

Stancor Number	Secondary		Insul. Test V_{rms}	Prf. Volts	Termination		Mtg.	Size, Inches H. x W. x D.
	V	A			Pri.	Sec.		
P-8696	32.0 CT 15.0 CT	0.25 0.75	1500	230	Leads	Leads	A	2 1/4 x 3 3/4 x 1 7/8
P-8698	32.0 CT 15.0 CT	1.0 4.0	1500	230	Leads	Leads	NV	3 3/4 x 2 15/16 x 2 1/2
P-8699	32.0 CT 15.5 CT	0.05 0.2	1500	115	Leads	Leads	A	1 5/8 x 2 7/8 x 1 3/8
P-8750	32.0 CT 15.5 CT	0.25 0.75	1500	115	Leads	Leads	A	2 1/4 x 3 3/4 x 1 7/8
P-8753	32.0 CT 15.0 CT	1.0 6.0	1500	115	Leads	Leads	NV	3 3/4 x 3 1/8 x 3 3/16
P-8754	32.0 CT 15.0 CT	1.0 10.0	1500	115	Leads	Leads	NV	4 1/8 x 3 7/16 x 3 1/2

LINE TO VOICE COIL TRANSFORMERS

Transformers with 70-7 V constant voltage output. Lug terminations except 8084, leads. Test Volts, 1000.

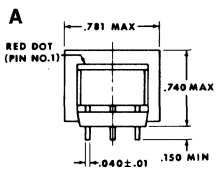
Stancor Number	Mfg. Style	Impedance Ohms		Audio Watts
		Primary	Secondary	
A-8102	S	625/1250/2500/ 5000/10000	4/8/16	8/4/2 1/0.5
A-8103	S	312/625/1250/ 2500/5000/10000	4/8/16	16/8/4/2 1/0.5
A-8105	A	1000/2000/4000/ 8000/16000	4/8	5/2.5 1.25/0.62/.31
A-8109	A	2500/5000/10000	4/8	2/1/0.5
A-8084	A	1250/2500/5000/ 10000/20000/40000	8	4/2/1/0.5 0.25/0.12
A-8078	S	167/250/500/1000	4/8/16	30/12/10/5

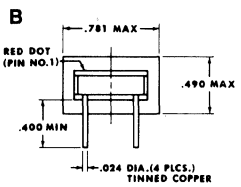
TELEPHONE COUPLING TRANSFORMERS

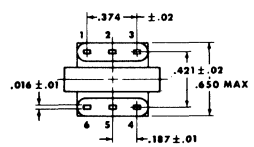
Case style, see below.

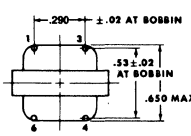
Stancor Number	Mtg.	Impedance Ohms		Pri. mA DC	Inser. ition Loss dB
		Primary	Secondary		
TTPC-1	A	600 CT	600 CT	0	1.4
TTPC-2	B	600	600	0	1.2
TTPC-5	B	4000	600	0	1.5
TTPC-6	A	600	600 CT	90	1.8
TTPC-7	A	600	600	0	1.2
TTPC-8	A	600 CT	600 CT	0	1.2
TTPC-10	A	600	900	0	1.2
TTPC-11	A	4000	600	0	1.2
TTPC-12	F	1.3 Henries*			
PCT-24	K	900 CT	600	3	2.0
PCT-27	K	600	600 CT 150 split	3	2.0
PCT-77	K	600 CT	600 CT	3	2.0
PCT-78	K	600	600	3	2.0

*Holding coil.

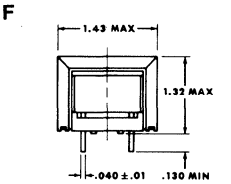




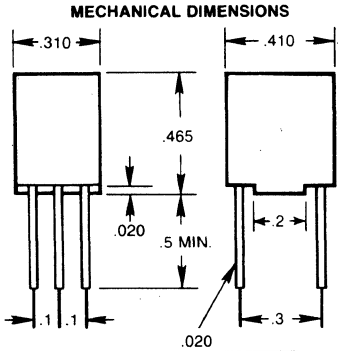




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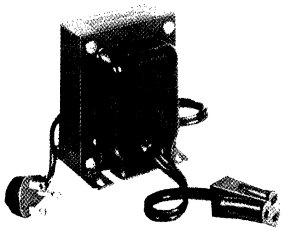
MECHANICAL DIMENSIONS



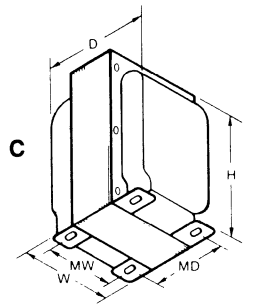
STANCOR®

Transformers

MINIATURE, PLUG-IN PC POWER TRANSFORMERS

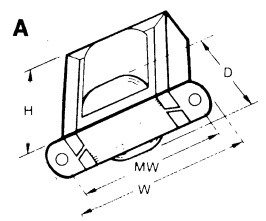


Stancor No.	Case Style	Secondary: Parallel	Secondary: Series	Size, Inches H. × W. × D.
WITH 115 VOLT PRIMARY AND EQUAL SECONDARIES				
PPC-1	PC	4.0 V at 0.376 A	8.0 VCT at 0.188 A	1 1/8 × 1 13/32 × 1 5/32
PPC-2	PC	7.5 V at 0.2 A	15.0 VCT at 0.1 A	1 1/8 × 1 13/32 × 1 5/32
PPC-3	PC	15.0 V at 0.1 A	30.0 VCT at 0.05 A	1 1/8 × 1 13/32 × 1 5/32
PPC-4	PC	27.0 V at 0.056 A	54.0 VCT at 0.028 A	1 1/8 × 1 13/32 × 1 5/32
PPC-7	PC	20.0 V at 0.076 A	40.0 VCT at 0.038 A	1 1/8 × 1 13/32 × 1 5/32
PPC-11	APC	4.0 V at 1.13 A	8.0 VCT at 1.562 A	1 13/32 × 2 3/8 × 1 1/4
PPC-12	APC	7.5 V at 0.6 A	15.0 VCT at 0.3 A	1 13/32 × 2 3/8 × 1 1/4
PPC-13	APC	15.0 V at 0.3 A	30.0 VCT at 0.15 A	1 13/32 × 2 3/8 × 1 1/4
PPC-14	APC	27.0 V at 0.168 A	54.0 VCT at 0.084 A	1 13/32 × 2 3/8 × 1 1/4
PPC-17	APC	20.0 V at 0.224 A	40.0 VCT at 0.112 A	1 13/32 × 2 3/8 × 1 1/4
PPC-22	APC	7.5 V at 1.0 A	15.0 VCT at 1.05 A	1 5/8 × 2 13/16 × 1 15/32
PPC-23	APC	15.0 V at 0.5 A	30.0 VCT at 0.25 A	1 5/8 × 2 13/16 × 1 15/32
PPC-27	APC	20.0 V at 0.376 A	40.0 VCT at 0.188 A	1 5/8 × 2 13/16 × 1 15/32
WITH 115/230 VOLT DUAL PRIMARIES AND EQUAL SECONDARIES				
PPC-8	PC	15.0 V at 0.1 A	30.0 VAC at 0.05 A	1 3/16 × 1 3/8 × 1 1/8
PPC-46	PC	7.5 V at 0.2 A	15.0 VCT at 0.1 A	1 1/8 × 1 3/8 × 1 1/8
PPC-51	PC	115 V at 0.013 A	230 VCT at 0.007 A	1 1/8 × 1 3/8 × 1 1/8
PPC-18	APC	6.3 V at 0.7 A	12.6 VCT at 0.35 A	1 7/16 × 2 3/8 × 1 1/4
PPC-47	APC	7.5 V at 0.6 A	15.0 VCT at 0.3 A	1 3/8 × 2 3/8 × 1 1/4
PPC-19	APC	8.0 V at 0.56 A	16.0 VCT at 0.28 A	1 7/16 × 2 3/8 × 1 1/4
PPC-28	APC	10.0 V at 0.45 A	20.0 VCT at 0.225 A	1 7/16 × 2 3/8 × 1 1/4
PPC-20	APC	12.0 V at 0.36 A	24.0 VCT at 0.18 A	1 7/16 × 2 3/8 × 1 1/4
PPC-48	APC	15.0 V at 0.3 A	30.0 VCT at 0.15 A	1 3/8 × 2 3/8 × 1 1/4
WITH 115/230 VOLT DUAL PRIMARIES AND UNEQUAL SECONDARIES				
DPC-X-12	PC	10.0 VCT at 0.39 A	20.0 VCT at 0.107 A	1 5/8 × 1 7/8 × 1 7/16
DPC-Y-12	PC	10.0 VCT at 0.9 A	20.0 VCT at 0.27 A	1 3/8 × 1 5/8 × 2 1/4
DPC-Y-15	PC	10.0 VCT at 0.9 A	24.0 VCT at 0.24 A	1 3/8 × 1 5/8 × 2 1/4



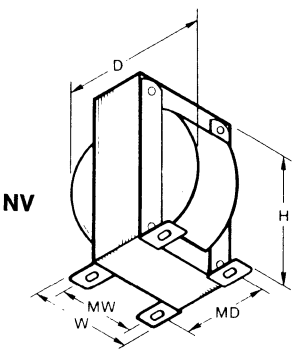
UNIVERSAL RECTIFIER TRANSFORMERS

Each transformer has the winding arrangement shown. The 117 VAC primary is connected to terminals 1, 2, 3, and 4. The separate winding 5, 6, and 7 may be used in series with the primary to raise or lower the secondary voltage output. Transformers are designed for 50-60 Hz operations, but may also be operated at 400 Hz. Case style is NV with solder lug terminations.



Stancor Number	Approx. Applies VAC Under Load	Max. DC Output: Resistive or Induct load: Volts	Max. DC Output: Resistive or Induct load: Amps	Max. DC Output: Capacitive Load: Volts	Max. DC Output: Capacitive Load: Amps	Filter Capacitor µF
RT-201	11.7-29.4*	11.2	2.0	13.8	2.0	1000
	11.1-28.5†	23.0	1.25	30.0	1.25	500
RT-202	12.0-29.8*	11.1	4.0	14.7	4.0	2000
	12.0-29.8†	24.3	2.0	33.0	2.0	1000
RT-204	11.7-29.2*	12.0	8.0	14.5	8.0	4000
	11.6-29.2†	24.0	4.0	32.4	4.0	2000
RT-206	12.0-29.7*	11.5	12.0	14.4	12.0	6000
	12.0-29.7†	24.0	6.0	32.0	6.0	3000
RT-208	12.1-29.2*	11.4	15.0	14.8	15.0	7500
	12.1-29.2†	23.7	8.0	32.5	8.0	4000
RT-2012	12.2-29.0*	11.4	22.5	14.3	22.5	1200
	12.2-29.0†	23.5	12.0	33.0	12.0	6000
RT-401	24.0-59.0*	25.0	2.0	34.0	2.0	2500
	24.0-59.0†	52.5	1.0	73.5	1.0	600
RT-402	23.0-58.0*	25.0	4.0	33.5	4.0	3000
	23.0-58.0†	51.5	2.0	72.5	2.0	600
RT-408	25.0-54.1*	23.4	12.0	32.0	12.0	4000
	25.0-54.1†	46.3	8.0	66.8	8.0	4000

*CT rectifier circuit. †Bridge rectifier circuit.

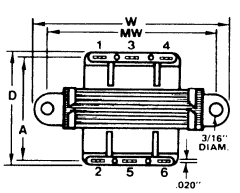


AUTOTRANSFORMERS

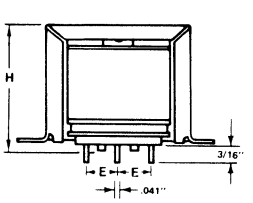
STEP-DOWN

Grounded safety type with case and core connected to third conductor of NEMA standard cord and receptacle. Primaries 230 VAC, secondaries 115 VAC. 50/60 Hz. May be operated from a 400 Hz source with no change in output ratings.

Stancor Number	Mtg. Style	VA	Size, Inches W. × D. × H.	Wt. Lbs.
GSD-75	C	75	3 3/16 × 2 3/4 × 3 7/8	3.0
GSD-100	C	100	3 3/16 × 3 × 3 7/8	3.7
GSD-150	C	150	3 3/16 × 3 1/4 × 3 7/8	4.4
GSD-250	C	250	3 3/16 × 3 5/8 × 3 7/8	5.8
GSD-350	C	350	3 13/16 × 4 5/16 × 3 7/8	7.3
GSD-500	C	500	3 13/16 × 4 7/16 × 4 5/8	10.6
GSD-750	C	750	3 13/16 × 5 3/16 × 4 5/8	14.4
GSD-1000	C	1000	3 13/16 × 6 × 4 5/8	17.0
GSD-1500	C	1500	4 5/8 × 6 × 5 1/2	20.0



STYLE APC (BOTTOM VIEW)



STYLE APC (SIDE VIEW)

Primaries 230 VAC, secondaries 115 VAC. 50/60 Hz. May be operated from a 400 Hz source with no change in output ratings. NEMA standard line cord and female receptacle.

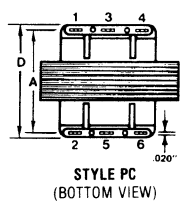
P-8620*	A	50	3 11/16 × 1 7/8 × 2 5/16	1.5
P-8630	C	85	2 5/8 × 2 3/4 × 3 1/2	2.5
P-8631	C	125	2 5/8 × 3 × 3 1/2	3.0
P-8632	C	200	3 1/8 × 3 3/4 × 3 7/8	4.2
P-8634	C	400	3 1/8 × 4 3/4 × 3 7/8	7.0

*Has lead wires instead of cord and receptacle.

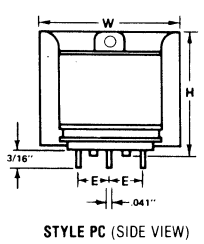
STEP-UP

Primaries 115 VAC, secondaries 230 VAC. 50/60 Hz. May be operated from a 400 Hz source with no change in output ratings. NEMA standard line cord and female receptacle.

P-8637	C	85	2 5/8 × 2 3/4 × 3 1/2	2.5
P-8638	C	125	2 5/8 × 3 × 3 1/2	3.0
P-8639	C	300	3 1/8 × 3 7/8 × 3 7/8	5.2
P-8640	C	500	3 3/4 × 4 3/4 × 4 9/16	10.3
P-8689	C	1000	3 3/4 × 6 1/8 × 4 5/8	17.4



STYLE PC (BOTTOM VIEW)



STYLE PC (SIDE VIEW)

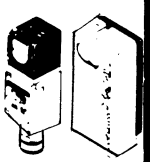
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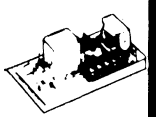
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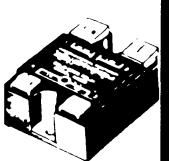
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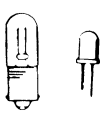
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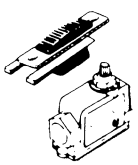
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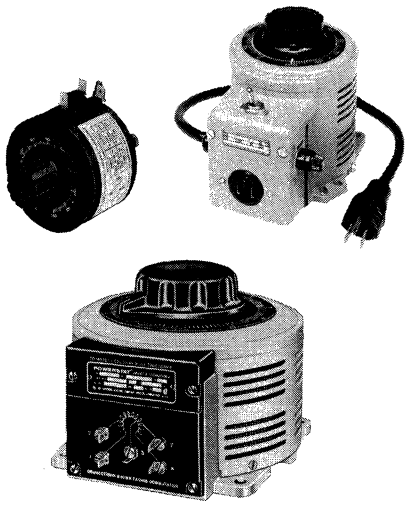
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POWERSTAT® Variable Transformers with POWERKOTE® Coils

Epoxy-coated POWERKOTE Coils make the POWERSTAT line the most outstanding value in variable transformers today. *Without increase in price, size or weight,* only POWERSTAT Variable Transformers give an average of 20% higher current ratings, 10:1 greater overload capability, longer life, greater resistance to fungus, salt spray and other contaminating atmospheres. POWERKOTE Coil commutator bars are embedded in place preventing steady-state operating temperature and severe overloads from distorting the commutator.

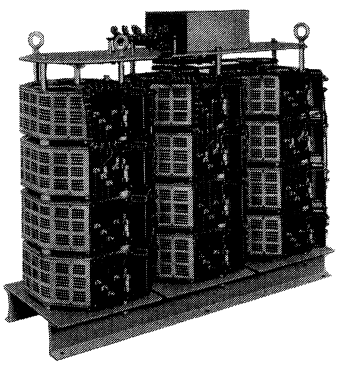
POWERSTAT Variable Transformers deliver continuously adjustable voltage from AC power lines. They introduce no waveform distortion and feature rugged construction, precious metal plated commutators, excellent regulation, high efficiency and conservative ratings. All manually operated types except the 10C-12 Series are available with motor drives if desired. Motor driven speeds are 5, 15, 30 or 60 seconds for full range travel on all except types 4-gang and over which do not offer the 5-second speed. Single types in the 116C-216C, 117C-217C, 126-226, and 136B-236B Series are also offered with 3-wire cord plug sets. 1156D-1256D Series types are available in ratings to 244 kVA and 1296D Series types to 313 kVA.





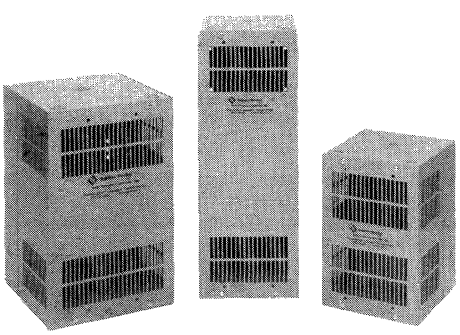
Enclosed Types

Meet OSHA requirements. Portable 120 V, single phase units have grounded NEMA cord-plugs, on-off switches, grounded output receptacles, pilot lights and fuses. Panel controls are recessed for protection from accidental bumping. Rear slots for hanger brackets. Type L10C rated 0-132 V, 2 A; type L21C rated 0-140 V, 4.5 A; type L116C rated 0-140 V, 10 A.



Heavy Duty 1296D Series

Single and 3-phase, manual and motor-driven types in the 1296D series boost ratings in the line to 313 kVA. They operate from 240 VAC, 50/60 Hz lines with rated output 35 A for constant current and 39 A for constant impedance loads. Common utilization voltages 240 to 575 VAC. Request special 1296D Series bulletin for complete data.



Variable Transformer Enclosures

New PBA Series Enclosures are specifically designed to house manually operated and motor-driven, open construction (suffix U) POWERSTAT Variable Transformers. Most are offered as independent assemblies suitable for new or retrofit applications. Constructed of heavy gauge sheet metal, these enclosures are classified NEMA Type 1 as defined in NEMA Standard ICS 1-110.

Three of the four series offered house small to medium frame size variable transformers having power ratings between 0.5 kVA, single phase and 15 kVA, 3 phase. The PBA50 series units are for use with larger assemblies having ratings between 6kVA, single phase and 60 kVA, three phase and can be fitted with optional caster kits.

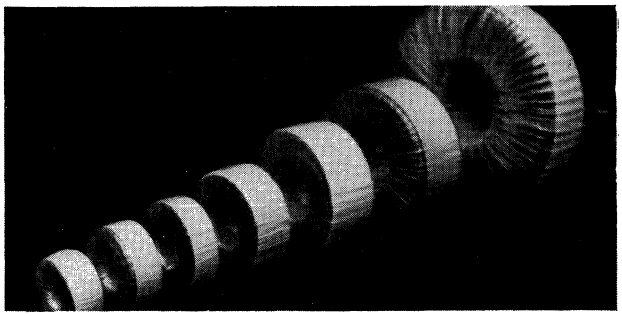
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TOROIDAL COMPONENTS TECHNICAL INFORMATION



THE COMPANY

TALEMA ELECTRONIC, INC. began operations in mid-1983. As a member of the TALEMA INTERNATIONAL GROUP OF COMPANIES, the significant growth of the U.S. operation was made possible by sharing design and manufacturing technologies with its German and Irish affiliates.

The factory is located in Rolla, Missouri, an area which typically has lower labor rates than coastal areas and offers the advantage of being the geographic center of the continental United States, thereby cutting shipping expenses.

ADVANTAGES OF TOROIDS

LOW WEIGHT
Save as much as 50% over traditional frame style transformers.

SMALL SIZE
To assist in the design of low profile, slim-line equipment.

EASE OF MOUNTING
One bolt through the center is all that's needed.

LOW MAGNETIC STRAYFIELD EMISSIONS
Excellent choice to reduce screen distortion in CRT's and high resolution monitors without costly shielding or reduce audible "hum" in high-end audio equipment.

IMPROVED EFFICIENCY
Reduces power consumption.

TALEMA PRODUCTS

UL RECOGNIZED STANDARD TRANSFORMERS with both single and dual secondary windings are available in power ranges from 15VA to 1000VA at a variety of output voltages. (See page A•2424)

CUSTOM DESIGNED TRANSFORMERS are available in sizes from 0.5VA to 8KVA for applications where standard transformers do not optimize electrical or mechanical performance. In-house manufacturing of silicon steel tapewound cores allows our engineers to economically vary core height and diameter to meet virtually any application.

SOPHISTICATED COMPUTER DESIGN software enables our engineers to quickly and accurately design custom transformers for rectified loads, eliminating approximations and producing prototypes that work the first time.

COMPLIANCE TO SAFETY STANDARDS is an advantage TALEMA offers equipment engineers. Our facility is certified to manufacture RECOGNIZED transformers, typically allowing even custom transformers to bear the UR symbol of recognition without expensive, time consuming applications.

UL RECOGNIZED INSULATION MATERIALS insure these standards are met. The insulation system of our standard line is rated for Class A, 105°C. For higher temperature applications, a **UL RECOGNIZED CLASS B**, 130 C insulation system is available.

OTHER PRODUCTS
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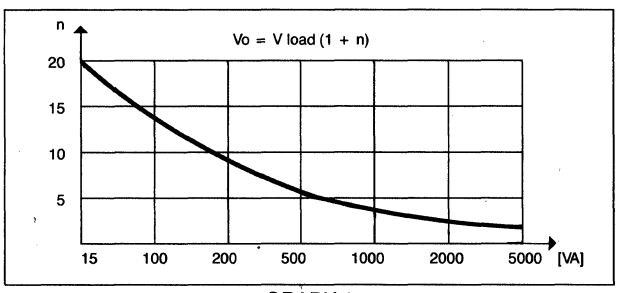
QUALITY

Other companies make grand claims such as "highest quality available", or they tout the "superiority" of their product. TALEMA doesn't have to—the fact that we maintain a ship-to-stock vendor rating with over 200 national and multinational companies is, to us, the best testimonial of our commitment to quality.

APPLICATION NOTES

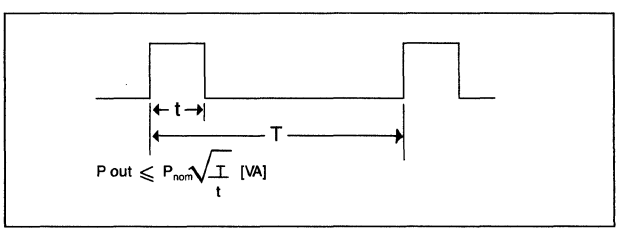
TEMPERATURE RISE
TALEMA transformers are ordinarily designed for a temperature rise of 55°C to 65°C at full load. Ventilation, mounting configuration, and load duty cycle are important considerations.

VOLTAGE DROP
Graph 1 shows the percentage of voltage drop for standard cores at 50/60 Hz. (Voltage drop is slightly higher in transformers designed for 60 Hz only operation.)

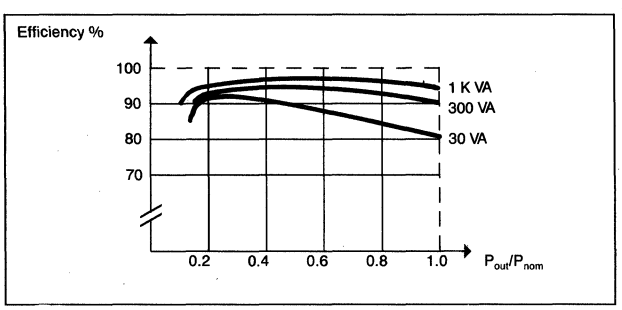


GRAPH 1

DUTY CYCLE
A smaller transformer can be used if the load is intermittent. Because the output power in this case significantly exceeds the nominal power, the secondary full-load voltage (using standard line as an example) drops below the voltages shown on the next page. The full-load voltage drop increases proportionately with the current being drawn.



EFFICIENCY
Graph 2 shows typical efficiency which can be expected as a function of the power relationship P_{out} / P_{nom} and transformer size.



GRAPH 2

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TOROIDAL COMPONENTS TECHNICAL INFORMATION

CUSTOM DESIGNED TOROIDAL TRANSFORMERS

Working in close partnership with equipment designers, TALEMA uses its technological expertise to create transformers which are as much a part of original equipment design as any other element of the final product. By operating in this way, TALEMA provides the optimum response to highly specific requirements across a wide application profile including professional audio equipment, specialty lighting, computers, video monitors, compact power supplies, and medical equipment.

We begin the design process by working closely with the equipment designer to create the transformer specifications. Often, our engineering staff will evaluate other key components of newly designed equipment to accurately specify power requirements, size, noise, and strayfield levels in order to provide the highest level of performance within a specific cost per unit framework. Then, by utilizing sophisticated design software, our engineers can quickly and accurately design the optimum toroidal transformer for your application.

There are some key properties of toroidal technology which are critical to success in sensitive applications. TALEMA boasts unequalled experience in the control of these areas.

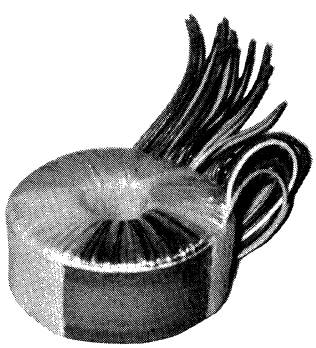
THE CORE AND NOISE.

The quality of the toroidal core is a vital consideration for sensitive applications. TALEMA has invested heavily to provide extensive core manufacturing, annealing, and testing facilities. Using high grade grain oriented silicon steel, with typical losses of 0.70 watts/lb at 1.7 Tesla, the core is manufactured in-house under close supervision of Quality Control in order to maintain the performance characteristics of the high grade steel.

Because TALEMA cores are manufactured from a continuous strip of high grade steel with both ends welded, there are no loose sheets or laminations to vibrate—minimizing the possibility of mechanical hum.

SIZE CONSTRAINTS

TALEMA engineers are able to utilize a wide range of diameter to height ratios, giving the equipment designer the opportunity to achieve the ultimate level of electrical performance within a specific size.



PERIMETER SHIELD

RADIATED MAGNETIC STRAYFIELD

Achieving low levels of stray field radiation is an important consideration for the equipment designer, as this phenomenon can create unwanted noise through interference with sensitive electronics.

A toroidal transformer generally offers a reduction of 8:1 in magnetic interference levels compared with traditional frame style laminate types. The engineer still has to be aware of the need to locate the transformer away from the sensitive parts of a circuit. Sometimes the only solution is to separate the device entirely by mounting in a remote enclosure, but this can be costly and undesirable.

TALEMA's engineering staff has vast experience in solving this type of problem, and has developed a range of successful techniques over several years. These include:

Using a combination of lower flux density and special winding techniques to provide further field reduction.

Grouping of leads to minimize openings in the windings while maintaining safe isolation.

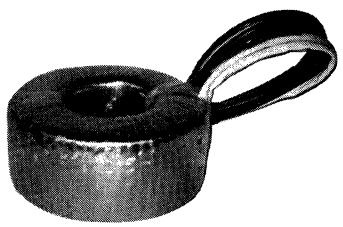
Applying a low cost silicon steel perimeter shield which is built into the transformer to further reduce stray field by an order of eight to ten times.

MEDICAL APPLICATIONS

TALEMA has vast experience designing toroidal transformers to meet the requirements of UL 544 and IEC 601. The most important aspects of designing a transformer of UL 544 requirements are construction, leakage current, and abnormal operation as defined in UL 544 sections 19, 27, and 41, respectively.

Unless the customer dictates otherwise, we use construction called out in paragraphs 19.4 C or E. These are for patient-care equipment.

Paragraph C is satisfied by using a grounded copper shield between primaries and secondaries in combination with a thermal protection device. Often, our customers prefer this type of construction because the copper shield is considered a fail-safe protection against electrical shock. However, this approach adds cost and may be unnecessary.



COPPER SHIELD

A more economical approach is construction per paragraph E, which is satisfied by using a thermal protection device in combination with "three layers of insulating material", of which any combination of two layers are capable of withstanding a 3500 volt 60 Hz dielectric withstand test potential for 1 minute.

LEAKAGE CURRENT

Leakage current is that current which can be conducted through the patient's body if the protective ground to the wall power cord is broken. Toroidal transformers can contribute leakage current through two paths: from primary to secondary, and from primary to mounting surface. Drawing on years of experience, our engineers can design toroidal transformers and mounting techniques that will minimize the transformers contribution to system leakage. However, the equipment designer must also account for other components within the system that will contribute leakage current such as power cords, switches, line filters, and fuse holders.

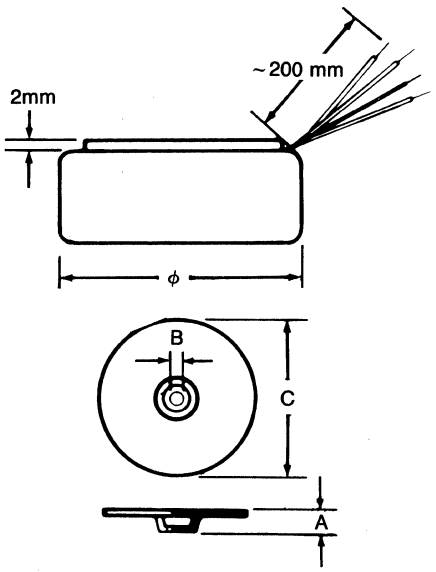
TALEMA can measure leakage current with a tester constructed to the circuit in UL 544 figure 27.1 and section 27.5, at the customer's request.

ABNORMAL OPERATION

Section 34 of UL 544 describes tests which the transformer will be subjected to in order to confirm that abnormal operation (which the system may encounter in actual service) will not present a shock or fire hazard to the patient or operator. Equipment designers should investigate the possible abnormal tests UL may perform on their particular system, then contact TALEMA engineers for assistance in creating the transformer specifications. Working together with our engineers as a team, designers can be assured of accurate, functional transformers without multiple iterations thereby cutting development costs.

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TOROIDAL COMPONENTS TECHNICAL INFORMATION



UL RECOGNIZED 117 VOLT, 60Hz STANDARDS

Part Number	SECONDARY DATA Full Load Voltage	No Load Voltage	Current	Dimensions and weight with Centering Washers ϕ mm	Height/mm	Weight/kg
15 VA UR0015-1-010	10	11.9	1.50	60	31	0.3
UR0015-1-015	15	17.8	1.00			
UR0015-1-030	30	35.7	0.50			
UR0015-2-006	2x6	2x7.2	1.25			
UR0015-2-010	2x10	2x11.9	0.75			
UR0015-2-012	2x12	2x14.3	0.62			
UR0015-2-015	2x15	2x17.8	0.50			
UR0015-2-018	2x18	2x21.4	0.41			
30 VA UR0030-1-010	10	11.9	3.00	72	32	0.48
UR0030-1-024	24	28.6	1.25			
UR0030-1-030	30	35.7	1.00			
UR0030-2-006	2x6	2x7.2	2.50			
UR0030-2-010	2x10	2x11.9	1.50			
UR0030-2-012	2x12	2x14.7	1.25			
UR0030-2-015	2x15	2x17.8	1.00			
UR0030-2-018	2x18	2x21.4	0.83			
50 VA UR0050-1-024	24	27.8	2.10	82	35	0.67
UR0050-1-035	35	40.6	1.40			
UR0050-1-117	117	135.8	0.43			
UR0050-2-006	2x6	2x6.9	4.10			
UR0050-2-010	2x10	2x11.6	2.50			
UR0050-2-012A	2x12	2x14.4	2.08			
UR0050-2-015	2x15	2x17.4	1.60			
UR0050-2-020	2x20	2x23.2	1.25			
80 VA UR0080-1-015	15	17.4	5.30	95	36	0.92
UR0080-1-024	24	27.8	3.30			
UR0080-1-035	35	40.6	2.30			
UR0080-1-042	42	48.7	1.90			
UR0080-1-117	117	135.8	0.68			
UR0080-2-006	2x6	2x6.9	6.60			
UR0080-2-012	2x12	2x14.4	3.33			
UR0080-2-018	2x18	2x20.9	2.20			
UR0080-2-022	2x22	2x25.5	1.80			
UR0080-2-030	2x30	2x34.8	1.30			
120 VA UR0120-1-024	25	27.2	5.00	95	45	1.2
UR0120-1-042	42	47.5	2.80			
UR0120-1-117	117	132.3	1.00			
UR0120-2-012	2x12	2x13.9	5.00			
UR0120-2-018	2x18	2x20.4	3.30			
UR0120-2-022	2x22	2x24.9	2.70			
UR0120-2-030	2x30	2x34.5	2.00			
160 VA UR0160-1-024	24	27.3	6.70	115	40	1.5
UR0160-1-042	42	47.8	3.80			
UR0160-1-054	54	61.6	2.90			
UR0160-1-117	117	133.3	1.37			
UR0160-2-012	2x12	2x14.1	6.67			
UR0160-2-018	2x18	2x20.5	4.40			
UR0160-2-022	2x22	2x25.1	3.60			
UR0160-2-030	2x30	2x34.2	2.60			
225 VA UR0225-1-024	24	27.0	9.40	115	48	1.9
UR0225-1-060	60	67.2	3.70			
UR0225-1-117	117	131.0	1.90			
UR0225-2-012	2x12	2x13.8	9.38			
UR0225-2-030	2x30	2x33.7	3.70			
300 VA UR0300-1-024	24	26.2	12.50	115	58	2.5
UR0300-1-060	60	65.8	5.00			
UR0300-1-117	117	128.0	2.60			
UR0300-2-012	2x12	2x13.4	12.50			
UR0300-2-030	2x30	2x32.9	5.00			
500 VA UR0500-1-117	117	126.5	4.30	140	60	3.6
UR0500-2-024	2x24	2x25.9	10.40			
UR0500-2-030	2x30	2x32.4	8.30			
UR0500-2-060	2x60	2x65.2	4.20			
625 VA UR0625-1-117	117	127.0	5.30	160	48	4.4
UR0625-2-024	2x24	2x26.0	13.00			
UR0625-2-030	2x30	2x32.7	10.40			
UR0625-2-060	2x60	2x65.0	5.20			
800 VA UR0800-1-117	117	125.2	6.80	160	60	5.6
UR0800-2-024	2x24	2x25.5	16.70			
UR0800-2-028	2x28	2x29.4	14.29			
UR0800-2-030	2x30	2x32.2	13.30			
UR0800-2-060	2x60	2x64.0	6.70			
1000 VA UR1000-1-117	117	123.4	8.50	160	72	6.7
UR1000-2-024	2x24	2x25.6	20.80			
UR1000-2-030	2x30	2x31.4	16.70			
UR1000-2-060	2x60	2x63.4	8.30			

CENTERING WASHER mm

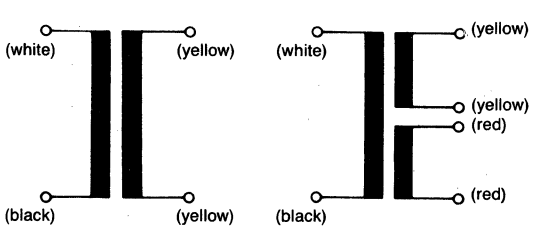
Power	A	B	C	Mtg. Torque IN-LB
15	4	5	50	3.5
30-50	4	6.7	60	7
80-120	6	6.7	70	10
160-300	6	6.7	90	15
500-625	6	6.7	112	15
500-1000	10	13	145	18

PRIMARY DATA

Secondary Power	Primary Current with Load	Primary No Load Current	Primary Resistance T = 20° C	No Load Core Loss
VA	A	mA	Ohm	W
15	0.15	1.8	43	0.21
30	0.31	2.3	23	0.27
50	0.49	3.8	11	0.44
80	0.79	4.4	7.4	0.52
120	1.2	6.6	4.5	0.78
160	1.6	7.2	3.1	0.85
225	2.1	10.9	1.9	1.3
300	2.8	14.4	1.4	1.7
500	4.6	21.5	0.5	2.5
625	5.8	24.8	0.4	2.9
800	7.3	33.3	0.3	3.9
1000	9.0	41.3	0.2	4.8

CONNECTION WIRES

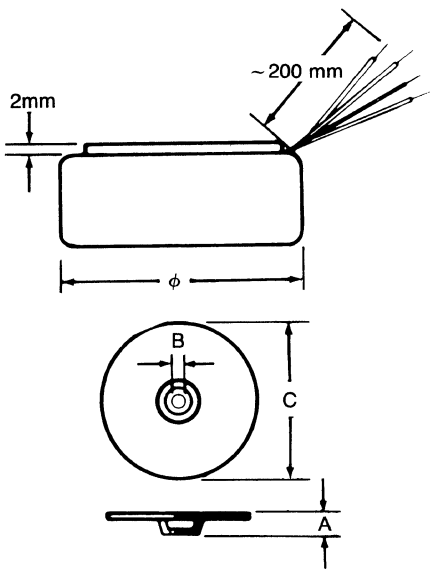
Standard length: 200 mm
(secondaries can be connected in series or parallel).



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TOROIDAL COMPONENTS TECHNICAL INFORMATION

UL RECOGNIZED 117/234 VOLT, 50/60 Hz STANDARDS



PART NUMBER	SECONDARY DATA			Dimensions and weight with Centering Washers		
	FULL LOAD VOLTAGE	NO LOAD VOLTAGE	CURRENT EACH SEC	Omm	HTmm	WTkg
30 VA						
UR2030-2-015	2 x 15	2 x 18.6	1.00	72	32	0.48
UR2030-2-018	2 x 18	2 x 21.6	0.84			
UR2030-2-117	2 x 117	2 x 145.6	0.13			
50VA						
UR2050-2-015	2 x 15	2 x 17.5	1.70	82	35	0.67
UR2050-2-018	2 x 18	2 x 20.6	1.40			
UR2050-2-117	2 x 117	2 x 133.8	0.21			
80VA						
UR2080-2-015	2 x 15	2 x 17.3	2.70	95	36	0.92
UR2080-2-018	2 x 18	2 x 20.9	2.30			
UR2080-2-117	2 x 117	2 x 134.8	0.34			
120VA						
UR2120-2-012	2 x 12	2 x 13.5	5.00	95	45	1.20
UR2120-2-015	2 x 15	2 x 16.9	4.00			
UR2120-2-018	2 x 18	2 x 20.3	3.30			
UR2120-2-117	2 x 117	2 x 132.1	0.51			
160VA						
UR2160-2-012	2 x 12	2 x 13.6	6.70	115	40	1.50
UR2160-2-015	2 x 15	2 x 17.0	5.40			
UR2160-2-018	2 x 18	2 x 20.1	4.50			
UR2160-2-117	2 x 117	2 x 131.5	0.70			
225VA						
UR2225-2-012	2 x 12	2 x 13.1	9.40	115	48	1.90
UR2225-2-015	2 x 15	2 x 16.8	7.50			
UR2225-2-018	2 x 18	2 x 20.0	6.30			
UR2225-2-117	2 x 117	2 x 127.7	1.00			
300VA						
UR2300-2-012	2 x 12	2 x 13.2	12.50	115	58	2.50
UR2300-2-015	2 x 15	2 x 16.4	10.00			
UR2300-2-018	2 x 18	2 x 19.5	8.30			
UR2300-2-117	2 x 117	2 x 127.5	1.30			

CENTERING WASHER mm

Power	A	B	C	Mtg. Torque IN-LB
15	4	5	50	3.5
30-50	4	6.7	60	7
80-120	6	6.7	70	10
160-300	6	6.7	90	15
500-625	6	6.7	112	15
500-1000	10	13	145	18

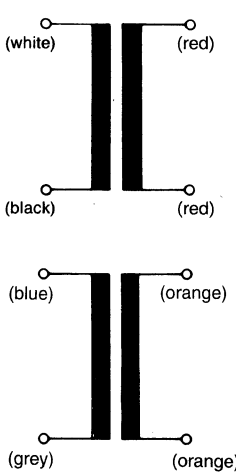
ORDERING INFORMATION

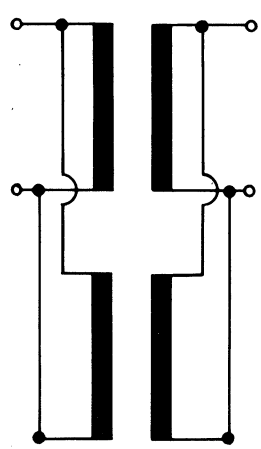
Orders for standard transformers must include the following information:

1. Transformer part number
2. Quantity per item
3. Delivery address
4. Billing address (if different from above)
5. Date of delivery
6. Method of shipment

CONNECTION WIRES

Standard length: 200 min (primaries or secondaries can be connected in series or parallel).





TALEMA ELECTRONIC INC.
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STANDARD TOROIDAL TRANSFORMER, PC MOUNT, LOW PROFILE, PRIMARY 2×110V or 220V 50/60 Hz

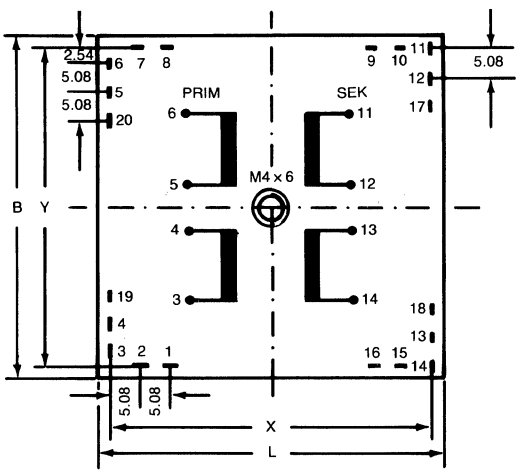
ADVANTAGES: Lower strayfield, higher efficiency, reduced "standby" current, reduced weight.

Standard Outputs

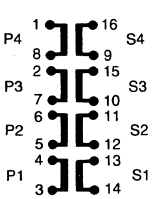
Power VA	Dimensions L×D×H mm	Pin Pattern XY mm	Pin Pattern mm	Weight Total gr	Weight Cu gr	Reg. ΔV/Sec %	Δt °C	Eff. %	No. Load IOtyp mA	220V Fuse mA	Max. Secondary Range VA	Max. Secondary Range ΔV/Sec %	Max. Secondary Range Δt °C	Max. Secondary Range Eff. %	Max. Secondary Range Rec. fuse mA
1.6	39.6×39.6×18.5	35.58	1.0×0.5	82	20	33	13	73	1.0	32	2.0	60	30	60	32
3.2	44.7×44.7×19.5	40.64	1.0×0.5	110	26	44	24	69	1.5	32	3.7	80	40	50	50
5.0	49.7×49.7×19.5	45.72	1.0×0.5	144	33	47	29	67	2.0	50	5.5	80	40	50	63
7.0	49.7×49.7×23.1	45.72	1.0×0.5	174	36	35	29	72	3.0	63	7.5	70	40	60	80
10.0	55.0×55.0×26.0	50.80	1.0×0.5	252	45	22	27	79	3.0	80	12.0	60	45	60	100
15.0	60.0×60.0×26.3	55.88	1.0×0.5	304	57	24	30	77	4.0	100	16.0	60	40	65	125
25.0	60.0×60.0×37.0	55.88	1.0×0.5	430	85	19	28	82	5.0	160	—	—	—	—	—

Order Number	Talema P/N	Sec-Full Load V	Current mA	Open Circuit V	Regulation %	Efficiency %
	1.6 VA					
70000	1.6-2-007	2× 7	114	2× 9.3	33	73
70001	1.6-2-009	2× 9	89	2×12.0	33	73
70002	1.6-2-012	2×12	67	2×16.0	33	73
70003	1.6-2-015	2×15	53	2×20.0	33	73
70004	1.6-2-018	2×18	44	2×23.9	33	73
70005	1.6-2-022	2×22	36	2×29.3	33	73
	3.2 VA					
70010	3.2-2-007	2× 7	229	2×10.1	44	69
70011	3.2-2-009	2× 9	178	2×13.0	44	69
70012	3.2-2-012	2×12	133	2×17.3	44	69
70013	3.2-2-015	2×15	107	2×21.6	44	69
70014	3.2-2-018	2×18	89	2×25.9	44	69
70015	3.2-2-022	2×22	73	2×31.7	44	69
	5 VA					
70020	005-2-007	2× 7	357	2×10.3	47	67
70021	005-2-009	2× 9	278	2×13.2	47	67
70022	005-2-012	2×12	208	2×17.6	47	67
70023	005-2-015	2×15	167	2×22.1	47	67
70024	005-2-018	2×18	139	2×26.5	47	67
70025	005-2-022	2×22	114	2×32.3	47	67
	7 VA					
70030	007-2-007	2× 7	500	2× 9.5	35	72
70031	007-2-009	2× 9	389	2×12.5	35	72
70032	007-2-012	2×12	292	2×16.2	35	72
70033	007-2-015	2×15	233	2×20.3	35	72
70034	007-2-018	2×18	194	2×24.3	35	72
70035	007-2-022	2×22	159	2×29.7	35	72
	10 VA					
70040	010-2-007	2× 7	714	2× 8.5	22	79
70041	010-2-009	2× 9	556	2×11.0	22	79
70042	010-2-012	2×12	417	2×14.6	22	79
70043	010-2-015	2×15	333	2×18.3	22	79
70044	010-2-018	2×18	278	2×22.0	22	79
70045	010-2-022	2×22	227	2×26.8	22	79
	15 VA					
70050	015-2-007	2× 7	1071	2× 8.7	24	77
70051	015-2-009	2× 9	833	2×11.2	24	77
70052	015-2-012	2×12	625	2×14.9	24	77
70053	015-2-015	2×15	500	2×18.6	24	77
70054	015-2-018	2×18	417	2×22.3	24	77
70055	015-2-022	2×22	341	2×27.3	24	77
	25 VA					
70060	025-2-007	2× 7	1785	2× 8.3	19	82
70061	025-2-009	2× 9	1377	2×10.7	19	82
70062	025-2-012	2×12	1041	2×14.3	19	82
70063	025-2-015	2×15	832	2×17.8	19	82
70064	025-2-018	2×18	694	2×21.4	19	82
70065	025-2-022	2×22	568	2×26.2	19	82

Primary-secondary test voltage 4.0 KV (VDE 0550).
Primaries and secondaries for parallel or series hookup.
Ambient operating temperature +60°C maximum.
Insulation Class A (105°C)



Pin No. 19 and 20 only in Version 15 and 25VA
Pin No. 17 and 18 only in Version 3, 2 thru 25VA



Schematic for alternate types per customer specifications

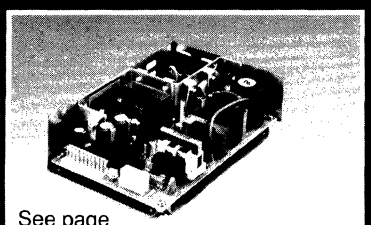
Special Voltages 1.6 VA thru 25 VA

Primary	Pin #	Secondary	Pin #
1. 100-120V	3-4	1. 7-120V	14-13
2. 100-120V	5-6	2. 7-120V	12-11
3. 5- 30V	7-2	3. 7- 42V	10-15
4. 5- 30V	8-1	4. 7- 42V	9-15
5. 220V	3-6		
and other special voltages			

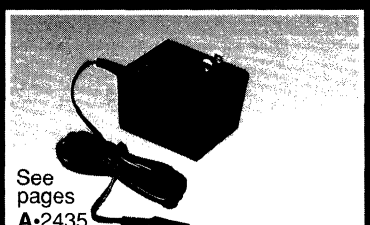
Specifications subject to change.

TAMURA

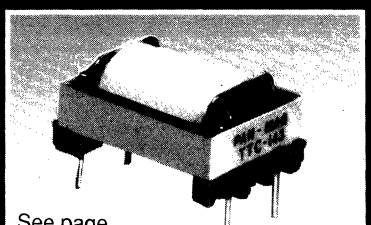
DELIVERS FROM STOCK



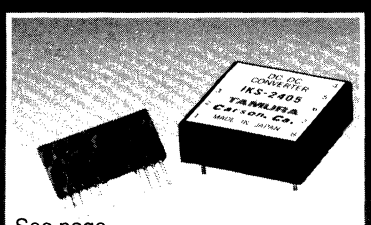
See page D•2062 — **SINGLE AND MULTI–OUTPUT SWITCHERS**



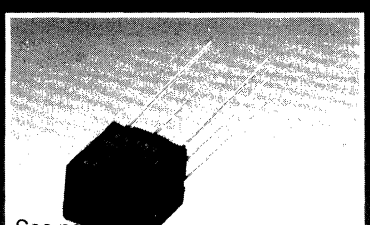
See pages A•2435, D•1495, D•2066 — **WALL PLUG–IN, AC & DC POWER**



See page A•2428 — **FCC PART 68 TELCOM LINE COUPLING**



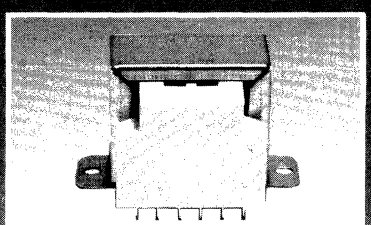
See page D•2059 — **DC/DC CONVERTERS SIP & DIP PKG**



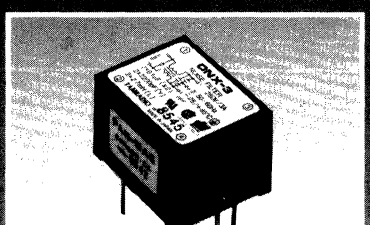
See page A•2430 — **MINIATURE AUDIO & PART 68 COUPLING**



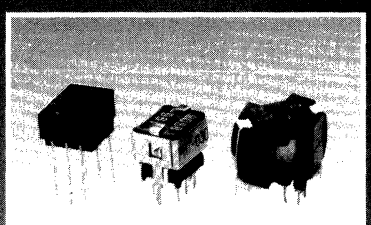
CONTACT FACTORY — **COMPUTER NETWORKING BALUNS**



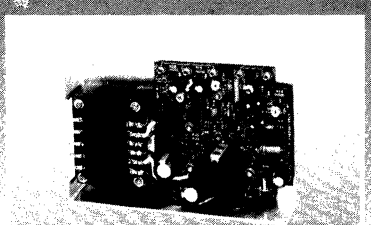
A•2432 — **INT'L PCB POWER– UL 1411, IEC, VDE, & CSA**



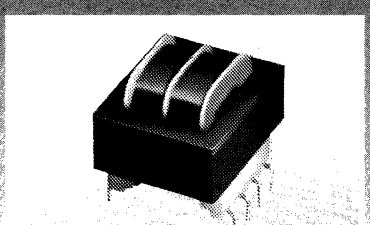
A•1643 — **EMI LINE FILTERS**



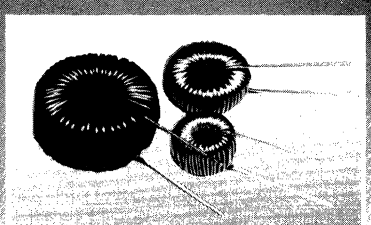
A•2431 — **WIDE BAND PULSE– T1 & DIGITAL**



D•2064 — **LINEAR POWER SUPPLIES**



A•2433 — **UL/CSA PCB POWER**



A•1270 — **NOISE, COMMON MODE & POWER COILS**

The strength of Tamura's AC and DC power conversion families lies in providing consistently dependable products. All Tamura power and magnetic devices are designed and manufactured to deliver lower AQL levels, guaranteeing you the lowest incoming rejection rates you've ever experienced. For example, last year we shipped over **100 million transformers**– most to customers using a **ship–to–stock** acceptance program.

At Tamura, we're already life testing (not just designing) tomorrow's products– today. Over 100 design engineers at our technology center are dedicated to this task, assuring you of having the most up–to–date technology in your products. Today we are already designing the robotics to build these quality products, in high volume and at low cost. Over 150 product support engineers at 16 Tamura factories see to it.

Satisfy your AC and DC requirements for today and tomorrow. Contact Tamura for your specific requirements.

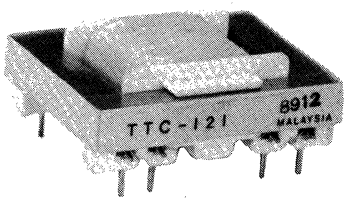
Tamura quality circles the electron world.

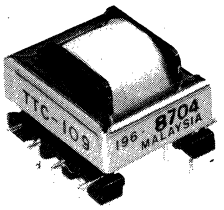
TAMURA CORPORATION OF AMERICA

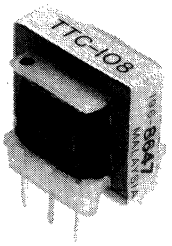
1150 DOMINGUEZ ST. ❑ CARSON, CA 90746-3518 ❑ 213/638-1790 ❑ FAX: 213 6389956

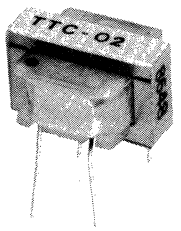
TAMURA TELECOMMUNICATIONS TRANSFORMERS - MEET FCC PART 68

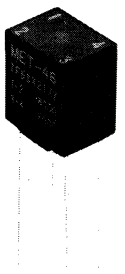
Holding Coils, Miniature Encapsulated and "DRY" (no DC bias) Coupling Transformers

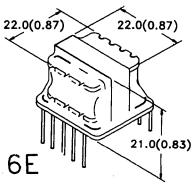




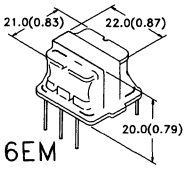




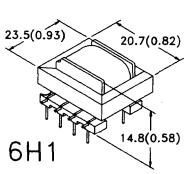




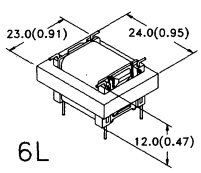
6E



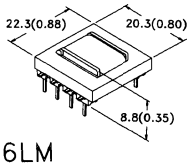
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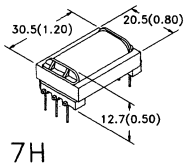
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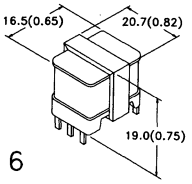
6L



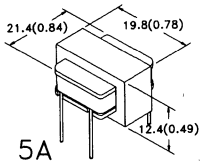
6LM



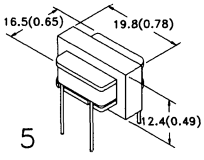
7H



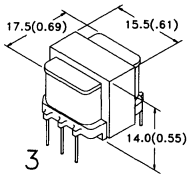
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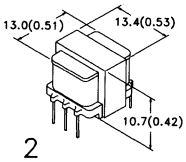
5A



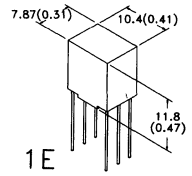
5



3



2



1E

"DRY" TELCOM COUPLING TRANSFORMERS (no DC bias) - FCC PART 68

MODEL No.	FIG No.	IMPEDANCE (Ω) PRI : SEC [1]	maDC UNBAL	IL [2] dB	FR [3] ± dB	CKT DIA	FEATURES (CROSS REF)	PRICE (qty) 1-9	10-24	25-99	100up
TTC-170	2	600:600	0	1.7	0.7	A	0.385" typ. ht.	$6.90	$6.20	$5.50	$4.80
TTC-170-2	2	600:600CT*	0	1.7	0.7	E	Small size	7.30	6.60	5.80	5.10
TTC-135	3	600:S:600	0	1.3	0.3	J	With static shield	7.60	6.80	6.10	5.30
TTC-171-2	3	600:600CT*	0	2.0	1.0	E	0.49" typ. ht.	6.70	6.00	5.40	4.70
TTC-167	3	10k:10k	0	1.4	0.7	A	Bridging transformer	7.60	6.80	6.10	5.30
TTC-02	5	600:600	0	1.2	0.4	A	Low cost	7.30	6.60	5.80	5.10
TTC-118	5	600:600	0	0.8	0.3	A	(Microtran T-1104)	7.40	6.70	5.90	5.20
TTC-03	5	600CT:600CT	0	0.8	0.3	D	(Stancor TTPC-03)	7.80	7.00	6.20	5.50
TTC-04	5	600:900	0	1.0	0.3	A	-	7.30	6.60	5.80	5.10
TTC-05	5	4k:600	0	1.0	0.3	A	Bridging transformer	7.80	7.00	6.20	5.50
TTC-108-1	6	600:600	0	1.2	0.3	A	-	6.00	5.40	4.80	4.20
TTC-110	6	600:600	0	0.8	0.3	A	(Stancor TTPC-07)	8.00	7.20	6.40	5.60
TTC-112	6	600:900	0	0.9	0.2	A	(James 13648)	8.10	7.30	6.50	5.70
TTC-108	6	600CT:600CT	0	1.2	0.3	D	Low cost	6.20	5.60	5.00	4.30
TTC-09	6	600CT:600CT	0	0.8	0.3	D	(Dale TA10-04)	8.30	7.50	6.60	5.80
TTC-13	6	4k:600	0	0.9	0.3	A	(Stancor TTPC-11)	8.10	7.30	6.50	5.70
TTC-263	6L	600:600	0	0.8	0.3	A	(Midcom 671-8000)	5.00	4.50	4.00	3.50
TTC-266	6LM	600:600	0	0.2	0.5	A	.375" typ. ht.	11.50	10.40	9.20	8.00
TTC-266-2	6LM	600:600CT*	0	0.2	0.5	E	-	11.80	10.60	9.40	8.30
TTC-101	8	600:1200CT*	0	0.8*	0.3	E	(Stancor TTPC-09)	12.60	11.30	10.10	8.80
TTC-168	8	600:600/600	0	0.6*	0.1	E	(Midcom 671-0256)	16.50	14.90	13.20	11.50

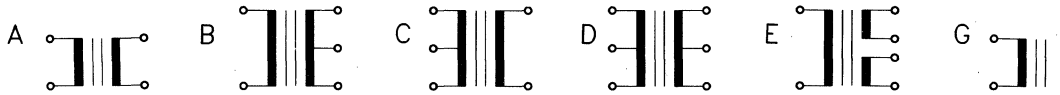
ENCAPSULATED TELCOM COUPLING TRANSFORMERS FOR MINATURE CIRCUITS & SEVERE ENVIRONMENTS [4]

MET-31	1E	600CT:600CT	3	1.5	1.0	D	(Triad SP-67)	13.00	11.70	10.40	9.10
MET-32	1E	600:600CT*	3	1.5	1.2	E	Tested to MIL-T-27	13.00	11.70	10.40	9.10
MET-46	1E	600:600	3	1.5	1.0	A	1500V rms hipot	12.30	11.10	9.80	8.60
MET-49	1E	600:600/600	3	1.6	1.1	E	Single hybrid	13.00	11.70	10.40	9.10
MET-29	1E	900CT:600	3	1.5	1.0	C	-	13.40	12.10	10.70	9.40
METC-99	1E	MU METAL SHIELD	-	-	-	-	EMI slip-on can	2.30	2.10	1.80	1.60
DP-108	6E	600:600CT	5	0.9	0.6	D	-	9.40	8.50	8.00	7.50
DP-101	6E	600CT:600CT	5	0.9	0.5	D	Tested to MIL-T-27	9.40	8.50	8.00	7.50
DP-105	6E	4kCT:600CT	1	1.1	0.6	B	Bridging transformer	9.40	9.40	8.50	7.50
DP-128	6EM	600:S:600CTx2	0	0.8	0.7	M	Electro - static shield	14.40	13.00	12.20	11.50
DP-129	6EM	600CT:S:600CT	0	0.9	0.1	N	Hi-performance	18.90	17.00	16.10	15.10
DP-204	28E	600:600CT	10	0.9	0.5	B	-	12.80	11.50	10.90	10.20
DP-222	28E	600CT*:600CT*	10	0.9	0.5	I	-	12.80	13.30	12.60	11.80
DP-226	28E	600:600CTx2	0	0.9	0.7	I	Single hybrid	15.50	14.00	13.20	12.40
DP-225	28E	4kCT*:S:600CT*	3	0.9	0.6	M	Bridging transformer	14.80	13.30	12.60	11.80

HOLDING COILS FOR TELCOM CIRCUITS

TTC-212	8M	HLDG: 0.275Hy	80	-	-	G	-	9.00	8.10	7.20	6.30
TTC-119 or	9	HLDG: 2.0Hy	60	-	-	H	(Triad TY350P)	11.50	10.40	9.20	8.00
TTC-119	9	HLDG: 1.3Hy	100	-	-	H	(Dale TA12-01)	11.50	10.40	9.20	8.00
TTC-120	11H1	HLDG: 1.4Hy	120	-	-	G	(Midcom 671-4031)	16.40	14.80	13.10	11.50

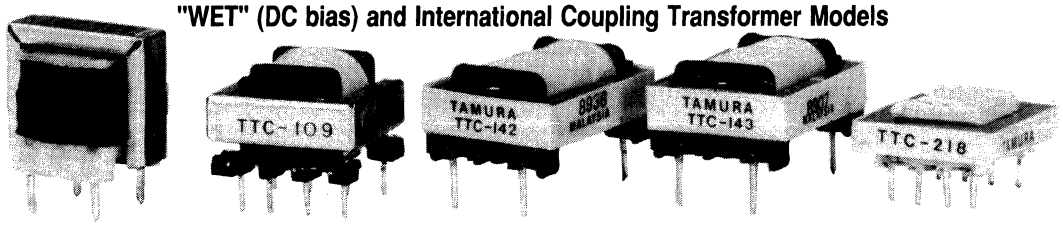
Note 1: CT* indicates winding can be connected as a centertapped winding or as two isolated windings.
Note 2: Typical insertion loss (iL) in dB @ rated unbalanced maDC, 0dBm & 1kHz. (*) add 3dB to IL for single hybrid use with balancing netwrok on 2-wire side.
Note 3: Typical frequency response (FR) from 0.3 to 3.5kHz, relative to 1kHz at rated maDC & 0dBm.
Note 4: Designed and tested to MIL-T-27 specifications.



CONTACT TAMURA for ORDERING, STOCK, OEM PRICING, DETAILED DATA SHEETS or YOUR CUSTOM REQUIREMENTS by FAX: 310/638/9956 or CALL: (310) 638-1790

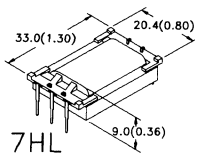
TAMURA TELECOMMUNICATIONS TRANSFORMERS - MEET FCC PART 68

"WET" (DC bias) and International Coupling Transformer Models

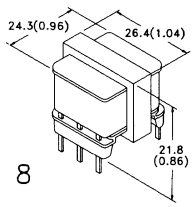


Original "Wet" Telcom

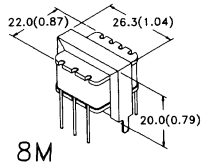
Height Above PC Board	18.3mm	16.0mm	12.7mm	12.7mm	8.9mm



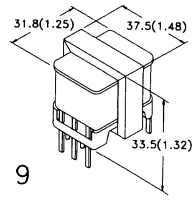
7HL



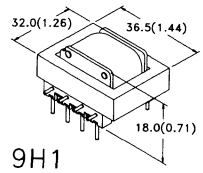
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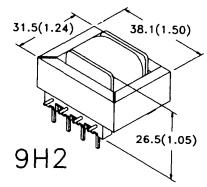
8M



9



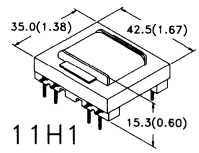
9H1



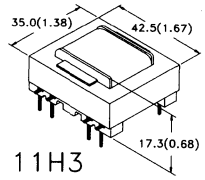
9H2

"WET" TELCOM COUPLING TRANSFORMERS (DC bias) - FCC PART 68

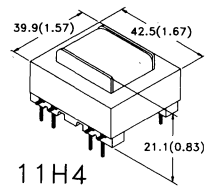
MODEL No.	FIG No.	IMPEDANCE (Ω) PRI : SEC [1]	maDC UNBAL	IL [2] dB	FR [3] ± dB	CKT DIA	FEATURES (CROSS REF)	PRICE (qty) 1-9	10-24	25-99	100up
TTC-258	5A	600:600	80	1.7	2.1	A	490" max. ht.	$10.90	$9.80	$8.70	$7.60
TTC-258-2	5A	600:600CT*	80	1.7	2.1	E	-	11.40	10.30	9.10	8.00
TTC-105	6	600:600	90	2.0	3.0	A	Low cost	6.10	5.50	4.90	4.30
TTC-105-1	6	600:600CT	90	2.0	3.0	B	(Stancor TTPC-06)	6.20	5.60	5.00	4.30
TTC-109	6H1	600:600	90	2.0	3.0	A	-	6.70	6.00	5.40	4.70
TTC-204	6H1	600:600	100	2.5	0.7	A	(Midcon 671-1046)	6.70	6.00	5.40	4.70
TTC-109-1	6H1	600:600CT	90	2.0	3.0	C	-	6.70	6.00	5.40	4.70
TTC-109-2	6H1	600:600CT*	90	2.0	3.0	E	(Stancor TTPC-13)	6.80	6.10	5.40	4.80
TTC-264	6L	600:600	100	2.3	2.1	A	(Mlidcon 671-8001)	5.00	4.50	4.00	3.50
TTC-265	6L	600:600	100	1.9	1.9	A	(Midcon 671-8005)	5.90	5.30	4.70	4.10
TTC-218	6LM	600:600	50	1.5	1.3	A	0.35" max. ht.	11.50	10.40	9.20	8.00
TTC-218-2	6LM	600:600CT*	50	1.5	1.3	E	-	11.80	10.60	9.40	8.30
TTC-142	7H	600:600	90	1.8	2.0	A	0.500" max. ht.	8.30	7.50	6.60	5.80
TTC-143	7H	600:600	90	1.6	1.8	A	For hi-speed modem	10.60	9.50	8.50	7.40
TTC-215	7H	600:600	90	1.6	1.8	A	Low cross talk	17.80	16.00	14.20	12.50
TTC-176-2	7H	600:600CT*	50	1.0	1.4	E	-	11.20	10.10	9.00	7.80
TTC-142-2	7H	600:600CT*	90	1.8	2.0	E	-	9.00	8.10	7.20	6.30
TTC-174	7H	600:600/600	50	1.0*	1.4	E	Single hybrid.	11.20	10.10	9.00	7.80
TTC-231	7H	600:1200CT	90	1.5	1.7	B	(Midcon 671-1489)	11.20	10.10	9.00	7.80
TTCC-7H	7H	MU METAL SHIELD	-	-	-	-	EMI slip-on can	5.20	4.70	4.20	3.60
TTC-142-LB	7HL	600:600	90	1.8	2.4	A	.36" max. ht.	8.70	7.80	7.00	6.10
TTC-143-LB	7HL	600:600	90	1.6	2.2	A	For hi-speed modem	10.90	9.80	8.70	7.60
TTC-142-2LB	7HL	600:600CT*	90	1.8	2.4	E	-	9.40	8.50	7.50	6.60
TTC-211	8M	600:600	90	1.2	1.5	A	Low cost	9.00	8.10	7.20	6.30
TTC-211-2	8M	600:600CT*	90	1.2	1.5	E	-	9.80	8.80	7.80	6.90
TTC-130	9H1	600:600	90	1.8	0.3	A	For hi-speed modem	12.00	10.80	9.60	8.40
TTC-130-2	9H1	600CT*600CT*	90	1.8	0.3	E	-	12.30	11.10	9.80	8.60
TTC-126-2	9H2	600:600	90	0.8	0.6	A	-	14.00	12.60	11.20	9.80
TTC-126	9H2	600CT*:600CT*	90	0.8*	0.6	I	-	14.10	12.70	11.30	9.90
TTC-126-3	9H2	600:600/600	50	0.8	0.3	E	Hi-perform hybrid	14.10	12.70	11.30	9.90
TTC-122	11H1	600:600	80	0.9	0.5	A	(Stancor TTPC-15)	16.80	15.10	13.40	11.80
TTC-121	11H1	600:600CT*	80	0.9	0.5	E	(Stancor TTPC-14)	17.20	15.50	13.80	12.00
TTC-123	11H1	900:600	80	0.9	0.6	A	(Prem SPT-111)	16.90	15.20	13.50	11.80
TTC-125	25H2	600CT*:600CT*	80	1.8	0.3	I	(Stancor TTPC-19)	21.90	19.70	17.50	15.30
TTC-124	25H2	600CT*:600CT	80	1.3	0.4	K	(Stancor TTPC-18)	22.40	20.20	17.90	15.70
TTC-129	25H2	600CT*:600/600	90	1.5*	0.4	L	-	22.50	20.30	18.00	15.70



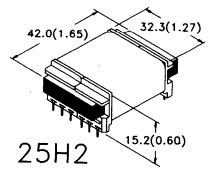
11H1



11H3



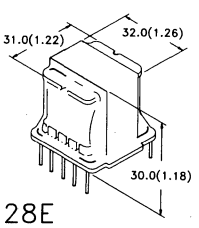
11H4



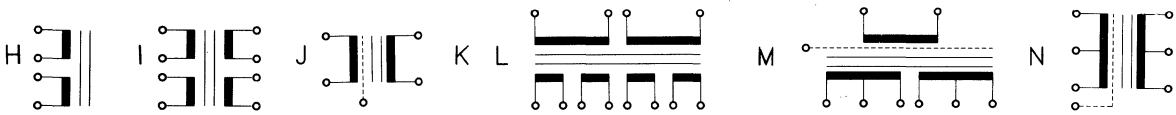
25H2

INTERNATIONAL TELCOM COUPLING TRANSFORMERS - (EUROPE, UK, AUSTRALIA)

TTC-158	7H	600:600	0	1.1	0.3	A	BSI telcom	17.80	16.00	14.20	12.50
TTC-243	7H	600:S:600	0	1.5	0.5	J	3750VAC hi-pot	20.50	18.50	16.40	14.30
TTC-238	7H	600:600	0	1.4	0.4	A	BABT telcom	18.80	16.90	15.00	13.20
TTC-238-1	7H	600CT:600CT	0	1.4	0.8	D	-	19.80	17.80	15.80	13.90
TTC-158-1	7H	600CT:600CT	0	1.1	0.3	D	3750VAC hi-pot	18.50	16.70	14.80	12.90
TTC-198	8M	600:600CT	0	1.2	0.3	B	Australia telcom	12.30	11.10	9.80	8.60
TTC-164	9H1	600:S:600	0	0.9	0.2	J	Europe bi-directional	14.90	13.40	11.90	10.40
TTC-221	7H	600:600	80	1.3	1.9	A	3750VAC hi-pot	18.50	16.70	14.80	12.90
TTC-131	9H1	600:S:600	90	1.8	0.3	J	BSI telcom	14.90	13.40	11.90	10.40
TTC-160	11H3	600:S:600	120	1.3	0.5	A	(PREM SPT-185)	24.20	21.80	19.40	16.90
TTC-199	11H4	600:600	70	1.2	0.5	A	(PREM SPT-186)	21.50	19.40	17.20	15.00



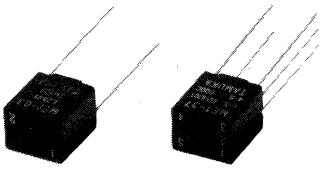
28E



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TAMURA MINIATURE ENCAPSULATED TRANSFORMERS AND INDUCTORS

Input, Interface, Isolation & Output Impedance Matching Circuits



FEATURES

- FCC Part 68 (hi-pot 1.5kV or 1kV).
- Miniature: 0.31"x0.41"x0.465".
- Tested to MIL-T-27 Specifications.
- Dielectric Strength: 1kVrms.
- Insulation Resistance: 10kMΩ.
- Oper. Temp: ≤105°C.
- Thermal Shock: 5 cyc, -55≈105°C.
- Freq. Response: ±2dB, .3≈100kHz.
- Max. Distort: 10-25% @ rated pwr.
- Impedance: 3.2 to 200kΩ.
- Solder/Gold Plated Nickel Leads.
- Molded Case Constr/Base Mtg Pad.

MINIATURE ENCAPSULATED TRANSFORMERS:

MODEL No.	MATCHING Z PRI:SEC [4]	PRI [2] maDC	DCR (Ω)		PWR [3] (mW)	TURN RATIO		FIG No.	PRICE (qty)			
			PRI	SEC		PRI	SEC		1-9	10-24	25-99	100up
MET-01	200kCT:1000CT	0.00	5300	120	10	14.10	1	1	$15.40	$13.90	$12.30	$10.80
MET-02	100kCT:1000CT	0.00	4300	120	10	10.00	1	1	15.40	13.90	12.30	10.80
MET-03	50kCT: 1000CT	0.00	3800	90	25	7.07	1	1	15.40	13.90	12.30	10.80
MET-04	50k:1kCT*	0.00	3800	90	25	14.10	1/1	2	15.40	13.90	12.30	10.80
MET-05	25kCT:1000CT	0.50	1600	95	30	5.00	1	1	15.10	13.60	12.10	10.60
MET-06	25K:1kCT*	0.25	1600	95	30	10.00	1/1	2	15.10	13.60	12.10	10.60
MET-07	25kCT:600CT	0.50	1600	95	30	6.45	1	1	15.10	13.60	12.10	10.60
MET-09	10kCT:10kCT	1.00	1000	1300	40	1.00	1	1	15.10	13.60	12.10	10.60
MET-10	10kCT:4000CT	1.00	1000	500	40	1.58	1	1	15.10	13.60	12.10	10.60
MET-11	10kCT:2000CT	1.00	1000	300	40	2.23	1	1	15.10	13.60	12.10	10.60
MET-12	10K:2kCT*	0.50	1000	300	40	4.47	1/1	2	15.10	13.60	12.10	10.60
MET-13	10kCT:1500CT	1.00	1000	260	40	2.58	1	1	15.10	13.60	12.10	10.60
MET-15	10k:1.2kCT*	0.50	1000	220	40	5.77	1/1	2	15.10	13.60	12.10	10.60
MET-17	10kCT:500CT	1.00	1000	80	40	4.47	1	1	15.10	13.60	12.10	10.60
MET-18	10kCT:4.0	1.00	1200	1	40	50.00	1	3	12.30	11.10	9.80	8.60
MET-19	10k:3.2	0.50	1200	0.8	40	55.90	1	4	12.30	11.10	9.80	8.60
MET-20	8000CT:3.2	1.00	1000	0.8	40	50.00	1	3	12.30	11.10	9.80	8.60
MET-21	5000CT:2000CT	1.00	490	300	40	1.58	1	1	14.30	12.90	11.40	10.00
MET-22	2500CT:2500CT	1.00	280	350	40	1.00	1	1	14.30	12.90	11.40	10.00
MET-23	1600CT:3.2	2.50	186	0.8	50	22.30	1	3	12.30	11.10	9.80	8.60
MET-24	1500CT:600	3.00	160	95	50	1.58	1	3	12.30	11.10	9.80	8.60
MET-25	1200CT:3.2	3.00	125	0.7	50	19.40	1	3	12.30	11.10	9.80	8.60
MET-26	1000CT:1000CT	3.00	80	100	50	1.00	1	1	13.40	12.10	10.70	9.40
MET-27	1000CT:600CT	3.00	85	95	50	1.29	1	1	13.40	12.10	10.70	9.40
MET-28	1000:50	3.00	110	8	50	4.47	1	4	12.30	11.10	9.80	8.60
MET-29 [1]	900CT:600	3.00	80	95	50	1.22	1	3	13.40	12.10	10.70	9.40
MET-31 [1]	600CT:600CT	3.00	70	95	50	1.00	1	1	13.00	11.70	10.40	9.10
MET-32 [1]	600:600CT*	3.00	70	95	50	2.00	1/1	2	13.00	11.70	10.40	9.10
MET-33	600CT:250CT	3.00	70	35	50	1.55	1	1	13.00	11.70	10.40	9.10
MET-35	600CT:8	4.50	60	1.5	50	8.66	1	3	11.90	10.70	9.50	8.30
MET-36	600CT:3.2	4.50	60	0.7	50	13.70	1	3	11.90	10.70	9.50	8.30
MET-37	500CT:600	3.00	65	95	50	0.91	1	3	11.90	10.70	9.50	8.30
MET-39	500:50	3.00	55	8	50	3.16	1	4	11.90	10.70	9.50	8.30
MET-40	320CT:3.2	6.00	35	0.7	50	10.00	1	3	11.90	10.70	9.50	8.30
MET-41	300CT:600	7.00	41	98	50	0.71	1	3	11.90	10.70	9.50	8.30
MET-42	150:12	10.00	20	2.5	50	3.54	1	4	11.90	10.70	9.50	8.30
MET-43	120CT:3.2	10.00	13	0.7	50	6.12	1	3	11.90	10.70	9.50	8.30
MET-44	300CT:12	7.00	42	3.4	50	5.00	1	3	11.90	10.70	9.50	8.30
MET-45	10k:10kCT*	1.00	1100	1300	50	2.00	1/1	2	15.10	13.60	12.10	10.60
MET-46 [1]	600:600	3.00	72	93	50	1.00	1	4	12.30	11.10	9.80	8.60
MET-49 [1]	600:600/600	3.00	72	210	50	1.41	1/1	2	13.00	11.70	10.40	9.10
MET-50	10k:125	0.00	1100	28	10	8.62	1	4	22.30	20.10	17.80	15.60
MET-59 [1]	600:600CT*	3.00	70	95	50	2.00	1/1	2A	13.00	11.70	10.40	9.10
MET60	135:135CT	10.00	10	10	50	1.00	1	1	12.30	11.10	9.80	8.60
METC-99	MU METAL SHIELD	-	-	-	-	-	-	1	2.30	2.10	1.80	1.60

Note 1: Meets FCC part 68 (Hi-pot 1.5kV or 1.0kV).
Note 2: PRI maDC - Primary maximum rated unbalanced current in milli-amps, DC.
Note 3: PWR (mW) - Maximum power level in milli-watts @ 300Hz.
Note 4: CT* - Winding can be connected as a centertapped winding or as two isolated windings.

MINIATURE ENCAPSULATED INDUCTORS:

MODEL No.	INDUCTANCE H (min) @ 300Hz	Q (min) @ 1V 1kHz	DCR (Ω)	DC (ma)	FIG No.	PRICE (qty)			
						1-9	10-24	25-99	100up
MEI-01	6 @ 15V	5.0	1800	2.0	5	$12.30	$11.10	$9.80	$8.60
MEI-02	3.5 @ 15V	4.0	1200	2.0	5	11.90	10.70	9.50	8.30
MEI-03	1.25 @ 3V	3.5	180	2.0	5	11.40	10.30	9.10	8.00
MEI-04	0.3 @ 3V	3.0	40	4.0	5	11.30	10.20	9.00	7.90
MEI-05	0.1 @ 3V	2.0	15	5.0	5	11.30	10.20	9.00	7.90

MET & MEI SCHEMATIC & CONNECTION DIAGRAMS

FIG. 1

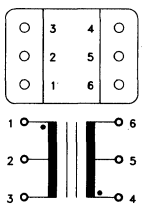


FIG. 2

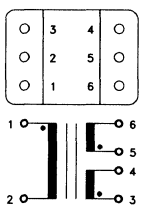


FIG. 2A

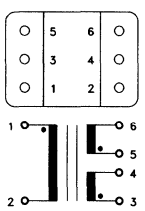


FIG. 3

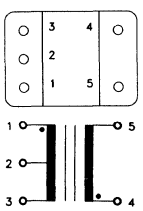


FIG. 4

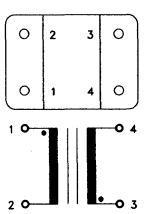
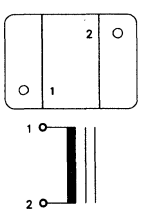
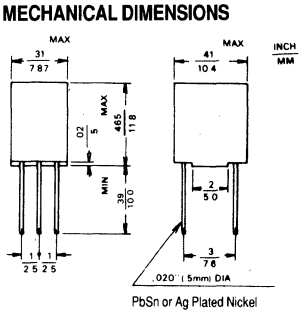


FIG. 5



MECHANICAL DIMENSIONS

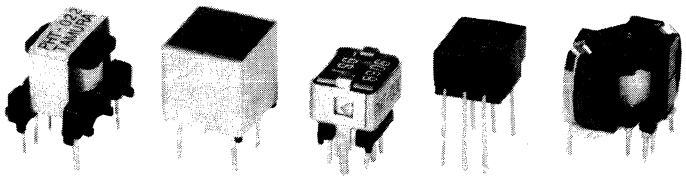


PbSn or Ag Plated Nickel

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TAMURA WIDE BAND and PULSE TRANSFORMERS

For Isolation, Data Interface and ISDN Applications



ENCAPSULATED PULSE TRANSFORMERS FOR ISOLATION & DATA INTERFACE

MODEL No.	FIG No.	PRIM [1] OCL mH	TURNS RATIO	PRI [2] C pF	SEC [3] L µH	DCR (Ω)	CKT DIA	FEATURES (CROSS REF)	PRICE (qty) 1-9	10-24	25-99	100up
PHT-029	3	1.70mH	1:0.83	87	3.9	0.27:0.12	A	-	$4.30	$3.90	$3.70	$3.00
PHT-023	RM5	2.40mH	1:0.65	25	2.0	0.45:0.13	C	(AIE 315-0719)	8.60	7.70	7.30	6.00
G511 [4]	G5	2.00mH	1:1	25	8.0	1:1	A	2kV rms hipot for LAN	6.00	5.40	5.10	4.20
PHT-022	2F	0.50mH	1:1	26	1.7	1.3:1.4	A	Low cost	4.50	4.10	3.80	3.10
G516	G5	0.50mH	1:1:3	32	0.7	1.35:1.35	A	-	3.70	3.30	3.10	2.60
PHT-031	EP10	10.00mH	1:4	15	350.0	7.3:24	A	2.5kV rms hipot	7.80	7.00	6.60	5.50
G510	G5	0.05mH	1CT:1CT	18	0.5	1.3:1.3	D	(Valor TT1500)	3.70	3.30	3.10	2.60
G509	G5	0.50mH	1CT:1CT	32	0.4	1.3:1.3	D	-	3.80	3.40	3.20	2.70
G508	G5	2.00mH	1CT:1CT	37	0.8	2.5:2.5	D	(Pulse PE-8270)	4.30	3.90	3.70	3.00
PHT-032	2F	7.00mH	1CT:1CT	30	19.0	2.4:2.8	D	(AIE 315-0729)	4.80	4.30	4.10	3.40
G517	G5	1.00mH	1CT:1.41CT	32	1.5	1.5:1.5	D	(Technitrol T1553-20)	3.80	3.40	3.20	2.70
PHT-030	EP7	9.00mH	1CT:2	12	15.0	1.6:3.8	C	-	10.80	9.70	9.20	7.60
G515	G5	0.20mH	2CT:1CT	8	0.8	0.9:0.5	D	-	3.70	3.30	3.10	2.60
G512	G5	2.00mH	2CT:1	19	1.8	2.5:1.4	C	(Pulse PE-8276)	4.30	3.90	3.70	3.00
G504	G5	0.05mH	1:1:1	18	0.5	1.3:1.3:1.3	E	(Valor CT1500)	3.70	3.30	3.10	2.60
G503	G5	0.20mH	1:1:1	18	0.3	0.9:0.9:0.9	E	-	3.70	3.30	3.10	2.60
G52E111 [5]	G5	0.25mH	1:1:1	16	0.5	1.1:1.1:1.1	E	(Datatronic 4258-0004)	4.50	4.10	3.80	3.10
G502	G5	0.50mH	1:1:1	32	0.4	1.3:1.3:1.3	E	(Pulse PE-5762)	3.80	3.40	3.20	2.70
PHT-029-3	3	1.00mH	1:1:1	130	1.0	0.75:0.75:0.75	E	-	4.50	4.10	3.80	3.10
G513	G5	1.20mH	1:1:1	25	0.5	0.7:0.7:0.7	E	-	4.30	3.90	3.70	3.00
G514	G5	1.20mH	1:1:1	30	0.7	0.7:0.7:0.7	E	-	3.80	3.40	3.20	2.70
G501	G5	2.00mH	1:1:1	37	0.8	2.5:2.5:2.5	E	-	4.30	3.90	3.70	3.00
G53E111P [5]	G5	2.50mH	1:1:1	35	0.8	2.4:2.4:2.4	E	(Datatronic 4258-0007)	5.10	4.60	4.30	3.60
PHT-034	2F	2.50mH	1:1:1	30	5.0	2:2:2	E	(Pulse PE-2229X)	4.90	4.40	4.20	3.40
G500	G5	5.00mH	1:1:1	60	1.3	3.9:3.9:3.9	E	0.25" ht.	4.70	4.20	4.00	3.30
G52J111P [5]	G5	0.80mH	1:1:1	20	0.4	1.4:1.4:1.4	E	-	4.60	4.10	3.90	3.20
G74B111 [5]	G7	12.50mH	1:1:1	127	3.0	8.9:8.9:8.9	E	(Datatronic 4259-0004)	7.80	7.00	6.60	5.50
PHT-068	EP13	35.00mH	1CT:1CT:1CT	20	50.0	3.5:6:5.5	T	-	6.60	5.90	5.60	4.60
G52E211 [5]	G5	0.25mH	2:1:1	10	2.5	1.0:0.7:0.7	E	(Technitrol 21HHA)	4.50	4.10	3.80	3.10
G507	G5	0.50mh	2:1:1	11	1.1	1.3:0.7:0.7	E	-	4.10	3.70	3.50	2.90
G506	G5	2.00mH	2:1:1	19	1.8	2.5:1.4:1.4	E	-	4.80	4.30	4.10	3.40
G505	G5	5.00mH	2:1:1	33	3.6	3.9:2:2	E	-	5.40	4.90	4.60	3.80
PHT-015	2F	0.60mH	4:1:4	12	19.0	0.6:0.2:0.6	F	1.2kV rms hipot	4.60	4.10	3.90	3.20

DATA BUS INTERFACE TRANSFORMERS: FOR MIL-STD-1553 APPLICATIONS

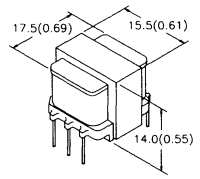
PHT-027 [5]	G5	2.90mH	1CT:1CT	50	2.3	1.25:1.25	D	(Technitrol T1553-21)	17.00	15.30	14.50	11.90
PHT-028 [5]	G5	2.90mH	1CT:1CT	25	2.3	1.25:1.25	D	(Technitrol 12UHD)	23.80	21.40	20.20	16.70
PHT-036 [5]	G5	4.00mH	1CT:1.41CT	24	0.9	1:1.4	D	(Technitrol T1553-22)	6.70	6.60	5.70	4.70

ISDN DATA TRANSFORMERS: MEET CCITT I-430

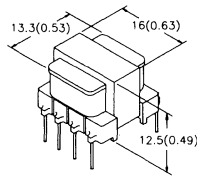
SEP-1	EP13	30.0mH	1CT:2CT	50	13.0	1.1:2.6	D	AMD 79030A	13.90	12.50	11.80	9.70
SEP-2	EP13	30.0mH	1CT:1CT	50	15.0	1.1:1.3	D	Motorola MC145474	13.90	12.50	11.80	9.70
SEP-3	EP13	30.0mH	1CT:2.5CT	50	13.0	1.1:4.2	D	Intel 29C53 Transmit	13.90	12.50	11.80	9.70
SEP-4	EP13	30.0mH	1CT:1.8CT	50	13.0	1.2:2.6	D	Intel 29C53 Receive	13.90	12.50	11.80	9.70
SEP-5	EP13	30.0mH	1CT:2CT	50	10.0	10:20	D	NEC µPD98201 Receive	14.70	13.20	12.50	10.30
SEP-6	EP13	30.0mH	1CT:1CT	50	10.0	2.2:2.2	D	NEC µPD98201 Transmit	14.70	13.20	12.50	10.30
SRM-1	RM5	30.0mH	1CT:2CT	50	15.0	2.2:4.8	D	Mitel MT8930	10.20	9.20	8.70	7.10
SRM-2	RM5	30.0mH	1CT:1CT	50	22.0	2.2:1.5	D	Motorola MC145474	10.20	9.20	8.70	7.10
SRM-3	RM5	30.0mH	1CT:2.5CT	50	15.0	2.2:8.2	D	Intel 29C53 Transmit	10.20	9.20	8.70	7.10
SRM-4	RM5	30.0mH	1CT:1.8CT	50	15.0	2.2:4.2	D	Intel 29C53 Receive	10.20	9.20	8.70	7.10

Note 1: "OCL" is typical primary open circuit inductance (L), in milli-Henry (except PHT-023), as read on an LC meter.
Note 2: "C pF" is primary to secondary interwinding capacitance (C) in pico-Farad.
Note 3: "L µH" is primary winding leakage inductance (L), in micro-Henry, with the secondary(s) shorted.
Note 4: Designed for IEEE-802.3 LAN applications.
Note 5: Designed and tested to MIL-T-27 specifications.

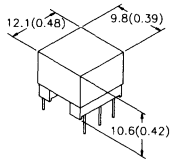
FIGS 3



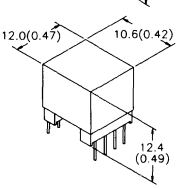
2F



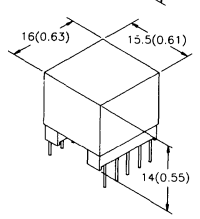
EP7



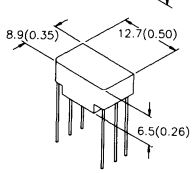
EP10



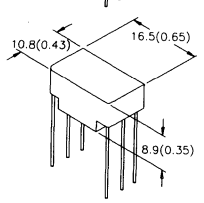
EP13



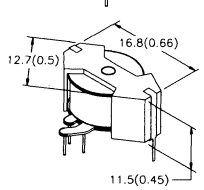
G5



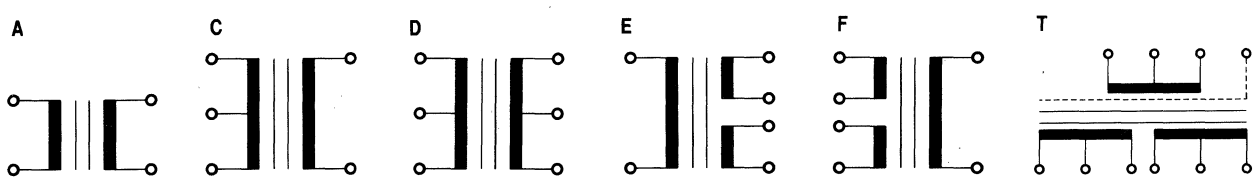
G7



RM5



SCHEMATIC CIRCUIT DIAGRAMS



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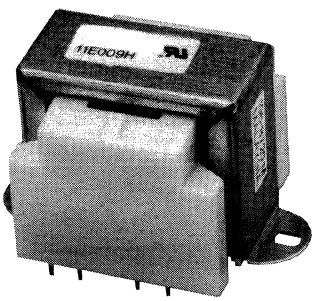
TAMURA INTERNATIONAL SERIES POWER TRANSFORMERS

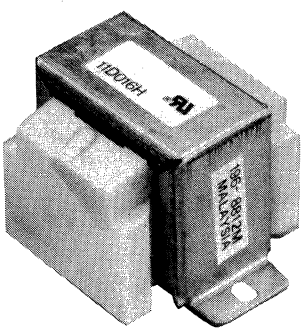
FEATURES

- UL 1411 Recognized - File No. E98949.
- Physical Barriers Between Primary and Secondary.
- Double Protection Sys:4000V Hipot.
- Triple Output Models.
- 5 Sizes - 0.7, 2.0. 5.0, 9.5 & 15VA.
- 115/230V, 50/60 Hz. Primary.

INTERNATIONAL SERIES MODELS & RATINGS

MODEL No.	SECONDARY RATINGS rms[1]		VA	CKT	FIG	PRICE (qty)			
	SERIES	PARALLEL	(max)	No.	No.	1-9	10-24	25-99	100up
10A006[2]	10.0V CT, 0.050A	Single secondary	0.7	1	A	$6.30	$5.70	$5.40	$4.70
10A009[2]	10.0V CT, 0.050A	Single secondary	0.7	2	A	6.70	6.00	5.70	5.00
10B004	10.0V CT, 0.110A	Single secondary	2.0	3	A	7.70	6.90	6.50	5.80
10C009	10.0V CT, 0.350A	Single secondary	5.0	3	B	8.80	7.90	7.50	6.60
11D014H	10.0V CT, 0.950A	5.0V, 1.900A	9.5	4	B	10.00	9.00	8.50	7.50
11E006H	10.0V CT, 1.250A	5.0V, 2.500A	15.0	4	C	12.20	11.00	10.40	9.20
10B005	12.6V CT, 0.090A	Single secondary	2.0	3	A	7.70	6.90	6.50	5.80
10C010	12.6V CT, 0.280A	Single secondary	5.0	3	B	8.80	7.90	7.50	6.60
11D015H	12.6V CT, 0.750A	6.3V, 1.500A	9.5	4	B	10.00	9.00	8.50	7.50
11E007H	12.6V CT, 1.000A	6.3V, 2.000A	15.0	4	C	12.20	11.00	10.40	9.20
10A007[2]	16.0V CT, 0.031A	Single secondary	0.7	1	A	6.30	5.70	5.40	4.70
10A010[2]	16.0V CT, 0.031A	Single secondary	0.7	2	A	6.70	6.00	5.70	5.00
10B006	16.0V CT, 0.070A	Single secondary	2.0	3	A	7.70	6.90	6.50	5.80
10C011	16.0V CT, 0.220A	Single secondary	5.0	3	B	8.80	7.90	7.50	6.60
11D016H	16.0V CT, 0.600A	8.0V, 1.200A	9.5	4	B	10.00	9.00	8.50	7.50
11E008H	16.0V CT, 0.780A	8.0V, 1.560A	15.0	4	C	12.00	11.00	10.40	9.20
10A008[2]	24.0V CT, 0.021A	Single secondary	0.7	1	A	6.30	5.70	5.40	4.70
10A011[2]	24.0V CT, 0.021A	Single secondary	0.7	2	A	6.70	6.00	5.70	5.00
11B001H	24.0V CT, 0.046A	Single secondary	2.0	3	A	7.70	6.90	6.50	5.80
10C012	24.0V CT, 0.150A	Single secondary	5.0	3	B	8.80	7.90	7.50	6.60
11D017H	24.0V CT, 0.400A	12.0V, 0.800A	9.5	4	B	10.00	9.00	8.50	7.50
11E009H	24.0V CT, 0.520A	12.0V, 1.040A	15.0	4	C	12.20	11.00	10.40	9.20
11B002H	36.0V CT, 0.031A	Single secondary	2.0	3	A	7.70	6.90	6.50	5.80
11C005H	36.0V CT, 0.100A	Single secondary	5.0	3	B	8.80	7.90	7.50	6.60
11D018H	36.0V CT, 0.260A	18.0V, 0.520A	9.5	4	B	10.00	9.00	8.50	7.50
11E010H	36.0V CT, 0.350A	18.0V, 0.700A	15.0	4	C	12.20	11.00	10.40	9.20
11D019H	56.0V CT, 0.170A	28.0V, 0.340A	9.5	4	B	10.00	9.00	8.50	7.50
11E011H	56.0V CT, 0.223A	28.0V, 0.446A	15.0	4	C	12.20	11.00	10.40	9.20





Note 1: Individual transformer coil rating is parallel connection voltage & series connection current.
Note 2: Single primary: models 10A006, 7, 8, 115VAC; models 10A009, 10, 11, 230VAC.

THREE (3) OUTPUT TRANSFORMER MODEL & RATINGS Regulated & Unregulated Power Supplies

MODEL No.	SECONDARY 1 AC - rms	SECONDARY 2 AC - rms	DC OUTPUT 1 C.T.F.W.	DC OUTPUT 2 C.T.F.W.	CKT No.	FIG No.	PRICE (qty)			
							1-9	10-24	25-99	100up
11E012H	9V, 800ma	24V, 300ma	+5V, 670ma	±15V, 170ma	5	C	$13.30	$12.00	$11.30	$10.00
11E013H	16V, 550ma	33V, 180ma	+9V[3], 470ma	±21V[3], 120ma	6	C	13.30	12.00	11.30	10.00

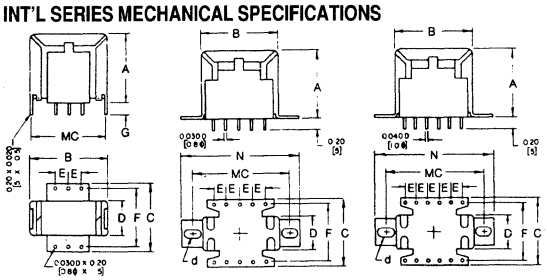
Note 3: ±9VDC and ±21VDC outputs are for input to ±5VDC and ±15VDC IC voltage regulators (ckt 6).

INTERNATIONAL SERIES DIMENSIONS AND WEIGHTS[4]

SERIES PREFIX	A	B	C	MC	D[5]	E	F	G	N	WT
10A	1.10	1.16	1.32	1.12	0.49	0.20	0.98	0.20	N/A	2.47
	(28)	(29.5)	(33.5)	(28.5)	(12.5)	(5)	(25)	(5)		(70)
10B &	1.26	1.44	1.69	1.40	0.61	0.30	1.38	0.24	N/A	4.59
11B	(32)	(36.5)	(43)	(35.5)	(15.5)	(7.5)	(35)	(6)		(130)
10C &	1.42	1.67	1.91	2.05	0.85	0.39	1.57	N/A	2.36	8.11
11C	(36)	(42.5)	(48.5)	(52)	(21.5)	(10)	(40)		(60)	(230)
11D	1.69	1.97	2.05	2.32	1.08	0.30	1.77	N/A	2.72	15.87
	(43)	(50)	(52)	(59)	(27.5)	(7.5)	(45)		(69)	(450)
11E	1.93	2.22	2.09	2.72	1.08	0.30	1.77	N/A	3.15	19.05
	(49)	(56.5)	(53)	(69)	(27.5)	(7.5)	(45)		(80)	(540)

Note 4: Dimensions in inches (mm). Weight in ounces (gm).
Note 5: See note under mechanical specifications for dimension "d".

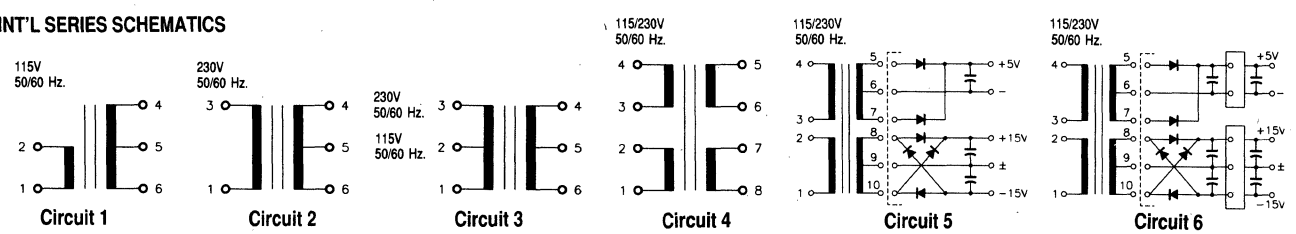
INT'L SERIES MECHANICAL SPECIFICATIONS



Dimension "d": 5VA Series, 0.138" x 0.177" (3.5mm x 4.5mm);
9.5 and 15VA Series: 0.177" x 0.256" (4.5mm x 6.5mm).

Figure A Figure B Figure C

INT'L SERIES SCHEMATICS

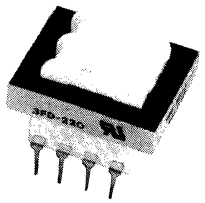


Circuit 1 Circuit 2 Circuit 3 Circuit 4 Circuit 5 Circuit 6

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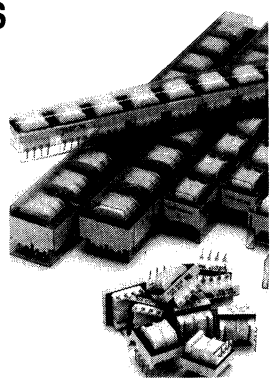
TAMURA OEM PC BOARD POWER TRANSFORMERS

3F Series - 3 Flange Bobbin



FEATURES

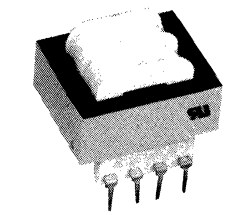
- UL 1585 Class II & III Xfmrs File No. E95844.
- UL Gnl Purpose Xfmrs File No. E91239.
- UL Class B Insulation Sys.
- CSA Cert: CSA 22.2 Nos. 0, 66 File No. LR 69808.
- 2500VAC Hipot, Pri to Sec.
- 115V or 115/230V Primary.
- Bobbin Molded Term. Nos.
- 1.1, 2.4, 6 & 12VA.
- Tube Packaged.
- 80 Models Stocked.
- Competitive Prices.
- Drop-in Compatibility.
- DC Power Supply Models.
- 120 Million Xfrms Shipped/Year.

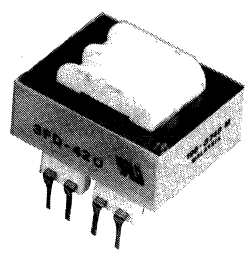


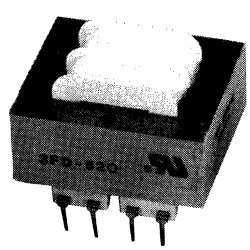
3F SERIES MODELS AND RATINGS

115V, 50/60 Hz. PRIMARY					115/230V, 50/60 Hz. PRIMARY					SECONDARY RATINGS rms[1]		
MODEL No.	PRICE (qty)				MODEL No.	PRICE (qty)				SERIES CONNECTION	PARALLEL CONNECTION	VA
	1-9	10-24	25-99	100up		1-9	10-24	25-99	100up			
3FS-210	$4.90	$4.40	$4.20	$3.70	3FD-210	$5.70	$5.10	$4.80	$4.30	10.0V CT, 0.110A	5.0V, 0.220A	1.1
3FS-310	4.90	4.40	4.20	3.70	3FD-310	5.70	5.10	4.80	4.30	10.0V CT, 0.250A	5.0V, 0.500A	2.4
3FS-410	5.40	4.90	4.60	4.10	3FD-410	6.30	5.70	5.40	4.70	10.0V CT, 0.600A	5.0V, 1.200A	6.0
3FS-510	6.30	5.70	5.40	4.70	3FD-510	7.10	6.40	6.00	5.30	10.0V CT, 1.200A	5.0V, 2.400A	12.0
3FS-212	4.90	4.40	4.20	3.70	3FD-212	5.70	5.10	4.80	4.30	12.6V CT, 0.090A	6.3V, 0.180A	1.1
3FS-312	4.90	4.40	4.20	3.70	3FD-312	5.70	5.10	4.80	4.30	12.6V CT, 0.200A	6.3V, 0.400A	2.4
3FS-412	5.40	4.90	4.60	4.10	3FD-412	6.30	5.70	5.40	4.70	12.6V CT, 0.500A	6.3V, 1.000A	6.0
3FS-512	6.30	5.70	5.40	4.70	3FD-512	7.10	6.40	6.00	5.30	12.6V CT, 1.000A	6.3V, 2.000A	12.0
3FS-216	4.90	4.40	4.20	3.70	3FD-216	5.70	5.10	4.80	4.30	16.0V CT, 0.070A	8.0V, 0.140A	1.1
3FS-316	4.90	4.40	4.20	3.70	3FD-316	5.70	5.10	4.80	4.30	16.0V CT, 0.150A	8.0V, 0.300A	2.4
3FS-416	5.40	4.90	4.60	4.10	3FD-416	6.30	5.70	5.40	4.70	16.0V CT, 0.400A	8.0V, 0.800A	6.0
3FS-516	6.30	5.70	5.40	4.70	3FD-516	7.10	6.40	6.00	5.30	16.0V CT, 0.800A	8.0V, 1.600A	12.0
3FS-220	4.90	4.40	4.20	3.70	3FD-220	5.70	5.10	4.80	4.30	20.0V CT, 0.055A	10.0V, 0.110A	1.1
3FS-320	4.90	4.40	4.20	3.70	3FD-320	5.70	5.10	4.80	4.30	20.0V CT, 0.120A	10.0V, 0.240A	2.4
3FS-420	5.40	4.90	4.60	4.10	3FD-420	6.30	5.70	5.40	4.70	20.0V CT, 0.300A	10.0V, 0.600A	6.0
3FS-520	6.30	5.70	5.40	4.70	3FD-520	7.10	6.40	6.00	5.30	20.0V CT, 0.600A	10.0V, 1.200A	12.0
3FS-224	4.90	4.40	4.20	3.70	3FD-224	5.70	5.10	4.80	4.30	24.0V CT, 0.045A	12.0V, 0.090A	1.1
3FS-324	4.90	4.40	4.20	3.70	3FD-324	5.70	5.10	4.80	4.30	24.0V CT, 0.100A	12.0V, 0.200A	2.4
3FS-424	5.40	4.90	4.60	4.10	3FD-424	6.30	5.70	5.40	4.70	24.0V CT, 0.250A	12.0V, 0.500A	6.0
3FS-524	6.30	5.70	5.40	4.70	3FD-524	7.10	6.40	6.00	5.30	24.0V CT, 0.500A	12.0V, 1.000A	12.0
3FS-228	4.90	4.40	4.20	3.70	3FD-228	5.70	5.10	4.80	4.30	28.0V CT, 0.040A	14.0V, 0.080A	1.1
3FS-328	4.90	4.40	4.20	3.70	3FD-328	5.70	5.10	4.80	4.30	28.0V CT, 0.085A	14.0V, 0.170A	2.4
3FS-428	5.40	4.90	4.60	4.10	3FD-428	6.30	5.70	5.40	4.70	28.0V CT, 0.200A	14.0V, 0.400A	6.0
3FS-528	6.30	5.70	5.40	4.70	3FD-528	7.10	6.40	6.00	5.30	28.0V CT, 0.420A	14.0V, 0.840A	12.0
3FS-236	4.90	4.40	4.20	3.70	3FD-236	5.70	5.10	4.80	4.30	36.0V CT, 0.030A	18.0V, 0.060A	1.1
3FS-336	4.90	4.40	4.20	3.70	3FD-336	5.70	5.10	4.80	4.30	36.0V CT, 0.065A	18.0V, 0.130A	2.4
3FS-436	5.40	4.90	4.60	4.10	3FD-436	6.30	5.70	5.40	4.70	36.0V CT, 0.170A	18.0V, 0.340A	6.0
3FS-536	6.30	5.70	5.40	4.70	3FD-536	7.10	6.40	6.00	5.30	36.0V CT, 0.350A	18.0V, 0.700A	12.0
3FS-248	4.90	4.40	4.20	3.70	3FD-248	5.70	5.10	4.80	4.30	48.0V CT, 0.023A	24.0V, 0.046A	1.1
3FS-348	4.90	4.40	4.20	3.70	3FD-348	5.70	5.10	4.80	4.30	48.0V CT, 0.050A	24.0V, 0.100A	2.4
3FS-448	5.40	4.90	4.60	4.10	3FD-448	6.30	5.70	5.40	4.70	48.0V CT, 0.125A	24.0V, 0.250A	6.0
3FS-548	6.30	5.70	5.40	4.70	3FD-548	7.10	6.40	6.00	5.30	48.0V CT, 0.250A	24.0V, 0.500A	12.0
3FS-256	4.90	4.40	4.20	3.70	3FD-256	5.70	5.10	4.80	4.30	56.0V CT, 0.020A	28.0V, 0.040A	1.1
3FS-356	4.90	4.40	4.20	3.70	3FD-356	5.70	5.10	4.80	4.30	56.0V CT, 0.045A	28.0V, 0.090A	2.4
3FS-456	5.40	4.90	4.60	4.10	3FD-456	6.30	5.70	5.40	4.70	56.0V CT, 0.110A	28.0V, 0.220A	6.0
3FS-556	6.30	5.70	5.40	4.70	3FD-556	7.10	6.40	6.00	5.30	56.0V CT, 0.220A	28.0V, 0.440A	12.0
3FS-2120	4.90	4.40	4.20	3.70	3FD-2120	5.70	5.10	4.80	4.30	120.0V CT, 0.010A	60.0V, 0.020A	1.1
3FS-3120	4.90	4.40	4.20	3.70	3FD-3120	5.70	5.10	4.80	4.30	120.0V CT, 0.020A	60.0V, 0.040A	2.4
3FS-4120	5.40	4.90	4.60	4.10	3FD-4120	6.30	5.70	5.40	4.70	120.0V CT, 0.050A	60.0V, 0.100A	6.0
3FS-5120	6.30	5.70	5.40	4.70	3FD-5120	7.10	6.40	6.00	5.30	120.0V CT, 0.100A	60.0V, 0.200A	12.0

Note 1: Individual transformer coil rating is parallel connection voltage & series connection current.

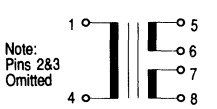




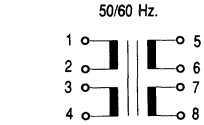


3F SERIES SCHEMATICS

Single Primary 50/60 Hz.



Dual Primary 115/230V 50/60 Hz.

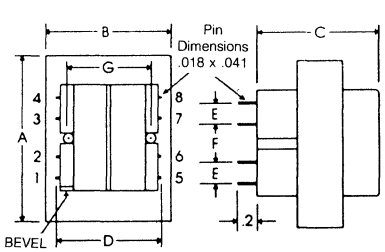


3F SERIES DIMENSIONS AND WEIGHTS[2]

SERIES PREFIX	A	B	C	D	E	F	G	WT
3FS, D-2	1.38	1.16	0.94	1.200	0.250	0.250	N/A	2.7
	(35.1)	(29.5)	(23.9)	(30.5)	(6.4)	(6.4)		(77.1)
3FS, D-3	1.38	1.16	1.18	1.200	0.250	0.250	N/A	4.0
	(35.1)	(29.5)	(30.0)	(30.5)	(6.4)	(6.4)		(113.4)
3FS, D-4	1.62	1.31	1.31	1.28	0.250	0.350	1.062	7.02
	(41.2)	(33.3)	(33.3)	(32.5)	(6.4)	(8.9)	(27.0)	(199.6)
3FS, D-5	1.89	1.58	1.44	1.41	0.300	0.400	1.25	11.2
	(48.0)	(40.1)	(36.6)	(35.8)	(7.6)	(10.2)	(31.8)	(317.5)

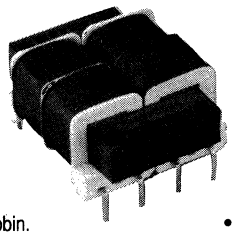
Note 2: Dimensions in inches (mm). Weight in ounces (gm).

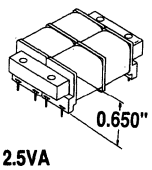
3F SERIES MECHANICAL SPECIFICATIONS



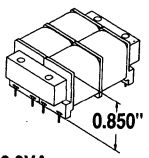
CONTACT TAMURA for ORDERING, STOCK, OEM PRICING, DETAILED DATA SHEETS or YOUR CUSTOM REQUIREMENTS by FAX: 310/638/9956 or CALL: (310) 638-1790

TAMURA LOW PROFILE, PLUG-IN, POWER TRANSFORMERS

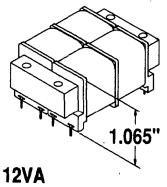




2.5VA



6.0VA



12VA

FEATURES

- Three Flange Bobbin.
- 1500V RMS Hipot.
- 115/230VAC, 50/60Hz., Dual Primary.
- Low Profile: 0.65", 0.85", 1.065" Heights.
- 3 Sizes: 2.5, 6.0 and 12VA Ratings.
- NL-FL Regulation: 30%; 12VA, 20%.
- Tube Packaged.
- 80 Models Stocked.
- Competitive Prices.
- Drop-in compatibility.
- DC Power Supply Models.
- 120M Xfmrs Shipped/Year.

LOW PROFILE SERIES MODELS and RATINGS

MODEL No.	SECONDARY RATINGS [1]		VA	PRICE (qty)			
	SERIES	PARALLEL		1-9	10-24	25-99	100up
3FL-10-250	10 VCT @ 0.250A	5V @ 0.500A	2.5	$7.25	$6.55	$6.15	$5.45
3FL-10-600	10 VCT @ 0.600A	5V @ 1.200A	6.0	8.00	7.20	6.80	6.00
3FL-10-1200	10 VCT @ 1.200A	5V @ 2.400A	12.0	10.00	9.00	8.50	7.50
3FL-12-200	12.6 VCT @ 0.200A	6.3V @ 0.400A	2.5	7.25	6.55	6.15	5.45
3FL-12-475	12.6 VCT @ 0.475A	6.3V @ 0.950A	6.0	8.00	7.20	6.80	6.00
3FL-12-950	12.6 VCT @ 0.950A	6.3V @ 1.900A	12.0	10.00	9.00	8.50	7.50
3FL-16-150	16 VCT @ 0.150A	8V @ 0.300A	2.5	7.25	6.55	6.15	5.45
3FL-16-350	16 VCT @ 0.350A	8V @ 0.700A	6.0	8.00	7.20	6.80	6.00
3FL-16-700	16 VCT @ 0.700A	8V @ 1.400A	12.0	10.00	9.00	8.50	7.50
3FL-20-125	20 VCT @ 0.125A	10V @ 0.250A	2.5	7.25	6.55	6.15	5.45
3FL-20-300	20 VCT @ 0.300A	10V @ 0.600A	6.0	8.00	7.20	6.80	6.00
3FL-20-600	20 VCT @ 0.600A	10V @ 1.200A	12.0	10.00	9.00	8.50	7.50
3FL-24-100	24 VCT @ 0.100A	12V @ 0.200A	2.5	7.25	6.55	6.15	5.45
3FL-24-250	24 VCT @ 0.250A	12V @ 0.500A	6.0	8.00	7.20	6.80	6.00
3FL-24-500	24 VCT @ 0.500A	12V @ 1.000A	12.0	10.00	9.00	8.50	7.50
3FL-30-85	30 VCT @ 0.085A	15V @ 0.170A	2.5	7.25	6.55	6.15	5.45
3FL-30-200	30 VCT @ 0.200A	15V @ 0.400A	6.0	8.00	7.20	6.80	6.00
3FL-30-400	30 VCT @ 0.400A	15V @ 0.800A	12.0	10.00	9.00	8.50	7.50
3FL-34-75	34 VCT @ 0.075A	17V @ 0.150A	2.5	7.25	6.55	6.15	5.45
3FL-34-170	34 VCT @ 0.170A	17V @ 0.340A	6.0	8.00	7.20	6.80	6.00
3FL-34-340	34 VCT @ 0.340A	17V @ 0.680A	12.0	10.00	9.00	8.50	7.50
3FL-40-60	40 VCT @ 0.060A	20V @ 0.120A	2.5	7.25	6.55	6.15	5.45
3FL-40-150	40 VCT @ 0.150A	20V @ 0.300A	6.0	8.00	7.20	6.80	6.00
3FL-40-300	40 VCT @ 0.300A	20V @ 0.600A	12.0	10.00	9.00	8.50	7.50
3FL-56-45	56 VCT @ 0.045A	28V @ 0.090A	2.5	7.25	6.55	6.15	5.45
3FL-56-100	56 VCT @ 0.100A	28V @ 0.200A	6.0	8.00	7.20	6.80	6.00
3FL-56-200	56 VCT @ 0.200A	28V @ 0.400A	12.0	10.00	9.00	8.50	7.50
3FL-88-28	88 VCT @ 0.028A	44V @ 0.056A	2.5	7.25	6.55	6.15	5.45
3FL-88-65	88 VCT @ 0.065A	44V @ 0.130A	6.0	8.00	7.20	6.80	6.00
3FL-88-130	88 VCT @ 0.130A	44V @ 0.260A	2.0	10.00	9.00	8.50	7.50
3FL-120-20	120 VCT @ 0.020A	60V @ 0.040A	2.5	7.25	6.55	6.15	5.45
3FL-120-50	120 VCT @ 0.050A	60V @ 0.100A	6.0	8.00	7.20	6.80	6.00
3FL-120-100	120 VCT @ 0.100A	60V @ 0.200A	12.0	10.00	9.00	8.50	7.50
3FL-230-10	230 VCT @ 0.010A	115V @ 0.020A	2.5	7.25	6.55	6.15	5.45
3FL-230-25	230 VCT @ 0.025A	115V @ 0.050A	6.0	8.00	7.20	6.80	6.00
3FL-230-50	230 VCT @ 0.050A	115V @ 0.100A	12.0	10.00	9.00	8.50	7.50

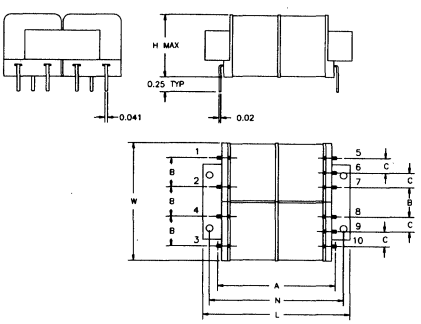
Note 1: Individual Xfmr coil rating is parallel connection voltage & series connection current.

3FL SERIES DIMENSIONS and WEIGHTS [2]

VA	A	B	C [3]	L	W	H	WT
2.5	1.60 (40.6)	0.375 (9.5)	0.187 (4.8)	1.87 (47.5)	1.56 (39.6)	0.650 (16.5)	5 (142)
6.0	1.60 (40.6)	0.375 (9.5)	0.187 (4.8)	1.87 (47.5)	1.56 (39.6)	0.850 (21.6)	7 (198)
12.0	2.00 (50.8)	0.500 (12.7)	0.250 (6.4)	2.50 (63.5)	2.00 (50.8)	1.065 (27.1)	11 (312)

Note 2: Dimensions in inches (mm). Weight in oz. (gm).
Note 3: 3 output config. has 10 pins, all others 8 pins (omit pin 6 & 9).

3FL SERIES MECHANICAL SPECIFICATIONS

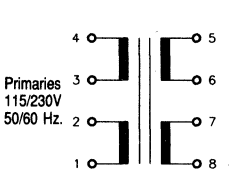


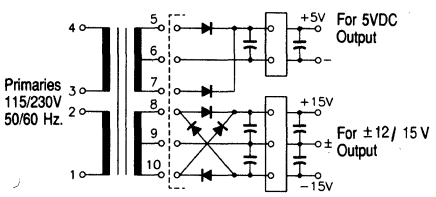
THREE (3) OUTPUT TRANSFORMER MODELS & RATINGS

Regulated Power Supplies for Microprocessors

MODEL No.	SECONDARY 1 AC - rms	SECONDARY 2 AC - rms	DC OUTPUT 1 C.T.F.W.	DC OUTPUT 2 C.T.F.W.	VA	PRICE (qty)			
						1-9	10-24	25-99	100up
3FL-612	17.5V, 155ma	31.5V, 65ma	+5V, 135ma	± 12V, 40ma	6	$9.75	$8.80	$8.30	$7.30
3FL-615	17.5V, 155ma	37.5V, 60ma	+5V, 135ma	± 15V, 35ma	6	9.75	8.80	8.30	7.30
3FL-1212	17.0V, 340ma	29.0V, 140ma	+5V, 270ma	± 12V, 85ma	12	11.25	10.15	9.55	8.45
3FL-1215	17.0V, 340ma	36.0V, 115ma	+5V, 270ma	± 15V, 70ma	12	11.25	10.15	9.55	8.45

3FL SERIES SCHEMATICS





CONTACT TAMURA for ORDERING, STOCK, OEM PRICING, DETAILED DATA SHEETS or YOUR CUSTOM REQUIREMENTS by FAX: 310/638/9956 or CALL: (310) 638-1790

TAMURA WALL PLUG-IN and SCREW TERMINAL AC-AC TRANSFORMERS

120VAC, 60Hz. and 220VAC, 50Hz.

UL file nos. E82180 CSA file nos. LR38236 VDE file nos.7969-3330 7969-3331

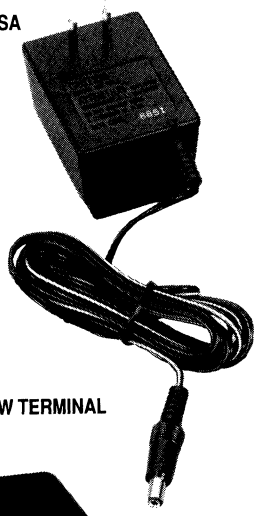
FEATURES

- UL Class II Xfmrs - UL 1310.
- UL 544 Medical Capability.
- Thermal Overload Protection.
- 100% Testing.
- Transformer: 3 flange bobbin.
- US 3-Blade Ground Plug Available.
- Temp Range: 0 to +40°C.
- Case Temp Rise: ≤35°C.
- Oper Humidity: 10-90% RH.
- Material: Black ABS resin/UL 94-V0.
- No Audible Noise.
- Mounting Tab Available.

AC-AC CLASS II TRANSFORMERS - 120VAC, 60Hz.

UL/CSA MODEL No.	RATED OUTPUT VOLTS AC	RATED OUTPUT ma AC	OUTPUTVAC[1] 100% FL 108VAC	100% FL 132VAC	10% FL 132VAC	UL[2]	CSA[3]	PLUG[4]	PRICE (qty) 1-9	10-24	25-99	100up
310A0001	2.5	500	2.15	2.70	3.20	UL*	L	P	$6.40	$6.40	$5.10	$4.50
420A0003	9.0	800	7.75	9.20	10.90	UL*	L	M	8.90	7.60	7.10	6.20
825A0007G	9.0	1500	7.85	10.00	11.25	UL	L	I	16.60	14.10	13.30	11.60
420A0001	11.0	600	9.85	12.35	13.65	UL*	L	I	8.90	7.60	7.10	6.20
310A0002	12.0	110	11.00	13.70	15.30	UL*	C	I	6.70	5.70	5.40	4.70
825A0001	12.0	1300	10.50	13.50	15.90	UL	C	I	16.30	13.90	13.00	11.40
816A0001	14.0	500	12.60	15.85	17.75	UL	L	I	15.00	12.70	12.00	10.50
420A0002	14.0	770	12.25	15.50	18.30	UL*	L	I	8.90	7.60	7.10	6.20
420A0008	16.5	600	14.10	18.25	19.90	UL	C	I	8.90	7.60	7.10	6.20
818A0001	17CT	500	16.00	20.10	23.40	UL	L	V	11.90	10.10	9.50	8.30
825A0002	18.0	880	15.95	21.50	22.90	UL	C	I	16.30	13.90	13.00	11.40
420A0005	24.0	450	20.60	26.50	30.50	UL*	L	I	8.90	7.60	7.10	6.20
825A0003	24.0	660	21.00	26.60	30.25	UL	C	I	16.30	13.90	13.00	11.40

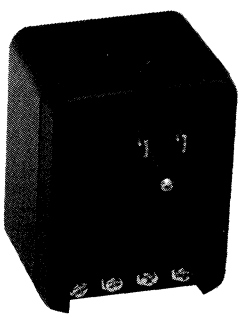
FIG. 1 UL/CSA



SCREW TERMINAL TYPE - 120VAC, 60Hz.

820A0060-03	10.0	1200	8.60	11.40	12.75	UL	L	SCRW	13.90	13.10	12.00	11.10
825A0050-03	10CT	1600	8.70	11.30	12.65	UL	L	SCRW	16.20	15.20	13.90	13.00
830A0060-03	10.0	2000	8.60	11.20	12.55	UL	L	SCRW	16.10	15.10	13.80	12.90
820A0061-03	12.0	1000	10.25	13.75	15.40	UL	L	SCRW	13.90	13.10	12.00	11.10
825A0051-03	12CT	1330	10.40	13.60	15.25	UL	L	SCRW	16.20	15.20	13.90	13.00
830A0061-03	12.0	1600	10.55	13.75	15.30	UL	L	SCRW	16.10	15.10	13.80	12.90
820A0062-03	14.0	850	12.05	15.70	17.55	UL	L	SCRW	13.90	13.10	12.00	11.10
825A0052-03	14CT	1140	12.00	15.60	17.45	UL	L	SCRW	15.40	14.50	13.20	12.30
830A0062-03	14.0	1430	11.90	15.50	17.35	UL	L	SCRW	16.10	15.10	13.80	12.90
820A0063-03	16.0	750	13.50	17.70	20.10	UL	L	SCRW	13.90	13.10	12.00	11.10
825A0053-03	16CT	1000	13.80	18.05	20.05	UL	L	SCRW	15.40	14.50	13.20	12.30
830A0063-03	16.0	1250	13.65	17.90	19.90	UL	L	SCRW	15.30	14.40	13.20	12.20
820A0064-03	18.0	650	15.45	20.30	22.65	UL	L	SCRW	13.90	13.10	12.00	11.10
825A0054-03	18CT	880	15.45	20.30	22.70	UL	L	SCRW	14.50	13.60	12.50	11.60
830A0064-03	18.0	1110	15.35	20.25	22.60	UL	L	SCRW	15.30	14.40	13.20	12.20
820A0065-03	20.0	600	17.00	22.35	25.10	UL	L	SCRW	13.90	13.10	12.00	11.10
825A0055-03	20CT	800	17.10	22.40	25.10	UL	L	SCRW	14.50	13.60	12.50	11.60
830A0065-03	20.0	1000	16.95	22.30	25.05	UL	L	SCRW	15.30	14.40	13.20	12.20
820A0066-03	22.0	550	18.85	24.85	27.80	UL	L	SCRW	13.90	13.10	12.00	11.10
825A0056-03	22CT	720	18.75	24.75	27.65	UL	L	SCRW	14.50	13.60	12.50	11.60
830A0066-03	22.0	900	18.70	24.70	27.60	UL	L	SCRW	15.30	14.40	13.20	12.20
820A0067-03	24.0	500	20.70	26.95	30.10	UL	L	SCRW	13.90	13.10	12.00	11.10
825A0057-03	24CT	660	20.60	26.85	29.95	UL	L	SCRW	14.50	13.60	12.50	11.60
825A0067-03	24.0	830	20.60	26.85	30.00	UL	L	SCRW	15.30	14.40	13.20	12.20

FIG. 2 SCREW TERMINAL



Note 1: Typ. output VAC for load & line shown. Note 2: UL Notes: UL, UL1310 listed; UL*, UL 1310 & UL1411 Xfmr.

Note 3: Complies (C) or listed (L) to CSA 22.2, No. 223/66. Note 4: Screw term: 4ea #6-32; input gnd & output screw term gnd.

AC-AC TRANSFORMER - 220VAC, 50Hz. - VDE APPROVED

VDE MODEL NO.	RATED OUTPUT VOLTS DC	RATED OUTPUT ma DC	OUTPUT VAC[5] 100% FL 198VAC	100% FL 242VAC	10% FL 242VAC	PLUG TYPE	PRICE (qty) 1-9	10-24	25-99	100up
310F0006	9.5	150	9.40	11.80	18.50	I	$9.70	$8.20	$7.80	$6.80
310F0007	12.0	100	10.00	14.00	18.70	I	9.70	8.20	7.80	6.80

FIG. 3 VDE



Note 5: Typical output voltage for % load (FL) and line (VAC) as indicated.

MECHANICAL DIMENSION TABLE

SERIES PREFIX	LENGTH (L) mm (inch)	WIDTH (W) mm (inch)	HEIGHT (H) mm (inch)	WEIGHT gm (oz)	FIG No.
310A	60 (2.36)	45 (1.77)	35 (1.38)	150 (5.29)	1
310F	58 (2.28)	45 (1.77)	39 (1.54)	190 (6.70)	3
420A	61 (2.40)	55 (2.17)	41 (1.62)	270 (9.52)	1
816A	81 (3.19)	59 (2.32)	52 (2.05)	297 (10.49)	1
818A	51 (2.01)	60 (2.36)	50 (1.97)	330 (11.64)	1
820A-03	75 (2.95)	63 (2.48)	50 (1.97)	400 (14.13)	2
825A	82 (3.23)	60 (2.36)	55 (2.17)	490 (17.28)	1
825A-03	75 (2.95)	63 (2.48)	50 (1.97)	470 (16.58)	2
830A-03	75 (2.95)	63 (2.48)	50 (1.97)	530 (18.73)	2

OUTPUT PLUG DIMENSIONS

PLUG TYPE	D1 (mm)	D2 (mm)	L (mm)	MALE/ FEMALE	FIG No.
I	5.5	2.10	9.5	FEMALE	4
M	5.5	2.55	9.5	FEMALE	4
O	5.5	2.55	12.4	FEMALE	4
P	2.5	2.30	11.0	MALE	5
V	3 POS. AMP 102241-1 MOLDED				N/A

FIG. 4 FEMALE

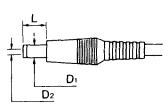
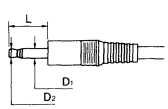
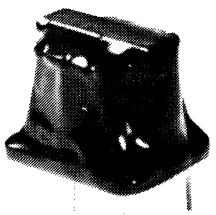


FIG. 5 MALE



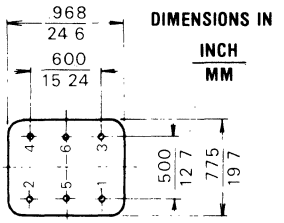
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TAMURA ENCAPSULATED SCR and TRIAC TRIGGER TRANSFORMERS



Tamura's STT series transformers are designed for low cost source isolation in half and full wave SCR or TRIAC control citcuits. The STT trigger transformers are encapsulated for environmental protection and pass 2600V rms dielectric breakdown testing.

MODEL No.	TURNS RATIO	PRIM L mH(≥)	LEAK L uH(≤)	WDG C pF	E.T. (≥) V-μsec	DCR ohms (max)	DIA No.	PRICE (qty) 1-9	10-24	25-99	100up
STT-101	1:1	1.0	15	80	90	2.5/2.5	1	$12.40	$11.20	$10.50	$9.90
STT-102	1:1	5.0	50	80	200	5.0/5.0	1	12.40	11.20	10.50	9.90
STT-103	1:1	10.0	100	80	280	7.0/7.0	1	12.40	11.20	10.50	9.90
STT-104	1:1:1	1.0	25	80	90	2.5/2.5/2.5	2	13.80	12.40	11.70	11.00
STT-105	1:1:1	5.0	100	80	200	5.0/5.0/5.0	2	13.80	12.40	11.70	11.00
STT-106	1:1:1	10.0	200	80	280	7.0/7.0/7.0	2	13.80	12.40	11.70	11.00
STT-107	2:1	1.0	20	80	90	2.5/1.5	1	12.40	11.20	10.50	9.90
STT-108	2:1	5.0	60	80	200	5.0/2.5	1	12.40	11.20	10.50	9.90
STT-109	2:1	10.0	130	80	280	7.0/3.5	1	12.40	11.20	10.50	9.90
STT-110	2:1:1	1.0	30	80	90	2.5/1.5/1.5	2	13.80	12.40	11.70	11.00
STT-111	2:1:1	5.0	130	80	200	5.0/2.5/2.5	2	13.80	12.40	11.70	11.00
STT-112	2:1:1	10.0	200	80	280	7.0/3.5/3.5	2	13.80	12.40.	11.70	11.00



MAX. HT. = .775 / 19.7

DIAGRAM 1

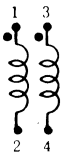
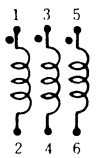
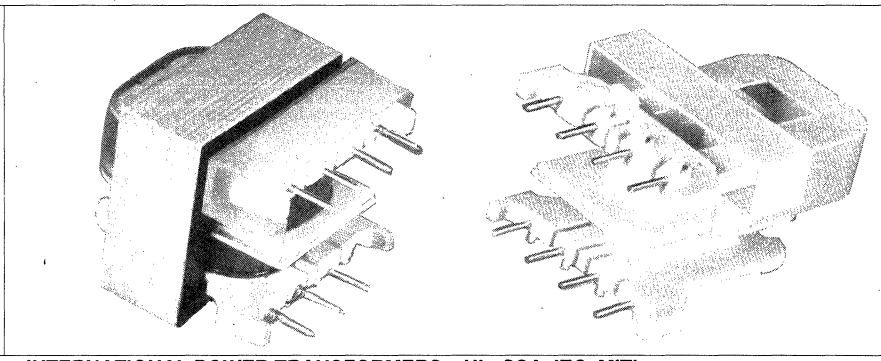


DIAGRAM 2



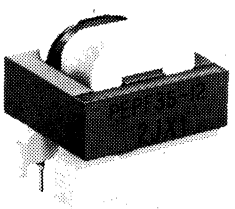
Tamura Designs Custom Power and Audio Transformers

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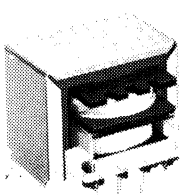


INTERNATIONAL POWER TRANSFORMERS – UL, CSA, IEC, MITI

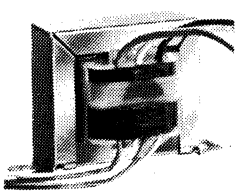
PEPF Series
- Ratings–0.7 to 6VA
- Physical Barrier Between Primary, Secondary & Core



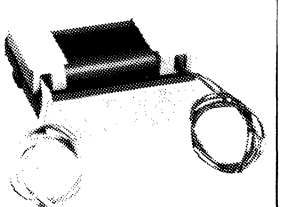
PEPY Series
- Ratins–4 to 20VA
- Physical Barrier Between Primary, Secondary & Core



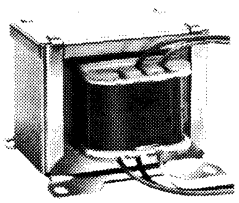
PEE Series
- Ratings–0.7 to 40VA
- 8mm Creepage
- 4000VAC HiPot



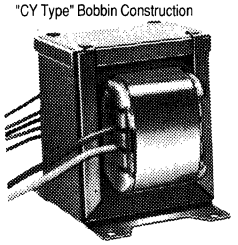
PMZF Series
- 10 to 80VA
- Minimum Flux Field for CRT Applications
- Low Profile



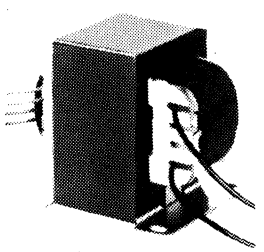
PEB Series
- Ratings–70 to 300VA
- Horizontal Mounting
- CU Flux Shorting Band
- Concentric Wound Coils
- "CY Type" Bobbin Construction



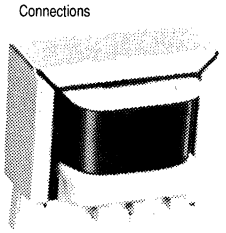
PEBT Series
- Ratings–70 to 300VA
- Vertical Mounting
- CU Flux Shorting Band
- Concentric Wound Coils
- "CY Type" Bobbin Construction



PEKT Series
- Ratings–70 to 200VA
- Welded Stack
- Shielded Core to Reduce Stray Field



EPH Series AUDIO TRANSFORMERS
- Double Protection System
- 3500VAC HiPot
- Isolation for TV Audio and Video External Connections



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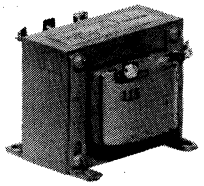
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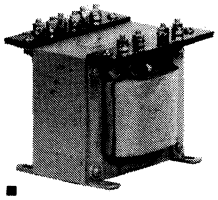
• NAME PLATES • WIRING DIAGRAMS

HIGH CURRENT TRANSFORMERS

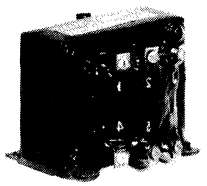
• 45° TEMP. RISE • MINIMUM REGULATION



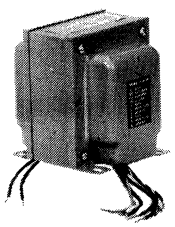
STYLE B



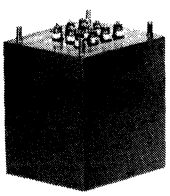
■ STYLE B (OVER 700 VA)



STYLE BE



STYLE V



STYLE CM

FOUR STYLES STOCKED IN DEPTH

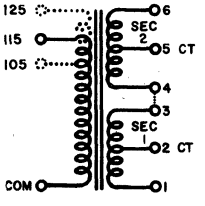
SECONDARY VOLTS TAP VOLTS	PART NO.	RATING VA	PRIMARY VOLTS 50-500 Hz.	OPTIONAL SECONDARY HOOKUP SERIES VOLTS	SERIES AMPS (RMS)	PARALLEL VOLTS	PARALLEL AMPS (RMS)
10 VOLTS Parallel: 2.5, 5V Series: 7.5, 10V	10 02	20	115	10V CT OR 7.5V	2 5 10 20	5V CT OR 2.5V	4 10 20 40
	10 05	50	115				
	10 10	100	115				
	10 20	200	115				
12.6 VOLTS Parallel: 3.1, 6.3V Series: 9.4, 12.6V	12 02	24	115	12.6V CT OR 9.4V	2 5 10 20	6.3V CT OR 3.1V	4 10 20 40
	12 05	60	115				
	12 10	120	115				
	12 20	240	115				
16 VOLTS Parallel: 4, 8V Series: 12, 16V	16 01	16	115	16V CT OR 12V	1 2 5 10 20	8V CT OR 4V	2 4 10 20 40
	16 02	32	115				
	16 05	80	115				
	16 10	160	115				
	16 20	320	115				
24 VOLTS Parallel: 6, 12V Series: 18, 24V INTERMEDIATE RATINGS AVAILABLE	24 01	24	115	24V CT OR 18V	1 2 4 6 8 12 20 25 50 100	12V CT OR 6V	2 4 8 12 16 24 40 50 100 200
	24 02	48	115				
	24 04	96	115				
	24 06	144	115				
	24 08	192	115				
	24 12	288	105, 115, 125				
	24 20	480	105, 115, 125				
	24 25	600	105, 115, 125				
	24 50	1200	105, 115, 125				
	24 100	2400	115, 230				
36 VOLTS Parallel: 9, 18V Series: 27, 36V	36 00	18	115	36V CT OR 27V	0.5 1 2 4 6 8 12 20 30 50 100	18V CT OR 9V	1 2 4 8 12 16 24 40 60 100 200
	36 01	36	115				
	36 02	72	115				
	36 04	144	115				
	36 06	216	115				
	36 08	288	115				
	36 12	432	105, 115, 125				
	36 20	720	105, 115, 125				
	36 30	1080	105, 115, 125				
	36 50	1800	115, 230				
	36 100	3600	115, 230				
56 VOLTS Parallel: 14, 28V Series: 42, 56V	56 01	56	115	56V CT OR 42V	1 2 5 8 12 25 50 100	28V CT OR 14V	2 4 10 16 24 50 100 200
	56 02	112	115				
	56 05	280	115				
	56 08	448	105, 115, 125				
	56 12	672	105, 115, 125				
	56 25	1400	105, 115, 125				
	56 50	2800	115, 230				
	56 100	5600	115, 230				
64 VOLTS Parallel: 16, 32V Series: 48, 64V	64 00	32	115	64V CT OR 48V	0.5 1 2 4 8 12 25 50	32V CT OR 16V	1 2 4 8 16 24 50 100
	64 01	64	115				
	64 02	128	115				
	64 04	256	115				
	64 08	512	105, 115, 125				
	64 12	780	105, 115, 125				
	64 25	1600	105, 115, 125				
	64 50	3200	115, 230				
68 VOLTS Parallel: 17, 34V Series: 51, 68V	68 01	68	115	68V CT OR 51V	1 2 4 8 12	34V CT OR 17V	2 4 8 16 24
	68 02	136	115				
	68 04	272	115				
	68 08	544	105, 115, 125				
	68 12	816	105, 115, 125				
80 VOLTS Parallel: 20, 40V Series: 60, 80V	80 01	80	115	80V CT OR 60V	1 2 5 10 25 50	40V CT OR 20V	2 4 10 20 50 100
	80 02	160	115				
	80 05	400	115				
	80 10	800	105, 115, 125				
	80 25	2000	115, 230				
	80 50	4000	115, 230				
120 VOLTS Parallel: 30, 60V Series: 90, 120V	120 01	120	115	120V CT OR 90V	1 2 4 8 12	60V CT OR 30V	2 4 8 16 24
	120 02	240	115				
	120 04	480	115				
	120 08	960	105, 115, 125				
	120 12	1440	105, 115, 125				
180 VOLTS Parallel: 45, 90V Series: 135, 180V	180 00	90	115	180V CT OR 135V	0.5 1 4 8	90V CT OR 45V	1 2 8 16
	180 01	180	115				
	180 04	720	105, 115, 125				
	180 08	1440	105, 115, 125				
230 VOLTS Parallel: 57.5, 115V Series: 172.5, 230V	230 00	115	115	230V CT OR 172.5V	0.5 1 2 5 8	115V CT OR 57.5V	1 2 4 10 16
	230 01	230	115				
	230 02	460	115				
	230 05	1150	105, 115, 125				
	230 08	1840	115, 230				
300 VOLTS Parallel: 75, 150V Series: 225, 300V	300 00	150	115	300V CT OR 225V	0.5 1 2 5	150V CT OR 75V	1 2 4 10
	300 01	300	115				
	300 02	600	115				
	300 05	1500	105, 115, 125				

DC TO RMS CONVERSION CHART

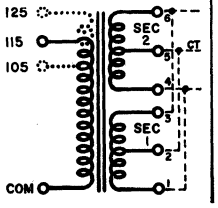
SECONDARY RMS CURRENT = DC CURRENT × FACTOR BELOW	Choke Input Filter or Inductive Load	Resistive Load	Capacitor Input Filter or Capacitive Load
FULL WAVE BRIDGE	1.0	1.0	1.8
FULL WAVE C.T.	.7	1.0	1.15

CUSTOM VARIATIONS QUOTED PROMPTLY

SERIES HOOKUP



PARALLEL HOOKUP



TODD SYSTEMS "HIGH CURRENT TRANSFORMERS & CHOKES" are designed for use in high power rectifier circuits, and high current A.C. applications. "TODD ENGINEERED" designs feature a nominal temperature rise of 45°C., at full load, thus providing outstanding overload capacity. All designs utilize extremely low regulation, varying from 10% in the smallest to 1% in the larger units.

Four styles . . . select the type best suited for your lab, test rigs, OEM or production equipment

DATA SUBJECT TO CHANGE WITHOUT NOTICE

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED

TODD SYSTEMS INC.

PRECISION BUILT

FAX: (914) 963-3506

50 ASH STREET, YONKERS, NY, U.S.A. 10701

(914) 963-3400

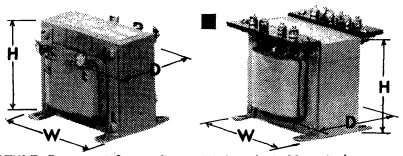
TODD ENGINEERED

HIGH CURRENT TRANSFORMERS

MECHANICAL SPECIFICATIONS · · · · · · · · · · · · · · SPECIFY STYLE REQUIRED

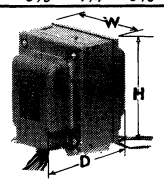
PART NO.	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) H	W	D	MW	MD	WGT.	• FULLY MTD. SHELLS (STYLE V) H	W	D	MW	MD	WGT.	• HERMETIC SEALED MIL-T (STYLE CM) H	W	D	MW	MD	WGT.	PART NO.
10 02	2 1/4	2 5/8	2 1/16	2 3/16	1 11/16	1 1/4	2 5/8	2 3/16	2	1 3/4	1 1/4	1 1/4	3 1/8	3	2 5/16	2 3/32	1 27/32	2	10 02
10 05	2 1/2	3	2 5/8	2 1/2	2 1/8	2 3/8	3 1/16	2 1/2	2 3/4	2	1 13/16	2 1/2	3 13/16	3 1/2	3	2 5/8	2 1/8	4	10 05
10 10	3 1/8	3 3/4	3	3 1/8	2 1/8	4 3/8	3 7/8	3 1/4	3 5/8	2 1/2	2 3/8	5	4 1/4	3 7/8	3 5/16	3	2 1/16	7 3/4	10 10
10 20	3 3/4	4 1/2	3 5/8	3 3/4	2 3/8	7 1/2	4 5/8	3 7/8	3 7/8	3	2 13/16	8	5 1/16	5	4 1/4	4 1/16	3 5/16	12 1/2	10 20
12 02	2 1/2	3	2 1/8	2 1/2	1 5/8	1 1/2	3 1/16	2 1/2	2 1/4	2	1 5/16	1 5/8	3 13/16	3 1/2	3	2 5/8	2 1/8	2 1/2	12 02
12 05	2 1/2	3	2 7/8	2 1/2	2 3/8	2 3/4	3 1/16	2 1/2	3	2	2 1/16	2 7/8	3 13/16	3 1/2	3	2 5/8	2 1/8	4	12 05
12 10	3 1/8	3 3/4	3 11/16	3 1/8	2 1/2	5 1/4	3 7/8	3 1/4	3 3/4	2 1/2	2 1/2	5 1/2	4 1/16	4 1/4	3 5/8	3 5/16	2 11/16	8	12 10
12 20	3 3/4	4 1/2	4	3 3/4	2 3/4	9	4 5/8	3 7/8	4 5/16	3	3 1/8	9 1/4	5 1/16	5	4 1/4	4 1/16	3 5/16	13	12 20
16 01	2 1/4	2 5/8	2	2 3/16	1 5/8	1 1/4	2 5/8	2 3/16	1 15/16	1 3/4	1 3/16	1 3/8	3 1/8	3	2 1/16	2 3/32	1 27/32	2 1/8	16 01
16 02	2 1/2	3	2	2 1/2	1 3/4	1 7/8	3 1/16	2 1/2	2 1/2	2	1 1/16	1 7/8	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/8	16 02
16 05	2 13/16	3 3/8	2 3/4	2 13/16	2 1/4	3 1/2	3 3/8	2 13/16	3 5/16	2 1/4	2 3/16	3 3/4	4 1/4	3 7/8	3 15/16	3	2 1/16	5 1/4	16 05
16 10	3 1/16	4 1/8	3 3/4	3 1/16	2 5/8	7	4 1/8	3 1/16	4	2 3/4	3	7 1/8	4 7/8	4 5/8	3 15/16	3 11/16	3	11	16 10
16 20	3 3/4	4 1/2	5	3 3/4	3 3/4	12 3/4	4 5/8	3 7/8	5 3/8	3	3 1/4	13	5 1/16	5	4 1/4	4 1/16	3 5/16	16 1/4	16 20
24 01	2 1/2	3	2 1/8	2 1/2	1 3/4	1 3/4	3 1/16	2 1/2	2 1/2	2	1 1/16	1 3/4	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/4	24 01
24 02	2 1/2	3	2 1/2	2 1/2	2	2 1/4	3 1/16	2 1/2	2 5/8	2	1 3/4	2 1/4	3 13/16	3 1/2	3	2 5/8	2 1/8	4 1/4	24 02
24 04	3 1/8	3 3/4	3 1/8	3 1/8	2 1/8	4 1/4	3 7/8	3 1/4	3 1/4	2 1/2	2 1/16	4 3/8	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	7 1/2	24 04
24 08	3 7/16	4 1/8	3 1/2	3 7/16	2 3/8	6	4 1/8	3 7/16	3 3/4	2 3/4	2 11/16	6 1/4	4 7/8	4 5/8	3 15/16	3 11/16	3	10	24 08
24 08	3 7/16	4 1/8	4	3 7/16	2 7/8	7 1/2	4 1/8	3 7/16	4 1/4	2 3/4	3 5/16	7 3/4	4 7/8	4 5/8	3 15/16	3 11/16	3	13	24 08
24 12	3 3/4	4 1/2	4 5/8	3 3/4	3 3/8	11	4 5/8	3 7/8	4 7/8	3	3 3/4	11 3/8	5 1/16	5	4 1/4	4 1/16	3 5/16	15	24 12
24 20	4 3/8	5 1/4	5 1/4	4 3/8	3 7/16	16 1/4	5 3/8	4 1/2	5 3/8	3 1/2	3 7/8	16 7/8	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	23	24 20
24 25	4 3/8	5 1/4	5 1/4	4 3/8	3 7/8	18 1/2	5 3/8	4 1/2	5 3/4	3 1/2	4 1/4	19 1/2	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	26	24 25
24 50	■5 1/2	6 3/8	7 1/8	5 5/16	5 1/4	42	6 3/8	5 5/16	7 1/4	4 1/4	5 1/2	43	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	53	24 50
24 100	■6 1/32	7 1/16	7 3/8	5 13/16	5 1/4	51							8 1/4	7 1/16	6 17/32	5 13/16	4 25/32	65	24 100
36 00	2 1/4	2 5/8	1 7/8	2 3/16	1 5/8	1 1/4	2 5/8	2 3/16	2 1/8	1 3/4	1 3/8	1 1/2	3 13/16	3 1/2	3	2 5/8	2 1/8	3 3/8	36 00
36 01	2 1/2	3	2 1/8	2 1/2	1 7/8	2	3 1/16	2 1/2	2 5/8	2	1 11/16	2	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/4	36 01
36 02	2 13/16	3 3/8	2 3/4	2 13/16	2 1/4	3 1/2	3 3/8	2 13/16	3 5/16	2 1/4	2 1/8	3 1/2	4 1/4	3 7/8	3 5/16	3	2 1/16	5 1/4	36 02
36 04	3 7/16	4 1/8	3 5/8	3 7/16	2 1/2	6 1/4	4 1/8	3 7/16	4	2 3/4	2 7/8	6 1/2	4 7/8	4 5/8	3 15/16	3 11/16	3	10	36 04
36 06	3 3/4	4 1/2	3 3/4	3 3/4	2 5/8	8 1/4	4 5/8	3 7/8	4 1/16	3	2 7/8	8 1/2	5 1/16	5	4 1/4	4 1/16	3 5/16	11	36 06
36 08	3 3/4	4 1/2	4 3/4	3 3/4	3 1/2	11 3/4	4 5/8	3 7/8	5 1/8	3	3 7/8	12 1/2	5 1/16	5	4 1/4	4 1/16	3 5/16	15 1/2	36 08
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36 50	■6 1/32	7 1/16	6 3/4	5 13/16	5 1/4	48							8 1/4	7 1/16	6 17/32	5 13/16	4 25/32	55	36 50
36 100	■7 1/2	9	9 1/4	7 5/8	7 1/8	85													36 100
56 01	2 1/2	3	2 3/4	2 1/2	2 1/4	2 1/2	3 1/16	2 1/2	3	2	2	2 3/4	3 13/16	3 1/2	3	2 5/8	2 1/8	4	56 01
56 02	3 1/8	3 3/4	3 3/16	3 1/8	2 3/8	4 1/2	3 7/8	3 1/4	3 3/16	2 1/2	2 3/8	4 3/4	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	6 3/4	56 02
56 05	3 3/4	4 1/2	4 3/4	3 3/4	3 1/2	11 1/2	4 5/8	3 7/8	5 1/8	3	4	12	5 7/16	5	4 1/4	4 1/16	3 5/16	18	56 05
56 08	4 3/8	5 1/4	5	4 3/8	3 11/16	16 3/4	5 3/8	4 1/2	5 5/8	3 1/2	4	17	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	24	56 08
56 12	■5 1/2	6 3/8	5 1/2	5 5/16	3 7/16	24	6 3/8	5 5/16	5 1/2	4 1/4	3 1/2	25	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	30	56 12
56 25	■5 1/2	6 3/8	7	5 5/16	5 1/8	33	6 3/8	5 5/16	7	4 1/4	5 1/16	34 1/2	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	45	56 25
56 50	■6 1/32	7 1/16	8	5 13/16	6	60							8 1/4	7 5/16	6 17/32	5 13/16	4 25/32	68	56 50
56 100	■7 5/8	9	11 1/2	7 5/8	9 5/8	146													56 100
64 00	2 1/4	2 5/8	2 5/16	2 3/16	2	1 3/4	2 5/8	2 3/16	2 5/16	1 3/4	1 1/2	1 3/4	3 1/8	3	2 1/16	2 3/32	1 27/32	2 1/2	64 00
64 01	2 1/2	3	2 13/16	2 1/2	2 3/8	3	3 1/16	2 1/2	3	2	2 1/8	2 3/4	3 13/16	3 1/2	3	2 5/8	2 1/8	4 1/2	64 01
64 02	3 1/8	3 3/4	3 1/16	3 1/8	2 3/8	4 3/4	3 7/8	3 1/4	3 1/8	2 1/2	2	4 1/8	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	8	64 02
64 04	3 3/4	4 1/2	4 1/4	3 3/4	3 1/16	10	4 5/8	3 7/8	4 5/8	3	3 1/2	10 1/2	5 7/16	5	4 1/4	4 1/16	3 5/16	14 1/2	64 04
64 08	4 3/8	5 1/4	5 5/8	4 3/8	3 15/16	18 3/4	5 3/8	4 1/2	6	3 1/2	4 3/8	18 1/2	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	24	64 08
64 12	■5 1/2	6 3/8	5 3/4	5 5/16	3 7/8	26	6 3/8	5 5/16	5 7/8	4 1/4	3 7/8	28	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	34	64 12
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68 01	2 1/2	3	2 13/16	2 1/2	2 3/8	3 1/4	3 1/16	2 1/2	3	2	2 1/16	2 7/8	3 13/16	3 1/2	3	2 5/8	2 1/8	4 1/2	68 01
68 02	3 1/8	3 3/4	3 1/8	3 1/8	2 1/2	5	3 7/8	3 1/4	3 3/4	2 1/2	2 1/2	5 1/2	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	8	68 02
68 04	3 3/4	4 1/2	4 3/8	3 3/4	3 1/8	10 1/2	4 5/8	3 7/8	5 1/8	3	3 7/8	12 1/2	5 7/16	5	4 1/4	4 1/16	3 5/16	15	68 04
68 08	4 3/8	5 1/4	5 3/4	4 3/8	4	19 1/2	5 3/8	4 1/2	6	3 1/2	4 3/8	19	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	23	68 08
68 12	■5 1/2	6 3/8	5 7/8	5 5/16	4	26	6 3/8	5 5/16	6	4 1/4	4	30	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	35	68 12
80 01	2 13/16	3 3/8	2 3/4	2 13/16	2 1/4	3 1/2	3 3/8	2 13/16	3 5/16	2 1/4	2 3/16	3 3/4	4 1/4	3 7/8	3 5/16	3	2 7/16	5 1/2	80 01
80 02	3 7/16	4 1/8	3 5/8	3 7/16	2 1/2	6 1/2	4 1/8	3 7/16	4 3/16	2 3/4	2 5/8	7	4 7/8	4 5/8	3 15/16	3 11/16	3	11	80 02
80 05	4 3/8	5 1/4	5 1/8	4 3/8	3 1/2	15 1/4	5 3/8	4 1/2	5 1/2	3 1/2	3 7/8	16 1/2	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	27	80 05
80 10	■5 1/2	6 3/8	5 1/2	5 5/16	4	28	6 3/8	5 5/16	5 3/4	4 1/4	4	29	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	35	80 10
80 25	■6 1/32	7 1/16	6 3/8	5 13/16	4 1/4	39							8 1/4	7 1/16	6 17/32	5 13/16	4 25/32	53	80 25
80 50	■7 5/8	9	8 1/2	7 5/8	6 5/8	89													80 50
120 01	3 1/8	3 3/4	3 3/8	3 1/8	2 1/2	5 3/8	3 7/8	3 1/4	3 3/4	2 1/2	2 1/2	5 1/2	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	8	120 01
120 02	3 3/4	4 1/2	4	3 3/4	3 1/8	9 3/4	4 5/8	3 7/8	4 3/8	3	3 1/8	9	5 7/16	5	4 1/4	4 1/16	3 5/16	12	120 02
120 04	4 3/8	5 1/4	4 7/8	4 3/8	3 5/8	16 3/8	5 3/8	4 1/2	5 1/2	3 1/2	3 7/8	15	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	25	120 04
120 08	■5 1/2	6 3/8	5 3/4	5 5/16	4 5/8	33	6 3/8	5 5/16	6	4 1/4	4 1/4	34	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	34	120 08
120 12	■5 1/2	6 3/8	7 1/2	5 5/16	5 3/4	43	6 3/8	5 5/16	7 3/4	4 1/4	6	44	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	47	120 12
180 00	3 1/8	3 3/4	3	3 1/8	2 1/8	4 1/4	3 7/8	3 1/4	3 1/8	2 1/2	2	4 1/4	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	7 1/8	180 00
180 01	3 7/16	4 1/8	3 7/8	3 7/16	2 5/8	7	4 1/8	3 7/16	4 1/8	2 3/4	3	7 1/4	4 7/8	4 5/8	3 15/16	3 11/16	3	12	180 01
180 04	■4 3/8	5 1/4	6 3/8	4 3/8	4 7/8	24	5 3/8	4 1/2	6 3/4	3 1/2	5 1/4	25	7 3/8	5 3/4	4 7/8	4 3/8	3 1/2	29	180 04
180 08	■5 1/2	6 3/8	7 1/2	5 5/16	5 3/4	43	6 3/8	5 5/16	7 3/4	4 1/4	6	44	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	47	180 08
230 00	3 1/8	3 3/4	3 1/4	3 1/8	2 3/8	5	3 7/8	3 1/4	3 5/16	2 1/2	2 3/8	5 1/8	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	7 3/4	230 00
230 01	3 7/16	4 1/8	4 3/8	3 7/16	3 1/8	8 1/4	4 1/8	3 7/16	4 5/8	2 3/4	3 1/2	8 3/4	4 7/8	4 5/8	3 15/16	3 11/16	3	12 3/4	230 01
230 02	4 3/8	5 1/4	5 1/4	4 3/8	3 3/4	17	5 3/8	4 1/2	5 11/16	3 1/2	4	17	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	27	230 02
230 05	■5 1/2	6 3/8	5 7/8	5 5/16	4	29	6 3/8	5 5/16	6 1/8	4 1/4	4 3/8	30	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	35	230 05
230 08	■6 1/32	7 1/16	7 5/8	5 13/16	5 1/2	50							8 1/4	7 5/16	6 17/32	5 13/16	4 25/32	68	230 08
300 00	3 7/16	4 1/8	3 3/8	3 7/16	2 5/16	6	4 1/8	3 7/16	3 7/8	2 3/4	2 3/4	6 1/4	4 7/8	4 5/8	3 15/16	3 11/16	3	10 1/2	300 00
300 01	3 3/4	4 1/2	4 5/8	3 3/4	3 7/16	11 1/4	4 5/8	3 7/8	4 13/16	3	3 3/4	11 1/4	5 7/16	5	4 1/4	4 1/16	3 5/16	14 1/2	300 01
300 02	4 3/8	5 1/4	6	4 3/8	4 5/8	20	5 3/8	4 1/2	6 1/2	3 1/2	5	21	7 3/8	5 3/4	4 7/8	4 3/8	3 1/2	28	300 02
300 05	■5 1/2	6 3/8	6 5/8	5 5/16	5	38	6 3/8	5 5/16	6 7/8	4 1/4	5 1/8	40	8 3/4	6 7/8	5 13/16	5 5/16	4 1/4	53	300 05

Add 3/16 to H W D for Style BE



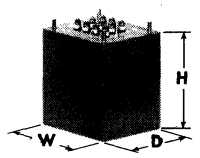
STYLE B: • "Open Frame" Bracket Mounted
• Double Vacuum Varnish Impregnated

STYLE BE: • Conforms to MIL-T-27B
• Epoxy Encapsulation added to Style B



OUTLINE DRAWINGS AVAILABLE

STYLE V: • Fully Enclosed in Metal Shells
• Ease of "Wiring with Leads"
• Attractive Appearance
• Dbl Vacuum Varnish Impregnated



STYLE CM: • Hermetically Sealed to MIL-T-27B
• Environment Proof
• Attractive Gray Finish
• Permanent Name Plate

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED
TODD SYSTEMS INC.
PRECISION BUILT
FAX: (914) 963-3506
50 ASH STREET, YONKERS, NY, U.S.A. 10701
(914) 963-3400

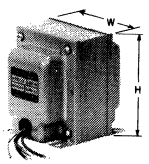
TODD ENGINEERED LINE ISOLATION ..... HIGH CURRENT CHOKES

LINE ISOLATION — OUTPUT 115 VOLTS — 50/60 HERTZ *UL* COMPONENTS

STRAIGHT ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — TWO STYLES

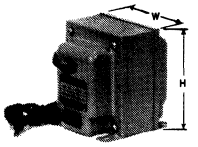
CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-25	25	115	1500	3 1/8	2 5/8	2 1/2	2	1 1/2	1 5/8
LI-50	50	115	1500	3 1/2	2 7/8	3	2 1/4	1 7/8	3
LI-100	100	115	1500	3 1/2	2 7/8	3 1/2	2 1/4	2 1/4	4
LI-175	175	115	1500	4 5/8	3 7/8	3 7/8	3	2 3/4	7
LI-250	250	115	1500	4 5/8	3 7/8	4 3/8	3	3 1/4	10
LI-350	350	115	1500	4 5/8	3 7/8	5 1/4	3	4 1/8	14
LI-500	500	115	1500	6	4 3/8	5 1/8	3 7/16	3 3/8	17 1/2
LI-750	750	115	1500	6	4 3/8	6 3/8	3 7/16	4 1/2	24
LI-1000	1000	115	1500	6	4 3/8	7 1/4	3 7/16	5 1/2	30
LI-1500	1500	115	1500	6 1/2	5 1/2	7 1/2	4 1/4	5 3/8	42
LI-2000	2000	115	1500	6 1/2	5 1/2	9	4 1/4	6 7/8	58
LI-100-1	100	230	2000	3 1/2	2 7/8	3 1/2	2 1/4	2 1/4	4
LI-250-1	250	230	2000	4 5/8	3 7/8	4 3/8	3	3 1/4	10
LI-500-1	500	230	2000	6	4 3/8	5 1/8	3 7/16	3 3/8	17 1/2
LI-1000-1	1000	230	2000	6	4 3/8	7 1/4	3 7/16	5 1/2	30
LI-1500-1	1500	230	2000	6 1/2	5 1/2	7 1/2	4 1/4	5 3/8	42
LI-2000-1	2000	230	2000	6 1/2	5 1/2	9	4 1/4	6 7/8	58

STYLE LO



LEAD WIRE TERMINALS

STYLE LRG



LINE CORD RECEPTACLE (W/GROUND)

ADJUSTABLE ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — • PRIMARY TAPPED • TWO STYLES

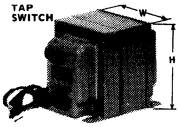
CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-50-2	50	105/115/125	1500	3 1/2	2 7/8	3 7/8	2 1/4	2 1/2	3
LI-100-2	100	105/115/125	1500	3 1/2	2 7/8	4 3/8	2 1/4	3	4 1/2
LI-250-2	250	105/115/125	1500	4 5/8	3 7/8	5 1/8	3	4	11 1/2
LI-500-2	500	105/115/125	1500	6	4 3/8	5 7/8	3 7/16	4 1/8	19
LI-1000-2	1000	105/115/125	1500	6	4 3/8	8 1/8	3 7/16	6 3/8	34
LI-50-3	50	210/230/250	2000	3 1/2	2 7/8	3 7/8	2 1/4	2 1/2	3
LI-100-3	100	210/230/250	2000	3 1/2	2 7/8	4 3/8	2 1/4	3	4 1/2
LI-250-3	250	210/230/250	2000	4 5/8	3 7/8	5 1/8	3	4	11 1/2
LI-500-3	500	210/230/250	2000	6	4 3/8	5 7/8	3 7/16	4 1/8	19
LI-1000-3	1000	210/230/250	2000	6	4 3/8	8 1/8	3 7/16	6 3/8	34

STYLE LO



LEAD WIRE TERMINALS

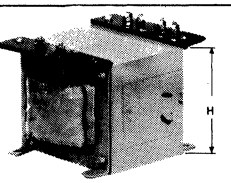
STYLE LRG



LINE CORD RECEPTACLE (W/GROUND)

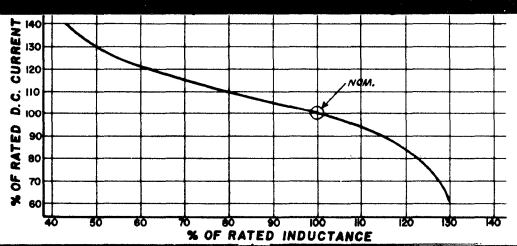
HI-POWER ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — BRACKET MOUNTED

CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-2500-4	2500	115/230	2000	6 1/8	7 1/8	8 3/4	5 7/8	7	60
LI-3000-4	3000	115/230	2000	7 1/2	9	7 7/8	7 1/2	6 1/2	95
LI-4000-4	4000	115/230	2000	7 1/2	9	9	7 1/2	7 5/8	113
LI-5000-4	5000	115/230	2000	7 1/2	9	10 1/4	7 1/2	8 7/8	135
LI-6000-4	6000	115/230	2000	7 1/2	9	11 3/4	7 1/2	10 1/4	168
LI-2500-5	2500	230/460	2500	6 1/8	7 1/8	8 3/4	5 7/8	7	60
LI-3000-5	3000	230/460	2500	7 1/2	9	7 7/8	7 1/2	6 1/2	95
LI-4000-5	4000	230/460	2500	7 1/2	9	9	7 1/2	7 5/8	113
LI-5000-5	5000	230/460	2500	7 1/2	9	10 1/4	7 1/2	8 7/8	135
LI-6000-5	6000	230/460	2500	7 1/2	9	11 3/4	7 1/2	10 1/4	168



SCREW TERMINALS

HIGH CURRENT CHOKES — 50/500 HERTZ — DIMENSIONS REFER TO HIGH CURRENT XFMR SKETCHES



- **Matching styles complement high current transformers**
- **Wide variety of compatible current ratings**

INDUCTANCE VARIATION

Graph indicates typical variation of inductance (%) when used at D.C. currents (%) other than the rated values.

Chokes operated at D. C. currents higher than rated value must be run on an intermittent basis to avoid overheating.

CATALOG NUMBER	INDUCTANCE (mh)	D.C. CURRENT (AMPS)	RESISTANCE (OHMS)	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) H	W	D	MW	MD	WGT.	• FULLY MTD. SHELLS (STYLE V) H	W	D	MW	MD	WGT.	• HERMETICALLY SEALED MIL-T (STYLE CM) H	W	D	MW	MD	WGT.
CH-00	200	.5	3.00	2 1/4	2 5/8	2	2	1 3/4	1 1/2	2 5/8	2 1/4	2 1/4	1 3/4	1 5/8	1 3/4	3 1/8	3	2 3/16	2 5/8	1 7/8	2 1/8
CH-01	100	1	1.50	2 1/2	2	2 1/8	2 1/2	2	2 1/4	3 1/8	2 1/2	2 5/8	2	1 3/4	2 1/4	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/4
CH-02	80	2	1.30	2 1/2	3	2 1/2	2 1/2	2	2 1/2	3 1/8	2 1/2	2 1/2	2	1 3/4	2 1/2	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/2
CH-04	60	4	.60	3 1/8	3 3/4	3 1/4	3 1/8	2 1/2	5 1/4	3 7/8	3 3/16	3 3/4	2 1/2	2 1/4	6	4 7/16	4 1/4	3 5/8	3 3/16	2 11/16	7 1/4
CH-05	50	5	.50	3 1/8	3 3/4	3 3/8	3 1/8	2 3/4	5 3/4	3 7/8	3 3/16	4	2 1/2	3	6 1/2	4 7/16	4 1/4	3 5/8	3 3/4	2 11/16	8
CH-06	40	6	.35	3 1/8	3 3/4	3 3/8	3 1/8	2 3/4	6	3 7/8	3 3/16	4	2 1/2	3	6 1/2	4 7/16	4 1/4	3 5/8	3 3/4	2 11/16	8 5/8
CH-08	30	8	.25	3 1/2	4 1/8	3 7/8	3 3/8	3	8	4 1/8	3 1/2	4 3/8	2 3/4	3 3/8	8 1/2	4 7/8	4 5/8	4	3 11/16	3	11 1/8
CH-12	20	12	.12	3 3/4	4 1/2	4 7/8	3 3/8	3 1/2	15 1/2	4 5/8	3 7/8	4 7/8	3	3 3/4	14	5 5/16	5	4 1/4	4 1/16	3 5/16	20
CH-16	15	16	.08	4 7/16	5 1/4	4 5/8	4 3/8	3 3/8	14 1/4	5 5/16	4 1/2	5 1/4	3 1/2	3 3/4	15	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	22 1/2
CH-20	10	20	.05	4 7/16	5 1/4	4 1/2	4 3/8	3 1/2	15 1/2	5 5/16	4 1/2	5 3/8	3 1/2	3 7/8	16	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	24
CH-25	6.5	25	.028	4 7/16	5 1/4	5	4 3/8	4	18 1/2	5 5/16	4 1/2	5 7/8	3 1/2	4 3/8	19 1/2	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	26 1/2
CH-30	5.5	30	.022	5 3/8	6 3/8	4 1/2	5 1/4	3 1/4	21	6 1/2	5 7/16	5 1/2	4 1/4	3 1/4	24	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	29 1/2
CH-40	4.0	40	.014	5 3/8	6 3/8	4 5/8	5 1/4	3 1/2	23	6 1/2	5 7/16	5 3/4	4 1/4	3 1/2	25	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	32 1/2
CH-50	3.0	50	.010	5 3/8	6 3/8	5 1/2	5 1/4	4 1/8	29	6 1/2	5 7/16	6 3/8	4 1/2	4 1/8	30	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	37
CH-100	.8	100	.003	5 3/8	6 3/8	5 3/4	5 1/4	4 5/8	35	6 1/2	5 7/16	6 7/8	4 1/4	4 3/8	36	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	45
CH-200	.35	200	.001	6 1/8	7 1/8	6 3/4	5 7/8	5 1/2	43												

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED
TODD SYSTEMS INC.
PRECISION BUILT
FAX: (914) 963-3506
50 ASH STREET, YONKERS, NY, U.S.A. 10701
(914) 963-3400

TODD ENGINEERED

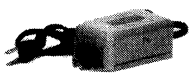
STEPDOWN AUTOTRANSFORMERS

CONVERT DOMESTIC APPLIANCES FOR USE ON FOREIGN VOLTAGES

50/60 HERTZ—*UL* COMPONENTS

PORTABLE MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-35	20	.7	1 1/2	1 3/4	2 3/4
SD-36	40	1.3	1 5/8	2	3 3/4
SD-37	60	1.4	1 5/8	2	3 3/4
SD-41	80	1.5	1 5/8	2	3 3/4



LINE CORD • RECEPTACLE

CHANNEL MOUNTED MODEL — 220/240 INPUT 110/120 OUTPUT

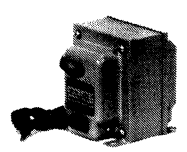
CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-24	50	1.6	2 1/4	2 3/4	2 1/4
SD-21	65	1.6	2 1/4	2 3/4	2 1/4
SD-25	80	1.9	2 1/4	2 3/4	2 3/8
SD-23	100	1.9	2 1/4	2 3/4	2 3/8
SD-26	125	2.4	2 5/8	3 1/16	2 1/2
SD-27	150	2.4	2 5/8	3 1/16	2 1/2



LINE CORD • PIGTAIL

HEAVY DUTY MODEL — 220/240 INPUT 110/120 OUTPUT

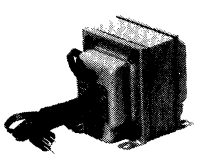
CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-16	100	2.5	3 1/8	2 5/8	3 1/4
SD-17	150	3.3	3 1/8	2 5/8	3 5/8
SD-38	200	4	3 1/8	2 5/8	4
SD-12	250	4.5	3 1/8	2 5/8	4 3/8
SD-43	300	4.6	3 1/8	2 5/8	4 1/2
SD-18	350	6.5	4 5/8	3 7/8	3 5/8
SD-11	500	9.7	4 5/8	3 7/8	4 1/4
SD-19	750	12	4 5/8	3 7/8	5
SD-13	1000	13.8	4 5/8	3 7/8	5 1/4
SD-14	1500	19	4 5/8	3 7/8	6 5/8



TWO PRONG LINE CORD/RECEPTACLE

HEAVY DUTY GROUNDED MODEL — 220/240 INPUT 110/120 OUTPUT

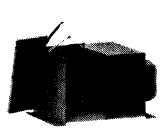
CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-16LRG	100	2.5	3 1/8	2 5/8	3 3/8
SD-17LRG	150	3.3	3 1/8	2 5/8	3 3/4
SD-38LRG	200	3.8	3 1/8	2 5/8	4 3/16
SD-12LRG	250	4.5	3 1/8	2 5/8	4 9/16
SD-43LRG	300	4.5	3 1/8	2 5/8	4 5/8
SD-18LRG	350	6.7	4 5/8	3 7/8	4 1/8
SD-11LRG	500	8.7	4 5/8	3 7/8	4 3/4
SD-19LRG	750	12.4	4 5/8	3 7/8	5 5/8
SD-13LRG	1000	13.7	4 5/8	3 7/8	6
SD-14LRG	1500	18.2	4 5/8	3 7/8	7 1/16
SD-20LRG	2000	24.2	5 15/16	4 3/8	6 7/16
SD-39LRG	2500	36	6 3/8	5 5/16	7 5/8



3 WIRE (GROUNDING) LINE CORD/RECEPTACLE

INDUSTRIAL MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-11JB	500	9.0	4	4 1/2	5 7/8
SD-19JB	750	12.8	4	4 1/2	6 3/4
SD-13JB	1000	14.3	4	4 1/2	7 3/4
SD-14JB	1500	18.5	4	4 1/2	9
SD-20JB	2000	25.	4 9/16	5 3/4	8 5/8
SD-39JB	2500	36.5	5 5/8	6 3/8	9 1/2
SD-28JB	3000	44.5	6 1/4	7	10
SD-29JB	4000	61.	6 1/4	7	12
SD-22JB	5000	54.	6 1/4	7	11
SD-30JB	6000	66.	6 1/4	7	12 1/4



JUNCTION BOX LEAD TERMINALS

3 TAP REFRIGERATION — 188/210 210/234 234/258 → 105V-50Hz (115V - 60Hz. INPUT V. +10%)

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31LRG	350	7.7	4 5/8	3 7/8	4 7/8
SD-32LRG	550	10.5	4 5/8	3 7/8	5 3/8
SD-33LRG	750	12.7	4 5/8	3 7/8	6
SD-42LRG	850	14.7	4 5/8	3 7/8	6 3/8
SD-34LRG	1000	17	4 5/8	3 7/8	7
SD-40LRG	1500	24.5	5 1/2	4 1/2	7 7/8
SD-44LRG	2000	24.7	5 1/2	4 1/2	7 7/8

STYLE LRG

TAP SWITCH



3 WIRE (GROUNDING) LINE CORD/RECEPTACLE

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31LO	350	7.5	4 5/8	3 7/8	3 7/8
SD-32LO	550	9.9	4 5/8	3 7/8	4 3/8
SD-33LO	750	12.2	4 5/8	3 7/8	5
SD-42LO	850	14	4 5/8	3 7/8	5 1/2
SD-34LO	1000	16.2	4 5/8	3 7/8	6
SD-40LO	1500	24	5 1/2	4 1/2	6 7/8
SD-44LO	2000	24	5 1/2	4 1/2	6 7/8

STYLE LO

JUNCTION BOX

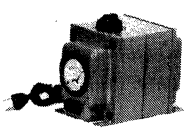


LEAD WIRE TERMINALS

MULTI-TAPPED VOLTAGE REGULATOR — METER • SWITCH

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	110/120
12	84	92	100	108	115	122	130	138	220/240
21	170	185	200	215	230	245	260	275	110/120
22	170	185	200	215	230	245	260	275	220/240

CATALOG NUMBER	TYPE	WATTS (VA)	WGT. LBS.	DIMENSIONS H	W	D
MVR-17	11 or 22	150	4.7	4 5/8	3 7/8	4 7/8
MVR-18	11 or 22	350	6.5	4 5/8	3 7/8	5 1/4
MVR-11	11 or 22	500	8.2	4 5/8	3 7/8	5 7/8
MVR-19	11 or 22	750	10	4 5/8	3 7/8	6 3/8
MVR-13	11 or 22	1000	13.7	4 5/8	3 7/8	7
MVR-14	11 or 22	1500	15.5	6	4 3/8	6 3/4
MVR-20	11 or 22	2000	20.5	6	4 3/8	7 3/8
MVR-17	12 or 21	150	5.9	4 5/8	3 7/8	5 1/2
MVR-18	12 or 21	350	7.9	4 5/8	3 7/8	5 3/4
MVR-11	12 or 21	500	13.3	6	4 3/8	6 3/4
MVR-19	12 or 21	750	15.5	4 5/8	3 7/8	7 1/4
MVR-13	12 or 21	1000	19	6	4 3/8	7 1/4
MVR-14	12 or 21	1500	25	6	4 3/8	8 3/8
MVR-20	12 or 21	2000	33.5	6	4 3/8	9 3/4

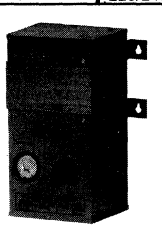


3 WIRE (GROUNDING) LINE CORD/RECEPTACLE

PANEL MOUNTED VOLTAGE REGULATOR — METER • SWITCH JUNCTION BOX

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	110/120
12	84	92	100	108	115	122	130	138	220/240
21	170	185	200	215	230	245	260	275	110/120
22	170	185	200	215	230	245	260	275	220/240

CATALOG NUMBER	TYPE	WATTS (VA)	WGT. LBS.	DIMENSIONS H	W	D
PVR-20	11 or 22	2000	27.	5 3/4	6 3/8	10 5/8
PVR-28	11 or 22	3000	34.5	5 3/4	6 3/8	11 1/2
PVR-29	11 or 22	4000	42.5	5 3/4	6 3/8	12 1/4
PVR-22	11 or 22	5000	48.5	5 3/4	6 3/8	13
PVR-30	11 or 22	6000	50.5	5 3/4	6 3/8	13 3/4
PVR-20	12 or 21	2000	57.5	6 1/2	7	13
PVR-28	12 or 21	3000	63	6 1/2	7	14 1/8
PVR-29	12 or 21	4000	67.5	6 1/2	7	14 1/2
PVR-22	12 or 21	5000	74.5	6 1/2	7	15
PVR-30	12 or 21	6000	78.5	6 1/2	7	15 1/2



- JUNCTION BOX
- LEAD TERMINALS

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED
FAX: (914) 963-3506
TODD SYSTEMS INC.
50 ASH STREET, YONKERS, NY, U.S.A. 10701
PRECISION BUILT
(914) 963-3400

Toroid®
SUPERIOR TRANSFORMERS

TOROIDAL POWER TRANSFORMERS

FOR 50/60 HZ LINE FREQUENCY

FEATURES OF TOROIDAL DESIGN

Our transformers will be your solutions in critical areas of:

- MAGNETIC STRAYFIELD
- TRANSFORMER NOISE
- SMALL DIMENSIONS
- LOW WEIGHT
- HIGH EFFICIENCY
- EASY ASSEMBLY

PRODUCT PROGRAM

CUSTOM DESIGN

CUSTOM MADE TRANSFORMERS from 20VA to 10,000VA for 60 Hz or 50/60Hz operation with UL and CSA family recognition. The table on the next page lists maximum data for custom made transformers using our standard core sizes. Other core sizes are available. Custom made transformers are often a preferred choice for optimized technical performance. For certain applications, custom design is also a cost saving alternative to standard transformers.

STANDARD OFF-THE-SHELF

STANDARD TRANSFORMERS UL recognized, for both 117V/60Hz and 115/230V 50–60Hz, 26VA–1000VA power range. All types are available from stock in Salisbury, MD. (See last page.)

We also offer transformer kits with factory made primary windings in sizes from 80VA to 1400VA. A line of **multi-voltage rectifier transformers** for 5V and ± 15V regulated DC are also stock items.

OTHER PRODUCTS

- 400 HZ TRANSFORMERS
- 3-PHASE TRANSFORMERS
- AUTO TRANSFORMERS
- INVERTER TRANSFORMERS FOR 50 OR 60 HZ
- CURRENT TRANSFORMERS FOR CONTROL APPLICATIONS
- FILTER CHOKES OF TOROIDAL DESIGN FOR 50/60 HZ

TOROID CORPORATION OF MARYLAND OFFERS

over 15 years experience of designing and manufacturing toroidal power transformers.

COMPUTERIZED TRANSFORMER DESIGN. For rectifier transformers we use proprietary software to calculate and optimize the design to meet the DC-data required after your rectifier circuitry.

UL AND CSA RECOGNIZED CONSTRUCTION including UL544 Medical Standard. UL and CSA recognition of custom designs can be obtained quickly under our family recognitions.

Our transformers are built to meet the requirements of IEC, VDE and other foreign safety agencies.

THE FACTORY

TOROID CORPORATION OF MARYLAND started its operation in late 1982. The rapid growth of the company and its early position as the market leader was made possible by design and manufacturing technology transferred from its Swedish affiliate Toroid Transformator AB. The U.S. operation occupies a modern plant in Salisbury, MD.

QUALITY

With our proprietary software programs, we can quickly and accurately design transformers for rectifier loads without approximations.... Thus we guarantee that our prototypes will meet the specified DC data the first time around. To ensure that our customers will always receive not only the ultimate design solution but also the highest quality of workmanship, strict control of our manufacturing processes is maintained together with ample training of operators and supervisors.

Winding our own cores of grain oriented high flux silicon steel is another step we have taken to have full control of every aspect of our manufacturing processes.

All transformers are subject to 100% inspection of electrical and mechanical data. Our standard electrical tests include no-load currents and no-load voltages;; 4000 volt Hi-Pot test for 2 seconds between primaries and secondaries. Winding resistances are measured on every production lot. Visual inspection includes physical dimensions and appearance. Additional tests can be specified by customer, e.g. maximum level of magnetic strayfields, mechanical hum, leakage current, etc. As a result, ALL OUR PRODUCTS ARE BACKED WITH A 36 MONTH WARRANTY.

For further information, please contact the factory sales department (301) 860-0300 or FAX (301) 860-0302 or our sales representative in your area:

U.S. SALES REPRESENTATIVES

California South	(213) 596-9411	FAX (213) 430-9084
California North	(408) 272-6836	FAX (408) 259-7376
Chicagoland	(708) 520-1200	FAX (708) 520-7927
New England	(508) 485-2215	FAX (508) 485-5186
Eastern Penn.	(215) 659-8938	FAX (215) 659-8076
MD, VA, DC	(703) 360-9039	FAX (703) 360-9202
Upstate New York	(716) 381-8350	FAX (716) 385-2103
	(315) 853-6126	FAX (315) 853-3011
Metro New York	(516) 724-3456	FAX (516) 724-3485
	(201) 579-7654	

CANADIAN REPRESENTATIVES

Ontario	(613) 727-3892	FAX (613) 727-0368

EUROPEAN DISTRIBUTORS

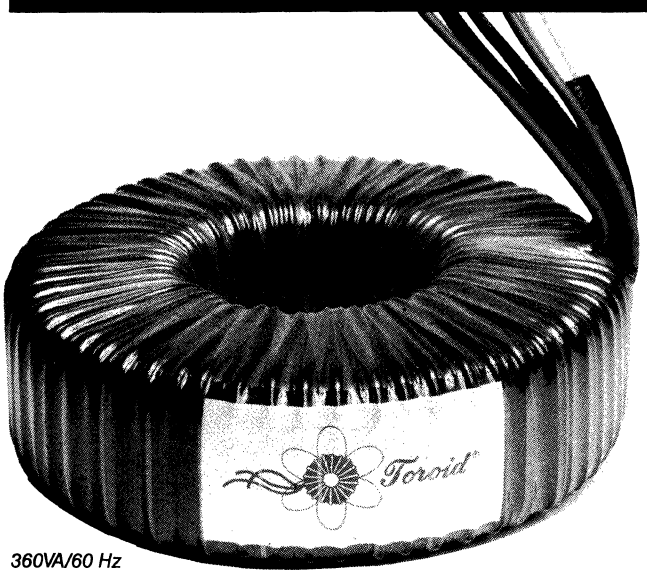
Austria	(43) 4762 5340	FAX 4762 534075
Finland	(358) 0880 152	FAX (358) 0889 112
France	(33) 1 30 64 09 00	FAX (33) 1 30 64 11 46
Sweden	(46) 47046000	FAX (0470) 46061
Switzerland	(41) 32 84 35 80	FAX (41) 32 84 62 87
United Kingdom	(44) 295 758 337	FAX (44) 295 750 040

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(301) 860-0300 • FAX (301) 860-0302

Toroid®
SUPERIOR TRANSFORMERS

TOROIDAL POWER TRANSFORMERS

FOR 50/60 HZ LINE FREQUENCY



360VA/60 Hz transformer— 4.5" OD x 2.3" H Weight = 5.3 lbs

SAFETY PARAMETERS

COMPLIANCE WITH SAFETY STANDARDS

Our transformers are recognized to UL standard 1411 and to CSA C22.2 No. 66.1988. Transformers for medical applications, recognized to UL 544, is one of our specialties. Our transformers are designed and built to meet the equivalent standards of IEC, VDE, CSA and other foreign safety regulatory agencies.

INSULATION SYSTEMS

To meet the stringent safety requirements for transformers, we use only UL recognized insulation material. Our transformers are constructed with reinforced insulation, which allows the transformer to be used without grounding. All our transformers are 100% hipot tested at 4000V rms for 2 seconds and have a minimum creep distance of 8 mm.

TEMPERATURE CONSIDERATIONS

Operating temperature is another important safety factor. Our transformers, built for Class A (105°C) operation, are normally calculated for a temperature rise of 60°–65°C. Actual increase will depend on how and where the transformer is mounted and how well it is cooled. When higher temperature ratings are needed, we offer UL recognized (UL1411 and UL544) transformers to class B (130°C). Transformers rated for class H (180°C) are also available.

Off-the-shelf standard transformers are listed on the last page.

APPLICATION NOTES

Our engineering staff has written three application notes (Transformer Facts):

- Bulletin #1—Form Factor and Size of Rectifier Transformers
- Bulletin #2—Supply Voltage and Primary Windings for Power Transformers
- Bulletin #3—Fuses and Overload Protection of Transformers

We will be glad to send you any of these bulletins free of charge.

MAXIMUM DATA FOR CUSTOM MADE TRANSFORMERS USING OUR STANDARD CORE SIZES

60 Hz operation		50/60 Hz operation		Approx Size & Weight of finished transformer		Core #
Max rated power (VA)	No-load loss (W)	Max rated power (VA)	No-load loss (W)	OD x H (inches)	Weight (lbs)	
26	.26	20	.20	2.4 x 1.2	.7	532
45	.32	35	.24	2.8 x 1.3	1.1	642
65	.48	50	.36	2.9 x 1.8	1.4	643
70	.54	57	.40	3.2 x 1.4	1.5	742
100	.79	85	.59	3.3 x 1.9	2.0	743
105	.63	87	.47	3.7 x 1.4	2.2	852
120	.77	100	.57	3.9 x 1.5	2.2	952
150	.94	120	.70	3.7 x 1.8	2.9	853
180	1.14	150	.85	3.9 x 1.9	3.0	953
185	1.21	150	.90	4.5 x 1.6	3.3	052
200	1.26	165	.94	3.8 x 2.3	3.3	854
240	1.52	190	1.13	3.9 x 2.3	3.8	954
265	1.81	225	1.35	4.5 x 1.9	4.4	1053
360	2.41	300	1.80	4.5 x 2.3	5.3	1064
440	2.60	360	1.94	5.5 x 2.0	5.7	1263
600	3.06	500	2.28	5.5 x 2.4	8.2	1274
720	3.82	600	2.85	5.5 x 2.8	9.7	1275
1,000	4.70	800	3.51	6.3 x 2.4	12.1	1584
1,200	5.90	1,000	4.40	6.3 x 2.9	15.0	1585
1,450	7.10	1,200	5.30	6.3 x 3.3	17.4	1586
1,700	7.20	1,400	5.40	7.9 x 2.6	20.0	18104
2,000	9.00	1,700	6.70	7.9 x 3.0	24.0	18105
2,400	10.80	2,000	8.10	7.9 x 3.3	27.8	18106
2,750	10.30	2,300	7.70	8.7 x 3.2	29.7	20125
3,250	12.40	2,700	9.30	8.7 x 3.5	35.2	20126
3,500	10.8	3,000	10.8	9.2 x 4.7	41.2	903200
4,100	14.3	3,600	14.3	10.3 x 4.7	44.6	904083
5,000	15.4	4,500	15.4	11.6 x 4.7	52.3	905060
6,200	18.0	5,400	18.0	11.6 x 5.0	65.5	905745
7,000	21.2	6,000	21.2	13.0 x 4.8	72.0	906477
7,800	24.7	6,600	24.7	13.2 x 5.1	79.5	907357
8,500	22.0	7,600	22.0	13.9 x 5.0	82.0	908182
10,000	25.7	8,500	25.7	14 x 5.5	95.5	909281

Power rating (VA) is determined by secondary RMS data. Physical size may vary from above data depending on number of primary and secondary windings.

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SUPERIOR TRANSFORMERS

TOROIDAL POWER TRANSFORMERS

AVAILABLE DESIGN OPTIONS

ULTRA-LOW MAGNETIC STRAYFIELD EMISSION DESIGN

Our standard design considerably reduces the strayfields in comparison with a laminated transformer. For sensitive applications, our optional Ultra-low Strayfield Design, achieved through a special process, further reduces the emission. In applications such as high resolution CRT displays, a magnetic shield around the circumference of the transformer can be added to achieve even lower strayfield levels.

FOREIGN SAFETY STANDARDS

In addition to offering UL recognized transformers, we also have a CSA family recognition to CSA C22.2 No. 66.1988. When required, we will construct our transformers to comply with other foreign safety standards, like EN 60742, IEC 742, VDE 0550, etc.

MEDICAL SAFETY STANDARDS

Our UL family recognition for custom designed transformers also includes UL544 safety standard for medical equipment. For your equipment exported to the Canadian and the overseas markets, our transformers can be built to meet their equivalent standards (CSA C22.2 No. 125, VDE 0551, IEC 601.1, etc.)

STATIC SHIELDING

Static shielding may be required to minimize capacitive coupling between primary and secondary winding when the transformer is used in an extremely noisy environment. Since the shield adds layers, a larger core size may be necessary to provide adequate inside diameter for the shuttle of the winding machine.

LEADS AND CONNECTORS

Standard is 8″ flying self-leads. Other lead lengths, multistranded leads, and mounted connectors are options.

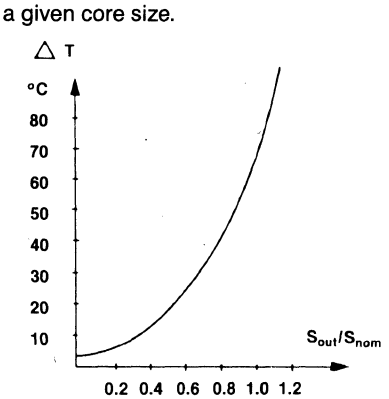
DESIGN DATA AND APPLICATION NOTES

A custom designed transformer is usually based on a standard core with appropriate power rating. Data for TOROID standard cores are shown on preceding page. Special cores can be manufactured to meet specific requirements, e.g. extremely low profile designs.

TEMPERATURE RISE

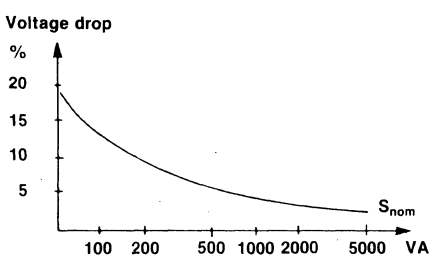
Our transformers are typically designed for a temperature rise of 60°C over ambient at full load. Using a larger core size will reduce the temperature rise due to the small core losses (in comparison with a laminated E/I core). The temperature rise will drop drastically when the output power is reduced. At half the load the temperature rise will only be approximately 25% of the rise at full load.

The figure shows how the temperature rise varies with the actual output power (S out) in relatin to nominal power (S nom) for a given core size.



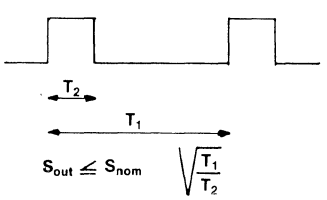
VOLTAGE DROP

Figure 2 shows voltage drop at full load for standard cores at 50/60 Hz. The voltage drop is slightly higher for a 60 Hz transformer. A design with an oversized core will reduce voltage drop and temperature rise.



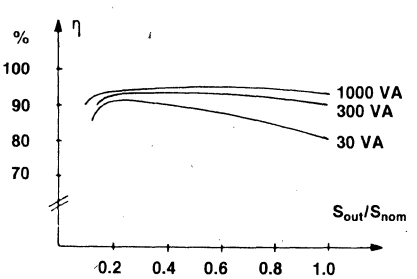
DUTY CYCLE

A smaller transformer can be designed if the load is not constant and the duty cycle is much shorter than the transformer's thermal time constant (which has a magnitude of hours). Note that the voltage drop increases linearly with the instantaneous current.



EFFICIENCY

Figure 4 shows typical curves for efficiency as a function of utput power in relation to nominal output power for different core sizes.



Off-the-shelf standard transformers are listed on the last page.

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608 Naylor Mill Road, Salisbury, MD 21801-9627
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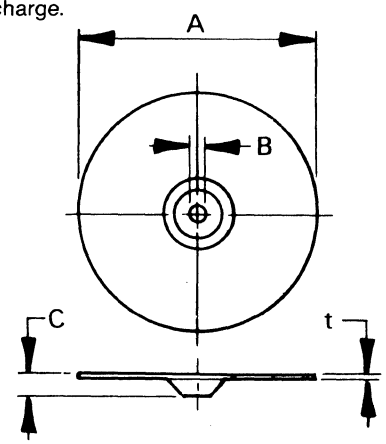
SUPERIOR Toroid® TRANSFORMERS

TOROIDAL POWER TRANSFORMERS

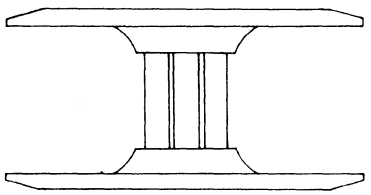
MOUNTING METHODS

MOUNTING WASHER

The normal mounting method of our transformers is by using a metal washer and two rubber pads, furnished at no extra charge.



P/N	A	B	C	t
W050	2.0	0.17	0.18	0.04
W060	2.4	0.20	0.22	0.05
W070	2.8	0.24	0.26	0.05
W090	3.5	0.24	0.28	0.06
W110	4.4	0.32	0.33	0.08
W145	5.7	0.32	0.37	0.08



POLY-MOUNT

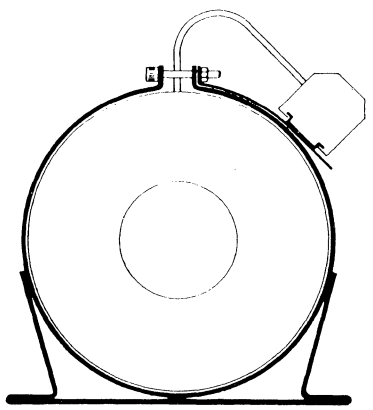
Our new Poly-Mount is an option and replaces the standard metal washer and rubber pads for transformers with power ratings up to 600VA. The Poly-Mount is shipped as an integral part of the transformer and will reduce the mounting time of the transformer. If required, the Poly-Mount can be removed from the transformer. The Poly-Mount consists of two parts made of UL recognized Polyamide with high temperature ratings. A screw through the center hole holds the assembly to the chassis. The Poly-Mount adds slightly to the total height of the transformer.

POTTED CENTER

For large size transformers, 15 lbs or more, or when the washer may cause height problems, we recommend Epoxy potting of the center hole. The top of the potting will be recessed to accommodate the screw head. A flat bottom of the potting is available upon request.

OMEGA BRACKET

For applications when vertical mounting i preferred, our **Omega** bracket is availabl with or without UL listed terminal blocks. I provides firm support for the transforme without any significant increase of size an weight. The bracket is made of yello chromated steel welded to a stand with slot for screw mounting. A large part of th transformer surface is exposed to the su rounding air, allowing for maximum cooling The Omega bracket is available fo transformers up to 3800 VA.



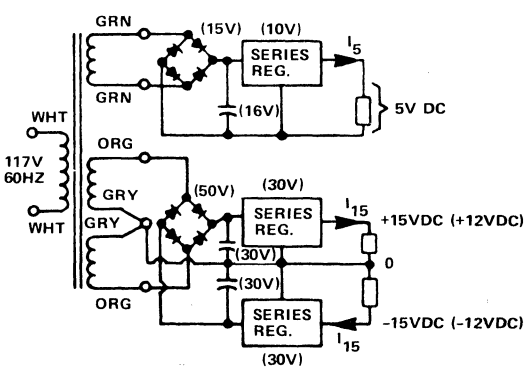
Off-the-shelf standard transformers are listed on the last page.

MULTIVOLTAGE RECTIFIER TRANSFORMERS

FOR 5V AND ±15V (OR ±12V) REGULATED DC AT 108V-130V LINE, 60 HZ (AVAILABLE FROM STOCK)

Max DC Current		OD × H Weight	Part No.	Price FOB Factory (includes 1 washer and 2 rubber pads)	
I_5	I_{15}			1-4	5-24
1.0A	.25A	2.4″ × 1.2″ .7 lbs	102.515	$41.00	$37.70
2.0A	.30A	2.8″ × 1.3″ 1.1 lbs	104.515	$44.10	$40.60
3.0A	.50A	3.2″ × 1.4″ 1.5 lbs	107.515	$47.30	$43.50
5.0A	.90A	3.9″ × 1.5″ 2.2 lbs	112.515	$53.60	$49.30

These transformers are designed to work with user-provided components per schematic shown. Note that the rated operating voltage for each component must be larger than the voltage shown in the diagram, and diodes and regulators must be rated to handle the DC current actually used. Capacitor sizes should be at least 7,000 μF per ampere DC used.



36 MONTHS PRODUCT WARRANTY *ENGINEERING HOT LINE NO.: 800-274-57*

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TOROIDAL POWER TRANSFORMERS

OFF-THE-SHELF TRANSFORMERS FOR 117V/60 Hz, UL/CSA RECOGNIZED

Part No.	Rated Power (VA)	Size OD x H (inches) Weight	Secondary Data		Typical DC data when transformer supplies bridge rectifier with large filter capacitor				Price FOB Factory Salisbury, MD (includes 1 washer and 2 rubber pads)		
					Secondaries in series		Secondaries in parallel				
			Volts/Amps	No-load Voltage (V)	DC Voltage (V)	DC Current (A)	DC Voltage (V)	DC Current (A)	Part No.	1-4	5-24
602.082	26	2.4 x 1.2	2 x 8.5/1.47	2 x 10.7	19.2 or 2 x 9.6	.94	8.6	1.88	602.082	$ 32.60	$ 30.00
602.122		.7 lbs	2 x 12/1.08	2 x 14.9	28.6 or 2 x 14.3	.68	13.3	1.36	602.122	$ 32.60	$ 30.00
602.152			2 x 15/0.87	2 x 18.6	36.0 or 2 x 18.0	.55	17.0	1.20	602.152	$ 32.60	$ 30.00
602.182			2 x 18/0.71	2 x 22.5	44.0 or 2 x 22.0	.45	21.0	.90	602.182	$ 32.60	$ 30.00
602.242			2 x 24/0.54	2 x 29.8	59.0 or 2 x 29.5	.34	28.5	.68	602.242	$ 32.60	$ 30.00
604.082	45	2.8 x 1.3	2 x 8.5/2.59	2 x 10.2	19.8 or 2 x 9.9	1.58	8.9	3.16	604.082	$ 34.50	$ 31.70
604.122		1.1 lbs	2 x 12/1.77	2 x 14.5	29.0 or 2 x 14.5	1.08	13.5	2.16	604.122	$ 34.50	$ 31.70
604.152			2 x 15/1.40	2 x 18.1	36.6 or 2 x 18.3	.86	17.3	1.72	604.152	$ 34.50	$ 31.70
604.182			2 x 18/1.24	2 x 21.6	44.0 or 2 x 22.0	.76	21.0	1.52	604.182	$ 34.50	$ 31.70
604.242			2 x 24/0.88	2 x 29.0	60.0 or 2 x 30.0	.54	29.0	1.08	604.242	$ 34.50	$ 31.70
607.082	70	3.2 x 1.4	2 x 8.5/3.94	2 x 9.80	20.0 or 2 x 10.0	2.30	9.0	4.60	607.082	$ 36.20	$ 33.30
607.122		1.5 lbs	2 x 12/2.92	2 x 13.8	29.4 or 2 x 14.7	1.70	13.7	3.40	607.122	$ 36.20	$ 33.30
607.152			2 x 15/2.30	2 x 17.3	37.0 or 2 x 18.5	1.34	17.5	2.68	607.152	$ 36.20	$ 33.30
607.182			2 x 18/1.90	2 x 20.8	44.8 or 2 x 22.4	1.10	21.4	2.20	607.182	$ 36.20	$ 33.30
607.242			2 x 24/1.44	2 x 27.6	60.0 or 2 x 30.0	.84	29.0	1.68	607.242	$ 36.20	$ 33.30
612.082	120	3.9 x 1.5	2 x 8.5/7.06	2 x 9.50	20.0 or 2 x 10.0	3.90	9.0	7.80	612.082	$ 41.40	$ 38.10
612.122		2.2 lbs	2 x 12/5.00	2 x 13.3	29.4 or 2 x 14.7	2.70	13.7	5.40	612.122	$ 41.40	$ 38.10
612.152			2 x 15/4.00	2 x 16.6	37.6 or 2 x 18.8	2.20	17.8	4.40	612.152	$ 41.40	$ 38.10
612.182			2 x 18/3.33	2 x 20.2	45.2 or 2 x 22.6	1.85	21.6	3.70	612.182	$ 41.40	$ 38.10
612.242			2 x 24/2.50	2 x 26.7	61.4 or 2 x 30.7	1.37	29.7	2.74	612.242	$ 41.40	$ 38.10
612.220			220/0.55	247	N/A						
617.122	180	3.9 x 1.9	2 x 12/7.50	2 x 13.0	29.6 or 2 x 14.8	3.90	13.8	7.80	617.122	$ 48.30	$ 44.40
617.152		3.0 lbs	2 x 15/5.90	2 x 16.4	38.0 or 2 x 19.0	3.10	18.0	6.20	617.152	$ 48.30	$ 44.40
617.182			2 x 18/5.00	2 x 19.5	45.8 or 2 x 27.9	2.60	21.9	5.20	617.182	$ 48.30	$ 44.40
617.242			2 x 24/3.58	2 x 26.3	61.8 or 2 x 30.9	1.90	29.9	3.80	617.242	$ 48.30	$ 44.40
636.242	360	4.5 x 2.3	2 x 24/7.45	2 x 25.4	62.0 or 2 x 31.0	3.63	30.0	7.26	636.242	$ 63.80	$ 58.70
636.302		5.3 lbs	2 x 30/6.00	2 x 31.7	78.8 or 2 x 39.4	2.90	38.4	5.80	636.302	$ 63.80	$ 58.70
636.332			2 x 33/5.45	2 x 34.9	87.0 or 2 x 43.5	2.60	42.5	5.20	636.332	$ 63.80	$ 58.70
636.382			2 x 38/4.74	2 x 40.3	100.0 or 2 x 50.0	2.30	49.0	4.60	636.382	$ 63.80	$ 58.70
636.502			2 x 50/3.60	2 x 52.9	132.0 or 2 x 66.0	1.75	65.0	3.50	636.502	$ 63.80	$ 58.70
636.220			220/1.64	233	N/A				636.220	$ 63.80	$ 58.70
660.242	600	5.5 x 2.4	2 x 24/12.50	2 x 25.2	65.0 or 2 x 32.5	5.85	31.5	11.70	660.242	$ 86.30	$ 79.40
660.302		8.1 lbs	2 x 30/10.00	2 x 31.5	79.0 or 2 x 39.5	4.70	38.5	9.40	660.302	$ 86.30	$ 79.40
660.332			2 x 33/8.64	2 x 34.7	87.0 or 2 x 43.5	4.10	42.5	8.20	660.332	$ 86.30	$ 79.40
660.382			2 x 38/7.76	2 x 39.9	100 or 2 x 50.0	3.65	49.0	7.30	660.382	$ 86.30	$ 79.40
660.502			2 x 50/6.00	2 x 52.5	133 or 2 x 66.5	2.80	65.5	5.60	660.502	$ 86.30	$ 79.40
660.220			220/2.59	231	N/A				660.220	$ 86.30	$ 79.40
699.502	1000	6.3 x 2.4	2 x 50/10.00	2 x 51.8	134 or 2 x 67.0	4.40	66.0	8.80	699.502	$120.80	$111.10
699.652		12.1 lbs.	2 x 65/7.69	2 x 67.4	175 or 2 x 87.5	3.40	86.5	6.80	699.652	$120.80	$111.10

OFF-THE-SHELF TRANSFORMERS 2x115V, 50-60 Hz, UL/CSA RECOGNIZED

Part No.	Rated Power (VA)	Size OD x H (inches) Weight	Secondary Data		Typical DC data when transformer supplies bridge rectifier with large filter capacitor				Price FOB Factory Salisbury, MD (includes 1 washer and 2 rubber pads)		
					Secondaries in series		Secondaries in parallel				
			Volts/Amps	No-load Voltage (V)	DC Voltage (V)	DC Current (A)	DC Voltage (V)	DC Current (A)	Part No.	1-4	5-24
703.082	35	2.8 x 1.3	2 x 8.5/2.10	2 x 10.3	19.2 or 2 x 9.6	1.40	18.2	2.80	703.082	$ 38.00	$35.00
703.152		1.1 lbs	2 x 15/1.20	2 x 18.8	36.2 or 2 x 18.1	.75	17.1	1.50	703.152	$ 38.00	$35.00
703.182			2 x 18/1.00	2 x 21.9	43.6 or 2 x 21.8	.65	20.8	1.30	703.182	$ 38.00	$35.00
706.082	57	3.2 x 1.4	2 x 8.5/3.30	2 x 10.1	20.0 or 2 x 10.0	2.00	9.0	4.00	706.082	$ 39.80	$36.60
706.152		1.5 lbs	2 x 15/1.90	2 x 17.6	36.8 or 2 x 18.4	1.15	17.4	2.30	706.152	$ 39.85	$36.60
706.182			2 x 18/1.60	2 x 21.2	44.6 or 2 x 12.3	.95	21.3	1.90	706.182	$ 39.80	$36.60
710.082	100	3.9 x 1.5	2 x 8.5/5.90	2 x 9.6	20.2 or 2 x 10.1	3.50	9.1	7.00	710.082	$ 45.60	$42.00
710.122		2.2 lbs	2 x 12/4.20	2 x 13.7	29.4 or 2 x 14.7	2.40	13.7	4.80	710.122	$ 45.60	$42.00
710.152			2 x 15/3.30	2 x 17.3	37.4 or 2 x 18.7	1.90	17.7	3.80	710.152	$ 45.60	$42.00
710.182			2 x 18/2.80	2 x 40.4	45.0 or 2 x 22.5	1.65	21.5	3.30	710.182	$ 45.60	$42.00
714.152	150	3.9 x 1.9	2 x 15/5.00	2 x 16.6	37.6 or 2 x 18.8	2.75	17.8	5.50	714.152	$ 53.10	$48.90
714.182		3.0 lbs	2 x 18/4.20	2 x 20.0	46.0 or 2 x 23.0	2.20	22.0	4.40	714.182	$ 53.10	$48.90
714.120			115/1.30	126.6	—	—	—	—	714.120	$ 53.10	$48.90

Prices are FOB factory, Salisbury, MD and include 1 mounting metal washer and 2 rubber pads.
AC and DC voltages are nominal. Tolerance for standard transformers ± 3%. Prices apply to total order quantity. Mixing and scheduled shipments over maximum 12 months allowed. Please call factory for larger volume prices. Prices and data are subject to change without prior notice.

36 Months Product Warranty

Engineering Hot Line No.: 800-274-5793

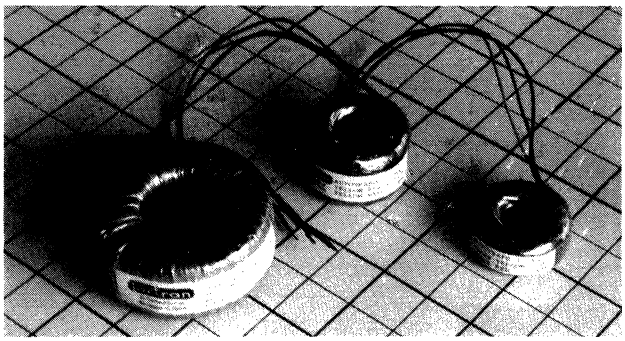
TOROID CORPORATION OF MARYLAND
608 Naylor Mill Road, Salisbury, MD 21801-9627
(301) 860-0300 • FAX (301) 860-0302

Tortran TOROIDAL MAGNETIC COMPONENTS
CUSTOM MADE-HIGHEST QUALITY

LINE POWER TRANSFORMERS

TOROIDAL TRANSFORMERS OFFER:

Low Profile	**High Efficiency**
Reduced Weight	**Improved Regulation**
Low Noise Level	**Easy Mounting**
Low Magnetic Stray Field	**Unlimited Flexibility**



STANDARD PROGRAM, TOROIDAL POWER TRANSFORMERS

In order to meet the day-to-day demand for prototypes and short production runs, we carry a stock of semi-fabricated transformers. These consist of cores with the primary winding and insulation already in place. In most cases the core with a 117V 60Hz primary represents the generic part of a transformer, whereas the secondary often requires special voltages, centertaps or multi-voltages at different current ratings.

By means of our semi-fabricated stock, in the majority of cases we can tailor make your secondaries with windings as required and color coded leads, and ship product out within a few days from the receipt of your order.

The stock program provides us with added flexibility, but in no way limits our capability of providing you with totally tailored transformers, meeting demands for odd dimensions, multiple primaries, or off-standard operating frequencies.

OFF-THE-SHELF PRIMARY WOUND TRANSFORMERS

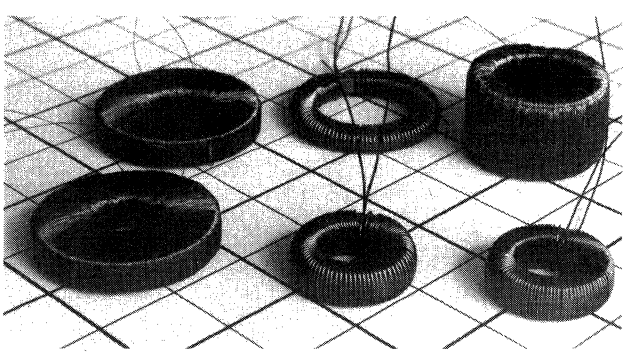
VA RATING FULL LOAD	REGULATION % VOLTAGE	MOUNTING DETAILS	FINISHED O.D x HT.	FIN. WEIGHT APP. LBS.
15	15	A	2.2" x 1.1"	.4
26	14	A	2.3" x 1.3"	.6
42	13	A	2.6" x 1.6"	.9
65	12	B	3.0" x 1.6"	1.3
100	10	B	3.4" x 1.8"	1.7
135	9	B	3.8" x 1.8"	2.6
180	8	B	4.1" x 1.9"	3.1
240	7	C	4.2" x 2.0"	3.9
320	6	C	4.5" x 2.1"	4.8
450	6	C	4.9" x 2.4"	5.8
600	5	C	5.2" x 2.8"	7.7

MOUNTING DETAILS

Zinc plated, circular steel washer +2 neoprene washers.
Mounting by means of one central screw.

SIZE 1	2" DIA.	.19 HOLE
SIZE 2	2.38" DIA.	.19 HOLE
SIZE 3	2.75" DIA.	.25 HOLE
SIZE 4	3.50" DIA.	.25 HOLE
SIZE 5	4.38" DIA.	.31 HOLE

CURRENT TRANSFORMERS, CHOKES, BALLASTS AND FILTERS



The toroidal design is utilized in instrument transformers to measure high currents in power cables and busbars. Instrument transformers can be taped, resin dipped or potted.

Toroids are also used to regulate current in AC systems for electronic and lighting applications and to filter out transients in sensitive electronic equipment. For these applications cores are often provided with a closely controlled air gap which is cut into the core before the wire is put into place. Core size, Gap width, Number of turns and Wire gauge are infinitely variable design parameters.

TORTRAN Inc. 915 PEMBROKE STREET, BRIDGEPORT, CT 06608
Phone: 203 - 367 - 5188 FAX: 203 - 384 - 8120

TOROTEL PRODUCTS INC.
13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 FAX (816) 763-2278

TRANSFORMERS

400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

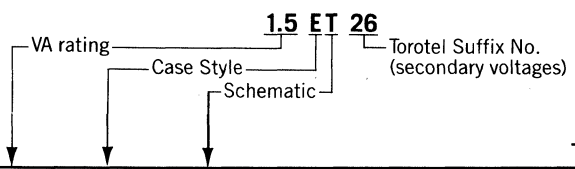
These 400 Hz Miniature Power Transformers are selected for use in all Military and Industrial applications requiring high performance in the smallest possible package size. They conform to all of the requirements of MIL-T-27, Class S (−55°C to +130°C). The minimum continuous operating life expectancy is 10,000 hours. This series is available having power ratings of 0.5 VA through 25 VA. The primaries are 115 Vrms with secondary voltages ranging from 5 Vrms through 300 Vrms.

Approved to all requirements of applicable MIL-T-27 Specification sheets

SEE MIL-T-27/XX QPL LISTING FOR QUALIFIED PARTS

It is recommended that these transformers be specified for all applications where space, weight, and cost effectiveness are prime considerations.

TOROTEL PART NUMBER EXAMPLE



MIL-T-27 Cross Reference

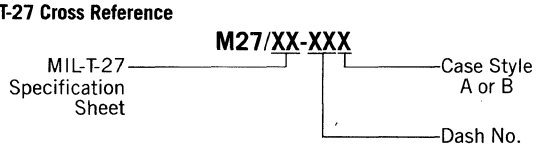


TABLE I

VA Rating	Package Style	Schematic	Size	Max. Height (Inches)	Regulation (%)		Available Secondary Voltages (VRMS)		Exciting Current (ma)	Efficiency (%)		Temperature Rise (°C)—MIL-T-27 No Heat Sink		Weight (Oz.)	
					Nom.	Max.	Min.	Max.	Max.	Min.	Nom.	Nom.	Max.	Nom.	Max.
0.5	S	T, X	—	—	15	18	5	300	1.5	65	70	10	15	0.38	0.4
0.5	S	S, Y	—	—	17	21	5	300	1.5	65	70	12	17	0.38	0.4
1.5	E, P	T, X	1	0.47	20	23	5	300	1.5	70	76	13	17	0.76	0.85
1.5	E, P	S, Y	1	0.59	15	18	5	300	3	70	76	13	17	0.97	1.1
2	E, P	T, X	1	0.78	3	3.7	5	300	6	72	87	10	15	1.5	1.65
2.4	E, P	S, Y	1	1.03	3	3.8	5	300	9	73	88	11	16	1.9	2.2
3	E, P	T, X	1	0.59	15	18	5	300	3	75	84	15	20	0.97	1.1
3	E, P	S, Y	1	0.78	10	12	5	300	6	75	84	15	20	1.5	1.65
3.6	E, P	T, X	1	1.03	3	3.8	5	300	9	76	87	10	15	1.9	2.2
6	E, P	T, X	1	0.78	10	12	5	300	6	81	88	18	25	1.5	1.65
6	E, P	S, Y	1	1.03	8	10	5	300	9	80	88	18	25	1.9	2.2
7.3	E, P	S, T, X, Y	2	0.97	3	3.5	5	300	16	84	92	15	23	3.2	3.4
9	E, P	T, X	1	1.03	8	10	5	300	9	83	89	23	30	1.9	2.2
13	E, P	S, T, X, Y	2	1.20	3	3.6	5	300	25	87	93	21	28	4.2	4.4
16	E, P	S, T, X, Y	2	0.97	7	8	5	300	16	87	92	25	32	3.2	3.4
25	E, P	S, T, X, Y	2	1.20	6	7	5	300	25	88	93	36	45	4.2	4.4

MAX WV = 325V for 180V sec. & lower
440V for 200V to 240V sec.
580V for 270V sec. & higher

M27/ DASH NUMBERS	TOROTEL PART NUMBERS	M27/ DASH NUMBERS	TOROTEL PART NUMBERS
M27/37-XXA	1.5ET **	M27/43-XXA	9 ET **
M27/37-XXB	1.5PT **	M27/43-XXB	9 BT **
M27/38-XXA	1.5ES **	M27/44-XXA	16 ET **
M27/38-XXB	1.5PS **	M27/44-XXB	16 PT **
M27/39-XXA	3 ET **	M27/45-XXA	16 ES **
M27/39-XXB	3 PT **	M27/45-XXB	16 PS **
M27/40-XXA	3 ES **	M27/46-XXA	25 ET **
M27/40-XXB	3 PS **	M27/46-XXB	25 PT **
M27/41-XXA	6 ET **	M27/47-XXA	25 Es **
M27/41-XXB	6 PT **	M27/47-XXB	25 PS **
M27/42-XXA	6 ET **		
M27/42-XXB	6 PS **		

TABLE II

USE SECONDARY VOLTAGES FOR TOROTEL SUFFIX NUMBER			
MIL. DASH NO.	TOROTEL SUFFIX (SEC. VOLTAGE)	MIL. DASH NO.	TOROTEL SUFFIX (SEC. VOLTAGE)
XX	**	XX	**
01	6	23	39
02	6.3	24	43
03	7	25	47
04	7.5	26	51
05	8	27	56
06	9	28	62
07	10	29	68
08	11	30	75
09	12	31	82
10	12.6	32	91
11	13	33	100
12	15	34	110
13	16	35	115
14	18	36	120
15	20	37	130
16	22	38	150
17	24	39	180
18	26	40	200
19	28	41	220
20	30	42	240
21	33	43	270
22	36	44	300

TOROTEL PRODUCTS INC.
13402 South 71 Highway / Grandview, MO 64030 / (816) 761-6314 FAX (816) 763-2278

TRANSFORMERS

400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

PHYSICAL SPECIFICATIONS

Size: Sizes for Standard VA Types are given in Table I, and Outline Drawings.

Construction: MIL-T-27, Grade 5; Black Epoxy Encapsulated.

Terminals: Printed circuit pins — tinned brass.

Terminal Strength (Method 211 of MIL-STD-202, Test Condition A): 2.0 pounds.

Marking: Includes MIL-T-27 Type Designation, winding ratings, maximum working voltage, schematc, Torotel name, and part number.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature Range: −55°C to +130°C (ambient plus temperature rise).

Altitude: 70,000 feet, maximum.

Vibration: MIL-STD-202, Method 204, Test Condition D.

Life Expectancy: 10,000 hours minimum.

Other Environmental Specifications: In accordance with MIL-T-27, Grade 5 Class S, Family 03.

ELECTRICAL SPECIFICATIONS

Primary Voltage: 115 volts rms ±10%.

Frequency: 400 Hz ±5%.

Secondary Voltage: See Table II.

Secondary Voltage Tolerance: ±3% at full load and 115 volts, 400 Hz applied to primary.

Electrostatic Shielding (Schematics S and Y): 5 to 1 minimum voltage ratio at 20 KHz.

Phase Shift: 1.0 electrical degree between primary and secondary voltage at rated load, maximum.

Insulation Resistance: 10,000 megohms minimum at 500 VDC.

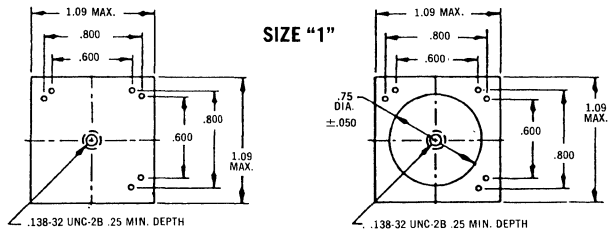
Dielectric Strength: At sea level—2.8 times the maximum working voltage. At reduced barometric pressure—1.25 times the maximum working voltage.

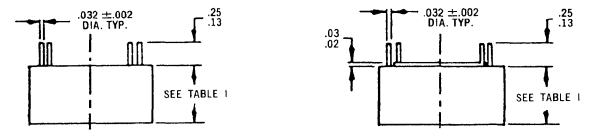
Mech. Tol. = ±.005 unless indicated.

PACKAGE STYLE E
(MIL-T-27 STYLE "A")

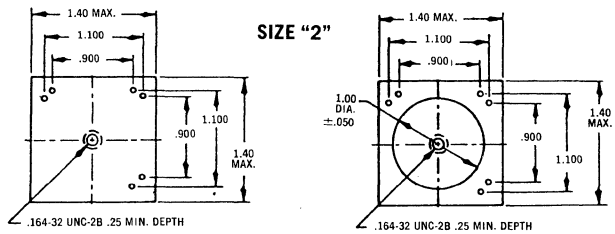
PACKAGE STYLE P
(MIL-T-27 STYLE "B")

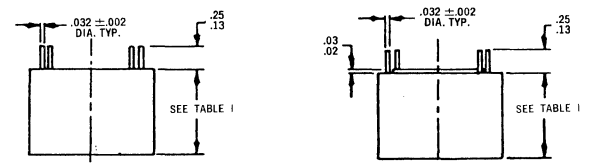
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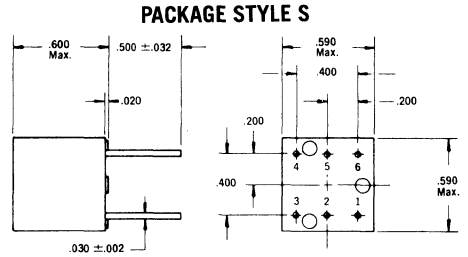


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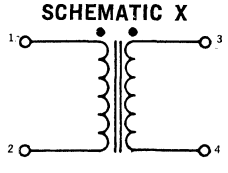
PACKAGE STYLE S



MECH. TOL. FOR STYLE "S" = ±.010 UNLESS INDICATED.

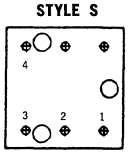
SCHEMATIC AND TERMINAL CONFIGURATIONS

SCHEMATIC X

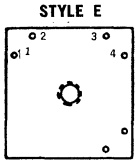


TERMINAL LAYOUTS

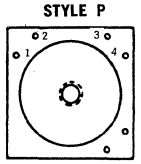
STYLE S



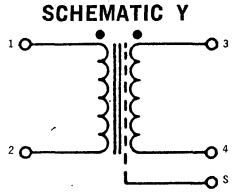
STYLE E



STYLE P

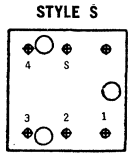


SCHEMATIC Y

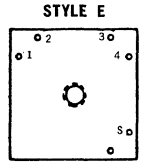


TERMINAL LAYOUTS

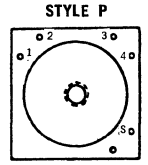
STYLE S



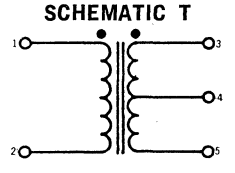
STYLE E



STYLE P

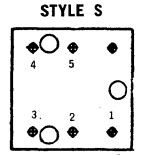


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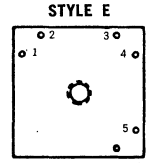


TERMINAL LAYOUTS

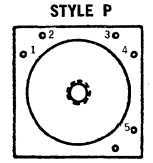
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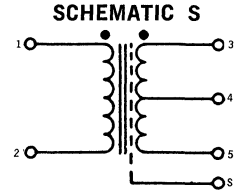
STYLE E



STYLE P

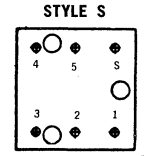


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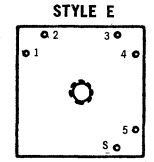


TERMINAL LAYOUTS

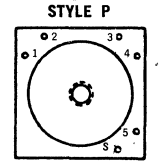
STYLE S



STYLE E



STYLE P



TRANSFORMERS

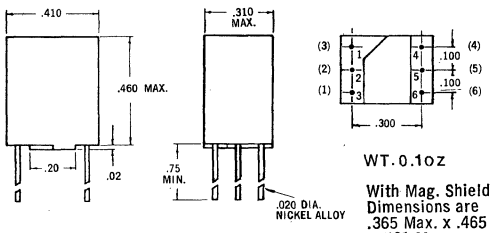
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SUBMINIATURE AUDIO TRANSFORMERS

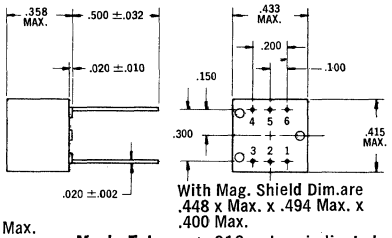
LT & LS SERIES
LU SERIES

A wide range of standard designs are available which meet the requirements of most common applications and allow for rapid delivery of prototype quantities. Special designs are also available in all three types.
LS, LT, and LU Series transformers are manufactured to the rigid requirements of MIL-T-27, Class S, Grade 5.

LS/LT SERIES



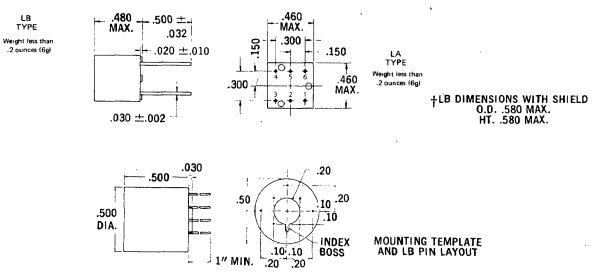
LU SERIES



Mech. Tol. = ±.010 unless indicated.

LA & LB SERIES

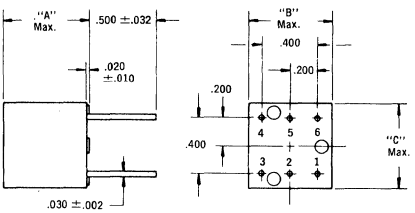
Torotel LA and LB Series transformers are manufactured to MIL-T-27, Grade 5, Class S specification. These series have 0.1 grid spaced terminals for printed circuit application. Both types have risers on mounting surfaces to prevent the formation of moisture traps and to facilitate cleaning of board assemblies.
The LA Series is electrically the same as the LB Series, but is packaged in a .460 inch cube with smaller outline dimensions for application where this configuration is more suitable.



AUDIO TRANSFORMERS

LL & LR SERIES

These tiny versatile "LL" transformers are provided with .020 risers and 0.1 grid spacing for printed circuit board applications and are manufactured to MIL-T-27, Grade 5, Class S specifications.
Response: ± 1 dB 200 to 50,000 Hz
Distortion: 10% max. at rated power, 200 to 50,000 Hz
Weight: 0.4 oz.
These miniaturized "LR" transformers are manufactured to MIL-T-27, Grade 5, Class S specifications and are ideally suited for a wide range of printed circuit applications.
Response: ± 1 dB 200 to 20,000 Hz
Distortion: 10% max. at rated power, 200 to 20,000 Hz
Weight: 1.0 oz.

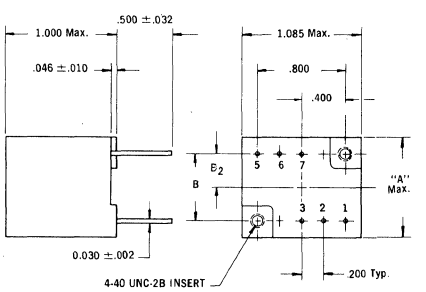


Series	A	B	C
LL	.600	.590	.590
LR	.925	.800	.710

LW & LY SERIES

"LW" Series transformers are manufactured to MIL-T-27, Grade 5, Class S specifications. Riser areas and 0.1 grid spacing make these units ideal for printed circuit board applications.
Response: ± 1 dB 100 to 10,000 Hz
Distortion: 1.5% max. at 60 mW, 200 to 10,000 Hz
Weight: 2.0 oz.
"LY" Series transformers are highly compact, efficient units with power output ratings to 7.5 watts. These transformers are manufactured to MIL-T-27, Grade 5, Class S specifications.
Response: ± 1 dB 60 to 10,000 Hz
Distortion: 1% max. at 250 mW, 200 to 10,000 Hz—10% max. at rated power 200 to 10,000 Hz
Weight: 2.5 oz.

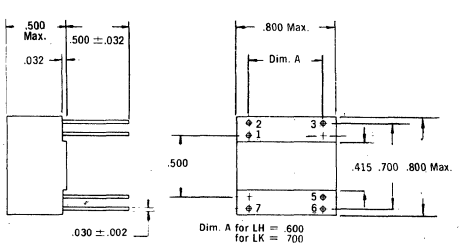
Series	A	B	B_2
LW	.900	.600	.300
LY	1.125	.800	.400



LH & LK SERIES

"LH" & "LK" Series transformers are the ultimate in compactness. Designed to meet MIL-T-27, Grade 5, Class S.
Response: ± 1 dB 200 to 10,000 Hz
Distortion: 10% max. at rated power, 200 to 10,000 Hz
Weight: .75 oz.

Series	A
LK	.700
LH	.600



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TRANSFORMERS

FAX THIS PAGE OR CALL CATALOG DATA DEPARTMENT, FOR CATALOG DATA SHEETS ON 201 STANDARD AUDIO AND 736 STANDARD POWER TRANSFORMERS ALL BUILT TO THE REQUIREMENTS OF MIL-T-27

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COMPANY _____

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See Inductor Section 1800 for 1762 Standard Inductors.

P.C. MOUNT 400Hz POWER TRANSFORMERS

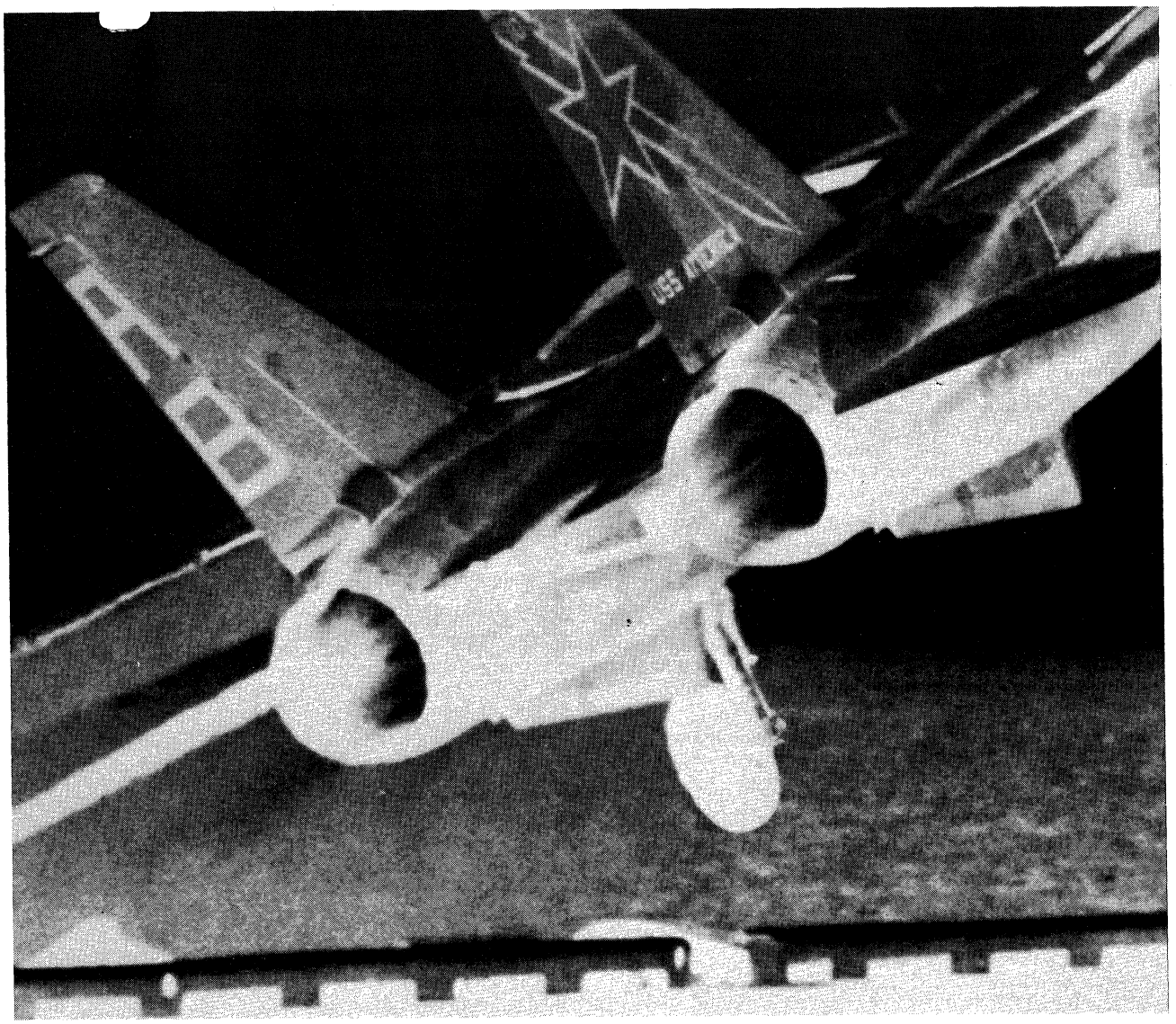
Primary: 115 Vrms Secondary: 5 Vrms-300Vrms

VA Rating	Size–Nom.*	Nom. Weight (oz)	Nom. Regulation (%)	Nom. Temp. Rise (°C)	Check Box
0.5	.59×.59×.60	0.38	15	10	
0.5 w/es	.59×.59×.60	0.38	17	12	
1.5	1.09×1.09×0.47	0.76	20	13	
1.5 w/es	1.09×1.09×0.59	0.97	15	13	
2	1.09×1.09×0.78	1.5	3	11	
2.4	1.09×1.09×1.03	1.9	3	11	
3	1.09×1.09×0.59	0.97	15	15	
3 w/es	1.09×1.09×0.78	1.5	10	15	
3.6	1.09×1.09×1.03	1.9	3	10	
6	1.09×1.09×0.78	1.5	10	18	
6 w/es	1.09×1.09×1.03	1.9	8	18	
7.3	1.40×1.40×0.97	3.2	3	15	
9	1.09×1.09×1.03	1.9	8	23	
13	1.40×1.40×1.20	4.2	3	21	
16	1.40×1.40×0.97	3.2	7	25	
25	1.40×1.40×1.20	4.2	6	36	

AUDIO TRANSFORMERS

*Custom Case Sizes Available

Series	Size–Nom.*	Max. Power	Check Box
LU	.42×.43×.36	50mW @ 1 KHz	
LS	.31×.41×.46	50mW @ 1 KHz	
LT	.31×.41×.46	50mW @ 1 KHz	
LA	.46×.46×.48	500mW @ 1 KHz	
LB	.50×.50	500mW @ 1 KHz	
LL	.59×.59×.60	150mW @ 200 Hz	
LH	.80×.80×.50	325mW @ 200 Hz	
LK	.80×.80×.50	325mW @ 200 Hz	
LR	.80×.71×.93	750mW @ 200 Hz	
LW	1.09×.09×1.00	3.5W @ 200 Hz	
LY	1.09×1.13×1.00	7.5W @ 200 Hz	



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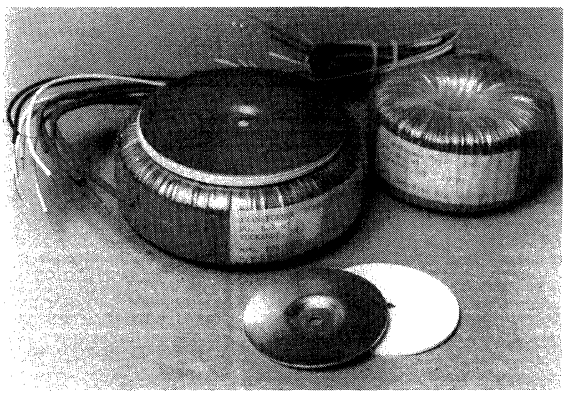
Trans American Transformer, Inc.

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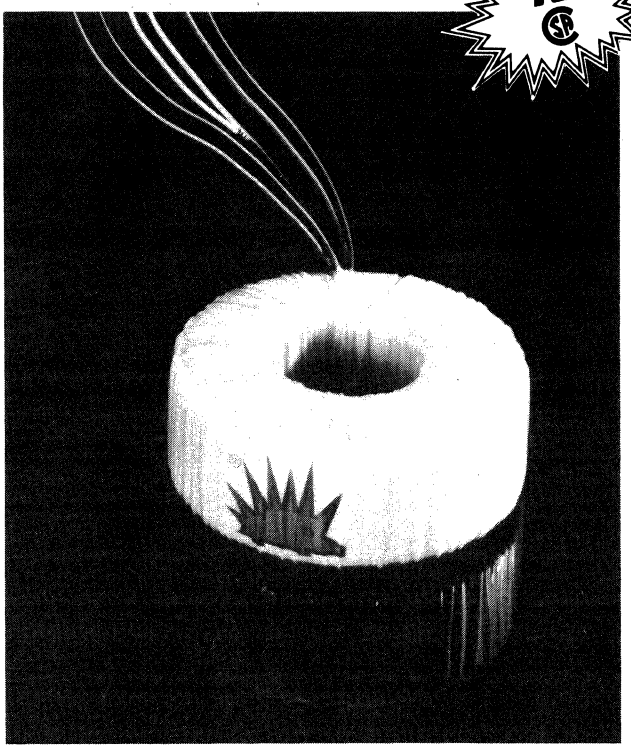
UL Recognized

The transformers listed below are supplied with a dimpled mounting washer and two rubber insulators.
Inputs based on 120V 60Hz
115/230V 50Hz also available.

NOMINAL POWER VA	SECONDARY OUTPUT VOLTS AC.			SECONDARY CURRENT AMPS AC		SIZE OD x H WEIGHT	PART NUMBER
	OUTPUT	PARALLEL	SERIES	PARALLEL	SERIES		
20	2 x 9	9V	18V	2.22	1.11	2.4 x 1.3 .7 LBS	SPT-20-9
	2 x 12	12V	24V	1.67	.835		SPT-20-12
	2 x 15	15V	30V	1.33	.666		SPT-20-15
	2 x 18	18V	36V	1.12	.560		SPT-20-18
	2 x 24	24V	48V	.83	.417		SPT-20-24
40	2 x 9	9V	18V	4.44	2.22	2.8 x 1.3 1.2 LBS	SPT-40-9
	2 x 12	12V	24V	3.34	1.67		SPT-40-12
	2 x 15	15V	30V	2.66	1.33		SPT-40-15
	2 x 18	18V	36V	2.24	1.12		SPT-40-18
	2 x 24	24V	48V	1.66	.83		SPT-40-24
60	2 x 9	9V	18V	6.66	3.33	3.2 x 1.5 1.5 LBS	SPT-60-9
	2 x 12	12V	24V	5.00	2.50		SPT-60-12
	2 x 15	15V	30V	4.00	2.00		SPT-60-15
	2 x 18	18V	36V	3.34	1.67		SPT-60-18
	2 x 24	24V	48V	2.50	1.25		SPT-60-24
80	2 x 9	9V	18V	8.88	4.44	3.6 x 1.5 1.8 LBS	SPT-80-9
	2 x 12	12V	24V	6.66	3.33		SPT-80-12
	2 x 15	15V	30V	5.33	2.66		SPT-80-15
	2 x 18	18V	36V	4.44	2.22		SPT-80-18
	2 x 24	24V	48V	3.33	1.66		SPT-80-24
100	2 x 9	9V	18V	11.11	5.55	3.9 x 1.5 2.2 LBS	SPT-100-9
	2 x 12	12V	24V	8.33	4.17		SPT-100-12
	2 x 15	15V	30V	6.67	3.33		SPT-100-15
	2 x 18	18V	36V	5.56	2.78		SPT-100-18
	2 x 24	24V	48V	4.17	2.08		SPT-100-24
120	2 x 12	12V	24V	10.00	5.00	3.9 x 1.7 2.7 LBS	SPT-120-12
	2 x 15	15V	30V	8.00	4.00		SPT-120-15
	2 x 18	18V	36V	6.67	3.33		SPT-120-18
	2 x 24	24V	48V	5.00	2.50		SPT-120-24
150	2 x 12	12V	24V	12.50	6.25	3.9 x 1.9 3.2 LBS	SPT-150-12
	2 x 15	15V	30V	10.00	5.00		SPT-150-15
	2 x 18	18V	36V	8.33	4.17		SPT-150-18
	2 x 24	24V	48V	6.25	3.12		SPT-150-24
180	2 x 12	12V	24V	15.00	7.50	4.5 x 1.5 3.6 LBS	SPT-180-12
	2 x 15	15V	30V	12.00	6.00		SPT-180-15
	2 x 18	18V	36V	10.00	5.00		SPT-180-18
	2 x 24	24V	48V	7.50	3.75		SPT-180-24
200	2 x 15	15V	30V	13.33	6.66	4.5 x 1.7 4.0 LBS	SPT-200-15
	2 x 18	18V	36V	11.11	5.55		SPT-200-18
	2 x 22	22V	44V	9.09	4.54		SPT-200-22
	2 x 24	24V	48V	8.33	4.16		SPT-200-24
	220V	—	—	.90	—		SPT-200-220
250	2 x 18	18V	36V	13.89	6.95	4.5 x 1.9 4.6 LBS	SPT-250-18
	2 x 22	22V	44V	11.36	5.68		SPT-250-22
	2 x 24	24V	48V	10.42	5.21		SPT-250-24
	2 x 30	30V	60V	8.33	4.17		SPT-250-30
	220V	—	—	1.14	—		SPT-250-220
300	2 x 18	18V	36V	16.67	8.33	4.5 x 2.2 5.2 LBS	SPT-300-18
	2 x 22	22V	44V	13.64	6.82		SPT-300-22
	2 x 24	24V	48V	12.50	6.25		SPT-300-24
	2 x 30	30V	60V	10.00	5.00		SPT-300-30
	220V	—	—	1.36	—		SPT-300-220
350	2 x 24	24V	48V	14.58	7.29	4.5 x 2.4 5.8 LBS	SPT-350-24
	2 x 30	30V	60V	11.66	5.38		SPT-350-30
	2 x 33	33V	66V	10.60	5.30		SPT-350-33
	2 x 38	38V	76V	9.21	4.60		SPT-350-38
	220V	—	—	1.59	—	—	SPT-350-220
400	2 x 30	30V	60V	13.33	6.66	5.2 x 2.1 6.1 LBS	SPT-400-30
	2 x 33	33V	66V	12.12	6.06		SPT-400-33
	2 x 38	38V	76V	10.52	5.26		SPT-400-38
	220V	—	—	1.81	—	—	SPT-400-220
550	2 x 30	30V	60V	18.33	9.16	5.5 x 2.4 8.5 LBS	SPT-550-30
	2 x 33	33V	66V	16.66	8.33		SPT-550-33
	2 x 38	38V	76V	14.47	7.23		SPT-550-38
	220V	—	—	2.50	—	—	SPT-550-220

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Over 90% of our output is for custom designs. Because they require no elaborate production tools and are individually wound, **toroidal transformers are particularly suited to custom designs.**

Take advantage of our **custom design service at no obligation.** Our experts can become part of your power supply design group. We'll show you how you can optimize your product's appearance and performance without increasing cost.

Our interactive computer aided design facilities enable us to optimize designs for either AC or DC loads.

Toroidal Power Transformers

Low Weight
Typically 50% lighter than traditional stacked lamination transformers.

Small Size
Low height profile allows slim, compact design of electronic equipment.

Flexible Dimensions
The Ulveco Toroidal Power Transformer can be "modeled" to fit very limited spaces and still conform to your electrical requirements.

Easy To Mount
Just one center screw easily and quickly mounts the Ulveco Toroidal Power Transformer to the chassis.

Low Magnetic Strayfield
No air gap and with primary and secondary windings evenly spread around the core, resulting in a very low radiated magnetic field.

Low Mechanical Hum
A single continuous strip of steel tightly wound into a roll results in a very solid and stable unit. No loose parts to buzz.

Small No Load Losses
Ulveco Toroidal Power Transformers can reduce open circuit power by 90% compared to traditional stacked lamination transformers.

Ulveco *Is* Dedicated To Product Quality & Customer Service.

Experience
With over twenty-five years of dedication to product excellence and quality, Ulveco enjoys the position of world leader in the design and manufacture of toroidal power transformers and inductors. We know Ulveco has been successful because of two key company philosophies:

—A strong belief that our quality standards will drive us to success

—A commitment to unequaled customer service

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California (South)	(619) 286-3633	FAX (619) 489-8167
California (North)	(408) 244-2200	FAX (408) 244-3058
Oregon	(503) 277-1761	
Washington	(206) 524-5170	FAX (206) 524-0402
Colorado	(303) 660-8750	FAX (303) 660-8752
Minnesota	(612) 338-3475	FAX (612) 338-6048
Georgia	(404) 455-0405	FAX (404) 457-7359
Wisconsin	(414) 242-6800	FAX (414) 242-6816

QUALITY IS AN ULVECO TRADITION

Ulveco Inc. **10401 Westoffice Drive, Houston, TX 77042** • **Tel.: 1-800-527-7042** • **FAX (713) 977-5031**

Ulveco

Standard Toroidals

- **Available from stock**
- **UL and CSA Recognized**
- **2 × 117 Volt, 50/60 Hz primary**
- **Dual isolated secondaries**
- **Power rating 15VA to 990VA**

We also carry a line of UL and CSA recognized off the shelf transformers for 117V/60 Hz from 18VA to 1,000 VA.

Our inventory of off-the-shelf toroidal transformers has been refined by years of experience in satisfying the requirements of engineers and designers for breadboards, prototypes, and short production runs.

Series AA 5 XXXX-YYY
Dual (2) 117 Volt, 50/60 Hz primaries to be connected in series or parallel. UL recognized and CSA certified.

Mounting
Supplied with one metal mounting disk and two rubber washers for simple, inexpensive one hole, one screw mounting.

Leads
Each winding is terminated with 10 inch insulated "flying leads" stripped at 1/4". Secondaries may be connected in series or parallel. Primary leads are double insulated.

Transformer Data, Standard Off-The-Shelf Toroidals

Nominal Power VA	Secondary Voltage VAC	Secondary Current AAC	Size Weight lbs.	Type No.
15	2×6	1.25	2.5×1.3	AA50152-006
	2×9	0.83	.07	AA50152-009
	2×12	0.62	#8	AA50152-012
	2×15	0.50		AA50152-015
	2×18	0.42		AA50152-018
	2×22	0.34		AA50152-022
30	2×6	2.50	3.0×1.5	AA50302-006
	2×9	1.67	1.1	AA50302-009
	2×12	1.25	#10	AA50302-012
	2×15	1.00		AA50302-015
	2×18	0.83		AA50302-018
	2×22	0.68		AA50302-022
50	2×6	4.2	3.2×1.4	AA50502-006
	2×9	2.8	1.6	AA50502-009
	2×12	2.1	#10	AA50502-012
	2×15	1.7		AA50502-015
	2×18	1.4		AA50502-018
	2×22	1.1		AA50502-022
	2×24	1.0		AA50502-024
95	2×9	5.3	3.9×1.5	AA50952-009
	2×12	3.9	2.2	AA50952-012
	2×15	3.2	1/4"	AA50952-015
	2×18	2.6		AA50952-018
	2×22	2.2		AA50952-022
	2×24	2.0		AA50952-024
	2×28	1.7		AA50952-028
	2×30	1.6		AA50952-030
140	2×12	5.8	3.9×1.9	AA51402-012
	2×15	4.7	3.0	AA51402-015
	2×18	3.9	1/4"	AA51402-018
	2×22	3.2		AA51402-022
	2×24	2.9		AA51402-024
	2×28	2.5		AA51402-028
	2×30	2.3		AA51402-030
	2×117	0.6		AA51402-117
185	2×12	7.7	4.5×1.9	AA51852-012
	2×15	6.2	4.0	AA51852-015
	2×18	5.1	1/4"	AA51852-018
	2×22	4.2		AA51852-022
185	2×24	3.9		AA51852-024
	2×28	3.3		AA51842-028
	2×30	3.1		AA51852-030
	2×117	0.8		AA51852-117
240	2×15	8.0	4.5×2.1	AA52402-015
	2×18	6.7	4.8	AA52402-018
	2×24	5.0	1/4"	AA52402-024
	2×30	4.0		AA52402-030
	2×38	3.2		AA52402-038
	2×117	1.0		AA52402-117
300	2×15	10.0	4.6×2.6	AA53002-015
	2×18	8.3	5.7	AA53002-018
	2×24	6.2	1/4"	AA53002-024
	2×30	5.0		AA53002-030
	2×38	3.9		AA53002-038
	2×117	1.3		AA53002-117
375	2×18	10.4	5.4×2.0	AA53752-018
	2×24	7.8	6.7	AA53752-024
	2×30	6.3	1/4"	AA53752-030
	2×38	4.9		AA53752-038
	2×117	1.6		AA53752-117
460	2×24	9.6	5.4×2.6	AA54602-024
	2×30	7.7	7.9	AA54602-030
	2×38	6.0	1/4"	AA54602-038
	2×117	2.0		AA54602-117
625	2×24	13.0	5.5×3.2	AA56252-024
	2×30	10.4	9.5	AA56252-030
	2×33	9.5	1/4"	AA56252-033
	2×38	8.2		AA56252-038
	2×117	2.7		AA56252-117
800	2×24	16.7	6.4×2.7	AA58002-024
	2×30	13.3	12.3	AA58002-030
	2×38	10.5	5/16"	AA58002-038
	2×48	8.2		AA58002-048
	2×117	3.4		AA58002-117
990	2×24	20.6	6.5×3.0	AA59902-024
	2×42	11.8	15.2	AA59902-042
	2×55	9.0	5/16"	AA59902-055
	2×117	4.2		AA59902-117

Ulveco

Custom Designed Toroidals

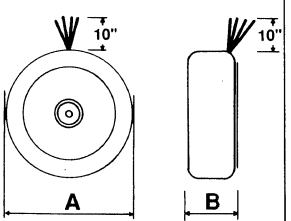
The Design Process
Our Computer Aided Design System, based upon years of experience, processes customer furnished data and presents our designers with several alternative solutions for electrical and mechanical dimensions, and a specification is assembled. In some cases the specification is forwarded to the customer for review, in others, prototype design is begun immediately.

Prototype Design
Initial prototypes are designed according to our general procedure based upon UL 1411, 506 and 544, as applicable, as well as CSA 22.2, No. 66. Every effort is made to fit the prototype design into our standard manufacturing process, but, when necessary, engineering and manufacturing cooperate to find new ways to solve customer's problems.

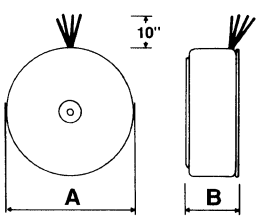
Prototypes
Prototypes are built and extensively tested, usually within a few days, by our regular production and inspection departments. After additional engineering tests for conformity to design specifications and safety agency requirements, the prototypes are shipped with their individual test reports. Our customers are encouraged both to bench test the transformers and to test them in the end equipment. We discuss and process modifications and, when necessary, furnish new prototypes. In most cases, the design is covered by our existing safety agency recognition/certification. In the few instances not covered, we will work closely with the agencies involved until the toroids are accepted.

Questions? Call 1-800-527-7042

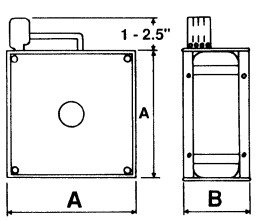
General Data Custom Designed Toroidals



Disk Mounting



TD-Capsule



Flange Mounting

Nominal Power (VA)	Copper Losses[2] (W)	Core Losses (w)	Disk Mounting Dimensions A inch	Disk Mounting Dimensions B inch	Disk Mounting Weight lb	TD-Capsule Dimensions A inch	TD-Capsule Dimensions B inch	TD-Capsule Weight lb	Flange Mounting Dimensions A inch	Flange Mounting Dimensions B inch	Flange Mounting Weight lb
15 (18)[1]	3.0	0.20	2.5	1.3	0.7	2.6	1.65	0.8			
30 (36)	5.8	0.25	3.0	1.5	1.1	3.1	1.65	1.2			
50 (60)	8.6	0.45	3.2	1.4	1.6	3.5	1.65	1.8			
80 (95)	12.0	0.60	3.9	1.5	2.2	3.9	1.65	2.4			
120 (145)	16.0	0.90	3.9	1.9	3.0	3.9	2.05	3.1	3.9	2.8	3.6
160 (190)	19.0	1.20	4.5	1.7	3.8	4.8	1.85	3.8	4.7	2.7	5.1
225 (270)	20.0	1.40	4.5	2.0	4.9	4.8	2.25	4.9	4.7	3.1	6.0
300 (360)	22.0	1.70	4.6	2.6	5.7	4.8	2.65	5.8	4.7	3.5	6.9
400 (480)	27.0	2.00	5.4	2.0	6.5				5.7	3.3	8.7
500 (600)	31.0	2.40	5.4	2.4	8.0				5.7	3.7	10.0
625 (750)	36.0	3.10	5.5	3.2	9.5				5.7	4.2	12.0
800 (960)	45.0	3.80	6.4	2.7	12.3				6.9	3.9	14.0
990 (1200)	45.0	4.70	6.4	3.0	16.0				6.9	4.3	17.0
1100 (1320)	45.0	6.50	6.4	3.3	17.0				6.9	4.6	19.0
1300 (1560)	60.0	5.70	8.0	2.6	20.0				8.3	3.9	22.0
1600 (1920)	62.0	7.10	8.0	3.0	23.0				8.3	4.3	24.0
1900 (2280)	65.0	8.50	8.0	3.4	26.0				8.3	4.7	29.0
2200 (2640)	73.0	8.10	8.9	3.3	29.0				9.3	5.1	33.0
2500 (3000)	79.0	9.70	8.9	3.5	33.0				9.3	5.3	37.0
2800 (3360)	89.0	11.00	9.8	3.1	35.0				10.2	4.9	40.0
3200 (3840)	91.0	11.00	9.8	3.5	42.0				10.2	5.3	46.0
3700 (4440)	93.0	15.00	9.8	3.9	46.0				10.2	5.7	51.0
4400 (5280)	112.0	17.00	11.2	4.3	53.0				11.6	6.1	59.0
5000 (6000)	112.0	20.00	11.2	4.7	62.0				11.6	6.5	68.0
6300 (7560)	130.0	27.00	12.4	4.7	76.0				13.8	6.5	82.0
8000 (9600)	140.0	28.00	13.4	4.7	88.0				13.8	6.5	97.0
10000 (12000)	140.0	39.00	13.4	5.9	120.0				13.8	7.7	130.0

The values given are typical values.
[1] Values within parenthesis are for 60Hz operation only.
[2] Copper losses at 25°C ambient temperature and full load.

QUALITY IS AN ULVECO TRADITION

LIFETIME WARRANTY

Ulveco Inc. **10401 Westoffice Drive, Houston, TX 77042** • **Tel.: 1-800-527-7042** • **FAX (713) 977-5031**

Ulveco

Specify Your Own Toroidal

Company _____ Date _____

Contact Name _____

Address _____ Telephone _____

City _____ State _____ Zip _____ FAX _____

Application _____

Customer P/N _____ Quote on: 1 10 25 50 100 250 500 1000

Estimated Power Out _____ Expected Duty Cycle (%) _____ Ambient Temp. _____ °C

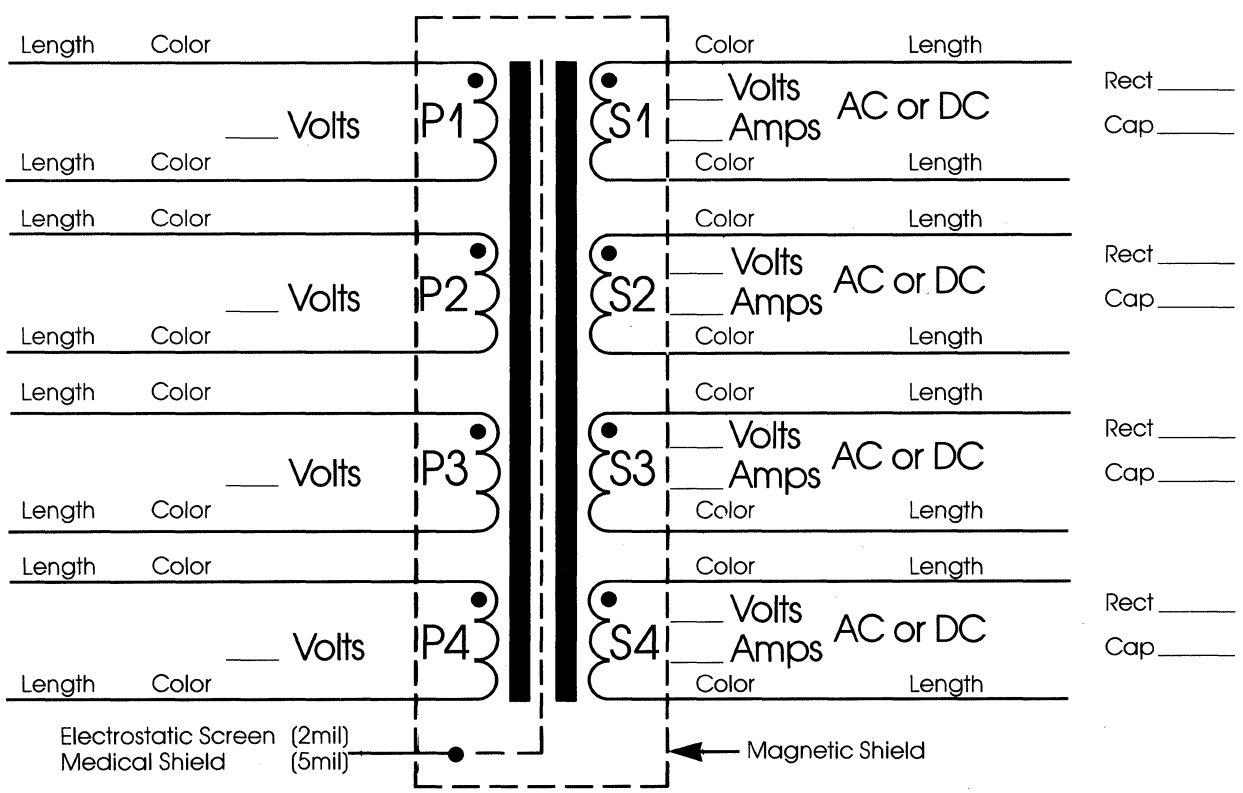
Max Temp Rise _____ °C AC Line Voltages 100 115 120 200 220 230 240 Other _____

Line Frequency _____ (Hz) Thermal Protection: resettable single-shot Temp _____ °C

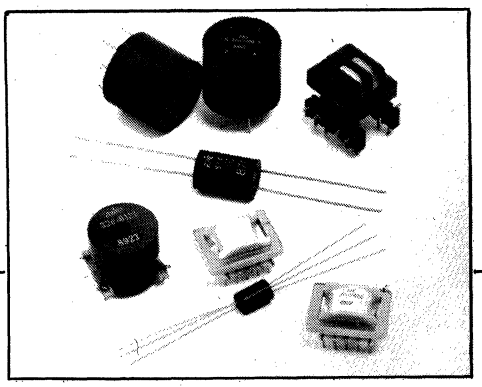
Dimensional Restrictions: Max Diameter _____ Max Height _____ (inch or mm)

Preferred Mounting Configuration: Disk Td Cap Center Potted Flange or "L" Bracket

Lead Type: Self or Stranded Safety Agency Considerations: UL CSA IEC VDE Other _____



VERNITRON
CORPORATION
AIE MAGNETICS DIVISION
2801 72nd St. N. • St. Petersburg, FL 33710
(813) 347-2181 • FAX: (813) 347-3881



TRANSFORMERS

Wide Band Transformers
AIE Magnetics offers thousands of existing designs of impedance matching wide band transformers. These miniature transformers are ideal for coupling and impedance matching over a frequency range from audio to several megahertz. The units feature printed circuit and axial lead designs.

TYPICAL APPLICATIONS
• LOW POWER CIRCUITS • COMMUNICATIONS EQUIPMENT • INDUSTRIAL CONTROLS • ANALOG MONITORING EQUIPMENT • TEST EQUIPMENT • IF • RF
FEATURES
• MINIATURE SIZE • WIDE FREQUENCY RESPONSE • LOW DISTORTION • LOW PHASE SHIFT • UP TO 1 WATT RATING

Pulse Transformers...Bobbin & Sleeve and Toroidal
AIE Magnetics has developed two distinct categories of pulse transformers. For transfer of maximum pulse power with volt-microsecond products ≥ 10, excellent pulse reproduction, lowest leakage inductances and high inductance values, our unique bobbin and sleeve constructions are used. Our toroidal construction is limited to low volt-microsecond products ≤ 10, very low DC bias current; and less than 50% duty cycles. This type of transformer is widely used in digital equipment for isolation and voltage transformation.

TYPICAL APPLICATIONS
• MULTIVIBRATORS • ONE-SHOT OSCILLATORS • BLOCKING OSCILLATORS • VOLTAGE TRANSFORMATION • ISOLATION
FEATURES
• MAXIMUM PULSE POWER • HIGH INDUCTANCES • LOW LEAKAGE INDUCTANCES • SMALL PACKAGE SIZE

Balun Transformers
AIE Magnetics offers a standard series of common-mode line chokes in a wide range of current and inductance values. These chokes are used to reduce the AC line conducted interference which is produced by switching power supplies with switching frequencies of 10KHz or greater.

TYPICAL APPLICATIONS
• DATA COMMUNICATIONS • TELECOMMUNICATIONS
FEATURES
• DESIGNED TO MEET VDE, IEC, UL, CSA • WIDE RANGE OF CURRENT RATINGS AND INDUCTANCES AVAILABLE • 3750 VRMS ISOLATION BETWEEN WINDINGS • COST-EFFECTIVE DESIGN • LOW INTERWINDING CAPACITANCE

Modem Transformers
AIE Magnetics offers an extensive line of modem transformers including units for private line transmission at 56,000 bits per second.

TYPICAL APPLICATIONS
• DATA COMMUNICATIONS • TELECOMMUNICATIONS
FEATURES
• LARGE SELECTION • COST-EFFECTIVE DESIGN • LOW DISTORTION

Low Profile Modem Transformers
AIE Magnetics has designed and developed a line of very low profile transformers for voice or data communication for use on voice grade telephone lines. They have a maximum height of .400" and occupy only 1.0 square inch of circuit board space. Two types of units were designed; one to carry 5 mA dc unbalance current, the other Ø mA dc. Longitudinal balance is better than 60 dB over the operating frequency range of 300 Hz to 3500 Hz.

TYPICAL APPLICATIONS
• DATA COMMUNICATIONS • TELECOMMUNICATIONS
FEATURES
• MINIATURE SIZE • COST-EFFECTIVE DESIGN • LEVEL: −15 dBm to +7 dBm • VOLTAGE BREAKDOWN: 1500 VAC MIN. • LONGITUDINAL BALANCE: 60 dB MIN. (MEASURED ON A WILCOM T-207 TEST SET) • DISTORTION: 0.5% max.

SCR Transformers
AIE Magnetics manufactures a broad line of SCR transformers for commercial and industrial applications where fast rise time and efficient energy transfer are desired. Series 306 and 314 meet all applicable requirements of Underwriters Laboratory and Canadian Standards Association for line isolation up to 550v and temperature ambients of −55°C to +105°C. Our Series 326 is a commercial grade designed for application in typical industrial conditions between −30°C and +85°C.

TYPICAL APPLICATIONS
Numerous SCR circuit applications utilizing transformer coupling are given in the GE, Westinghouse, and Motorola SCR handbooks, as well as application notes from all of the leading SCR manufacturers. Contact AIE for the recommended transformer for optimum performance in any of these circuit applications.
FEATURES
• FAST RISE TIME • LOW DC RESISTANCE • HIGH ET • HIGH DIELECTRIC • SMALL SIZE

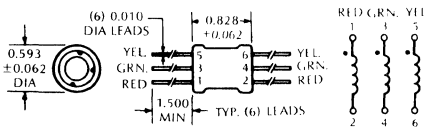
VITEC

TRANSFORMERS & INDUCTORS

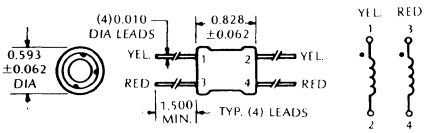
TYPE 11Z *TRIGATE® PULSE TRANSFORMERS*

- Designed for low cost SCR triggering applications including motor speed controls, heater controls and incandescent lighting controls.
- Choice of flexible lead and printed circuit mounting constructions.
- Balanced pulse characteristics and energy transfer from the primary to secondary and tertiary windings.
- Minimum saturation effect to allow operations where increased pulse widths are required.
- Fast pulse rise time and increased current capability to prevent SCR failure.
- Increased energy transfer efficiency.
- Operating Temperature: −10°C to +70°C

STYLE 2



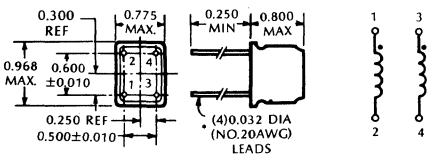
STYLE 1



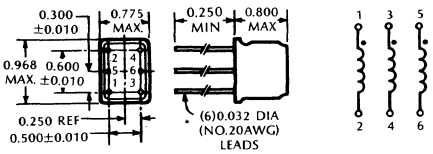
Part Number	Turns Ratio	Lp μH Min.	LI μH Max.	Cc pF Max.	DCR OHM Max.	Dielectric Test @ 60 Cy Vrms Min.	A-C Line Voltage @ 60 Cy Vrms Max.	Case Style
11Z12	1:1	200	3	800	1.5-1.5	1600	240	1
11Z13	1:1:1	200	3	800	2-2-2	1600	240	2
11Z14	2:1	1000	10	1300	10-2	1600	240	1
11Z15	2:1:1	1000	15	1300	10-2-2	1600	240	2
11Z16	5:1	5000	1500	400	19-3	1600	240	1

TYPE 11Z *PRINTED CIRCUIT BOARD DESIGNS/ THERMOPLASTIC SHEATH*

STYLE 3



STYLE 4

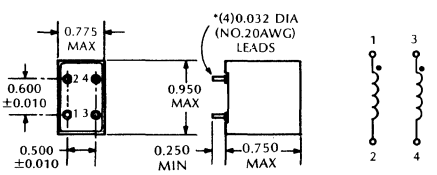


11Z2000	1:1	200	3.0	800	1.5-1.5	1600	240	3
11Z2001	1:1	1000	12.0	2000	8-8	1600	240	3
11Z2002	1:1	5000	15.0	3500	18-18	1600	240	3
11Z2003	2:1	1000	10.0	1300	10-2	1600	240	3
11Z2004	5:1	5000	1500	400	19-3	1600	240	3
11Z2100	1:1:1	200	3.0	800	2-2-2	1600	240	4
11Z2101	1:1:1	1000	12.0	2000	10-10-10	1600	240	4
11Z2102	1:1:1	5000	15.0	3500	2-27-27	1600	240	4
11Z2103	2:1:1	1000	15.0	1300	10-2-2	1600	240	4
11Z2104	5:1:1	5000	1500	400	20-4-4	1600	240	4
11Z2200	1:1	200	5.0	500	3-3	2500	550	3
11Z2201	2:1	1000	16.0	1300	10-5	2500	550	3
11Z2300	1:1:1	200	5.0	500	5-5-5	2500	550	4
11Z2301	2:1:1	1000	20.0	1300	40-20-20	2500	550	4

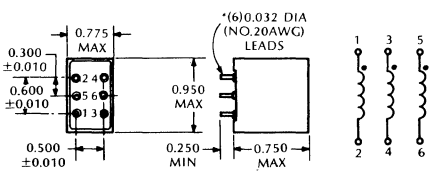
TYPE 11Z *PRINTED CIRCUIT BOARD DESIGN/PRE-MOLDED CASE*

- Superior moisture protection under conditions of high humidity.
- Mechanical and electrically interchangeable with 11Z 2000 series having the corresponding last digits in the part number.
- Underwriter Laboratories recognized.

STYLE 5



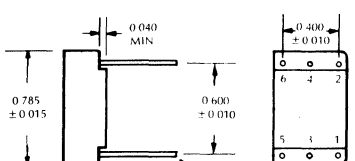
STYLE 6



11Z3000	1:1	200	3.0	800	1.5-1.5	1600	240	5
11Z3001	1:1	1000	12.0	2000	8-8	1600	240	5
11Z3002	1:1	5000	15.0	3500	18-18	1600	240	5
11Z3003	2:1	1000	10.0	1300	10-2	1600	240	5
11Z3004	5:1	5000	1500	400	19-3	1600	240	5
11Z3100	1:1:1	200	3.0	800	2-2-2	1600	240	6
11Z3101	1:1:1	1000	12.0	2000	10-10-10	1600	240	6
11Z3102	1:1:1	5000	15.0	3500	27-27-27	1600	240	6
11Z3103	2:1:1	1000	15.0	1300	10-2-2	1600	240	6
11Z3104	5:1:1	5000	1500	400	20-4-4	1600	240	6
11Z3200	1:1	200	5.0	500	3-3	2500	550	5
11Z3201	2:1	1000	16.0	1300	10-5	2500	550	5
11Z3300	1:1:1	200	5.0	500	5-5-5	2500	550	6
11Z3301	2:1:1	1000	20.0	1500	40-20-20	2500	550	6

TYPE 12Z *SCR TIRGGER TRANSFORMERS IN PRE-MOLDED CASE*

- Designed specifically for industrial and military SCR triggering applications
- Epoxy encapsulated in a small pre-molded case gives superior humidity resistance.
- Provide low-noise operation of high power SCR resonant inverters.
- Meet design requirements of most sine wave inverter circuits.
- Operating Temperature: −55°C to +125°C
- Peak Working Voltage: 10,000 Megohms Per MIL-STD-202, Method 302
- Dissipation Rating: 0.3 Watts at +25°C



Part Number	Turn Ratio ±5%	Primary* Inductance mH Min.	Primary ET-Rating VμS Min.	Pri/Sec** CC pF Max.	Pri/Sec** LL μH Max.	Primary DCR OHMS Max.	Secondary DCR OHMS Max.	Dielectric Test Vrms Min.	Schematic Fig.
12Z4903	1:1:1	0.7	60	25	300	6.5	6.5	2200	1
12Z4906	1:1	4.8	110	50	20	3.0	3.5	2200	2
12Z4923	1:1	0.7	60	25	350	5.5	5.5	2200	2
12Z4932	1:1:1	4.8	110	50	20	5.0	6.0	2200	3

*Test Frequency at 10 KHz
**Test Frequency at 130 KHz

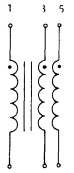
FIG. 1 

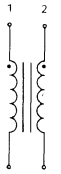
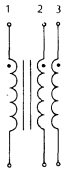
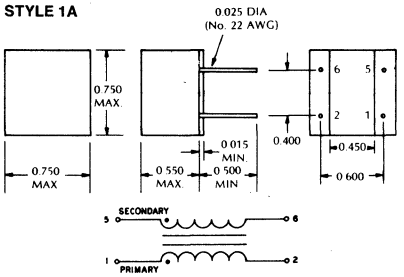
FIG. 2 

FIG. 3 

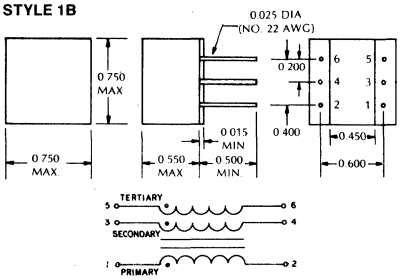
VITEC

TRANSFORMERS & INDUCTORS

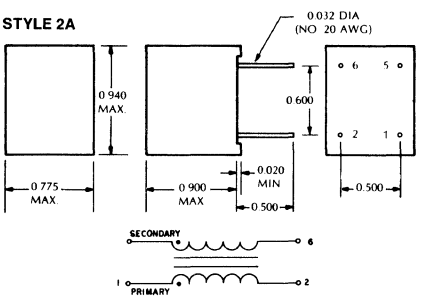
STYLE 1A



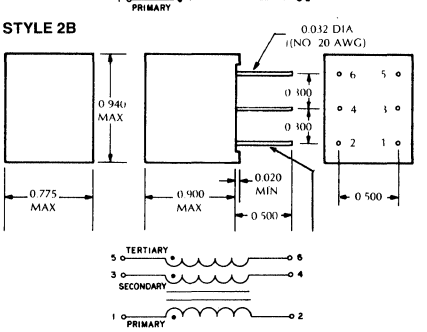
STYLE 1B



STYLE 2A



STYLE 2B



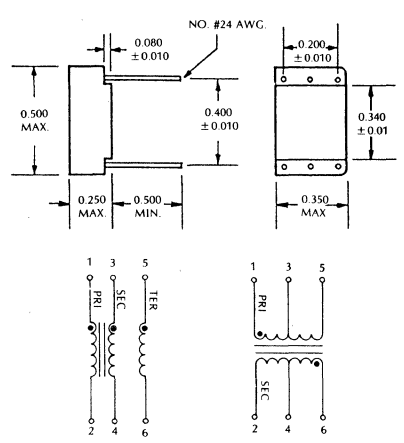


FIG. 1

FIG. 2

TYPE 13Z *SCR TRIGGER TRANSFORMER*

- Meet design requirements of most sine wave inverter circuits.
- High ET-Ratings.
- High dielectric strength capability.
- Fast rise time.
- Low interwinding capacitance.
- Average Power Rating: 2 Watts
- Peak Pulse Voltage: 100 to 300 Volts
- Insulation Resistance: 10,000 Megohms

Part Number	Turn Ratio	Primary* Inductance	Primary ET-Rating	Pri/Sec CC	Pri/Sec LL	Primary DCR	Secondary DCR	Dielectric Test	Case Style
		mH	$V_\mu S$	pF	μH	OHMS	OHMS	Vrms	
	±5%	Min.	Min.	Max.	Max.	Max.	Max.	Min.	
13Z1000	1:1	0.2	180	24	3.2	1.4	1.5	1600	1A
13Z1001	1:1	1.0	360	30	15.0	2.8	3.1	1600	1A
13Z1002	1:1	5.0	866	36	64.0	6.0	7.5	1600	1A
13Z1003	2:1	0.2	180	24	5.0	1.4	0.9	1600	1A
13Z1004	2:1	1.0	360	30	13.0	2.8	1.8	1600	1A
13Z1005	2:1	5.0	866	36	65.0	6.0	3.6	1600	1A
13Z1006	1:1:1	0.2	180	30	5.0	1.4	1.5	1600	1B
13Z1007	1:1:1	1.0	360	36	12.0	2.8	3.6	1600	1B
13Z1008	1:1:1	5.0	866	42	80.0	6.0	7.2	1600	1B
13Z1009	2:1:1	0.2	180	30	4.1	1.4	1.0	1600	1B
13Z1010	2:1:1	1.0	360	36	30.0	2.8	2.0	1600	1B
13Z1011	2:1:1	5.0	866	42	80.0	6.0	3.8	1600	1B
13Z1013	1:1	0.2	290	30	6.2	1.4	1.5	2400	2A
13Z1014	1:1	1.0	700	36	26.0	3.0	3.2	2400	2A
13Z1015	1:1	5.0	1500	62	130.0	6.3	7.0	2400	2A
13Z1016	2:1	0.2	290	30	8.9	1.4	1.0	2400	2A
13Z1017	2:1	1.0	700	36	24.0	3.0	2.0	2400	2A
13Z1018	2:1	5.0	1500	42	125.0	6.3	4.0	2400	2A
13Z1019	1:1:1	0.2	290	34	4.7	1.4	1.5	2400	2B
13Z1020	1:1:1	1.0	700	40	25.0	3.0	3.3	2400	2B
13Z1021	1:1:1	5.0	1500	46	174.0	6.3	7.5	2400	2B
13Z1022	2:1:1	0.2	290	34	6.0	1.4	1.0	2400	2B
13Z1023	2:1:1	1.0	700	40	27.0	3.0	2.0	2400	2B
13Z1024	2:1:1	5.0	1500	46	160.0	6.1	4.0	2400	2B

*Test Frequency at 60Hz

TYPE 16Z *PULSE TRANSFORMERS FOR GENERAL PURPOSES*

- Wide range of inductances for a variety of circuit applications.
- Small physical size.
- Flexible leads adaptable to PC board or axial lead mounting.
- Low cost.
- Operating Temperature: −20°C to +105°C
- Peak Pulse Voltage: 100 Volts
- Insulation Resistance: 10,000 Megohms
- Average Power Rating: 500 mW
- Dissipation Rating: 150 mW
- Dielectric Test Voltage: 500 VDC

Part Number	Turn Ratio	Primary Inductance	Primary ET-Rating	Rise Time	Pri/Sec CC	Pri/Sec LL	Primary DCR	Secondary DCR	Tertiary DCR	Sch. Fig.
		μH	$V_\mu S$	nS	pF	μH	OHMS	OHMS	Vrms	
	±5%	Min.	Min.	Max.	Max.	Max.	Max.	Max.	Min.	
16Z5760	1:1:1	5000	25.0	10.5	60	1.3	3.9	3.9	3.9	1
16Z5761	1:1:1	2000	16.0	8.2	37	0.8	2.5	2.5	2.5	1
16Z5762	1:1:1	500	8.5	5.3	32	0.4	1.3	1.3	1.3	1
16Z5763	1:1:1	200	5.0	4.2	18	0.3	0.9	0.9	0.9	1
16Z5764	1:1:1	50	5.2	5.6	18	0.5	1.3	1.3	1.3	1
16Z5765	1:1:1	20	3.2	4.1	21	0.4	0.9	0.9	0.9	1
16Z5765	1:1:1	10	3.7	5.1	22	0.5	0.9	0.9	0.9	1
16Z5767	2:1:1	5000	25.0	16.0	33	3.6	3.9	2.0	2.0	1
16Z5768	2:1:1	2000	16.0	11.0	19	1.8	2.5	1.4	1.4	1
16Z5769	2:1:1	500	8.5	5.6	11	1.1	1.3	0.7	0.7	1
16Z5770	2:1:1	200	5.0	3.2	8	0.8	0.9	0.5	0.5	1
16Z5772	2:1:1	20	5.8	7.5	12	1.5	1.3	0.8	0.8	1
16Z5777	3:1:1	200	5.0	3.6	7	1.1	0.9	0.4	0.4	1
16Z5779	3:1:1	20	3.2	2.7	6	1.3	0.9	0.4	0.4	1
16Z5782	4:2:1	2000	16.0	13.0	20	2.5	2.5	1.4	0.8	1
16Z5783	4:2:1	500	8.5	4.7	13	0.9	1.4	0.8	0.5	1
16Z5784	4:2:1	200	5.0	3.7	8	0.8	0.9	0.5	0.4	1
16Z8270	1:1 *	2000	16.0	8.2	37	0.8	2.5	2.5	—	2
16Z8271	1:1 *	500	8.5	5.3	32	0.4	1.3	1.3	—	2
16Z8272	1:1 *	200	5.0	4.2	18	0.3	0.9	0.9	—	2
16Z8273	1:1 *	50	5.2	5.6	18	0.5	1.3	1.3	—	2
16Z8274	1:1 *	20	3.2	4.1	21	0.4	0.9	0.9	—	2
16Z8275	1:1 *	10	3.7	5.1	22	0.5	0.9	0.9	—	2
16Z8276	2:1 *	2000	16.0	11.0	19	1.8	2.5	1.4	—	2
16Z8277	2:1 *	500	8.5	5.6	12	1.2	1.4	0.8	—	2
16Z8278	2:1 *	200	5.0	3.2	8	0.8	0.9	0.5	—	2
16Z8279	2:1 *	50	5.2	5.2	12	1.3	1.3	0.7	—	2
16Z8280	2:1 *	20	5.8	7.5	12	1.5	1.3	0.8	—	2
16Z8281	2:1 *	10	3.7	4.5	9	1.5	0.9	0.5	—	2

* Center Taped, Both Primary and Secondary Windings.

VITEC ELECTRONICS CORP. / 8530 W. ROOSEVELT AVE. / VISALIA, CA 93291 / TEL (209) 651-1535 / FAX (209) 651-1538

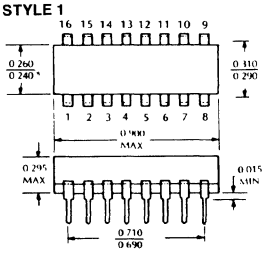
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ISOLATION TRANSFORMERS FOR LOCAL AREA NETWORK

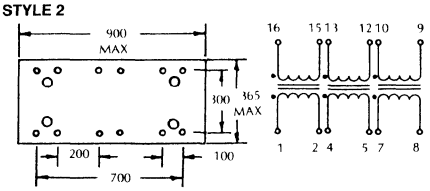
FOR ETHERNET APPLICATIONS

- Low profile automatic insertable
- IEEE 802.3 (10 Base 2, 10 Base 5) and ECMA compatible
- High isolation voltage to meet international safety requirement for local area network
- Fast rise time
- Low cost

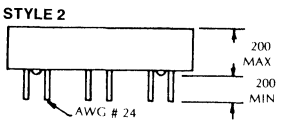
STYLE 1

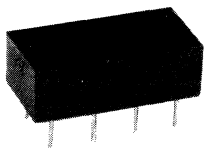


STYLE 2



STYLE 2





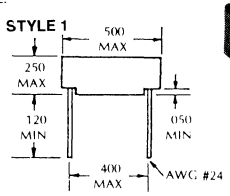
PART NUMBER		TURN RATIO	PULSE(1) INDUCTANCE	PRIMARY ET-RATING	RISE TIME (2)*	PRI/SEC CC	PRI/SEC LL	PRIMARY DCR	DIELECTRIC TEST (3)
CASE	STYLE		μH	V-μH	nS	pF	μH	OHMS	Vrms
1	2	±5%	±20%	MIN.	MAX.	MAX.	MAX.	MAX.	MIN.
14Z4500	24Z4105	1:1	35	1.8	3.5	8	0.25	0.3	2000
14Z4501	24Z4106	1:1	50	2.2	3.5	9	0.25	0.3	2000
14Z4502	24Z4107	1:1	75	2.4	3.5	10	0.25	0.3	2000
14Z4503	24Z4108	1:1	100	2.5	3.5	10	0.25	0.4	2000
14Z4504	24Z4109	1:1	150	3.0	3.5	12	0.25	0.5	2000

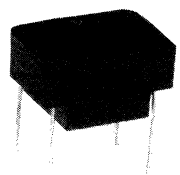
NOTES:
(1) PULSE INDUCTANCE, measured at 1 volt and 0.4 μSec. at a PRR of 1 Khz.
(2) RISE TIME measured in 78 OHM system.
(3) DIELECTRIC TEST of 2KV is between PRI & SEC and from coils to coils.

FOR STARLAN APPLICATIONS

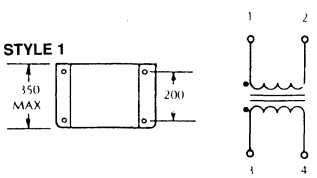
- Designed for HUB and NODE use.
- IEEE 802.3 (1 Base 5) compatible.
- High isolation voltage to meet international safety requirement for local area networks.
- Alternate packages may be available.

STYLE 1

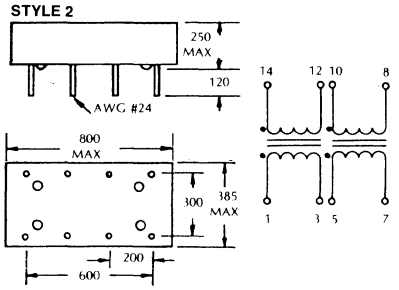




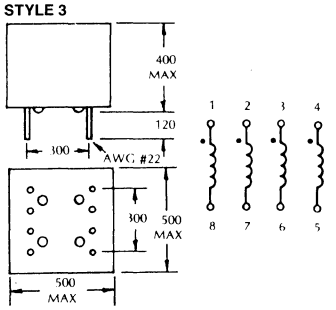
STYLE 1



STYLE 2



STYLE 3



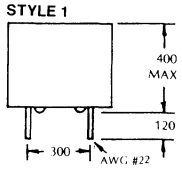
PART NUMBER	TURN RATIO	PULSE (1) INDUCTANCE	PRIMARY ET-RATING	RISE TIME	PRI/SEC CC	PRI/SEC LL	PRIMARY DCR	DIELECTRIC TEST (3)	CASE STYLE
		mH	V-μH	nS	pF	μH	OHMS	Vrms	
	±5%	±20%	MIN.	MAX.	MAX.	MAX.	MAX.	MIN.	
16Z4352	1:1	2.5	20	100	25	8	1.0	2000	1
16Z4552	1:1	2.5	20	25	40	1.1	1.0	2000	1
24Z4382	1:1	2.5	20	100	25	8	1.0	2000	2 (4)
24Z4582	1:1	2.5	20	25	40	1.1	1.0	2000	2 (4)
18Z4514	1:1:1:1	(2)	N/A	N/A	30	0.3	0.06	2000	3

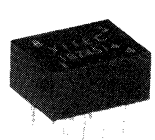
NOTES:
(1) PURSE INDUCTANCE measured per test schematic at 3 volts and 3 sec. at a PRR of 1 KHz.
(2) OPEN CIRCUIT SINE WAVE INDUCTANCE at 40 μH Min. measured on Tek 130 LC Meter.
(3) DIELECTRIC TEST of 2 KV is between PRI and SEC and from coil to coil in the 24Z Type.
(4) Characteristics are for each coil.

FOR TOKEN RING APPLICATIONS

- Designed to meet Texas Instruments TMS380 Chipset requirements.
- IEEE 802.5 compatible.
- High isolation voltage to meet international safety requirement for local area network.
- Low cost

STYLE 1

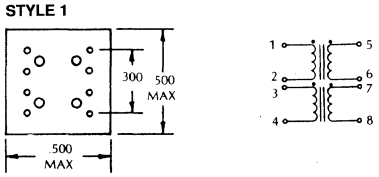




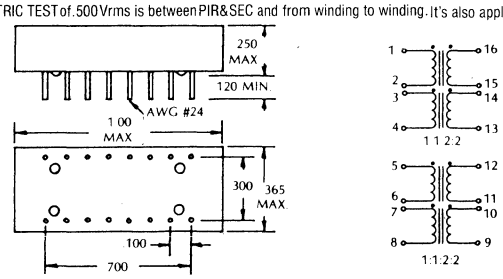
PART NUMBER	TURN RATIO	INSERTION LOSS (1)	RISE TIME	CMRR (2)	RETURN LOSS (3)	DIELECTRIC TEST (4)	CASE STYLE
		dB	nS	dB	dB	Vrms	
	±1%	MAX.	MAX.	MIN.	MIN.	MIN.	
18Z4838	1:2:2:2	0.5	15	-60	20	500	1
24Z4538	1:1:2:2	0.5	15	-60	20	500	2

NOTES:
(1) INSERTION LOSS is measured at 10 MHz.
(2) COMMON MODE REJECTION RATIO is measured as common mode to differential at 1 MHz.
(3) RETURN LOSS is measured at 5 MHz.
(4) DIELECTRIC TEST of 500 Vrms is between PIR&SEC and from winding to winding. It's also applied between coils for dual transformer version Type 24Z.

STYLE 1



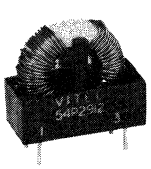
STYLE 2

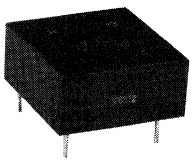


VITEC

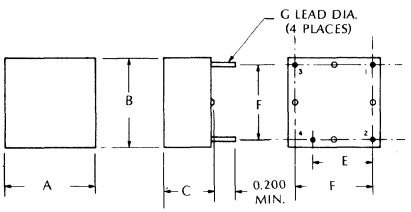
TRANSFORMERS & INDUCTORS

TYPE 54P *EMI COMMON-MODE SUPPRESSION INDUCTORS*

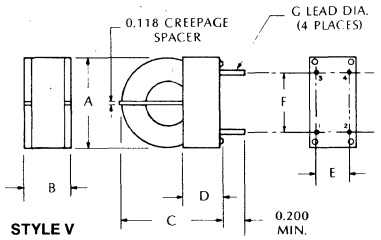




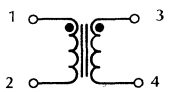
- Designed for use in input filter circuits of switching power supplies
- Low profile or vertical mounting for printed circuit mounting
- Encapsulation materials meet UL 94 V-0
- Operating Temperature: −55°C to +105°C
- Inductance: measured at 1 KHz with no DC current
- Rated current: continuous operating at any input voltage
- Dielectric Strength: 1250 Vrms
- Winding: Balun-wound to within 1%



STYLE H



STYLE V

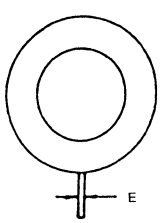


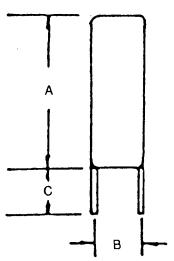
Part Number	Rated Current	Primary Inductance	Test Level	Leakage Inductance	DCR/ Winding	Case Style	Dimensions						
	AMP	mH	Vrms	μH	OHM		A	B	C	D	E	F	G
	Typ.	Min.		Max.	Max.		Max.	Max.	Max.	Max.	±0.010	±0.010	±0.005
54P2891	1.8	10	0.50	130	0.25	H	1.25	1.25	0.60	—	0.900	1.00	0.032
54P2892	3.5	3	0.20	35	0.06	H	1.25	1.25	0.60	—	0.900	1.00	0.032
54P2893	6.0	1	0.08	12	0.02	H	1.25	1.25	0.60	—	0.900	1.00	0.036
54P2894	2.6	16	1.00	180	0.16	H	1.52	1.52	0.80	—	1.083	1.28	0.032
54P2895	3.2	8	0.50	90	0.12	H	1.52	1.52	0.80	—	1.083	1.28	0.032
54P2896	5.2	4	0.20	45	0.04	H	1.52	1.52	0.80	—	1.083	1.28	0.036
54P2897	7.5	2	0.08	25	0.02	H	1.52	1.52	0.80	—	1.083	1.28	0.047
54P2911	1.8	10	0.50	130	0.24	V	1.15	0.55	1.15	0.45	0.400	0.80	0.032
54P2912	3.5	3	0.20	35	0.06	V	1.15	0.55	1.15	0.45	0.400	0.80	0.032
54P2913	6.0	1	0.08	12	0.02	V	1.15	0.55	1.15	0.45	0.400	0.80	0.036
54P2914	2.6	16	1.00	180	0.16	V	1.52	0.80	1.50	0.70	0.600	0.90	0.040
54P2915	3.2	8	0.50	90	0.12	V	1.52	0.80	1.50	0.70	0.600	0.90	0.040
54P2916	5.2	4	0.20	45	0.04	V	1.52	0.80	1.50	0.70	0.600	0.90	0.036
54P2917	7.5	2	0.08	25	0.02	V	1.52	0.80	1.50	0.70	0.600	0.90	0.047

TYPE 55P *HIGH CURRENT TOROID INDUCTORS*

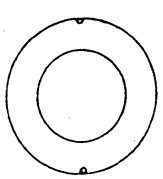
- Designed for use in Switching Power Supplies, SCR or Triac Control Circuits
- Printed Circuit Board Mounting
- Pre-tinned Leads
- Broad inductance and current rating
- Low cost
- Special values available upon request
- Inductance: Measured at 1KHz with no DC load
- Rated current: A maximum 15% drop in inductance when rated current applied

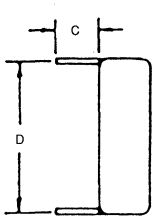
VB—Vertical style without tape
HB—Horizontal style without tape
VT—Vertical style with tape
HT—Horizontal style with tape





VERTICAL STYLE





HORIZONTAL STYLE

Part Number	Inductance	Rated Current	DCR	Dimensions				
	μH	Amp.	OHM	A	B	C	D	E
	±10%	Typ.	Max.	Nom	Nom	Nom	Nom	±0.005
55P9231	50	1.5	.030	.62	.25	.50	.56	.028
55P9232	75	1.0	.045	.62	.25	.50	.56	.025
55P9233	100	1.0	.055	.62	.25	.50	.56	.025
55P9234	50	3.0	.035	.82	.32	.50	.75	.036
55P0235	75	2.5	.050	.82	.32	.50	.75	.032
55P9236	100	2.0	.070	.82	.32	.50	.75	.028
55P9237	250	1.5	.155	.85	.35	.50	.75	.023
55P9238	50	4.5	.030	1.10	.40	.50	1.02	.046
55P9239	75	4.0	.035	1.10	.40	.50	1.02	.040
55P9240	100	3.0	.050	1.10	.40	.50	1.02	.036
55P9241	250	2.0	.090	1.15	.40	.50	1.02	.032
55P9242	500	1.5	.180	1.15	.40	.50	1.05	.028
55P9243	750	1.0	.250	1.15	.40	.50	1.05	.025
55P9244	50	7.0	.020	1.30	.55	.75	1.15	.057
55P9245	75	6.0	.025	1.30	.55	.75	1.20	.061
55P9246	100	5.0	.030	1.30	.56	.75	1.20	.061
55P9247	250	3.0	.070	1.25	.56	.75	1.20	.040
55P9248	500	2.0	.130	1.30	.56	.75	1.20	.032
55P9249	750	2.0	.170	1.30	.60	.75	1.25	.032
55P9250	1000	1.5	.220	1.30	.60	.75	1.20	.028

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TRANSFORMERS & INDUCTORS

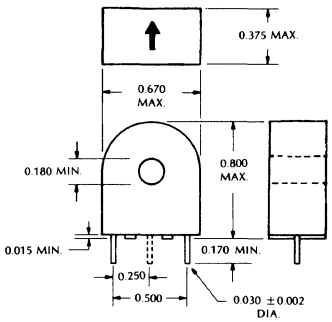




FIG. 1

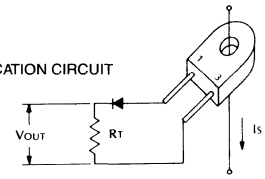


FIG. 2

TYPE 57P *CURRENT SENSE INDUCTORS*

- Designed for use with switching power supplies
- Frequency range above 50 KHz
- Epoxy encapsulated construction
- Low cost

TYPICAL APPLICATION CIRCUIT

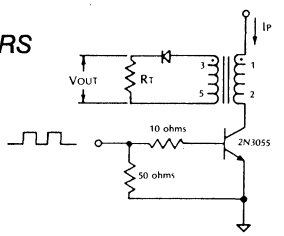


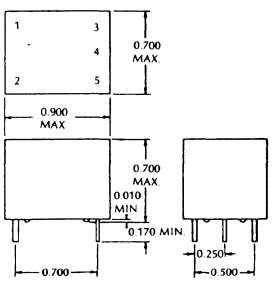
PART NUMBER	SCHEMATIC FIG.	TURNS	INDUCTANCE (1-3)	INDUCTANCE TEST VOLTS	DC RESISTANCE* (1-3)	TERMINATING RESISTANCE
			mH	VOLT	OHMS	OHMS
		±5%	MIN.		MAX.	TYP.
57P1686	1	50	5.0	0.50	0.70	50
57P1687	1	100	20.0	1.00	1.40	100
57P1688	1	200	80.0	2.00	4.50	200
57P1717	2	50 C.T.	5.0	0.50	0.70	50**
57P1718	2	100 C.T.	20.0	1.00	1.40	100**
57P1719	2	200 C.T.	80.0	2.00	4.50	200**

*For voltage across terminating resistance of 1 volt per ampere.
**For center taped units, terminating resistance for each half of winding is ½ the listed value.

TYPE 57P *CURRENT SENSE TRANSFORMERS*

- Designed for use with switching power supplies.
- One turn primary furnished
- Operating temperature to +105°C
- Frequency range above 20 KHz
- Epoxy encapsulated construction
- 3750 Vrms primary to secondary hipot
- Low cost





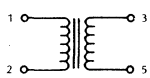


FIG. 1

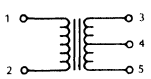
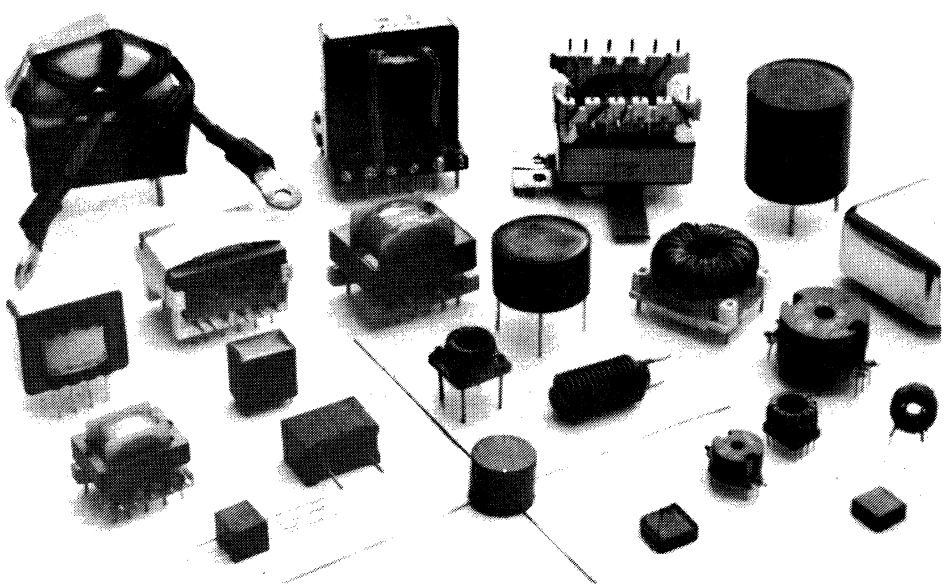


FIG. 2

PART NUMBER	SCHEMATIC FIG.	SECONDARY TURNS	SECONDARY INDUCTANCE (1-3)	SECONDARY INDUCTANCE TEST VOLTS	SECONDARY DC Resistance (1-3)	SECONDARY TERMINATING* RESISTANCE	PRIMARY UNIPOLAR RATING
			mH	VOLT	OHMS	OHMS	AMP μ SEC
		±5%	MIN.		MAX.	TYP.	MAX.
57P3586	1	50	5.0	0.50	0.70	50	150
57P3587	1	100	20.0	1.00	1.40	100	300
57P3588	1	200	80.0	2.00	4.50	200	600
57P3617	2	50 C.T.	5.0	0.50	0.70	50**	150
57P3618	2	100 C.T.	20.0	1.00	1.40	100**	300
57P3619	2	200 C.T.	80.0	2.00	4.50	200**	600

*For voltage across terminating resistance of 1 volt per ampere.
**For center taped units, terminating resistance for each half of winding is ½ the listed value.
Peak sense current 20 ampere max.



CUSTOM DESIGN CAPABILITY

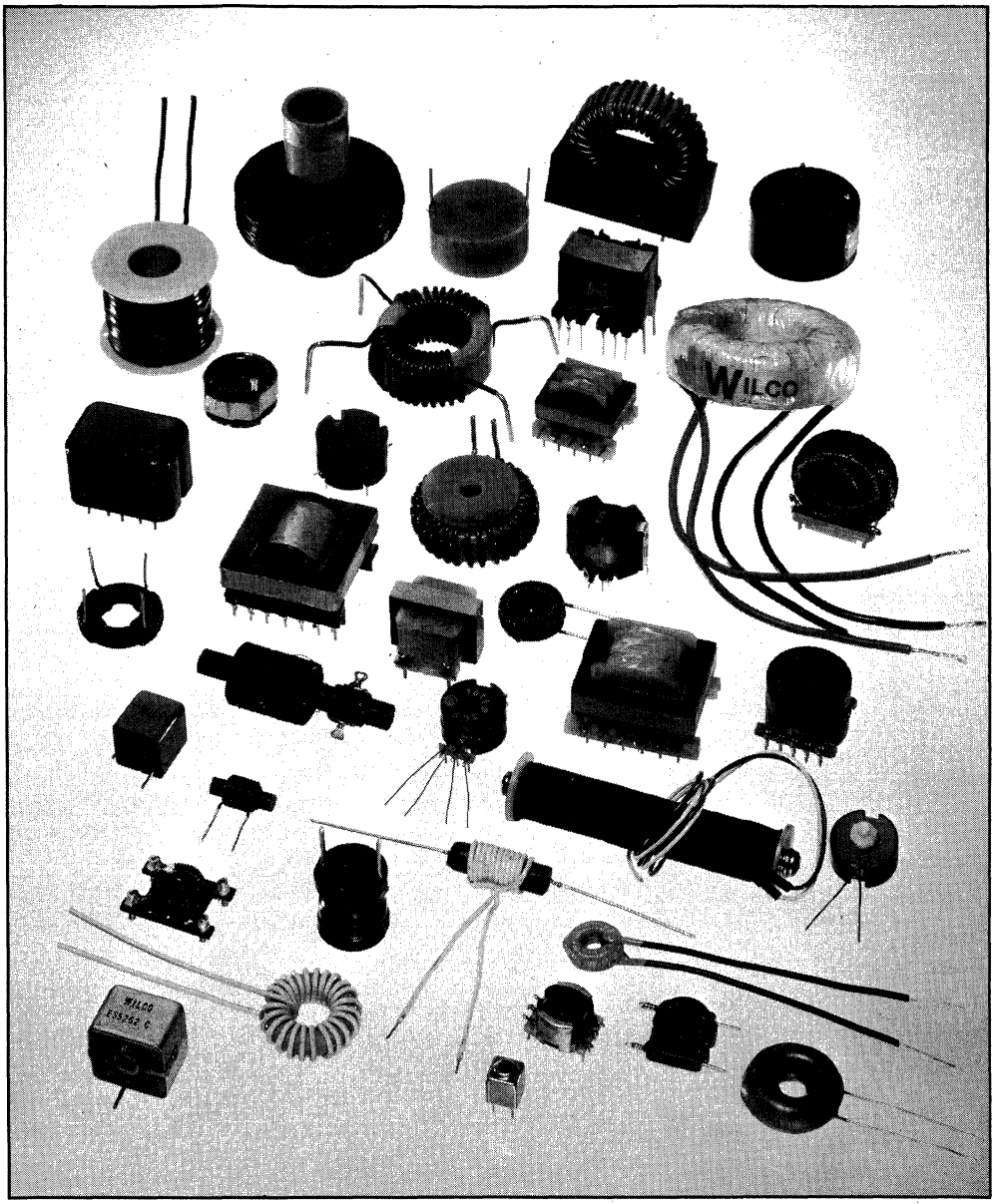
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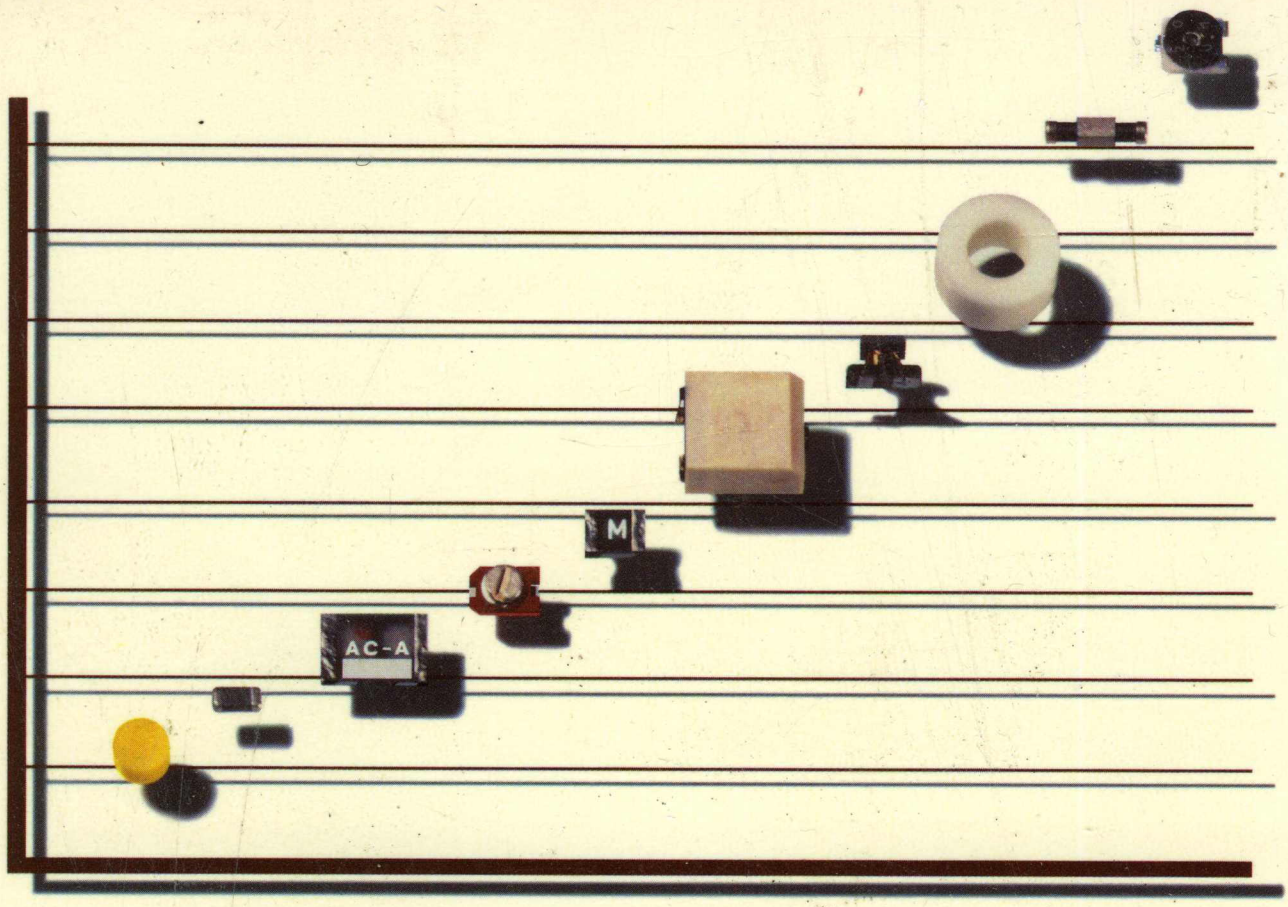
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